THE EFFECTS OF EDUCATION ON HEALTH AND FERTILITY IN GHANA

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DEDICATION

TO MY MOTHER, AKOSUA OTUBEA, WHO NEVER ATTENDED SCHOOL BUT REALISED ITS VALUE AND MADE SURE ALL HER NINE SONS AND DAUGTERS BENEFITTED BY SENDING US TO SCHOOL.

Abstract

THE EFFECTS OF EDUCATION ON HEALTH AND FERTILITY IN GHANA

AMA A. AHENE-CODJOE PHD IN ECONOMICS

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Using the Ghana Living Standards Survey (GLSS) conducted in 1987/88 and 1998/99, this thesis examines two thematic areas of non-monetary returns to education in Ghana. One of the primary aims is to find the differences in the effects of education over the decade (1987/88–1998/99), using standard and non-standard econometric analysis. In addition, the later survey year serves as a robustness check on the first.

The first theme examines health status; measured as illness and its duration, as well as the use of anthropometric indicators. The study finds that parental education is positively associated with child's reported illness and its duration. Further verification of this outcome using an instrumental variable (2SLS) approach that assumes possible endogeneity of parental education supports the results relating to maternal education in both survey years. In contrast, paternal primary education tends to reduce children's reported illness; but this is only statistically significant in GLSS 1. These outcomes, although perverse are not uncommon in developing countries, and may be the result of systematic reporting bias. The analysis also reveals inconsistent results regarding adults' health status between the two survey years. For example, we find that illness and its duration increase with personal education in GLSS 1, but the converse is true in GLSS 4, ceteris paribus. The mixed results of this study imply that the relationship between education and health status varies across health measures, and probably over time. Hence caution should be exercised before broad conclusions are drawn and policies made regarding these two vital socioeconomic indicators (education and health).

The last theme analyses fertility in both structural and reduced form functions. The structural function involves a two-stage process. The first stage estimates the effect of education on three proximate determinants of fertility - the duration of breastfeeding, contraceptive use and age at cohabitation. The second stage subsequently models the fertility function by estimating three measures: the probability of having at least one birth; the unconditional number of births; and the number of births conditional on one having occurred, using the predicted values of the proximate determinants as inputs similar to the conventional production function. The reduced form fertility model estimates the impact of women's education on the number of live births. The findings are that (1) education increases the use of contraception, delays age at cohabitation and shortens the duration of breastfeeding, as anticipated; (2) contraception and age at cohabitation subsequently tend to reduce the overall number of live births, though we observe an ambiguous outcome regarding breastfeeding; (3) education, in a fuller and direct way, also shows a strong negative association with fertility in both surveys; and finally (4) fertility appears to have declined over the period studied. We also find a structural shift in respect of the influence of women's education from post-primary to primary level on fertility, ceteris paribus.

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ACRONYMS

ADI	African Development Indicators
CEE	Common Entrance Examination
DHS	Demographic Health Survey
ERP	Economic Recovery Programme
EA	Enumeration Areas
FCUBE	Free Compulsory Basic Education
GDHS	Ghana Demographic Health Survey
GHS	Ghana Health Service
GLSS	Ghana Living Standards Survey
GPRS I	Ghana Poverty Reduction Strategy
GSS	Ghana Statistical Service
GDP	Gross Domestic Product
GPRS II	Growth and Poverty Reduction Strategy
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IV	Instrumental Variable
ILO	International Labour Organisation
KMO	Kaiser-Meyer-Oklin
MSLE	Middle-School Leaving Examination
MDG	Millennium Development Goals
MOH	Ministry of Health
OLS	Ordinary Least Squared
PRB	Population Reference Bureau
PCA	Principal Component Analysis
SAP	Structural Adjustment Programme
SSA	Sub-Saharan-Africa
SGER	The State of the Ghanaian Economy Report
2SLS	Two-Stage Least Squares
UN	United Nations
UNICEF	United Nations Children's Fund
UNESCO	United Nations Educational, Scientific and Cultural Organisation
WDI	World Development Indicator
WHO	World Health Organisation

Chapter 1: INTRODUCTION

This thesis estimates the non-wage returns to education in two thematic areas using two household surveys in Ghana. The analysis focuses on the relevance of education to health and fertility. These are two important variables that affect the pattern of economic growth and development of any country, most of all, a developing one. Ghana, one of the African countries to expand its educational sector in the early sixties because of the expected gains to be derived (Hinchliffe, 1971) and currently implementing a policy of Free Compulsory Basic Education (FCUBE), makes a good choice for this study. As the thesis explores in subsequent chapters, education has the potential to improve the general welfare of societies through for example, improvement in health and reduction of fertility levels. These work together to increase national income, growth and development as well as reduce poverty. Considering its role in economic development, education could arguably be the most vital investment countries in Africa need to leapfrog into the heights of development.

The first thematic area in the study is health, where an estimate of non-monetary returns to education is analysed. This explores the relationship between education and health status in the entire country for adults and children. The measurement of health is reported illness by individuals in a household. A special emphasis is given to maternal education since mothers are the primary source of childcare in a household.

The other thematic area of the thesis focuses on women's education and fertility, measured as number of children ever born to the woman. Both structural and reduced forms are examined in the fertility analysis to draw insights into how education affects fertility through the proximate determinants of fertility as well as its reduced form effects. The proximate determinants used in the structural model are contraception, duration of breastfeeding and age at cohabitation. Two periods of the survey data, which are a decade apart, are used in the estimation of the models. The second survey serves as a robustness check on the first and where relevant, notable changes in policy related variables as well as their implications are brought to attention. The sections below present the general issues of education in the thematic areas, an overview of Ghana, and a brief explanation of the organisation of the thesis.

1.1. General Issues

A surge of interest in education, productivity and human development in general has been witnessed over the past few decades through many studies on the topic. The belief that education plays a considerable role in improving the welfare of the populace is undoubtedly the crux of this interest. Both macro and micro-economic analyses in published and unpublished literature indicate the importance of education to a nation's productivity (see Shultz, 2003; Gueye and Gauci, 2003; Glewwe, 2002, 1991; Appiah and McMahon, 2002; Teal, 2001; Appleton, 2001; Fafchamps and Quisumbing, 1999; Appleton and Balihuta, 1996; World Bank, 1986; Lockheed, Jamison and Lau, 1980; and Hinchliffe, 1971). New growth theorists have also emphasised the effective role of education in accelerating and sustaining growth (see Romer, 1990, 1986; Lucas, 1988) and the returns benefit not only individuals but also society in general. Early proponents of the theory argued that investment in physical capital alone is not adequate for growth; equal if not more investment in human capital is also required. Therefore education became one of the core developmental goals of most developing countries, and Ghana is no exception. Hinchliffe (1971) for instance notes that due to the increased belief in education as the means to growth, both finance and trained manpower were channelled in increased quantities into the educational sector of many countries, even to the detriment of other sectors.

For low-income countries especially, investment in education is desired for the additional purpose of reducing poverty through increased efficiency and productivity. Poverty is a significant feature in most developing countries, but for Africa, it has almost become a synonym for the continent's name. No story about sub-Saharan-Africa (SSA) is written without a reference to poverty. This has led to an increasing quest among leaders of nations and international institutions to find techniques to reduce poverty drastically, if not eradicate it all together. Poverty reduction is one of the most challenging goals of developing countries. Thus, analysing education in any developing country needs no further justification. Studies on returns on education provide assurance and advice to these low-income countries on plausible channels to improve productivity and therefore growth. Some of the studies include the World Bank (1986), Glewwe (1991; 2002), Appleton (2001), and Gueye and Gauci (2003), which give support to education as a way to increase incomes, promote growth and aid poverty eradication. However, the economic returns estimated for Africa are sometimes found to be relatively small, and also as in most developing countries it increases economic inequalities, especially at higher levels of education (Shultz, 2003). Education moves labour from farm to non-farm activities (especially giving access to wage employment), which although increasing household incomes (Jolliffe, 1998, 2004; Fafchamps and Quisumbing, 1999; and Appleton, 2001), also creates inequalities because gains from non-farm activities are unevenly distributed (Canagarajah et al., 2001).

This is not the case for non-wage returns, most of which are shown to be favourable. In the past few decades, research focus has been geared towards the assessment of some of the underlying social or external returns on education that are important to the development of low-income countries. Most findings indicate that education improves health status and reduces fertility (Lawson, 2004; Appleton, 1996). It also and serves as screening and signalling device for workers' uncertain productivity and employer learning (Strobl, 2004) as well as increase farm productivity in relation to both internal and external returns (Appleton and

Balihuta, 1996; and Weir and Knight, 2000). Appiah and McMahon (2002) analysed the comprehensive net effects of education in Africa, and they found that education goes beyond increasing incomes and growth to improving infant survival, longevity, strengthening civic institution and democratisation, increasing political stability, lowering fertility and population growth rates as well as contributing to sustainable environment. Female education particularly plays role in these social developments. Summers (1994) show how increases in female education have the potential of altering society over time. He declared that, "…. once its benefits are recognised, investment in girls' education may well be the highest return investment available to the developing world." Herz (2004) succinctly summarises the benefits of female education, and to paraphrase, thus: female education is the single most effective way to encourage a shift to smaller, healthier, and better educated families with an enormous subsequent impact on population growth and sustainable development. She explains that education boosts women's earnings capacity; increases the opportunity cost of their time and bargaining positions in families and society which results in fewer offspring who consequently would have better education and healthier livelihood.

Because of this and other many important benefits to education several international institutions have adopted measures of health and education as the fundamental non-monetary indicators of development. The Millennium Development Goals (MDGs) represent an example of such a measure. Under the MDGs – using a baseline of 1990 – world leaders set targets for developing countries to be achieved by 2015. More than half of the goals are related to education and health in addition to the fundamental focus of poverty reduction. This includes the reduction of malnutrition, under-five mortality, infant mortality, maternal mortality and HIV/AIDS among others. In addition, country-specific development targets such as those in the Ghana Poverty Reduction Strategy (GPRS I, 2003-5) include health and education as challenges to its basic goal of reducing poverty. The emphasis placed on these two stems from the generally accepted view that education positively affects the general efficiency of labour as well as makes the implementation of new technologies possible. On the other hand, health stabilises households and the economy's budget by making available a consistent labour supply that increases income and expenditure, which eventually leads to development. Also, higher survival rates of children lead to lower fertility by ending the culture of "hoarding" of children to replace deaths. This consequently results in lower fertility.

Indeed fertility plays a crucial role in economic development since high population growth rates unmatched by economic growth increases poverty. One of the effective ways noted of promoting development, is curbing fertility rates; and education plays a significant role. There are however, positive and negative impacts of education in general and of female education on fertility in particular. Thus the net effect on population growth rates could be positive or negative, or even insignificant depending on the strength of the channel through which education works (Bongaarts et al., 1984; and Appiah and McMahon, 2002). First of all educated adults are able to obtain knowledge about health and nutrition for both themselves and their offspring, which reduces mortality and increases life expectancy. Although educated women have a higher tendency to breastfeed, which improves the survival rates of children, they also tend to breastfeed for shorter periods as well as shorten post-partum abstinence. Unaccompanied by effective contraceptive use, the possible consequence is increased population size.

Conversely, female education may lower fertility by increasing contraceptive use as well as participation in wage employment, which raises the opportunity cost of women's time. Female education also leads to the postponement of marriage and later family formation (Martin, 1995). Indeed Westoff et al., (1994) cited in Martin (1995), show that even when sexual activities precedes marriage, education leads to the postponement of first birth, which is likely to have a lowering effect on final family size. As Jain (1981) explains, female school enrolment alone without a simultaneous change in other factors such as increased opportunities in paid labour force could also influence fertility behaviour, especially by increasing age at marriage.

Sub-Saharan Africa is noted to have experienced some of the negative effects of education on fertility. Nevertheless, for the majority of the countries, the percentage of the female population with education beyond the primary level is not high enough to warrant a substantial fall in fertility in the continent. Bongaarts et al., (1984) suggested fertility in SSA would fall after literacy levels of women of reproductive age reaches above 70 percent, for the effects of increased contraceptive use and delayed age at first union to outweigh the effect of shorter breastfeeding and post-partum abstinence. A more recent simulation by Appiah and McMahon (2002) also show that net population growth rate is still increasing in SSA but would stabilise around 2035 AD; and begin to fall when most female education reaches beyond the ninth grade[1]. This is when the negative effects of education (through behaviours including enrolment in school that delays age at reproduction debut; increase use of contraception; higher opportunities and wages in the labour force and hence participation) on fertility would outpace the

[1] The average for most of the poor countries in Africa is third grade.

positive effects. However, for some countries like Zimbabwe, Kenya and Botswana, the fertility transition has begun.

Despite the many studies done in the area, there is room for more. This thesis adds to the existing knowledge by analysing two sets of data, which are a decade apart to roughly capture socioeconomic dynamics as well as the influence of education. Through the interaction of health, fertility and education, the development of human resources of a country is also enhanced. The wheels of social and economic development are consequently set into motion. Thus, the importance of the thematic areas in this thesis and their subsequent effects on socioeconomic development cannot be over-emphasised. The chapter on health answers questions like: does education determine morbidity and its duration in households? Which kinds of people are more likely to fall ill and if they do, for how long? Does education matter in the development of children in relation to height and weight? Is there any underlying gender discrimination in any of the above situations? And what other policy relevant variables affect illness, duration, height-for-age and weight-for-height, as well as their implications in the country? The chapter on fertility also examines whether education influences fertility by estimating a reduced form as well as a structural model. The former estimates the overall impact of education on fertility while the latter examines its influence through particular channels such as contraceptive use, breastfeeding duration and age at cohabitation. Questions as to whether fertility has changed over the period understudy as well as whether education contributes to the change are answered. This thesis uses various econometric methods in the estimation of the two thematic areas with control for endogeneity for variables with valid instruments.

Whilst Ordinary Least Squares (OLS) is employed in estimating most models, Probit, Tobit and duration models are also used where necessary.

This thesis focuses on non-wage returns to education in Ghana because many economic returns have been analysed by other studies. These include Glewwe (1999) who estimated private rate of return to education using the second round (1988/89) of Ghana Living Standards Survey (GLSS), Jolliffe who in a series of studies in 1998, 1999 and 2004 estimated farm and non-farm earnings also used the second round and Teal (2001) who used all the four rounds of the GLSS to estimate earnings in relation to education. Also studies of the non-wage returns to education in Ghana, especially with the GLSS are few and most are quite dated. Thus possible changes over the years are not uncovered. This thesis adds to the knowledge in the field by focusing on some of the social outcomes as well as non-wage returns to education. It also has the novelty of estimating changes over the period of a decade.

1.2. THE CONTEXT

This section gives the general background information of the country under-study. The main focus is on the socioeconomic variables to be analysed in subsequent chapters. This also highlights changes, especially over the period being assessed in the thesis.

1.2.1 Ghana

In 1957 Ghana won her independence from British colonial rule and at the time emerged as a beacon of hope on a continent blighted by slavery, colonial rule and poverty. The first half of her 54 years existence as an independent country was characterised by political instability mainly as the result of military coup d'états, the first of which occurred in 1966. The consequence of this instability was generally a poor economic performance. Table 1.1 gives some of the major socio-economic indicators on Ghana from 1984 to 2010. Located along the west coast of Africa, independent Ghana is today a low-income country with a per capita income just over $700. The period between 1972 and 1983 represented a decade of economic downturn. Aryeetey and Harrigan (2000) have described this decade as nothing short of an unmitigated economic disaster.

Table 1.1: Socioeconomic Indicators of Ghana, 1984 – 2010

General	**1984**	**2000**	**2005**	**2008**	**2010**
Population (mill.)	12.3	18.9	21.3	23.6	25.0 (2011)
Urban (%)	32	43.8		48	48
Population Growth Rate	2.6	2.4	2.2	2.1	2.1 (2009)
Percentage of people in poverty		39.5 (1998/99)	28.5		
GDP per capita (US $)	334 (1985)	247	476	712	753*
GDP Growth (%)	8.6	3.7	5.9	8.4	6.6*
Agriculture					
Contribution to GDP (%)	52.5 (1985)	39.6	39.5	37.7	35.6*
Education					
Primary Net Enrolment Ratio					
Total	53.6 (1991)	62.9	65.1	76.5	75.9 (2009)
Female	50.4 (1991)	62	64.9	77	76.2 (2009)
Secondary Net Enrolment Ratio					
Total		33.8	39.2	47.4	46.1(2009)
Female		31.2	36.7	45.3	44.1 (2009)
Adult Literacy (%)	32.5 (1987/88)	49.8	56.2	65.8	66.6 (2009)
Health					
Infant Mortality Rate (per 1000 live births)	77 (1988)	57 (1998)	64 (2003)	71	
Life Expectancy (Years):					
Male	50.3	55.4		58	63
Female	53.8	59.6		59	65
Population per Doctor		1:20,036 (2001)	1:17,929	1:13,683 (2007)	
Fertility					
Total Fertility Rate	6.4 (1988)	4.4 (1998)	4.4(2003)	4.3	4.1

Source: Ghana Statistical Service; UNESCO Institute for Statistics, Global Education Database; Population Reference Bureau (PRB); African Development Indicators.

- Gross Domestic Product (GDP) is based on the old series estimates. Source: News Brief, New Series of the Gross Domestic Product (GDP) Estimates, (2010). Ghana Statistical Service, Statistical Newsletter, No. B12-2003.

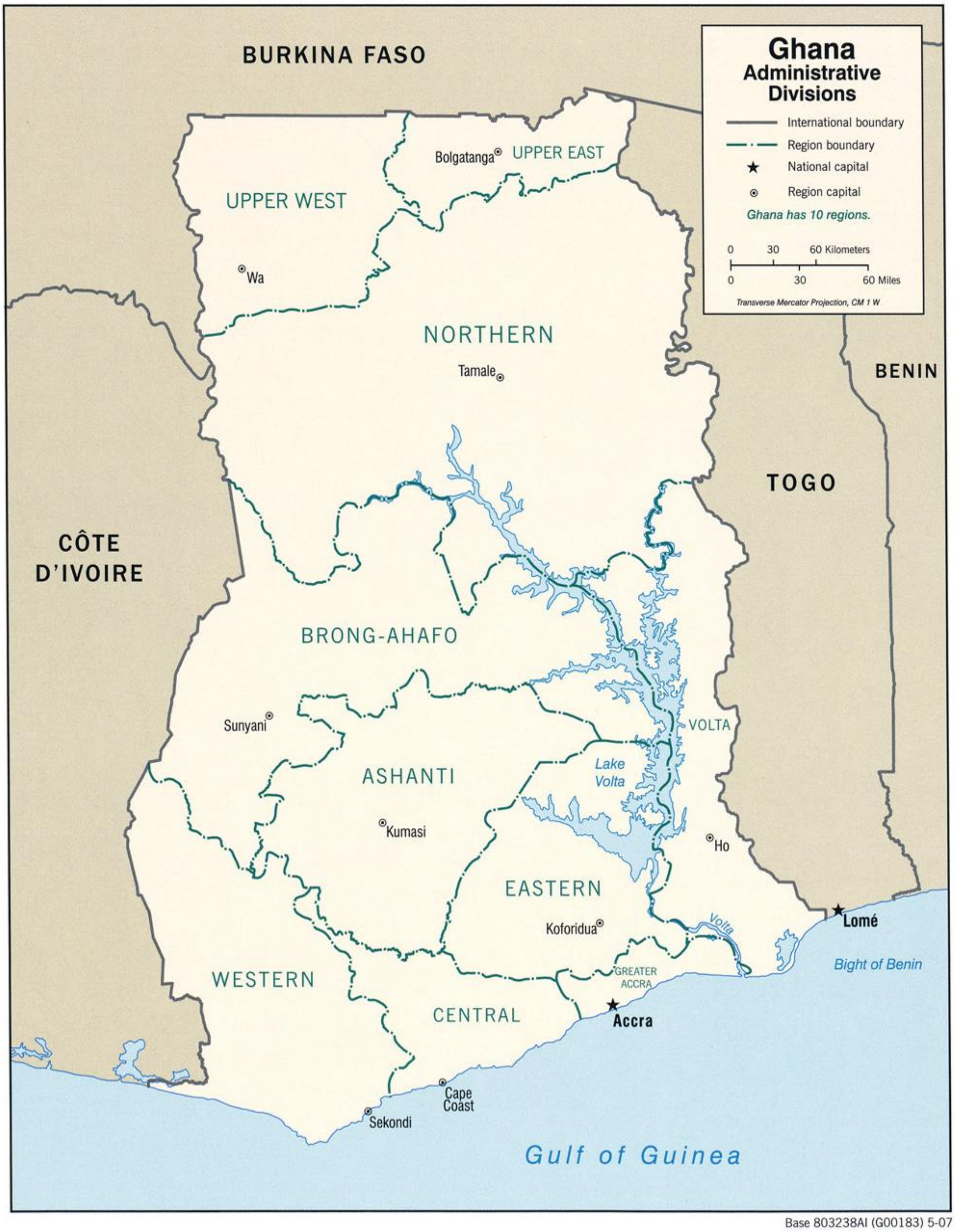
* Provisional

Real GDP per capita, real export earnings, domestic saving and investment all declined dramatically. The economic and social infrastructure was near collapse, the majority of economic transactions took place in parallel markets, and there was a massive haemorrhage of human capital to neighbouring countries. The crisis in the Ghanaian economy, which started from the early 1970s and persisted until the mid-1980s resulted in a gradual migration of professionals and other skilled individuals to neighbouring countries as well as countries in Europe, North America, the Middle East and other countries on the African continent. This loss of skilled personnel to the rest of the world later termed the 'brain drain' had severe impacts especially in the health and education sectors. Van Hear (1998) for example estimates that approximately 14,000 teachers left Ghana between 1975 and 1981, of which 3,000 were university graduates (Rado, 1986). Initially most of them settled in Nigeria although others found themselves in Liberia, Gambia, Libya, Botswana, Europe and North America (Anarfi et al., 2003). As Awumbila et al., (2008) affirm, Ghana in the 1970s lost many of teachers to Nigeria and in the 1980s also lost health professionals to developed economies such as UK and the USA (Anarfi, 1982; Nuro, 2000). Although accurate numbers are hard to come by, Akurang-Parry (2002) reports that estimates by the Ghana Medical Association for 2000 show that more than 600 Ghanaian doctors trained locally worked in the state of New York. Dovlo (2003) also reports that 61 percent of the output of one medical school in Ghana had left the country between 1986 and 1995. The migration of people was not restricted only to skilled professionals. Other non-skilled individuals faced with difficult domestic economic challenges also joined the exodus.

Real economic activity however began to improve from 1984 a year after the Economic Recovery Programme (ERP) commenced. Growth of real GDP averaged 5 percent between 1984 and 2000, and since 2001 real GDP growth has averaged nearly 7 percent. Agriculture's share of GDP, which exceeded 50 percent in 1980, is now less than 40 percent. Nonetheless, it still represents the largest sector of national output. Its significance to the economy is therefore unquestionable. About 60 percent of the economically active population either engages directly or indirectly (agriculture-related activities) in agriculture. It is also a major source of foreign exchange especially the cocoa sub-sector that contributed about 39.2 and 74.0 percent to total foreign and agricultural earnings respectively. Despite its major contribution to the country's GDP, the agricultural sector has the highest proportion of poor households in the country (ISSER, 2005).

According to the Ghana Statistical Service (GSS) and Population Reference Bureau (PRB), the country's population as at mid-2011 is approximately 25 million with an estimated growth rate of 2.1 percent. Close to half the population currently live in urban areas, increasing from 32.0 percent in 1984. This reflects increased rural-urban migration, which consequently strains the ability of the state to provide social services such as education, health care, water and sanitation. There are 10 administrative regions in the country whose living standards are partly determined by variation in agro-climatic conditions. Figure 1.1 provides a map of Ghana.

Fig. 1.1: The Map of Ghana



Regions in the north (Upper East, Upper West and Northern Region) are the poorest in economic terms. Apart from them being farther from the capital Accra, which is at the south and on the coast, they have a dry savannah climate; hence produce few crops most of the seasons. Therefore people from the north often migrate to the south, especially to the neighbouring forest regions with lush vegetation for seasonal crops. Related to the regions are ethnicity and religion. The Akans are the largest ethnic group in Ghana, constituting about 53 percent of the population and are located in the middle, central, eastern and western part of the country. Other major ethnic groups are Ga-Adangbes, Ewes and Guans located in the south and north-eastern of Ghana respectively, and Mole-Dagbon, Grusi and Mande-Busanga are located north. Major religious practices in Ghana include Christianity, Islam, Traditional African and no religion. Christianity is mainly practiced in the south, Islam in the north and Traditional African in the northeast and northern regions.

Like many developing countries, Ghana has integrated the MDGs with its national goals outlined in the Growth and Poverty Reduction Strategy (GPRS) part II, 2006-9. The current GLSS 5 report indicates that the percentage of people who are poor has decreased to 28.5, suggesting that the MDG target of 26 percent by 2015 is likely to be met. This success however does not extend to the other targets. Education and health for instance are far from meeting the targets. Although Ghana launched a policy of free compulsory basic education in the mid-90s, net primary enrolment ratio has only increased from 53.6 to 75.9 percent in 2009 (UNESCO, 2011). Calculating from 2005 net enrolment of 65.1 percent, the World Development Indicator (WDI, World Bank cited on UNESCO (2008) website) shows that Ghana would need to increase primary enrolment by 5.1 percent to achieve the universal primary education target in 2015. Although this rate is better than some countries in West Africa like Nigeria and Burkina Faso who need increases of 5.27 and 9.52 percent respectively to achieve the goal, it is bigger than its nearest neighbour, Togo, and Senegal who require 2.87 and 4.11 percent rises respectively. Other countries needing smaller percentage increases to achieving universal primary education include Kenya (3.13%), Tanzania (0.87%) and India (1.37%).

Secondary education enrolment is far lower than primary with less than half (46.1% in 2009) secondary school-aged students in school. However, it compares favourably with Kenya (49.6% in 2009) and has higher rates than Nigeria (25.8% in 2007), Senegal (20.8% in 2006) and Zimbabwe (37.2% in 2006). The gap between boys and girls' enrolment in both primary and secondary education is also closing in Ghana. Similar to the other education indicators, adult literacy has improved over the years to 66.6 percent in 2009, but is still low compared to Zimbabwe's 91.9, Uganda's 73.6, and Tanzania's 72.9 percent in the same year.

The health sector's plan with the theme "creating wealth through health" also emanates from the framework of the MDGs in the GPRS II. The Annual Report of the Ghana Health Service (GHS, 2007) propounds the theme as one of the main pathways to the ultimate middle-income status by 2015. However, the health targets are far from being achieved. The health status of the country is poor and deteriorating. Morbidity increased by about 40 percent between GLSS 1 and 4 and about a third of the child population is stunted. The disease burden is dominated by communicable diseases, almost all of which are preventable. Malaria, the leading cause of morbidity and mortality in Ghana (Annual Report, 2007, GHS), can easily be prevented by clearing stagnant water bodies and nearby bushes as well as by providing easy access to treated mosquito nets. Due to limited action on prevention, malaria constitutes about 40% of all outpatients' attendance and over 18% of deaths reported at health facilities (ibid). Children under five years old and pregnant women are the most affected. Other common diseases include acute respiratory infection, diarrhoea, ulcers, anaemia and pregnancy related complications. The report also indicated that HIV/AIDS reached the pandemic state at a prevalence rate of 3.4% in 2006. Other indicators of health such as the infant mortality ratio, under-five mortality ratio and maternal mortality ratio are worsening.

Government figures differ slightly from the Ghana Demographic Health Survey (GDHS) but basically show the same trend of the health indicators. Infant and under-five mortality ratios from 1988 to 2008 could be described as U-shaped. The rates declined from the 80s to the 90s, then increased thereafter**.** The figures from government health statistics show that infant mortality ratio decreased from 77 per thousand live births in 1988 to 57 per thousand live births in 1998. Then it began to increase to 64 per thousand in 2003 and 71 per thousand live births (2008). The increase in infant mortality between 2003 and 2007 is mainly attributed to the increase in neo-natal mortality (MOH, 2008). Similarly, under-five mortality declined from 155 per thousand births in 1988 to 108 per thousand births in 1998 but then started increasing to around 111 per thousand live births in 2006. Maternal mortality has also increased to 230 per 100,000 live births (2007) from 205 per 100,000 live births in 2003. These health indicators are high relative to international standards. However within West Africa, Ghana has better health status than countries like Cote D'Ivoire, Nigeria, Burkina Faso and Mali with regard to under-five mortality rates. The State of the World's children report

(2008) ranks[2] Ghana number 32 amongst 194 developing countries. Of the ten West African countries included, Ghana rates better than all except Cape Verde, Togo and Senegal.

The Millennium development targets for Ghana to achieve include reducing under-five mortality to 40 per 1000 births, underweight in children to 14.7 percent, maternal mortality by three-quarters and to stop the spread of HIV/AIDS, malaria and other diseases. With falling poverty levels, Ghana is projected to be on its way to achieving the coveted poverty reduction goal of cutting the proportion of people living on one dollar a day by half by 2015. Indeed by assuming a linear projection of the decline in poverty from 52% (1992) to 40% (1999), the proportion of the population living below the poverty and extreme poverty lines will be around 9.3 and 4.0 percents respectively by 2015[3] (ISSER, 2005). This proportion far exceeds the 2015 MDG targets of 26 and 19 percents for the upper and extreme poverty lines respectively. However, such anticipated declines cannot be observed with respect to the other MDGs such as malnutrition using the same projections. Although the proportion of children underweight declined from 27.0% (1992) to 23.3% (2003), the millennium target of 14% is not expected to be achieved by 2015, instead a higher value of 21% is projected (ibid). The other targets in the MDGs, namely, child mortality, maternal health, eradicating malaria and HIV/AIDS as well as universal basic education are also far from being achieved.

[2] Countries with lower under-five mortality rates are ranked higher

[3] The assumption of a downward slope was based on the past 17 years experience rate of decline of poverty in the country.

Life expectancy on the other hand is improving, perhaps in part because of a decreased patient to doctor ratio from about 20 thousand to 13.7 thousand to one doctor in 2000 and 2007 respectively as well as increased percentage of adult literacy. Education, as already elaborated on in the section above, sensitises health awareness and paves the way for increased access to the limited healthcare available. Also related to increased literacy as well as urbanisation is fallen fertility rates. Fertility rates declined from 6.4 in 1988 to 4.4 percent in 1998, and it has remained that after a decade. Some researchers doubt fertility would fall below 4.0 in Ghana, at least not in the near future. Agyei-Mensah (2005) for example suggests that unless fertility decline drastically in rural areas especially, as well as a more drastic societal transformation occurs, the transition would stall for sometime. He explained that although having six children is seen as a burden in recent times, couples are nonetheless anxious and insecure if they have less than four children. Thus the projection by the UN (2004) that Ghana would reach fertility replacement level by 2045-2050 is uncertain (ibid).

1.2.2 The Education System

The education system in Ghana from 1957 to 1986/1987 covered elementary or basic school, secondary and university education. The elementary takes 10 years to complete and a pass of Middle-School Leaving Examination (MSLE) qualifies one to enter formal employment at the lower ranks for clerical duties. It is made up of 6 years primary, which is officially free and compulsory (now or before), and 4 years of middle school. Secondary education consisted of grammar schools, teacher training colleges, nursing and technical and vocational institutions. Secondary grammar school takes 5 years for an Ordinary Level and a further 2 years for the Advanced Level Certificate. Entry requires a pass from the Common Entrance Examination (CEE), which is taken at primary 6 or any year at the middle school. Teacher training colleges take either middle school leavers for a four-year or fifth and sixth form students from secondary grammar schools for a three and two-year certificate course respectively. Nursing and technical/vocational institutions like teacher training colleges take students from either middle or secondary grammar schools at several levels.

The university education was primarily at the University of Ghana, University of Science and Technology and the University of Cape Coast. Duration is usually 3 years[4]. Historically taking the mainstream education, that is, via the middle and secondary grammar system for instance gave 6-4-5-2-3 years of education. Students who avoided middle[5] school and entered secondary grammar straight from primary school had 6-5-2-3 years instead, but were still credited with the 4 years of middle school because their education level is likely to be equal to that of a student in M3 or 4 (Basic Information, GLSS 1 and 2, 1987/88).

After the educational reforms in 1986/87, the system changed from 13–17 years pre-tertiary schooling to 12 years. Basic education became 6 years primary and 3 years junior secondary school. Secondary education changed to 3 years senior secondary, which could be grammar, technical or vocational, and university undergraduate degrees changed to 4 years. Thus, the educational system now is 6-3-3-4. The training schools mentioned earlier still operate alongside this new system, with some (including polytechnics) upgraded to tertiary levels. There are

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[4] An additional year is taken by students pursuing a teaching degree. This is mainly at the University of Cape Coast, which was built for that purpose.

[5] These are usually students from private schools.

also private universities specialising in various courses as well as institutes of journalism and professional studies.

1.2.3 Data

This thesis draws on data from a comprehensive household survey programme, the Ghana Living Standards Survey (GLSS) carried out by the Ghana Statistical Service (GSS). GLSS is a nationwide survey devised to give standards of living information on a continuous basis to the government, for a more effective welfare policy formulation for the country. There are currently five rounds[6] completed: GLSS 1 in 1987/88, GLSS 2 in 1988/89, GLSS 3 in 1991/92, GLSS 4 in 1998/99 and GLSS 5 in 2005/06. The data are collected over a period of 12 months at the individual, household and community levels. Information on individuals includes demographic characteristics, education, health, employment and time use, and migration. At the household level, data on income, expenditure, housing, household enterprises and assets are collected whilst provision of public services (education and health), communication, transportation, food and commodity prices, main demographic, religious, economic and social characteristics are the focus of the community level data.

In addition to this common coverage in all the data sets, each round focuses and gives extra information on particular topics that may not be in the others. For instance GLSS 1 and 2 have anthropometric information whilst the rest do not; and GLSS 2 alone has data on cognitive skills tests[7]. In fact the first two surveys

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[6] This thesis began before the most recent, GLSS 5, was completed.

[7] These are Raven's, English reading and mathematics tests.

were designed with a rotating panel sequence in mind, where half of the sample in the first is retained for re-interview in the second, with the other half replaced. GLSS 3 differed from the first two by giving more detailed information on income, consumption and expenditure of households at disaggregated levels. The emphasis for GLSS 4 and 5 are the country's labour force and non-farm household enterprises respectively. New sections, on tourism, migration and remittances, are also included in GLSS 5.

Apart from the extra data or emphasis of each round of the surveys, they also cover different sampling sizes – they increase with each subsequent round. However only the first and fourth rounds, which this thesis uses, are discussed[8] for brevity. GLSS 1 covered 176 enumeration areas (EAs), about 63 percent of which are rural and a total of 3,136 households with 15,492 individuals. The corresponding figures for GLSS 4 are 300, 65 percent, 5,998 and 25,855. Although a multi-staged stratified sampling procedure was used in selecting enumeration areas (EAs) and households for all rounds, some of them are self-weighting whilst others are not. For example, GLSS 1 is self-weighting (proportional allocation)[9] but not GLSS 4. Therefore sample weights provided with the GLSS 4 data are applied where the econometric method employed under sub-sections of thematic areas allows. This may present some limitations in the comparison of the two surveys as done in all the chapters of this thesis. Also, due to lack of data on some

[8] Actual achieved sample are given.

[9] Chosen households had equal probability of being selected and grouped into "workloads" of 16 households each whilst considering the three main ecological zones (coastal, forest and savannah) as well as rural, urban and semi-urban location. This is done in order to form the same proportion in the sample as in the national population. Upon the selection of EAs, 200 workloads were assigned to them such that areas with higher than average increases in sampling size had a greater than one chance of being selected. Therefore each enumeration was assigned zero, one, two or sometimes three workloads of 16 households. Each group of 16, 32, or 48 households within a sampling or enumeration area is referred to as a cluster in the data sets. (Source: Basic Information, GLSS 1 & 2, Poverty and Human Resources Division, The World Bank, 1993).

topics in one or the other of these two data sets as well as differences in the measurement of some variables[10], a strict comparison sometimes could not be made. However the results obtained still give some important insights into the general trend on topics covered over the years in the country and for some level of comparison to be made, which may be useful for policy.

The GLSS 1 and 4 datasets are used in this study because they were the first and last rounds at the beginning of the thesis; and with a span of a decade between them, it is anticipated that potential trends in the socioeconomic variables could be observed. Also some of the information required for analysis, such as the anthropometric measures, is available in only GLSS 1; besides GLSS 1 and 2 are quite similar, as is GLSS 3 and 4. Thus with slight dissimilarities coupled with maximum information between the GLSS 1 and 4 datasets, the opportunity to use one (especially the later) for robustness checks exists.

[10] Details are given in main text under the various chapters.

1.3. ORGANISATION OF THESIS

The two thematic areas are analysed in two substantive chapters. Additional two chapters – on introduction and conclusions – are included to make up the whole thesis. Chapter 1 has provided an overview of the research questions, motivation and context of the thesis. Chapter 2 covers the analysis of health outcomes, which includes the incidence of illness and its duration, as well as anthropometric measures. These are divided into sub-sections in the chapter, and under each the relevant literature, methodology and econometric specification are presented, as well as discussions of econometric results. Models of fertility, both structural and reduced form, are estimated in chapter 3. The analyses comprise proximate (contraceptives, breastfeeding and age at cohabitation) and socioeconomic determinants with the literature, methodology, econometric specifications and estimations examined under each sub-topic to give easier reference. Finally chapter 4 summarises the major findings as well as suggestions for future research.

Chapter 2: EDUCATION AND HEALTH STATUS

This chapter examines the relationship between education and health status using household survey data from two periods. The analysis of is conducted separately for children and adults using variety of health measures to explore the different effects of education on each. The main reason for this is that children in households do not make decisions concerning their health; other household members with responsibility roles for the household such as their parents or household head make these decisions on their behalf. Hence the characteristics, education in this case, of these members is important and thus used in the analyses.

Additionally data on one of the health indicators (the anthropometrics) is available for only children, which makes the separation of children and adults in the analysis more appropriate. Although maternal education is more often than not found to be the primary determinant of child's health (see Glewwe, 1998 and Doyle et al., 2007), other studies also find the education of both parents influential (Thomas et al., 1990; 1991) and sometimes that of the father instead of the mother (Appleton, 1991; Lavy et al., 1996) as influential. Consequently in our estimations, both parents' education is used for children, and personal education for adults in this study.

The health status measures considered for adults are the incidence of illness and the duration of illness, with the main research question being whether own education improves these outcomes. An additional dimension to the adult's sample is the assessment of potential effects of their parent's education on their health outcomes. This is to see whether controlling for parent's education reduces or removes own education effects. The empirical literature does not give a consistent outcome. For instance Behrman and Wolfe (1987) find own education becomes insignificant when the parent's education is also controlled in Nicaragua; but Joshi (1994) finds a contrary outcome in Nepal.

With regard to children, anthropometric measures (height-for-age and weight-for-height) are examined in addition to the health measures, incidence of illness and its duration. The main question asked is whether parental education favourably influences these health outcomes of children. The variety of health indicators analysed provides an opportunity to observe whether parental education has consistent effects on different dimensions of health outcomes. They can also act as sensitivity checks for each other, although the health outcomes are not strictly comparable. This is because morbidity is self-reported and therefore subjective; largely influenced by the socioeconomic characteristics of households and errors (most likely recall). However, anthropometric measures, albeit also subject to some errors[11], are the more objective of the two. The comparison is on whether education is found to be beneficial in all the measures.

In order to assess the full effect of education without the carry-on effect of other socioeconomic or policy indicators highly correlated with it, some of the latter including income and location are controlled in the empirical model. For example, education and income are positively correlated, hence omitting income from the specification will cause an upward bias of estimates, as education will not only show its own effect but also reflect the effect of income. Therefore with the aim of analysing the impact of education without the indirect influence of income, an

[11] Measurement errors due to inaccurate alignment of children on measuring boards or recorded figures, officials might forget to recalibrate scales, not to mention variation in for instance a child's weight over the course of a day or across days (Strauss and Thomas, 1998)

alternative specification holding household expenditure (used in accordance with the permanent income hypothesis) constant is conducted. These control variables are also briefly discussed later in the study for possible direct influence and policy relevance.

Regarding expenditure, one of the interests is to find whether its inclusion removes the significance of education, as education might be reflecting its effect on expenditure, or they complement each other. Controlling location also distinguishes quality and availability of facilities between rural and urban communities as well as regional differences. Further analysis is also made by separating the full sample of both the children and adults' samples into rural and urban sub-samples with the aim of observing possible differences in the educational returns on health in these areas. There is also the added benefit to control additional variables observed at community levels in rural areas only.

Introducing these controls into the model does not only imply that estimates of education would be indicating a more direct influence but it is also likely to reduce the potential bias of education due to correlation with unobserved variables in the error term. This bias, which could be as a result of endogeneity, might occur because there exists multiple connections between education and health, as well as other socioeconomic variables. The fundamental argument here is that education affects health, and health affect education; and there are common factors such as genetic endowment, social background or time preference that simultaneously affect both education and health, which contribute to the correlation between them. In order to avoid reverse causality as well as a possible correlation with the error term due to an omitted or unobserved variable, instrumental variable (IV) approach is required in the estimation of the model.

This could then result in a possible identification of a causal link between education and health. However the outcome is achievable if valid instrumental variables, that is: (1) variables that correlate with education but not health; (2) uncorrelated with the error term, which involves unobserved variables or measurement errors; and (3) not required to be included in the estimating the model as explanatory variables; could be found.

In this chapter, we attempted the use of the instrumental variable procedure in a two-stage least-squares (2SLS) approach but achieved few successes with a pass at the validity test. However, various statistical indicators, which are discussed in details under the methodology section, suggest the instruments are weak. Therefore proof of the causality effect of education on health is performed under only one section (the estimation of child's incidence of illness). All the models in the remaining sections, and indeed those under the fertility theme in the next chapter are estimated with education presumed as exogenous. This approach has been used in similar studies such as those by Thomas et al., (1990; 1991), Appleton (1991), Alderman and Garcia (1994), Glewwe and Desai (1999), Jalan and Ravallion (2003), Cooper et al., (2006). Consequently, where possible, relevant and available control variables are included in the model specifications to minimise the influence of unobserved factors or omitted variable bias.

The ensuing estimates of education in this thesis might then be indicative of association rather than causal relationship with the dependent outcomes due to the potential problem of endogeneity. This is a primary limitation of the study. However, the source of bias could be regarded as less serious in the analyses of the educational returns, especially adults', because most investments or decisions about education inputs would have occurred early in the lifecycle (Currie and

Madrian, 1999). The discussion of estimates in this study might sometimes appear to be causal due to the ease of interpreting results as "effects", but it must be borne in mind that the relationship is most likely not causal.

The effect of education or more precisely adult/parental education on child's health has usually been found beneficial. However, studies on developing countries frequently use health indicators such as child mortality and anthropometric measures (see Appendix A–1). This restricts health information to only a sub-section of the household (children) with the health knowledge of the remaining members thus neglected. Many detailed studies have also been conducted on the anthropometric indicators on Ghana (see Lavy et al., 1996; Asenso-Okyere et al., 1997; Glewwe and Desai, 1999; and Blunch, 2004). However, very few have been conducted on the prevalence of illness and its duration. It is valuable for the purposes of policy making to explore several other dimensions of health, for consistency of evidence found regarding the relationship between education as well as other socioeconomic variables and health status. Further, there is limited research on adult health, particularly in Sub-Saharan Africa (SSA) where the subject appears to have been neglected. In the case of Ghana for example, there is none, except for Schultz and Tansel (1993; 1997) who estimated the duration of adult's illness as a first-stage regression to a final analysis of a wage function as well as labour supply and annual earnings. This study therefore contributes to research in the area by filling this gap.

This study also adds to the body of research in the area by examining the sensitivity of results using two survey data from the same source but a decade apart; two rounds of the national household surveys conducted in 1987/88 (GLSS 1) and 1998/99 (GLSS 4) are used in this study. This is contrary to existing studies on the subject of health, which used only one of the rounds of the living standards surveys (and there are five rounds on Ghana now), or the demographic and health surveys datasets or personal data collection in some particular regions. The concurrent use of the data sets allows for a comparison analysis over the decade, to the extent that the data permits, and also serves as a robustness test. The novelty in this approach is to better comprehend the assessment of health status in Ghana.

2.1. Literature Review

Evidence on the influence of education and other socio-economic determinants of health is discussed in this section. The focus of this literature review is mainly but not exclusively restricted to studies on Africa. The aim is to collate current research on the topic to help validate and add to existing deliberations on the relationship between education and health in the region. A summary of some of the literature reviewed is presented in Appendix A–1.

Of the many factors that influence health outcomes, education has been identified as one of the most prominent. Grossman (1972) in his seminal work outlined the important role of education in improving the efficiency of health production by individuals and households. His theory is built around the assumption that individuals initially have a stock of health that depreciates over time, but could be forestalled by investing in the health capital. This investment in health is part of an overall household production function and would vary based on household decisions. This therefore shows that the level of health is not exogenous but dependent on the resources allocated to its production. He showed that one of such resources is education. There is extensive empirical research that confirms the importance of education on health outcomes. Some of which are discussed here but a lot more could be found in Ware (1984), Behrman and Deolalikar (1988), Hobcraft (1993), Currie (2000) and Cutler and Lleras-Muney (2006) for both developing and developed countries.

The studies on health outcomes in developing countries are largely skewed towards children. Many concentrate on health indicators such as survival/mortality and anthropometric indicators with few attempts at estimating morbidity (Blunch, 2004). Sensitivity analysis is usually the reason for most studies that include morbidity, for example, to check if their findings on the main health indicators are robust. However, there are a handful of notable studies whose primary objective is morbidity. Two of these are Appleton (1991) and Lawson (2004) who do not only examine children but also adults in four African countries. Studies on adults' health are scant in Africa not to mention those concerning the immediate physical well being of a person. Wolfe and Behrman (1984) and Behrman and Wolfe (1987) have also undertaken a significant number of studies on adults but mainly on women (mothers) in Nicaragua.

The effects of education on morbidity are mixed, at least for adults and as yet inconclusive in Africa and for other developing countries. However for children, the relationship is commonly noted as positive, where in this case education is rather parental education. Appleton (1991) analysed socioeconomic health determinants in Kenya, Tanzania and Cote d'Ivoire using the countries' various household living standard surveys. He analysed children and adults separately, and also gives attention to gender and residence for each country. He finds that education is significant in only Kenya and rural Cote d'Ivoire but not in a consistent pattern. In Kenya, where health status is measured as number of diseases suffered, women with primary level education are observed as likely to report more ailments, whilst those with secondary level education tend to report less, compared to no education. On the other hand, men with secondary level education are noted as having higher tendencies of reporting ailments. In rural Cote d'Ivoire, adults' own education does not have any effects on the incidence of illness, but rather the education of the senior male and female reduces and raises household members' probability of falling ill respectively.

In the same study, he finds maternal education to be positively associated with child's illness in almost all the countries where education was statistically significant. In some of these countries, paternal education was found to be significant and that also suggested a positive association. This gives the general impression that parental education makes children more prone to illness, but the study argues that this may be the result of parents spending less time with their wards due to formal employment. Moreover, educated mothers are less likely to breastfeed for the medically required duration therefore increasing the risk of ill health in children. It is also plausible that the positive correlation between parental education and illness could be reflecting systematic reporting bias. Nonetheless, the study finds parental education reduces the duration of child's illness in these countries.

Similar results on education and morbidity are also noted in a study on Uganda. Lawson (2004) who estimated the effects of education, wealth and other socioeconomic variables on health finds a positive relationship between parental education and morbidity amongst children (school-aged and pre-school). Meanwhile amongst adults, only personal secondary education is found as significant in influencing the tendency to fall ill and shows the expected negative sign. Thus on the whole, the effect of education on health status of children and adults is varied.

In another study in a rural district in Uganda, Katahoire et al., (2004) find evidence on education that suggests that mother's schooling makes no difference on child's incidence of morbidity, defined as fever, cough with fever and diarrhoea. They speculate that their results may be due to the existing poor socioeconomic environment such as poverty, food shortage, insufficient government health services, poor sanitation and unprotected water sources that is likely to cause sickness and malnutrition for children of both educated and uneducated mothers. Nonetheless, those with some education increase the chances of their children's survival by taking advantage of the available preventive health services[12].

Blunch (2004) also modelled child health production in Ghana using literacy and numeracy skills of mothers. He used the GLSS 4 dataset to estimate the effects of maternal skills on illness and other intermediate and final health outcomes. Like some of the results already discussed, maternal education gives mixed evidence on illness. Mother's ability to read English reduces the tendency of child's illness whilst the ability to write English increases it. Also, adult literacy course participation (where health knowledge skills are also instructed) raises the probability of child's illness. However, one of the formal schooling categories is found significant.

These ambiguous results on morbidity are not only found in sub-Saharan Africa but also in other developing countries like Nicaragua (see Wolfe and Behrman, 1984; Behrman and Wolfe, 1987). In these studies, the latent variable approach is used to examine how women's education affects their own as well as their children's health. The analysis also examines the effect of education on three main household health factors (nutrition, medical usage and water and sanitation), and how they consequently affect health status. For women, the latent health status is determined by "days too ill to work", parasitic, medically preventable and therapeutically treatable diseases. Their findings indicate that literate women are less likely to report parasitic and medically preventable diseases. However, their

[12] They find educated mothers are more likely to complete child's immunisation. Thus children could be protected from diseases like tetanus and measles that have vaccines.

being literate does not have any statistically significant influence on days of illness and therapeutically treatable diseases. They also did not find women's schooling is directly influential on their own health status when the above health indicators are put together. On the other hand, Jalan and Ravallion (2003) find mother's education improves child's health (reduces prevalence of diarrhoea and its duration) in rural India, as expected.

Unlike the findings in most developing countries, those on developed countries mostly provide beneficial evidence of education influencing health. One of such is the study by Cooper et al. (2006) of 13 European countries using a household panel data from 1994 – 2002. They used duration analysis and accounted for unobserved individual heterogeneity by correcting for frailty using the inverse Gaussian distribution. With the duration of good health (where a relapse to bad health occurs when one suffers a physical and mental health problems, illnesses and disabilities) as the health measure, they observe that education has positive effect in ten of the thirteen countries namely Germany, France, UK, Ireland, Italy, Greece, Spain, Portugal, Austria and Finland. Education is however not found statistically significant in the remaining three: Denmark, the Netherlands and Belgium. Doyle et al. (2007) also finds parental education reduces ill health in children in England, with or without the control of income. However when instrumental variables are used to estimate the effects of education, only maternal education retains its influence. They thus conclude that maternal education is more important to child's health, as indeed others have also noted.

A drawback to the studies in SSA so far is that none appears to have checked the robustness of the results using instrumental variables approach, considering the possible endogeneity of education. This raises the question of whether the problem of endogeneity is the cause of the mixed evidence on education and morbidity observed in SSA and other developing countries? This is probably not the case, as very few studies in SSA that attempted to solve the problem of endogeneity do not give very reassuring evidence. In some cases, education is found influential only through indirect means (Glewwe, 1998) and might not always be significant (Blunch, 2005). The health measures used in these cases however are height-for-age and mortality; none has been done on estimates of morbidity[13].

The use of reduced form estimation by Glewwe (1998) finds that mother's schooling raises the height-for-age of children aged 5 and below in Morocco when schooling is assumed exogenous. However the relationship is weakened, both in magnitude and significance, with fixed effects estimations. Further estimations of the same models, where maternal education is treated as endogenous found the relationship statistically insignificant. The instrumental variables used in this case are the educational levels of both parents as well as the number of married sisters of the mother. But the study finds an informative pathway by which mother's schooling indirectly increases child's height. This is termed health knowledge[14], which is acquired outside school but made possible or improved by schooling through literacy and numeracy skills. Female schooling thus becomes important in the long run.

Following a similar procedure using the GLSS 4, Blunch (2005) finds a negative association between formal maternal schooling and child mortality in Ghana. The

[13] To the best of the author's knowledge.

[14] Instrumented with the mother's parental schooling, whether husband was born in current residence, number of married sisters of mother and her husband, number of radios and television in household and the availability of local newspapers.

instrumental variable approach is however only significant in rural areas where adult literacy course participation[15] as well as literacy and numeracy skills reduce child mortality substantially relative to the OLS. Using IVs (interactions between maternal birth cohort and region of birth) for the educational variables did not find education statistically significant in determining child's mortality in urban areas or indeed the full sample. However they enhanced the influence of literacy course participation and sometimes, formal schooling on the intermediate health measures (postnatal care and vaccinations) examined.

Due to the difficulties (not to mention the cumbersome estimation process) of the instrumental variable approach, with few satisfactory results with using data from SSA, most studies directly control variables that are correlated with education and may also affect health in reduced form estimations. Some of the unobserved factors too are controlled using parental family background or endowment (see Behrman and Wolfe, 1987; and Joshi, 1994). Although these procedures improved the specification models on health, the results are not always consistent and thus inconclusive with regard to morbidity[16]; but frequently beneficial with the other health measures such as height, weight and mortality.

For example, Desai and Alva (1998) upon analysing 22 developing countries using demographic health surveys conclude that maternal education improves child health as measured by infant mortality, height-for-age and immunisation. (The study however cautions that maternal education may be acting as proxy for socio-economic effects. This is because its magnitude decreased in two (infant mortality

[15] This is also where some of the direct health knowledge on family planning, immunisation, safe motherhood and child care, and safe drinking water are acquired. And rural areas are noted for higher participations, where formal schooling is also low.

[16] The earlier studies cited controlled some of these variables and still found the mixed results.

and height-for-age) of the three health outcomes with the introduction of access to piped water and toilet facilities as well as father's education and community fixed effects). They find persistent negative relationship between maternal education and the probability of infant mortality. Infants of mothers with primary education are less likely to die relative to infants of mothers with no education whilst the least likely infants to die are those of mothers with secondary education, ceteris paribus. The relationship is found significant in 11 countries for maternal primary education, 15 countries for secondary education, and jointly significant in 14 countries. Height-for-age and the immunisation status of children are also positively linked to maternal education in their study.

Similarly, Frost et al. (2005) using the Bolivian demographic health survey assents to the positive link between maternal education and child's height-for-age. Like Desai and Alva (1998), the magnitude of the impact decreases with the inclusion of other socio-economic determinants.

Further evidence of the positive relationship of education, not only of mother but also father's education, is observed in Brazil on child's height and survival (Thomas et al., 1990; 1991), rural Nepal (Joshi, 1994) and Uganda (Lawson, 2004) on child's height and weight, and in Ghana (Lavy et al., 1996) on only height at higher levels of education. Alderman and Garcia (1994) also found that maternal education improve child's height and weight but father's education was not significant. Their findings on father's education are not exceptional. Glewwe (1998) noted similar results in Morocco. However, there are certain estimations that show paternal educational influence instead of the usual mother's education. Lavy et al., (1996) provide evidence for such an outcome in their analysis of weight-for-height in Ghana.

An earlier study by Behrman and Wolfe (1987) in Nicaragua explains that the positive effect of mother's education on child's health is only a reflection of the unobserved factors of the mother's background. Thus the control of these factors with the mother's childhood endowment (her mother's schooling, urban childhood, mother and father present during her childhood and number of siblings) renders mother's education insignificant. However, Joshi (1994) found maternal education still significant in raising child's height after controlling for the mother's parental education.

Despite a reasonable number of studies showing favourable effects of maternal education on child's anthropometry and mortality, there are few that show weaker links and even statistically insignificant relationships. In Ghana for example, Lavy et al., (1996) observed a rather weak relationship between maternal education and child survival. They however found nutritional status of the mother to be one of the very influential factors and suggest that improving the health of mothers rather than their education would increase the survival rates of children. The weak and sometimes insignificant relations of maternal education also emerge in other studies on Ghana using data from GLSS 1 or GLSS 2. One such study of Asenso-Okyere et al., (1997), find neither years of mother's schooling nor literacy influential in improving the height and weight of children respectively. It is however not clear why they used different educational measures for height and weight in their study. Glewwe and Desai (1999) also do not find mother's years of schooling significant in raising child's height, but rather mother's mathematics scores (the only amongst the cognitive tests scores) seem significant in increasing the child's weight-for-height. They thus speculatively conclude that skills (mathematics) and not innate abilities (Raven's test score) improve child's health (weight-for-height).

It is worth mentioning that almost all the studies reviewed took account of income or related variables that capture household wealth. This is with the view that education is highly correlated with income and a disaggregated effect of each is desired more than one carrying the effect of the other. Also more often than not, it is income or the household wealth that is treated as an endogenous variable. This is probably because of the availability of instruments for household wealth in most of the household surveys used. Despite solving this econometric problem, the effect of income holding education constant also shows mixed but fewer perverse results on health. Wolfe and Behrman (1984) argue that the sometimes-perverse effects of income (and education) on health result from a possibility of altered consumption patterns due to taste changes associated with more resources (or schooling).

Appleton (1991) for instance finds that predicted consumption income per capita reduces the probability of an individual falling ill amongst adults in urban Cote d'Ivoire, whereas amongst children the effect is perverse. The study also finds that livestock per capita and land per capita reduce the duration of child illness in Kenya but a reverse effect is found in Tanzania with regard to land per capita. Glewwe and Desai (1999) on the contrary find land is not statistically significant in determining child's health in Ghana. Mackinnon (1995) that finds real expenditure improves the health of children (weight-for-height) in Uganda, which is also confirmed in a different study (Lawson, 2004) of the same country. Lawson (2004) notes that a raise in income significantly lower the probability of sickness for male adults and female school aged children. Studies that also show favourable effects of income on health status include Alderman and Garcia (1994), Glewwe (1998), Jalan and Ravallion (2003) and Haddad et al., (2003).

In sum, the effects of education mainly seem influential and improve health in SSA depending on the indicator of health understudy. For anthropometric measures and mortality, which is mainly for children, education of the mother (and sometimes father) becomes very valuable. With regard to morbidity, the outcome appears to be more deteriorating for children with educated mothers; but the children benefit by experiencing shortened duration of illness (Appleton, 1991). However, the results for adults are mixed and very few have been estimated indeed, not to mention over a set period of time. Further, none of the studies attempted to use the instrumental variable approach in the estimation of education on morbidity. These are some of the gaps that needs filling in SSA and especially Ghana; and this study contributes to that cause.

2.2. METHODOLOGY

This section draws on theory to examine the relationship between education and the production of individuals' health in households. Household members are separated into children and adults. The models to be estimated are therefore specified to analyse the effects of parental education on child's health, and personal education on adults' health. Description of the data and estimation strategies are subsequently discussed.

2.2.1 Conceptual Framework

The conceptual framework of health production is based on the theory of household production that has health as one of its arguments in maximising utility. This study adopts Pitt (1993) model, which assumes household maximises utility thus:

$U_i = U_i\ (H_i, F_i, C_i, L_i, \partial_i)$ ……………………………………………(1)

where H_i is the health production function, F_i is food which is consumed for reasons other than nutrients, C_i is all other commodities consumed, L_i is labour supply and ∂_i is leisure. He explained that the health of household members as well as the consumption of food, other commodities and leisure increases their utility whilst labour may have decreasing effects on utility due to its detrimental work efforts on health. The utility is subject to a set of constraints including health production, time and income.

The health production unlike other household productions is biomedical where each individual is born with a degree of healthiness that depreciates over time. The health produced could either be final health outcomes such as morbidity and its duration, anthropometrics, mortality or intermediate health demands including usage of medical services for either treatment or prevention of ill-health, for example, immunisation, pre- and post-natal care. The production function however depends on consumers' own time as well as market and non-market goods including health inputs. It thus involves costs, resource availability, tastes and random and non-random environmental factors (Pitt, 1993). Health is therefore modelled as a function of nutrients from foods, non-food health inputs, time and labour conditional on the education, socio-demographic characteristics, such as age and gender, and innate healthiness. The health production function is thus:

$H_i = H_i\ (N_i, Z_i, T_i, L_i, v; E_i, A_i, G_i, \mu_i, e_i)$……………………………………(2)

where H_i is the health of individual *i* in the household, N_i is nutrients from food consumption and Z_i represents all non-food health inputs. The non-food health inputs includes the availability and individual consumptions of amenities, such as immunisations or other medical services/treatment; household public goods, such as water, sanitation and housing qualities. T_i is the time household members assign to health related activities including food preparation, housekeeping and childcare, whereas L_i constitutes labour supply and v is regional specific health attributes, such as rainfall, drought and the existence of rivers with its links to parasitic and communicable diseases. Nutrients from food, health inputs like medical services, time and labour are under the control of individuals with parents or adult members of households making the decisions for children. These aforementioned choice variables may depend on education (E_i), age (A_i) and gender (G_i). The health production of people also varies with their own innate health endowment (μ_i), which may be unobserved, and measurement error (e_i).

The second constraint is time; where household members invest their total time (T_i) in work where wages are earned (W_i), health and care related activities in household ($\prod_i$), farm production and processing in farming households (Q_i) and leisure (∂_i). The total time constraint thus become:

$T_i = W_i + \prod_i + Q_i + \partial_i$ ………………………………………………(3)

The third constraint, wage, is also affected by health through productivity. Therefore where market rewards health related productivity differentials, wage (W_i) becomes a function of health, and intensity of effort required in chosen occupation (labour). Wage also varies with education, age, gender, ability and community characteristics that affect labour demand. Thus:

$W_i = W_i\ (H_i, L_i; E_i, A_i, G_i, I_c, a_i, e_i)$ ………………………………………………..(4)

where H_i, L_i, E_i, A_i, G_i and e_i are as previously defined; I_c represents community characteristics like infrastructure and culture and a_i captures unobserved characteristics such as ability.

The final constraint is household budget based on their incomes, which is the household total income (Y_{hh}) made up of earned [$W_i(E_i).L_i$] and unearned income (K_i). The earned income involves wage acquired as a result of labour supplied in a given time period. The unearned income is from remittances.

$Y_{hh} = W_i(E_i).L_i + K_i$…………………………………………………..(5)

Household spending is also restricted since people cannot spend more on commodities and health inputs than their total income, giving an expenditure equation such as:

$Y_{hh} = P_h.H_i + P_c.C_i$……………………………………….(6)

where P_h is prices of health inputs including food and non-food and P_c is prices of all other commodities. The income equation thus becomes:

$W_i(E_i).L_i + K_i = P_h.H_i + P_c.C_i$……………………………………….(7)

Maximising the household utility subject to its constraints yields a generic health production thus:

$H_i^* = h_i^* (N_i, Z_i, T_i, W_i(E_i).L_i, K_i, E_i, A_i, G_i, I_c, v, \mu_i, e_i)$…………………………..(8)

However, the health inputs (N_i, Z_i, T_i) are choice variables, which have either cost in money and/or time. Thus, substituting the price of the choice variables as well as generalising community characteristics (I_c) to rural/urban residence (R_i), and inserting into equation 8 gives a reduced form demand function:

$H_i^* = h_i^*(P_f, P_{nf}, W_i(E_i).L_i, K_i, E_i, A_i, G_i, R_i, v, \mu_i, e_i)$…………………………..(9)

where P_f is price of food, P_{nf} is price of non-food health inputs which does not only cover the direct price but also the opportunity cost of acquiring such inputs.

It should however be noted that equation 9 could also be used to estimate the food and non-food health inputs because households simultaneously choose these variables; quantity or accessibility of which is dependent upon their income and time, which is also influenced by education. These choices also depend on the characteristics of the household, the health endowments of its members and community that are outside the control of the household. Such characteristics include the initial asset of the household, parental background including schooling, family values and individual intelligence, community socio-economic and health infrastructure. In effect the exogenous determinants and households' choice variables are same for both health outcomes and inputs.

A drawback of the framework is that it captures only one-period of the individual's life cycle featuring the effects of current factors on current health, which is probably correlated with past health status or activities. Thus investment in health is unobserved. Despite this shortcoming of the model, some information is gathered on how individual and family health is determined. One of such important information is individual or parental education, which is also of policy relevance in a developing country with relatively few health infrastructures. It is noted in the conceptual framework that education influences many of the arguments in the health function as well as common factors that may influence both education and these arguments. This presents econometric problems of endogeneity and simultaneity in the empirical estimations of the model, which are discussed in the next section.

2.2.2 Empirical Specification, Estimation Strategies and Data

Equation 9 shown in the framework suggests individual's health is affected by the prices of food and non-food health inputs, education and income, age, gender and community characteristics as well as the innate healthiness. However, not all of these factors are available in the data used for this study. For instance the price of food and some non-food health inputs (like medicines) are collected only at the community levels in rural areas. Other non-food health inputs such as household public goods are not collated by their prices but by their availability in households. This section therefore explains the specification, data and econometric strategies used in our analysis of the effects of education on health.

First of all, we adapt equation 9 to model a health function with education as its main determinant controlling for age, gender, rural residence, and regional characteristics. This is done with the assumption that the influence of variables, such as income, and of non-food health inputs, such as the availability of household public goods and medical treatment are all captured through education, which tends to increase their acquisition or usage. Thus the model to be estimated is:

$H_i^* = h_i^*(E_i, A_i, G_i, R_i, v, ø_i)$……………………………..(10)

In order not to neglect the available price data, which apart from having direct effect on health could also act as control on education, a model for only rural areas is specified as:

$H_i^* = h_i^*(E_i, P_f, P_{nf}, W_i, A_i, G_i, v, ø_i)$……………………………..(10')

A model for only urban areas is also estimated using the same model as equation (10) but without (R_i). Apart from the community level data that is available for only the rural sub-samples, separating the estimation models into rural and urban also presents an opportunity to observe whether education relates to health differently in the two areas. This is because the availability and quality of infrastructure is different (better in urban than rural areas). Besides, rural communities are more attached to their traditional/cultural values, and may have different outlook on health that could be captured in the sub-sample estimates.

For both equations 10 and 10', clearly the observed variables are education (E_i), prices (P_f, P_{nf}, W_i)[17], age (A_i) and gender (G_i), rural residence (R_i) and regional characteristics (v) represented by dummies for region of residence. The unobserved variables ($ø_i$) are innate healthiness (μ_i) of members in the household, measurement errors (e_i) from education and health, and others such as ability and quality of education to mention a few. These unobserved variables are also influential because in the empirical analysis, they might under- or over-estimate the effects of the variables of interest. Also, their control (or lack of it) partly determines whether the relationship estimated is causal or just correlation, which brings to fore the problem of endogeneity in the model specified above.

Indeed only few of the variables estimated could be termed as exogenous in the strictest sense and they include age and gender as well as prices of goods and services at community levels. Education on the other hand is endogenous because of the reverse causality of health on education as well as possible common factors such as ability, motivation or even inherent interest in the outcome, genetics or social background that affect both health and education. The heterogeneous effects of education also makes investigating its causal effects challenging since it is likely to be rather associational. Instrumental variables are usually used to correct for the problem of endogeneity. However, the search for valid instruments, that is, variables that are highly correlated with the endogenous variables but not the error term as well as proved not to belong to the main estimated equation is difficult to achieve. Instruments found for this study failed the validity test for some sub-samples and in others, indicated as weak instruments (details are

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[17] P_f is price of food: maize; P_{nf} is price of non-food: medicine and distance to the nearest clinic; W_i is wage: agricultural wage rates for men, ratio of women to men and ratio of child to men. Agricultural wage rates are included here because they are fixed, and to a large extent do not vary with education.

discussed under the results section). Following such an outcome and also to have comparable estimates, both the Ordinary Least Squares (OLS) and Two-Stage Least Squares (2SLS) are estimated. However, only the results of samples that passed the over-identification test are presented, for the latter.

From the conceptual framework, it is also observed that in addition to having a direct effect on health, education also has indirect effects through income (Y_{hh}). In order to isolate the effect of income that is likely to be picked up by education, variants of the health model outlined in equations 10 and 10' are specified to include household expenditure. Thus equations 10 and 10' become:

$H_i^* = h_i^*(E_i, X_{hh}, A_i, G_i, R_i, v, ø_i)$………………………………..(11)

$H_i^* = h_i^*(E_i, X_{hh}, P_f, P_{nf}, W_i, A_i, G_i, v, ø_i)$………………………………..(11')

Wherefore equations 10 and 10' could be described (and known from now in this chapter) as variant 1 (where education is estimated) and equations 11 and 11' may be referred to as variant 2 (estimates education conditioning on household expenditure (X_{hh})), for the full (as well as urban) and rural sub-samples respectively. These different estimations are also performed because the education coefficient in variant 1 may overestimate the overall effect of education as a result of an upward bias due to a positive correlation between education and expenditure. Variant 2 reduces such a bias. Household expenditure is used in the equations instead of earned income because income fluctuates more in the farming and business sectors of the economy; and they are the major employers in the country. Besides, current income is subject to more measurement error, which maybe due to deliberate under-reporting whilst expenditure on the other hand may capture long-term income effects. Economic theory also suggests households try to smooth expenditure over the life cycle.

Similar to education, expenditure does not only have a direct effect on health, but also there exists a reverse causality of health on expenditure. Whereas expenditure or wealth may increase the ability of individuals to invest more in health, a better health also enables individuals to work and therefore earn more. Again, there may be some common unobserved factors such as ability and innate healthiness ($\emptyset_i$) that influence health and expenditure, as well as education when all are considered in the same equation. In view of such inter-correlations amongst education, health and expenditure, as well as the unobserved factors that simultaneously affect all, there arises a need for instrumental variables to solve the likely econometric problem of endogeneity that may arise. Expenditure is therefore treated as an endogenous variable in variant 2, and identifying variables are substituted for it. Unlike education, IVs for expenditure are relatively easier to find and those used are explained in the section where explanatory variables are described.

Additional versions of equations 11 and 11' are also estimated where instead of expenditure, unearned income (remittances and 'other' income) is used in the estimation. This version is described as variant 3, and unearned income is assumed exogenous[18] to be compared with instrumented expenditure. An advantage of the use of unearned income is that the occurrence of ill health is not anticipated to terminate its flow or acquisition unlike expenditure.

[18] This is true only if transferred monies are not as a result of ill health or as a result of migration to search for 'greener pastures' to improve household income.

Another variable of interest especially for a developing country is household public goods: availability of water and sanitation in the households. These form part of the health inputs in the conceptual framework outlined in the previous section. Including water and sanitation in the model is somewhat important because they act as control variables in estimating the effects of education, with or without expenditure. They also have direct impact on health because most communicable diseases could be prevented with increased availability of safe drinking water and human waste disposal. Subramanian (1995) for instance notes that most morbidity and mortality in Ghana result from poor environment and sanitation conditions that are largely preventable. Mustard (1990) cited in Joshi (1994) also indicates that maternal education is of limited effectiveness in protecting children where extensive sources of infection are present. Therefore it seems relevant to separate their effects from income and education by adding them in the reduced form health model. Besides it is imperative to know, for the sake of policy, the independent effects of these household public goods since its supply is not universal. Even in some higher income communities, frequent water interruptions and fewer/no toilet facilities in neighbouring communities could spread communicable diseases across areas with none of these problems. Therefore variants 1, 2 and 3 of the reduced form model described above are also estimated controlling for the availability of water and sanitation in clusters.

However, these are choice variables and households' decision to acquire them might be based on income and education. These health inputs are also simultaneously determined with health production and therefore make them endogenous. However there are no instruments or their prices in the data to solve for this problem. Indeed several studies that control for household public goods including Appleton (1991), Lawson (2004) and Blunch (2005) do not treat them as endogenous because the living standards survey data do not contain information to be used as instruments. In order to overcome this and somewhat avoid the potential endogeneity problem, community averages (calculated as cluster mean value of households y exclusive of household y_i) of these variables are used.

Health [$H_i^*(\bullet)$] is multi-dimensional in measure, which in this study represents outcomes like self-reported illness and its duration, as well as the anthropometrics (height-for-age and weight-for-height). For this study, all these measurements are estimated using the econometric specification (variants 1, 2 and 3) described above. For morbidity and its duration, the analysis is divided into two; children (household members below the age of 16 years) and adults (household members who are 16 years of age and above), whilst the anthropometrics are estimated for only children. The Ghana Living Standard Surveys (GLSS), Rounds 1 and 4 are the data used in this study. Both data sets have a section on health where all household members are asked about their health condition in a given period of time prior to the survey: this is four weeks in GLSS 1 and two weeks in GLSS 4. Details of variables used are discussed below.

2.2.2.1 Dependent Variables

Morbidity

The incidence of illness, the first health outcome estimated in this study, is observed at the individual level in the data. The question asked is whether the respondent has suffered any illness or injury in the above-specified period before the survey. The reported illness in the questionnaire is non-clinical, that is not backed by any medical confirmation. It is entirely based on the response of the individual or heads of households for their families. The GLSS 1 questionnaire gave examples of illness as cold, cough, diarrhoea and injury due to accident. Indeed these are not exhaustive but cover some of the common early symptoms of prevalent diseases in the country including malaria, HIV/AIDS, respiratory and chest infections. It is however still possible that other illnesses with unrelated symptoms as referenced in the questionnaire as well as those unknown, concealed and/or respondents presume as shameful enough to be disclosed would be lost. This could lead to the underestimation of ill health and hence a potential drawback of this study.

The incidence of illness may also suffer from measurement problems due to the nature of response. The problem could arise as a result of re-call periods and subjectivity influenced by socioeconomic status. With regard to re-call periods, self-reported information on illness or injury may be subject to positive or negative bias due to inaccuracies as a result of memory decay as well as under-reporting where respondents might be answering on behalf of others (Mock et al., 1999). A study on injuries in Ghana notes that the rate of decline of re-call is influenced by its severity. Mock et al., (1999) finds injuries involving less than 7 days of disability show 86 percent estimated rates of decline from one month to a 12 month re-call period; whereas injuries resulting in more than 30 days of disability show minimal decline. They concluded that longer re-call periods significantly under-estimate the injury rate compared to shorter ones. They thus suggested that shorter re-calls of 1 – 3 months should be used when overall non-fatal injury incidence rate is calculated. The re-call period of both surveys used in this study is within the suggested period but the indicator includes both illness and injuries, with the latter constituting a lesser proportion of response of the two. Thus, the bias as a result of re-call errors may not be as negligible as observed in the injury studies.

Reported illness is subjective because they maybe interpreted differently by individuals based on their education, income and age (Pitt, 1993) or may reflect sensitivity rather than illness itself (Appleton, 1991). Systematic reporting bias may also occur due to information the individual already has, most probably as a result of prior use of medical care (Strauss and Thomas, 1998). Hence conditional on a level of health status, those likely to report better health are those with less exposure to the health system (ibid). Therefore given that low-income households are less likely to seek health care, especially in a country where health care operates a "cash and carry" system, they are also less likely to report ill health. Linked to income, in the use of medical facilities and therefore increased probability of reported ill health, is education and region of residence. As educated people and urban residents have increased accessibility and/or availability of health facilities, they tend to have more information on their health status and therefore more likely to report illness. This subjectivity of self-reported illness could lead to a spurious relationship with education and income; and this has been noted in studies such as Appleton (1991) and Lawson (2004), especially regarding children.

Despite the subjective nature of morbidity and measurement problems, it still seems a relevant subject for research because it is informative and gives useful indication on health in the absence of an objective or clinically verified measure. Strauss and Thomas (2008) for instance suggest that self-assessments of health and health behaviours do not only provide important insights into the distribution of health and the characteristics associated, but also reflect intrinsic health. It has also been noted that self-reported health is positively correlated with clinically confirmed diseases (Fayers and Sprangers, 2002 cited in Groot and van den Brink, 2006). In addition, not all the determinants of health status may be highly related to the measurement error of self-reported illness. Some household public goods, community variables and prices could independently determine the incidence of illness of an individual too. Finally, only morbidity as a health measure is available in most household surveys, which also contains information on children and adults as well as gender.

The incidence of illness is estimated using a binary probit model due to the dichotomous response to the question on health status. The specified equations in variants 1, 2 and 3 are therefore estimated as a probit function thus:

$Prob(p=1) = probit\ h_{ill}^{*}(\bullet)$……………………………………………..(12)

where *p* is the probability of falling ill indicated as "1" and zero otherwise. This is estimated for the full sample as well as the urban and rural sub-samples as outlined in the specification section.

The Duration of Illness

This is the number of days an individual suffers illness or injury preconditioned on illness in the requested period prior to the survey. As noted in the conceptual framework, the same variables essentially determine both illness and its duration. Two econometric problems are however immediately noted in the estimation of this health outcome: censoring and sample selectivity bias. The duration of illness is both left- and right-censored. Left-censored because only days ill, four and two weeks before the survey in GLSS 1 and 4 respectively, are reported. Thus illnesses that have lasted over four and two weeks are reported as 28 and 14 days respectively. The data is also right-censored because the most recent illness within the requested time period may continue after the survey but there is no information regarding this in the data. The problem of sample selection also arises because the duration of illness is observed on people who only reported sick.

One of the solutions to the econometric problem here is to use a Tobit model. Only the left-censor could however be controlled because whether an individual was still ill after the period was not reported. The Tobit model translates the specified equations with arguments as described with variants 1, 2, and 3 into:

$h_i^* = tobit\ h_{dur}^*(\bullet)$…………………………..(13)

where h_i^* is the latent variable, the duration of illness, observed only when $H_{i(dur)}^*$ is greater than zero, and zero otherwise. A disadvantage of the Tobit model is the assumption that the same probability mechanism generates both the probability of illness and its duration. To allow for the possibility of separate mechanisms, a two-part model with a binary probit that models prob (duration > 0) with a subsequent linear regression modelling E (duration | duration > 0) with an identifying instrument for selectivity is required. However exclusive restricting variables are not found in the data, without which the interpretation of selectivity bias must be treated with caution due to a bivariate normality assumption resulting from lack of identifying instruments (Cameron and Trivedi, 2010). Therefore only the Tobit model is presented.

Anthropometric Measures

The anthropometric measures are based on long-term (height-for-age) and short-term (weight-for-height) health indicators. Compared with a standardised international height and weight given age and gender, the height and weight of children, especially of age five and below are calculated to indicate their health status. Although regarded as the more objective measure of health status, the anthropometric indictors are typically collected for only young children. This analysis is therefore conducted for only the children sub-samples.

In this study, the anthropometric measures are not only estimated as additional health indicators but also used as robustness check on illness. Even though they cannot be compared, in the strictest sense, they could be used to give credence to the overall effects of education (and also expenditure, due to systematic reporting bias). It also helps in building a general consensus on the overall health status of children in the country as the anthropometrics and morbidity show different aspects of health. In a way, the anthropometrics would not be that "long-term" when compared with illness amongst children; and they are also somewhat correlated. For instance, frequent illness could harm a child's physical development and possibly future health. Case and Deaton (2006) suggest much of the variation in adult height is set by age 4, therefore deficiencies in growth up to that age cannot be made up later.

In order to have another dimension of health status analysed for a more comprehensive outlook of health in the country, the height-for-age and weight-for-height are estimated using OLS with the models outlined in variant 1, 2 and 3. An additional variable, mother's height, is however included in these equations because it is believed to be indicative of the health endowment that is subsequently transferred to children. Controlling mother's height is thus expected to reduce the estimates' bias resulting from unobserved health endowment of the children. However most importantly, it removes physical variation in height that is not health related. The equations estimated here are therefore slightly changed to:

$H_i^* = h_{(haz)}^*(E_i, MH_i, A_i, G_i, R_i, v, ø_i)$ …………………………..(14)

$H_i^* = h_{(whz)}^*(E_i, MH_i, A_i, G_i, R_i, v, ø_i)$ …………………………..(14')

where MH_i is mother's height, $h_{(haz)}$ is height-for-age z-scores and $h_{(whz)}$ is weight-for-height z-scores. All the other variables remain as previously defined. The estimations are conducted for children with complete observations for all the anthropometric measures as well as mother's height. Thus, children in this analysis may include but not necessarily be the same set in the estimations of reported illness. The sample is also divided into two: pre-school (0 – 5 years) and school-aged (6 – 15 years) children. However, for the school-aged sample, weight –for- height z-scores (WHZ) is observed only for children between ages 6 – 10 years inclusive due to the inability of the software to calculate WHZ for ages beyond 10 years.

2.2.2.2 Explanatory Variables

Education (E_i):

The measure of education is number of completed years of schooling and used in this analysis in categorical terms as No education; Primary; Middle & JSS; and Secondary and above. Education is differently represented in the children and adult sub-samples. Parental education is used in the children's sub-sample and personal education in the adults'. An additional version of the adults' model is estimated controlling for parental education as well as personal. This is in a bid to capture some of the unobserved component of personal education, which is correlated with childhood family background or endowment (Behrman and Wolfe, 1987; 1989). This could also mitigate omitted variable bias.

As the theory suggests education is generally expected to improve the health of individuals and their families, and therefore expected to result in lower likelihood to report illness. Education ensures better health status in several ways including better choice of health inputs, increased productivity through increased use of information on health services and healthy behaviours. It is also likely to increase wealth with a consequent increase in spending on good health related activities (Becker, 2007). Education also influences the health of individuals by determining many decisions that appear to affect quality of life, which includes choice of occupation, ability to select healthy diets and avoid unhealthy habits as well as efficient use of medical care.

Education however, upon increasing access to job opportunities, thus increasing the opportunity cost of time, could also worsen health status. This is especially the case with educated mothers (in employment) who tend to have less time to spend at home to care for their children, tend to breastfeed for shorter periods, thus increasing their children's exposure or risk of contracting communicable or immunological diseases amongst others.

As already mentioned, estimates of education might be subject to a potential endogeneity bias. However instruments are found for the children's sample only. The instruments used in the estimation of the children's model for maternal education are the interactions between maternal birth cohort and maternal region of birth. This is adopted from Blunch (2005) who explained that maternal birth cohorts and region of birth are closer, in time and space, to the relevant time period for school attendance and skills acquisition than are school supply and quality variables of the current time period. Also time and region of birth are likely to explain school supply and quality through differential effects for different cohorts and regions following changes in economic and political conditions in Ghana at the time relevant for school attendance and skills acquisition (ibid).

Although the same could be said for paternal education, the restriction test for identification rejected the instruments as valid. Therefore paternal mother and father's education are used in combination with the maternal birth cohort and region of birth interactions as instruments in this study. However as mentioned earlier, these instruments are not found valid in some of the sub-samples estimated. Due to such unsatisfying outcomes after several laborious estimation processes, subsequent models are estimated without instruments for education (as is common in many studies including Appleton, 1991; Hobcraft, 1993; Glewwe, 1999 and Frost et al., 2005).

Household expenditure (X_{hh})

Household expenditure is already imputed[19] and available in the survey data. This comprises expenditure on food, non-food items, water, garbage disposal, electricity, schooling, employee benefits, imputed rent, and durable goods and services. It is included in the econometric estimations as expenditure per capita and its quadratic. Expenditure, like education is expected to improve health status. Therefore in our case, it is expected to reduce the propensity to fall ill; as increased expenditure would ensure greater access to the required nutrients and other inputs for a healthy lifestyle. Also, in a situation that illness is unavoidable, expenditure is expected to reduce its duration. On the other hand, expenditure may result in a reduction in the time for childcare, especially with regard to women who work outside the house for increased earnings, and this may be detrimental to child's health.

As with the education variable, there is the likely endogeneity of expenditure, hence the need for its substitution with instrumental variables. The instrumental variables for expenditure per capita are relatively less difficult to find for all the estimations in this study, unlike education. They include the employment of household head, value of land per capita, durable goods per capita, business assets per capita and room per capita. All the assets are included with their quadratics except for the number of rooms in a household. Their over-identifying restrictions are reported and discussed in the estimated results sub-section.

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[19] See details in the documentation sections of GLSS 1 and 4 surveys.

Prices

The price of food (P_f), non-food (P_{nf}) and agricultural wage rates (W_i) are available at the community level covering only rural areas. Since there could be more than one community in a cluster, average cluster prices are used. The prices of food and non-food are exogenous. Agricultural wage rates are also included in the model as exogenous because unlike formal wage that is dependent on education and health, they are fixed in rural areas. They only differ by age and gender. To some extent, education and age are expected to capture wage effects in urban centres in addition to their direct influence in the health outcomes (Appleton, 1991).

The price of food partially represents nutrients in-take of household members. This is because it is only one of the factors that influence the production of nutrients and likely to underestimate its effects on health outcomes. Other factors include storage and preparation of food, which may change the nutrients of food (Behrman and Deolalikar, 1988). Increased food prices negatively impacts on in-take and thus nutrients and health. Nutrients in developing countries positively affect the health outcomes of individuals and are estimated as one of the important determinants of health (ibid). Controlling for the regional attributes (v) of households reduces the bias of the effects of various prices of food since different types of foods are cultivated and thus consumed in different regions of the country.

The price of non-food is captured as health inputs: price of medicine[20] and distance to the nearest clinic. Similar to the price of food, increased price of medicine reduces its demand to ward off the incidence of illness when early signs

[20] This is the average price of aspirin, paracetamol and nivaquine (an anti-malarial drug)

are noted, thus worsening health status and possibly its duration. Distance to the nearest clinic is also used as a proxy for the price of non-food health input since it serves as the opportunity cost of time to health services. Thus the further health facilities are from communities, the less accessible they become and therefore less likely to be used for preventative care amongst others. This is assumed to be independent, that is, the allocation of clinics is not influenced by the prevalence of diseases in the area, politics or migration (to access better health services).

The agricultural wage rates constitute the total amount of money received as a result of weeding. These are separated into men, women and children. In the estimations however, alongside the men's wage rate, the ratios of women to men and child to men's wages are also used. This is to measure the relative effect of women and children's wages, given their men's counterpart on the estimated health outcomes. Besides, the actual wages are highly correlated and it is expected that the use of proportions could reduce problems of multicolinearity. Increased men's agricultural wage is expected to increase household income and therefore health inputs and improve health status. Increased proportion of women to men's wage rates may have the same effect as the men; but could also be detrimental to child's health due to the opportunity cost of time. Because women are the primary carers of children, the reduction in time committed to child or home care such as breastfeeding, hygiene and food may negatively affect health status. Children who work are also more likely to have worse health status although they contribute to a rise in the household income. They are also more likely to expend more nutrients than they consume, as well as be exposed to hazardous conditions at work, that could easily be managed by adults.

Household public goods

This is measured as the availability of water and sanitation in households. This study adopts the approach by Lavy et al., (1996) of "minimising" the endogeneity of the household public goods. This is where the external effect of non-availability of water and toilet in households is used; calculated as the proportion of "neighbouring" households with no protected water (that is, use water from rivers, lakes and rainwater) or toilet or both in the cluster. It is anticipated that an increase in the proportion of neighbours with unprotected water and sanitation would increase the probability of illness and its duration in households, all things held constant.

Age (A_i) and gender (G_i)

Age and gender are controlled because health production basically varies accordingly, even if individuals belong to the same household and utilise the same health inputs. In the case of age, we note that infants or pre-schoolers easily fall ill due to their less developed immune systems. They are also more prone to bacterial infection with increased mobility and a change in diets from breast-milk to infant formulars and solid food. Improved health starts to be observed after their second to third birthdays in the case of reported illness, two and four years in the case of wasting and stunting respectively (see results on the anthropometrics in this study). The full effect of age may also depend on gender and residence.

Gender is controlled because women at some phase, experience several health challenges due to pregnancy or menopause. It has been observed in the literature that at younger ages, females have better health than males; this increases to a certain age and then the reverse is observed. At very old ages however, females are found to be healthier again than men. In addition, the distribution of health inputs may not be uniform in households and thus females may be more prone to illness due to lesser health inputs; some cultures (not only in Ghana) perceive females to be of less economic importance to the family because they leave home as result of marriage. On the other hand, males maybe given more food or allowed more access to health with the limited resources available to the household because of their perceived higher productivity returns to health.

Mother's height

Mother's height is expected to have a positive relationship with health status as well as the height-for-age of her children. This is because some of their genetic health endowments could be attributed to the health status of the mother.

Regional attributes (v) and Rural residence (R_i)

Regional attributes are controlled using dummies representing the administrative regions of the country. An additional representation is rural, a categorical term indicating rural residence, is also controlled. Ethnicity, which is somewhat linked to the regions, is also controlled to cover the influence of cultural differences on health outcomes and inputs. This is also a categorical term with a dummy equal one representing the non-Akan ethnic group and zero otherwise. The default category is the Akans.

2.2.3 Descriptive Statistics of Variables Used

Tables 2.1-2.3 show the means and standard deviations of covariates used in the estimations of all the samples (children, adults, pre-school and school-aged) as well as by residence at the time of the two surveys understudy. This comprises 2.1: children in GLSS 1 & 4; 2.2: adults in GLSS 1 & 4; and 2.3: the anthropometric measures for pre-school and school-aged children (GLSS 1 only). Table 2.4 shows the summary statistics of the community variables used whilst tables 2.5-2.7 present cross-tabulations of the dependent variables (illness, duration and the anthropometrics) and education as well as other pertinent variables. These tables are discussed concurrently where relevant. The tables also have sub-divisions relating to age (children, adults, pre-school and school-aged) and the various dependent variables. This section as in all the subsequent ones first discusses children in GLSS 1 then 4, and then goes on to discuss adults in the same order.

In the first survey year, about a third of the children are reported ill in the four-week period prior to the survey. And pre-schoolers have a higher percentage of reported illness than school-aged children. Surprisingly, slightly more children are reported ill in urban than rural areas. However, the urban children experience shorter duration of illness relative to their rural counterparts. The average duration of illness for the whole sample is about six and a half days with about a day shorter for urban than rural. Further, about a third of pre-schoolers are stunted (height-for-age z-scores of less than -2) and 6.4 percent are wasted (weight-for-height z-scores of less than -2). These statistics are similar to the findings of Alderman (1990) and Asenso-Okyere *et. al*. (1997) using the same data. The corresponding figures for school-aged children are 26.8 and 6.0 percent. The cross-tabulations also show that boys generally have poorer health status than girls and the only instant that the reverse is true is amongst school-aged children's weight-for-height. For the rest of the indicators, the statistics suggest boys experience higher reported illness, longer duration of illness and are more stunted in both pre- and school-aged children relative to girls. Boys are also thinner for their height compared to girls amongst pre-schoolers.

In GLSS 4, about a quarter of the children are reported ill in the two-week period before the survey. Unfortunately a comparison between GLSS 1 and 4 cannot be made due to the difference in reference periods, however GLSS 4 makes a good source for a robustness check on GLSS 1. For example, unlike GLSS 1, rural children show higher reported illness than urban children and roughly have the same duration of illness (about 5 days). But similar to GLSS 1 boys show higher percentage of reported illness and slightly longer duration than girls, especially in rural areas. This raises a question of whether there is an element of discrimination whereby boys are more favoured so receive more attention, and would quickly be noted when they fall ill or they are actually less healthier than girls. Other suggestions made in the literature are that since boys feed more, they are weaned or given complementary foods earlier than girls. This thus exposes the boys to disease causing bacteria, which make them fall ill and worsen their health status, more than girls.

More so, the higher percentage report of illness amongst pre-schoolers relative to school-aged children in GLSS 4 is consistent with GLSS 1. Pre-school children fall ill more often because of the processes of weaning from breastfeeding to solid foods. They also get exposed to new bacteria because they become more mobile by crawling and learning to walk. Due to low immunity at this stage, contacts with contaminated household objects probably causes pre-schoolers to fall ill relatively easier than their older counterparts.

Reported illness amongst adults in GLSS 1 is particularly high: about forty percent with an average duration of 8 days. In GLSS 4, adults who reported ill are about 30 percent with an average duration of about 6 days. In both surveys, women are noted as having reported more illness than men. A plausible explanation to this observation is that women are more prone to gynaecological complications, especially pregnancies and menopause, as they get older. Illness is also reportedly high amongst pensioners. Thus the general trend from both the adults and children's cross-tabulation in relation to age suggests that incidence of illness drops from a relatively higher level from pre-school to school-aged, and then begins to rise again from young adults to pensioners in both surveys.

In relation to education, maternal levels are lower than paternal especially at higher education levels. Nevertheless, table 2.1 shows some overall increase in education over the decade (including females'). This is quite common in developing countries where males are encouraged to go to school compared to females. As with most surveys on self-assessed illness in developing countries, educated mothers in GLSS 1 reported more illness (Table 2.5) of their children but shorter duration of these illnesses (Table 2.6) than their uneducated counterparts. Pre-schoolers of educated mothers are less stunted and wasted; and this is less so in urban than rural areas. Similarly, school-aged children of post-primary educated mothers are less stunted (except in rural areas); but contrary to expectation, more wasted.

The positive relationship between maternal education and height as well as weight would suggest that the positive relationship between education and the incidence of reported illness is possibly due to systematic reporting bias, especially for pre-school children. Several reasons could be linked to the positive association between self-assessed illness and maternal education. This includes illusory perception of ill health of an objectively healthier child; possibility of actual illness due to a general exposure to some seasonal diseases that could not be effectively prevented by both educated and uneducated mothers but the former may give it more attention or consider it worth mentioning compared to the latter; educated mothers may be more likely to have attended clinical procedures with children to have been properly diagnosed and therefore have superior knowledge of the health status of their children, which suggests they could be accurately reporting the incidence of the child's illness unlike the their uneducated counterparts. Finally, due to the higher opportunity cost of time (of formal labour market participants), children of educated mothers are often left in the care of young uneducated house helps, which in effect means increased risk of exposure and contracting diseases as a result of the carers, in most cases, being young themselves.

Regarding school-aged children, reported illness, stunting in rural areas as well as wasting, in many cases, show a positive relationship with mother's education, but in an uneven sequence. There is no apparent explanation to this, except to imply that maternal education does not seem to influence the health status of these children.

The positive association between maternal education and reported illness is also observed amongst the same age group in GLSS 4, with children of primary educated mothers showing the highest reported illness. Interestingly, unlike GLSS 1 the perverse pattern is not observed amongst urban children. These children are relatively less likely to be reported as ill the higher the level of education of their mothers. However, the overall illness duration is slightly longer amongst children of educated mothers in GLSS 4. It initially increases from the uneducated to primary education, and then falls thereafter (but not lower than the duration of children of uneducated mothers suffer).

In contrast to the children's samples, adults in GLSS 1 tend to report less illness as own education rises beyond post-primary in urban areas. However in the full and rural sub-samples, individuals with primary education report more illness, and those with middle/JSS show relatively close percentages as those with none. Yet in GLSS 4, reported illness is negatively related with own education right from the primary school level upwards. With regard to the duration of adult illness, both surveys tend to indicate shorter periods as the levels of education increases compared to no education. This seems to suggest the educated manage to take better care of themselves than their young children. On the other hand, they might be indicating more attention and thus sensitivity to their children's rather than their own health; hence the relatively higher reports of the children's illness.

Differentials in reported illness in relation to expenditure quartile show similar perverse correlation as education amongst children. However in this case, only stunting contradicts this pattern for both pre-school and school-aged children. High expenditure negatively correlates with stunting as expected. This is probably because households are able to afford better health inputs including food, and better environment. Wasting amongst the children however worsens as household expenditure increases. This is very much at odds with expectations and contradicts the expenditure quartile trend with stunting (see also Asenso-Okyere *et. al*., 1997). The rural and urban expenditure quartiles show no difference in the pattern of the relationship compared to the overall sample. Unlike this study and Asenso-Okyere *et. al*., (1997) that observe higher wasting amongst the rich households, Alderman (1990) finds no pattern whatsoever within the expenditure deciles using the same data. However as in Alderman (1990), we find that households at the highest levels appear to have children with very acute malnutrition.

Reported illness and expenditure pattern amongst children in GLSS 4 is also not different from GLSS 1. They are positively correlated, and the same relationship is observed in relation to the duration of illness in both survey years. The adults' sample also shows positive correlation of the duration of illness and expenditure in GLSS 1, but in GLSS 4 the relationship is more of an inverted 'U'- shape. The duration of illness at the higher quartiles however is still longer than the lowest in GLSS 4. This finding appears to support the argument in the literature that, households with higher income often seek treatment and are therefore more likely to know their health status, which has probably been diagnosed by a medical system beforehand (Strauss and Thomas, 1998; 2008). The wealthy would also most likely continue treatment till declared fit by medical officers, which might translate into increased duration of illness. This could explain the finding, which suggests that relatively poor appear healthier than the rich, when indeed this might actually be the opposite; because the relatively poor are unaware of their status until they are properly diagnosed.

Table 2.1: Summary Statistics of Variables Used for Children's Estimations, 1987/88 & 1998/99

	GLSS 1						**GLSS 4**					
	Full		Urban		Rural		Full		Urban		Rural	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Illness	0.342	0.47	0.362	0.48	0.329	0.47	0.239	0.43	0.216	0.41	0.250	0.43
Number of days ill	6.574	5.94	6.105	5.47	6.888	6.22	5.211	3.42	5.214	3.40	5.210	3.43
Mother's Primary	0.102	0.3	0.097	0.3	0.105	0.31	0.158	0.36	0.171	0.38	0.148	0.35
Mother's Middle	0.295	0.46	0.354	0.48	0.26	0.44	0.237	0.43	0.336	0.47	0.2	0.4
Mother's Sec & above	0.031	0.17	0.069	0.25	0.008	0.09	0.047	0.21	0.1	0.3	0.02	0.14
Father's Primary	0.058	0.23	0.037	0.19	0.071	0.26	0.108	0.31	0.107	0.31	0.098	0.3
Father's Middle	0.433	0.5	0.464	0.5	0.414	0.49	0.392	0.49	0.415	0.49	0.4	0.49
Father's Sec & above	0.114	0.32	0.169	0.37	0.08	0.27	0.163	0.37	0.259	0.44	0.103	0.3
Log of expenditure per capita	10.587	0.62	10.782	0.58	10.470	0.61	13.487	0.66	13.838	0.62	13.334	0.62
Log of unearned income per capita	5.230	3.53	6.323	3.37	4.567	3.45	6.205	5.05	6.794	5.31	5.947	4.90
Age (years)	6.971	4.51	7.234	4.52	6.81	4.49	7.604	4.43	8.063	4.41	7.491	4.43
Female	0.492	0.5	0.498	0.5	0.489	0.5	0.495	0.5	0.508	0.5	0.491	0.5
Non-Akan	0.525	0.5	0.565	0.5	0.5	0.5	0.535	0.5	0.487	0.5	0.518	0.5
Water and sanitation	0.576	0.43	0.211	0.316	0.797	0.33	0.452	0.43	0.200	0.33	0.563	0.42
Rural	0.622	0.48					0.696	0.46				
Western Region	0.114	0.32	0.092	0.29	0.128	0.33	0.122	0.33	0.082	0.27	0.132	0.34
Central Region	0.083	0.28	0.077	0.27	0.087	0.28	0.097	0.3	0.106	0.31	0.118	0.32
Eastern Region	0.144	0.35	0.107	0.31	0.167	0.37	0.117	0.32	0.08	0.27	0.142	0.35
Volta Region	0.091	0.29	0.058	0.23	0.111	0.31	0.125	0.33	0.112	0.31	0.148	0.36
Ashanti Region	0.191	0.39	0.159	0.37	0.21	0.41	0.158	0.36	0.194	0.4	0.166	0.37
Brong-Ahafo Region	0.119	0.32	0.105	0.31	0.128	0.33	0.093	0.29	0.065	0.25	0.086	0.28
Upper West Region	0.014	0.12			0.022	0.15	0.03	0.17	0.012	0.11	0.03	0.17
Northern Region	0.093	0.29	0.082	0.27	0.099	0.3	0.107	0.31	0.058	0.23	0.087	0.28
Upper East Region	0.019	0.14	0.01	0.1	0.025	0.16	0.048	0.21	0.016	0.12	0.068	0.25
Observation no.	6378		2410		3968		11660		3547		8113	

*Note for all the summary tables:
(1) – Mean of number of days ill is conditional upon the incidence of illness; (2) – Water and sanitation is measured as proportion of 'neighbours' in cluster with no water & toilet; (3) – Mean of Log of expenditure and unearned income, as well as age are also controlled with their quadratics but not reported in table for brevity.

Table 2.2: Summary Statistics of Variables Used for Adults' Estimations, 1987/88 & 1998/99

	GLSS 1						**GLSS 4**					
	All		Urban		Rural		All		Urban		Rural	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Illness	0.404	0.49	0.411	0.49	0.399	0.49	0.279	0.45	0.250	0.43	0.296	0.46
Number of days ill	8.298	7.02	8.007	7.04	8.505	6.99	6.389	4.06	6.170	3.97	6.493	4.10
Primary	0.098	0.30	0.086	0.28	0.106	0.31	0.147	0.35	0.141	0.35	0.151	0.36
Middle	0.372	0.48	0.436	0.50	0.327	0.47	0.320	0.47	0.382	0.49	0.284	0.45
Sec & Higher	0.086	0.28	0.143	0.35	0.047	0.21	0.119	0.32	0.208	0.41	0.068	0.25
Mother's Primary	0.019	0.14	0.025	0.16	0.015	0.12	0.062	0.24	0.085	0.28	0.049	0.22
Mother's Middle	0.039	0.19	0.064	0.24	0.022	0.15	0.091	0.29	0.149	0.36	0.059	0.23
Mother's Sec & above	0.005	0.07	0.011	0.11	0.001	0.03	0.023	0.15	0.050	0.22	0.008	0.09
Father's Primary	0.025	0.16	0.024	0.15	0.026	0.16	0.058	0.23	0.070	0.26	0.051	0.22
Father's Middle	0.139	0.35	0.191	0.39	0.104	0.30	0.198	0.40	0.260	0.44	0.162	0.37
Father's Sec & above	0.037	0.19	0.064	0.24	0.018	0.13	0.086	0.28	0.145	0.35	0.053	0.22
Log of expenditure per capita	10.787	0.70	11.006	0.67	10.635	0.68	13.700	0.73	14.047	0.68	13.505	0.68
Log of unearned income per capita	5.362	3.65	6.470	3.46	4.598	3.58	6.450	5.24	6.884	5.56	6.206	5.04
Age (years)	35.621	16.36	34.794	15.45	36.191	16.94	37.111	16.73	35.797	16.31	37.865	16.92
Female	0.528	0.50	0.523	0.50	0.532	0.50	0.539	0.50	0.544	0.50	0.536	0.50
Non-Akan	0.546	0.50	0.566	0.50	0.532	0.50	0.521	0.50	0.493	0.50	0.536	0.50
Water and sanitation	0.544	0.44	0.194	0.30	0.785	0.34	0.407	0.42	0.165	0.30	0.543	0.42
Rural	0.592	0.49					0.635	0.48				
Western Region	0.105	0.31	0.085	0.28	0.118	0.32	0.114	0.32	0.075	0.26	0.136	0.34
Central Region	0.085	0.28	0.069	0.25	0.096	0.29	0.087	0.28	0.070	0.26	0.096	0.29
Eastern Region	0.144	0.35	0.107	0.31	0.169	0.38	0.119	0.32	0.077	0.27	0.143	0.35
Volta Region	0.092	0.29	0.054	0.23	0.118	0.32	0.127	0.33	0.077	0.27	0.157	0.36
Ashanti Region	0.168	0.37	0.153	0.36	0.177	0.38	0.166	0.37	0.189	0.39	0.154	0.36
Brong-Ahafo Region	0.11	0.31	0.091	0.29	0.122	0.33	0.084	0.28	0.071	0.26	0.092	0.29
Upper West Region	0.016	0.13			0.027	0.16	0.034	0.18	0.032	0.18	0.036	0.19
Northern Region	0.093	0.29	0.073	0.26	0.107	0.31	0.090	0.29	0.052	0.22	0.112	0.32
Upper East Region	0.025	0.16	0.012	0.11	0.035	0.18	0.044	0.21	0.014	0.12	0.062	0.24
Observation no.	6519		2659		3860		13547		4873		8674	

Table 2.3: Summary Statistics of Variables Used for the Anthropometric Measures Estimations, 1987/88 (GLSS 1)

	Pre-school						**School-Aged**					
GLSS 1 only	All		Urban		Rural		All		Urban		Rural	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
Illness	0.422	0.49	0.440	0.50	0.412	0.49	0.319	0.47	0.374	0.48	0.283	0.45
HAZ	-1.149	1.57	-0.893	1.48	-1.286	1.60	-1.190	1.33	-0.914	1.24	-1.369	1.36
WHZ	-0.552	1.02	-0.461	1.00	-0.601	1.03	-0.655	0.89	-0.643	0.88	-0.662	0.90
Mother's Primary	0.129	0.34	0.118	0.32	0.135	0.34	0.095	0.29	0.111	0.31	0.084	0.28
Mother's Middle	0.344	0.48	0.436	0.5	0.294	0.46	0.243	0.43	0.314	0.46	0.198	0.4
Mother's Sec & above	0.035	0.18	0.086	0.28	0.007	0.08	0.034	0.18	0.072	0.26	0.01	0.1
Father's Primary	0.062	0.24	0.042	0.2	0.073	0.26	0.063	0.24	0.032	0.18	0.083	0.28
Father's Middle	0.475	0.5	0.523	0.5	0.449	0.5	0.382	0.49	0.457	0.5	0.334	0.47
Father's Sec & above	0.117	0.32	0.176	0.38	0.086	0.28	0.114	0.32	0.165	0.37	0.081	0.27
Log of expenditure per capita	10.604	0.60	10.817	0.54	10.490	0.60	10.593	0.64	10.843	0.60	10.431	0.62
Log of unearned income per capita	5.225	3.56	6.583	3.29	4.497	3.49	5.071	3.60	6.216	3.58	4.332	3.42
6-11months	0.099	0.3	0.107	0.31	0.095	0.29						
12-23months	0.154	0.36	0.141	0.35	0.161	0.37						
24-35months	0.202	0.4	0.209	0.41	0.198	0.4						
36-47months	0.171	0.38	0.188	0.39	0.162	0.37						
48-60months	0.289	0.45	0.269	0.44	0.3	0.46						
Age (years)							9.828	2.85	10.037	2.89	9.693	2.81
Mother's Height	157.817	6.87	158.49	8.22	157.456	6	157.677	6.74	158.185	7.09	157.349	6.48
Rural	0.651	0.48					0.608	0.49				
Female	0.507	0.5	0.487	0.5	0.517	0.5	0.477	0.5	0.495	0.5	0.465	0.5
Non-Akan	0.525	0.5	0.538	0.5	0.518	0.5	0.53	0.5	0.555	0.5	0.513	0.5
Water and sanitation	0.593	0.43	0.202	0.30	0.803	0.33	0.555	0.43	0.198	0.30	0.785	0.33
Observation no.	2168		757		1411		2207		866		1341	
obs. (Whz) for school-aged							1268		465		803	

*Note: Mean of regional dummies is similar to those of table 2.1; they are not reported here for brevity.

Table 2.4: Summary Statistics of Community Variables Used in Estimations, 1987/88 & 1998/99

Community variables	**Children**				**Adults**			
	GLSS 1		GLSS 4		GLSS 1		GLSS 4	
	mean	sd	mean	sd	mean	sd	mean	sd
Price of Maize (kg)	2.853	1.89	5.759	3.29	2.897	1.86	5.972	3.17
Price of Anti-malarial pill	1.159	0.51	3.301	1.56	1.151	0.52	3.432	1.48
Dummy for missing price	0.085	0.28	0.16	0.37	0.092	0.29	0.133	0.34
Dist. to the nearest clinic	13.075	12.98	12.483	46.02	12.182	12.58	10.037	43.83
Men’s agric. wage	5.247	0.9	8.094	1.58	5.27	0.82	7.839	2.07
Ratio of women’s wage	0.55	0.45	0.604	0.41	0.565	0.45	0.577	0.43
Ratio of child wage	0.583	0.4	0.451	0.41	0.588	0.39	0.416	0.43
Observation no.	3968		8113		3860		8674	

	GLSS 1 only			
	Pre-school		School-aged	
	mean	sd	mean	sd
Price of Maize (kg)	2.916	1.86	2.82	1.89
Price of Anti-malarial pill	1.178	0.5	1.146	0.52
Dummy for missing price	0.086	0.28	0.087	0.28
Dist. to the nearest clinic	13.648	13.63	13.433	12.79
Men’s agric. wage	5.258	0.89	5.257	0.86
Ratio of women wage	0.546	0.46	0.536	0.45
Ratio of child wage	0.577	0.4	0.581	0.39
Observation no.	1411		1341	
For school-aged (WHZ)			803	

*Note: Community variables are controlled in rural samples’ estimations only.

Table 2.5: Cross-Tabulations of Health Status (Illness) and Key Socio-Economic Variables, 1987/88 & 1998/99

	Children (%)							**Adults (%)**						
ILLNESS	GLSS 1			GLSS 4	Weighted			GLSS 1			GLSS 4	Weighted		
	Full	Urban	Rural	Full	Full	Urban	Rural	Full	Urban	Rural	Full	Full	Urban	Rural
Full	34.2	36.2	32.9	24	24.2	21.1	25.6	40.4	41.1	40	27.9	28.2	24.9	30.1
Boys	35.2	37.6	33.8	24.7	25.3	20.9	27.1	39	38.6	39.2	23.9	24.3	21.5	25.9
Girls	33.1	34.9	32	23.2	23.1	21.3	24	41.7	43.4	40.6	31.3	31.5	27.7	33.8
Urban	36.2			21.6	21.1			41.1			25	24.9		
Rural	32.9			25	25.6			40			29.6	30.1		
Age (Years)														
0 – 5	41	42.3	40.3	36	35.7	34	36.3							
6 – 15	29.3	32.34	27.3	17.6	18.1	15.5	19.3							
16 - 24								33.6	35.1	32.5	18.6	18.8	18.4	19
25 - 34								40.1	42.2	38.5	28.2	29.4	26.5	31.1
35 - 49								42.9	43.6	42.4	28.6	28.6	24	31.1
50 - 59								44.4	41.2	46.5	31.8	31.9	29.3	33.2
60 plus								52	52.6	51.8	41.8	42.5	37.8	44.6
Education														
None	30	30.3	29.8	24	23.8	22.4	24.1	40	42.7	38.7	32.5	32.3	30	33
Primary	42.5	44.9	41.2	25.3	26.8	21.1	29	46	48.5	44.6	27	28.5	25.5	30.1
Middle	38.3	40.1	36.8	23.6	24	21.4	25.1	40.6	40.2	40.9	24.4	25.4	24	26.5
Secondary & Higher	45.7	45.8	45.6	23.7	24	19.7	28.9	36.1	35.9	36.6	21.9	21.2	19.5	24.3
Expenditure quartile														
Lowest	25.7	29.2	24.7	22.2	23.5	20.8	23.9	34.7	41.3	32.9	24.4	25.7	23	26.1
Lower middle	33.8	33.2	34.2	23.6	23.6	20.9	24.4	39.1	38.3	39.5	26.4	26.7	24.2	27.5
Upper middle	36.2	35.6	36.7	24	23.7	18.9	26.3	38.9	37.2	40.2	28.2	28.1	23.9	30.6
Highest	43.1	43.2	43	27.1	26.5	22.8	32	46.1	44.7	47.8	31.5	30.9	25.9	38.1
Observation no.	6378	2410	3968	11660	11660	3547	8113	6519	2659	3860	13547	13547	4873	8674

*Notes: (1) – Education for children is maternal education; and for adults, it is personal education. (2) – Proportional sampling weights created by the survey team and supplied with the data are applied in GLSS 4.

Table 2.6: The Duration of Illness by Key Socio-Economic Variables, 1987/88 & 1998/99

Children	**GLSS 1**						**GLSS 4**					
	All		Urban		Rural		All		Urban		Rural	
	Duration	Std. Dev.	Duration	Std. Dev.	Duration	Std. Dev.	Duration	Std. Dev.	Duration	Std. Dev.	Duration	Std. Dev.
All	6.57	5.94	6.11	5.47	6.89	6.21	5.21	3.42	5.21	3.4	5.21	3.43
Boys	6.79	6.12	6.38	5.9	7.09	6.26	5.31	3.54	5.14	3.38	5.36	3.59
Girls	6.33	5.71	5.81	4.95	6.69	6.15	5.11	3.29	5.28	3.41	5.04	3.24
Urban	6.11	5.47					5.21	3.4				
Rural	6.89	6.21					5.21	3.43				
Maternal Education												
None	6.99	6.19	6.07	4.95	7.43	6.66	5.06	3.3	4.93	2.99	5.09	3.36
Primary	6.28	5.69	5.48	5.07	6.75	6.01	5.42	3.47	5.32	3.47	5.45	3.48
Middle	6.17	5.62	6.41	5.95	5.95	5.31	5.26	3.47	5.2	3.37	5.28	3.51
Secondary & Higher	5.73	5.71	5.8	6	5.33	4.06	5.29	3.56	5.45	3.75	5.14	3.38
Expenditure quartile												
Lowest	6.35	5.99	6.22	5.94	6.4	6.01	4.9	3.3	4.81	3.03	4.92	3.34
Lower middle	6.86	6	6.29	5.26	7.16	6.34	5.3	3.43	5.05	3.09	5.36	3.51
Upper middle	5.99	5.43	5.55	5.06	6.32	5.67	5.29	3.44	5.36	3.6	5.26	3.37
Highest	7.08	6.3	6.41	5.73	7.89	6.85	5.41	3.54	5.34	3.52	5.48	3.56
Observation no.	2176		873		1303		2774		763		2011	

*Notes: (1) – The cross-tabulations of the duration of illness are conditional on the incidence of illness.

Table 2.6 contd: The Duration of Illness by Key Socio-Economic Variables, 1987/88 & 1998/99

Adults	**GLSS 1**						**GLSS 4**					
	All		Urban		Rural		All		Urban		Rural	
	Duration	Std. Dev.	Duration	Std. Dev.	Duration	Std. Dev.	Duration	Std. Dev.	Duration	Std. Dev.	Duration	Std. Dev.
All	8.3	7.02	8.01	7.04	8.5	6.99	6.39	4.06	6.17	3.97	6.49	4.1
Men	8.38	6.98	7.98	6.99	8.66	6.97	6.37	4.14	6.05	4.05	6.51	4.17
Women	8.23	7.05	8.03	7.09	8.37	7.02	6.4	4.02	6.24	3.92	6.48	4.06
Urban	8.01	7.04					6.17	3.97				
Rural	8.5	6.99					6.49	4.1				
Own Education												
None	9.55	7.74	9.44	7.94	9.6	7.64	6.81	4.21	6.73	4.18	6.83	4.22
Primary	8.25	6.63	8.38	6.7	8.16	6.6	6.01	3.84	6.3	3.88	5.87	3.82
Middle	7.05	5.93	7.06	6.16	7.04	5.72	6.12	3.9	5.88	3.79	6.29	3.97
Secondary & Higher	7.31	6.92	6.93	6.82	8.09	7.11	5.52	3.82	5.51	3.84	5.53	3.82
Expenditure quartile												
Lowest	7.58	6.02	6.82	5.49	7.84	6.18	6.14	4.04	5.8	3.84	6.2	4.07
Lower middle	8.27	7.04	8.42	7.38	8.2	6.86	6.78	4.21	6.68	4.16	6.82	4.23
Upper middle	8.07	7.06	7.36	6.48	8.58	7.41	6.41	4.04	6.16	3.95	6.53	4.08
Highest	8.79	7.37	8.44	7.44	9.19	7.28	6.26	3.99	6.09	3.94	6.42	4.02
Observation no.	2635		1093		1542		3770		1216		2554	

Table 2.7: Cross-Tabulations of Health Status (Illness, Stunted & Wasted) and Key Socio-Economic Variables, 1987/88 (GLSS 1)

Pre-school	Illness			Stunted			Wasted		
	Full	Urban	Rural	Full	Urban	Rural	Full	Urban	Rural
Full	42.2	43.99	41.25	29.15	19.68	34.23	6.37	5.28	6.95
Boys	44.81	47.16	43.47	29.75	21.13	34.65	7.11	6.96	7.2
Girls	39.67	40.65	39.18	28.57	18.16	33.84	5.64	3.52	6.71
Urban	43.99			19.68			5.28		
Rural	41.25			34.23			6.95		
Maternal Education									
None	37.17	37.36	37.11	33.24	25.64	35.85	7.68	4.76	8.68
Primary	49.29	41.57	52.88	31.79	24.72	35.08	6.07	6.74	5.76
Middle	46.04	49.39	43.37	24.56	16.06	31.33	4.83	5.45	4.34
Secondary & Higher	49.33	47.69	60	6.67	6.15	10	4	4.62	0
Expenditure quartile									
Lowest	32.43	36.36	31.58	35.5	25.25	37.72	6.13	5.05	6.36
Lower middle	42.52	41.28	43.08	30.27	20.35	34.73	5.41	3.49	6.27
Upper middle	44.81	43.08	46.01	26.3	18.58	31.68	6.49	5.53	7.16
Highest	50.45	50.21	50.72	23.76	18.03	30.14	7.69	6.44	9.09
Age (months)									
0 - 5months	24.46	15.38	29.41	5.43	3.08	6.72	2.17	0	3.36
6-11months	49.77	53.09	47.76	7.91	6.17	8.96	7.91	11.11	5.97
12-23months	55.99	58.88	54.63	28.44	28.04	28.63	14.37	15.89	13.66
24-35months	48.86	48.1	49.29	33.11	24.05	38.21	6.39	3.8	7.86
36-47months	39.19	38.03	39.91	40.81	29.58	47.81	4.86	3.52	5.7
48-60months	34.61	42.65	30.73	34.13	15.69	43.03	3.67	1.47	4.73
Observation no.	2168	757	1411	2168	757	1411	2168	757	1411

Table 2.7 contd.: Cross-Tabulations of Health Status (Illness, Stunted & Wasted) and Key Socio-Economic Variables, 1987/88 (GLSS 1)

School-Aged	Illness			Stunted			Wasted		
	Full	Urban	Rural	Full	Urban	Rural	Full	Urban	Rural
Full	31.85	37.41	28.26	26.82	17.55	32.81	5.99	5.59	6.23
Boys	32.24	37.99	28.73	32.06	20.82	38.91	5.41	4.8	5.75
Girls	31.43	36.83	27.72	21.08	14.22	25.8	6.86	6.7	6.96
Urban	37.41			17.55			5.59		
Rural	28.26			32.81			6.23		
Maternal Education									
None	28.79	33.72	26.53	27.71	20.18	31.16	4.46	4.55	4.43
Primary	39.71	48.96	31.86	28.71	17.71	38.05	10	7.02	12.33
Middle	34.45	36.03	32.83	25.88	15.81	36.23	7.74	6.49	8.79
Secondary & Higher	48	51.61	30.77	12	6.45	38.46	7.5	5.88	16.67
Expenditure quartile									
Lowest	21.51	30.63	19.36	29.95	23.42	31.49	5.59	4.76	5.78
Lower middle	29.93	29.72	30.05	28.4	17.92	34.31	6.36	4.42	7.3
Upper middle	34.98	36.84	33.33	30.21	21.43	38	5.07	6.41	3.91
Highest	43.22	46.57	38.46	16.95	11.19	25.13	7.29	6.02	8.77
Observation no.	2207	866	1341	2207	866	1341	1268	465	803

2.3. ECONOMETRIC RESULTS

This section presents the results of the various models estimated. The results' tables first show estimated results of the impact of education in the various specification models described in the methodology section. These are variants 1, 2, and 3, which presents estimates of only education, education conditional on expenditure and education controlling unearned income respectively. The version of education conditioning on expenditure is estimated using a two-stage least squares (2SLS) with instruments for expenditure and its quadratic[21]. The external effects of household public goods are also controlled as separate versions of each of the above-mentioned variants. These are the results presented in text in an abridged form (for the sake of brevity) with the discussions. The entire results can however be found in appendix A–2 to A–11. The estimates of the controlled variables are then presented in different tables, and are briefly discussed. Other variables also controlled in all versions of the estimations but not presented for the sake of brevity are region of residence, ethnicity and a dummy for missing price in the rural sub-sample.

Also all the estimated results are presented as full samples, urban and rural sub-samples for each survey year. The rural sub-samples have additional variables that are observed at community levels in rural areas only. The full samples are however the main focus points of the discussions. The residence sub-samples are referred to where relevant differences or interesting results are observed. A pooled sample result of both GLSS 1 and 4 is also presented with a dummy, which

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[21] Instrumental variables are also used for education where valid instruments are found; but this will be mentioned under sections where the procedure is used. Details of the instrumental variables are also discussed under such sections and results' tables of the first-stage regressions are presented in the appendix A.

equals one representing the former survey year and zero otherwise. Results on children and adults are presented separately, with that of children examined first followed by adults. Generally, the primary focus is on GLSS 1, and then results from GLSS 4 are considered to examine the robustness of the first.

2.3.1 Morbidity: Reduced Form Estimates

I: Children

The impact of parental education on child's illness

Table 2.8 presents the estimates of parental education in GLSS 1, GLSS 4 and the pooled sample of both survey years. These results are the marginal effects after probit. The results in GLSS 1 and 4 are not consistent. The first survey year indicates a perverse relationship whilst the later suggests no influence at all. In GLSS 1, the results suggest that parental education positively influence child's reported illness (variant 1). All the levels of mother's education show they are more likely to report illness relative to the uneducated mother, ceteris paribus. Child's reported illness is also noted to increase with fathers' education, but is only significant after primary education. Whilst only maternal education is found significant in urban areas, it is paternal education that influences increased reported illness in rural areas. This pattern is also found in Appleton (1991), where paternal education sometimes replaces the significant impact of maternal education in his analysis on Kenya, Tanzania and Cote d'Ivoire.

Table 2.8: The Impact of Parental Education on The Probability of Child Illness, (GLSS 1 & 4, and Pooled)

	Full			**Urban**			**Rural**		
Sample	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 4**	**Pooled**
	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects
Variant 1: Education									
Mother's Primary	0.07**	0.011	0.026*	0.104**	-0.007	0.025	0.037	0.019	0.027*
Mother's Middle	0.035*	0.016	0.018*	0.089***	-0.004	0.023	0.011	0.03	0.018
Mother's Sec & above	0.094*	0.014	0.035	0.169***	0.011	0.057*	0.126	0.027	0.032
Father's Primary	0.013	0.028	0.012	-0.03	-0.017	-0.012	0.043	0.041	0.022
Father's Middle	0.034*	-0.006	0.004	-0.021	-0.02	-0.017	0.059**	-0.006	0.006
Father's Sec & above	0.048*	0.021	0.02	-0.049	-0.023	-0.014	0.125***	0.048	0.045**
GLSS_1			0.087***			0.135***			-0.02
Variant 2: Education conditioning on expenditure									
Mother's Primary	0.066**	0.009	0.027*	0.106**	-0.008	0.023	0.044	0.021	0.029*
Mother's Middle	0.037*	0.008	0.014	0.092***	-0.011	0.019	0.014	0.025	0.013
Mother's Sec & above	0.086	0.01	0.022	0.184***	0.001	0.044	0.119	0.029	0.015
Father's Primary	0.029	0.002	0.003	-0.029	-0.015	-0.022	0.046	0.007	0.014
Father's Middle	0.051**	-0.021*	-0.007	-0.018	-0.031	-0.029	0.056*	-0.023	-0.002
Father's Sec & above	0.067*	-0.007	0.008	-0.044	-0.022	-0.028	0.127***	-0.001	0.033
GLSS_1			0.302**			0.304*			0.206
Variant 3: Education conditioning on unearned income									
Mother's Primary	0.065**	0.008	0.022*	0.101**	-0.011	0.022	0.034	0.016	0.024
Mother's Middle	0.033*	0.013	0.015	0.083**	-0.008	0.02	0.012	0.026	0.016
Mother's Sec & above	0.088*	0.01	0.033	0.152**	0.007	0.052*	0.119	0.019	0.03
Father's Primary	0.016	0.03	0.012	-0.035	-0.013	-0.01	0.046	0.041	0.02
Father's Middle	0.028	-0.007	-1.15E-04	-0.027	-0.02	-0.018	0.053**	-0.008	0.001
Father's Sec & above	0.041	0.016	0.017	-0.058	-0.028	-0.016	0.118***	0.044	0.042*
GLSS_1			0.086***			0.148***			-0.017
Observation no.	6378	11660	18038	2410	3547	5957	3968	8113	12081

*Notes: (1) – Proportional sampling weights are applied in the estimations of GLSS 4.
(2) – The entire results with t-ratio are presented in Appendix tables A-2, A-3, and A-4.
(3) – Age and its quadratic, gender, rural residence, water and sanitation, ethnicity, and regional dummies are controlled in all the estimations.
(4) – Community variables are controlled in addition to the above for the rural sub-samples.

Unlike GLSS 1, parental education is not found significant in determining morbidity in GLSS 4. The outcome is parallel to Blunch (2004) with the same data (GLSS 4). He finds that maternal formal education does not significantly influence reported illness amongst children aged 0 – 7 years. However, other literary indicators controlled for do influence the incidence of illness in the same estimation with mixed signs. For instance, he finds English reading and writing (this forms part of his maternal literacy measure) negatively and positively determine illness respectively; and adult literacy course participation positively affects child's illness.

The results of the pooled sample also show a positive relationship between parental education and child's illness. But this is significant at only the primary level of maternal education in the full sample, maternal and paternal secondary and above in the urban and rural sub-samples respectively. The dummy variable indicating "1" for GLSS 1 survey period and zero otherwise suggests that the increased reported illness of children is 8.7 percentage points higher in GLSS 1 than GLSS 4, ceteris paribus. The corresponding difference in the urban sub-sample is 13.5 percentage points. The survey dummy in the rural sub-sample is not statistically significant, but this is because of the control of the community variables. Without these controls, reported illness amongst children in GLSS 1 is estimated as being 6.8 percentage points higher than in GLSS 4 (results not presented). This could be implying that the percentage of reported illness may actually be noticed as unchanged between the years, when community variables are also controlled in the full and urban sub-samples. But this can only remain a conjecture since lack of community data in urban areas makes verification impossible.

Meanwhile, the supposedly reduced probability of reported illness over the years of these surveys might be suggestive of improved information on healthy lifestyles through the advancement of the media, increased access and use of health facilities as well as services such as taking immunisation activities to communities for maximum coverage. However, these improved services are most likely to be prevalent in urban relative to rural areas.

The impact of parental education on child's illness conditioning on household wealth

Household wealth is first represented by expenditure, which is included in the model as an endogenous variable (variant 2), and secondly by unearned income as an exogenous variable (variant 3)[22]. The effect of maternal education on child's reported illness changed marginally with the control of expenditure per capita in the model. In GLSS 1, maternal secondary school and above became statistically insignificant. In GLSS 4, paternal middle/JSS changed from having no influence, just as other levels of parental education, to lowering the probability of reported illness. This is arguably a weak and random relationship since it is the only indicator amongst six that is statistically significant and at the 10 percent level.

Similar to expenditure per capita, the impact of parental education on child's reported illness changed slightly in magnitude and significance (especially the urban sub-sample) with the control of unearned income per capita. All the categories in the full samples as well as the rural sub-sample remained fairly same and show positive association of mother's education with reported illness. Similarly, the parental education categories in GLSS 4 are unaffected. However, the paternal education categories in GLSS 1 are not as stable as maternal. Paternal

[22] Both variables are controlled in their per capita forms as well as their quadratics.

post-primary became insignificant in the full sample, whilst that of the rural sub-sample did not change.

The evidence from the estimated outcomes indicate that parental education generally increases child's reported illness. The relationship, either in direction or significance, does not dramatically change with the inclusion of household wealth, or the proportion of neighbours with poor household public goods (estimates without can be found in appendix A-2 to A-4). Although the estimated relationship of parental education and child's illness seem perverse, they are consistent with the descriptive statistics for maternal education and also what is usually found in the literature on self-reported morbidity especially in developing countries (see Appleton, 1991 and Lawson, 2004). Several reasons have been attributed to the possibility of such a relationship occurring. This includes correlation between education and some of the unobserved variables in the error term like innate health, ability and taste, or to a common factor that is correlated with both education and health; and lifestyle choices such as early termination of breastfeeding, either due to modern practices of bottle-feeding or participation in formal employment, which may have adverse consequences on children. These lifestyles might be influenced by education, which increases the opportunity cost of mothers' time hence less spent with children. In order to rule out the possibility of education being endogenous and therefore affecting the direction on illness, the next section estimates the effects of parental education in a two-stage least-square model.

2.3.2 Morbidity: Conditional Estimates

As outlined in the conceptual framework, education is likely to be endogenous because it is simultaneously determined with health, or maybe correlated with omitted variables or measurement errors, or a combination of all three. In order to examine this and therefore verify whether the previous findings are causal or just associational, instrumental variables are substituted for education in a two-stage regression model. As already discussed interaction between maternal birth cohorts and region of birth are used as instrumental variables for maternal education. We anticipate that this could influence the levels of education because of the variation in the quality and supply of schools over time and space in the country. However, this is not identified for paternal education hence paternal parents years of education is used as instruments in their case. The first-stage regressions, reported in the appendix A, are estimated as:

$E_i = ß_1 + ß_2 Z_i + ß_3 X_i + e_i$ ………………………………………………..(15)

Where E_i is the endogenous variables (categorical levels of education of child's mother and father), Z_i is a vector of the instrumental variables (the interaction between maternal region of birth and age, and paternal parent's education, as well as the value of land and durable goods with their quadratics when expenditure per capita and its square are also controlled in the model as endogenous); X_i represents a vector of all the control variables, which have already been discussed under the reduced form model; and e_i is the error term. Estimates of the control variables are not presented in the results table for brevity.

The second stage is estimated as:

$H_i^{illness} = \partial_1 + \partial_2 \hat{E}_i + \partial_3 X_i + \pi_i$ ……………………………………..(16)

Where $H_i^{illness}$ is child's reported illness, $\hat{E}_i$ is a vector of predicted levels of education of the child's parents and π_i is the error term. Instrumental probit is used in estimating the model because of the categorical nature of the dependent variable of equation 16.

Appendix A–5 shows the results of the first stage regression. The P-values of the F-statistics reported in the last rows indicate the instruments jointly predict parental education in both GLSS 1 and 4, at the 1 percent level of statistical significance. However, most of the F-statistics are less than 10, which may be an indication of the instruments not being strong predictors (see Stock, Wright and Yogo, 2002). They also point out that an adjusted R-squared of about 0.25 of the first-stage regression is an indication of weak instruments. According to them, strong instruments should have the adjusted R-squared of the first-stage regression to be nearly 1. The over-identification test on the other hand indicates that the instruments are valid, which suggests they have all passed the exclusion restriction test. That is, the instruments are not correlated with the error term and could also be excluded from the model. The over-identification test statistics are reported with the results tables.

Table 2.9 presents the 2SLS results on child's reported illness with only parental education as endogenous. Several differences are immediately noted. In GLSS 1, firstly, the magnitude of parental education changed massively from that of the OLS model. Secondly, although the signs remained same for maternal education where significant, those of paternal education changed. Thirdly, only maternal primary education is found significant at the 1 percent level. Finally, whereas previously in the OLS model, none of the educational outcomes in GLSS 4 was found significant even though it also showed a positive relationship with child's reported illness, this time maternal primary is found statistically significant. These results therefore somewhat concur with the previous model as well as others (Appleton, 1991 and Lawson, 2004) that show that maternal education (primary levels in this case) have higher probability of reporting illness relative to those with no education. This also confirms what was observed in the descriptives; and that the relationship is not only associational but also most possibly causative.

The change in magnitudes is however very big; and thus caution must be exercised in drawing strong conclusions from these results. For example in GLSS 1, the likelihood of increased reported illness changed from 6.8 (OLS) to 65.7 (2SLS) percentage points, ceteris paribus. The corresponding 2SLS estimate for GLSS 4 is 54.3 percentage points. Paternal primary education however lowers the probability of child's reported illness by about 26.9 percentage points in GLSS 1. The result in GLSS 4 is not significant. Estimates of the pooled sample of both GLSS 1 and 4 indicate that child's illness is reported more in GLSS 1 than 4, all else held constant.

Table 2.9: Probability of Child Illness – Treating Parental Education as Endogenous (GLSS 1 & 4, and Pooled); with and without conditioning on Expenditure

2SLS/IV	**Full**			**Urban**	**Rural**		
Sample	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 1**	**GLSS 4**	**Pooled**
	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects
Variant 1: Education							
Mother's Primary	0.657***	0.543***	0.568***	0.712***			
Mother's Middle	-0.022	-0.043	0.164	0.049			
Mother's Sec & above	0.061	0.068	-0.025	0.441			
Father's Primary	-0.269*	-0.109	-0.183*	-0.34***			
Father's Middle	-0.022	-0.049	-0.106	-0.092			
Father's Sec & above	0.088	0.064	-0.015	-0.186			
GLSS_1			0.094***				
Observation no.	6378	11660	18038	2410			
Over-identification stats.	47.224	41.039	40.328	34.610			
(Chi-sq)	(36)	(38)	(38)	(34)			
P-value	0.0998	0.3388	0.3677	0.4387			
Variant 2: Education conditioning on expenditure							
Mother's Primary	0.614***	0.572***	0.501***	0.655***	0.395*	0.128	0.291
Mother's Middle	-0.018	-0.02	0.13	0.02	0.045	0.008	0.205
Mother's Sec & above	0.276	0.047	0.255	0.701***	-0.012	0.355	-0.245**
Father's Primary	-0.294***	-0.121	-0.226***	-0.343***	-0.154	-0.035	-0.157
Father's Middle	-0.032	-0.088	-0.065	-0.103	-0.05	0.007	-0.146
Father's Sec & above	0.092	0.047	-0.108	-0.276*	0.091	0.035	0.107
GLSS_1			0.189				0.108
Observation no.	6378	11660	18038	2410	3968	8113	12081
Over-identification stats.	50.166	42.15	49.186	39.310	39.310	56.670	47.855
(Chi-sq)	(39)	(41)	(41)	(37)	(37)	(41)	(41)
P-value	0.1085	0.421	0.1781	0.3668	0.3668	0.0525	0.2144

*Notes: (1) – The entire results with t-ratio are presented in Appendix tables A-6.
(2) – Age and its quadratic, gender, rural residence, water and sanitation, ethnicity, and regional dummies are controlled in all the estimations.
(3) – Community variables are controlled in addition to the above for the rural sub-samples, except for GLSS 1 in this table.
(4) – The empty cells imply IVs of those sub-samples did not pass the over-identification test; hence not reported.

The estimates of the urban sub-sample in GLSS 1, like the full sample, also show increased child's reported illness with maternal primary and the reverse with paternal primary education. The rural sub-sample in GLSS 1 as well as the rural and urban sub-samples in GLSS 4 are not presented because the instruments did not pass the over-identification test.

The results on parental education also did not alter from the discussion above upon conditioning on expenditure[23], except for a negligible decrease in magnitude in GLSS 1 and an increase in GLSS 4 (the full samples). The urban sub-sample (GLSS 1 only) however shows increased probability in child's reported illness with maternal secondary and above relative to no education. This is in addition to the positive outcome with maternal primary education. Similarly, paternal secondary and higher gained some statistical significance and has the same negative relationship with reported illness as that of primary. The rural[24] sub-sample also indicates that only maternal primary level of education is statistically significant, and supports the positive relations with child's reported illness compared to women with no education.

Parental education of the rural sub-sample of GLSS 4 however appears not to have any influence on the children's illness. However, the pooled sample of GLSS 1 and 4 of the rural sub-samples gives a different outcome to what has so far been observed with the 2SLS model. Here it appears mothers with secondary and above level of education tend to report fewer children's illness, ceteris paribus.

[23] This model estimates with instrumental variables for both parental education and expenditure per capita and its quadratics.

[24] Community variables are not controlled in GLSS 1 because the instruments do not pass the over-identification test when they are. The rural sub-sample in GLSS 4 however controls for the community variables.

Generally, the models estimated with parental education as an endogenous variable in the two survey periods also show mixed but consistent variation in the educational outcomes compared to the models with exogenous education variables. For example, the sign on maternal education when significant is not different whether education is endogenous or not. In this case, maternal primary is consistently found to positively influence child's reported illness. This outcome is even re-enforced in GLSS 4 where hitherto was not significant. However, paternal primary education changed from a positive (exogenous) to a negative (endogenous) influence on children's reported illness in GLSS 1 whilst the outcome in GLSS 4 remained unaltered (not significant) in either scenario.

The 2SLS somewhat confirms the positive relationship usually found to exist between maternal education and children's reported illness, especially in the individual survey periods. Thus endogeneity is most likely not the cause of the positive relationship in this study. It is possible that the higher opportunity cost of time of educated mothers, which results in less time directly spent with their children, contributes to the higher incidence of illness amongst these children. Or possibly, increased sensitivity and awareness of disease symptoms (because educated mothers are more informed and also more likely to seek medical attention) result in raising educated mothers' potential to report more illness.

Since the pattern of parental education and reported illness did not change often in sign, and some of the sub-samples could not be reported due to lack of valid instrumental variables, we resort to estimating the subsequent models with education included as an exogenous variable[25]. In order to reduce the potential

[25] Indeed this is done for all remaining models in the other health outcomes (duration of illness and the anthropometric measures).

correlation between education and unobserved variables, additional control variables (parental education for the adults' samples) are included in the models[26]. However models conditioning on expenditure are estimated using the instrumental variable approach since expenditure, with available information for instrumental variables, is controlled as endogenous; similar to many of the studies on Africa including Appleton (1991), Lavy et al., (1996), Benefo and Schultz (1996) and Lawson (2004).

II: Adults

The impact of own education on self-reported illness

Table 2.10 gives the estimated results of the impact of own education on self-reported illness in GLSS 1, 4 and the pooled sample of both. Education amongst adults is similar to those of the children. For instance, own primary and middle/JSS level of education are positively related to reported illness in GLSS 1, all else held constant, whereas in GLSS 4 education does not appear to matter. However, the outcome in GLSS 4 is different, when water and sanitation is not controlled (appendix A-8).

[26] This is also experimented with the children's samples, by controlling the education of grandparents, but the outcome does not show any dramatic differences; hence not reported.

Table 2.10: The Impact of Own Education on The Probability of Adult Illness, (GLSS 1 & 4, and Pooled)

	Full			**Urban**			**Rural**		
Sample	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 4**	**Pooled**
	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects
Variant 1: Education									
Primary	0.082***	0.023	0.024*	0.098*	0.004	0.009	0.07*	0.033	0.032
Middle	0.039*	-0.002	0.003	0.02	-0.009	-0.007	0.058*	-0.004	0.003
Sec. & above	-0.003	-0.03	-0.021	-0.019	-0.041	-0.033	0.013	-0.028	-0.011
GLSS_1			0.133***			0.171***			0.008
Variant 2: Education conditioning on expenditure									
Primary	0.08***	0.013	0.022	0.106*	-0.02	0.004	0.065*	0.019	0.026
Middle	0.035	-0.03*	-4.70E-04	0.03	-0.022	-0.012	0.045	-0.033*	-0.008
Sec. & above	-0.008	-0.129***	-0.024	0.008	-0.051*	-0.04*	-0.005	-0.082**	-0.022
GLSS_1			0.249*			0.282**			0.48***
Variant 3: Education conditioning on unearned income									
Primary	0.078***	0.021	0.021	0.095*	0.003	0.007	0.067*	1.42	0.028
Middle	0.031	-0.006	-0.001	0.015	-0.013	-0.009	0.051*	-0.48	-0.002
Sec. & above	-0.016	-0.037*	-0.027*	-0.028	-0.049*	-0.039*	0.001	-1.4	-0.018
GLSS_1			0.139***			0.183***			0.024
Observation	6519	13547	20066	2659	4873	7532	3860	8674	12534

*Notes: (1) – Proportional sampling weights are applied in the estimations of GLSS 4.
(2) – The entire results with t-ratio are presented in Appendix tables A-7, A-8, and A-9.
(3) – Age and its quadratic, gender, rural residence, water and sanitation, ethnicity, and regional dummies are controlled in all the estimations.
(4) – Community variables are controlled in addition to the above for the rural sub-samples.

Secondary and above level of education is found significant at the 10 percent level, and it shows adults with such level of education tend to have lower probability of self-reported illness compared to none, ceteris paribus. This probably depicts the circumstance whereby the prevalence of diseased environment countermands the influence of education. The dummy variable representing time of survey suggests reported illness is higher in GLSS 1 than 4, ceteris paribus. This is possibly due to the improvement and use of health services, and more so with improved spread of information on available services as well as health education through the media.

The impact of own education on self-reported illness conditioning on household wealth

In relation to the impact of own education of the adults, upon controlling for expenditure per capita, only personal primary education is found significant amongst adults in GLSS 1, compared to personal primary and middle/JSS when expenditure is not controlled. However, the direction of impact is same in both models, that is, primary education is positively related to the probability of self-reported illness, ceteris paribus. The converse is true in GLSS 4, where adults with post-primary education tend to report illness less frequently. Similarly, post-primary, and secondary and above levels are found significant in rural and urban areas respectively, which hitherto were insignificant. This outcome suggests expenditure per capita might be complementary to education rather than a substitute. The two are therefore essential in the production of health, as explained by Cutler and Lleras-Muney (2006) that education allows individuals to know about a particular health input and income allows them to purchase it. Self-reported illness is also observed as being higher in the earlier relative to the later year in the full sample as well as the urban and rural sub-samples.

The outcome of adults' own education controlling for unearned income is quite similar to when household wealth is not controlled. For example, only middle/JSS lost its weak statistical significance in GLSS 1 (full sample). The outcomes in the rural and urban sub-samples did not change. Own primary education (urban) as well as primary and middle/JSS levels remain significant and positively affect self-reported illness. In GLSS 4 however, the results changed and show rather similar results as those with the control of expenditure. Secondary and above level of education is observed as having lowering tendencies towards self-reported illness in the full and urban sub-sample, ceteris paribus.

The inconsistency of outcomes between the two survey years makes conclusion of personal education on self-reported illness a bit dicey, especially when expenditure is controlled. This is where education is noted as having increased tendencies in GLSS 1, but a reduced probability to report illness in GLSS 4. A plausible conclusion is thus, with heightened awareness of illness as a result of education, adults with lower levels at the first survey year had a higher propensity to report illness. However this changed in the later survey year, probably because relatively more people are educated and/or exposed to environments (widespread media and other modern health related activities) that promote healthier lifestyles. It is also possible that due to the shorter re-call period of the later year, these adults are more able to separate actual illness from maybe serious tiredness, and so report less illness. This is however mostly true for people with secondary education and above in the later year. These conclusions are mainly based on conjecture, since there is not enough information to categorically test them.

The impact of personal education on self-reported illness controlling the parental education of adults

For a robustness check on the outcomes earlier discussed, the parental education of adults is controlled to reduce some of the unobserved effects through family background, and the results are presented in Table 2.11. Incorporating parental education did not change the direction of impact of personal education in both survey years, even with the control of unearned income as well as expenditure. In GLSS 1, own primary education is still positively related with self-reported illness, middle/JSS education lost its significance in the full sample but the outcomes in urban and rural sub-samples remained same. Also in GLSS 4, own secondary and above education remained stable and negatively correlated with self-reported illness. The pooled sample, where significant supports this negative relationship, indicating that education at higher levels is associated with less reported illness, especially in urban areas. Self-reported illness is generally noted as being higher in GLSS 1 compared to GLSS 4, ceteris paribus.

Table 2.11: The Impact of Own Education on The Probability of Adult Illness, (GLSS 1 & 4, and Pooled); controlling Adult's Parental Education

	Full			**Urban**			**Rural**		
Sample	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 4**	**Pooled**
	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects	Marginal Effects
Variant 1: Education									
Primary	0.076**	0.018	0.021	0.082*	0.006	0.005	0.069*	0.024	0.029*
Middle	0.03	-0.007	0.001	-0.001	-0.008	-0.008	0.058*	-0.009	0.001
Sec. & above	-0.018	-0.038*	-0.025	-0.054	-0.041	-0.038*	0.009	-0.035	-0.014
GLSS_1			0.135***			0.175***			0.009
Variant 2: Education conditioning on expenditure									
Primary	0.074**	0.011	0.02	0.088*	-0.02	0.001	0.064*	0.015	0.024
Middle	0.025	-0.027*	-0.002	0.006	-0.02	-0.013	0.046	-0.034*	-0.01
Sec. & above	-0.023	-0.122***	-0.028	-0.031	-0.05*	-0.043*	-0.009	-0.081**	-0.023
GLSS_1			0.246*			0.286**			0.482***
Variant 3: Education conditioning on unearned income									
Primary	0.073**	0.017	0.019	0.08*	0.006	0.003	0.066*	0.021	0.026
Middle	0.024	-0.01	-0.003	-0.004	-0.011	-0.01	0.051*	-0.013	-0.004
Sec. & above	-0.029	-0.044*	-0.029*	-0.059	-0.047	-0.042*	-0.001	-0.042	-0.019
GLSS_1			0.14***			0.186***			0.075***
Observation	6519	13547	20066	2659	4873	7532	3860	8674	12534

*Notes: (1) – Proportional sampling weights are applied in the estimations of GLSS 4.
(2) – The entire results (including those of parental education) with t-ratio are presented in Appendix tables A-10, A-11, and A-12.
(3) – Age and its quadratic, gender, rural residence, water and sanitation, ethnicity, and regional dummies are controlled in all the estimations.
(4) – Community variables are controlled in addition to the above for the rural sub-samples.

Where parental education is controlled, estimates show mixed results and often fall in line with the direction of own education of the adults in each survey year (Appendix tables A-10 to 11). However, significant categories of parental education are few and often weak, with the dominant category being parental primary education. The association is however stronger in urban areas, even with the control of expenditure or unearned income; but there appears to be no parental influence on adults' reported illness in rural areas. Paternal primary is however mostly not significant and when it is, the relationship is also found weak with mixed outcomes, especially in the urban and rural sub-samples in GLSS 1.

In GLSS 4, maternal primary lowers the probability of adults' reported illness in urban areas whilst paternal primary increases the probability in the full and rural samples. Statistically significant parental education categories in GLSS 4 are even fewer than GLSS 1, and except for maternal primary in urban areas, are weak too. The pooled sample of both surveys gives less convincing evidence of the influence of parental education of adults on their illness. The relevant information however acquired from this analysis is that controlling parental education of adults does not replace the direct personal education impact on adults' self-reported illness. This is parallel to the findings of Joshi (1994) but contradicts those of Behrman and Wolfe (1987) in Nicaragua[27] on their suggestion that mother's education is a reflection of their own parents' education. This is because the mother's education becomes insignificant when their parent's education is controlled.

[27] Even though their focus was on mother's education and child's health, a parallel comparisons could still be made with their analysis. Indeed, estimation of the children's sample controlling for grandparents', in addition to parents', education showed a similar outcome (unreported) as the adults'.

2.3.2.1 Morbidity: Control Variables

This section briefly discusses some of the socioeconomic variables controlled in the estimation of the models (variant 2). Variant 3 is only referred to in relation to unearned income. Consistent with the earlier pattern of discussions, each variable is first discussed for children, and then followed by adults.

The impact of household wealth on reported illness

Household wealth is controlled initially as household expenditure per capita (endogenous: variant 2) and then as household unearned income per capita (exogenous: variant 3). This is basically conducted to use one as a sensitivity check on the other; unearned income is however discussed first.

1: Unearned income per capita

Table 2.12 shows the estimates of household unearned income per capita of the children and adults' samples. The results reflect the pattern of education earlier discussed in this study. It shows an initial positive correlation with child's reported illness, which turns to negative at the quadratics in GLSS 1. They show a joint significance at 5 percent level, suggesting unearned income does not increase reported illness for all households[28]. For instance, increased unearned income at higher levels has the probability of lowering child's reported illness, ceteris paribus.

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[28] In order to capture the non-linear impact of unearned income, and also expenditure in the next sub-section, the turning point of each sub-sample is first calculated, then the recorded figures of these household wealth in the data are sorted by ascending order so that the lowest is the poorest and the highest is the richest household in the sample (In the case of expenditure). Regarding unearned income, it would be those who receive no unearned income (the lowest) to the highest recipients of unearned income. Then locating the turning point in the sample (as well as inter-quartile ranges), the proportion of households found before this point (or after) is calculated to get the varying impact of the household wealth. See appendix C for some few illustrations of the Impact of household wealth on health status.

Table 2.12: The Impact of Unearned Income on The Probability of Illness, (GLSS 1 & 4, and Pooled) ; Treating Unearned Income as Exogenous.

	GLSS 1		**GLSS 4**		**Pooled**	
Sample	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
Children						
Full						
Log of unearned income pc	0.015	2.49*	-0.007	-1.4	0.009	3.05**
Log of unearned income pc2	-0.001	-1.46	0.001	1.88	-4.56E-04	-1.57
Joint F-statistics [chi2(2)]	13.9		8.6		40.07	
Joint Sig. (Prob. > chi2)	0.001		0.0136		0.0000	
Urban						
Log of unearned income pc	0.003	0.31	-0.012	-1.5	-0.003	-0.6
Log of unearned income pc2	4.23E-04	0.42	0.001	1.67	0.001	1.34
Joint F-statistics [chi2(2)]	5.0		3.44		9.84	
Joint Sig. (Prob. > chi2)	0.0822		0.1789		0.0073	
Rural						
Log of unearned income pc	0.019	2.33*	-0.005	-0.85	0.012	3.01**
Log of unearned income pc2	-0.002	-1.78	0.001	1.29	-0.001	-1.87
Joint F-statistics [chi2(2)]	6.4		5.79		28.27	
Joint Sig. (Prob. > chi2)	0.0407		0.0554		0.0000	
Adults						
Full						
Log of unearned income pc	0.007	3.82***	-0.008	-1.66	0.005	1.75
Log of unearned income pc2			0.001	2.45*	2.33E-05	0.09
Joint F-statistics [chi2(2)]			19.79		53.6	
Joint Sig. (Prob. > chi2)			0.0001		0.0000	
Urban						
Log of unearned income pc	0.005	1.7	-0.019	-2.65**	-0.002	-0.39
Log of unearned income pc2			0.002	2.86**	0.001	1.25
Joint F-statistics [chi2(2)]			9.01		14.2	
Joint Sig. (Prob. > chi2)			0.011		0.0008	
Rural						
Log of unearned income pc	0.007	2.85**	-0.003	-0.48	0.003	0.82
Log of unearned income pc2			0.001	1.3	2.45E-04	0.67
Joint F-statistics [chi2(2)]			16.27		36.3	
Joint Sig. (Prob. > chi2)			0.0003		0.0000	

Notes: (1) – "pc" represents per capita and "pc2" represents per capita squared
(2) – These are estimates that also controlled for "neighbours" poor water and sanitation; the version without this control are not reported for brevity.

Calculating the turning point and assessing it based on the unearned income figures in the data show that only about a third of the sampled households found at higher levels (after the turning point) in the full sample experience the lowering impact of unearned income. This pattern is also true for the rural sub-sample but with a higher percentage (approximately 58 percent) of its sampled households experiencing the lowering impact of unearned income on child's reported illness, ceteris paribus. However unearned income appears to be statistically insignificant in relation to child's illness in urban households.

In contrast to the earlier survey year, unearned income in GLSS 4 indicates an initial negative relationship with the probability of child's reported illness, which then changes to a positive one at the quadratics. The turning point is much earlier and about 61 percent of households found after this point are observed as having a higher probability of reporting illness. Actually, these are all the households who received unearned income in GLSS 4. The rural and urban sub-samples' estimates however support no such evidence of the influence of unearned income. Evidence from the pooled sample supports the outcome in GLSS 1 for the full and rural sub-samples. The pooled urban sub-sample however indicates an initial decrease in reported illness as unearned income increases. These are mainly households with no unearned income; but about 63 percent of the sampled households who also receive unearned income show increased tendencies of reported illness, ceteris paribus. It does appear that increased unearned income in households tends to be more beneficial to rural compared with urban children, all else held constant.

In the adults' samples unearned income is controlled in linear terms in GLSS 1 because the quadratics had the same signs and was not significant (unless jointly tested). Similar to the children's outcome, unearned income significantly increase the probability of self-reported illness of adults. But in this case, the increase is for all income groups, especially in rural areas. A percentage increase in household unearned income has the probability of increasing reported illness by 0.7 percent amongst adults in GLSS 1, ceteris paribus. The GLSS 4 estimates give a contrary outcome of unearned income. Consistent with the children's scenario, it initially lowers the probability of self-reported illness but increases at the quadratics.

Approximately 61 percent of households are observed after the turning point, and these are also the only recipients of unearned income in the sample. Thus implying that increased unearned income also tends to increase self-reported illness of adults in GLSS 4, ceteris paribus. The pooled sample estimates somewhat support this positive relationship, which give an overall implication that for the majority of residents in the country (except for children in rural areas), households who receive increased unearned income are also more likely to report illness, all else held constant.

A possible reason for such an outcome is that unearned income might be simultaneously determined with illness (for example, unearned income is received because of already existing ailments, although it was presumed under the specification section of this study that it was not the case) or correlated an unobserved factor. Any of these reasons may render unearned income potentially endogenous, hence the need to estimate these models again with expenditure as endogenous for robustness test.

2: Expenditure per capita

An instrumental variable approach is used in the estimations of all the models estimating the effects of education conditioning on expenditure per capita[29]. Various combinations of the instrumental variables are used since the same set does not pass the over-identification test for the different sub-samples of the survey data. The instrumental variables include the value of land and durable

[29] The results discussed here are the estimates acquired when education is assumed exogenous. With the exception of the rural sub-sample of children in GLSS 4, none of the samples indicated that expenditure per capita influences child's reported illness when education is also instrumented. For these rural children, expenditure per capita initially increases the tendency of them being reported as ill and then begins to lower at the quadratics, ceteris paribus.

goods, and in some cases the employment of head of household, room per capita and whether the household owns a radio. The instruments are found to be jointly significant in determining expenditure per capita, and the over-identification test also shows they are valid. The over-identification test statistics are reported with the estimates in table 2.13. Those of the joint F-test statistics are however reported with the first-stage regression and presented in appendix tables A-13 and A-14 for children and adults respectively.

Expenditure per capita, from the theoretical perspectives, is presumed to improve health status because it enables increased access to health inputs. However, the empirical findings show mixed effects of expenditure and its related indicators. Whilst studies such as Alderman and Garcia (1994) on rural Pakistan, Glewwe (1998) on Morocco and Haddad et al., (2003) show favourable effects, others such as Appleton (1991) finds seemingly perverse effects in Tanzania and Glewwe and Desai (1999) find it not significant in Ghana using GLSS 2. From the descriptives of this study, it could be observed that reported illness increases with expenditure in both survey years. This perverse pattern is further observed in some of the econometric results but generally, the results are mixed.

Expenditure per capita is not found significant amongst children in GLSS 1 and seems to have perverse effects in GLSS 4 at a joint significance level of 10 percent. Expenditure per capita at the mean (log of expenditure of 13.5) has positive effect on reported illness by about 4 percentage points, ceteris paribus. This is just below the turning point (approximately log of expenditure of 14.0), and thereafter expenditure begins to have negative effects. About 76.5 percent of the sampled households are below this turning point and they are low to middle level expenditure households. Thus, high earners (households found after the turning point) probably getting the necessary and adequate health inputs, which might tend to improve their children's health status are observed as less likely to be reported ill. However, when the proportion of neighbours with poor water and sanitation is also controlled, majority of households (about 91 percent) including some of the high expenditure households report increased child's illness, ceteris paribus. The pooled sample also shows increase in households' expenditure per capita initially increases child's reported illness but tends to lower it at the quadratics. This also mirrors the pattern observed with unearned income per capita, which generally seems to suggest that household wealth tends to increase child's reported illness.

Table 2.13: The Impact of Expenditure on The Probability of Illness, (GLSS 1 & 4, and Pooled); Treating Expenditure as Endogenous.

	GLSS 1		**GLSS 4**		**Pooled**	
Sample	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
Children						
Full						
Log of expenditure pc	-1.698	-1.3	0.978	1.17	0.465	2.16*
Log of expenditure pc2	0.077	1.28	-0.034	-1.12	-0.016	-2.09*
Joint F-statistics [chi2(2)]	2.19		8.05		5.48	
Joint Sig. (Prob. > chi2)	0.3343		0.0178		0.0646	
Over-identification stats. (Chi-sq)	1.924 (3)		4.433 (3)		9.763 (5)	
P-value	0.5884		0.2184		0.0822	
Urban						
Log of expenditure pc	0.825	0.34	-0.86	-0.56	0.373	0.99
Log of expenditure pc2	-0.038	-0.36	0.032	0.58	-0.013	-0.95
Joint F-statistics [chi2(2)]	0.52		2.81		1.26	
Joint Sig. (Prob. > chi2)	0.7712		0.2459		0.5335	
Over-identification stats. (Chi-sq)	0.136 (2)		3.693 (3)		2.435 (2)	
P-value	0.9344		0.2966		0.296	
Rural						
Log of expenditure pc	-3.436	-1.46	2.228	1.54	0.406	1.07
Log of expenditure pc2	0.166	1.47	-0.081	-1.52	-0.014	-0.99
Joint F-statistics [chi2(2)]	2.34		4.99		3.4	
Joint Sig. (Prob. > chi2)	0.3109		0.0826		0.1827	
Over-identification stats. (Chi-sq)	3.363 (3)		1.446 (3)		1.77 (2)	
P-value	0.339		0.6949		0.4126	
Adults						
Full						
Log of expenditure pc	0.56	0.4	-6.815	-2.68**	0.325	1.15
Log of expenditure pc2	-0.025	-0.4	0.255	2.71**	-0.012	-1.16
Joint F-statistics [chi2(2)]	0.21		12.47		1.4	
Joint Sig. (Prob. > chi2)	0.9019		0.002		0.4977	
Over-identification stats. (Chi-sq)	8.66 (5)		4.713 (3)		1.497 (2)	
P-value	0.1234		0.194		0.4732	
Urban						
Log of expenditure pc	0.131	0.04	-1.464	-1.15	0.349	1.27
Log of expenditure pc2	-0.009	-0.06	0.052	1.16	-0.013	-1.27
Joint F-statistics [chi2(2)]	2.84		2.14		1.61	
Joint Sig. (Prob. > chi2)	0.2421		0.3435		0.4463	
Over-identification stats. (Chi-sq)	1.333 (5)		1.353 (3)		3.247 (3)	
P-value	0.9315		0.7165		0.3551	
Rural						
Log of expenditure pc	0.671	0.47	-3.242	-1.16	1.227	3.80***
Log of expenditure pc2	-0.026	-0.39	0.126	1.22	-0.044	-3.64***
Joint F-statistics [chi2(2)]	6.65		15.42		26.76	
Joint Sig. (Prob. > chi2)	0.0359		0.0004		0	
Over-identification stats. (Chi-sq)	9.811 (5)		5.267 (2)		0.414 (1)	
P-value	0.0808		0.0718		0.5199	

Note: (1) – "pc" represents per capita and "pc2" represents per capita squared
(2) – These are estimates that also controlled for "neighbours" poor water and sanitation; the version without this control are not reported for brevity.

Similar to the children's, estimates of expenditure per capita of the adults' samples do not always indicate statistical significance. But when it does, like education, has different signs in GLSS 1 and 4. Interestingly, the trend in expenditure and education is similar in each survey year; for example if education show a positive (negative) tendency in GLSS 1 (GLSS 4) to report illness, expenditure per capita is also likely to show the same association in the same year. In GLSS 1, only the rural sub-sample shows some significant effects on self-reported illness. The relationship is rather relatively weak and suggests an increased tendency of adults to report illness till the highest expenditure level, after which decreasing effects are observed. At the mean expenditure level (log of expenditure 10.6), which is observed around middle expenditure households, the probability of reported illness increases by 13 percentage points, ceteris paribus. The turning point is occurs at log of expenditure 12.9 (higher expenditure households); after which the probability of reported illness begins to decrease. However, the decreasing impact at the quadratics is negligible because it represents a very small percentage of households. The majority of households, about 99.8 percent, are estimated as having high probabilities of self-reporting illness in the rural areas.

In GLSS 4, only the full and rural sub- samples show expenditure per capita as significant in influencing self-reported illness of adults. They suggest the expected negative relationship, but this is only at the lower levels of expenditure, that is, amongst adults in poor households. They constitute a third of the households sampled and indicate that self-reported illness decreases as expenditure levels increase. Meanwhile households with middle to high level expenditure tend to do the reverse. This is more so in rural areas where the estimated turning point is much earlier on the expenditure ladder (lowest) and about 83.5 percent of adults from the lower to higher expenditure households tend to report increased illness as expenditure increases, ceteris paribus.

The overall picture of expenditure per capita and reported illness appears to be geared more towards a positive linkage, since the majority of the households sampled tend to report more illness with expenditure increase (also observed with unearned income). The positive relationship observed might also not be due to the potential endogeneity of household wealth since both cases of unearned income (exogenous) and expenditure (endogenous) gave fairly similar results. The mixed results in this study however concur with others in the literature, and show that household wealth affects the health status of different members as well as sections of society differently. Wolfe and Behrman (1984) also explain the positive or not significant outcome of income (and education) as "consistent with the possibility that altered consumption patterns due to taste changes associated with more schooling and more resources may offset the positive impact on health of greater productivity and more household resources. The "new morbidity: associated with the consumption of high-priced "junk" food and the stresses of "modern" life may set in at fairly low income levels"

The impact of other control and community variables on reported illness

Table 2.14 presents the remaining control variables of the model variant 2, which also includes poor water and sanitation. The others are age and gender, rural residence in the case of the full and urban sub-samples, and in addition, community variables for the rural sub-samples.

Water and sanitation ("neighbours" in cluster with poor household public goods)

These estimates are marginally different (negligible) from those that do not control poor water and sanitation (not reported for brevity). Meanwhile it could be observed that where significant, increased proportion of poor water and sanitation in a cluster tends to increase reported illness of both children and adults, ceteris paribus. This is as anticipated because prevalence of poor and diseased environments could override the beneficial influence of education and wealth to cause detrimental effects on health status.

The outcomes in the urban sub-samples estimated are however not statistically significant. This might be due to other variables that countermand the presumed detrimental effects. These possibly include the availability or easier access and use of health protective equipments such as mosquito-insecticide nets to prevent malaria, which is one of the main causes of ailments in the country; acquisition and safer handling of water even if it is piped-borne because of frequent interruptions and storage; and better access to information on public health to avoid contracting contaminable diseases.

Rural communities appear to be more at disadvantaged positions since poor water and sanitation are mostly found statistically significant in these areas. This probably suggests that improved water and sanitation, in spite of education and wealth, is critical to health production particularly in rural areas. One reason being that of the sample estimated, only 20 percent of urban dwellers have neighbours with poor water and sanitation in the two survey years, whilst in rural areas, about 80 percent in GLSS 1 and 56 percent in GLSS 4 have neighbours with poor water and sanitation. In such circumstances the perception that education or wealth serves as proxies for these environmental factors may not be well founded, especially in developing countries. Although both are correlated with better housing conditions the empirical evidence demonstrates that clean water and sanitation also directly improve health (see Lavy et al., 1996[30]; and Lawson, 2004). Therefore policy makers should endeavour to make accessibility to these goods in communities a task of primary importance, in addition to education.

[30] They used the same data and a similar indicator, which to some extent controls the likely endogeneity of household public goods to estimate child survival. They find child survival is positively related to good quality water and sanitation.

Table 2.14: The Impact of Other Control and Community Variables on The Probability of Illness, (GLSS 1 & 4, and Pooled)

	GLSS 1		**GLSS 4**		**Pooled**	
	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
CHILDREN						
Full						
Age (years)	-0.032	-6.20***	-0.042	-12.94***	-0.037	-13.67***
Age squared (years)	0.001	4.05***	0.002	7.07***	0.001	7.70***
Female	-0.026	-2.11*	-0.015	-1.95	-0.02	-2.97**
Rural	-0.033	-1.64	0.014	1.3	-0.001	-0.09
Water & sanitation	0.036	1.66	0.041	3.39***	0.044	4.26***
Urban						
Age (years)	-0.02	-2.39*	-0.045	-7.96***	-0.036	-7.45***
Age squared (years)	0.001	1.5	0.002	4.57***	0.001	4.26***
Female	-0.019	-0.96	0.001	0.09	-0.009	-0.78
Water & sanitation	-0.128	-1.88	0.011	0.38	0.009	0.36
Rural						
Age (years)	-0.037	-5.83***	-0.042	-10.60***	-0.039	-11.62***
Age squared (years)	0.002	3.87***	0.002	5.78***	0.001	6.50***
Female	-0.03	-1.9	-0.023	-2.38*	-0.025	-3.02**
Water & sanitation	0.082	2.83**	0.052	3.54***	0.059	4.78***
Community variables						
Price of Maize (kg)	-0.005	-0.83	-0.002	-0.94	-0.003	-1.37
Price of Anti-malarial pill	-0.04	-1.6	-0.02	-2.42*	-0.013	-1.88
Dist. to the nearest clinic	0.002	2.20*	1.11E-04	1.02	2.35E-04	2.18*
Male Agric. Wage	-0.038	-3.82***	-0.01	-2.44*	-0.01	-3.12**
Ratio of female Wage	-0.016	-0.64	0.06	3.92***	0.032	2.76**
Ratio of child Wage	0.043	1.57	0.003	0.24	0.012	0.76
ADULTS						
Full						
Age (years)	0.007	3.97***	0.004	3.59***	0.006	6.58***
Age squared (years)	-3.21E-05	-1.62	-1.05E-05	-0.82	-2.30E-05	-2.33*
Female	0.03	2.25*	0.075	7.80***	0.056	7.80***
Rural	-0.017	-0.85	0.057	3.39***	0.002	0.2
Water & sanitation	0.061	2.71**	0.049	3.44***	0.05	4.35***
Urban						
Age (years)	0.006	1.89	0.003	1.82	0.003	2.18*
Age squared (years)	-2.60E-05	-0.75	2.30E-07	0.01	-7.58E-07	-0.05
Female	0.039	1.87	0.062	4.74***	0.057	5.11***
Water & sanitation	-0.013	-0.15	-0.032	-1.17	0.002	0.07
Rural						
Age (years)	0.009	3.74***	0.006	4.43***	0.007	6.38***
Age squared (years)	-4.21E-05	-1.69	-2.87E-05	-1.91	-3.39E-05	-2.74**
Female	0.031	1.67	0.076	6.29***	0.058	6.28***
Water & sanitation	0.049	1.7	0.089	5.47***	0.08	6.31***
Community variables						
Price of Maize (kg)	0.009	1.42	0.001	0.23	0.002	0.72
Price of Anti-malarial pill	-0.047	-1.8	-0.026	-2.92**	-0.014	-2.02*
Dist. to the nearest clinic	0.003	3.47***	-4.54E-05	-0.45	1.02E-04	1.12
Male Agric. Wage	-0.04	-3.44***	-0.009	-2.16*	-0.017	-5.72***
Ratio of female Wage	-0.031	-1.32	0.071	4.45***	0.039	3.23**
Ratio of child Wage	0.032	1.16	-0.003	-0.17	-0.024	-1.59

*Note: Water and sanitation is measured as proportion of 'neighbours' in cluster with no water & toilet

Age and gender, and location

The probability of the incidence of illness generally varies with the age of children. The effect is however non-linear whereby reported illness falls to about 16 and 10 and half years of age in GLSS 1 and 4 respectively, and then rises thereafter. The rise in reported illness continues into adulthood as the adults' samples show in both surveys till over a century old[31]. This outcome is consistent with Appleton (1991) amongst adults in Cote d'Ivoire.

With regard to gender, the results show girls are less likely to be reported as ill compared to boys in both survey years, which also concurs with the descriptive statistics. This might not exactly be indicative of gender discrimination. Although it is possible that because of the boisterous nature of boys, they might be quickly noted as ill when they become lethargic. It is also possible that the boys may actually be less healthy than girls for no obvious reasons; but hardly would be due to gender discrimination because unlike Asia, there has rarely been evidence of such in relation to childcare in SSA. At adulthood, women show higher probability of reporting illness as opposed to men, ceteris paribus. This may be due to problems related to reproduction and menopause.

Current residence, represented by a dummy indicating rural, is observed as statistically significant in only GLSS 4 of the adults' sample. It indicates that these rural dwellers are 5.7 percentage points more likely to report illness relative to their counterparts in urban areas, all else held constant. This is as anticipated because not only does settlements in rural/urban communities differ as a result of socioeconomic determinants, but also accessibility to facilities that may generally

[31] Which is very rare in a developing country, and therefore suggests that there is no respite from illness with regard to age as one reaches adulthood.

promote health is different in rural and urban areas. This is one of the reasons for the disaggregation of specified models into rural and urban sub-samples. The other is the opportunity to include some relevant variables that are only observed at community levels in rural areas.

Community variables

Of the community variables controlled, the results show that the price of anti-malarial treatment drugs is negatively related to reported illness. This is however significant in only GLSS 4 (both the children and adults' samples). The estimated results is contrary to expectation, since an increase in the cost of an health input is presumed to reduce its demand and therefore worsen health status, which in this case is an increase in reported illness. This contradicts Lawson (2004) who finds higher antibiotic price increase morbidity levels in female adults and school-aged boys in Uganda. However another price of health input, distance to the nearest clinic, shows the expected outcome. For instance, a kilometre increase in distance to the nearest clinic increases reported illness in rural areas by about 0.2 (children) and 0.3 (adults) percentage points in GLSS 1[32], ceteris paribus. This indicates how lack of easy access to medical facilities impedes health. Ill health probably prevails because of lack of preventative health care programmes in communities as well as immediate medical attention in the event that illness occurs.

[32] Distance to the nearest clinic is also found positive and statistically significant in the children's sample in GLSS 4 as well as the pooled samples of children and adults, when expenditure and poor water and sanitation are not controlled.

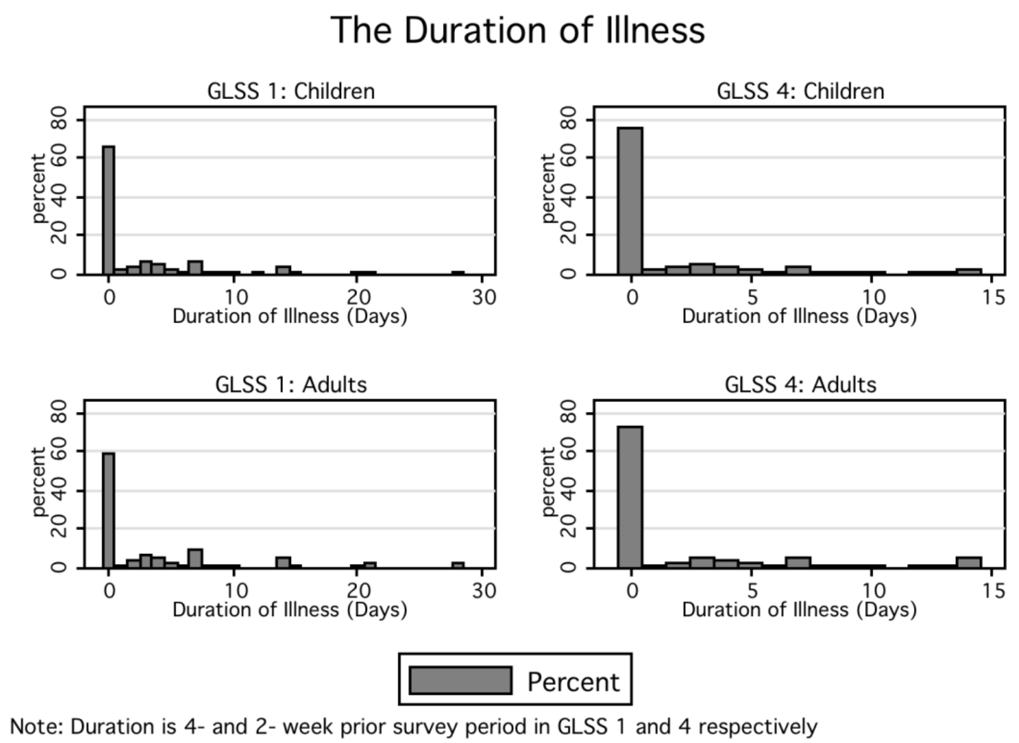
Increase in men's agricultural wage rates tend to lower the probability of reported illness of both children and adults, all else held constant. For children, this suggests that with increased men's rates, other members (especially children) are less likely to work to support household income, and therefore less likely to fall ill. For adults, it means they could reduce working periods and enjoy more leisure that could improve their health. The outcome may also be suggesting affordability of health inputs in households including nutrition that consequently improves health.

The effect of the ratio of women to men's wage rates is not significant in GLSS 1, but it increases reported illness in GLSS 4. The pooled samples of children and adults also support the positive relationship, which implies that an increase in the proportion of women to men's wage rates could worsen households' health status. This outcome is not unexpected since as primary carers in most households, less time or attention given to members, especially children due to an increased opportunity cost of time could be detrimental to the health production of all household members.

2.3.3 Duration of Illness: Reduced Form Estimates

The duration of illness is recorded for respondents who only reported they were ill within the reference period in both surveys: 28 days in GLSS 1 and 14 days in GLSS 4. As mentioned in section 2.2.2.1, this presents an econometric problem of censoring and truncation, and therefore the use of Tobit in the econometric estimations. The upper limit is set according to the end of the reference period of each survey year and the lower limit is zero (mainly representing respondents who did not suffer any illness or injury within the reference periods). This gives the overall sample size of each sub-group estimated as equal to that of the incidence of illness estimated in the previous sub-section. It can be observed from figure 2.1 that the highest duration frequency in the various sub-samples is zero. For instance, of the 6378 (GLSS 1) and 11660 (GLSS 4) children observed, about 65.9 and 76.2 percent respectively were not reported as ill, hence the high proportion of zero days ill. The analogous figures for adults are 59.6 and 72.2 percent. It is thus fairly possible that with the dominance of zeros in the observed sample sizes, the estimated results would be similar to those of the incidence of illness.

Fig. 2.1



Upon an onset of illness, days ill could be mostly observed around the initial few days, with slight intermittent peaks, which then taper off to the end of the reference period. The distribution is highest on day three for children (6.4% in GLSS 1 and 4.7% in GLSS 4) and day 7 for adults (8.7% in GLSS 1 and 5.1% in GLSS 4). A distinguishing feature of the distribution however is that the intermittent peaks, apart from day three, are points of memorable day-counts (7, 14, 21 and 28 days) of weekly basis. This gives an impression of respondents' likelihood to round up ("bunching") days to weeks the longer the days of illness. This pattern is however neither ascertained as true reflections nor solved using a more econometrically appropriate semi-parametric discrete choice duration model due to lack of information in the datasets.

Similar to the incidence of illness, estimates are presented separately for children and adults, and are discussed accordingly. Also, the models are estimated with the primary focus on parental education for children and personal education for adults. Personal characteristics, such as age and gender, rural location, and the community variables discussed in the methodology are also controlled in the estimations. In order to reduce potential endogeneity or omitted variable bias that might occur due to a likely correlation between education and some unobserved variable in the error term, additional control variables are included but not reported for brevity. These are ethnicity, region of residence, and a dummy representing missing commodity prices.

Further, as in the case of incidence of reported illness, estimations are conducted according to the specified model described under the conceptual framework section. The model is in three variants, where "1" is estimating only education with its controls, "2" education conditioning on expenditure per capita as an endogenous variable and "3" is education conditioning on unearned income per capita as an exogenous variable. These three model variants are also estimated controlling for the proportion of 'neighbours' with poor water and sanitation in cluster as well as parental education of adults (for the adults' sample only). These re-estimations are performed for robustness test and also to further reduce the bias as a result of unobserved variables.

Finally, all the estimations in GLSS 4 are performed using weights created by the survey team, with the exception of the instrumental Tobit estimates (the Stata econometric software does not allow the use of probability sampling weights with this procedure). The estimates of education are presented in text with the discussions in an abridged form for the sake of brevity. The entire results can however be found in appendix A–15 to A–20. The estimates of the controlled variables are also presented in different tables, and briefly discussed.

I: Children

The impact of parental education on child's duration of illness

Table 2.15 presents the results of parental education on the duration of child's illness for GLSS 1, 4 and the pooled sample of both surveys. The results are not consistent with the expectation outlined in the conceptual framework, but they are not unusual. By working through a higher tendency to seek information, education is expected to create or improve healthy environments for individuals and households through higher exposure and accessibility to health related facilities, increase the tendency to use these facilities, efficient use of medical care, taking prescribed medicines more regularly, and adopting better nutritional habits. Thus children with educated parents are expected to experience shorter duration of illness in the event that they fall ill. However, similar to the incidence of illness, duration of illness could also be subject to personal sensitivities and perhaps the socioeconomic environment.

Table 2.15: Tobit Results – The Impact of Parental Education on the Duration of Child Illness, (GLSS 1 & 4, and Pooled)

	Full			**Urban**			**Rural**		
Sample	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 4**	**Pooled**
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Variant 1: Education									
Mother's Primary	0.204	0.083	0.1	0.323	-0.085	0.067	0.063	0.145	0.125
Mother's Middle	0.12	0.04	0.039	0.453***	-0.124	0.082	-0.057	0.115	0.023
Mother's Sec & above	0.333	0.003	0.12	0.713**	-0.002	0.24	0.438	-0.03	0.098
Father's Primary	-0.024	0.179	0.047	-0.307	-0.122	-0.098	0.134	0.256	0.109
Father's Middle	0.14	-0.075	-0.019	-0.155	-0.14	-0.109	0.261*	-0.088	-0.018
Father's Sec & above	0.204	0.168	0.119	-0.275	-0.104	-0.046	0.539**	0.299	0.235*
GLSS_1			0.541***			0.762***			-0.04
Variant 2: Education conditioning on expenditure									
Mother's Primary	0.18	0.061	0.101	0.348	-0.086	0.064	0.108	0.144	0.117
Mother's Middle	0.136	-0.02	0.027	0.473***	-0.176	0.077	0.001	0.085	0.007
Mother's Sec & above	0.322	-0.01	0.079	0.796**	-0.055	0.223	0.546	0.061	0.033
Father's Primary	0.083	0.028	0.024	-0.266	-0.061	-0.117	0.23	0.055	0.101
Father's Middle	0.256*	-0.169*	-0.047	-0.097	-0.185	-0.131	0.283*	-0.189*	-0.027
Father's Sec & above	0.331*	-0.005	0.085	-0.189	-0.021	-0.061	0.63**	0.001	0.204
GLSS_1			1.012			0.915			0.16
Variant 3: Education conditioning on unearned income									
Mother's Primary	0.183	0.056	0.078	0.311	-0.114	0.044	0.049	0.121	0.104
Mother's Middle	0.115	0.012	0.021	0.433**	-0.153	0.063	-0.047	0.091	0.009
Mother's Sec & above	0.333	-0.029	0.106	0.667**	-0.033	0.211	0.424	-0.073	0.086
Father's Primary	-0.009	0.192	0.048	-0.32	-0.093	-0.086	0.145	0.256	0.102
Father's Middle	0.114	-0.08	-0.04	-0.173	-0.138	-0.12	0.233*	-0.101	-0.048
Father's Sec & above	0.173	0.137	0.104	-0.301	-0.15	-0.063	0.499**	0.278	0.219*
GLSS_1			0.535***			0.84***			-0.024
Observation no.	6378	11660	18038	2410	3547	5957	3968	8113	12081

*Notes: (1) – Proportional sampling weights are applied in the estimations of GLSS 4, except for variant 2.
(2) – These estimates are not marginal effects; the entire results with t-ratio are presented in Appendix tables A-15, A-16, and A-17.
(3) – Age and its quadratic, gender, rural residence, water and sanitation, ethnicity, and regional dummies are controlled in all the estimations.
(4) – Community variables are controlled in addition to the above for the rural sub-samples.

However, this study finds that children of educated mothers, especially post-primary education, seem to have longer duration of reported illness in urban areas (GLSS 1). Paternal post-primary education also appears to be positively associated with longer duration of child's illness in the same survey year; this is however observed in rural areas. Although this relationship appears perverse, it is possible that educated parents (who are also more likely to seek treatment for their sick children) might not consider the child's duration of illness as complete until informed otherwise by a medical practitioner. Hence children of uneducated parents may not be healthier than educated ones, as the results seem to indicate.

In GLSS 4, none of the parental education categories seem to determine the duration of child's illness. These findings are quite similar to the analysis of reported illness in the previous section. The pooled samples also do not suggest any significant influence of parental education on this health indicator, except paternal secondary and above in rural areas. However, the dummy representing the GLSS 1 survey period is significant in only the full and urban sub-samples, which seems to suggest that the duration of illness is relatively longer in GLSS 1 compared to GLSS 4, ceteris paribus.

Conditioning on household wealth however gives different results depending on whether it is exogenous unearned income per capita or an endogenous expenditure per capita. The parental education estimates do not dramatically change upon conditioning on unearned income per capita and its quadratic in the model. There are fairly negligible reductions in magnitudes of categories found significant in GLSS 1, but the outcome in GLSS 4 remains same.

The estimates of parental education however change upon conditioning on expenditure per capita and its quadratic. In the full sample of GLSS 1 for instance, post-primary paternal education becomes statistically significant; but like the rural sub-sample, it appears positively related to the duration of child's illness. There are also some perceptible changes in GLSS 4, where paternal middle education level is found significant in reducing the duration of child's illness compared to none, especially in rural areas. This relationship is however quite weak, and cannot be directly compared with the outcome of the previous model without expenditure because sampling weights are not used in this estimation[33].

II: Adults

The impact of personal education on adult's duration of illness

The results on adult's duration of illness are presented in Table 2.16 and they indicate that own primary education of adults in GLSS 1 tends to be positively related with the duration of illness compared to none, ceteris paribus. These results concur with those of Schultz and Tansel (1993) who used a combination of GLSS 1 and 2, and a different specification for a first-stage estimation of education on adults' duration of illness, which was subsequently used in estimating morbidity effects on wage rates in Ghana. Our results are also similar to those for children in respect of reported illness.

In contrast, the results in GLSS 4 suggest that persons with secondary education and above report shorter (about 7.8%)[34] duration of illness relative to those with

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[33] The software does not allow for probability sampling weights with instrumental tobit estimations. When estimations are conducted without the control of expenditure per capita and sampling weights for GLSS 4, paternal education is also found significant in reducing the duration of children's illness. This then implies that the control of expenditure per capita per se does not change the initial results on parental education.

[34] This is the marginal effects after tobit (unconditional expected value).

no education, ceteris paribus. The corresponding figures for adults living in urban and rural areas are 8.6 and 8.4 percent respectively. The reason however behind the discrepancy in outcomes (direction of impact) between GLSS 1 and 4 is not very clear. It is likely that the difference in re-call periods may be a contributory factor, but this could not be verified. The pooled sample however supports the outcome in GLSS 4, especially in urban areas; and the survey dummy indicator being significant suggests longer duration of illness in GLSS 1 than 4, ceteris paribus.

The control of unearned income (variant 3) slightly reduces the magnitude and strength of the results in mostly GLSS 1, but is generally fairly stable. Moreover, conditioning on expenditure (variant 2) seems to complement the impact of adults' own education. The outcomes in GLSS 1 barely changed, except primary education, which lost its statistical significance in the rural sub-sample; but those in GLSS 4 increased in magnitude and strength of impact. For example, the estimate of persons with secondary and above level of education is about three times that observed when expenditure is not controlled; and the outcome is significant at the 1 percent level. Thus adults with secondary education and above experience comparatively shorter duration of illness conditioning on expenditure than not. This type of dramatic change is not observed in the urban sub-sample. However, the rural sub-sample shows similar changes; and in both the full and rural sub-samples, persons with middle/JSS level of education are also observed as experiencing shorter duration of illness relative to those with no education, ceteris paribus.

The parental education levels of these adults are also controlled as a sensitivity analysis to the earlier outcomes (see appendix tables A-21 to 23). The results did not change in signs although the magnitudes of the coefficients as well as significance reduced slightly. Nonetheless, when unearned income is also controlled, personal secondary education and above in the urban sub-sample of GLSS 1 becomes significant and negatively influences the duration of illness. Of the parental education itself, only primary levels are significant in GLSS 1 and they tend to increase the duration of illness in adults in the full and urban sub-samples.

In GLSS 4 however, only the urban sub-sample shows maternal primary education as significant in reducing the duration of adult's illness. Thus even with parental education the direction of the link with illness duration is different in the two surveys; each mirroring that of the personal education of the adults, which is similar to the pattern observed in the estimation of reported illness. Considering this and the observation that the control of parental education does not change the outcome on personal education of adults, the remaining discussions focus on estimates without these controls.

Table 2.16: Tobit Results – The Impact of Own Education on the Duration of Adult Illness, (GLSS 1 & 4, and Pooled)

	Full			**Urban**			**Rural**		
Sample	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 4**	**Pooled**	**GLSS 1**	**GLSS 4**	**Pooled**
	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.
Variant 1: Education									
Primary	0.386***	0.059	0.103	0.517**	0.075	0.096	0.294*	0.051	0.103
Middle	0.114	-0.018	-0.03	0.062	-0.058	-0.071	0.163	-0.019	-0.032
Sec. & above	-0.095	-0.315**	-0.214**	-0.158	-0.37*	-0.27*	-0.006	-0.329*	-0.154
GLSS_1			0.81***			1.033***			0.116
Variant 2: Education conditioning on expenditure									
Primary	0.384***	0.035	0.1	0.546**	-0.091	0.071	0.274	0.027	0.163
Middle	0.108	-0.2*	-0.03	0.096	-0.159	-0.096	0.111	-0.205*	-0.027
Sec. & above	-0.1	-0.944***	-0.195*	-0.018	-0.406*	-0.3*	-0.062	-0.599***	-0.484**
GLSS_1			0.936			1.579**			-3.293
Variant 3: Education conditioning on unearned income									
Primary	0.369**	0.048	0.088	0.502**	0.07	0.085	0.283*	0.032	0.085
Middle	0.077	-0.042	-0.053	0.032	-0.094	-0.088	0.126	-0.043	-0.059
Sec. & above	-0.158	-0.37**	-0.248**	-0.219	-0.434**	-0.306**	-0.061	-0.384*	-0.193
GLSS_1			0.855***			1.109***			0.205
Observation	6519	13547	20066	2659	4873	7532	3860	8674	12534

*Notes: (1) – Proportional sampling weights are applied in the estimations of GLSS 4, except for variant 2.
(2) – These estimates are not marginal effects; the entire results with t-ratio are presented in Appendix tables A-18, A-19, and A-20.
(3) – Age and its quadratic, gender, rural residence, water and sanitation, ethnicity, and regional dummies are controlled in all the estimations.
(4) – Community variables are controlled in addition to the above for the rural sub-samples.

2.3.3.1 The Duration of Illness: Control Variables

The impact of household wealth on the duration of self-reported illness

The impacts of household wealth are mixed, and mostly non-significant, especially in relation to expenditure per capita and the duration of children's illness. This is however not uncommon. Appleton (1991) for instance finds predicted consumption per capita, and livestock per capita as well as land per capita not significant in reducing the duration of illness in Cote d'Ivoire and Kenya respectively; but finds that land per capita increases illness duration in Tanzania. In this study too, it generally appears that the majority of households who receive unearned income or has higher expenditure experience longer duration of illness, as also observed in relation to reported illness.

1: Unearned income per capita (exogenous)

Table 2.17 presents the results of both children and adults of the two survey years. With regard to children, the duration of illness initially increases with unearned income in GLSS 1 and then changes at the quadratics, where shorter durations are observed. Approximately 51 percent of households from the lowest (received no unearned income) to lower middle level of unearned income are estimated as having children who experience lengthened duration of illness whereas the converse is the case for children in households that received higher unearned income, ceteris paribus. These outcomes are however significant in only the full and rural sub-samples. In contrast, in GLSS 4 unearned income is found significant in only the full and urban sub-samples, indicating that children in households that did not receive any unearned income experience shortened duration of illness whilst those who did (about 61 percent) experience lengthened duration.

In relation to adults, the association between unearned income and the duration of illness is observed as positive for all the households in GLSS 1, especially in the rural sub-sample. On the other hand, adults in GLSS 4 who received no unearned income, like their children, experience shortened duration, whilst those who received unearned, experience longer duration of illness, ceteris paribus. The outcomes in the pooled samples concur with what is observed in GLSS 1, for the full and rural sub-samples; but that of the urban sub-sample seems to support the findings from GLSS 4.

Table 2.17: Tobit Results – The Impact of Unearned Income on the Duration of Illness, (GLSS 1 & 4, and Pooled)

Sample	**GLSS 1**		**GLSS 4**		**Pooled**	
Children	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio
Full						
Log of unearned income pc	0.098	3.04**	-0.05	-1.46	0.054	2.77**
Log of unearned income pc2	-0.008	-2.21*	0.006	1.96	-0.002	-1.31
Joint F-statistics [chi2(2)]	6.77		3.56		18.94	
Joint Sig. (Prob. > chi2)	0.0012		0.0296		0.0000	
Urban						
Log of unearned income pc	0.024	0.48	-0.09	-1.69	-0.022	-0.64
Log of unearned income pc2	-3.25E-05	-0.01	0.009	2.20*	0.004	1.31
Joint F-statistics [chi2(2)]	1.07		4.57		4.26	
Joint Sig. (Prob. > chi2)	0.3419		0.0125		0.0141	
Rural						
Log of unearned income pc	0.12	2.57*	-0.028	-0.52	0.075	2.97**
Log of unearned income pc2	-0.012	-2.12*	0.004	0.84	-0.004	-1.8
Joint F-statistics [chi2(2)]	3.95		1.61		14.32	
Joint Sig. (Prob. > chi2)	0.0194		0.2029		0.0000	
Adults						
Full						
Log of unearned income pc	0.017	0.59	-0.055	-1.43	0.019	1.11
Log of unearned income pc2	0.002	0.55	0.007	2.09*	0.001	0.62
Joint F-statistics [chi2(2)]	6.23		7.45		23.59	
Joint Sig. (Prob. > chi2)	0.002		0.0007		0.0000	
Urban						
Log of unearned income pc	-0.033	-0.73	-0.135	-1.99*	-0.017	-0.59
Log of unearned income pc2	0.006	1.27	0.012	2.32*	0.004	1.42
Joint F-statistics [chi2(2)]	1.9		4.72		6.77	
Joint Sig. (Prob. > chi2)	0.1491		0.0109		0.0012	
Rural						
Log of unearned income pc	0.003	0.08	-0.024	-0.5	0.007	0.33
Log of unearned income pc2	0.004	0.77	0.005	1.09	0.002	1.09
Joint F-statistics [chi2(2)]	4.01		4.68		16.15	
Joint Sig. (Prob. > chi2)	0.0182		0.0104		0.0000	

Notes: (1) – “pc” represents per capita and “pc2” represents per capita squared
(2) – These are estimates that also controlled for “neighbours” poor water and sanitation; the version without this control are not reported for brevity.

2: Expenditure per capita (endogenous)

The first stage regression is very similar to that of reported illness presented in appendix A-13 and A-14, hence not reported for brevity. The instruments are also found significant in determining expenditure per capita and its quadratic at the 1 percent level. They all pass the over-identification test, which is reported with the results in table 2.18 for both children and adults. Expenditure per capita and its quadratic are found statistically significant in only the rural sub-sample of children in GLSS 1, the full and rural sub-samples of adults in GLSS 4 as well as the rural sub-sample of the pooled.

In GLSS 1, children found in poorer households (lowest to lower middle on the expenditure ladder that has been divided into four quartiles in ascending order), are observed as having shorter duration of illness, ceteris paribus. However, children in the relatively well-resourced households, constituting about two-thirds of the sampled households, experience longer duration of illness.

A similar pattern is observed amongst adults in GLSS 4, especially in rural areas, as well as the pooled sample. These show an initial reduction in the duration of illness of adults as expenditure per capita increases (mostly in poorer households). In rural areas for example, this represents households found in the lowest quarter of the expenditure group. Thus the majority of households, mainly middle to upper level expenditure, experience longer duration of illness, ceteris paribus.

Table 2.18: Tobit Results – The Impact of Expenditure on the Duration of Illness, (GLSS 1 & 4, and Pooled)

Sample	**GLSS 1**		**GLSS 4**		**Pooled**	
Children	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio
Full						
Log of expenditure pc	-9.69	-1.37	1.896	0.33	0.93	0.69
Log of expenditure pc2	0.435	1.34	-0.061	-0.29	-0.032	-0.64
Joint F-statistics [chi2(2)]	3.49		4.8		0.84	
Joint Sig. (Prob. > chi2)	0.1747		0.0905		0.6555	
Over-identification stats. (Chi-sq)	2.422 (3)		4.342 (3)		7.47 (3)	
P-value	0.4895		0.2269		0.0583	
Urban						
Log of expenditure pc	-0.465	-0.04	-10.382	-0.91	0.741	0.32
Log of expenditure pc2	0.008	0.01	0.377	0.92	-0.028	-0.34
Joint F-statistics [chi2(2)]	1.32		1.33		0.15	
Joint Sig. (Prob. > chi2)	0.5163		0.5147		0.9289	
Over-identification stats. (Chi-sq)	0.098 (2)		4.099 (3)		2.471 (2)	
P-value	0.952		0.2509		0.2906	
Rural						
Log of expenditure pc	-40.378	-2.19*	7.379	0.78	-0.859	-0.37
Log of expenditure pc2	1.935	2.19*	-0.264	-0.76	0.04	0.45
Joint F-statistics [chi2(2)]	4.8		3.61		2.41	
Joint Sig. (Prob. > chi2)	0.0906		0.1648		0.2997	
Over-identification stats. (Chi-sq)	0.952 (2)		1.68 (3)		1.187 (2)	
P-value	0.6213		0.6415		0.5523	
Adults						
Log of expenditure pc	1.045	0.15	-41.185	-2.57*	0.889	0.55
Log of expenditure pc2	-0.047	-0.15	1.537	2.60**	-0.035	-0.6
Joint F-statistics [chi2(2)]	0.03		10.06		1.35	
Joint Sig. (Prob. > chi2)	0.9864		0.0065		0.5097	
Over-identification stats. (Chi-sq)	9.143 (5)		5.007 (3)		3.12 (2)	
P-value	0.1035		0.1713		0.2101	
Urban						
Log of expenditure pc	3.774	0.24	-10.804	-1.22	2.037	1.27
Log of expenditure pc2	-0.185	-0.27	0.385	1.23	-0.074	-1.29
Joint F-statistics [chi2(2)]	4.09		1.84		1.69	
Joint Sig. (Prob. > chi2)	0.1294		0.3987		0.4303	
Over-identification stats. (Chi-sq)	0.561 (2)		1.582 (3)		4.734 (3)	
P-value	0.7556		0.6636		0.1924	
Rural						
Log of expenditure pc	0.95	0.13	-20.117	-1.19	-23.916	-2.33*
Log of expenditure pc2	-0.02	-0.06	0.778	1.25	0.95	2.38*
Joint F-statistics [chi2(2)]	5.82		13.72		17.33	
Joint Sig. (Prob. > chi2)	0.0545		0.001		0.0002	
Over-identification stats. (Chi-sq)	6.274 (3)		4.252 (2)		0.208 (1)	
P-value	0.099		0.1193		0.648	

Notes: (1) – “pc” represents per capita and “pc2” represents per capita squared
(2) – These are estimates that also controlled for “neighbours” poor water and sanitation; the version without this control are not reported for brevity.

The impact of "neighbours" with poor household public goods (water and sanitation) on the duration of illness

The high proportion of "neighbours" with poor water and sanitation in a cluster does not only have unfavourable effects on the incidence of illness, but also increases illness duration of all household members (table 2.19). This is particularly prevalent in rural areas, which has also been noted by Jalan and Ravallion (2003) who find that access to piped water shortens child's duration of illness as a result of diarrhoea in rural India. However, in our study, the urban sub-samples in both surveys do not appear to be influenced by the condition of household public goods in the community. But as already explained under the incidence of illness, there may be other facilities available in these areas that alleviate or override the deteriorating effects of poor water and sanitation in these communities.

Age and gender

Age negatively affects the duration of illness amongst children initially, gets to a maximum, and then increases thereafter. The turning point is significantly earlier in the first (11 years) than the later (15 years) survey year. The effect of age on the duration of illness amongst adults is contrary to what is observed in the case of children. The duration of illness generally rises with age in both years, which is similar to the findings of Appleton (1991).

With regard to gender, where significant, the estimates suggest shorter duration of illness for girls relative to boys in both surveys. This is largely observed in rural areas, unlike the urban sub-samples, which are not significantly different from zero. There are no apparent reasons to explain why girls seem healthier than boys, all else held constant. Meanwhile amongst adults the duration of illness does not differ by gender in GLSS 1, but in GLSS 4 women are associated with the tendency of reporting longer duration, ceteris paribus. The pooled samples of both children and adults support their statistically significant outcomes; and generally suggest that females are healthier when young but become worse off as they get to adulthood.

Current residence

Contrary to expectations, and what is observed in the descriptive statistics, the duration of illness is significantly shorter amongst rural than urban children in GLSS 1. However, the outcome does not significantly differ from zero in GLSS 4, which is not surprising because the descriptives for this survey year do not show variation between rural and urban children's duration of illness. Amongst adults however, rural dwellers tend to have longer duration of illness compared to their urban counterparts, ceteris paribus.

Community variables

The effects of the community variables on the duration of illness in rural areas are mixed and some of them are not consistent with the conceptual framework. For example, an increase in the price of anti-malarial treatment drugs rather shortens the duration of illness of children (GLSS 1) and adults (GLSS 4) instead of lengthened duration, due to the anticipated fall in demand. However, this may not actually be a perverse outcome because upon the incidence of illness, patients may not have any option but to purchase the medicines. Those who still cannot afford the cost could get it on credit.

Distance to the nearest clinic however increases the duration of illness in children and adults, as expected. This is found significant in the pooled sample of children, and the adult sample of GLSS 1. The positive correlation is probably due to the opportunity cost of time (parents in the case of children), whereby longer distance to clinics may discourage treatments or follow-ups if they do seek the initial treatment. It is also possible that the discomfort and burden of long distance travels to clinics could worsen and prolong the duration of illness.

Concerning agricultural wage rates, a rise in men's wages prove beneficial for both children and adults. There seems to be a reduction in the duration of illness amongst household members with a percentage increase in men's rates, ceteris paribus. On the other hand an increase in the ratio of women to men's agricultural wage rates has adverse impact on the duration of illness. In GLSS 4 and the pooled samples where it is significant, both children and adults experience longer duration of illness as the proportion of women to men's wage rates increases. This is probably due to the increased opportunity cost of time for woman, with the result that less time is available for childcare as well as for the entire household, in respect of health production. An increase in the ratio of child to men's agricultural wage rates is found significant in the pooled sample of adults. This is probably a random outcome; but if not, it is quite obvious how child labour could be detrimental to child's health. It is difficult to see how that can adversely affect adult health.

Table 2.19: Tobit Results – The Impact of Other Control and Community Variables on the Duration of Illness, (GLSS 1 & 4, and Pooled)

Sample	**GLSS 1**		**GLSS 4**		**Pooled**	
CHILDREN	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio
Full						
Age (years)	-0.218	-7.87***	-0.293	-13.29***	-0.257	-15.13***
Age squared (years)	0.01	5.40***	0.01	7.18***	0.01	8.74***
Female	-0.152	-2.27*	-0.099	-1.82	-0.124	-2.96**
Rural	-0.246	-2.26*	0.042	0.57	-0.059	-1
Water & sanitation	0.369	3.12**	0.302	3.67***	0.316	4.88***
Urban						
Age (years)	-0.166	-3.87***	-0.316	-7.52***	-0.24	-8.19***
Age squared (years)	0.008	2.86**	0.011	4.09***	0.009	4.88***
Female	-0.108	-1.07	0.039	0.38	-0.046	-0.65
Water & sanitation	-0.448	-1.3	-0.105	-0.5	-0.01	-0.07
Rural						
Age (years)	-0.244	-6.37***	-0.295	-11.33***	-0.269	-12.91***
Age squared (years)	0.011	4.21***	0.011	6.24***	0.01	7.34***
Female	-0.188	-1.99*	-0.149	-2.35*	-0.156	-3.05**
Water & sanitation	0.637	3.54***	0.403	4.14***	0.434	5.66***
Community variables						
Price of Maize (kg)	0.019	0.53	-0.013	-0.83	-0.014	-1.04
Price of Anti-malarial pill	-0.405	-2.63**	-0.107	-1.92	-0.082	-1.9
Dist. to the nearest clinic	0.005	1.19	0.001	1.61	0.002	2.54*
Male Agric. Wage	-0.221	-3.70***	-0.055	-2.16*	-0.065	-3.26**
Ratio of female Wage	-0.038	-0.25	0.462	4.56***	0.278	3.87***
Ratio of child Wage	0.294	1.73	-0.046	-0.47	0.147	1.44
ADULTS						
Full						
Age (years)	0.036	4.10***	0.032	4.10***	0.038	7.18***
Age squared (years)	-1.15E-04	-1.21	-8.05E-05	-1.01	-1.31E-04	-2.34*
Female	0.109	1.65	0.466	7.53***	0.294	7.07***
Rural	-0.131	-1.35	0.355	3.24**	-3.01E-04	-0.01
Water & sanitation	0.368	3.32***	0.293	3.29**	0.265	4.03***
Urban						
Age (years)	0.03	2.01*	0.023	1.94	0.022	2.43*
Age squared (years)	-8.63E-05	-0.53	6.15E-06	0.05	4.77E-06	0.05
Female	0.158	1.58	0.428	4.57***	0.325	4.83***
Water & sanitation	0.024	0.06	-0.222	-1.15	0.024	0.17
Rural						
Age (years)	0.041	3.70***	0.047	5.90***	0.04	5.06***
Age squared (years)	-1.51E-04	-1.25	-2.32E-04	-2.73**	-1.70E-04	-2.06*
Female	0.107	1.16	0.401	6.00***	0.254	4.00***
Water & sanitation	0.354	2.49*	0.533	5.55***	0.632	5.86***
Community variables						
Price of Maize (kg)	0.037	1.12	0.003	0.21	-0.02	-1.16
Price of Anti-malarial pill	-0.231	-1.76	-0.118	-2.34*	-0.291	-3.40***
Dist. to the nearest clinic	0.013	3.11**	-0.001	-1.22	-0.001	-0.81
Male Agric. Wage	-0.125	-2.38*	-0.09	-4.55***	-0.068	-3.04**
Ratio of female Wage	-0.132	-1.12	0.5	5.29***	0.495	4.41***
Ratio of child Wage	0.23	1.65	-0.088	-0.97	0.785	2.46*

2.3.4 Anthropometric Measures: Reduced Form Estimates

Estimations are performed for children with complete observations for all the anthropometric measures as well as mother's height. The sample is divided into two, pre-school (0 – 5 years) and school-aged (6 – 15 years)[35] children. The former is discussed first followed by the latter in different sub-sections. Similar to the previously discussed health indicators the anthropometrics are sub-divided into full, urban and rural sub-samples and estimated as three variants of the model specified under the conceptual framework.

The main focus of the discussion is the relationship between parental education and height-for-age as well as weight-for-height. The morbidity results are reported along side for easy reference. It must be noted however that these three health indicators are not exactly comparable because some are more recently observed than others. For example, height-for-age is a long-term measurement of health that is basically linked to chronic malnutrition whilst weight-for-height is acute malnutrition, which is short-term. Further, reported illness is four weeks prior to the survey (GLSS 1). We also note that repeated illness could lead to wasting in children on one hand, and malnutrition generally could lead to increased susceptibility to diseases (Tomkins and Watson, 1989 cited in Asenso-Okyere *et. al*. 1997). Thus to a large extent, they may be correlated and examining them concurrently could be beneficial in drawing a general consensus on health status.

[35] However weight-for-height for school-aged is only between 6 – 10 years, which is a limitation placed by the software used: it could not calculate WHZ for age 10 years and above.

I: Pre – School Children

The impact of parental education on pre-schoolers' height-for-age and weight-for-height

Table 2.20 presents estimates of parental education on reported illness, height, and weight for pre-schoolers in GLSS 1. It can be observed that all else held constant, maternal secondary and above tend to increase the height and weight of pre-schoolers (full sample). From the rural/urban demarcation, it appears maternal post-primary education is more influential in raising their height in urban whereas only maternal secondary and above improve their weight in rural areas. For instance in urban areas maternal middle and maternal secondary and above raise pre-school height by 0.54 and 0.85 standard deviations respectively, whilst in rural areas maternal secondary and above raise their weight by 0.83 standard deviations compared to mothers with no education, ceteris paribus.

Paternal education on the other hand does not seem to have any significant relationship with pre-schoolers' height and weight. However, paternal post-primary education is associated with increased reported illness, especially in rural areas. Maternal middle education also appears to increase reported illness amongst urban pre-schoolers. Thus apart from the single perverse outcome on height in rural areas, maternal education seems to favourably influence the anthropometric measures of health.

The association of parental education and the anthropometric health measures changed marginally upon conditioning on unearned income as exogenous household wealth in the full sample. First, the positive relationship with weight lost its statistical significance, and secondly, the size of the coefficients previously found significant reduced, albeit slightly. This suggests that a small part of parental education may be working through household unearned income. With the exception of maternal middle education's negative effect on height in the rural sub-sample, the results of maternal education on height and weight are consistent with the findings of Wolfe and Behrman (1987) in Nicaragua and Thomas et al. (1990 & 1991) in Brazil.

In order to rule out a possible endogeneity bias of household wealth as a result of likely correlation with the error term, a 2-stage least square model is also employed in estimating the health indicators, with expenditure per capita as household wealth. Conditional on expenditure, maternal education lost its statistically significant association with height and weight of pre-schoolers in the full sample; but that of the urban sub-sample remained same. The outcome observed in the full sample is not uncommon, but there are also findings that contradict it. Indeed, studies including Alderman (1990) using GLSS 1 and Glewwe and Desai (1999) using GLSS 2 find similar results. However Lavy et al. (1996), who also used GLSS 1 but with a different anthropometric sample specification[36], find a contrary result with height. They find that maternal education significantly improves child's height at higher education levels; only the urban sub-sample of this study yields such results. Regarding weight, all the above-mentioned studies including Lavy et al. (1996) obtain similar results to that in this study. Joshi (1994) also finds that whilst height rises consistently by levels of schooling, no such evidence is observed with weight amongst children in rural Nepal.

This study's estimates for education conditioning on expenditure per capita rather show paternal, instead of maternal, education as significant in determining pre-

[36] Their estimation sample is divided into children under 3 years and 3 years and older.

schoolers’ height. A positive relationship is observed with height at higher levels of paternal education, but there seems to be no significant association with weight. The former relationship is also noted by Lavy et al., (1996), but not the latter. They found that higher levels of paternal education improve child’s weight. In conclusion, we note that all else held constant, parental education, albeit not concurrently, is more prominent in influencing pre-schoolers’ height rather than weight.

Table 2.20: The Effects of Parental Education on Health Status (Illness, Height-for-age Z-scores & Weight-for-height z-scores) of Pre-School Children, 1987/88 (GLSS 1)

Pre-School	**Variant 1: Education**			**Variant 2: Education conditioning on Expenditure per capita**			**Variant 3: Education conditioning on Unearned income**		
	Illness Marginal Effects	Haz Marginal Effects	Whz Marginal Effects	Illness Marginal Effects	Haz Marginal Effects	Whz Marginal Effects	Illness Marginal Effects	Haz Marginal Effects	Whz Marginal Effects
Full Sample:									
Mother's Primary	0.049	-0.038	0.003	0.049	-0.057	0.02	0.04	-0.037	0.00036
Mother's Middle	0.026	0.048	0.005	0.026	0.07	-0.017	0.021	0.039	-0.006
Mother's Sec & above	0.044	0.493**	0.299*	0.029	0.357	0.206	0.039	0.448**	0.25
Father's Primary	0.071	-0.064	-0.016	0.079	0.142	-0.1	0.075	-0.066	-0.017
Father's Middle	0.081**	0.044	0.009	0.09*	0.288*	-0.101	0.07*	0.04	-0.002
Father's Sec & above	0.15***	0.157	0.09	0.157**	0.36*	-0.02	0.138**	0.152	0.078
Observation no.	2168								
Urban sub-sample:									
Mother's Primary	-0.002	0.199	0.028	-0.012	0.037	-0.13	-0.006	0.183	0.022
Mother's Middle	0.112*	0.535***	-0.021	0.113*	0.476**	0.007	0.102	0.494***	-0.035
Mother's Sec & above	0.13	0.849***	0.249	0.141	0.717*	0.441	0.122	0.806***	0.217
Father's Primary	-0.131	-0.181	-0.037	-0.144	-0.331	-0.268	-0.134	-0.19	-0.043
Father's Middle	-0.053	-0.092	0.084	-0.086	-0.528	-0.434	-0.06	-0.116	0.072
Father's Sec & above	-0.05	-0.094	0.074	-0.084	-0.587	-0.48	-0.062	-0.134	0.058
Observation no.	757								
Rural sub-sample:									
Mother's Primary	0.06	-0.159	0.019	0.068	-0.186	0.103	0.054	-0.145	0.016
Mother's Middle	-0.006	-0.212*	-0.009	0.0000943	-0.173	0.048	-0.008	-0.215*	-0.016
Mother's Sec & above	0.147	0.192	0.829*	0.142	0.468	0.678	0.123	0.201	0.773*
Father's Primary	0.133*	-0.102	0.019	0.133*	0.001	-0.006	0.137*	-0.109	0.024
Father's Middle	0.118**	0.109	-0.036	0.116**	0.208	-0.094	0.107**	0.129	-0.049
Father's Sec & above	0.266***	0.276	0.165	0.26***	0.368*	0.067	0.257***	0.298	0.157
Observation no.	1411								

*Notes: (1) –These estimations are performed for only GLSS 1, due to lack of data in GLSS 4; (2) – The entire results with t-ratio are presented in Appendix tables A-24a and A-24b; (3) – Age and its quadratic, gender, rural residence, ethnicity, and regional dummies are controlled in all the estimations; (4) – Community variables are controlled in addition to the above for the rural sub-samples.

II: School – Aged Children

Unlike the pre-schoolers parental education appears not to have any significant correlation with the height and weight of school-aged children, at least in the full sample (table 2.21). In the urban sub-sample however, maternal secondary and above is noted as positively related to their height. Thus school-aged children, whose mothers have high levels of schooling, show 0.44 standard deviations of increased height compared to similar children whose mothers are uneducated, ceteris paribus. In contrast, the impact of parental education in rural areas seems perverse. All else held constant, maternal primary and middle as well as paternal middle level education are found to be negatively correlated with school-aged children's height.

Controlling unearned income does not cause any dramatic changes on the impact of parental education. It only seems to have weakened the statistical significance of maternal secondary and above level of education on height in the urban sub-sample. Otherwise, all other results remained unchanged. Conditioning on expenditure per capita on the other hand leads to the loss of statistical significance of maternal education in relation to height in urban areas. This might be suggesting that the influence of maternal secondary and above level of education could partially be working through household wealth.

Father's middle level education is rather found as negatively related to the children's height in the full sample, which is replicated in the rural sub-sample in addition to mother's middle level education.

In terms of the weight, only father's primary education is found significant in the urban sub-sample, which is also perversely related to the weight of the school-aged children. These findings are contrary to expectation (except for maternal secondary and above relationship with height in variants 1 and 3), and indeed puzzling. Unfortunately, to the best of our knowledge, there are no studies that use the same data and sample demarcation, to compare our findings with. This is because most studies focus on pre-school[37] children for the anthropometric analysis.

[37] The height and weight of pre-schoolers give better reflection of nutrition and health relative to school-aged children. At an older age (that is school-aged and above), it is the genetics of parents that are most likely to determine the physical attributes of these children rather than nutrition (Case and Deaton, 2006).

Table 2.21: The Effects of Parental Education on Health Status (Illness, Height-for-age Z-scores & Weight-for-height z-scores) of School-Aged Children, 1987/88 (GLSS 1)

School-Aged	**Variant 1: Education**			**Variant 2: Education conditioning on Expenditure per capita**			**Variant 3: Education conditioning on Unearned income per capita**		
	Illness Marginal Effects	Haz Marginal Effects	Whz Marginal Effects	Illness Marginal Effects	Haz Marginal Effects	Whz Marginal Effects	Illness Marginal Effects	Haz Marginal Effects	Whz Marginal Effects
Full Sample:									
Mother's Primary	0.077*	-0.079	-0.032	0.079	0.032	0.09	0.076*	-0.077	-0.026
Mother's Middle	0.025	-0.106	-0.064	0.024	-0.118	-0.086	0.028	-0.126	-0.083
Mother's Sec & above	0.119	0.23	0.043	0.099	0	-0.108	0.127	0.133	-0.075
Father's Primary	0.019	-0.053	-0.093	0.021	-0.142	-0.222	0.02	-0.052	-0.093
Father's Middle	-0.008	-0.125	-0.026	-0.008	-0.286**	-0.18	-0.013	-0.123	-0.018
Father's Sec & above	0.004	0.086	0.016	0.001	-0.137	-0.171	-0.002	0.095	0.025
Observation no.	2207	2207	1268						
Urban sub-sample:									
Mother's Primary	0.156**	0.171	0.009	0.146*	0.131	0.061	0.156**	0.169	0.01
Mother's Middle	0.043	0.134	-0.073	0.039	0.067	-0.188	0.041	0.122	-0.088
Mother's Sec & above	0.246**	0.443**	-0.002	0.27**	0.214	-0.211	0.238**	0.376*	-0.111
Father's Primary	0.19	-0.23	-0.224	0.162	-0.382	-0.768*	0.187	-0.249	-0.253
Father's Middle	0.013	-0.029	0.011	-0.027	-0.208	-0.185	0.012	-0.04	0.006
Father's Sec & above	-0.089	0.14	0.108	-0.128*	-0.118	-0.183	-0.091	0.128	0.1
Observation no.	866	866	465						
Rural sub-sample:									
Mother's Primary	0.004	-0.252*	-0.05	0.026	-0.105	0.049	0.002	-0.251*	-0.042
Mother's Middle	0.038	-0.288**	-0.108	0.05	-0.311**	-0.116	0.044	-0.306**	-0.132
Mother's Sec & above	0.019	-0.09	-0.117	-0.049	-0.31	-0.351	0.035	-0.158	-0.189
Father's Primary	-0.009	-0.014	-0.096	-0.013	-0.108	-0.169	-0.011	0.001	-0.08
Father's Middle	-0.04	-0.209*	-0.03	-0.066	-0.328**	-0.115	-0.047	-0.202*	-0.017
Father's Sec & above	0.082	0.045	-0.002	0.041	-0.132	-0.135	0.068	0.07	0.025
Observation no.	1341	1341	803	1341	1341	803	1341	1341	803

*Notes: (1) –These estimations are performed for only GLSS 1, due to lack of data in GLSS 4; (2) – The entire results with t-ratio are presented in Appendix tables A-25a and A-25b; (3) – Age and its quadratic, gender, rural residence, ethnicity, and regional dummies are controlled in all the estimations; (4) – Community variables are controlled in addition to the above for the rural sub-samples.

2.3.4.1 Anthropometric Measures: Control Variables

The impact of household wealth on pre-school and school-aged children's height-for-age and weight-for-height

1: Unearned income per capita (exogenous)

Table 2.22 presents the results of unearned income per capita estimates on both pre-school and school-aged children's health status. Unearned income appears to have no influence on either the height or weight of pre-schoolers. It is only found significant in influencing reported illness in the full sample. The evidence, using the quadratics, also indicates an initial rise and then a fall in its impact on reported illness. However, in relation to school-aged children, estimated unearned income appears to reduce the height and weight of the children initially and then begins to increase after the quadratics. In both health measures, the reduction is observed in about a third of the sampled households that are found at the lower end of the income ladder. These are people who do not get any unearned income (lowest) and those that receive marginal unearned income.

The turning point however is below the average unearned income and majority of the households sampled are above this point. The school-aged children of these households achieve increased height and weight with increased unearned income. In the rural-urban demarcation however, unearned income appears insignificant in determining the height of these children. But in relation to weight, about 77 percent of the children found in the upper to middle level unearned income achieve increased weight in urban areas, ceteris paribus. The analogous figure for rural areas is 59 percent. It thus suggests that unearned income is more favourable in determining the anthropometric health measures of school-aged children when more is received in households.

Table 2.22: The Effects of Unearned Income on Health Status (Illness, Height-for-age Z-scores & Weight-for-height z-scores) of Pre-School and School-Aged Children, 1987/88 (GLSS 1)

Pre-School	Illness Marginal Effects	t- ratio	Haz Marginal Effects	t- ratio	Whz Marginal Effects	t- ratio
Full						
Log of unearned income pc	0.021	1.96*	-0.04	-1.31	-0.029	-1.33
Log of unearned income pc2	-0.001	-1.1	0.005	1.51	0.004	1.72
Joint F-statistics	9.13		1.21		1.96	
Joint Sig. (Prob.)	0.0104		0.2989		0.1411	
Urban						
Log of unearned income pc	0.021	1.08	0.056	1.17	-0.015	-0.38
Log of unearned income pc2	-0.001	-0.56	-0.002	-0.45	0.002	0.62
Joint F-statistics	2.69		2.44		0.4	
Joint Sig. (Prob.)	0.2612		0.0882		0.6704	
Rural						
Log of unearned income pc	0.011	0.78	-0.071	-1.69	-0.028	-1.01
Log of unearned income pc2	-4.06E-04	-0.24	0.007	1.43	0.004	1.39
Joint F-statistics	3.41		1.61		1.49	
Joint Sig. (Prob.)	0.1822		0.2		0.2252	

School-Aged	Illness Marginal Effects	t- ratio	Haz Marginal Effects	t- ratio	Whz Marginal Effects	t- ratio
Full						
Log of unearned income pc	0.017	1.72	-0.076	-2.78**	-0.083	-3.49***
Log of unearned income pc2	-0.001	-1.37	0.009	2.95**	0.01	3.63***
Joint F-statistics	3.66		4.36		6.59	
Joint Sig. (Prob.)	0.1606		0.0129		0.0014	
Urban						
Log of unearned income pc	-0.008	-0.51	-0.068	-1.75	-0.082	-2.32*
Log of unearned income pc2	0.001	0.55	0.007	1.87	0.009	2.56*
Joint F-statistics	0.3		1.75		3.29	
Joint Sig. (Prob.)	0.8613		0.1738		0.0381	
Rural						
Log of unearned income pc	0.028	1.99*	-0.076	-1.93	-0.101	-2.89**
Log of unearned income pc2	-0.003	-1.76	0.009	2.06*	0.012	2.96**
Joint F-statistics	4.2		2.13		4.39	
Joint Sig. (Prob.)	0.1224		0.1195		0.0127	

Notes: (1) – “pc” represents per capita and “pc2” represents per capita squared

2: Expenditure per capita (endogenous)

Conditioning on expenditure per capita also shows some significant effects on height and weight, but this is mainly observed in the sub-samples of pre-schoolers, and the full samples of school-aged children (table 2.23). The various instrumental variables used include the employment of household head, land, durable goods and business assets. The statistical significance of these instruments is reported with the first-stage regressions (appendix A-26 and A-27 for pre-school and school-aged children respectively) but the over-identification test statistics are reported with the estimates of expenditure in text.

Expenditure is only found significant in determining the height of pre-schoolers in urban areas, where it appears to initially increase, reaches a turning point at the highest level of expenditure, and then begins to fall. This is jointly significant at the 5 percent level. About 95 percent of the urban households sampled are below this highest expenditure level, thus it could be concluded that expenditure increases the height of pre-schooled urban children. Most importantly, this observation is in spite of the positive influence of maternal post-primary education. The positive influence of wealth on height is confirmed in similar studies such as Thomas et al. (1990) for Brazil, Alderman and Garcia (1994) for Pakistan, Lavy, et al. (1996) for Ghanaian children 3 years and older using same data, Glewwe (1998) for Morocco and Lawson (2004) for Uganda.

In relation to weight, expenditure per capita is also found significant but in only the rural sub-sample. However in this case expenditure initially tends to reduce the weight of rural children before the increase at the quadratics. The reduction in weight is observed amongst low expenditure households, which is also below the average expenditure per capita level. Children in households with middle to high expenditure levels experience increased weight with expenditure increase; this is observed in nearly 58 percent of the sampled rural households.

With regard to school-aged children, the estimated outcomes of expenditure support the beneficial effect of increased wealth in the majority of households. With increases in expenditure, approximately 99.6 and 97.9 percent of the sampled households experience increased height and weight respectively, in the full sample, ceteris paribus. It however appears that the outcome is mainly true for the school-aged children in urban households since expenditure is found non-significant in the rural sub-sample. Expenditure also appears to be more influential in improving the anthropometric health status of children compared to education, especially in relation to weight of children.

Table 2.23: The Effects of Expenditure per capita on Health Status (Illness, Height-for-age Z-scores & Weight-for-height z-scores) of School-Aged Children, 1987/88 (GLSS 1)

Pre-School	**Illness**		**Haz**		**Whz**	
	Marginal		**Marginal**		**Marginal**	
Full	**Effects**	**t- ratio**	**Effects**	**t- ratio**	**Effects**	**t- ratio**
Log of expenditure pc	-1.435	-0.51	-25.379	-1.55	3.193	0.53
Log of expenditure pc2	0.067	0.51	1.166	1.5	-0.131	-0.47
Joint F-statistics chi2(2)	0.26		2.78		2.7	
Joint Sig. (Prob.)	0.8764		0.0625		0.0677	
Over-identification stats. (Chi-sq)	2.204 (3)		0.638 (3)		0.224 (2)	
P-value	0.5313		0.8878		0.8939	
Urban						
Log of expenditure pc	2.319	0.27	20.447	0.76	38.994	1.49
Log of expenditure pc2	-0.103	-0.27	-0.876	-0.72	-1.745	-1.47
Joint F-statistics	0.15		5.43		1.95	
Joint Sig. (Prob.)	0.9282		0.0046		0.1429	
Over-identification stats. (Chi-sq)	3.253 (5)		0.218 (2)		5.102 (3)	
P-value	0.661		0.8967		0.1645	
Rural						
Log of expenditure pc	-2.513	-0.65	-5.11	-0.43	-28.276	-2.98**
Log of expenditure pc2	0.121	0.65	0.223	0.39	1.364	3.02**
Joint F-statistics	0.43		0.49		5.97	
Joint Sig. (Prob.)	0.8064		0.6138		0.0026	
Over-identification stats. (Chi-sq)	3.219 (3)		3.323 (3)		6.763 (5)	
P-value	0.3591		0.3445		0.2389	

School-Aged	**Illness**		**Haz**		**Whz**	
	Marginal		**Marginal**		**Marginal**	
Full	**Effects**	**t- ratio**	**Effects**	**t- ratio**	**Effects**	**t- ratio**
Log of expenditure pc	-0.31	-0.17	5.292	1.01	7.506	1.31
Log of expenditure pc2	0.016	0.19	-0.211	-0.89	-0.314	-1.22
Joint F-statistics chi2(2)	0.39		7.98		6.44	
Joint Sig. (Prob.)	0.8238		0.0004		0.0017	
Over-identification stats. (Chi-sq)	3.991 (3)		4.923 (2)		3.692 (2)	
P-value	0.2624		0.0853		0.1578	
Urban						
Log of expenditure pc	4.603	1.84	13.325	1.29	20.386	2.05*
Log of expenditure pc2	-0.204	-1.84	-0.563	-1.23	-0.862	-1.98*
Joint F-statistics	3.4		4.68		7.51	
Joint Sig. (Prob.)	0.1827		0.0095		0.0006	
Over-identification stats. (Chi-sq)	3.808 (3)		5.421 (3)		0.625 (3)	
P-value	0.2829		0.1435		0.8906	
Rural						
Log of expenditure pc	-5.337	-0.95	20.556	1.36	9.165	0.97
Log of expenditure pc2	0.267	0.98	-0.972	-1.33	-0.418	-0.92
Joint F-statistics	3.7		1.71		2.1	
Joint Sig. (Prob.)	0.1575		0.1807		0.1236	
Over-identification stats. (Chi-sq)	1.655 (3)		2.655 (2)		12.131 (6)	
P-value	0.6469		0.2651		0.0591	

Notes: (1) – "pc" represents per capita and "pc2" represents per capita squared

The impact of additional control and community variables on the anthropometric measures of health

Age and gender

Estimates of other control and community variables are given in tables 2.24 and 2.25 for pre-school and school-aged children respectively. Observations of the health indicators analysed suggest that age strongly influences pre-school children's health. The descriptives showed that the children generally become less healthy as they grow from month zero but more so after the sixth month to their first birthday. Reported illness, stunting and wasting all surge upwards after this period till their second to third birthdays where they begin to fall and stabilise. Glewwe and Desai (1999) find similar pattern using the GLSS 2 data. The feeding processes of children could possibly explain this pattern between age and health status. The months of poorer health are usually the weaning periods from exclusive breastfeeding. Adapting to new food, not to mention the exposure to different carers as working mothers return to work, tends to lower the child's health. In addition, increased child mobility exposes them to all sorts of communicable diseases in neighbouring environments. With a default category of 0 – 5months, the coefficients on age dummies confirm the descriptive statistics above: higher reported illness is predicted for children 6months and above, relative to the default. The magnitudes however start to decrease after the second birthday. Correspondingly, higher stunting as well as wasting is also observed. This continues till the age of 2 years in the case of wasting, and 4 years in the case of stunting. The implication is that children's heights are affected longer by previous malnutrition and disease than weight or current illness.

There appears to be no evidence of gender discrimination in relation to height and weight of pre-schoolers because the female dummy is not significant. However the outcome on reported illness suggests girls are less likely to be reported ill. Similarly school-aged girls are estimated as taller than their male counterpart, and it is significantly more so in the rural relative to the urban areas, ceteris paribus. This supports the outcome that was previously observed with reported illness; and plausibly suggests that girls are healthier than boys, ceteris paribus.

Current residence and mother's height

Also as anticipated and consistent with the descriptives, pre-schoolers in rural areas are noted as shorter and thinner than their urban counterparts. School-aged children in rural areas are however observed as generally only shorter than their urban counterparts. The weight of school-aged children does not seem to matter. A variable worth noting is mother's height, which is found significant in determining the height-for-age z-scores of both pre-school and school-aged children. The height of mothers positively determining the height of pre-school children for instance concurs with findings of other authors like Lavy, et al (1996) and Asenso-Okyere, et al. (1997) using GLSS 1, Glewwe and Desai (1999) using GLSS 2 and Glewwe (1998) for Morocco.

Community variables

Unfortunately many of the community variables are found to be statistically insignificant. It was anticipated that proximity to health facilities might encourage better nutritional habit of households and thus improve the production of the anthropometric health status. The closeness of a medical facility does not seem to have any impact on the anthropometrics but only increases the incidence of reported illness of children as expected. The price of maize is only found significant in determining height but the outcome implies that an increase in the price of maize increases the height of pre-school children. This seems perverse, as increased price could lead to a fall in demand and thereby nutrition; except for households that produce maize. In that case, given the same quantity of maize produced, household profits would increase and thereby increase the nutritional and other health inputs.

Men's agricultural wage rate is the only community variable found significant in the school-aged rural sub-sample of the anthropometric measures. It however only determines their weight, which also appears to be consistent with the outcome on their reported illness. It indicates that a percentage rise in men's agricultural wage rates increase the weight and reduce the incident of illness reported of school-aged children by 0.14 standard deviations and 6.6 percentage points respectively, ceteris paribus. The ratio of child to men's agricultural wage rates also tends to increase the height of pre-schoolers. This probably suggests that the children's wage complements household wealth, which improves nutritional intake of the children.

Table 2.24: The Effects of other Control and Community Variables on Health Status (Illness, Height-for-age Z-scores & Weight-for-height z-scores) of Pre-School Children, 1987/88 (GLSS 1)

Pre-school	Illness		Haz		Whz	
	Marginal		Marginal		Marginal	
Full	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
6-11months	0.272	5.51***	-0.743	-6.09***	-1.131	-11.01***
12-23months	0.331	7.55***	-1.412	-11.18***	-1.206	-11.86***
24-35months	0.267	5.96***	-1.523	-12.80***	-0.862	-9.39***
36-47months	0.173	3.64***	-1.874	-15.01***	-0.709	-7.62***
48-60months	0.13	2.90**	-1.619	-14.18***	-0.775	-8.78***
Mother's Height	-0.001	-0.74	0.034	5.49***	0.001	0.23
Female	-0.058	-2.66**	0.007	0.11	0.015	0.36
Rural	0.006	0.23	-0.226	-3.15**	-0.102	-2.14*
constant			-4.918	-5.02***	0.169	0.35
Observation no.	2168		2168		2168	
Urban sub-sample:						
6-11months	0.432	6.37***	-0.73	-3.61***	-1.19	-7.52***
12-23months	0.447	6.77***	-1.782	-8.60***	-1.198	-7.40***
24-35months	0.385	5.25***	-1.358	-6.79***	-0.706	-5.35***
36-47months	0.305	3.83***	-1.837	-9.43***	-0.648	-5.06***
48-60months	0.338	4.45***	-1.442	-8.13***	-0.735	-6.03***
Mother's Height	0.001	0.35	0.021	3.05**	-0.002	-0.68
Female	-0.075	-1.99*	0.176	1.78	0.108	1.53
constant			-3.029	-2.70**	0.54	0.89
Observation no.	757		757		757	
Rural sub-sample:						
6-11months	0.188	2.92**	-0.762	-5.12***	-1.088	-8.30***
12-23months	0.268	4.80***	-1.297	-8.40***	-1.228	-9.51***
24-35months	0.214	3.84***	-1.659	-11.58***	-0.947	-7.87***
36-47months	0.111	1.9	-1.956	-12.47***	-0.734	-5.89***
48-60months	0.029	0.54	-1.763	-12.45***	-0.799	-6.81***
Mother's Height	-0.004	-1.61	0.047	6.55***	0.006	1.26
Female	-0.054	-1.97*	-0.068	-0.87	-0.016	-0.31
Community variables						
Price of Maize (kg)	-0.003	-0.31	0.098	3.56***	-0.015	-0.82
Price of Anti-malarial pill	-0.038	-0.87	-0.113	-0.96	-0.017	-0.2
Dist. to the nearest clinic	0.003	2.14*	0.005	1.28	-0.002	-0.87
Men's agric. wage	-0.031	-1.81	0.051	1.2	0.004	0.13
Ratio of women's wage	-0.018	-0.46	-0.071	-0.63	0.036	0.48
Ratio of child's wage	0.009	0.22	0.273	2.12*	-0.022	-0.26
constant			-8.002	-6.82***	-0.691	-0.92
Observation no.	1411		1411		1411	

Table 2.25: The Effects of other Control and Community Variables on Health Status (Illness, Height-for-age Z-scores & Weight-for-height z-scores) of School-Aged Children, 1987/88 (GLSS 1)

School-aged	Illness		Haz		Whz	
	Marginal		Marginal		Marginal	
Full	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Age (years)	0.012	0.44	0.06	0.77	-0.087	-0.53
Age squared (years)	-0.001	-0.37	-0.005	-1.48	0.006	0.63
Mother's Height	0.001	0.45	0.028	5.63***	-0.006	-1.46
Female	-0.016	-0.78	0.299	5.51***	0.034	0.62
Rural	-0.03	-1.24	-0.396	-6.14***	-0.106	-1.8
constant			-5.398	-6.19***	0.404	0.46
Observation no.	2207		2207		1268	
Urban sub-sample:						
Age (years)	0.076	1.6	-0.022	-0.18	0.028	0.11
Age squared (years)	-0.003	-1.45	-0.002	-0.28	0	0
Mother's Height	0.001	0.51	0.012	2.03*	-0.001	-0.13
Female	-0.011	-0.33	0.19	2.27*	0.141	1.54
constant			-2.536	-2.43*	-1.055	-0.84
Observation no.	866		866		465	
Rural sub-sample:						
Age (years)	-0.02	-0.56	0.148	1.47	-0.149	-0.7
Age squared (years)	0.001	0.58	-0.01	-2.02*	0.009	0.71
Mother's Height	0.001	0.3	0.041	4.47***	-0.009	-1.67
Female	-0.02	-0.81	0.378	5.28***	-0.013	-0.19
Non-Akan	0.003	0.09	0.225	2.18*	0.042	0.45
Community variables						
Price of Maize (kg)	-0.002	-0.26	-0.019	-0.79	-0.017	-0.76
Price of Anti-malarial pill	-0.072	-1.92	-0.088	-0.81	0.02	0.2
Dist. to the nearest clinic	0.003	2.75**	-0.003	-0.81	-0.001	-0.26
Men’s agric. wage	-0.066	-4.20***	-0.029	-0.58	0.142	3.87***
Ratio of women’s wage	-0.02	-0.55	-0.025	-0.26	0.07	0.76
Ratio of child’s wage	0.141	3.51***	0.197	1.73	0.026	0.26
constant			-8.311	-5.01***	0.467	0.38
Observation no.	1341		1341		803	

2.4. SUMMARY: HEALTH STATUS

This section summarises the estimated results on education and the various health status examined in the study. The relationship between education and reported illness and its duration has not been consistent with the health theory so far in most of the estimated models. For children especially, parental education perversely increases illness and its duration in GLSS 1, and does not appear to influence these two indicators in GLSS 4[38]. Estimates of the pooled sample of both GLSS 1 and 4 also give evidence of the positive relationship between parental education and the reported illness of children. However those on the duration of illness are mostly statistically insignificant. The survey dummy though suggests that all else held constant children in GLSS 1 are more often reported as ill and also experience longer duration of illness relative to GLSS 4.

Working on the assumption that the positive association or insignificant outcome may be due to endogeneity/simultaneity bias, an instrumental variable approach is used to verify the results. This somewhat changed the results but not as anticipated, at least with maternal education. In both GLSS 1 and 4, mothers with primary level of education are estimated as having increased propensity of reporting child's illness[39]. This confirms the earlier results in GLSS 1 and probably concurs with some suggestions in the literature that educated mothers have higher tendencies to seek health care and therefore might have prior diagnoses or knowledge to recognise symptoms of diseases, hence the increased report of their

[38] Except when expenditure per capita is controlled; upon which children with fathers of middle/JSS education level tend to have less reported illness as well as experience shorter duration of illness. The latter is especially experienced in rural areas. However less emphasis is placed on this outcome because it is the only significant parental education category out of six.

[39] In GLSS 1 only, father's primary education is however negatively associated with child's reported illness.

child's illness (see Strauss and Thomas, 1998). It does not necessarily mean that the less or un- educated is any healthier. This systematic reporting bias, commonly noted with maternal education on child's reported illness, thus gives arguably an erroneous view of detrimental effects of education on health in developing countries, which might objectively not be the case.

The anthropometric measures of health believed to be relatively more objective in measurements to some extent do not support this view. Although the indicators are not actually comparable, their results give evidence that parental education is not a total waste of human resource investment when child's health is concerned. At least for pre-schoolers in urban areas, height-for-age tends to increase with mothers' post-primary level of education, ceteris paribus. This becomes father's post-primary education when expenditure per capita is controlled for, probably suggesting that it is both parents' education at work instead of just one. For each of these outcomes of height-for-age too, the estimates show a positive association of parental education and child's reported illness. Thus the favourable impact of parental education on height-for-age of pre-school children contradicts the adverse outcome observed in relation to their reported illness.

Education also gives mixed results on illness and its duration amongst adults. In GLSS 1 adults with primary as well as middle education level tend to self-report more illness compared to those with no education, whereas the converse occurs in GLSS 4. Adults with personal secondary and above level of education rather less frequently tend to self-report illness in this later survey year. A similar pattern is also observed with the duration of their illness, where adults in GLSS 1 with primary level education report longer whilst those in GLSS 4 with secondary and above education relative to none report shorter duration, ceteris paribus.

Controlling for the parental education of these adults does not change the direction and statistical significance of their own education on either illness or its duration. This is somewhat contrary to the hypothesis that the influence of education on health is primarily a reflection of own parents' education and background. They might be a contributory factor, but they do not replace the impact of own education. Generally, the pooled samples suggest adults with personal education at the secondary and above level are less likely to report illness but those with primary education do the opposite. The former is however more likely to observed in urban areas when household wealth is also controlled for. Regarding the duration of illness, only own education at the secondary and above level is found statistically significant in the pooled sample and indicates overall shorter duration of adults' illness. Finally the pooled sample estimates, like the children's, suggest that adults in GLSS 1 have higher probability of illness as well as longer duration of illness compared to those in GLSS 4, ceteris paribus.

Generally, the estimated results also revealed no dramatic changes in most of the estimated models that also controlled for household wealth, as well as household public goods. This gives the impression that education directly impacts on health outcomes regardless of its possible indirect influence through expenditure and other socioeconomic variables such as the availability of water and sanitation, age and gender, as well as residence and ethnicity. In addition, these socioeconomic variables also, more often than not, tend to have their own independent influence on health outcomes.

Chapter 3: EDUCATION AND FERTILITY

A large and growing body of research provides evidence to suggest the existent of a consistent negative relationship between education and fertility (Martin, 1995; Benefo and Schultz, 1996; Ainsworth et al., 1996). This relationship has been identified in both developed and developing countries using various types of data. For developing countries in particular the proliferation of Demographic and Health Surveys (DHS) data as well as the Living Standard Measures Surveys (LSMS) by the World Bank has contributed to the surge in research in the area. Although the existing literature shows a negative association between education and fertility, it has not always been observed as a linear downward-sloped relationship. A non-monotonic or an inverted "U" type has also been observed (Thomas and Maluccio, 1996). Most studies also focus on women's education, presumably because they are the primary carers and in some cases are the heads of households. Thus, all else held constant, the decision to demand more or less children is influenced by the value of time available to them. Nevertheless, where the study involves both men and women, the magnitudes are usually smaller with regard to men's education, and sometimes even statistically insignificant (see Ainsworth et al., 1996).

Fertility differentials between educated and uneducated women also differ from country to country. The degree of difference could be as high as five children in Peru whilst others like Indonesia and Sri-Lanka record differentials of about one child or less (Martin, 1995). In SSA however, the differentials between the upper and lower educational groups observed in most countries are between two to three children (ibid). Despite these variations in the pattern and magnitudes, most of the existing literature gives little doubt of the lowering impacts of education on fertility. Whether the relationship is causal or just correlation is still an on-going debate with very little empirical support, especially in SSA where data limitation is the bane of research.

Economic theory suggests that not only does education affect fertility but there also exists a reverse causality, which means fertility could also influence education (or possibly that both are jointly determined). Fertility affects levels of education attained when decisions on the latter are based on the former. This usually occurs when schooling is cut short because of an unplanned or even in certain societies planned pregnancy or birth. This reverse causality and/or simultaneous effect mean education may be subject to possible endogeneity bias. However it is argued that parents make most decisions on a child's education when they are young, and that many children complete the required schooling levels of their countries before their reproductive phase begins; hence the feedback from fertility decisions is less prominent. Another possible way by which education can be endogenous is via omitted or unobserved variables, such as the individual's innate ability (which assists her to climb up the educational ladder), family norms and expectations as well as status in the society, and non-random placement of public facilities.

Very few studies have tested the causal relationship between education and fertility in SSA. This is due to lack of the necessary information to be used as instrumental variables in the available nationally representative surveys. Nonetheless, some of the authors who have performed the instrumental variable approach to establish the causality have also found that education causes fertility to decrease. An example is Osili and Long (2008) who used the introduction of the universal primary education in Nigeria as instruments and found that a year's increase in education reduces early fertility by a range of 0.26 to 0.48 births[40] in Nigeria. In this chapter, because we are unable to find appropriate instrumental variables, we compensate with available control variables for education in estimated models.

The association between women's education and fertility has been established based on the theory of time, available resources and exposure to foreign values through the mass media or urbanisation. This is basically related to the demand-side theory of cost and benefits. Parents benefit from having children because they assist in household production if there is one; they are status symbols in developing countries; and they become the future financial and social security of the parents at old age. But producing children is also costly in terms of physical (child services) and opportunity cost (the value of time). Thus, faced with the fixed constraints of resources and time, the number of children demanded would depend on whether the total benefits of having them exceed costs. For educated women, the choice usually tends to be heavier on the demand for fewer children because the cost of having them is higher than the benefits. This is because firstly, educated women have increased opportunities in the formal labour market and thus are more likely to participate in these jobs outside the home with relatively higher wage rates. This implies that the price of the woman's time is raised and hence her opportunity cost. As child upbringing is time-intensive, this consequently means increased costs of raising children and therefore less demand for them.

[40] Depending on three different specification models, which are the baseline, state fixed effects and birth year fixed effects.

Secondly, based on the same analogy of higher job opportunities and wages for educated women, some women may decide to delay cohabitation and births, which could eventually lower overall fertility levels. Thirdly, educated women tend to have higher aspirations for their children so are more inclined to invest more time and resources in their children. Thus faced with the household's constraints, these women choose to have fewer children (quantity) in order to raise the "quality" of children, through for example increased investment in child's schooling and healthcare. Related to this is the fact that the economic contribution of the children is non-existent or minimal, especially whilst young, because they would not be available for home productions/businesses. The increased investment in education as well as health cost of children, associated with an increase in the overall cost, and lower economic returns consequently leads to a fall in the demand for children. In addition, the improved health of children implies higher survival rates and hence fewer births to act as replacements in the event of deaths (Benefo and Schultz, 1996).

Finally, urbanisation, mass education and "modernisation" as well as exposure to foreign values via the mass media have led to a diminishing cultural and traditional preference for big family sizes. An important element that straddles these various aspects of modernisation is education, which is expected to change the structure, tastes and norms of the society. Educated people are the early adopters of new programmes (including contraception) or technology that later diffuses to all. They are also less fatalistic, and they take control of decisions that affect them and their families through knowledge acquisition, gaining access to resources and intermingling in wider social circles. With acquired new values comes weakening norms, such as less dependency on children as a form of social security in old age, which is a characteristic in societies with no institutional programs for the aged, such as in SSA. There is also a change in the view that childbearing is the status quo for women. Further, with increased tastes for consumer goods and less “hoarding” of children because of declining infant and child mortality, fertility rate is expected to eventually decline.

Several of these underlying channels by which education influences fertility have been empirically investigated and found relevant. However, there are still many that need to be explored, especially in SSA, and also examined with different econometric methods to establish an irrefutable association between education and fertility. This chapter contributes to the existing literature in that regard.

The chapter is made up of four main sections. Section 3.1 presents the general literature review, which discusses the economic theory of fertility and a priori analyses as well as some empirical findings of its determinants (primarily focusing on education). It also shows why the proximate determinants are potentially endogenous and should be considered as such in a fertility model.

The next, section 3.2, empirically examines the proximate determinants of fertility, the predicted values of which would be used as inputs in a structural fertility model. This section is divided into three sub-sections, with each of the proximate determinants analysed in considerable detail. Sub-sections 3.2.1, 3.2.2, and 3.2.3 look at contraceptive use, age at cohabitation, and the duration of breastfeeding respectively. In each of these sub-sections, we briefly discuss background and related literature, econometric model and specification, as well as analysis of estimated results. These are relevant because they do not only present the opportunity to draw attention to the various measures used in the prediction of each proximate determinant, and how they consequently affect fertility but also give expositions to other reasons (besides fertility) behind their adoption.

The third, section 3.3, presents estimates and analysis of the structural model of fertility in two sub-sections. This is preceded by an explanation of the conceptual framework. Sub-section 3.3.1 examines the predicted effects of the three proximate determinants of fertility in two components. The first component presents a model that is analogous to the conventional production function (named as a "reproduction function" (Appleton, 1996)) in three measures: (Model A) – the probability of a woman having at least one child, (Model B) – the unconditional number of children a woman has, and (Model C) – the number of children a woman has conditional on having given birth to one. These three measures are used because breastfeeding is not defined for some women. This is because they have never given birth or do not have children below five years of age (age at which information on breastfeeding patterns are made available). This also results in a sample selectivity bias, but no attempt is made at solving it because we could not identify a priori variable(s) that may be likely to influence childbirth (such as sterility) but not the duration of breastfeeding in the available data.

The second component 3.3.2 presents a sensitivity analysis, which examines whether the explained variation of the predicted proximate determinants captures all the variations in models A, B, and C. This involves the introduction of some of the socioeconomic variables into the structural model to check their significance. This is expected to reveal whether some unobserved characteristics still influence fertility in spite of the proximate determinants. If the socioeconomic variables in these test models are found significant despite the presence of the proximate determinants, then it means the structural fertility model is not complete – presumably due to omission of some proximate determinants or imperfect measurement of those that are included.

The final, section 3.4, looks at a reduced form estimation of fertility (number of live births). This gives the full and direct influence of education on fertility, controlling for other socioeconomic variables. This allows for the capture of the full impact of education. The section also checks whether fertility has changed over the years. One primary limitation of this chapter, like the previous, is that education is considered as exogenous; hence the estimated outcomes may be associational rather than causal. It is however anticipated that the control variables employed in the various models might reduce the bias in the estimates, by capturing a fraction of the unobserved factor in the error term. Moreover, as in the previous chapter, all the models here are estimated using GLSS 1 and 4 (except for age at cohabitation that has information in only GLSS 1). The estimations are performed for women of reproductive age between 15 and 49 years inclusive, and all the analyses are disaggregated into full, rural and urban as well as women aged 15-34 and those aged 35-49 sub-samples. The summary of results in chapter 3 is however presented together with the general conclusions in chapter 4.

3.1. Literature Review

Proponents of education and fertility theories could basically be divided into three main schools of thoughts: the demand side (the New Home Economics); the interaction of demand and supply (the synthesis model); and the supply side (proximate) theorists. The demand theory structured from the perspectives of microeconomics is based on the consumer choice theory. It proposes that households desire for children primarily depend on their costs. But unlike the traditional economic theory of household production of consumer or producer goods that has explicit market prices that of children do not. Hence shadow prices, which depend on the prices and quantities of their production inputs (example: socioeconomic variables), are derived. Then given household full income and preferences, the quantity of children is produced. A notable reference is Becker's (1960) seminal paper, which addresses determinants of fertility within the framework of consumer choice theory. The theory illustrates that children are desired for the benefits they generate towards household activities as well as their direct utility to parents, like the many consumer or producer goods in the household utility function. Parents thus assess the utility of having more children with other products in the function and make a choice thereof. In line with this comes increased cost (direct and opportunity costs) because parents receive utility from having more children as well as their "quality" (involves child services: education, health, shelter etc). Therefore in order for the household's utility to be maximised subject to the constraints of income and prices, households trade-off quantity for "quality" of children which subsequently leads to fewer births. The preference for child quality overrides quantity even with increased household income because of the interaction of child quality and quantity; increased quantities of child services instead of number of children are desired.

Becker and Lewis (1973) further elaborate the above concept with their shadow price analysis theory. They explain that quality and quantity are interrelated; one cannot be produced independent of the other. An increase in the quantity of children raises the cost or shadow price of their quality and vice versa. For example a decline in the shadow price of child quality, one that is exogenous to the household, like a decline in the price of schooling or healthcare, is likely to cause a decline in the equilibrium quantity of children desired. Thus the shadow price of child quantity rises with the level of child quality chosen. Similarly, the shadow price of child quality rises with child quantity chosen. This explains the many observed empirical analysis whereby income elasticity of demand for quality of children is high at the same time that the observed quantity elasticity is low; and hence the often negative relationship despite children being a "normal good".

Willis (1987) compares the "quality-quantity" analysis to changing from an economy car to a luxury one rather than an increase in the number of cars with increased income. He also contributes to the "quality-quantity" interaction by bringing to attention the importance of female time allocation between home based and outside work (Willis, 1974 cited in Willis, 1987). He suggests this gives one of the plausible reasons[41] behind the negative relationship between income and fertility. His female cost of time hypothesis is based on the assumption that child-care is relatively more intensive in the use of mother's time than non-child related household production activities. Hence when a woman does not engage in market work, the shadow value of her time and therefore the marginal cost of

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[41] The other being the "quality-quantity" interactions hypothesis.

children becomes an increasing function of husband's income. But when women do participate in the market, the cost of time tends to depend on her marginal wage rate.

Female time allocation is somewhat influenced by her education, a link that explains the lowering effects of female education on fertility. Since wage tends to be positively correlated with education, the opportunity cost of educated women leaving the labour force for child services (bearing and rearing) increases. Hence in societies where wages and thus the woman's opportunity costs of time are relatively higher, fewer children are desired. This somewhat distributes the determining factors of fertility behaviour between children (quality) and women (time allocation and labour force participation). Thus the influence of education is not only important from the children's angle, as indeed emphasised in Becker's child quality theory, but also from the angle of parents (mother in particular).

Empirical evidence that supports the demand theory includes studies[42] such as Schultz (1997) who indicate that children are an important form of human capital investment with increasing returns that leads to parents having to invest more (usually through education), which consequently reduce fertility. He finds that the changing composition of income between labour and physical capital, as well as between male and female productivity are as important for fertility decrease as the overall level of national income. Handa (2000) also affirms that the negative impact of education on fertility appears to occur through raising the value of time for the woman rather than changing tastes or desire for children.

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[42] Empirical studies reviewed in this study focus on those with education as the primary determining factor of fertility outcome.

However, not all the empirical studies do support these theories. Data limitation is usually suggested as the reason behind this (Keeley, 1975). Although Keeley (1975) defends the quantity-quality theory, he also admits to its limitations as being static because it does not take the dynamic part of childbearing as well as the sequential nature of decisions made under uncertainty into account. He also suggests, "marriage, labour force behaviour, and fertility are all simultaneously determined variables; and it is very difficult to break out a single segment of theory for proper analysis." Some of the more recent studies that empirically contradict the demand theories of fertility include DeRose et al. (2002) and Yu (2006). Based on a focused-group study in Ghana using current students in the secondary and university level of education, DeRose et al. (2002) found that fertility preferences of girls at the Junior Secondary level and higher do not reflect the inverse pattern of education and fertility. They argue in their paper that schooling per se has little effect on fertility preferences and that differentials by education observed in national level data may be heavily determined by selection factors determining school continuation[43]. The better-educated women in the sample expected to get better jobs which would enable them to care for more children relative to those who had not yet achieved the same degree of success. What the study failed to account for is the potential opportunity cost of these students time when they join the labour force. But it appears such expectations of educated women are not unique to Ghana. Yu (2006) finds similar results in Australia, which indicate that educated women do expect higher fertility in the

[43] Girls who participated were selected by school administrators. The paper assumes that if they were chosen to favourably reflect the school, it is likely that they may be the kind of students who will continue in the educational process and therefore not represent the attitudes of girls whose education ended when or before secondary school was completed. Therefore their fertility preferences may better reflect the attitudes of the university women they will become than attitudes of women who attained up to the junior or senior secondary school level.

future relative to the least educated women. However in her case, the association is non-linear. She also explained the positive relationship as that although educated women face higher opportunity costs with regard to fertility decisions, they are also potential higher earners, and tend to marry men with higher incomes. Therefore they might be able to afford more children. But their expectation is not realised due to deferred age at cohabitation as well as unexpected problems with fecundity and partners; and thus the negative relationship between actual fertility and education (Yu, 2006).

There have been many criticisms of the quantity–quality trade-off, mainly but not only from sociologists and demographers. Many of who do not believe such stark and simple model as the demand theory could explain fertility behaviour. They questioned the unaccounted for variables such as the role of taste, norms or culture, and the natural fecundity of individuals as well as the costs of regulations. One of the later critics is Robinson (1997) who argues that most of the assumptions and proposed theories explaining fertility decline in relation to economic development are not crucial. According to him, the relative time-intensity of the technology necessary to child services[44] compared to other household production as well as the increasing value of time of women as a result of the high opportunity cost of market labour participation appear sufficient reasons for the inverse relationship between women's education and fertility. In addition, fertility transitions are likely driven by a fall in the expected total utility of child services rather than a change in consumer preferences towards quality over quantity. He explains that given the desire for sexual pleasure, and also because in most developing countries control over the processes of conception,

[44] Leibeinstein (1975) (cited in Robinson, 1997) explain child service as three types of utilities that parents derive from having children: consumption, labour productivity and age-old security utilities.

pregnancy and childbirth is difficult, unreliable and costly, fertility can increase independent of the effect of expected child benefit or cost. Thus there are many factors that determine fertility behaviour other than just child's quality or women's time allocation that cannot be assumed as constant or left as an error term.

Similar doubts and criticisms have evolved over the years; one of the earliest being Caldwell's (1976) "intergenerational wealth flows" theory. His paper describes fertility behaviour based on the general direction of the flow of wealth from pre-modern or transitional to modern societies, and also the belief that fertility transition is more to do with social and cultural change than merely for economic reasons. His explanation is that in pre-modern societies[45], the net wealth flow is from children to parents whereas in modern ones the reverse is more the case. The consequent fertility implication is that more children are desired in the former relative to the latter society. He explains that the contributions of children include working for the parents during both childhood and adulthood, act as security at old age, increase family's political power, ensure the survival of family lineage and undertake religious services for ancestors. However such child services tend to decline during transitional and modern societies[46] making children more costly than beneficial to parents leading to lower fertility.

[45] Made up of the primitive: consisting of tribes or clans with minimal outside security or indeed control, and communal land hence the importance of size; and traditional: the period whereby the State and Church intervened in community disasters, increased use of money, travel and trade as well as introduced national legal system toward freehold tenure of land and thus weakening the strength of extended families.

[46] This is the period where societies become more monetised and urbanised; therefore women do not only stay at home to bear and care for children but also participate in work outside the home.

The costs and benefits are however not wholly due to economic reasons, even in transitional societies. As one of his fundamental arguments, Caldwell[47] lists non-economic reasons for lower fertility to include the spacing of births to reduce infant or child mortality, which then maximises the number of living children; cessation of sexual relations by a woman on the birth of her first grandchild or when husband takes on a new wife; postponement of age at marriage due to education and job opportunities; and problems of control, noise and emotional deprivation. An additional reason for lower fertility is the separation (especially emotional obligations) of the nuclear family from the extended family. Parents are then more concerned with their children's future than extended families and ancestors. Thereby giving more emotion and wealth to their children than they expect back as well as anticipates a similar treatment from their children to grandchildren.

Education seems to play an important role in this reversal flow of wealth. Children become more costly because of parents' encouragement to have more education in a bid to have better salaries and occupy influential positions in the society. Although this means more wealth at adulthood and thus the family, the net flow of wealth changes to children from the parents. One possible reason is that school attendance prevents children from contributing to the family's work both in and out of the household. Education also facilitates social and cultural change by exposure to "Western" values through foreign religion, colonisation, mass media, and schools' curriculums.

Bulatao and Lee (1982) illustrate similar outline for their analysis of fertility based on Easterlin's model. They explain that fertility behaviour based on a

[47] He based some of these reasons on a study of the Yoruba people in Nigeria.

combination of three major features, namely, supply, demand and the cost of regulation. The supply of children is the number of surviving children a couple could have without deliberate control; and demand as a couple's choice of family size and composition. The main supply-side determinants are child survival and natural fertility. The latter involves spontaneous intrauterine mortality, age at marriage or exposure to sexual intercourse, post-partum infecundability (indicates breastfeeding and sexual abstinence), waiting time to conception and the onset of permanent sterility. The above authors also explain that the degree of impact of these variables on natural fertility differs holding the others constant. However, the most dominant ones are age at marriage and post-partum infecundability. The timing of marriage is noted to have a strong negative association with fertility by way of lowering exposure to sexual intercourse in the more fecund years of the reproductive span. With regard to breastfeeding, increase in its duration typically increases the period of postpartum amenorrhoea, and in some cultures postpartum sexual abstinence, which subsequently extends the period of infecundability.

Child survival also influences fertility on the supply side since it removes the desire to "hoard" for replacement and also helps in spacing the children. It has been observed that children are more likely to survive to see their fifth birthday with increased education of women (Benefo and Schultz, 1996). This is because educated women tend to be healthier and therefore beget healthier children; and also with increased knowledge acquired from schooling and other media, are able to care better for their children by providing better nutrition, water and sanitation; as well as making use of available health services and being less fatalistic. Thus with fewer chances of deaths parents are well able to plan and stick to their desired fertility without adding extras as some sort of "insurance".

The other important supply side determinant of fertility is the natural fecundity level of parents, which is primarily dependent on age.

Determinants of the demand-side are the direct benefits and cost of children, their opportunity costs, the effects of income and wealth, and norms and tastes of children. The benefits of children involve the financial and practical assistance to household both in the current (in societies where child labour is renowned) and the expected future as insurance for old age. Costs also involve partly financial and time costs, and opportunity cost, which is primarily determined by forgone earnings. Whilst benefits of children tend to increase, costs tend to lower with the demand for children; thus the total number desired depends on the net value the children. The increase in income and wealth rather tend to be associated more with fewer children because parents would rather increase child quality. This may also depend on norms and tastes, which has no tangible measurement but may vary by religion, culture or exposure to new consumer goods.

Fertility regulation is only employed when the supply of birth exceeds demand. However the deliberate use of control depends on cost. The regulation costs involve both the physical and the psychological costs. The former does not only involve monetary but also travel and information costs, which are major deterrents of use in developing countries. Besides these, communication between partners, religious or other moral attitudes as well as perceived health consequences, not to mention the trauma of abortion, bears considerable psychological costs on potential users. Thus the ultimate fertility outcome is determined when supply equals demand of birth and also upon the use of fertility controls.

The theories described above are labelled as "the synthesis" theory (Birdsall, 1988), since they incorporate the social and biological constraints to the economic decision-making of the demand theory in explaining the rationale behind fertility behaviours. Birdsall adds that the difference between these and the demand-oriented theory is the emphasis on the endogeneity of tastes. This is explained as the possibility that one's family's fertility behaviour is influenced by the fertility behaviour and average consumption of other families, as opposed to the economists' emphasis on utility maximisation constrained only by prices and income. However one of the main limitations of the synthesis model is that the supply side and the cost of regulation are treated as exogenous (Shultz, 1986 cited in Birdsall, 1988[48]).

Although the supply side and cost of regulation are expected to have direct effects on fertility, their outcomes are also varied by health, socioeconomic and cultural background including education, income, location and ethnic or religious beliefs. In addition they are likely to be simultaneously influenced with the level of fertility itself or correlated with some unobserved variables making the supply side determinants endogenous. That is, it is possible that fertility, age at marriage, the duration of breastfeeding, labour force participation and child survival are determined simultaneously. For example, a woman is more likely to marry early because she is more fecund or as a result of an inefficient use of contraception. Highly fertile women may also breastfeed for longer as well as abstain from sexual intercourse to control their fertility.

[48] Other limitations, which are somewhat similar to the demand-oriented theory are also outlined in the paper.

Another school of thoughts regarding fertility behaviours is the supply-oriented only approach. Bongaarts (1978) expounding on works of Davis and Blake in the 1950 identified variables that directly impacts on fertility behaviour. He labels these as intermediate variables because they are biological and behavioural factors through which all the socioeconomic, cultural and environmental factors work to influence fertility levels. He divides the intermediate variables, also known as proximates, into 3 main categories namely exposure factors: proportioned married; deliberate marital fertility control factors: contraception, and induced abortion; and natural marital fertility factors: lactational infecundability, frequency of intercourse, sterility, spontaneous intrauterine mortality and the duration of fertile period. He argues that fertility levels change only when one or more of these proximate variables change. He gives examples such as fertility levels fall with rises in educational levels because more educated women marry relatively late or frequently use contraceptives. Also, labour force participation rate of women is weakly related to fertility because it has a strong positive effect on contraceptive use as well as a strong negative and compensating effect on lactation. The implication of Bongaarts' fertility concept is that it is possible to estimate variations in fertility levels if all the proximate variables are captured in a model; and upon such, all the direct effects of socioeconomic, environment and cultural variables would be eliminated[49].

Bongaarts (1982) however demonstrates empirically that not all of the above mentioned proximate variables have massive effects on the variation of fertility among populations. He finds fertility level is more sensitive to some proximates than others. For example variations in the level of intrauterine mortality has least

[49] This is because they are all supposed to work through the proximate or intermediate determinants.

effect on fertility compared to variations in proportion married and contraceptive use. Upon using aggregate analysis on countries at various stages of fertility transitions (developing, developed and historical populations), he estimates that only four of the proximate variables largely influence variance in fertility levels. The remaining variables are much less important. According to his model the most important determinants of fertility are the proportions married, contraceptive prevalence and its effectiveness, the incidence of induced abortion, and the duration of postpartum infecundability. They explain about 96 percent of the variation in fertility levels. The unexplained part is due to errors in measurement, specification and observed total fertility rates, deviations from the total fecundity value, absence of data such as induced abortion (except in developed countries).

The principal proximate determinants in SSA tend to be slightly different though within the ambit of the general framework. They include lactational amenorrhea due to breastfeeding, decreased exposure to conception due to postpartum sexual abstinence, and pathological involuntary infertility due to gonorrhoea (Bongaarts et al., 1984). Thus following Bongaarts (1978) argument, education and other socioeconomic characteristics influence fertility basically because they initially modify the above intermediate factors. They further explain that socioeconomic variables, education for instance, can have negative fertility effects on one set of proximate variables (say contraceptives) and positive effects through another set (for example duration of breastfeeding). The overall net effect of education on fertility could therefore be positive, negative or insignificant depending on the relative contributions of the positive and negative effects of the proximate determinants. Few empirical researches have been conducted based on Bongaarts' fertility level determining concept, especially using individual level data[50]. Only two of the studies are discussed here because of their relevance to this chapter. These studies focus on two countries in SSA, and also use a theoretical concept of which this chapter relates to.

Baschieri and Hinde (2007) for instance used the model to estimate birth intervals in Egypt. They test Bongaarts' fertility model using the country's DHS calendar data, which is one of the rare types that contains month-by-month information on contraception, breastfeeding behaviour and postpartum amenorrhoea. But since the data do not contain all the required intermediate variables[51], a discrete-time hazard model with a gamma-distributed error term to account for unobserved heterogeneity is employed in the estimations. They basically estimate four different models: the first includes only duration, and tests whether the raw hazard varies with duration since first birth; the second includes only variables measuring the proximate determinants, that is, age of mother at first birth, breastfeeding, amenorrhoea, use of types of contraception, and length of interval between marriage and first birth; the third includes only social, economic and cultural variables; and the fourth includes both the proximate and socioeconomic and cultural variables.

Their purpose for the different models is that they would be able to compare the 'only' socioeconomic to the 'only' proximate model; and also by comparing the 'only' socioeconomic with the combination model of socioeconomic and proximate variables to examine whether the socioeconomic variables become insignificant in the latter model. They find that months from marriage to first birth, breastfeeding

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[50] This may probably be due to data limitation.

[51] Their data lacks information on induced abortion, spontaneous intra-uterine mortality, duration of viability ova and sperm and frequency of sexual intercourse.

and use of modern contraceptives[52] significantly reduces the risk of conception of second birth among women who are aged 18-22 years at the time of their first child. They find that the 'only' proximate model results have more explanatory power than the 'only' socioeconomic model. In the latter, secondary level education of the woman is found significant and suggests reduced hazard to conception. Also the survival of the first child significantly reduces the hazard to the conception of the second birth. However, results of the combined model seem to suggest that some socioeconomic variables[53] have direct impact on the second birth interval, even in the presence of proximate variables.

Upon introducing unobserved heterogeneity term into the combined model, they find all the economic variables except husband's education lose their significance whilst proximate variables become more significant. Meanwhile, similar models estimating the third birth interval shows that all the variations in length are captured by the proximate variables. They however conclude, after conducting log-likelihood ratio test and few caveats, that social, economic and cultural factors become insignificant upon incorporating full proximate determinants in a fertility model. This is especially so when an unobserved heterogeneity term is included in the model to capture variation in the proximate determinants that are hard to measure directly (Baschieri and Hinde, 2007). They also conclude that including socioeconomic variables in the model could improve the effects of the proximate variables whereby unobserved heterogeneity is not controlled.

With a less detailed living standard data set, compared to the calendar data of DHS, Appleton (1996) estimates the effects of two proximate determinants on the

[52] With intra-uterine device (IUD) relatively more effective than the pill or other modern contraceptives.

[53] For example, higher educated women as well as their partner's education became significant and seems to have an increased hazard to conception compared with women of no education.

number of births in Cote d'Ivoire. In his approach the reduced form impact of education and other socioeconomic variables on age at cohabitation and the duration of breastfeeding is first estimated. Then the effects of these two proximate variables on fertility are subsequently estimated as a 'reproduction function' (ibid) by using the predicted values of the first stage results. In this way the possible endogeneity of the proximate determinants is controlled in order to obtain consistent estimators. He finds that female primary schooling barely has any influence on the proximate variables and thus fertility. However attainment of secondary level education by these women has the effect of increasing the age at cohabitation and decreasing the duration of breast-feeding. The overall effect on fertility is somewhat dependent on their age. It seems that delaying cohabitation by three years reduces the number of children a woman gives birth to by one, whilst the duration of breast-feeding only tends to reduce fertility of women over thirty-five. Thus for younger cohorts, the net effects of education is negative because shorter breastfeeding does not have any influence on fertility. But for older cohorts the effects of cohabitation and breastfeeding tends to counteract each other resulting in an increase in fertility.

Appleton (1996) cautions the outcome may plausibly be influenced by omitted variables. He also debates on whether the result is depicting an age or cohort effect; explaining that if it is the former then the negative effects of education on the fertility of younger women would be reversed upon reaching middle age, ceteris paribus. On the other hand if it is a cohort effect, then the negative association between female schooling and fertility should also be expected to hold for women's lifetime fertility. He finally challenges the use of proximates as exogenous variables in fertility models by arguing that assumed exogeneity obscures the strength of education's impact on fertility through cohabitation and breastfeeding. A limitation of his study however is that variables identified to have predicted the proximate variables are not tested for exclusive restriction.

This chapter follows Bongaarts' concept, but uses Appleton's (1996) 'reproduction function' approach in estimating a fertility model for Ghana. This chapter adds to the literature on the subject by using data collected at different survey periods of a decade apart for robustness check. And additional sensitivity analysis is performed to test for the potential feedback from the unobserved proximate determinants.

Before examining the effects of the proximate determinants on fertility, we first explore the impact of education and other socioeconomic factors on these proximate determinants. For the purposes of this study, emphasis is given to the role of education on the various direct determinants of fertility. Similar to the demand theory, education to a large extent plays a decisive role in many of the supply-side determinants. Education does not always work alone, it sometimes operate through other socioeconomic variables (such as rural/urban residence and household wealth) as well as several of the direct determinants simultaneously, which may make its distinct effects difficult to capture. However, holding some of these other socioeconomic variable constant, education is predicted to delay the age at marriage or exposure to sexual activities, increase the effective use of contraceptives, but shorten the duration of breastfeeding. The overall impact on fertility cannot be determined a priori because, as already mentioned, the impact of the increase in contraceptives use and age at cohabitation must be weighed against the impact of shortened breastfeeding duration. The following sections present the first-stage proximate determinants models outlined above.

3.2. MODELLING PROXIMATE DETERMINANTS

This section examines socioeconomic variables and their anticipated impact on contraception, age at cohabitation, and the duration of breastfeeding. Education is however the prime interest with the remaining socioeconomic variables used as controls. Each proximate determinant has sub-divisions on (1) – background and literature, which briefly review some related empirical literature that mainly shed light on how women's education affects that proximate determinant; (2) – data, econometric model and specification as well as variables used and their expected impact in estimations; and (3) – the discussion of estimation results.

3.2.1 Contraceptives Use

3.2.1.1 Background and Literature Review

Contraception is one of the main regulatory instruments of fertility and it mostly involves deliberate actions on the part of the user. Many developed countries success with lower fertility goals have been suggested to stem from the effective use of contraception, not to mention increased supply and access at reduced costs. Developing countries however have failed to achieve such goals despite their government's involvement because of the challenges of their cultural settings. Oliver (1995) note that Ghana is one of the first countries in SSA to implement a population policy in 1969 but population is still growing, fertility is high and contraceptive use is low. Actually, prevalence of contraception in SSA in general is noted as the lowest amongst developing countries (Martin, 1995). With the exception of Botswana, Kenya and Zimbabwe, the demand for contraceptive use in SSA is often reported to be virtually negligible. Bongaarts et al. (1984) however explain that the nominal contraceptive behaviour in SSA is due to high illiteracy rates and desire to fulfil traditional reproductive norms; one of which is the desire for big family size. Therefore not only does lower percentage of female education affect contraceptive use, not to mention accessibility, but also strong cultural links to ancestry and family prevent usage. Caldwell et al. (1992) gives support the concept of cultural and ancestral beliefs as one of the reasons for low contraceptive use with their studies on Nigeria. They however observe a new type of contraceptives demand emerging where it is acquired primarily for purposes of delaying the onset of childbearing and marriage as well as maintaining and perhaps increasing the length of birth intervals. Westoff and Bankole (2000) assent to this pattern having done a similar research in the same country.

It is well documented that contraception becomes essential in limiting family size, when upon exposure to modernisation or indeed education, breastfeeding as well as postpartum abstinence is shortened. In this way, unwanted pregnancies are avoided and planned family size achieved. Contraception also helps in the avoidance of forced marriages due to unplanned pregnancies. This is especially beneficial to younger girls whose schooling otherwise may have to be terminated due to such event. Consequently fertility levels are controlled because research shows that the longer women wait to start giving birth, the fewer children they tend to have. However, the effective use of contraceptives is not observed worldwide, especially in developing countries with lower levels of education. Since low fertility rates, a plausible consequent of high contraceptive use, are mainly observed in countries with high proportions of female education.

The economic theory behind the positive association between the education of women and contraceptive is based on the former and fertility. This is because the demand for contraception is a derived demand, that is, it is conditional on the demand for children given her natural fecundity level. The hypothesis is that education positively influences the use of contraceptives as a result of its negative influence on fertility. A list of explanations for this relationship gathered from various theories and empirical analysis in a nutshell includes an increase in the value of the woman's time and the direct cost of child services (bearing and rearing) whilst the economic benefits received from having the children decreases with women's education. Education raises the opportunity cost of children by raising the wage that a woman could earn in the labour force, which in turn may reduce fertility. The direct costs of child services are also increased by female education because women with more schooling tend to also aspire to educate their children to the highest level possible. This increases child's quality, and even more so when extra investments are made concerning time spent to ensure good learning habits. Other investments also made to improve child quality are good nutrition and health care, which may in turn reduce mortality. Coupled with the reduction in child benefit as a result of less reliance by educated women on their children to contribute to family income or housework while young as well as economic/social security at old age, cost per child may be inclined to increase and hence smaller family size desired. This then increases the demand for contraceptives.

However women have to use contraceptives appropriately for it to be effective. This makes education relevant as it has been found that educated women tend to seek knowledge, and they also have the ability to better process information (Mackinnon, 1995), therefore may be more able to effectively use contraceptives. They also have easier acquisition and use of facilities than the less educated because they have the social and economic resources to afford the cost. A relatively strong influence of education on contraceptive use widely noted is the break in dependency on traditional values (Leridon, 2006); the shrouds of culture and beliefs are dropped in order for new ideas to be practiced upon exposure. Other studies have also found that education gives relative autonomy (Hogan et al. 1999; Benefo, 2005) to the woman and improve communication about family planning between spouses (Lasee and Becker, 1997; Oheneba-Sakyi and Takyi, 1997; Tawiah, 1997; Hogan et al. 1999). Such weakening of religious/traditional hold on couples, improved information and communication leads to a reduction in the psychosocial cost, which subsequently increases contraceptive use.

Communication between spouses also depends on the husband's education but existing literature is yet to conclude on its universal relevance. For example Ezeh (1993) finds husband's education dominant in his studies on Ghana. He suggests that it facilitates the success of the couple's family planning decisions and recommends its inclusion in estimations should not to be overlooked. This finding is however contradicted by Tawiah (1997) using the same data; he finds the association not statistically significant. However, what both studies appear to agree on, from their added qualitative research, is that the husband's consent is critical.

Unlike the husband's education, many multivariate studies have found undisputed evidence to support the hypothesis that educated women are more likely to use contraceptives compared to the less or un-educated women. Amongst such findings is that of Weinberger (1987) who shows in her studies that even a few years of schooling usually have marked positive effect on contraceptive use. Martin (1995) concurs to this finding and adds that schooling however short prompts a visible change in contraceptive behaviour. Studies on Ghana in particular have frequently found educated women most likely to use contraceptives relative to the uneducated counterparts. Ezeh (1993) for example finds educated wives are more likely to approve of using family planning methods compared to the uneducated ones and Oliver (1995) using the second wave of the GLSS finds an extra year of schooling increases the probability of current use of modern contraceptives by 0.3 percent.

Ainsworth et al., (1996) studying fertility and current contraceptive use in fourteen SSA countries with the DHS, including Ghana's 1993, also find only female education statistically significant in half of the countries. They deduced from their study that these are countries where wives and husbands have roughly similar schooling levels or the wife has more schooling than the husband. This they suggest is consistent with the female bargaining power theory. Where the husbands tend to be more likely to be educated than the wife, both the husband and the wife's education matters, but the wife's influence is larger. Other evidences of the positive relationship between education and contraceptive use on Ghana with various datasets include Oheneba-Sakyi and Takyi (1997); Tawiah (1997); Kirk and Pillet (1998); Parr (2003); and Benefo (2005)[54]. A number of similar outcomes have also been noted in Latin America and the Caribbean (Moreno, 1993), Nigeria (Feyisetan and Ainsworth, 1996), Zimbabwe (Thomas and Maluccio, 1996), Kinshasa (Shapiro and Tambashe, 1997), Kenya (Lasee and Becker, 1997); and Turkey (Koc, 2000).

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[54] Oheneba-Sakyi and Takyi (1997) and Tawiah (1997) used the 1988 DHS; Kirk and Pillet (1998) used 1988 and 1993 DHS; Parr (2003) used the 1998 DHS; Benefo (2005) used the first and second waves of GLSS to estimate child schooling and contraceptive use in rural Africa.

There are also factors that correlate with both education and fertility that need to be controlled for in the econometric model (Kravdal, 2002); and there are empirical evidences to their influence on contraception. These include place of residence (Moreno, 1993; Oheneba-Sakyi and Takyi, 1997; and Kirk and Pillet, 1998), age (Thomas and Maluccio, 1996; Parr, 2003), religion and ethnicity (Tawiah, 1997; Adongo et. al., 1998; Koc, 2000) and household wealth (Thomas and Maluccio, 1996). Also important to the analysis is direct cost of child services and contraceptives, which studies like Oliver (1995), Feyisetan and Ainsworth (1996), and Benefo (2005) find statistically significant.

3.2.1.2 Econometric Model, Specification, Data and Variables Used

It can therefore be gathered from the above outlined economic theory and empirical evidence that educated women are more likely to control or reduce their fertility and consequently, are expected to increase contraceptives use. Therefore the decision to use contraception is proposed to be a function of all the variables that affect fertility as well as the costs of the contraceptives. Thus the model for contraceptives use in this study is an extension of the economic model of fertility based on the standard household production model and utility maximisation. The model follows Becker's (1960) household production function where utility is maximised by the consumption of child services and consumer commodities subject to the constraints of income and prices. Fertility decisions are thus made based on a reduced form equation:

$$F^* = F[PxC, PxR, w, Y; X, \mu] \text{ ----------------------------------- (1)}$$

Where PxC is all the direct cost of children such as food, clothing and shelter, the availability and quality of health services as well as primary and secondary schools (Montgomery, 1993). The cost of fertility regulation ($PxFR$) can be divided into actual and perceived costs. The actual costs include access and use, which are explained as purchase price ($PurPx$), price of information, travel and waiting time (IT). The quality of services by providers may also play some vital role in contraceptive use. Perceived costs include psychosocial costs ($Psoc$) relating to difficulty in spousal communication, religious concerns (Rl) and extended families' attitudes that differs by ethnicity (Eth). Due to these costs, the incentive to control fertility has to be considerably strong. This incentive may be associated with a couple's desire and ability to reduce fecundity below its natural levels due to the value of the woman's time. This is represented by wage (w): earnings that would have to be forgone (opportunity cost) with increased fertility.

Availability of household resources (Y) including non-labour income, housing characteristics, durable goods and assets also contributes as inputs in producing and achieving desired fertility. Agricultural wage (Aw) rates especially for children in rural households may also influence fertility decisions because of their contributions to household income. All the factors described so far also vary by the individual woman's and other family characteristics (X), which include her age (A), education (Ed) and residence (R); as well as all unobserved and unmeasured (μ) features like taste, innate ability as well as errors in measurements. Since the demand for contraception is inferred from that of fertility, the reduced form function of contraceptives use follows that of fertility in equation (1) with an opposite expected impact of the variables in the model. For example, whereas a variable like education is expected to lower fertility levels in the equation, it would be anticipated in this section that education would increase contraceptive use. The equation, based on the variables mentioned above is expanded to become:

$$C^{*} = F\left[PxC, PurPx, IT, Psoc, Rl, Eth, w, Y, Aw, A, Ed, R, \mu\right] \text{--------------------} (2)$$

However, considering the lack of some of the variables described above in the data for this study, proxy variables are used in replacement where suitable. For example, distance to the nearest health facility/family-planning provider (*Dsfp*) is used in the estimations instead of the purchase price of contraceptives (*PurPx*). This is because the data, as in many others of its kind, report only households' responses to costs, which may vary with quality or source. Its inclusion may thus introduce plausible endogeneity bias in the estimates. For many developing countries, distance to the nearest health provider best captures the cost of contraceptives than cash price, which is small and do not vary much within a region. Similarly wage (*w*), information (*IT*) and psychosocial costs (*Psoc*) are dropped from the equation due to lack of data. With regard to wage, few women are reported as having received one because they usually are not found in wage employment. However, the use of education in its stead is expected to capture the wage effects on contraceptive use. Education (*Ed*) as proxy for wage, for instance, captures the value of the individual woman's time and opportunity cost of women who do not work or are unpaid family workers. Education and wage are also predicted as highly correlated (Schultz and Tansel, 1993) and the econometric problem of sample selection bias is avoided. Education also increases accessibility to information (*IT*) and improves the efficient use of resources not to mention the weakening of cultural or religious norms hence reducing psychosocial costs (*Psoc*).

The use of education also presents a possible econometric problem of endogeneity bias. This is because there could be some unobserved variables that simultaneously determine education and contraception not to mention reverse causality: where the use of contraceptives may have an impact on education because it allowed a woman to complete or further her education. Solving the problem of endogeneity first requires the use of variables that are highly correlated with education but neither with contraception nor the error term. Secondly, the selected variable should pass the exclusion restriction test, that is, it must be a variable that can be excluded from the model without causing any specification problem. The initial part of the first condition is relatively easy to achieve; but the remaining and second condition present a primary problem for most researchers due to data limitation. Attempts made to solve the problem in the previous chapter proved cumbersome with minimal satisfactory results. Therefore for simplicity and also the fact that the predicted form of contraceptives would be further used in a subsequent second-stage model, this study like many others including Ainsworth et al., (1996), Moreno, (1993), Feyisetan and Ainsworth, (1996), Thomas and Maluccio (1996), Shapiro and Tambashe (1997), Lasee and Becker (1997), and Koc (2000) estimates contraceptive use by presuming education as exogenous. Thus the outcome on education is interpreted as associative instead of causative.

Finally, a factor score index of household durable goods and housing qualities is used as proxy for household wealth or resources (Y). Another score index is generated for access to health facilities and personnel (*Dsfp*), and also for the prices of food and non-food (*PxFN*) that forms part of the cost of children (*PxC*). Additional child's costs are included in the form of distances to primary (*DsP*), middle (*DsM*), and secondary (*DsS*) level of schooling. Translating equation (2) into an empirically feasible contraceptive model by taking variables with information in the data set employed into consideration gives an equation model estimated in three versions. The first is variant 1 and it is estimated thus:

$C^{*} = [Ed, A, R, \mu]$ ----------------------------------- (3': Variant 1)

This provides a parsimonious version of the model and gives the chance for attention to be particularly drawn to the influence of education, which is the primary focus of this study. The influence of education (*Ed*) on contraceptive use is examined with control variables age (*A*), rural and region of residence (*R*). These might minimise the problem of omitted variable bias but would not entirely solve it. This is because Location might also present an endogeneity problem if fertility control programs are intentionally or strategically placed to encourage use, or where demand is high. Besides the availability of contraception is likely to be high in urban relative to rural locations, and educated women have higher tendencies to migrate to urban areas. However, this would be more likely to seek job opportunities in formal employment than because of increased access to contraception. Therefore since the incentives behind placement of fertility programs are not entirely known, given the available data, and most health facilities are established to provide services other than contraception, this study presumes location to be exogenous. The error term is *u*.

Additional control variables, namely the woman's religion (*Rl*), ethnicity (*Eth*) and household asset index score (*Y*), are also included in the model to be estimated as variant 2 thus:

$C^{*} = [Ed, A, R, Rl, Eth, Y, \mu]$ --------------------------- (3': Variant 2)

And the final version of the model (variant 3) where variables representing some of the direct child and contraceptives' cost as explained above are included thus:

$$C^{*} = \left[Ed, A, R, Rl, Eth, Y, Aw, PxFN, DsP, DsM, DsS, Dsfp, \mu\right] \text{ --------- (3': Variant 3)}$$

The different versions allow for the strength of female education on contraception and therefore fertility to be tested by controlling and including variables that may also correlate with education or have direct effects. This may help policy makers in making decisions as to the sector to invest limited national resources. That is whether to invest more into education, which can subsequently affect contraceptive use or directly invest into contraceptive facilities that may promote its use. The analysis is also stratified into rural and urban areas as well as women aged 15-34 and those aged 35-49. In this way differences in the average level of education in these sub-samples are exposed and the magnitude of their influence, if at all, are duly examined. These empirical analysis procedures are repeated throughout this study unless otherwise stated.

3.2.1.2.1 Dependent Variable: Definition and Descriptives

The data on contraceptive use is of women of reproductive age between 15 and 49 inclusive. GLSS 1 has more detailed information including knowledge, ever used, currently using as well as cost and distance. Thus some women are observed to have some knowledge about contraceptives but have never used one. Indeed, very few women use any contraceptives in GLSS 1. Also, there are women who used contraceptives before the survey period but no more using, and vice versa. In contrast, GLSS 4 asked respondents to mention the main contraceptive currently being used. The data set does not have records of knowledge or ever used contraceptives by the sampled women. Both data sets however, have methods of traditional and modern contraceptives listed. Therefore in order to have some form of comparative analysis, current use of contraceptive is estimated for both data sets. But ever-used contraception is also examined for only GLSS 1 for explorative purposes. It must be noted that the impact of physical facilities in the communities may be less meaningful in this case because a respondent may have dwelt at a different address when the contraceptive was used.

Table 3.1 gives the information on knowledge, ever and current use of contraceptives by method amongst women who have had sexual relations[55]. Traditional methods of contraception include abstinence, rhythm, withdrawal, herbs/potions to drink, herbs/portions to insert and douche. Modern methods are condom, spermicides/foam, diaphragm, pill, IUD, injection female sterile, male sterile and other scientific. The statistics for GLSS 1 show that knowledge of contraceptives is very high in Ghana, around 79.8 percent. Of these, about 72.7 percent of the women observed have heard of at least one traditional method and 59.9 percent of at least one modern method. Abstinence and the pill are the most widely known amongst the traditional and modern methods respectively. Friend appears to be the most mentioned source of knowledge for all contraceptive types except abstinence and diaphragm that cited relative/spouse and family planning clinic respectively. Also closely following friends as source of knowledge for use of the pill is family planning clinic.

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[55] This is not categorically stated in GLSS 4 unlike GLSS 1. But there are about 20 observed women aged between 15 and 24 inclusive in GLSS 4 with no response to contraceptive use. It is assumed the lack of response suggests they had not commenced sexual relationship hence not asked questions on contraceptive use as was done in GLSS 1. Though in GLSS 1, this was made clearer with a subsequent question on cohabitation: interpreted in the survey as whether the woman has commenced sexual relations. Those who had not, about 198 women, were not asked the questions on contraceptive knowledge and use.

Fewer women have ever used contraceptives, also reported only for GLSS 1. This is about 48.1 percent with 43.2 percent of them ever-using traditional and 21.6 percent for modern contraceptives. Similar to knowledge, abstinence is the most ever used traditional contraception followed by Rhythm withdrawal, douche and herbs. The corresponding method for modern contraception is the pill, spermicides, condom, diaphragm, injection and IUD. However, condom is widely known but less used than spermicides.

The percentage of women who currently use contraceptives is dramatically low, especially compared to those that know about contraception in the country. About a third of the women currently use contraceptives in GLSS 1, of which 28.5 percent patronise the traditional methods and as few as 4.9 percent use modern methods. The analogous figures for GLSS 4 are 16.7 percent for overall use with 5.0 percent and 11.6 percent for traditional and modern use respectively[56]. Often cited current traditional use of contraception differs between the two survey years. Abstinence is the most cited traditional method in GLSS 1 whilst the rhythm method dominates in GLSS 4. But the pill is the most commonly used modern methods in both surveys. The second favourite is spermicides in GLSS 1 but was probably not available during the GLSS 4 survey year, which rather suggests injection as the second preference. This is probably because it is one of the most advertised in the media and can be bought without prescription from pharmacies and small-scale drug stores (Oliver, 1995). Other sources include chemical sellers, hospitals, family planning and prenatal clinics.

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[56] Survey sample weights are used in the calculations for GLSS 4.

Table 3.1: Knowledge and Use of Contraceptives by Method Among Women Who have Started Sexual Relations[a]

GLSS 1						**GLSS 4**		
Method	***Knowledge***	***Source of Knowledge[b]***	***Ever Used***	***Currently used***	***Where Obtained[b]***	***Currently used***	***Currently[c] used***	***Where Obtained[b]***
All	**79.82**		**48.09**	**30.31**		**15.13**	**16.69**	
Any Traditional	***72.67***		***43.19***	***28.5***		**4.4**	**5.04**	
Abstinence	60.14	Rel/spouse	31.19	19.49		0.99	1.06	
Rhythm	39.47	Friend	21.74	14.94		2.58	3.1	
Withdrawal	32.91	Friend	9.7	4.36		0.33	0.36	
Herbs (portions)	31.29	Friend	2.64	0.39		n.a		
Herbs (insert)	26.35	Friend	2.35	0.98		n.a		
Douche	17.09	Friend	4.75	2.01		0.12	0.11	
Other	n.a					0.38	0.41	
Any Modern	***59.89***		***21.55***	***4.9***		**10.73**	**11.64**	
Condom	45.79	Friend	6.27	0.83	Chem. Seller	1.95	1.98	Other
Spermicides	34.72	Friend	8.67	1.67	Pharmacy	n.a		
Diaphragm	22.87	Fam.Pl. Clinic	0.73	0.2	Hospital/ Fam.Pl. Clinic	n.a		
Pill	52.2	Friend/Fam.Pl. Clinic	13.96	2.3	Pharmacy	5.46	6.08	Other
IUD	13.03	Friend	0.54	0.1	Fam.Pl. Clinic	0.33	0.4	Hospital
Injection	29.73	Friend	0.64	0.1	Fam.Pl. Clinic	2.52	2.62	Prenatal Clinic
Female Sterile	n.a					0.27	0.32	Hospital
Male Sterile	n.a					--		
Other scientific	n.a					0.21	0.24	Hospital
Observation	2042					5843		

Source: Author's calculation using the Ghana Living Standards Survey, 1987/88 (GLSS 1) & 1998/99 (GLSS 4)

a. Based on respondents affirmative response to having cohabited at the time of the survey.
b. Most common response given
c. Survey sample weights are used in the calculations.

Contraceptive knowledge, ever- and current-use of traditional and modern method by socioeconomic variables of the woman is presented in Table 3.2 (GLSS1) and 3.3 (GLSS 4). Knowledge and use as expected generally increases with schooling but the most dramatic is observed amongst women in GLSS 1 who currently use modern contraceptives. This increases from 1.4 percent of women with no education to 14.1 percent of those with secondary and above level of education. The analogous figure in GLSS 4, albeit not as dramatic, is roughly 10.0 and 15.7 percent. Comparison across age groups however suggests a non-monotonic sequence. Similar to the reports of the Ghana Demographic and Health Survey (GDHS, 2003), both survey years show an increase in contraceptive use with age to a maximum of age 30 – 34[57], then falls thereafter. A similar pattern can also be observed with traditional knowledge of contraceptives; but when it relates to modern, the age group with the highest knowledge is 25 and 29 inclusive.

With regard to the place of residence, women in urban areas always appear to know and use more contraceptives than those in rural areas in GLSS 1. Knowledge of traditional contraceptives for instance is about 82.5 percent among women in urban compared to 67.2 percent of those in rural areas. The corresponding figures for knowledge of modern methods are 77.2 and 50.2 percent respectively. Current use is also highest among urban women whereby traditional is recorded as 38.7 compared to 22.8 percent in rural areas, and modern use is 7.7 percent to 3.4 percent in rural areas. Comparison by residence among women in GLSS 4 however reveals a different pattern. Indeed there appears to be hardly any variations in the usage of contraceptives, either traditional or modern, between urban and rural dwellers (Table 3.3). However comparison across expenditure per adult quartiles

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[57] Except current modern use in GLSS 4 that rises till age 35 – 39 and falls thereafter.

is consistent with expectation in both survey years: knowledge and use rise with expenditure. In all categories women in the highest expenditure quartile have the most knowledge and highest ever as well as current use, compared to women in the lowest expenditure quartile.

Table 3.2: Knowledge and Use of Contraceptives by School, Age, Residence & Expenditure Among Women Who have Started Sexual Relations[a] (1987/88)

GLSS 1	Traditional				Modern		
	Obs.	Knowledge	Ever Use	Current Use	Knowledge	Ever Use	Current Use
Women's Sch.							
None	970	64.64	33.81	21.24	45.36	9.79	1.44
Primary	260	80.77	48.46	31.15	71.92	22.31	3.08
Middle/JSS	720	79.58	52.22	35.97	72.78	33.89	9.03
Sec. & Higher	92	80.43	56.52	39.13	78.26	46.74	14.13
Woman's age							
Age at/below 24	620	72.1	42.74	30.48	59.03	19.68	6.13
Between 25 & 29	472	76.06	48.09	31.78	66.1	27.12	5.08
Between 30 & 34	361	77.29	47.92	32.96	62.6	27.7	6.65
Between 35 & 39	239	73.22	42.68	25.52	61.51	17.57	4.18
Between 40 & 49	350	64	32.86	18	49.14	13.71	1.14
Current Residence							
Urban	732	82.51	55.19	38.66	77.19	32.24	7.65
Rural	1310	67.18	36.49	22.82	50.23	15.57	3.36
Expend. per Adult							
Lowest	490	64.49	34.69	21.63	44.29	11.02	1.43
Second	504	74.6	40.67	28.97	62.5	17.06	2.98
Third	515	70.1	45.24	29.51	65.05	26.99	6.41
Highest	533	80.86	51.41	33.4	66.79	30.21	8.44
All Women	2042	72.67	43.19	28.5	59.89	21.55	4.9

Source: Author's calculation using the Ghana Living Standards Survey, 1987/88 (GLSS 1)
a. Based on respondents affirmative response to having cohabited at the time of the survey

Table 3.3: Knowledge and Use of Contraceptives by School, Age, Residence & Expenditure Among Women (1998/99)

GLSS 4				With Sample weights[a]	
		Traditional	**Modern**	**Traditional**	**Modern**
	Obs.	Current use	Current use	Current use	Current use
Women's Sch.					
None	2443	2.95	9.21	3.7	9.96
Primary	1081	4.35	10.82	4.77	12.7
Middle/JSS	1876	5.6	11.89	6.53	12.28
Sec. & Higher	443	7.45	14	7	15.69
Woman's age					
Age at/below 24	2070	2.22	5.36	2.46	5.57
Between 25 & 29	968	5.48	15.19	6.14	15.84
Between 30 & 34	863	7.07	16.22	8.52	18.88
Between 35 & 39	784	5.87	17.09	6.9	19.42
Between 40 & 49	1158	4.4	8.2	4.63	7.56
Current Residence					
Urban	2195	4.56	10.93	4.3	11.33
Rural	3648	4.3	10.61	5.5	11.83
Expend. Per Adult					
Lowest	1465	2.59	6.69	2.5	7.12
Second	1460	4.11	10.41	5.14	11.99
Third	1460	4.93	11.85	4.98	12.27
Highest	1458	5.97	13.99	7.14	14.57
All Women	5843	4.4	10.73	5.04	11.64

Source: Author's calculation using the Ghana Living Standards Survey, 1998/99 (GLSS 4)
a. Survey sample weights are used in the calculations.

The style of question in GLSS 1 leads to multiple responses for contraceptive use, with use of both traditional and modern contraceptives as one possible response. Therefore, for the purpose of consistency and because only few sampled women used modern contraceptives alone, those who used modern contraceptives alone and those who used both modern and traditional contraceptives are grouped into one category in GLSS 1. On the other hand, responses in GLSS 4 are exclusive to each type of contraceptive with no allowance for use of both modern and traditional contraception. The dependent variable is thus divided into three categories made up of: "0" if no contraceptive is currently being used; "1" if only traditional and "2" if only modern or a mixture of modern and traditional is being used.

Because the dependent variable is in three categories, the estimation is conducted by employing a multinomial logit econometric method. The reference category is women who do not use contraceptives. The econometric model estimates coefficients of explanatory variables, $\beta_1, \beta_2, \ldots \beta z$ - - - (4)

These coefficients indicate the effects of the controlled variables on each category of contraceptive outcome with reference to the base group. The expressions for the response probabilities are:

$$\Pr(y_i = 1) = \frac{\exp(\chi_i'\beta_1)}{\left[\exp(\chi_i'\beta_1) + \exp(\chi_i'\beta_2) + \exp(\chi_i'\beta_3)\right]} \quad \text{.......................................(5)}$$

$$\Pr(y_i = 2) = \frac{\exp(\chi_i'\beta_2)}{\left[\exp(\chi_i'\beta_1) + \exp(\chi_i'\beta_2) + \exp(\chi_i'\beta_3)\right]} \quad \text{.......................................(6)}$$

$$\Pr(y_i = 3) = \frac{\exp(\chi_i'\beta_3)}{\left[\exp(\chi_i'\beta_1) + \exp(\chi_i'\beta_2) + \exp(\chi_i'\beta_3)\right]} \quad \text{.......................................(7)}$$

One set of coefficients is then normalised to zero otherwise y_i would have same probabilities across outcomes. The three equations above then become:

$$\Pr(y_i = 1) = \frac{1}{\left[1 + \exp(\chi_i'\beta_2) + \exp(\chi_i'\beta_3)\right]} \quad \text{..............................(8)}$$

$$\Pr(y_i = 2) = \frac{\exp(\chi_i'\beta_2)}{\left[1 + \exp(\chi_i'\beta_2) + \exp(\chi_i'\beta_3)\right]} \quad \text{..............................(9)}$$

$$\Pr(y_i = 3) = \frac{\exp(\chi_i'\beta_3)}{\left[1 + \exp(\chi_i'\beta_2) + \exp(\chi_i'\beta_3)\right]} \quad \text{..............................(10)}$$

where β_1 is normalised to zero. Therefore, the probability of outcome 2 or 3 occurring relative to the base category is:

$$\frac{\Pr(y_i = 2)}{\Pr(y_i = 1)} = \exp(\chi_i'\beta_2) \qquad (11)$$

$$\frac{\Pr(y_i = 3)}{\Pr(y_i = 1)} = \exp(\chi_i'\beta_3) \qquad (12)$$

The Multinomial Logit model uses the maximum likelihood estimations where each observation has conditional log likelihood[58]:

$$L_i(\beta) = \sum_{j=1}^{3} 1[y_i = j] \log\left[p_j(\chi_i, \beta_j)\right] \qquad (13)$$

The full sample sizes for the contraceptive estimations are 2240 and 5863 of women of reproductive age 15 – 49 gathered during GLSS 1 and 4 respectively. These are women with all the information required for the econometric estimations. The observations here are a bit more than those used in Tables 3.1 to 3.2 above. This is because the women who had not cohabited, and therefore not asked questions about contraception, have now been included as practitioners of abstinence and therefore traditional contraceptives users (Oliver, 1995) in GLSS 1 but as non-users in GLSS 4[59]. Therefore for the full sample, it can now be observed that women currently using traditional contraceptives constitute about 34.8 percent and those using modern are 4.5 percent in GLSS 1. Also the percentage of women who have ever-used contraceptives are as usual higher: 48.2 and 19.6 for traditional and modern contraceptives respectively. However the current contraceptives figures for GLSS 4 remain about the same with 4.4 percent of women using traditional and 10.7 percent of them uses modern contraceptives.

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[58] Wooldridge, J.M, 2002, Econometric Analysis of Cross Section and Panel Data Analysis

[59] This is because GLSS 4 does not have information on cohabitation, and with an observation of 20 women, we believe this will not make much difference on outcomes.

Tables 3.4 and 3.5 show these summary statistics and those of the explanatory variables used in the estimations for GLSS 1 and 4 respectively.

Table 3.4: Summary Statistics of Variables Used by Full Sample, Residence and Age Sub-Samples, 1987/88

GLSS 1	Full		Rural		Urban		Age 15-34		Age 35-49	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Contraceptives										
Current Use (Trad.)	0.348	0.477	0.280	0.449	0.462	0.499	0.397	0.489	0.211	0.408
Current Use (Mod.)	0.045	0.207	0.031	0.174	0.067	0.250	0.052	0.222	0.024	0.152
Ever Use (Trad.)	0.482	0.500	0.408	0.492	0.607	0.489	0.523	0.500	0.368	0.483
Ever Use (Mod.)	0.196	0.397	0.145	0.352	0.283	0.451	0.212	0.409	0.153	0.360
External Use[a]	0.365	0.248	0.293	0.212	0.486	0.255	0.370	0.246	0.351	0.252
School										
None	0.454	0.498	0.539	0.499	0.313	0.464	0.379	0.485	0.666	0.472
Primary	0.133	0.340	0.132	0.338	0.135	0.342	0.148	0.355	0.092	0.289
Middle/JSS	0.362	0.481	0.306	0.461	0.455	0.498	0.419	0.494	0.200	0.401
Sec. & Higher	0.051	0.220	0.023	0.151	0.097	0.296	0.054	0.226	0.042	0.202
Still in School	0.046	0.209	0.041	0.197	0.055	0.228	0.062	0.242		
Age										
15_24	0.362	0.481	0.366	0.482	0.356	0.479	0.491	0.500		
25_34	0.375	0.484	0.364	0.481	0.393	0.489	0.509	0.500		
35_49	0.263	0.440	0.270	0.444	0.251	0.434				
40_49	0.156	0.363	0.173	0.378	0.128	0.334			0.594	0.491
Current Residence										
Rural	0.627	0.484					0.621	0.485	0.643	0.479
Northern Region	0.142	0.349	0.189	0.392	0.062	0.242	0.127	0.333	0.185	0.389
Religion & Ethnicity										
Christian	0.625	0.484	0.585	0.493	0.692	0.462	0.635	0.481	0.596	0.491
Muslim	0.138	0.344	0.108	0.311	0.187	0.390	0.133	0.339	0.151	0.358
Traditional	0.172	0.377	0.232	0.422	0.071	0.256	0.166	0.372	0.188	0.391
Other	0.066	0.248	0.075	0.263	0.050	0.219	0.066	0.248	0.065	0.246
Non-Akan	0.533	0.499	0.526	0.500	0.544	0.498	0.513	0.500	0.587	0.493

Table 3.4 contd: Summary Statistics of Variables Used by Full Sample, Residence and Age Sub-Samples, 1987/88

GLSS 1	**Full**		**Rural**		**Urban**		**Age 15-34**		**Age 35-49**	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Household Asset Score[b]										
Basic	3.26 E-17	1.000	-0.460	0.374	0.773	1.222	0.007	0.988	-0.020	1.035
High	5.73 E-18	1.000	-0.060	0.214	0.102	1.610	0.011	1.118	-0.032	0.546
Community variables										
Distance Primary school	0.632	1.829	1.008	2.226			0.618	1.829	0.670	1.830
Distance Middle school	2.268	4.959	3.615	5.860			2.158	4.829	2.575	5.298
Distance Secondary school	13.492	19.632	21.398	21.110			12.956	18.810	14.993	21.720
Access to Health facilities/personnel[b]	-9.24 E-18	0.792	-1.47 E-17	1.000			-0.020	0.760	0.055	0.874
Price score[b] (foodstuffs)	-2.09 E-17	0.792	-3.33 E-17	1.000			0.008	0.788	-0.022	0.804
Price score[b] (cereals)	-9.65 E-18	0.792	-1.54 E-17	1.000			-0.008	0.791	0.022	0.794
Log of real Men's Agric. Wage	2.809	2.710	4.262	2.205			2.824	2.716	2.769	2.695
Ratio of female to men's wage	0.300	0.435	0.460	0.463			0.308	0.438	0.277	0.425
Ratio of child to men's wage	0.307	0.408	0.469	0.423			0.305	0.406	0.310	0.412
Observation	2240		1405		835		1651		589	

a. Proportion of "other" women in cluster using contraceptives.
b. Generated scores using Principal Component Analysis.

Table 3.5: Summary Statistics of Variables Used by Full Sample, Residence and Age Sub-Samples, 1998/99

GLSS 4	Full		Rural		Urban		Age 15-34		Age 35-49	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Contraceptives										
Current Use (Trad.)	0.044	0.205	0.043	0.203	0.045	0.208	0.041	0.198	0.050	0.218
Current Use (Mod.)	0.107	0.309	0.106	0.308	0.109	0.311	0.102	0.302	0.118	0.323
External Use[a]	0.151	0.133	0.149	0.140	0.154	0.120	0.153	0.131	0.146	0.135
School										
None	0.418	0.493	0.511	0.500	0.263	0.441	0.363	0.481	0.528	0.499
Primary	0.185	0.389	0.184	0.388	0.187	0.390	0.206	0.404	0.144	0.351
Middle/JSS	0.322	0.467	0.272	0.445	0.404	0.491	0.354	0.478	0.256	0.436
Sec. & Higher	0.076	0.265	0.033	0.180	0.146	0.353	0.077	0.267	0.073	0.260
Still in School	0.124	0.330	0.106	0.307	0.155	0.362	0.185	0.388	0.001	0.032
Age										
15_24	0.356	0.479	0.333	0.471	0.395	0.489	0.533	0.499		
25_34	0.313	0.464	0.322	0.467	0.298	0.457	0.467	0.499		
35_49	0.331	0.471	0.346	0.476	0.307	0.461				
40_49	0.198	0.398	0.204	0.403	0.186	0.389			0.596	0.491
Current Residence										
Rural	0.624	0.484					0.610	0.488	0.651	0.477
Northern Region	0.135	0.341	0.171	0.377	0.073	0.261	0.121	0.327	0.161	0.368
Religion & Ethnicity										
Christian	0.776	0.417	0.760	0.427	0.801	0.399	0.793	0.405	0.739	0.439
Muslim	0.122	0.327	0.098	0.298	0.161	0.368	0.118	0.322	0.130	0.336
Traditional	0.062	0.240	0.093	0.291	0.009	0.095	0.050	0.219	0.084	0.277
Other	0.041	0.199	0.048	0.215	0.029	0.168	0.038	0.192	0.047	0.211
Non-Akan	0.490	0.500	0.499	0.500	0.474	0.499	0.477	0.500	0.514	0.500

Table 3.5 contd: Summary Statistics of Variables Used by Full Sample, Residence and Age Sub-Samples, 1998/99

GLSS 4	**Full**		**Rural**		**Urban**		**Age 15-34**		**Age 35-49**	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Household Asset Score[b]										
Basic	-4.60 E-17	1.000	-0.419	0.704	0.694	1.032	0.031	1.016	-0.062	0.964
High	-5.38 E-17	1.000	0.248	0.930	-0.411	0.977	-0.040	1.003	0.081	0.989
Community variables										
Distance Primary school	4.504	54.666	7.221	69.079			5.281	59.537	2.935	43.160
Distance JSS school	5.473	35.510	8.774	44.641			5.663	36.993	5.088	32.314
Distance Secondary school	15.433	56.260	24.743	69.603			15.417	56.824	15.466	55.117
Access to Health facilities/personnel[b]	1.01 E-17	0.790	1.61 E-17	1.000			0.001	0.795	-0.001	0.779
Price score[b] (foodstuffs)	-1.19 E-17	0.790	-1.91 E-17	1.000			0.012	0.905	-0.024	0.479
Price score[b] (cereals)	1.45 E-17	0.790	2.33 E-17	1.000			0.008	0.815	-0.016	0.736
Log of real Men's Agric. Wage	4.992	4.128	7.894	2.009			4.863	4.155	5.252	4.060
Ratio of female to men's wage	0.376	0.435	0.591	0.412			0.365	0.433	0.398	0.439
Ratio of child to men's wage	0.270	0.390	0.428	0.416			0.260	0.387	0.290	0.396
Observation	5863		3657		2206		3921		1942	

a. Proportion of "other" women in cluster using contraceptives.
b. Generated scores using Principal Component Analysis.

3.2.1.2.2 *Explanatory Variables: Definitions, Descriptives and Expected Impacts*

The explanatory variables of interest are observed at personal, household, cluster and community levels. Those collected at personal levels include education, age, rural and region of residence as well as religion and ethnicity[60]. Information on household wealth or resources, as the name suggests, are collected at household levels and external contraceptive use is at cluster level but for the individual woman. Finally community variables included in the model are distances to primary, middle and secondary schools as well as health facilities and personnel's, commodity prices, log of real agricultural wage rates for men, the ratio of women's agricultural wage to men's, and the ratio of child's agricultural wage to men's. The community level variables are unfortunately collected in rural areas only. Therefore for the full samples and the sub-samples stratified by age, urban clusters are replaced with zero according to the zero-order condition (Maddala, 1977).

Education is defined as years of completed schooling of sampled women. It is included in the model in categorical terms, namely, no education (base category), primary, middle/JSS, secondary and above as well as women still in school. Education is expected to increase contraceptive use because as proxy for wage and hence opportunity cost of time, fewer children may be demanded with its increase. Also child's cost pertaining to child quality through schooling increases with educated women, they are more likely to desire fewer births and hence would require more contraceptives. Education also reduces information cost on acquiring contraceptives. However, an increase in education can also increase income or household wealth in general, unless unearned income is used.

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[60] This is however that of the household head in GLSS 1.

Otherwise the other measures of wealth may tend to have a negative impact on contraceptives if it increases the demand for children. But empirical evidences usually show the substitution price effect of education counteracts the income effect, and the net effect on the demand for children is negative, hence increased demand for contraception.

Of the sampled women, about 45.4 percent have no education at all in GLSS 1 and barely reduces in GLSS 4 (41.8 percent). Average schooling is highest at the middle/JSS levels in both surveys and constitutes about a third of the sampled women. This is followed by primary schooling, of which 13.3 percent have completed in GLSS 1 and 18.5 percent in GLSS 4. However less than 10 percent of them have secondary and above education: 5.1 and 7.6 percent in GLSS 1 and 4 respectively. Also, roughly 4.6 percent of the women were still in school at the time of the survey in GLSS 1 with a corresponding 12.4 percent in GLSS 4. Finally the rural/urban sub-samples show that there are more uneducated women in rural than urban areas. This is about 53.9 percent in rural areas compared to 31.3 percent in urban areas in GLSS 1. The corresponding figures for GLSS 4 are 51.1 and 26.3 percent. All the remaining schooling categories consequently indicate higher average levels attained in urban areas relative to rural ones.

This difference in education levels by residence is one of the reasons for its control in the model. It also to some extent indicates the quality of education, which is higher in urban than rural areas. Residence also controls for accessibility of contraceptives and hence cost; whereby urban residents may have easy access to information, the actual product as well as less extended family pressure to conform to traditional values. Other child’s costs are however higher in urban areas because of generally higher living standards and educated women are more likely to work in formal environments and higher wages. This is expected to increase the demand for contraceptives as a result of fewer demands for children. The positive relationship between urban residence and contraceptives has been observed in other studies including Moreno (1993), Oheneba-Sakyi and Takyi (1997), and Kirk and Pillet (1998).

In addition to place of residence (rural/urban) of which about three-quarters of the sampled women reside in the former, region of residence is also included in the model to basically control for level of development and exposure to modern or “westernised” values. There is a big North-South divide in terms of development and poverty. Therefore based on administrative regions, a dummy variable indicating the Northern regions is represented as “1” and “0” otherwise. The Northern regions are made up of Northern, Upper East and West. They are least developed compared to the Southern regions including the Brong-Ahafo, Ashanti, Volta, Eastern, Central, Western and the Greater Accra regions. The northern regions also have less access to public facilities such as schools, hospitals and other infrastructure compared to the south. So the expectation is that residents up north may be less inclined to use contraceptives with increased costs resulting from lack of these facilities. Around 15 percent of the women in this study on average reside in the northern regions.

To a greater extent, tastes are also controlled with the rural/urban as well as the north/south stratification. Additional variables also acting as such controls are religion and ethnicity. Christianity (base category) appears to be the most practiced religion amongst women in the GLSS 1 (62.5%) and GLSS 4 (77.6%) study samples. This is made up of Catholics, Protestants, and other Christianity. The other religious affiliations are Muslims (13.8% in GLSS 1 and 12.2% in GLSS

4), Traditional (17.2% in GLSS 1 and 6.2% in GLSS 4), and other: the Bahai faith, Eckankar, and Buddhism (6.6% in GLSS 1 and 4.1% in GLSS 4).

With regard to ethnicity, the women are separated into the Akans (base category) and the non-Akans. The Akans are the *twi*-speaking people in the country and forms the largest language group, nearly half of the entire women in this study. The non-Akans are the Ewes, Ga-Adangbes, Mole-Dagbanis, Hausas and others. Religion and language are expected to be pro-natalist, upholding traditional values that promote extending family size and ancestry. This may not be so much the case for the Christian (especially Catholics) and the Muslim religions but they nonetheless do not much encourage use of contraception. Therefore the overall effect may be geared towards less inclination to contraceptive use. However, Adongo et al., (1998) caution this may not always be the case because Traditional religion reflects socioeconomic determinants rather than a factor independently affecting reproductive change[61]. For GLSS 1, the religious belief and ethnicity of the household head is used as a proxy for that of the women since there are no individual records unlike in GLSS 4.

The woman's age controls fecundity level, which varies over her lifetime and hence demand for contraception. It may also control censoring, in that, some women may not have completed their fertility or even began. Age in years is included in the model in categorical terms: 15 – 24 (base category), 25 – 34, and 35 – 49. The effect of age on contraceptive use is expected to be non-monotonic.

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[61] Their study is based on the influence of traditional religion on reproductive preferences of the heads of the Kassena-Nankana lineage in Northern Ghana. It is a qualitative study where questions on reproductive preferences were administered to both lineage heads and ancestral spirits through with the assistance of soothsayers. Their findings showed that some ancestral spirits preferred smaller families than even the lineage heads. One of the main reasons given is economic and social changes in their environment.

Contraception is likely to increase with age, decline and increase again. Younger women would probably use contraceptives to delay marriage or birth. But this will decrease as they reach childbearing age band (any use would more likely be for birth-spacing), to be picked again upon achieving the desired number of births. But then again the increase during the latter phase would not be as large due to declining natural fecundity levels or menopause (Thomas and Maluccio, 1996).

External contraceptive use is included in the model to sort of capture the influence of other people or friends using contraceptive within a community on an individual in that community. It is calculated as the proportion of other women, except the individual, in the cluster who use contraceptives. As Table 3.1 shows, the most common source of knowledge of contraception methods is from friends. And it is expected that as the proportion of women in a cluster that use contraception increases, so too will individual women adopt and increase use of contraception.

The household wealth measure used in this study is a factor score index of household durable goods and physical characteristics of dwelling place using principal component analysis. Bollen et al. (2002) by comparing several proxies of economic status in their study on fertility in Ghana and Peru recommends principal components score as the best amongst indicators such as expenditure per adult; sum of current value of assets as reported by owners; simple sum of the assets, that is, the total number owned; sum of the median value of goods, that is, median value of asset across all households; and occupational status of the household head. Filmer and Pritchett (2001) also support the reliability of the principal component procedure as a proxy of economic status. They find it performs as well as consumption expenditure, and in some cases better, although it does not have theoretical backings as expenditure. The drawback however is that potential measurement errors of the proxy variables (albeit fewer than expenditure) or their correlation with other variables in the model are not corrected with the use of principal component analysis. Filmer and Pritchett (2001) suggestions to the choice between using the component analysis for asset index and consumption expenditure is that the latter is better depending on its quality and variability. They state, "In such cases, using assets as instruments for household per capita expenditures is most likely the more effective way of extracting the maximum amount of information from the data while reducing the impact of measurement error." But this study adopts the principal component analysis in generating asset scores as proxy for wealth not only because it performs better with the Ghana data (Bollen et al. 2002) but also because the predicted outcome of the dependent variable (that is, contraceptive, in this section) is further used in the ultimate estimation of fertility.

Principal component analysis transforms original set of variables into a smaller number of linear combinations in a way that captures most of the variability in the pattern of correlation (Pallant, 2007). Each principal component is a weighted linear combination of the original variables. Variables used in this study for the component analysis are household durable goods and physical characteristics of the house. The household durable goods in GLSS 1 includes sewing machine, stove, fridge-freezer, air-conditioner, fan, radio, cassette player, phonographs, stereo equipment, video equipment, washing machine, black and white television, colour television, bicycle, motor bike, car and camera. The physical characteristics of dwelling place include the house has room greater than one, piped water, flush toilet, electricity, and non-dirt floor. The variables used in GLSS 4 are same as the ones above but also includes furniture, house, plot of land, shares, boat, canoes and outboard motors.

Of the 22 variables in GLSS 1 and 29 in GLSS 4, only half remained in the former and 10 in the later survey year upon assessment for their suitability for factor analysis. First variables are examined for factorability using correlation matrix as well as the Kaiser-Meyer-Oklin (KMO) measure of sampling adequacy and the Barlett test of sphericity[62] (Pallant, 2007). Factors are then extracted using principal component analysis followed by oblique rotation of factors using Oblimin rotation. The final number of factor components kept for further analysis was guided by Kaiser's criterion[63] and the scree test[64]. Summary statistics of the variables used and graphs (screeplot) are presented in Appendix B-1 to B-3. The KMO value is 0.82 in GLSS 1 and 0.90 in GLSS 4, both of which exceeds the recommended value of 0.6 (Kaiser, 1970 & 1974 cited in Pallant, 2007); and the Bartlett's Test of Sphericity was also highly significant. These results thus support the factorability of the correlation matrix.

The principal component analysis initially more than two components but upon assessing the total variance explained and the screeplot as well as the communalities[65], two components factors are retained for further analysis. These two component factors used showed Eigen values exceeding 1 and explained 52.3

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[62] A good indication that the data is suitable for factor analysis is that the correlation matrix has many coefficients with values of 0.3 and above; KMO has a value of at least 0.6 and the Barlett test is significant.

[63] That suggests factors retained should have Eigen values greater than one.

[64] This is a graph made up of Eigen values and the principal components. The cut-off point for factors to be retained in the analysis is where the line changes slope. Although the test is subjective, it is usually found to have high inter-scorer reliability (Kline, 2008).

[65] This shows how much of the variance in each item is explained; only variables with values above 0.3 are retained for the final analysis. Lower value may imply that the variable does not fit well with the other variables in its component, and removing them tend to increase the total variance explained (Pallant, 2007).

and 58.8 percent of the variance in GLSS 1 and 4 respectively. The first component in GLSS 1 explained 34.2 percent of the variance and the second explained 18.1 percent. The corresponding figures in GLSS 4 are 44.0 and 14.7 percent respectively. The two factors also show many higher variable loadings on each of the factors, giving reasonable meaning to the pattern formed. Table 3.4 gives loadings on the component, pattern and structure matrix. Factor loadings are correlations between variables and factors; and those with values above 0.3 are considered significant, after rotation (Kline, 2008). Such values are bolded in table 3.6 below.

Table 3.6: Component, Pattern and Structure Matrix for PCA with Oblimin Rotation of Two Factor Solution of Household Wealth, GLSS 1 and GLSS 4.

Variable	Component Matrix[a]		Pattern Matrix[b]		Structure Matrix		Communalities
GLSS 1							
	Component		Component		Component		
	1	2	1	2	1	2	
Electricity	0.683	-0.38	**0.802**	-0.103	**0.775**	0.107	0.61
Fans	0.698	-0.318	**0.775**	-0.037	**0.766**	0.166	0.587
Black & White TV	0.642	-0.33	**0.737**	-0.071	**0.719**	0.122	0.521
Piped Water	0.619	-0.358	**0.735**	-0.106	**0.708**	0.087	0.511
Fridge-Freeze	0.729	-0.117	**0.676**	0.168	**0.721**	0.345	0.546
Flush Toilet	0.567	-0.09	**0.525**	0.131	**0.56**	0.269	0.329
Stove	0.554	-0.103	**0.523**	0.114	**0.552**	0.25	0.317
Video equipment	0.504	0.643	0.016	**0.813**	0.229	**0.817**	0.668
Colour TV	0.497	0.633	0.016	**0.800**	0.226	**0.805**	0.648
Washing Machine	0.397	0.669	-0.088	**0.797**	0.12	**0.774**	0.606
Air Conditioner	0.444	0.458	0.083	**0.611**	0.243	**0.633**	0.407
GLSS 4							
	Component		Component		Component		
	1	2	1	2	1	2	
Fans	0.832	0.057	**0.832**	-0.026	**0.834**	-0.075	0.696
Electric iron	0.827	0.025	**0.822**	-0.057	**0.825**	-0.105	0.684
Fridge-Freeze	0.8	0.164	**0.817**	0.085	**0.812**	0.036	0.667
TV	0.791	0.159	**0.808**	0.08	**0.803**	0.033	0.651
Electricity	0.765	-0.251	**0.717**	**-0.325**	**0.737**	**-0.368**	0.648
Piped water	0.688	-0.355	**0.624**	**-0.422**	**0.649**	**-0.459**	0.599
Stove	0.631	0.136	**0.645**	0.073	**0.641**	0.035	0.416
Video equipment	0.528	0.277	**0.566**	0.224	**0.553**	0.19	0.356
House	-0.165	0.757	-0.043	**0.771**	-0.089	**0.773**	0.6
Room Gter1	0.004	0.747	0.121	**0.745**	0.077	**0.737**	0.558

Note: a – Unrotated loadings; b – Rotated loadings (rotation converged in 4 iterations)

The pattern and structure matrices reveal the first component factor in GLSS 1 strongly loads on electricity, fans, black and white television, piped water, fridge-freezer, flush toilet, and stove; and the second factor loadings are video equipment, colour television, washing machine and air conditioner. GLSS 4 showed slightly different loadings to the above for the first component factor that includes fan, electric iron, fridge-freezer, television, electricity, piped water, stove and video equipment. The second factor in this survey year is whether the household has rooms greater than one, owns a house, piped water and electricity. Although piped water and electricity showed cross-loadings, which strongly loaded in both factors, they are stronger in the first. The Oblimin rotation also reveals a weak correlation between the two components used in both surveys. The correlation in GLSS 1 is positive with a value of 0.26, and that of GLSS 4 is negative with a value of 0.06. These support the use of the two component factors as separate scores.

Loadings on the first component factor in each survey year seem to measure material wealth and housing qualities that are relatively basic in households considering the period of the survey. And the second factor shows wealth indicators typical of households with higher earnings. Therefore factor scores of these components are used as measures of wealth in estimations and labelled as basic and high household assets. The expected impact of these wealth scores, holding education constant, cannot be determined a priori. This depends on whether the demand for children is seen as a 'normal' good or not. If it is, then a negative relationship between these scores and contraceptive is expected. But the reverse is more the case as fewer children tends to be demanded with increases in wealth. This is possibly because of the hypothesised household behaviour of desiring to exchange 'quantity' of children for higher 'quality' (Becker, 1960). In this case, demand for contraceptives increases.

Distance to health facilities and personnel represent the cost of contraceptives in this study. In order to have all the facilities represented[66] but with fewer indicator variables, a principal component analysis is also employed here to generate a factor score to be used in the regression. The factor score also helps to solve the problem of high correlation that is present among all these community variables. The variables used in this case are distance[67] to the nearest hospital, clinic, family planning clinic, pharmacy, doctor, nurse, community health worker, family planning worker, and pharmacist in GLSS 1. These same variables in addition to distance to the nearest drugstore, maternity home, midwife, medical assistant, traditional healer, and traditional birth attendant are used in GLSS 4. A Table showing summary statistics and screeplot that supports use of the component analysis for both survey periods can be found in Appendix B-4 to B-6. The procedure used in arriving at the final component factor used for additional analysis is same as described under household wealth. The KMO value for GLSS 1 is 0.82 and that for GLSS 4 is 0.92. The Bartlett's test of sphericity is also found significant in both surveys, and based on the Kaiser criterion two components showing Eigen values greater than 1 are maintained for the analysis.

The total variance explained by these components is 81.0 and 90.5 percent in GLSS 1 and 4 respectively. It can be observed after rotation (pattern and structure columns of table 3.7) that the first factor in the pattern matrix loads strongly on

[66] As contraceptives are often not only obtained from family planning clinics but also from hospitals, pharmacies, and chemical sellers (Table 3.1).

[67] All distances used in this analysis are measured in kilometres.

family planning clinic and worker, pharmacy, pharmacist, hospital and doctor in GLSS 1. The second factor, in the same survey year loads on nurse, clinic and community health worker. The outcome in GLSS 4 is same as 1 regarding relatively more substantial loadings on the first factor. But the second factor on the other hand loads highly on pharmacy, pharmacist, hospital, doctor, maternity home and midwife. The first factor in both survey periods shows substantial loadings on both facilities and workers of those facilities, thus it is aptly named distance to health facilities and personnel. But with a higher correlation matrix of 0.5 in GLSS 1 and 0.7 in GLSS 4 between the two components, only scores of the first factor are used for the econometric estimations. This may not undermine the results because the first component factor alone explains 67.6 percent of the variance in GLSS 1 and 79.9 percent in GLSS 4. Just as would be expected of a cash price, distance to the nearest health facilities and personnel is expected to be negatively associated with contraceptive use.

Table 3.7: Component, Pattern and Structure Matrix for PCA with Oblimin Rotation of Two-Factor Solution to Distance to the Nearest Health Facility and Personnel, GLSS 1 and GLSS 4.

	Component Matrix[a]		Pattern Matrix[b]		Structure Matrix		Communalities
GLSS 1	Component		Component		Component		
	1	2	1	2	1	2	
Fam. Pl. clinic	0.863	-0.302	**0.965**	-0.1	**0.91**	**0.43**	0.836
Fam. Pl. worker	0.886	-0.252	**0.94**	-0.035	**0.92**	**0.48**	0.848
Pharmacist	0.835	-0.27	**0.914**	-0.07	**0.876**	**0.431**	0.77
Pharmacy	0.918	-0.159	**0.885**	0.082	**0.929**	**0.567**	0.869
Hospital	0.949	-0.105	**0.861**	0.154	**0.946**	**0.627**	0.912
Doctor	0.92	-0.105	**0.838**	0.145	**0.918**	**0.605**	0.857
Nurse	0.642	0.656	-0.056	**0.948**	**0.464**	**0.917**	0.843
Clinic	0.639	0.61	-0.018	**0.894**	**0.472**	**0.884**	0.781
Com. Health worker	0.668	0.358	0.227	**0.61**	**0.561**	**0.734**	0.575
GLSS 4							
	Component		Component		Component		
	1	2	1	2	1	2	
TBA	0.934	-0.291	**1.01**	-0.046	**0.978**	**0.676**	0.957
Trad. Healer	0.894	-0.307	**1.003**	-0.083	**0.943**	**0.633**	0.893
Nurse	0.948	-0.232	**0.946**	0.041	**0.975**	**0.716**	0.952
Medical Asst.	0.95	-0.226	**0.941**	0.049	**0.976**	**0.721**	0.954
Fam. Pl. worker	0.951	-0.218	**0.932**	0.06	**0.975**	**0.726**	0.952
Clinic	0.851	-0.267	**0.924**	-0.045	**0.892**	**0.614**	0.796
Fam. Pl. clinic	0.851	-0.267	**0.924**	-0.045	**0.892**	**0.615**	0.796
Com. Health worker	0.95	-0.207	**0.917**	0.076	**0.971**	**0.73**	0.945
Drug store	0.92	-0.173	**0.854**	0.111	**0.933**	**0.721**	0.877
Pharmacy	0.814	0.5	-0.06	**0.997**	**0.652**	**0.955**	0.913
Pharmacist	0.822	0.497	-0.051	**0.997**	**0.66**	**0.96**	0.923
Doctor	0.874	0.427	0.073	**0.92**	**0.729**	**0.972**	0.947
Hospital	0.798	0.447	-0.005	**0.918**	**0.651**	**0.914**	0.836
Maternity home	0.864	0.388	0.114	**0.863**	**0.73**	**0.944**	0.898
Midwife	0.959	0.122	**0.512**	**0.532**	**0.892**	**0.898**	0.935

Note: a – Unrotated loadings; b – Rotated loadings (rotation converged in 4 iterations)

Similarly two price scores are generated using the principal component analysis. These price scores cover commodities households usually use. The prices[68] of commodities used in GLSS 1 include cassava, guinea corn, millet, bread, gari, garden eggs, tomatoes, egg, tilapia, palm oil, groundnut oil, sugar, milk, and soap. A dummy controlling missing values is also included. Those used in GLSS 4 are maize, plantain, fish, sugar, guinea corn, millet, bread, gari, yam, cocoyam, onion, garden eggs, and tomatoes. After a satisfactory assessment of the KMO measure of sampling adequacy: 0.84 in GLSS 1 and 0.86 in GLSS 4 as well as a statistically

[68] These are in real terms.

significant Bartlett's test, PCA revealed three component factors with Eigen values exceeding 1. However a scree plot (reported in Appendix B-7 to B-9) shows a break after the second component; therefore the first two components, explaining a total of 52.2 percent of the variance in GLSS 1 and 83.4 percent in GLSS 4, are kept for the analysis. The first component explains 38.7 and 52.2 percent of the variance in GLSS 1 and 4 respectively. The equivalent for the second component are 13.6 and 31.2 percent respectively.

With the aid of an Oblimin rotation, the first factor is noted with substantial loadings on variables such as egg, milk, garden egg, soap, tomatoes, palm oil, cassava, gari, tilapia, bread and sugar, as well as the missing dummy variable in GLSS 1 (Table 3.8). Since these mainly show a range of basic foodstuffs consumed by households, they are so named as "foodstuffs" in the regression model. The second factor however, strongly loaded on millet and guinea corn but relatively less so on groundnut oil and bread. Therefore "cereals" is the name given to that factor.

Table 3.8: Component, Pattern and Structure Matrix for PCA with Oblimin Rotation of Two Factor Solution of Commodity prices, GLSS 1 and GLSS 4.

GLSS 1

	Component Matrix[a]		Pattern Matrix[b]		Structure Matrix		Communalities
	Component		Component		Component		
	1	2	1	2	1	2	
Egg	0.702	-0.279	**0.767**	-0.177	**0.735**	-0.038	0.57
Milk	0.767	-0.069	**0.761**	0.044	**0.769**	0.182	0.594
Missing price	-0.807	-0.056	**-0.758**	-0.175	**-0.79**	-0.313	0.654
Garden egg	0.72	-0.139	**0.739**	-0.033	**0.733**	0.101	0.538
Soap	0.753	-0.021	**0.732**	0.09	**0.748**	0.223	0.567
Tomatoes	0.622	-0.343	**0.712**	-0.254	**0.666**	-0.124	0.505
Palm oil	0.719	-0.058	**0.711**	0.047	**0.72**	0.177	0.521
Cassava	0.647	-0.248	**0.704**	-0.154	**0.676**	-0.026	0.479
Gari	0.628	-0.007	**0.607**	0.085	**0.622**	0.196	0.394
Tilapia	0.556	-0.093	**0.566**	-0.012	**0.564**	0.091	0.318
Bread	0.633	0.231	**0.533**	**0.325**	**0.593**	**0.423**	0.454
Sugar	0.577	0.201	**0.489**	0.288	**0.542**	**0.377**	0.374
Millet	0.21	0.835	-0.072	**0.871**	0.087	**0.858**	0.742
Guinea corn	0.177	0.805	-0.094	**0.836**	0.058	**0.819**	0.679
Groundnut oil	0.387	0.547	0.193	**0.607**	**0.304**	**0.643**	0.449
GLSS 4							
	Component		Component		Component		
	1	2	1	2	1	2	
Guinea corn	0.826	-0.546	**1.006**	-0.184	**0.973**	-0.003	0.98
Millet	0.836	-0.53	**1.005**	-0.165	**0.976**	0.016	0.979
Maize	0.834	-0.528	**1.004**	-0.164	**0.974**	0.016	0.975
Gari	0.904	-0.407	**0.995**	-0.023	**0.991**	0.156	0.983
Sugar	0.955	-0.219	**0.933**	0.173	**0.964**	**0.34**	0.959
Fish	0.956	-0.067	**0.849**	**0.316**	**0.906**	**0.468**	0.918
Bread	0.897	0.039	**0.74**	**0.392**	**0.811**	**0.525**	0.806
Plantain	0.52	0.777	0.009	**0.934**	0.176	**0.935**	0.875
Cocoyam	0.469	0.771	-0.031	**0.907**	0.132	**0.902**	0.814
Tomato	0.466	0.713	-0.002	**0.852**	0.151	**0.852**	0.725
Garden egg	0.484	0.705	0.018	**0.851**	0.171	**0.855**	0.731
Onion	0.44	0.653	0.01	**0.785**	0.151	**0.787**	0.619
Yam	0.36	0.592	-0.024	**0.697**	0.101	**0.693**	0.48

Note: a – Unrotated loadings; b – Rotated loadings (rotation converged in 4 iterations)

Loadings on factors in GLSS 4 however show a slightly different pattern. The first factor highly loaded on guinea corn, millet, maize, gari, sugar, fish and bread. It is therefore given the name "cereals"; and "foodstuffs" given to the second factor because it loaded on plantain, cocoyam, and tomatoes, garden egg, onion, and yam. With a component correlation of 0.18 between the two factors in both surveys, which imply a weak correlation between the two factors and therefore can be used as separate variables, factors 1 and 2 are included in the regression model to represent commodity prices. Increases in these commodity prices is expected to have positive effects on the demand for contraception as the net effect on the desire for more children declines. Oliver (1995) explains this relationship with substitution and income effects: as commodity prices increase couple's may reduce the demand for these commodities and probably substitute with increased demand for children. But this will reduce household disposable income as child's cost increases and other needs in the utility function are unmet. The income effect will thus counteract the substitution effect with the presumption that the latter will be smaller given the combined negative income and own-price effect on the demand for children.

Other child's costs included in the model are distances to the nearest primary, middle/JSS and secondary schools at the period of the two surveys. The average distance to schooling appears to have increased in GLSS 4, compared to GLSS 1. For example, distance to primary school, for rural areas only, is 1.0 kilometre in GLSS 1 and 7.2 kilometres in GLSS 4. Corresponding figures for middle/JSS are 3.6 kilometres in GLSS 1 and 8.8 kilometres in GLSS 4; and those for secondary school are 21.4 in GLSS 1 and 24.7 in GLSS 4. The effect of distance to school on contraceptive use cannot be determined a prior.

The reason being that distance to school generally increases child's cost. And households that may not be able to afford the cost may withdraw children from schools or not allow them to attend at all. This will consequently reduce child's cost and also make them available for unpaid family work or other paid work that may increase household resources. It may also result in increased demand for children and quest for contraception may fall. The reverse could happen in higher income or educated households, or the outcome may be statistically insignificant. This is because of the culture of child fosterage in SSA, especially West Africa (King, 1987 in Knodel et al., 1990). Caldwell and Caldwell (1987) also suggest that the cost of children to biological parents and fertility is rendered meaningless due to one's household willingness to foster grandchildren, nephews and nieces.

Agricultural[69] wage rates also forms part of child's cost as result of the value of time. But unlike formal wage rates, agricultural wage rates are not dependent on education. It is fixed in communities based on gender and age. Thus we have wage rates for men, women and children. They are however highly correlated so in order to include all in the model without possibly causing multicollinearity, the wage rates for women and children are calculated as the proportion of men's. Hence we have three variables for these wage rates named as log of real[70] agricultural rates of men, the ratio of real women's wage rate to men's, and the ratio of real children's wage rates to men's. The expected effect could not be determined a prior. This is because fertility could increase if increased wage rates results in polygamy and/or increased births due to the economic returns to children and therefore a fall in contraceptive use. On the other hand the opportunity cost of time, especially for the women, may cause fertility to decrease and hence increased demand for contraception. An increase in child's wage is likely to increase fertility since some of the benefits of having a child are accrued earlier in life.

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[69] Total amount of money received as a result of weeding.

[70] Adjusted the measure for regional variations in price and inflation during the period of survey. The regional and monthly inflation adjustments are obtained from the basic information document provided by the World Bank for GLSS 1. That for GLSS 4 is obtained from the poverty profile data supplied with the GLSS 3&4 datasets. It is made up of the consumer price index using separate series for food and non-food as well as for Accra, urban and rural areas. A single overall cost of living index was constructed combining the geographic, and overtime variations (GSS, 2000).

3.2.1.3 Estimation Results

This section discusses the marginal impact of education and other socioeconomic variables on current and ever- (only for GLSS 1) use of contraception**.** The multinomial logit estimation model is used for the analysis and the results on education alone are presented in tables 3.9 and 3.10[71] for brevity. Table 3.9 shows the impact of women's education on current contraceptives use by all women as well as residence in both GLSS 1 and 4, and 3.10 shows the impact by Age. Table 3.11 presents the results on the impact of women's education on ever use of contraception. The results in GLSS 1 are first discussed followed by those in GLSS 4. There are three estimated models for each sample as discussed in the specification model. The first (variant 1) shows the influence of education on the use of traditional and modern contraceptives relative to none, controlling for women still in school, age and current residence. The second model (variant 2) differs from the first only by controlling more variables like religion and ethnicity, and most importantly household wealth that tends to correlate with education. The final model (variant 3) includes all the variables variants 1 & 2 as well as rural community characteristics.

[71] These are abridged versions of the various models estimated. Only the coefficients on education showing their statistical significance are shown here. The full results are presented in Appendix B-10 to B-12.

Table 3.9: The Impact of Women's Education on Current Contraceptives Use, by All Women and Residence – 1987/88 & 1998/99

	Full		Rural		Urban	
	Trad.	***Modern***	***Trad.***	***Modern***	***Trad.***	***Modern***
			GLSS 1			
Variant 1: Parsimonious						
Primary	0.068	0.014	0.023	0.025	0.16**	-0.019
Middle/JSS	0.042	0.06***	0.027	0.043*	0.071	0.079**
Sec. & above	0.021	0.14*	-0.022	0.212	0.051	0.127
Variant 2: Full model						
Primary	0.06	0.01	0.014	7.02E-06	0.145*	-0.002
Middle/JSS	0.017	0.049***	0.016	1.29E-05*	0.064	0.008*
Sec. & above	-0.038	0.093	-0.046	1.02E-04	0.025	0.009
Variant 3: Full model with rural community characteristics						
Primary	0.046	0.007	0.012	1.96E-05	0.105	-0.003
Middle/JSS	0.009	0.042***	0.018	3.54E-05*	0.03	0.008*
Sec. & above	-0.04	0.079	-0.046	2.36E-04	0.001	0.009
Observation	2240		1405		835	
			GLSS 4			
Variant 1: Parsimonious						
Primary	0.017	0.059**	0.005	0.092***	0.051*	-0.01
Middle/JSS	0.03**	0.046**	0.029	0.036	0.034**	0.047*
Sec. & above	0.048*	0.094**	0.054	0.051	0.051	0.094*
Variant 2: Full model						
Primary	0.015	0.046**	0.003	0.073***	0.049*	-0.014
Middle/JSS	0.024*	0.033*	0.023	0.025	0.031**	0.037
Sec. & above	0.034	0.075**	0.034	0.043	0.045	0.067
Variant 3: Full model with rural community characteristics						
Primary	0.008	0.031*	-0.001	0.053**	0.036*	-0.019
Middle/JSS	0.019*	0.027*	0.017	0.02	0.024*	0.031
Sec. & above	0.024	0.062*	0.026	0.039	0.033	0.06
Observation	5863		3657		2206	

Note: These coefficients are marginal effects after estimating multinomial logit regression models. Variant 1 control for women currently in school, age, rural residence, and Northern regional location. Variant 2 controls for religion, ethnicity and household wealth in addition to those in Variant 1. The final Variant 3 includes all the variables already mentioned as well as other determinants. See Appendix B-10 and B-11. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively.

-- Survey sample weights are used in GLSS 4.

Table 3.10: The Impact of Women's Education on Current Contraceptives Use, by Women's Age – 1987/88 & 1998/99

		GLSS 1		
	Age15-34		**Age35-49**	
	Traditional	***Modern***	***Traditional***	***Modern***
Variant 1: Parsimonious				
Primary	0.054	0.028	0.102	-0.015**
Middle/JSS	0.033	0.075***	0.053	4.97E-04
Sec. & above	0.034	0.124	-0.021	0.007
Variant 2: Full model				
Primary	0.046	0.022	0.094	-1.9E-05***
Middle/JSS	0.008	0.063***	0.029	4.76E-07
Sec. & above	-0.037	0.084	-0.031	6.14E-06
Variant 3: Full model with rural community characteristics			**Current use[a]**	
Primary	0.037	0.015	0.06	
Middle/JSS	-0.001	0.052**	0.033	
Sec. & above	-0.044	0.068	0.054	
Observation	1651		589	
		GLSS 4		
Variant 1: Parsimonious				
Primary	0.03*	0.047*	-0.017	0.078*
Middle/JSS	0.025*	0.047**	0.038	0.032
Sec. & above	0.033	0.091**	0.063	0.088
Variant 2: Full model				
Primary	0.027*	0.037*	-0.017	0.062*
Middle/JSS	0.022	0.039*	0.028	0.018
Sec. & above	0.025	0.085*	0.042	0.055
Variant 3: Full model with rural community characteristics				
Primary	0.017	0.022	-0.015	0.039
Middle/JSS	0.015	0.03	0.025	0.013
Sec. & above	0.017	0.071*	0.033	0.043
Observation	3921		1942	

Note: These coefficients are marginal effects after estimating multinomial logit regression models. Variant 1 control for women currently in school, age, rural residence, and Northern regional location. Variant 2 controls for religion, ethnicity and household wealth in addition to those in Variant 1. The final Variant 3 includes all the variables already mentioned as well as other determinants. See Appendix B-10 & B-11. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively.
a- did not distinguish between traditional and modern in this model.
-- Survey sample weights are used in GLSS 4.

The Impact of Education

In accordance to expectations, estimates show educated women are more likely to use contraception compared to their uneducated counterparts in most of the samples examined. Also not surprising, education tends to influence modern contraceptives more than traditional use, as observed from the many statistically significant estimates in the former's column. This may explain the common view that some level of education is required for understanding and confident practice of modern contraception. This is more so in earlier years or introductory stages of modern methods.

In GLSS 1 for instance, the impact of education is found statistically significant from the post-primary level and only with the use of modern contraceptives. Women with middle/JSS level of education are associated with an increase of about 6 percent in the probability of current use of modern contraceptives, ceteris paribus. Those with secondary education and above are associated with higher probabilities than the level before it. The increase in the tendency to use the modern methods with this highest level of education is about 14 percent compared to none, ceteris paribus. This is more than a fifty percent increase and somewhat tallies with the higher opportunity cost of time hypothesis with regard to higher education.

When stratified by current residence, it is noted that the highest level of education loses its significance. However where significant, education appears to have lower impact on contraceptive use by women in rural than urban areas. Women's education at the primary level is also found statistically significant in the influence of traditional contraceptive use in urban areas. Traditional contraception however is believed to be less effective than modern, except abstinence. When the data is also distinguished by age, it is estimated that only women with middle/JSS education in the younger group (Age 15 – 34) statistically have a positive tendency to use modern contraception. For the older group (Age 35 – 49), it is primary education that is statistically significant but contrary to the expected outcome. For example older women with primary education have lower tendencies to use modern contraception in GLSS 1. This may be due to a reluctance to adopt "foreign" methods with difficult information on correct use, side effects, and availability in these early years.

Contrary, in GLSS 4 the positive relationship between women's education and contraceptive use is observed among both traditional and modern users in all samples where education is statistically significant. In the full sample of Variant 1, education is found statistically significant on the impact of contraceptive use at all levels except for primary on traditional use. In rural areas, there does not appear to be the need to be educated in order to use traditional contraceptives. However in urban areas the rate of traditional use increases with primary and middle/JSS levels. Meanwhile women's education seems significant in the influence of modern contraceptives use in both rural (primary level) and urban (post-primary level). It can also be observed from the age stratification table that education increases the use of contraceptives among younger women than older ones. This is more so with regard to modern compared to traditional methods. It generally appears that education barely influences contraceptives use amongst older women. This is likely to be an age instead of a cohort effect, based on the assumption that the older women in GLSS 4 (whose educational influence is statistical less significant) behaved similarly as the younger ones in GLSS 1 (with the relatively higher educational influence in statistical significance) when they were at that age. It therefore means that as women grow older, the educational impact on contraceptive use becomes less relevant, which intuitively makes sense because they may be nearing or at the end of their fecundity stage in the reproductive phase.

The impact of education on contraceptive use seems to be quite robust, especially with the modern methods, as the inclusion of other variables (even household wealth) in the model does not often remove the statistical significance but sometimes weakens it (see Variants 2 and 3)[72]. The magnitudes of the coefficients do not change dramatically, and the direction of impact remains consistent in all the models. Overall, education appears to have a relatively weaker to no association with traditional methods. This probably implies minimal or no need to have an education for the practice of traditional contraception. It is also observed that where significant, the estimated magnitudes of education on modern methods are larger than those of traditional. The impact is almost twice as large with regard to secondary and above level of education in GLSS 4 (Variant 1). This contrast with Oliver (1995) who used GLSS 2[73] and finds that schooling has a larger influence on the current use of traditional compared to modern contraception. This study's results on urban and older women's sub-samples in both GLSS 1 and 4 are also not consistent with Oliver's. In her study, she finds no significant impact of education on modern contraceptive use in either urban areas or among older women. But outcomes in the remaining sub-samples are consistent with hers. The general positive relationship between education and contraceptive use is in accordance with many other studies including Weis (1993),

[72] Except weaker ones at higher levels of education.

[73] A follow-up data with similar questions to GLSS 1 used in this study.

Feyisetan and Ainsworth (1994), Thomas and Maluccio (1996), Ainsworth et al. (1996), Lasee and Becker (1997), and Benefo (2005).

Table 3.11 presents the impact of women's education and ever-use of contraception in GLSS 1. The outcomes are rather different from current use in some ways, but also have some similarities. The first notable difference is that ever use of traditional contraception consistently tends to decrease with women's education. This is mainly from post-primary education (Variant 2) whereas the only statistically significant impact of education on current use of traditional methods in the same data is primary level in urban areas (they are positively related). There are also substantial differences between magnitudes of middle/JSS and secondary and above, where both are found significant. For instance whilst women with middle/JSS level of education show 6.8 percent lower probabilities, those with secondary and above show 16.8 percent lower probabilities of ever having used contraception compared to none, ceteris paribus (Variant 2).

The relationship between women's education and ever use of modern contraception is however consistent with current use. It is positive and at least like the full sample in variant 1 of Table 3.9, the magnitudes increase with the level of education. However, the impacts are stronger with ever than current use, which concurs with Oliver (1995). For example, primary, middle/JSS and secondary and above levels of education increases the probability of ever using contraception by 9.2, 17.7 and 31.4 percent respectively in the full sample (Variant 1), and they are statistically significant at the 1 percent level.

Table 3.11: The Impact of Women's Education on Ever Use Contraception, by All Women, Residence & Age – 1987/88 & 1998/99

	GLSS 1					
	Traditional			***Modern***		
	Primary	Middle/ JSS	Sec. & above	Primary	Middle/ JSS	Sec. & above
Variant 1: Parsimonious						
Full	0.01	-0.042	-0.121**	0.092**	0.177***	0.314***
Rural	-0.013	-0.03	-0.176**	0.069*	0.149***	0.417***
Urban	0.049	-0.06	-0.117	0.113	0.212***	0.291***
Age15-34	0.001	-0.033	-0.113	0.113**	0.183***	0.303***
Age35-49	0.045	-0.09*	-0.165**	0.015	0.149**	0.345**
Variant 2: Full model						
Full	0.003	-0.068*	-0.168***	0.085**	0.162***	0.254***
Rural	-0.025	-0.048	-0.241***	0.06	0.138***	0.434***
Urban	0.045	-0.101*	-0.165**	0.117	0.196***	0.23**
Age15-34	-0.008	-0.066*	-0.178***	0.107**	0.174***	0.259***
Age35-49	0.047	-0.101*	-0.166**	0.008	0.115*	0.238
Variant 3: Full model with rural community characteristics						
Full	0.011	-0.051	-0.149**	0.048	0.119***	0.22***
Rural	-0.014	-0.014	-0.226***	0.035	0.092***	0.424***
Urban	0.04	-0.114*	-0.169*	0.067	0.159**	0.204*
Age15-34	0.007	-0.042	-0.155*	0.059	0.118***	0.196**
Age35-49	0.028	-0.093	-0.145	0.005	0.089*	0.261*

Note: These coefficients are marginal effects after estimating multinomial logit regression models. Variant 1 control for women currently in school, age, rural residence, and Northern regional location. Variant 2 controls for religion, ethnicity and household wealth in addition to those in Model 1. The final Variant 3 includes all the variables already mentioned as well as other determinants. See Appendix B-12. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. -- Survey sample weights are used in GLSS 4.

Similarly, the influence of education on ever use is greater in urban than rural areas, except at the secondary and above where the reverse is true. At this highest level of education, women in rural areas have higher probabilities (41.7%) than urban ones (29.1%). However, whereas the impact of education begins to show from the primary levels in rural areas, it does so from post-primary in urban areas. This is probably because contraception is less available in rural than urban areas. Outcomes by age stratification also show educated women of both the young and old have higher tendencies of ever using contraception, unlike current use where older educated women (primary level) do the converse compared to none. The estimates on education and ever-use contraception also appear to be fairly consistent with different specification models (Variants 2 & 3).

The Impact of Control Variables

This sub-section briefly discusses the control variables used in the estimations. It mainly focuses on estimates of Variant 2, which includes household wealth. Tables 3.12 & 3.13 present abridged versions of the results, and they comprise coefficients with their statistical significance by the full sample of all women, residence and age for current contraception use. Many of the control variables in only Variants 1 do not change much in Variant 2, but the few that do dramatically and of interest would be mentioned in the course of the discussion.

Women still in school show increased preference for traditional contraceptive use relative to none in GLSS 1. The impact is larger in rural (55%) than urban (37%) areas. They are also less likely to use modern contraception compared to none in urban areas. The outcome of women still in school in the younger women's sub-sample also indicates a positive relationship with traditional contraception as opposed to none. This probably reflects preference for the more discreet option of fertility regulation by younger women[74] or the practice of abstinence to avoid forced marriage as well as being stigmatised as a drop out in this earlier year. Recall women who had not started sexual relationships were included in this sample as traditional contraceptives practitioners. The results here maybe confirming some of the suggestions made in Turner (1991) by a group of investigators in a rural community in Uganda suggested and to quote "…. a family planning program that improves and takes advantage of some of the traditional methods will be more apt to be accepted by the population than an exclusively foreign one."

[74] They form the majority of women still in school; only two women in the data are above the age of 34 years and still in school. So the variable was dropped from the older sub-sample of the data.

Table 3.12: The Impact of Other Socioeconomic Variables on Current Use of Contraception, by All Women & Residence – 1987/88 & 1998/99

GLSS 1	Full		Rural		Urban	
	Traditional	Modern	Traditional	Modern	Traditional	Modern
Variant 2: Full model						
Still in School	0.478***	-0.006	0.549***	1.71E-06	0.365***	-0.004**
Age25-34	-0.1***	0.002	-0.049	-4.38E-07	-0.198***	0.001
Age35-49	-0.19***	-0.014	-0.155***	-3.49E-06	-0.274***	-0.003
Rural	-0.116***	-0.014				
Northern Region	-0.061	-0.018	-0.029	-4.62E-06	-0.188*	-0.003
Muslim	-0.113***	-0.02*	-0.092**	-0.001***	-0.144*	-0.003
Traditional	0.033	-0.012	-0.017	-8.41E-07	0.2*	-0.053***
Other	-0.182***	-0.028***	-0.201***	-1.96E-04***	-0.153*	-0.004**
Non-Akan	0.052*	0.012	0.04	1.77E-06	0.081	0.002
HAS- Basic	0.049***	-0.001	0.052	-5.28E-06	0.061***	-7.35E-05
HAS- High	0.004	0.004*	0.043	5.31E-07	0.003	0.001*
GLSS 4						
Still in School	-0.04***	-0.089***	-0.041***	-0.091***	-0.031***	-0.087***
Age25-34	0.034**	0.1***	0.031*	0.105***	0.042*	0.086**
Age35-49	0.025**	0.061***	0.012	0.059**	0.051*	0.055*
Rural	0.022*	0.016				
Northern Region	-0.016	0.029	-0.023	0.021	-0.001	0.044
Muslim	-0.005	0.005	-0.007	0.011	7.71E-05	0.001
Traditional	2.41E-04	-0.07***	-0.002	-0.072***	0.034	-0.033
Other	0.015	-0.055***	0.01	-0.049**	0.023	-0.066**
Non-Akan	-0.008	-0.008	-0.007	-0.008	-0.011	-0.005
HAS- Basic	0.006	0.002	0.007	-0.005	0.003	0.011
HAS- High	-0.003	2.67E-04	-0.005	-0.004	0.001	0.001

Note: These coefficients are marginal effects after estimating multinomial logit regression models. Variant 2 comprises all the categories of education already discussed as well as control variables such as women currently in school, age, rural residence, and Northern regional location, religion, ethnicity and household wealth. The final Variant 3 includes all the variables already mentioned as well as other determinants. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. -- Survey sample weights are used in GLSS 4.

Table 3.13: The Impact of Other Socioeconomic Variables on Current Use of Contraception, by Women's Age– 1987/88 & 1998/99

	Age15-34		Age35-49	
Variant 2: Full model				
GLSS 1	Traditional	Modern	Traditional	Modern
Still in School	0.463***	-0.009		
Age25-34	-0.112***	0.004		
Age40-49			-0.047	-1.21E-06
Rural	-0.119***	-0.021*	-0.063	4.27E-09
Northern Region	-0.046	-0.023	-0.077	-6.09E-07
Muslim	-0.121**	-0.021*	-0.082*	-1.29E-04**
Traditional	0.026	-0.02	0.057	4.67E-07
Other	-0.206***	-0.034***	-0.106*	-8.03E-06***
Non-Akan	0.038	0.013	0.076*	5.66E-07
HAS- Basic	0.055**	-0.004	0.043	2.49E-07
HAS- High	0.014	0.005	-0.172	2.20E-07
GLSS 4				
Still in School	-0.038***	-0.085***		
Age25-34	0.026***	0.082***		
Age40-49			-0.016	-0.112***
Rural	0.029**	0.02	0.001	-0.006
Northern Region	-0.006	0.025	-0.033*	0.042
Muslim	0.008	0.031	-0.036**	-0.042*
Traditional	0.007	-0.056***	-0.009	-0.091***
Other	0.024	-0.048**	-0.016	-0.06*
Non-Akan	-0.006	-0.009	-0.014	-0.011
HAS- Basic	0.005	-0.002	0.002	0.005
HAS- High	-0.008	-0.006	0.007	0.015

Note: These coefficients are marginal effects after estimating multinomial logit regression models. Variant 2 comprises all the categories of education already discussed as well as control variables such as women currently in school, age, rural residence, and Northern regional location, religion, ethnicity and household wealth. The final Variant 3 includes all the variables already mentioned as well as other determinants. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. -- Survey sample weights are used in GLSS 4.

In GLSS 4 however, women still in school show a strong negative association with both traditional and modern contraceptives use. Unless these women are sexually inactive, there are likely to be higher incidences of unplanned pregnancies that may end up in various unpleasant circumstances. One of which is abortion that is currently illegal in the country and usually conducted without medical help or quack doctors ending up in young deaths.

It also appears age in general is strongly related to traditional contraception. The older a woman gets, the less likely she is to practice traditional contraception. This is also observed in Benefo (2006). Women aged between 25-34 are 10 percent less likely to use traditional relative to none or modern methods compared to those between 15-24 years inclusive in GLSS 1, ceteris paribus. The corresponding effect of the oldest group, 35–49 years, is around twice that much. The relationship with modern contraception is not significant. Again the opposite is found in GLSS 4, where traditional and modern contraceptives use tend to increase with age but at a decreasing rate. Women aged between 25 and 34 are three percent more likely to use contraception compared to those between 15 and 24 years in the full sample, ceteris paribus. Meanwhile women age 35 to 49 are 2.5 percent more likely to do so compared to the same base category. The rural and urban sub-samples show slightly bigger differences in magnitudes between the age categories.

The reason for the difference in age effects between the two survey years could be the level of exposure to contraception in those periods. It is assumed that contraception, especially modern, might have been made more common during the later year that has encouraged use in general. The magnitudes decreasing with age cohorts are expected because aging makes women less fertile, decrease exposure to possible pregnancies and possibly achieved desired family size hence lower needs for contraception (Caldwell et al., 1992; Feyisetan and Ainsworth, 1996; Koc, 2000).

Rural residence has a negative significant effect on traditional contraceptives use in GLSS 1. Women in rural areas are also less likely to be using modern methods but the significance level do not quite reach the acceptable conventional levels. Younger women (in the age stratified table 3.13) in rural areas are noted as being 11.9 and 2.1 percent less likely to adopt the use of traditional and modern contraceptives respectively. The negative relationship between rural residence and contraceptives use is as expected and commonly found in related studies (Ainsworth et al., 1996; Thomas and Maluccio, 1996). Some of the reasons behind this outcome are the higher opportunity cost of the woman's time and increased cost of child services in urban areas that leads to reduced aspirations for big family size and hence increased need for contraception. There is also the fact that contraception is relatively easier to access, by way of facilities and information, in urban relative to rural areas. Thus in the specification where most of the facilities[75] are also controlled current residence appears to lose its significance in the equation (Variant 3, Appendix B-10 to B-12).

Estimations in GLSS 4 on the other hand suggest not only a weaker but also contrary outcome to expectations. Contraceptive use tends to be higher in rural compared to urban areas in this period. This is also statistically significant only with regard to traditional methods. The control of community variables in Variant 3 did also lead to a non-significant rural residence pertaining to traditional methods, and a rather weak negative association with modern contraceptives. This perhaps is due to chance. Current residence however does not matter at all in the practice of contraception among older women in this sample.

Regional dummy (Northern) included in the specifications to sort of capture the varying development levels in the country seems rarely relevant, especially with the additional control of other socioeconomic variables. However where significant, it shows a negative association with traditional contraceptives use.

In accordance with their pro-natal beliefs, Muslims tend to use contraceptives less than Christians in GLSS 1. Women in households of heads of "other" religion are

[75] Information on facilities are collected in only rural areas at community levels. Urban observations are replaced with zero in the econometric estimations.

also less likely to use both traditional and modern methods. Traditional beliefs appear influential on contraceptives use only in urban areas. They are likely to use traditional contraceptives but strongly oppose to the use of modern methods compared to the Christian religion. The general pattern observed in GLSS 1 that suggests women of all other religion are more likely to practice contraception compared to Christians is also observed in GLSS 4 where significant. Linked to religious beliefs is ethnicity, controlled in this study as non-Akan. Ethnicity barely shows any influential impact on contraceptives use among the women understudy. This contradicts Oliver's (1995) results that indicate that women in Akan households are 3.4 percent more likely to use modern contraceptives methods.

Asset scores[76] on household durable goods and housing qualities included in the model to control for household wealth indicate they are positively related to the use of contraception methods in GLSS 1 but not at all in GLSS 4[77]. The "basic" asset score is strongly associated with traditional contraceptives use whilst the "high" score is associated with modern contraceptives use. This is however observed in the full sample as well as the urban sub-sample. Younger women in households with "basic" resources are also more likely to use traditional contraception compared to none. The positive relationship between household wealth and contraceptive use is what was expected and consistent with other studies (Weis, 1993; Oliver, 1995; Feyisetan and Ainsworth, 1996; and Thomas and Maluccio, 1996) with various measures. This supports the "quality" for "quantity" substitution theory.

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[76] Women in households with higher asset scores suggest access to higher wealth.

[77] Except for a weak negative relationship between "high" score and modern contraception among women aged 15-34 when community variables are also controlled (Variant 3).

Estimates of the control variables for ever-use of contraceptives are given in Table 3.14. The signs of the coefficients generally follow the pattern of current use but with relatively more statistical significance of the variables in ever-use. The correlation between the explanatory variables and ever-use also appears stronger than current use. For instance whereas women still in school are more likely to use traditional contraception compared to none, they are less likely to use modern methods. The latter was also the case with regard to current use but was not statistically significant. Actually most of the variables under the modern contraceptives column are now observed as statistically significant. Younger women are noted as more likely to have ever use modern but less likely to have used traditional contraceptives relative to none, with the bigger impact in urban than rural areas. The results on older women are similar to those of current use.

Rural as well as Northern regional residence however now show strong negative association with ever use of modern contraceptives. The results on these two are as expected because women in these areas are less exposed to information or facilities that may promote the adoption of modern contraception. These areas are less developed and more tied to their cultural values than women in urban areas and Southern regions of the country. The effects of religion and ethnicity though are roughly the same as those of current use. Though household wealth also has similar outcomes as current use, "basic" wealth in rural areas and among older women is now also noted as influential in the ever use of contraception. The influence is positive with regard to the use of traditional contraception among rural and older women but negative with modern contraception in rural areas.

Table 3.14: The Impact of Other Socioeconomic Variables on Ever Use of Contraception, by All Women, Residence & Age – 1987/88

GLSS 1	Full		Rural		Urban	
	Traditional	Modern	Traditional	Modern	Traditional	Modern
Variant 2: Full model						
Still in School	0.455***	-0.104***	0.534***	-0.072**	0.332***	-0.185***
Age25-34	-0.128***	0.094***	-0.067*	0.063**	-0.239***	0.137***
Age35-49	-0.154***	0.025	-0.092**	-0.003	-0.261***	0.058
Rural	-0.026	-0.073***				
Northern Region	0.003	-0.137***	0.033	-0.095***	-0.061	-0.204***
Muslim	-0.044	-0.072***	-0.016	-0.085***	-0.075	-0.079
Traditional	0.035	-0.039	-0.001	-0.022	0.178*	-0.101
Other	-0.121**	-0.077**	-0.107*	-0.062**	-0.161*	-0.09
Non-Akan	0.009	0.03	-0.025	0.004	0.057	0.066
HAS- Basic	0.077***	0.002	0.112**	-0.045*	0.074***	0.007
HAS- High	0.002	0.017*	0.319	0.107	-0.012	0.021*

	Age15-34		Age35-49	
	Traditional	Modern	Traditional	Modern
Still in School	0.44***	-0.116***		
Age25-34	-0.142***	0.101***		
Age40-49			-0.087*	0.012
Rural	-0.032	-0.073**	0.016	-0.074*
Northern Region	0.034	-0.163***	-0.053	-0.079*
Muslim	-0.056	-0.068*	-0.02	-0.074*
Traditional	0.03	-0.038	0.051	-0.044
Other	-0.146**	-0.079**	-0.07	-0.066
Non-Akan	-0.007	0.017	0.048	0.066*
HAS- Basic	0.091***	-0.005	0.055*	0.014
HAS- High	0.014	0.023	-0.091	0.017

Note: These coefficients are marginal effects after estimating multinomial logit regression models. Model 2 comprises all the categories of education already discussed as well as control variables such as women currently in school, age, rural residence, and Northern regional location, religion, ethnicity and household wealth. The final Model 3 includes all the variables already mentioned as well as other determinants. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. -- Survey sample weights are used in GLSS 4.

Community Characteristics

These are community variables included in the final specification (Variant 3) to explore their direct effects as well as robustness of women's education on contraception. Tables 3.15, 3.16, & 3.17 show the results on only the community variables for current use in GLSS 1, GLSS 4 and ever use in GLSS 1 respectively, which forms part of the individual and household characteristics already discussed. The full results on the other variables of this specification model can be found in Appendix B-10 to B-12. This also gives output on all three models including the influence of external contraception: the proportion of other women in cluster who use contraceptives. This is created using individual response on contraceptives use.

The outcome of the external effects of contraceptive use is as expected. That is as the proportion of other women who use contraceptives (either traditional or modern) increases in the cluster, individuals own contraceptive use also increases. This is in accordance with premise explaining that women are influenced by other women's actions in a community. By observing the lifestyle of other women, individuals pick practices that are deemed successful, which in this case seems to be fertility regulation. According to the results noted in the full sample in GLSS 1 for instance, an increase in the proportion of women using contraceptives in a cluster may increase an individual's use by 0.65 (traditional) or 0.07 (Modern) compared to none, ceteris paribus. The analogous figures in GLSS 4 are 0.15 and 0.26 for traditional and modern respectively. As has been commonly observed with many of the other variables in this study, the results on this also suggest appreciable differential impact between urban and rural areas as well as younger and older women. The estimated coefficients are bigger in urban than in rural areas, and among younger than older women in GLSS 1. However the reverse is the case in GLSS 4.

Only few of the community variables controlled are significant. It is virtually non-existent in GLSS 1 where it looks like the community variables have no impact on contraceptive use. Only the ratio of child to men's agricultural wage rate show some statistical significance, which is weak and probably by chance. Meanwhile the outcome suggests a positive relationship with modern contraceptives use in the full sample.

In contrast, relatively more of the community characteristics are found statistically significant in GLSS 4. It is observed that increased distance to the nearest middle school is associated with a higher probability of modern contraceptives use. This is also significant in the rural and women aged 15-34 sub-samples. Increased distance is likely to increase child's cost and thus lower the desire for more children that may finally lead to increased demand for contraception. This would probably be more so for women who may have aspirations for child "quality" through education.

As anticipated in the discussion of the specification model increased cost of contraceptives, that is access to the nearest health facilities/personnel, lowers the probability of contraceptive use, especially in rural areas. This is consistent with similar studies including Oliver (1995), Thomas and Maluccio (1996) and Feyisetan and Ainsworth (1996). The outcome on price of other commodities is also as expected in the estimations model. This is represented by the price score of "foodstuff" and "cereals" but only the former is significant and with the anticipated sign. Traditional contraceptives use tends to increase with the price score of "foodstuffs" in the full, rural and older sub-samples. This is because child services eventually become expensive, which lowers the demand for children and therefore increases the demand for contraceptives.

It is also estimated that men's agricultural wage rates are highly related to women's use of modern contraception. Although this could not be determined a prior due to the presumption that increased wages within farming communities could increase the demand for children, the value of time appears to have counteracted this outcome giving the opposite as the likely results. That is, a percentage increase in men's agricultural wage rates is likely to increase women's use of modern contraceptives by 0.8 percentage points among all women, ceteris paribus. The same magnitude is also observed among rural women, but it is lower (0.6) and higher (1.1) percentage points among women aged 15-34 and those aged 35-49 respectively. However the tendency of modern contraceptives use is reduced with increased ratio of women to men's agricultural wage rates only among women aged 35-49. The reason behind this final outcome is not quite clear, as one would have expected a contrary outcome with increased opportunity cost of time.

Unlike the estimation results on current use in GLSS 1, those on ever use indicate statistically significant associations with distance to middle school, price score of "foodstuffs" and price score of "cereals". In this survey period the probability of ever using modern contraception decreases with increased distance to the nearest middle school. A kilometre increase in distance lowers the probability among all women by 1.0-percentage points, but it lowers by 0.6 and 1.2 percentage points among rural women and younger women between the ages of 15-34 respectively, ceteris paribus. The other side of the argument may explain the direction of this relationship, which is that children may be withdrawn from school as costs increase. Such an action may reduce child's cost, increase the demand for children and thereby lower the demand for contraception.

The results of the price scores are however as anticipated. And although of a different era and contraception definition, the price scores have consistent results as those of current use in GLSS 4. An increase in the price score of "foodstuffs" for instance tends to increase the use of modern contraception, but only statistically significant among the older women. The price score of "cereals" on the other hand is statistically significant in the full sample as well as among younger women.

Table 3.15: The Impact of Community Characteristics on Current Contraceptives Use by All Women, Residence and Age, 1987/88

Current Use				**GLSS 1**			
	Full		**Rural**		**Age15-34**		**Age35-49**
Variable	***Tradition***	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***	***Current use***
	M.E/t-ratio	M.E/t-ratio	M.E/t-ratio	M.E/t-ratio	M.E/t-ratio	M.E/t-ratio	M.E/t-ratio
Distance Primary school	0.004	-0.003	0.002	-3.00E-06	0.006	-0.003	-0.006
	0.67	-1.43	0.4	-1.48	0.8	-0.98	-0.47
Distance Middle school	0.001	-0.001	0.002	-2.09E-07	0.001	-0.001	0.003
	0.43	-0.6	0.61	-0.29	0.16	-0.47	0.79
Distance Secondary school	0.001	2.79E-04	0.001	2.54E-07	0.001	-2.07E-05	0.001
	0.63	1.25	0.61	1.45	0.88	-0.06	0.58
Access to Health facilities/personnel	-0.007	0.004	-1.79E-04	2.50E-06	-0.007	0.004	-0.009
	-0.37	1.17	-0.01	0.9	-0.32	1	-0.36
Price score of foodstuffs	-0.004	-0.006	-0.009	-3.98E-06	0.001	-0.009	-0.008
	-0.24	-1.75	-0.57	-1.41	0.04	-1.96	-0.28
Price score of cereals	-0.006	0.003	-0.002	7.96E-07	-0.022	0.005	0.031
	-0.35	0.82	-0.13	0.24	-1.09	0.9	1.35
Log of real Men's Agric. Wage	-0.002	-1.64E-04	-0.005	1.37E-08	-0.004	0.001	0.002
	-0.22	-0.08	-0.64	0.01	-0.4	0.34	0.19
Ratio of female to men's wage	-0.021	-0.016	-0.019	-1.35E-05	0.002	-0.013	-0.08
	-0.53	-1.56	-0.53	-1.44	0.03	-0.95	-1.34
Ratio of child to men's wage	-0.036	0.024	-0.014	1.47E-05	-0.064	0.02	0.051
	-0.79	2.18*	-0.34	1.65	-1.13	1.35	0.77
Observation	2240		1405		1651		589

Table 3.16: The Impact of Community Characteristics on Current Contraceptives Use by All Women, Residence and Age, 1998/98

Current Use	**GLSS 4**							
	Full		**Rural**		**Age15-34**		**Age35-49**	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Distance Primary school	1.04E-04	-6.30E-05	1.21E-04	-7.18E-05	-1.88E-05	-1.38E-04	8.91E-05	1.37E-04
	0.6	-1.2	0.6	-1.32	-0.02	-1.37	0.73	1.17
Distance Middle school	-4.60E-04	3.06E-04	-0.001	3.36E-04	-0.001	4.74E-04	-2.25E-04	-1.34E-04
	-1.28	2.88**	-1.25	3.01**	-1.05	2.96**	-0.85	-0.77
Distance Secondary school	-7.42E-05	1.08E-04	-8.64E-05	1.08E-04	-1.64E-05	1.74E-04	-1.79E-04	-1.39E-04
	-0.65	1.23	-0.67	1.3	-0.14	1.82	-0.98	-0.64
Access to Health facilities/personnel	0.002	-0.019	0.002	-0.02	-2.05E-04	-0.026	0.003	0.001
	0.37	-2.21*	0.37	-2.26*	-0.04	-1.79	0.31	0.07
Price score of foodstuffs	0.003	-4.97E-04	0.003	-0.001	0.002	-0.002	0.008	-0.009
	2.47*	-0.14	2.31*	-0.35	0.99	-0.57	2.28*	-0.6
Price score of cereals	-0.002	-0.015	-0.002	-0.012	-0.004	-0.011	4.97E-04	-0.004
	-0.34	-1.28	-0.38	-1.52	-0.38	-1.25	0.16	-0.43
Log of real Men's Agric. Wage	6.79E-05	0.008	1.95E-04	0.008	-0.001	0.006	0.003	0.011
	0.05	3.35***	0.13	2.90**	-0.62	2.46*	1.57	2.25*
Ratio of female to men's wage	0.003	-0.02	0.003	-0.022	0.001	-0.011	-5.86E-05	-0.045
	0.29	-1.6	0.26	-1.74	0.12	-0.68	0	-2.12*
Ratio of child to men's wage	-0.001	-0.002	-0.003	-0.002	0.004	-0.022	-0.012	0.047
	-0.14	-0.12	-0.38	-0.12	0.51	-1.73	-1.06	1.94
Observation	5863		3657		3921		1942	

-- Survey sample weights are used in GLSS 4.

Table 3.17: The Impact of Community Characteristics on Ever Use of Contraceptives by All Women, Residence and Age, 1987/88

Ever Use	**GLSS 1**							
	Full		**Rural**		**Age15-34**		**Age35-49**	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Distance Primary school	0.012	-0.006	0.011	-0.003	0.012	-0.004	0.01	-0.002
	1.78	-0.94	1.67	-0.83	1.37	-0.53	0.95	-0.25
Distance Middle school	0.005	-0.01	0.004	-0.006	0.006	-0.012	0.004	-0.003
	1.64	-2.77**	1.32	-2.49*	1.47	-2.69**	0.83	-0.76
Distance Secondary school	0.001	3.65E-04	4.53E-04	2.14E-04	0.001	-2.86E-04	-4.39E-04	0.001
	0.66	0.56	0.48	0.49	1.24	-0.37	-0.29	0.6
Access to Health facilities/personnel	-0.013	0.009	-0.003	0.003	-0.011	0.009	-0.012	0.004
	-0.62	0.76	-0.14	0.4	-0.44	0.63	-0.41	0.23
Price score of foodstuffs	-0.015	0.006	-0.02	0.009	0.002	-0.007	-0.055	0.07
	-0.82	0.51	-1.13	1.04	0.09	-0.49	-1.69	3.48***
Price score of cereals	-0.023	0.021	-0.01	0.009	-0.034	0.027	0.003	0.014
	-1.33	2.08*	-0.6	1.31	-1.65	2.13*	0.09	0.9
Log of real Men's Agric. Wage	-0.008	0.003	-0.016	0.006	-0.01	0.007	0.001	-0.007
	-0.97	0.58	-1.74	1.21	-0.99	1.03	0.06	-0.99
Ratio of female to men's wage	-0.041	-0.005	-0.026	-0.014	-0.032	0.012	-0.056	-0.045
	-1.02	-0.19	-0.63	-0.74	-0.66	0.36	-0.77	-1.19
Ratio of child to men's wage	0.006	0.004	0.028	-0.013	-0.001	-0.012	0.009	0.036
	0.12	0.15	0.57	-0.65	-0.02	-0.33	0.11	0.87
Observation	2240		1405		1651		589	

3.2.2 The Duration of Breastfeeding

3.2.2.1 Background and Literature Review

Breastfeeding is one of the immediate determinants of fertility that also has unique roles in the reproductive process. Not only does it supply the nutritional and immunological protection needs of babies, but also delay the resumption of ovulation. Both of which, on their own or a combination of the two, could determine fertility levels. The former increases the chances of child survival that is associated with extended birth interval and hence likely to lower fertility. This outcome is achieved either by lowering deliberate child's replacement due to mortality to achieve desired family size or naturally becoming less fecund over time. Prolonged post-partum amenorrhoea also delays next birth, which in turn improves the health of mother and child with the latter consequently lowering fertility.

Before the use of contraceptives became widespread, it was one of the main processes of controlling childbirths in both developed and developing countries. With the onset of development of modern contraceptives, the act does not feature much as a contraceptive in developed countries. However in many developing countries, especially SSA, it is one of the few prevailing contraceptives[78] used in controlling fertility. Weis (1993) show early cessation of breastfeeding is a critical risk factor for conception in the absence of other forms of contraceptives; although he argues that breastfeeding is not a reliable contraceptive. And Pérez-Escamilla et al. (2007) also noted that shorter breastfeeding duration increases the risk of unplanned pregnancies. The period of breastfeeding and postpartum

[78] Usually associated with sexual abstinence for cultural or customary reasons.

abstinence gets shortened mostly because of weakening traditional values with the onset of modernisation and the spread of education. This consequently increases unplanned or unwanted births and overall fertility; unless modern contraceptives prevalence increases. Bongaarts et al. (1984) emphasise that "reductions in fertility will occur only in populations where increases in contraceptive use and in age at marriage are sufficiently large to outpace the effects of the shortening of breastfeeding and the abandonment of postpartum abstinence as well as any declines in pathological sterility."

Breastfeeding has been found to protect against infections to the extent that an increase by 40 percent worldwide would reduce deaths from respiratory infection by 50 percent in children less than 18months of age (WHO, 1995 cited in Oddy et al., 2003). Although the adverse mortality impact of shortened breastfeeding duration dominates in poorer countries, reduced immunity to infectious diseases is more the case in affluent countries. Faldella et al., (1999) suggest babies in affluent countries would benefit from prolonged breastfeed because it prevents gastrointestinal, respiratory and allergic diseases early in life as well as reduce the risk of certain chronic diseases in adult life. Belfield and Kelly (2010) also find that breastfeeding at birth increases the probabilities of infants being in excellent health at 9 months, protective against obesity at 24 months and improve cognitive outcomes at 54 months. They also find breastfeeding up to 6 months and above increases infant motor scores at 9 months.

Although the decision to breastfeed should primarily be based on these important health reasons, socioeconomic factors have been observed as having a higher tendency in determining the outcome. Literature on the topic indicates that education plays a strong decisive role in breastfeeding duration (Jain and

Bongaarts, 1981; Trussell et al., 1992). It is commonly noted to shorten the period of breastfeeding, especially in developing countries (Akin et al., 1981; Anderson and Rodrigues, 1983; Weinberger, 1987; Popkin, 1989; Weis, 1993; Adair et al., 1993; Appleton, 1996; Giashuddin and Kabir, 2004; and Pérez-Escamilla et al., 2007). But the opposite is rather observed in developed countries (Donath and Amir, 2000; Yngve and Sjöström, 2001; Dennis, 2002; Giashuddin and Kabir, 2004; Lakati et al, 2007). Yngve and Sjöström (2001) for instance find that it is low educational attainment that rather negatively affects breastfeeding in Europe. This may be because the influence of breastfeeding on infant morbidity and mortality is well understood by the educated (Popkin, 1989) in these developed countries who then at least breastfeed till the medically accepted months. The immediate discrepancy in breastfeeding duration thus appears to be the level of development of the country understudy. However, like the developed countries at the early stages of development, educated women in developing countries have adopted shorter breastfeeding because it appears "modernised" and infant-formula can be seen as high status consumption good amongst peers.

Studies in Sri Lanka (Akin et al., 1981) and Bangladesh (Weis, 1993) have gone further to show that although educated women generally breastfeed for shorter periods, they breastfeed for at least the number of months recommended by health professionals. In Sri Lanka, duration drops with additional education only when the child is 9 months plus. Also, almost 100% of Bangladeshi women breastfeed in the immediate postpartum period till 15 months where it falls to 90%. Indeed similar to the developed countries, educated mothers in developing countries are at least as likely as uneducated ones to initiate breastfeeding. Hakim and El-Ashmawy (1992) find in Giza that 61.4 percent of the uneducated mothers initiate early suckling compared to 84.4 percent of the educated mothers. Other studies that assent to the positive link between education and the initiation of breastfeeding include Huffman (1984), Popkin (1989) and Becerra (1990). However, they also note that duration amongst the educated is shorter.

Time also appears very influential to a large extent and it is also related to education. The woman's time sets a constraint to the decision to breastfeed as well as its duration, and this is where it connects with education. Due to a higher opportunity cost of educated women's time, their breastfeeding duration usually tend to be shorter than the uneducated. Most educated women are also in formal employments, and so unless paid maternity leave exist or some arranged support system is provided by employers, breastfeeding duration ceases earlier for these women. Many developed countries are guided by the rules of international organisations[79] including WHO, UNICEF, ILO and country specific medical associations that ensures that legal requirements are met to protect such women. This perhaps partly explains why educated women in employment in developed countries exhibit improved breastfeeding practices than their counterparts in developing countries.

Apart from a possibly unsupportive employment system working against educated women, urban residence (where most educated may be located) and income that is positively related with education do not seem to promote extended breastfeeding in developing countries. This is because urban residence is associated with modernisation where supposedly "Westernised" practices such as bottle-feeding are deemed as the best. Also widespread advertisements portraying convenience and sophistication by mega-company producers of infant

[79] See Yngve and Sjöström (2001) for more information on these organisations and their rules.

formulars in cities overshadows the advantages of breastfeeding. Ties to traditional values are also weaker in urban areas not to mention dwindling breastfeeding role models for younger women to emulate in urban areas. The ability to easily afford these infant formulars, and the convenience and time value gained as a result imply a likely shortening of breastfeeding duration among educated working mothers. In so far as education shortens breastfeeding and hence possibly increase fertility levels, the overall net impact of education on fertility could decrease holding all other variables constant.

3.2.2.2 Econometric Model, Specification, Data and Variables Used

A reduced form demand equation for health input is adopted to estimate the model for breastfeeding duration as it is considered as one (Pitt, 1993). This also entails an economic framework that maximises the utility of a household based on its production and subject to the constraints of income, wage and time. Details of the derivation of the reduced form equation are presented in chapter 2 of this thesis. Breastfeeding is considered as an investment in child's health, whose production as well as those of other commodities enters into the household utility function. A child's health may also become consumption good if future income streams increase as a result of it (Belfield and Kelly, 2010). Apart from the health of the baby, breastfeeding may also improve the health of the mother, foster emotional and physical developments that bonds mother to baby and thereby increases utility that extends to the entire household. Breastfeeding is time-intensive and competes with time spent in earnings for the mother. Thus maximising the household utility function faced with a household income budget that is mostly earned, and a fixed time as constraints gives a modified reduced form equation for the estimation of breastfeeding as:

$$BF = BF\left[Ed, A_m, R, Sx, BY, Rl, Eth, Y, DsW, DsMk, Aw, Dsfp, PxFN\right]\ldots\ldots\ldots\ldots\ldots\ldots(14)$$

Where *Ed* is education, A_m is mother's age, *R* is rural and region of residence, *Sx* is gender of the child, *BY* is the birth year of the child, *Rl* is religion, *Eth* is ethnicity, *Y* is household wealth, *DsW* is distance to the nearest water source, *DsMk* is distance to the nearest market, *Aw* is agricultural wage, *Dsfp* is distance to the nearest health facilities and personnel, and *PxFN* is prices of food and non-food.

As already discussed in the estimation model of contraceptives, education is used as proxy for wages/employment. This also turns out to be a time cost to breastfeeding because of its positive relation to wages. And the hypothesis is that education increases employment opportunities and wage rates, which then implies higher cost of breastfeeding hence shorter duration.

The impact of employment though appears to depend on the type or location rather than whether the woman work or not, hence empirical findings has not been consistent. Jain and Bongaarts (1981) did not find an important or consistent effect of work after marriage on the duration of breastfeeding whereas Anderson and Rodrigues (1983)[80] find working women breastfeed relatively longer than those not working. Akin et al (1981) explanation is that work per se does not affect duration of breastfeeding but rather the location of the work as they find a strong negative effect of working away from home on the duration of breastfeeding. A further analysis in Tunisia, Yemen and rural Egypt show same outcome (Akin et al., 1986). Huffman (1984) also finds that where there is a high

[80] They explained the data did not distinguish type of work, that is, whether from home or outside home.

rate of female employment outside the home, the duration of breastfeeding reduces in developed countries. Yngve and Sjöström (2001) concur with the observation but their findings do not concern only employment outside the home but employment in general. But in Nairobi where mothers manage to combine work with breastfeeding, Lakati et al., (2007) noted no significant association between employment and the duration of breastfeeding.

As mentioned in the previous section, education is also correlated with location and income. Therefore they are controlled in order to separate their influence through education. This gives the estimates on education as its own and not indirect effects of residence and income. In-spite of this, there may still be some unobserved or unmeasured variables that correlate with both breastfeeding and education causing omitted variable bias and potential endogeneity. However as already explained, this is not solved in this study due to lack of data. Other background information is controlled in addition to residence and income in an attempt to reduce any potential bias.

These are age of the mother, gender and year of birth of the child, religion and ethnicity. Age of the mother is included in the model to control fecundity. Older women are less likely to easily fall pregnant and thereby terminate breastfeeding because they are less fecund. This also somewhat means they are less likely to use contraceptives, which is one of the reasons given by women for terminating breastfeeding. Apart from removing the risk of pregnancy hence no need for breastfeeding for that purpose, some women fear contraception, particularly modern, may turn their breast milk sour and unfit for the baby. Therefore in breastfeeding models where contraceptive use is also included, high prevalence is commonly found to reduce the duration of breastfeeding (Akin et al., 1981; 1986;

Weis, 1993). Relating this to age therefore suggests that older women are anticipated to breastfeed for longer. However, Akin et al., (1981) also argue that older women have smaller volumes of breast milk, so a negative relationship is more likely to be the case between age and breastfeeding duration. It is therefore unsurprising that the empirical literature on the topic shows mixed findings with regard to age. Studies that find older women breastfeed for longer include Akin et al. (1986), Adair et al. (1993), Donath and Amir (2000), Yngve and Sjöström (2001) and Dennis (2002), and studies with reverse findings include Akin et al. (1981) and Giashuddin and Kabir (2004).

The gender of the child is included in order to test for possible gender discrimination against female children. It is however not commonly found significant in many of the studies searched (Jain and Bongaarts, 1981; Akin et al., 1986; Weis, 1993; Appleton, 1996), except Adair et al., (1993) whose finding is more related to exclusive breastfeeding. They find that male infants are exclusively breastfed for shorter periods; implying that they are not totally weaned earlier but rather mothers supplement their breast milk to meet their increased need for growth (ibid). The child's year of birth may also indicate whether breastfeeding patterns are reflections of some cohort effects. Religion and ethnicity are similarly controlled to show traditional values and social attitudes towards breastfeeding duration. Women with traditional values for instance are expected to breastfeed for longer because they may still have ties with their roots.

Also apart from their roles as control variables for education, rural residence and household wealth are themselves principal determinants of breastfeeding (Huffman, 1984). Most studies note that mother's current residence significantly influence breastfeeding, with longer duration observed in rural than urban areas (Jain and Bongaarts, 1981; Huffman, 1984; Akin et al., 1986; Popkin, 1989; Weis, 1993; Pérez-Escamilla (2003); Giashuddin and Kabir, 2004; Pérez-Escamilla et al.; 2007). Household wealth, also a significant determinant of breastfeeding, is expected to shorten duration as many empirical studies show. Giashuddin and Kabir (2004) indicate that mothers from wealthy families breastfeed less in Bangladesh because they can afford wet nurse and baby formula or substitutes for breast milk. Earlier studies such as Akin et al (1981) observe similar outcome in Sri-Lanka and Appleton (1996) finds household consumption per capita reduces the duration of breastfeeding in Cote d'Ivoire. In addition, Adair et al. (1993) in the Cebu regions (Philippines), Dennis (2002) in a literature review between 1990 to 2000, and Lakati et al., (2007) in Nairobi show high socio-economic status tend to reduce breastfeeding duration in developing countries.

Since the major cost to breastfeeding is time, other time consuming activities the mother undertakes, which also increase the value of her time, are included in the model to examine their impact on breastfeeding habits. These are distance to the nearest water source and market, as well as distance to health facilities and personnel. The anticipation is that increased distance to these venues shortens the duration of breastfeeding, all other variables held constant. Agricultural wage rates also relate with time, more so with that of the women's wage rate since that of men's or indeed children frees up time for the mother to breastfeed. Thus increase in agricultural wage rates for men and children are expected to increase the duration of breastfeeding, especially in households where they are present. A converse outcome is anticipated with an increase in female wage rates. The prices of food and non-food form part of the household budget income. To the producers of these commodities, increase in prices implies a rise in income that could result in shorter duration of breastfeeding. However the opposite is the anticipated outcome for consumers.

The estimation process follows that of contraceptives use, where three versions of the model are estimated for all women (that is the full sample), the rural and urban as well as women aged 15 to 34 and 35 to 49 sub-samples. The first specification model (Variant 1) involves education and control variables including mother's age, current residence (a dummy each for rural and northern region), gender of the infant as well as it year of birth. The second specification (Variant 2) is made up of the first plus to religion, ethnicity and household wealth. The final model (Variant 3) is that of the above in addition to distance to the nearest water source, market, and health care facilities/personnel, prices food and non-food commodities, and agricultural wage rates for men, women and children.

3.2.2.2.1 Dependent Variable: Definition and Descriptives

The breastfeeding analysis is based on the information of the youngest child of individual women in households. The age of these women are between 15 and 45 inclusive. Breastfeeding duration is recorded in months as age last child was completely weaned in both data sets. Follow-up questions, especially in the GLSS 4, imply that the duration of breastfeeding is not exclusive. That is, other forms of feeding are noted in addition to breast milk. These questions include the age the child received any liquid other than breast milk for the first time; the age the child was first given pure water; and the age the child first received solid food other than breast milk.

In GLSS 1, only women who were randomly selected in households for the fertility questionnaire and have had at least one live birth have records of breastfeeding duration for the last child. However in GLSS 4, all women in the household with children of 5 years old and below have records of breastfeeding for each child. In order to have consistency in the analysis, only women with children aged 5 years and below are chosen for estimations in GLSS 1. Equally, only the last child[81] in GLSS 4 is used. With a sample selection of children of 5 years and younger, fewer measurement errors are expected due to relatively short re-call periods.

Breastfeeding is modelled with women's education as the primary determinant using survival analysis. This is because although all women eventually wean their children from breastfeed, many had not done so at the time of the survey resulting in censored[82] data. Thus their exact duration of breastfeeding is unknown. Deleting such women from the analysis will drastically reduce the number of observations, as about half of the women in the sample are still breastfeeding; which is reasonable since the survey sample is on infants. Also, not accommodating for censoring in the model would not fully explain breastfeeding duration in general but for a smaller completed sample. In contrast including these observations without the appropriate statistical methods may lead to bias estimates of the covariates; hence the relevance of the application of survival analysis for this model. The event of interest is the duration of breastfeeding and failure is when it ceases.

[81] This study assumes the last child to be the youngest child of each woman in the household.

[82] This is when some women have not yet completed breastfeeding at the time of the survey. GLSS 1 records about 55.35 percent of women still breastfeeding, which suggests right censoring. The analogous figure for GLSS 4 is 47.73 percent.

The duration of breastfeeding is denoted by a finite period T, which takes on values t = 1, 2, 3,….,n. The various durations are in order of magnitudes with $t_1 < t_2 < t_3 < \ldots < t_n < \infty$. The probability that the duration will end (fail) before time t is measured by the cumulative distribution function of T. That is

$$F(t) = \Pr(T \leq t) \text{ --------------------------- (15)}$$

On the other hand, the probability of surviving through time t, that is, not yet completed breastfeeding at that time is expressed as survival function:

$$S(t) = \Pr(T > t) = 1 - F(t) \text{ -- (16)}$$

The instantaneous probability of leaving a state or failure (woman completing the duration of breastfeeding) at time t, given that she has not done so at this time is termed as the hazard function. This is formally expressed as:

$$\lambda(t) = {f(t)}\big/{S(t)} \text{ -------------------------------- (17)}$$

where f(t) is the density function. Also survivor probabilities at time period t can be expressed in terms of hazard as:

$$S(t) = \prod\nolimits_{\lambda_i, t} (1 - \lambda_i) \text{ -- (18)}$$

Suppose at a point in time t_i where women are still breastfeeding, if r_i defines the number of observations at risk of failing at that time, and d_i is the number of failures that ends at time t_i , the hazard rate can be estimate as:

$$\lambda_i = r_i / d_i \text{ --- (19)}$$

and the survivor function estimated as:

$$S(t) = \prod_{i|t_i \leq 1} (r - d_i)/r_i = \prod_{i|t_i \leq 1} (1 - d_i / r_i) \text{ ------------------------------------ } (20)$$

This is also known as the Kaplan-Meier estimator used for non-parametric analysis. Estimates of a survivor function for the duration of breastfeeding amongst women in GLSS 1 and 4 are presented in Tables 3.18 and 3.19 respectively. The Kaplan-Meier Survivor and the Nelsen-Aalen (N-A) Cumulative Hazard functions show the distribution of the duration of breastfeeding. It summarises the various months of breastfeeding, those at risk of failing (completing the duration of breastfeed), number of women who have actually failed (that is completed), and those censored. The survivor column shows the probability of continuing breastfeeding beyond a particular month. The first month for example indicates that less than 1 percent of the sampled women have completed breastfeeding in that month in both GLSS 1 and 4 with a survival probability of 0.999 and 0.996 respectively. With 1,304 and 2, 396 women at risk of completing during the first month in GLSS 1 and 4 respectively, only 1 had failed in GLSS 1; and the corresponding figure in GLSS 4 is 9.

The median duration of breastfeeding appears to have increased between the two survey years. The median is observed around the 18th month in GLSS 1 and somewhere between the 23rd and 24th months in GLSS 4. The survival probability in the latter year is around 57 percent in the 23rd month, which suddenly dropped to 23 percent in the 24th month. It seems that relatively more women prefer to terminate breastfeeding just before their children's second birthday, then survival rates rapidly falls to 7 and 1 percent at the third birthday in GLSS 1 and 4 respectively. Graphical representation of the survival functions of GLSS 1 and 4 are given in Figure 3.1 with a 95 percent confidence interval.

Fig. 3.1

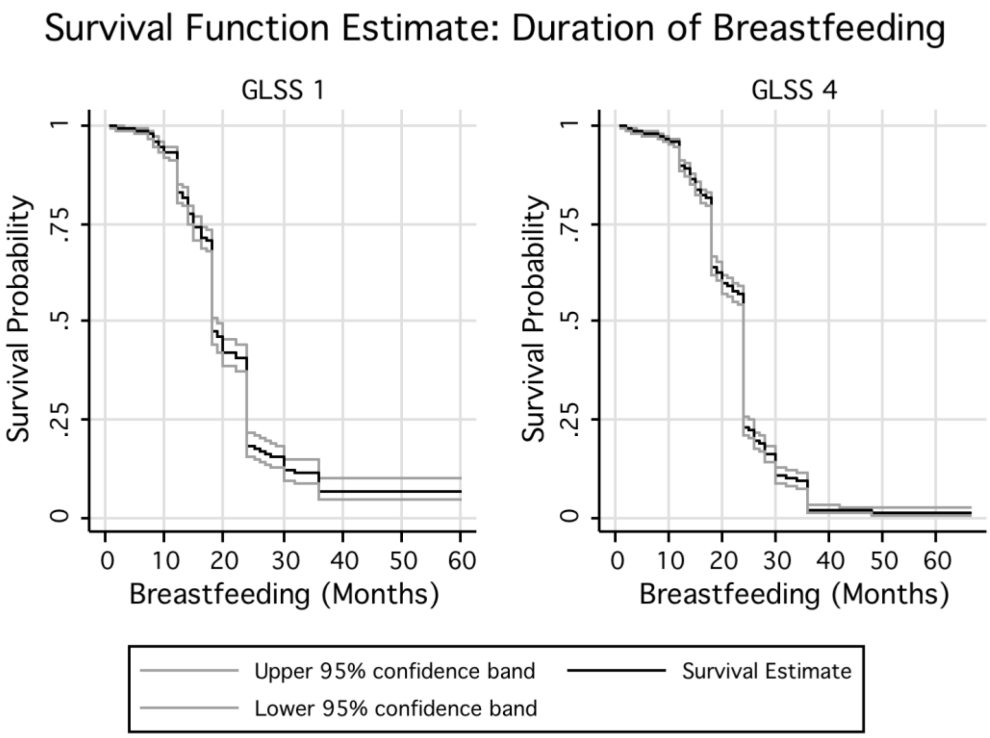

Survival Function Estimate: Duration of Breastfeeding
GLSS 1
GLSS 4
Survival Probability
Survival Probability
0
.25
.5
.75
1
0 10 20 30 40 50 60
Breastfeeding (Months)
Breastfeeding (Months)
Upper 95% confidence band
Lower 95% confidence band
Survival Estimate

Table 3.18: Duration of Breastfeeding: Survival Analysis; Failures, Censoring and the Kaplan Meier Empirical Hazard (GLSS 1 - 1987/88)

Month	Riskset	Failed	Censored	Survivor	N-A Cum. Hazard
1	1304	1	23	0.9992	0.0008
2	1280	7	36	0.9938	0.0062
3	1237	4	28	0.9906	0.0095
4	1205	0	25	0.9906	0.0095
5	1180	2	28	0.9889	0.0112
6	1150	4	37	0.9854	0.0146
7	1109	9	28	0.9774	0.0228
8	1072	19	33	0.9601	0.0405
9	1020	15	49	0.946	0.0552
10	956	15	24	0.9312	0.0709
11	917	3	27	0.9281	0.0741
12	887	95	46	0.8287	0.1813
13	746	9	15	0.8187	0.1933
14	722	41	24	0.7722	0.2501
15	657	29	34	0.7381	0.2942
16	594	18	22	0.7158	0.3245
17	554	6	9	0.708	0.3354
18	539	177	38	0.4755	0.6638
19	324	12	5	0.4579	0.7008
20	307	25	6	0.4206	0.7822
21	276	2	4	0.4176	0.7895
22	270	6	6	0.4083	0.8117
23	258	2	6	0.4051	0.8195
24	250	137	37	0.1831	1.3675
25	76	2	3	0.1783	1.3938
26	71	4	0	0.1682	1.4501
27	67	2	5	0.1632	1.48
28	60	3	4	0.1551	1.53
29	53	1	5	0.1521	1.5488
30	47	10	4	0.1198	1.7616
32	33	1	1	0.1161	1.7919
33	31	0	1	0.1161	1.7919
34	30	0	1	0.1161	1.7919
35	29	0	1	0.1161	1.7919
36	28	12	6	0.0664	2.2205
37	10	0	1	0.0664	2.2205
38	9	0	1	0.0664	2.2205
40	8	0	2	0.0664	2.2205
42	6	0	1	0.0664	2.2205
50	5	0	1	0.0664	2.2205
52	4	0	1	0.0664	2.2205
60	3	0	3	0.0664	2.2205

Table 3.19: Duration of Breastfeeding: Survival Analysis; Failures, Censoring and the Kaplan Meier Empirical Hazard (GLSS 4 - 1998/99)

Month	Riskset	Failed	Censored	Survivor	N-A Cum. Hazard
1	2396	9	57	0.9962	0.0038
2	2330	7	57	0.9933	0.0068
3	2266	14	38	0.9871	0.0129
4	2214	10	52	0.9827	0.0175
5	2152	4	52	0.9808	0.0193
6	2096	7	48	0.9776	0.0227
7	2041	1	72	0.9771	0.0231
8	1968	12	64	0.9711	0.0292
9	1892	14	53	0.9639	0.0366
10	1825	9	36	0.9592	0.0416
11	1780	6	50	0.9559	0.0449
12	1724	109	53	0.8955	0.1082
13	1562	14	40	0.8875	0.1171
14	1508	39	62	0.8645	0.143
15	1407	42	40	0.8387	0.1728
16	1325	27	40	0.8216	0.1932
17	1258	12	40	0.8138	0.2028
18	1206	258	62	0.6397	0.4167
19	886	17	23	0.6274	0.4359
20	846	45	36	0.594	0.4891
21	765	6	19	0.5894	0.4969
22	740	19	17	0.5743	0.5226
23	704	8	11	0.5677	0.534
24	685	405	20	0.2321	1.1252
25	260	8	9	0.2249	1.156
26	243	32	8	0.1953	1.2876
27	203	8	7	0.1876	1.3271
28	188	28	4	0.1597	1.476
29	156	1	13	0.1586	1.4824
30	142	47	10	0.1061	1.8134
31	85	0	2	0.1061	1.8134
32	83	6	2	0.0985	1.8857
33	75	0	3	0.0985	1.8857
34	72	4	4	0.093	1.9412
35	64	1	1	0.0915	1.9569
36	62	48	0	0.0207	2.7311
37	14	0	1	0.0207	2.7311
40	13	0	4	0.0207	2.7311
42	9	2	1	0.0161	2.9533
44	6	0	3	0.0161	2.9533
48	3	1	0	0.0107	3.2866
64	2	0	1	0.0107	3.2866
67	1	0	1	0.0107	3.2866

Since the fundamental aim of the study is to assess the effects of schooling on the duration of breastfeeding, survival functions are also analysed by schooling in categorical forms (Tables 3.20 & 3.21). It can be observed that in both years, secondary and above school leavers have lower survival rates; they are more likely to complete breastfeeding earlier than their less educated counterparts. In GLSS 1, the median duration of breastfeeding observed amongst women with secondary and above education is 15 months, compared to 18 months amongst primary and middle school leavers, and 24 months amongst women with no education. The corresponding durations in GLSS 4 are 16 months amongst secondary and above educated women, 20 months amongst middle school leavers, and 24 months amongst women with primary and those with no education. This somewhat supports the negative relationship between education and breastfeeding found in existing empirical literature (see inter alia Akin et al., 1981; Weis, 1993; Pérez-Escamilla, 2003). With relatively more active participation in the labour market, educated women are more likely to have jobs outside their homes that discourage lengthy breastfeeding. These women are also particularly found in formal institutions with little to no chance for periodic breaks for breastfeeding. The more educated women are also likely to give breast-milk substitutes to their infants because they can afford childcare assistance, baby formula and cleaner environment with access to good drinking water source.

Table 3.20: Duration of Breastfeeding: Time at Risk; Incidence Rate, and Survival Time (GLSS 1 - 1987/88)

	Time at Risk	Incidence Rate	No. of Subjects	Survival Time 25%	50%	75%
Education						
None	9803	0.028	613	18	24	30
Primary	2611	0.037	173	18	18	24
Mid/JSS	6544	0.042	474	14	18	24
Sec. & above	533	0.053	44	12	15	18
Total	19491	0.035	1304	15	18	24
Residence						
Urban	6239	0.044	448	13	18	20
Rural	13252	0.030	856	18	24	24
Total	19491	0.035	1304	15	18	24
Educ.; Residence						
None; Urban	2373	0.033	158	16	18	24
None; Rural	7430	0.027	455	18	24	30
Primary; Urban	712	0.048	51	14	18	20
Primary; Rural	1899	0.033	122	18	24	24
Mid/JSS; Urban	2830	0.051	209	12	16	18
Mid/JSS; Rural	3714	0.035	265	16	18	24
Sec. & above; Urban	324	0.059	30	12	14	17
Sec. & above; Rural	209	0.043	14	14	36	36
Total	19491	0.035	1304	15	18	24
Year of Birth						
1982	1152	0.047	57	16	18	24
1983	1456	0.048	73	12	18	24
1984	2717	0.046	138	14	18	24
1985	5156	0.043	271	15	18	24
1986	5023	0.028	302	18	20	24
1987	2911	0.008	338	18	20	24
1988	219	0.009	69	15	15	15
Missing	857	0.048	56	12	18	24
Total	19491	0.035	1304	15	18	24

Table 3.21: Duration of Breastfeeding: Time at Risk; Incidence Rate, and Survival Time (GLSS 4 - 1998/99)

	Time at Risk	Incidence Rate	No. of Subjects	Survival Time 25%	50%	75%
Education						
None	21434	0.028	1246	18	24	28
Primary	6219	0.035	388	18	24	24
Mid/JSS	10239	0.037	657	18	20	24
Sec. & above	1447	0.052	105	12	16	19
Total						
Residence						
Urban	10436	0.041	686	15	18	24
Rural	28903	0.029	1710	18	24	26
Total	39339	0.033	2396	18	24	24
Educ.; Residence						
None; Urban	3742	0.037	234	18	24	24
None; Rural	17692	0.027	1012	22	24	30
Primary; Urban	1816	0.044	123	14	18	24
Primary; Rural	4403	0.032	265	18	24	24
Mid/JSS; Urban	3906	0.041	257	16	18	24
Mid/JSS; Rural	6333	0.034	400	18	24	24
Sec. & above; Urban	972	0.055	72	12	15	19
Sec. & above; Rural	475	0.046	33	12	16	19
Total	39339	0.033	2396	18	24	24
Year of Birth						
1992_93	2162	0.047	103	18	22	24
1994	2926	0.048	140	18	23	24
1995	4237	0.046	200	18	24	24
1996	6556	0.032	315	18	24	26
1997	5701	0.008	438	19	24	26
1998_99	1871	0.006	319	18	24	30
Missing	15886	0.036	881	18	24	24
Total	39339	0.033	2396	18	24	24

Comparison between residences also indicates that women in rural areas breastfeed longer than those in urban areas. In both GLSS 1 and 4, the median duration of breastfeeding is 24 months in rural areas, compared to 18 months in urban areas. Further checks also reveal that women in urban areas with no education generally breastfeed for shorter periods than their counterparts in the rural areas in both survey years. This pattern in breastfeeding is observed across all the levels of education and residence of the women. Also, women with secondary and above education, especially in urban areas have the lowest duration of breastfeeding in both surveys. A similar estimation analysis is conducted for the years of birth of the children to assess whether they determine the distribution of their duration of breastfeeding. The pattern appears consistent over birth years: only few differences are observed within survival rates, especially in GLSS 4.

A follow-up to these descriptives is the conduction of a Log-rank test to check the null hypothesis of no subgroup differences in the survivor functions (Table 3.22). For the education categories, both survey years rejected the null hypothesis at the 1 percent significant level with Chi-squares 103.03 and 191.64 for GLSS 1 and GLSS 4 respectively. Similar outcomes are observed with regard to residence and year of child's birth. The Chi-squared test for the latter, for example, suggests that the distribution in the duration of breastfeeding by year of birth does not occur by chance.

Table 3.22: Log-rank test for equality of survivor functions, 1987/88 & 1998/99

	GLSS 1		**GLSS 4**	
	Events Observed	Events Expected	Events Observed	Events Expected
Education				
None	275	374.71	608	775.72
Primary	96	90.71	220	189.23
Mid/JSS	274	195.54	377	285.32
Sec. & above	28	12.04	75	29.73
Total	673	673	1280	1280
chi2(3)		103.03		191.64
Pr>chi2		0.0000		0.0000
Residence				
Urban	274	185.44	433	287.7
Rural	399	487.56	847	992.3
Total	673	673	1280	1280
chi2(1)		75.64		130.42
Pr>chi2		0.0000		0.0000
Educ.; Residence				
None; Urban	78	81.36	139	120.37
None; Rural	197	293.35	469	655.34
Primary; Urban	34	21.21	79	48.16
Primary; Rural	62	69.5	141	141.08
Mid/JSS; Urban	143	77.61	162	97.55
Mid/JSS; Rural	131	117.93	215	187.77
Sec. & above; Urban	19	5.26	53	21.61
Sec. & above; Rural	9	6.78	22	8.12
Total	673	673	1280	1280
chi2(7)		169.37		263.98
Pr>chi2		0.0000		0.0000
Year of Birth				
1982/1992_93	54	49.02	102	88.52
1983	70	61.81		
1984/1994	125	119.64	139	118.2
1985/1995	220	218.7	194	171.33
1986/1996	139	160.61	212	226.71
1987/1997	22	33.55	48	73.32
1988/1998_99	2	0.82	12	18.58
Missing	41	28.87	573	583.35
Total	673	673	1280	1280
chi2(7)		19.53		28.28
Pr>chi2		0.0067		0.0001

To obtain parametric estimates, covariates are introduced into the hazard function of equation 16 to give a continuous time hazard functional form such as:

$\lambda(t, X) = \lambda_0(t)e^{(x'\beta)}$ -- (21)

λ_0 (t) is the baseline hazard rate that does depend on *t* but not on the covariates (X). It is also known as the proportional hazard because the hazard for any X is proportional to the baseline hazard λ_0 (t) (Cameron and Hall, 2003). The hazard rate could be constant as expressed by the exponential distribution, or varying as could be seen the Weibull distribution or log-logistic. $e^{(x'\beta)}$ is the exponential function and β is a vector of the parameters to be estimated. The associated survivor function is:

$S(t; X_{it}) = \exp\left[-\lambda\int_0^t(\omega, X_{it})d\omega\right] = \exp\left\{-\exp\left[X_{it}'\beta + \log(H_t)\right]\right\}$ ---------------- (22)

Where $H_t = \int_0^t \lambda_0(\omega)d\omega$ is the integrated baseline hazard at *t*.

However a discrete time proportional hazard specification is applied in this study because responses are bunched up at months 12, 18, and 24. This specification allows for a flexible baseline hazard, hence no prior need to assume a functional form of the effect of duration. Also a flexible baseline hazard rate specification allows for non-monotonic variation with the duration, which then captures a lot more possible effects on the hazard rate. The model outlined below generally follows Jenkins' (1995), which is also published by STATA Corporation. The assumption underlying the model specification is that durations are intrinsically discrete. They are only observed in disjointed time intervals like [0 = m_0, m_1), (m_1, m_2), (m_2, m_3), ….., (m_{k-1}, m_k=∞); thus covariates may vary between time intervals but are assumed to be constant within each of them. For example the probability that a woman *i* will cease breastfeeding at the *j*th interval is given as:

$$\Pr\{T \in (m_{j-1}, m_j)\} = s(m_{j-1}; X_{it}) - s(m_j; X_{it}) \text{ ---------------------------------- (23)}$$

And the survivor function at the start of the jth interval is:

$$\Pr\{T \geq m_{j-1}\} = s(m_{j-1}; X_{it}) \text{ -- (24)}$$

Therefore the hazard of exit in the jth interval is given by:

$$h_j(X_{it}) \equiv \Pr\{T \in (m_{j-1}, m_j) \mid T \geq m_{j-1}\} = 1 - [s(m_j; X_{it}) / s(m_{j-1}; X_{it})] \text{ --------- (25)}$$

which for the discrete-time case can be rewritten as:

$$s(m_j; X_{it}) = \exp\left[-\exp(\beta' X_{it} + \delta_j)\right] \text{ ------------------------------(26)}$$

Where δ_j is log (H_{it}) for j = 1, 2, …, k.

Upon the assumption that all intervals are to be of unit length, which for this study is a month, and for each woman *i* the recorded duration of breastfeeding corresponds to the interval (t_i-1, t_i). Women are also identified with an indicator v_i =1 as having completed breastfeeding and v_i = 0 as still breastfeeding and thus right-censored. The number of intervals or months is defined to comprise the last within which the woman is observed. This also includes the censored spells. Thus the log-likelihood function for a sample of *N* women can be written as:

$$\log L(\beta, \delta) = \sum_{i=1}^{k} \{v_i \log[s(t_i - 1; X_{it}) - s(t_i; X_{it})] - (1 - v_i) \log[s(t_i; X_{it})]\} \text{ ----------- (27)}$$

This can be rewritten in terms of the hazard function as:

$$\log L = \sum_{i=1}^{k}\left[v_i \log\left\{h_{ti}(X_{it_i})\prod_{s=1}^{t_i-1}[1-h_s(X_{is})]\right\} + (1-v_i)\log\left\{\prod_{s=1}^{t_i}[1-h_s(X_{is})]\right\}\right] \text{------ (28)}$$

where the discrete-time hazard in the j[th] month is:

$$h_j(X_{ij}) = 1-\exp[-\exp(X_{ij}^{'}\beta+\theta_j)] \text{----------------------(29)}$$

where $\theta_j = \log\int_{m_{j=1}}^{m_j}\lambda_0(\omega)d\omega$; and can be interpreted as the logarithm of the integral of the baseline hazard over the relevant interval, especially for a fully non-parametric baseline hazard with a separate parameter for each duration interval. On the other hand the θ_j may be explained by some semi-parametric or parametric function $\tau(j)$. With a binary indicator variable $D_{it} = 1$ if a woman *i* stops breastfeeding in month *j*, and $D_{it} = 0$ otherwise, equation 27 can thus be rewritten in a sequential binary response form as:

$$\log L = \sum_{i=1}^{k}\sum_{j=1}^{t_i}\left\{D_{ij}\log h_j(X_{ij}) + (1-D_{ij})\log[1-h_j(X_{ij})]\right\} \text{--------------------- (30)}$$

However, it is well noted by Lancaster (1990) that duration analysis usually produces incorrect results if unobserved heterogeneity is ignored.

Jenkins (1997) also suggests that including unobserved heterogeneity is important because it tends to have the effect of over-estimating the negative duration dependence and under-estimating positive duration in the baseline hazard when not controlled. This implies that the sampled population with higher values of unobserved characteristics captured in the error term are inclined to fail faster in negative duration, ceteris paribus. Thus at any given survival time, the population understudy are made up of observations with lower hazard rates and the proportional effects of a given regressor is no longer constant and independent of survival time (ibid).

Therefore an additional random parameter is included in the model to account for the random unobserved or un-measurable variables (also known as frailties). The random parameter is then assumed to follow some parametric distribution like the Gamma or inverse Gaussian. Indeed the choice of heterogeneity distribution seems not to matter as long as the baseline is non-parametrically estimated (Meyer, 1990). This study incorporates the Gamma distributed random variable in its models because the Gamma distribution gives a closed form expression for the likelihood in order to avoid numerical integration (ibid). By introducing a Gamma distributed random variable to capture unobserved heterogeneity between individuals, the instantaneous hazard rate (that is similar to equation 20) becomes:

$$\lambda(t, X) = \lambda_0(t)e^{(x'\beta)}\mu = \lambda_0(t)e[(X'\beta) + \log(\mu)] \text{ -----------------------------(31)}$$

where μ is a Gamma distributed random variable with unit mean and variance *z*. The discrete-time hazard function then becomes:

$$h_j(X_{ij}) = 1 - \exp\{-\exp[X'_{ij}\beta + \theta_j + \log(\mu_i)]\} \text{ ----------------------------- (32)}$$

And the log-likelihood function becomes:

$$\log L = \sum_{i=1}^{k} \log\{(1 - v_i).A_i + v_i B_i\} \text{ ---------------------------- (33)}$$

where $A_i = \left[1 + z\sum_{j=1}^{t_i} \exp[X'_{ij}\beta + \tau(j)]\right]^{-(1/z)}$, and

$$B_i = \left[1 + z\sum_{j=1}^{t_i - 1} \exp[X_{ij}^{'}\beta + \tau(j)]\right]^{-(1/z)} - A_i, if\ t_i > 1, or$$

$$= 1 - A_i, if\ t_i = 1$$

where $\tau(j)$ is a function explaining duration dependence in the hazard rate, including the non-parametric baseline hazard specification. This study presents estimated models of both equations 29 and 32 for comparison in the discussion of results using *pgmhaz* in STATA (Jenkins, 1997). The first of the two equations is the Prentice and Gloeckler (1978) model (without heterogeneity) and the second is the Prentice and Gloeckler (1978) model with Gamma distributed unobserved heterogeneity by Meyer (1990).

3.2.2.2.2 Explanatory Variables: Definitions and Descriptives

Table 3.23 presents the summary statistics of variables used in estimating the full samples of both surveys. Those for rural and urban as well as age 15-34 and 35-49 sub-samples are presented in Appendix B-13a & B-13b for GLSS 1 and 4 respectively. The summary tables also show on the average the proportion of women who breastfed, months of breastfeeding duration and completed months of breastfed. Whether a woman breastfed is represented by a dummy, where "1" means "yes" and "0" is otherwise. This is included in the table to give an overview of breastfeeding patterns in the country. It appears nearly every woman who gives birth breastfeed and does so for at least one year on the average. Two different types of breastfeeding duration are given in the table; the first includes those of babies who are still breastfeeding (their age at the time of survey is used), and the second consists of only completed duration. In both cases, the duration of breastfeeding seems to have increased between GLSS 1 and 4, which is also observed in the overall non-parametric assessments. Indeed a Wald test shows the difference in means of the two survey years as statistically significant at the 1 percent level. That is, average breastfeeding has increased by about 3 months over the decade. This could be due to various breastfeeding campaigns in the media by the Ministry of Health, depicting nutritional and health advantages of the practice. They also advise clinics to encourage women to breastfeed exclusively and for longer duration.

The definitions of explanatory variables such as education, age, current residence, religion, ethnicity, household wealth, distance to health facilities/personnel, price of commodities and agricultural wage rates are as defined in the contraception modelling. Half of the sampled women have no education and about three-quarters live in rural areas. Majority of the women are also middle aged, which usually is the prime time for high fecundity. Christianity seems to be the most practiced religion amongst these women, half of whom are non-Akans.

The gender of the child is represented by a dummy variable “1” if child is female and zero otherwise. There is roughly equal representation of both genders and many of these infants are born after 1984 in GLSS 1 and 1994 in GLSS 4. However the percentage of missing birth years in the latter survey year is high; around a third was found missing. So they are included in the estimation model as a dummy variable “1” if year is missing and zero otherwise. Year of birth of the child is also in categorical terms, where in GLSS 1 birth85-86 means the child was born in the year 1985 or 1986 and birth87-88 means child was born in 1987 or 1988. In GLSS 4, the dummies for birth years are birth95-96 and birth97-99 denoting infants born in 1995 or 1996 and those born between 1997 and 1999 respectively. The base category for GLSS 1 is child born between 1982 and 1984 and that for GLSS 4 is child born between 1992 and 1994.

Distance to the nearest water source and community market is measured in metres and kilometres respectively. Although distance to the nearest water source appears shorter than that to the market on average, the former shows larger dispersions around the mean; at least in GLSS 1. The reverse is true in GLSS 4.

Finally, an additional variable in the form of the log of breastfeeding duration, which uniquely identifies each time period at risk for each person, is incorporated in the estimations to check whether the hazard increases monotonically or not. The estimated outcomes[83] of the proportional hazard models showed evidence of a monotonic increase in the baseline hazard. That is, the baseline of the hazard slopes upwards in both survey years of the study. However in order to estimate the models with a non-parametric baseline as outlined in the econometric model specification above, binary dummy variables are created for each duration interval. These are included in all the estimations to allow for flexibility in the duration dependence, with 0–1month interval as the base category.

[83] Not reported here for brevity.

Table 3.23: Summary Statistics – the Duration of Breastfeeding

	GLSS 1		GLSS 4	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Breastfeed	0.989	0.106	0.991	0.092
Months Breastfeed[1]	13.823	8.640	16.031	8.805
Completed Months Breastfeeding[2]	16.375	7.299	19.849	7.390
Censored	0.491	0.500	0.469	0.499
None	0.482	0.500	0.521	0.500
Primary	0.131	0.338	0.162	0.368
Middle/JSS	0.355	0.479	0.274	0.446
Sec. & above	0.032	0.176	0.043	0.203
Age15_24	0.279	0.449	0.190	0.393
Age25_34	0.475	0.500	0.500	0.500
Age35-49	0.245	0.430	0.309	0.462
Rural	0.665	0.472	0.713	0.452
Female child	0.458	0.498	0.507	0.500
Northern Region	0.160	0.366	0.171	0.377
Child's birth82-84/92-94	0.205	0.404	0.100	0.300
Child's birth85-86/95-96	0.419	0.494	0.211	0.408
Child's birth87-88/97-99	0.335	0.472	0.319	0.466
Missing birth year	0.040	0.197	0.370	0.483
Christian	0.611	0.488	0.742	0.438
Muslim	0.143	0.350	0.126	0.332
Traditional	0.182	0.386	0.078	0.268
Other	0.064	0.245	0.054	0.226
Non-Akan	0.533	0.499	0.504	0.500
HAS- Basic	-0.125	0.854	-0.189	0.900
HAS- High	-0.054	0.612	-0.011	0.979
Water distance (m)	1364.48	16544.43	764.17	16943.36
Market distance (km)	5.418	10.580	10.492	37.052
Access to Health facilities/personnel	0.008	0.798	-0.030	0.446
Price score of foodstuffs	-0.004	0.821	-0.008	0.867
Price score of cereals	0.022	0.819	0.010	0.989
Log of real Men's Agric. Wage	2.944	2.697	5.759	3.895
Ratio of female to men's wage	0.306	0.438	0.429	0.440
Ratio of child to men's wage	0.323	0.413	0.318	0.404
	1410		2454	

Note: 1. Includes current age of babies who are still breastfeeding; 2. Only babies who have completed breastfeeding

3.2.2.3 Estimation Results

Similar to the presentation of results on the contraceptive modelling, only estimated coefficients showing their level of statistical significance are given in this text for brevity. Also these results are those that accounted for unobserved heterogeneity and the gamma variance likelihood ratio test is found significant at the 5 and 1 percent level in GLSS 1 and 4 respectively (the full samples). They are therefore the preferred[84] of the two models estimated using the *pgmhaz* command in STATA. Where significant, models that control for unobserved heterogeneity tend to have slightly bigger magnitudes of the coefficients compared to those that do not account for it. This is suggestive of plausible under-estimation of covariates. The entire results on both models, with their t-ratios, are presented in Appendix B-14 to B-23, but an abridged version is presented in text. Again results in GLSS 1 are discussed first for each specification, and then followed by GLSS 4.

The Impact of Education

All else equal, increased education levels generally tend to raise the hazard of ceasing breastfeeding (table 3.24). This concurs with the theoretical expectations since the value of time, which breastfeeding strongly depends on, increases with education levels. The statistical significance of education is however observed beyond primary education of the women in GLSS 1 (all specifications of the full sample). For example, in Variant 1 that includes education and control variables such as age, residence, child's birth year and gender, the impact of middle/JSS level of education tends to increase the hazard of terminating breastfeeding by about 54 percent, ceteris paribus. The corresponding figure for women with

[84] Except for the rural/urban as well as women aged 35-49 sub-samples in GLSS 1, and the urban sub-sample in GLSS 4 whose results suggest that unobserved heterogeneity is not significant.

secondary and above education is about 108 percent. However, the introduction of additional control variables such as religion, ethnicity and household wealth (Variant 2) as well as some general community variables (Variant 3) seems to reduce the magnitude of the hazard. This is by about 10 percent in the case of middle/JSS and 40 percent in that of secondary and above education levels.

Separating the sampled women into rural/ urban sub-samples show estimates that suggest the impact of education differs by residence. First, the rural sub-sample indicates that only middle/JSS level of education is influential in the duration of breastfeeding. The statistical irrelevance of secondary and above level of education in this area may be due to the small percentage (1%) of sampled women with that level of education in the area. In contrast, the estimated hazard in the urban sub-sample mirrors that of the full sample in Variant 1, but only secondary and above level remains statistically significant in Variant 2. The age sub-samples follow the general trend in the survey year, especially in the context of the younger sub-sample. Also in this sub-sample, primary education (as well as the higher levels) is found significant in influencing the duration of breastfeeding, but only in Variant 1. The old age (35-49) sub-sample however shows only middle/JSS level of education as significant.

Table 3.24: Hazard Model Estimates of Education on the Duration of Breastfeeding

	Full	Rural	Urban	Age15-34	Age35-49
GLSS 1					
Variant 1: Parsimonious					
Primary	0.264	0.206	0.281	0.361*	0.025
Middle/JSS	0.54***	0.481***	0.407**	0.617***	0.357
Sec. & above	1.079***	0.488	1.283***	1.574***	0.166
Variant 2: Full model					
Primary	0.221	0.193	0.241	0.309	0.066
Middle/JSS	0.418***	0.44***	0.273	0.466**	0.526*
Sec. & above	0.721**	0.348	0.932**	1.187***	0.197
Variant 3: Full model with rural community characteristics					
Primary	0.197	0.182		0.23	0.163
Middle/JSS	0.405***	0.443***		0.424**	0.574**
Sec. & above	0.699**	0.293		1.089**	-0.015
Observation	1410	937	473	1064	346
GLSS 4					
Variant 1: Parsimonious					
Primary	0.323**	0.272*	0.205	0.425**	0.117
Middle/JSS	0.431***	0.465***	0.301*	0.57***	0.173
Sec. & above	1.268***	1.675***	0.718***	1.394***	0.876**
Variant 2: Full model					
Primary	0.174	0.155	0.106	0.246	0.053
Middle/JSS	0.213*	0.29*	0.128	0.317*	0.029
Sec. & above	0.853***	1.193***	0.415*	0.846***	0.837**
Variant 3: Full model with rural community characteristics					
Primary	0.162	0.141		0.262	0.014
Middle/JSS	0.209*	0.277*		0.355**	-0.033
Sec. & above	0.84***	1.148***		0.847***	0.821*
Observation	2454	1750	704	1695	759

Note: These coefficients are the estimated hazard rates using non-parametric proportional hazard model. Variant 1 consists of education and control variables such as women's age, rural residence, and Northern regional location, birth year and gender of child. Variant 2 comprises all the variables in Model as well as religion, ethnicity and household wealth. The final Variant 3 includes all the variables already mentioned as well as other determinants. See Appendix B-14 to B-23 for the full results. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively.

The estimated outcome in GLSS 4 is quite similar to GLSS 1 but with more and higher statistical significance of primary level education. In Variant 1 of the full sample for instance, a woman with primary level education may face an increased hazard of terminating breastfeeding by about 32 percent, ceteris paribus. The analogous figures for women with same education level but currently reside in rural areas, or younger women (aged 15-34) are 27 and 43 percent respectively. And as already observed in the former survey year, the magnitude of impact increases with higher education levels. Controlling more covariates however tends to result in the loss of statistical significance of primary education. In this survey year too the magnitude of educational influence appears to increase with each level with the highest being at secondary and above. Thus, secondary and above education have the greatest tendency of shortening breastfeeding in Ghana. The effect on the hazard is usually more than twice that of middle/JSS education in most of the models estimated in both GLSS 1 and GLSS 4. Invariably, the inverse relationship between breastfeeding and education found in this study has also been broadly observed in others such as Weinberger (1987), Weis (1993); Appleton (1996) and Pérez-Escamilla et al., (2007).

Estimates of Non-Parametric Baseline

Tables 3.25 and 3.26 present the estimated hazard of duration in Variant 1 for GLSS 1 and 4 respectively. This differs very slightly, entirely negligible points, from Variants 2 and 3. Including an unrestricted duration helps to identify the shape, and also test whether the hazard varies with the duration. It also avoids conflicting estimation of coefficients of the variables due to mis-specified baseline hazard (Meyer, 1990). It can be observed from estimates in GLSS 1 that the hazard of stopping breastfeeding non-monotonically reduces from the second to the eleventh month, compared to the base category of 0-1month. The twelfth month however show an increased hazard of termination of about 120 percent in the full sample. The next increased hazards of noticeable magnitudes are at the 18, 24, and 30 and above. This unsurprisingly matches the bunched-up points observed in the Kaplan-Meier analysis. These points also appear to be the recommended duration by campaigners in the health sector, especially with regard to the first two points. The extended breastfeeding beyond these points might rather be related to various ethnic or traditional values practiced upon childbirth and feeding.

The patterns observed in the residence and age demarcations are fairly consistent with that of the full sample. Breastfeeding seems to be totally ceased after month 24 mostly in the urban and older aged (35-49) sub-samples. It should however be noted that the hazard rates at the peak points are higher amongst the younger than the older women. Urban women as would be anticipated also show higher hazards, especially at 12 and 18months, compared to their rural counterparts. The reason behind this might be the opportunity cost of time, and/or exposure to "modern" practices in urban areas. Lower fecundity levels as well as experience from past breastfeeding practices might be the reason for completed duration by this month among the older aged group.

GLSS 4 also shows similar breastfeeding patterns as that of GLSS 1 but with peaks at 12, 18, 24, and above 30months. Also like GLSS 1, hazard rates at the termination peak points are higher in urban than rural areas, as well as amongst younger relative to older women. For instance the hazard of termination during the 12 month is about 66 percent higher amongst urban relative to rural women, ceteris paribus. Correspondingly, younger women experience 27 percent higher risk of ending breastfeeding compared to older women. Unlike GLSS 1 though final terminations go beyond 30 months for all the sub-samples and they are statistically significant.

Table 3.25: Baseline Hazard Estimates from Variant 1, GLSS 1.

Month	Hazard				
	Full	**Rural**	**Urban**	**Age15-34**	**Age35-49**
2	-1.823***	-2.075***	-1.334*	-1.538***	-3.639***
3_4	-3.044***	-3.434***	-2.394**	-2.595***	"
5	-3.023***	-3.414***	-2.372*	-2.568***	"
6	-2.306***	-2.706***	-1.647*	-2.136***	"
7	-1.462***	-1.991***	-0.691	-1.402**	-1.585*
8	-0.675*	-0.948**	-0.18	-0.746*	-0.581
9	-0.857**	-2.616***	0.361	-0.517	-1.929*
10	-0.793**	-1.189**	-0.179	-0.436	-1.907*
11	-2.373***	-3.249**	-1.391	-2.269**	-2.585*
12	1.201***	0.734**	1.859***	1.447***	0.671*
13	-1.01**	-2.382**	0.157	-0.85	-1.305*
14	0.59**	-0.204	1.5***	0.617*	0.507
15	0.374	-0.397	1.274***	0.806**	-0.851
16	0.013	-0.688	0.851	0.52	-1.511*
17	-1.022*	-1.728**	-0.192	-0.379	1.121***
18	2.695***	1.999***	3.414***	3.08***	"
19	0.438	-0.377	1.205*	0.816	-0.285
20	1.29***	0.313	2.239***	1.709***	0.483
21	-1.141	-1.496*	-0.11	-0.319	-2.224*
22	-0.008	-0.774	"	0.641	"
23	-1.056	-1.422	2.874***	-0.219	1.777***
24	3.779***	3.048***	"	4.343***	"
24plus			0.042		0.225
25	0.494	-0.087		1.557	
26	1.265*	0.703		0.921	
27	0.633	-0.623		0.96	
28	1.77	0.622		1.749*	
28plus		0.742			
29	0.209			1.169	
30	2.771***			3.434***	
30plus	2.18*			1.833**	
Constant	-2.742***	-2.977***	-3.61***	-2.999***	4.673
ln_varg (cons)	-1.371**	-3.435	-12.552	-0.954*	-16.275
lltest	5.421	0.028	-1.30E-05	7.546	-0.007
lltest_p	0.01	0.434	0.5	0.003	0.5

Note: These coefficients are the estimated hazard rates using non-parametric proportional hazard model. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. (") after a cell means that the hazard coefficient just before it covers that as well. For example the hazard coefficient of month 21 under the urban sub-sample is actually for both months 21 and 22. This is because none of the women in that subsample terminated in month 21 but some did in 22, requiring that the dummy variable be created for the two months to ensure the identifiability condition of the estimation model (Jenkins, 1997). Similarly, the hazard for month 23 is for both 23 and 24; and so on. Also, a plus by a month number means a dummy indicating all months above that number because there were not many terminations after that month.

Table 3.26: Baseline Hazard Estimates from Variant 1, GLSS 4.

Month	Hazard				
	Full	**Rural**	**Urban**	**Age15-34**	**Age35-49**
2	-1.482***	-2.405**	-0.552	-1.462**	-1.511*
3	-0.762*	-0.998*	-0.337	-1.027*	-0.508
4	-1.074**	-1.267**	-0.712	-1.184*	-0.956
5	-1.969***	-2.347**	-1.382	-1.676**	-2.543*
6	-1.388***	-2.329**	-0.439	-1.136*	-1.843*
7	-3.314**	-3.005**	-0.293	-2.721**	-2.113***
8	-0.794*	-2.982**	"	-0.477	"
9	-0.598	-1.569**	0.388	-0.325	-1.097
10	-1.004**	-1.543**	-0.259	-0.503	-2.464*
11	-1.387**	-2.219**	-0.452	-1.165*	-1.761*
12	1.602***	1.278***	2.119***	1.785***	1.293***
13	-0.348	-0.702	0.197	-0.276	-0.488
14	0.729**	0.25	1.421***	0.998**	0.249
15	0.892***	0.259	1.733***	0.97**	0.741*
16	0.53*	0.014	1.263**	0.708*	0.226
17	-0.221	-0.797	0.579	0.245	-1.338
18	3.112***	2.628***	3.797***	3.394***	2.611***
19	0.702*	0.099	1.557**	1.229**	-0.488
20	1.764***	1.332***	2.289***	2.059***	1.249**
21	-0.152	-1.359	1.231	-1.205	0.166
22	1.054***	0.388	1.99***	1.489***	0.212
23	0.242	-0.178	0.676	0.299	0.026
24	4.948***	4.374***	5.482***	5.206***	4.437***
25	1.899***	1.461**	2.67**	2.187***	1.307
26	3.448***	2.887***	"	4.089***	1.899**
27	2.239***	1.526**	2.813**	2.641***	1.473*
28	3.667***	3.077***	3.654***	3.914***	3.111***
29	0.472	0.029	4.658***	1.313	3.09***
30	4.742***	3.798***	"	5.147***	"
31 plus	3.758***	2.959***	3.792***	4.09***	3.022***
Constant	-4.049***	-4.318***	-4.469***	-4.346***	-3.322***
ln_varg (cons)	-0.882***	-1.571**	-0.796	-0.827*	-1.239**
lltest	29.745	4.754	3.033	13.106	4.868
lltest_p	0.0000	0.015	0.041	0.0000	0.014

Note: These coefficients are the estimated hazard rates using non-parametric proportional hazard model. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. (") after a cell means that the hazard coefficient just before it covers that as well. For example the hazard coefficient of month 21 under the urban sub-sample is actually for both months 21 and 22. This is because none of the women in that subsample terminated in month 21 but some did in 22, requiring that the dummy variable be created for the two months to ensure the identifiability condition of the estimation model (Jenkins, 1997). Similarly, the hazard for month 23 is for both 23 and 24; and so on. Also, a plus by a month number means a dummy indicating all months above that number because there were not many terminations after that month.

The Impact of Control Variables

The discussion here is primarily based on the second specification (Variant 2) of the econometric estimations. This is used because it contains relatively more of the control variables and has fairly consistent outcomes with the other specifications. However, it would be mentioned where differences in outcomes appear to be non-negligible.

As anticipated and also observed in the non-parametric analysis, the risk of terminating breastfeeding is lower amongst women who reside in rural areas compared to their urban counterparts, ceteris paribus (table 3.27). This is true in both GLSS 1 and 4, especially in the full and younger sub-samples. In the full samples for instance, women residing in rural areas face about 40 and 28 percent reduced hazard of shortening breastfeeding relative to those in urban areas in GLSS 1 and 4 respectively. The direction of impact is also observed amongst the older sub-group but not found statistically significant, at least in Model 2 and 3. However in Variant 1 where there are fewer control variables the negative impact of rural residence in this sub-sample is statistically significant at the 10 percent level in GLSS 1 and 1 percent in GLSS 4. This outcome is probably due to the theoretical view that rural women are less exposed to "modern" ways, more in touch with cultural values and face lesser opportunity cost of time compared to urban women. The result in this study is also in accordance with others including Weiss (1993), Giashuddin and Kabir (2004), Pérez-Escamilla et al., (2007) and Belfield and Kelly (2010).

Table 3.27: Hazard Estimates of Control Variables from Variant 2, GLSS 1 & 4.

	Full	Rural	Urban	Age15-34	Age35-49
GLSS 1					
Age25-34	-0.177			-0.215	-0.194
Age35-49	-0.056	0.14	-0.033		0.003
Rural	-0.401***			-0.52***	-0.261
Female child	-0.174	-0.263*	0.052	-0.167	-0.132
Northern Region	-0.581***	-0.622***	-0.503	-0.899***	-0.14
Child's birth85-86	-0.363***	-0.246*	-0.332*	-0.371**	-0.364*
Child's birth87-88	-0.801***	-0.892**	-0.521	-0.692**	-1.406**
Missing birth year	0.264	0.081	1.094**	0.493	0.001
Muslim	-0.203	-0.13	-0.27	-0.388*	0.086
Traditional	-0.113	-0.07	-0.077	-0.376*	0.271
Other	0.302	0.108	-0.077	0.215	0.653
Non-Akan	-0.166	-0.036	0.274	-0.023	-0.433*
HAS- Basic	0.244***	0.187	0.231***	0.226**	0.288*
HAS- High	0.053	-0.974	0.053	0.038	-0.236
GLSS 4					
Age25-34	0.151	0.199			
Age35-49	0.162	0.241	-0.095	0.135	
Age40-49					-0.142
Rural	-0.281**			-0.272*	-0.285
Female child	-0.066	-0.146	0.142	-0.112	0.063
Northern Region	-0.648***	-0.57***	-0.516*	-0.6***	-0.646**
Child's birth95-96	-0.233*	-0.227	-0.095	-0.186	-0.335
Child's birth97-99	-0.81***	-0.919***	-0.503*	-0.659**	-1.171***
Missing birth year	-0.04	0	-0.14	0.033	-0.164
Muslim	-0.035	0.004	-0.138	-0.173	0.167
Traditional	-0.305	-0.214	-0.464	-0.19	-0.389
Other	-0.042	0.068	-0.236	-0.261	0.422
Non-Akan	-0.292***	-0.354***	-0.096	-0.197	-0.44**
HAS- Basic	0.343***	0.328***	0.23***	0.418***	0.209*
HAS- High	-0.147***	-0.163**	-0.078	-0.181***	-0.097

Note: These coefficients are the estimated hazard rates using non-parametric proportional hazard model. Variant 1 consists of education and control variables such as women's age, rural residence, and Northern regional location, birth year and gender of child. Variant 2 comprises all the variables in Model as well as religion, ethnicity and household wealth. The final Variant 3 includes all the variables already mentioned as well as other determinants. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively.

Similar to women in rural residence, those located in the northern regions also show reduced risk of shortening breastfeeding. Compared to the southern regions, the north is less developed and hence less exposed, lack many health and socioeconomic infrastructure that may promote anything other than known cultural practices of lengthy breastfeeding. Also relating to religion, Muslims and Traditionalists tend to experience lower cessation risks of breastfeeding compared to Christians amongst younger women in GLSS 1. None of the samples in GLSS 4 however showed any statistical influence of religion on breastfeeding. Meanwhile, the non-Akan ethnic group seems to breastfeed for longer duration than the Akans, especially in GLSS 4 where it is mostly statistically significant.

The estimates also show a clear and consistent association between child's birth year and breastfeeding duration. It appears that, all else held equal, children born in later years do not stand the risk of earlier termination of breastfeeding. For example in GLSS 1, children born in 1985 and 1986 as well as those born in 1987 and 1988 tend to be breastfed for longer than those born in 1982 to 1984, the default category. Similarly in GLSS 4, children born in 1995 and 1996 (full sample) receive longer breastfeeding, and more so with regard to those born in 1997 to 1999, than 1992 to 1994. Unlike the child's birth year, mother's age somewhat depicts the mixed results found in existing empirical literature on developing countries. Results in Variant 2 do not show any influence on the duration of breastfeeding in the country. However in GLSS 1, signs on the coefficients are negative and found significant at the 10 percent level in the younger aged (15-34) sub-sample of Variant 3; whilst a contrary outcome is observed in GLSS 4 (Appendix B-22). It also appears that mothers are more likely to breastfeed female infants for longer periods than males, but only in GLSS 1 and mainly in rural communities. This however does not suggest discrimination. One of the common reasons given for such outcomes is that infant males feed more and therefore are weaned earlier to meet their increased demand for food.

The “basic” household asset score also show a consistent positive relationship with the duration of breastfeeding. This suggests that women in households that own standard basic household goods and housing qualities tend to have increased hazard of shortening breastfeeding, ceteris paribus. And this is statistically significant in both survey periods as well as all sub-samples except the rural residence sub-sample in GLSS 1. All else held constant, estimates of the full samples of GLSS 1 and 4 indicate that the risk of discontinuing breastfeeding increases approximately by 24 and 34 percent respectively. The coefficient magnitudes of the sub-samples in GLSS 1 do not differ much from the full sample. Yet in GLSS 4, the risk amongst women residing in rural areas is about 10 percent higher than urban women. Similarly younger women (age15-34) face about 20 percent increased risk than older women (age35-49). The positive association observed here concurs with the results of Akin et al. (1981), who also explain that such results is indicative of breastfeeding being seen by such households as inferior goods.

In contrast women with “high” household assets tend to have reduced risk of discontinuing breastfeeding, but found statistically significant in only GLSS 4: full sample, rural and younger women sub-samples. Breastfeeding duration amongst women in these households thus increases with wealth, implying that the practice is observed as a “normal good” (Akin et al., 1981).

Community characteristics

This section discusses additional socioeconomic determinants of breastfeeding included in the econometric estimations that makes up Variant 3. The abridged version is presented in table 3.28. All of these variables are community based except distance to the nearest water source, which was collected at the household level. Quite surprisingly, none of these variables show any statistical significance in GLSS 1. In contrast, the estimates in GLSS 4 lend support to the premise that market distance, other commodity prices (that is the price score of "cereals" in this case), and the proportion of women to male agricultural wage rates influence the duration of breastfeeding.

Table 3.28: Hazard Estimates of Other Determinants: Variant 3, GLSS 1 & 4.

GLSS 1	**Full**	**Rural**	**Age15-34**	**Age35-49**
Water distance	-9.98E-06	-9.24E-06	-9.35E-06	2.30E-05
Market distance	-4.93E-05	0.001	-4.14E-04	-0.003
Access to Health facilities/personnel	-0.046	-0.046	-0.089	0.13
Price score of "foodstuffs"	0.105	0.076	0.068	0.078
Price score of "cereals"	-0.014	-0.027	0.017	-0.103
Log of real Men's Agric. Wage	0.026	0.035	0.002	0.047
Ratio of female to men's wage	-0.231	-0.25	-0.173	-0.402
Ratio of child to men's wage	-0.127	-0.01	-0.153	-0.016
GLSS 4				
Water distance	2.24E-06	2.63E-06	2.35E-05	2.23E-06
Market distance	0.004**	0.004**	0.005**	0.003
Access to Health facilities/personnel	-0.075	-0.083	-0.043	-0.136
Price score of "cereals"	0.11***	0.095**	0.1*	0.157*
Price score of "foodstuffs"	-0.032	-0.017	-0.026	-0.062
Log of real Men's Agric. Wage	0.025	0.038	0.029	0.014
Ratio of women to men's wage	-0.245*	-0.259*	-0.42**	-0.02
Ratio of child to men's wage	0.023	0.028	0.137	-0.177

Note: These coefficients are the estimated hazard rates using non-parametric proportional hazard model. Variant 1 consists of education and control variables such as women's age, rural residence, and Northern regional location, birth year and gender of child. Variant 2 comprises all the variables in Variant 1 as well as religion, ethnicity and household wealth. The final Variant 3 includes all the variables already mentioned as well as other determinants. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively.

The results in this later survey period show that a kilometre increase in distance to the nearest market increases the hazard of stopping breastfeeding by 0.4 percent on the average for all women, ceteris paribus. This result adds to the evidence that the value of a woman's time affects her breastfeeding duration. Since it is women who usually shop for households, the opportunity cost of her time increases with lengthen breastfeeding; hence may tend to shorten the practice to meet some of these other household commitments. Also most women in the country work in the informal sector, which constitutes mostly petty trading in local markets, thus when the distance to their place of work increases, they may choose to breastfeed for a shorter period. Although the explanation regarding trading may relate with findings on employment in some studies, especially those in developed countries (Yngve and Sjöström, 2001; Dennis, 2002), it contrasts with that of Lakati et al. (2007) in Nairobi. They found no significant association between the duration of breastfeeding and employment; and explained that the mothers in the study were able to find ways of successfully combining work with breastfeeding. This probably explains the statistically insignificant relationship observed in GLSS 1.

The price score of "cereals" also increases the hazard of terminating breastfeeding whilst the proportion of women to men's agricultural wage rates reduces it. These two variables might seem to show perverse outcomes. Although with regard to the former, they may actually be a reflection of increased household incomes in farming (producer) households and thus the ability to afford breast milk substitutes. It may also increase the time cost of the women, as her assistance might be required in the fields of production or the markets for trading.

Equally, one would have expected that an increase in the proportion of women to men's agricultural wage rates is an indication of increased opportunity cost of her time, and therefore possible shorter duration of breastfeeding. But the converse result found here might be evidence of some level of autonomy in the household, achieved as a result of the possible economic gains from increased wage rates. Hence the woman may be in a position to decide when to have birth, the number of children to have and how to space them. Breastfeeding practices might help in the last two, especially in societies where contraceptive use is uncommon or accessible; longer breastfeeding periods may act as contraception. Appleton (1996) finds similar results in Cote D'Ivoire regarding the predicted values of women's share of household cash income.

3.2.3 Age at Cohabitation

3.2.3.1 Background and Literature Review

Cohabitation is specified as all consensual unions including marital and non-marital. Age at cohabitation is described as one of the immediate determinants of fertility since the risk of conception increases with exposure to cohabitation. Thus with delayed age at cohabitation, fertility is likely to be reduced due to limited number of more fecund years available in the reproductive period; and also reduced desire for children because partners might have developed characters and commitments during the delayed period prior to cohabitation that may conflict with the demands of big family sizes (Bulatao and Lee, 1982). Similar to contraceptive use, age at cohabitation needs to substantially increase for a dramatic decline in fertility in developing countries. Bongaarts et al. (1984) argue that reductions in fertility will only occur in societies where increases in contraceptive use and age at marriage are sufficiently large to outpace the effects of the shortening of breastfeeding. They indeed observed such impacts in urban and amongst well-educated women in relatively developed African countries.

There have been other evidences of delayed timing of cohabitation on reduced fertility (Appleton, 1996; Baizán, 2003), which could subsequently reduce population growth and improve economic development. This is because in addition to fertility reduction, cohabitation is likely to influence school attendance, labour force determination of women and hence social status, inequality in income and ability as well as the distribution of income and other household resources (Becker, 1973; Bloom and Reddy, 1986). The study of cohabitation patterns thus becomes essential in lieu of such varied influence on society. This notwithstanding, the timing of cohabitation may not always be due to the desire to influence fertility, but rather, actually be the consequence of it. Highly fecund women are also more likely to enter into early cohabitation; also not ignoring the fact that in some societies marital status of women is determined by their fecundity, resulting in some sort of self-selection and reverse causality. There may also be some unobserved or unmeasured parameters that influence both fertility and timing of cohabitation simultaneously making the latter an endogenous variable in an analysis of a fertility model. Appleton (1996), Baizán (2003), and Billari and Philipov (2004) found such an outcome in their fertility analysis on Cote D'Ivoire, Spain and Central and Eastern Europe respectively.

Not only does the possible endogeneity of the timing of cohabitation require that its estimates in a fertility model without variables to control endogeneity would not be consistent, but also it being a proximate determinant necessitates for the search for factors that influence it. Among others, education seems to be one of the notable determinants of age at cohabitation from the various empirical studies examined (inter alia Bloom and Reddy, 1986 in India; Weinberger, 1987; Martin, 1995; Singh and Samara, 1996; Billari and Philipov, 2004 in Central and Eastern Europe; Ikamari, 2005 in Kenya; and Behrman et al., 2006 in Guatemala).

Often, years spent in school by women or even men prevent early cohabitation. In most societies, the two are incompatible due to their demanding nature (Appleton, 1996) as well as lack of economic resources to achieve efficiency in both institutions. Thus, enrolment in school in itself is enough to postpone marriage to a later age. Billari and Philipov (2004) for instance find a significant impact of enrolment, even more than the current level of education, on the timing of first union in Central and Eastern Europe. Education also exposes women to many career opportunities that stifle desires for early cohabitation. Becker (1991; cited in Billari and Philipov, 2004) indicates that women with increased educational attainment benefit less from cohabitation. This is because with increased human capital as well as financial independence the economic advantage of cohabitation becomes less influential and hence they are more likely to postpone cohabitation. Singh and Samara (1996) also explain that young adults are encouraged to delay marriage due to increased access of women to formal and highly paid employment. They said this made being single affordable. With improved opportunities for educated women in SSA, young adults are encouraged to pursue diverse interests to improve their socio-economic status, which hitherto had been acquired through marriage and childbirth. Also as years of education increases, women get exposed to other value systems to the neglect of the traditional system of early marriage and increased childbirths. Caldwell et al., (1992) points out that early marriage is likely to be avoided by young and educated people with the increased demand for contraceptives to avoid pregnancies and hence forced marriages usually observed under the traditional system.

As well as education, another factor also noted as influential in determining the timing of cohabitation is urbanisation, as pointed out by Bongaarts et al. (1984). Both factors are somewhat related whereby one sometimes works in conjunction with the other to delay cohabitation. Urban women are usually more educated and with higher opportunity cost of their time relative to their rural counterparts. However, both also have their unique contributions to the timing of cohabitation. Women in urban areas are less influenced by traditional or cultural norms that promote early marriage. Also, exposure to cosmopolitan life-style patterns in cities directs their decisions on the timing of cohabitation. For instance, Ikamari (2005) finds rural women are 1.13 times more likely to enter into a first marriage relative to urban women. Additional influential factors of the timing of cohabitation include parental background, family norms and values, age, religion and ethnicity, as well as community infrastructure.

3.2.3.2 Econometric Model, Specification, Data and Variables Used

The econometric formulation is based on a section of Boulier and Rosenzweig's (1984) theoretical framework on search time (also expressed as the timing of consensual union) that outlines the mating process in the marriage market. In this framework, they show a mating process that occurs for the individual in a heterogeneous society with a life-cycle timing of family formation, which is based on Becker's (1973) positive assortative mating of persons with complementary characteristics and Keeley's (1977) search payoffs in the marriage market. Thus, marital matches are made through a search period, and the payoff to delayed marriage is the likelihood of finding a "better" spouse (defined as spouse with greater expected earnings potentials). The theory also holds when there exists a strong household division of labour relating to market and non-market activities between partners, and education is presumed to be a complementary factor in the "marriage production" (ibid). The mating function (the marital payoff) formulated, which is similar to the individual's earnings function relates the human capital, or earnings potential, or other traits of the spouse obtained through search in the marriage market to the individual's endowments such as schooling, search time as well as characteristics of the marriage and labour markets. For an individual (*i)* woman (*w*) the function is expressed in a linear form as:

$$M_i^{wp} = \beta_0^w + \beta_1 E_i^w + \beta_2 S_i^w + \beta_3 \chi_i^w + \beta_4 G^w + \beta_5 G^p + \beta_6 d^p + \beta_7 r^w + \varepsilon_{i1}^w \text{ --------- (34)}$$

where M_i^{wp} is the human capital of spouse (*p*) of the individual (*i*) woman (*w*), and the explanatory variables *E*, *S*, and χ are the education level, search time, and other characteristics (beauty, culinary abilities or intelligence) of the woman that attracts higher-quality partners respectively; *G* represents gender-specific labour market conditions, *d* and *r* are features of the marriage market reflecting the dispersion of potential mates and the ratio of potential mates to competitors respectively whilst ε is the error term. The anticipated outcomes for education, search time, other attractive characteristics and the ratio of potential mates to competitors are positive whilst the dispersion of potential mates is negative.

However, Boulier and Rosenzweig (1984) argue that search time and education might be endogenous in the framework and therefore developed a series of functions to overcome the problem. Search time is modelled on a concept related to two different but connected stages of the life cycle of the individual. One stage is the period when the individual is younger and in formal education and the other is the post-school single state phase till union formation. First, Boulier and Rosenzweig explain that the offspring who live π years, endowed with a level of attractiveness and provided with an optimal level of schooling, selects an optimal search time, and hence mate, by maximising lifetime welfare that equals weighted sum of per period utilities in the post-school, unmarried, and married states. This is given by the expression:

$$\max W_i = (S - E_i)Q_i + (\pi - S_i)I_i \text{ ---------------------------------- (35)}$$

subject to the mating function of equation (34).

In equation 35, Q_i represents post-school "single" income, or utility per period, π represents years offspring lives, I_i represents per period marital income or utility accruing to offspring *i*, and *E* and *S* are as previously defined.

Per period single and marital welfare are described by the functions $Q_i^w = Q(E_i^w, \chi_i^w, G^w)$ and $I_i^w = I(M_i^{wp}, E_i^w, \chi_i^w, G^w, G^p)$, where, presumably, Q_1, Q_2, Q_3, >0; and I_1, I_2, I_3, I_4 >0. They show that own education and the attractiveness endowment contribute positively to both single and marital welfare. Own job opportunities also positively influence single's welfare and spouse's human capital, whilst job market opportunities contribute positively to marital welfare. The linear solution of the offspring's search equation therefore becomes:

$$S_i^w = \alpha_0^w + \alpha_1 E_i^w + \alpha_2 \pi_i^w + \alpha_3 G^w + \alpha_4 G^p + \alpha_5 d^p + \alpha_6 r^w + \alpha_7 \chi_i^w + \varepsilon_{i2}^w \text{ -----------(36)}$$

Search time by offspring is thereby explained as a function of the offspring's education, age, job opportunities in the labour market, dispersion of potential mates and the ratio of potential mates to competitors and other personal "attractive" characteristics.

The second model, explaining the stage that involves parents of the offspring, is based on the concept that the individual female is also an offspring of parents who might have invested in her education during her formative years by also considering her personal characteristics including "attractive" traits, which may be influential in the marriage market. Therefore parents provide an optimal education level to the offspring by solving:

$$\max_{Z,E_i} U = U\left[Z_i, W(\chi_i)\right] \text{ --- } (37)$$

subject to their budget constraint

$Y_i = p_Z Z_i + p_E E_i$ -- (38) and with some knowledge of offspring's behaviour characterised by equation (35). The linear solution to the parents' problem becomes:

$$E_i = \nu_0^w + \nu_1\pi_i^w + \nu_2 G^w + \nu_3 G^p + \nu_4 d^p + \nu_5 r^w + \nu_6 P_Z^w + \nu_7 P_E^w + \nu_8 Y_i^w + \nu_9 \chi_i^w + \varepsilon_{i3}^w \text{ ------- --} (39)$$

where p_Z and p_E are price indices of parental consumption goods and schooling respectively, Z_i is consumption goods and Y_i is income of the individual woman's family. Educational attainment thus becomes a function of the exogenous variables describing the offspring, the labour market, and the availability of partners, educational costs, and the family budget constraints. Meanwhile, the necessary first order condition for the offspring is:

$$(\pi - S)\beta_2 I_1 = I - Q = H \text{ -------------------------------------} (40)$$

which suggests that the optimal duration of search time is determined when the gains from marriage per unit of time, H, which is assumed positive, are equal to the marital search gains accruing over the duration of the marriage. Therefore the exogenous effects of changes in the marriage and labour market variables as well as education levels and the other "attractive" characteristics will affect search time depending on how they are assumed to affect the gains from search and the difference between welfare in marriage and when single. Also, the effects of changes in the conditions of the labour and marriage markets and the attractiveness endowment on educational attainment will depend on how such variables affect the costs and returns to education, as well as how education affects the search time.

Hence if the assumption that education raises market productivity relative to home, which suggests that education contributes more to single than marital income for the woman, whilst attractiveness increases gains to marriage, and time in school is not compatible with both work and marriage but spouse search can be carried out with schooling and work, then it could be observed that an exogenous increase in education will result in an increased age at which women marry holding the level of attractiveness constant. On the other hand, with the same level of schooling, attractive women are more likely to marry earlier as well as women resident in communities with high male to female sex ratio. Given that the likelihood of marriage is high with regard to women with attractive features, and/or women in marriage markets with favourable gender ratio, the reverse outcome could be that less attractive women and women in unfavourable marriage markets will achieve higher education levels than otherwise. Finally, increased job opportunities for younger women, and life expectancy would result in higher investments in education and search time because the overall payoffs to both would also increase.

Since the interest of this section of the study is mainly on the timing of consensual union (search time) a modified version of equation (36) is estimated due to lack of data. Hence, age at cohabitation is estimated as a function of education (E_i), age (π_i), current residence (R_i), regional location (L_i), religion (rl_i) and ethnicity (eth_i) as well as socioeconomic status (ses_i) of the woman's family and some community (com) variables. This is given as:

$$AC_i = \alpha_0 + \alpha_1 E_i + \alpha_2 \pi_i + \alpha_3 R_i + \alpha_4 L_i + \alpha_5 rl_i + \alpha_6 eth_i + \alpha_7 ses_i + \alpha_8 com + \varepsilon \text{ --------- } (41)$$

3.2.3.2.1 Explanatory Variables: Definitions, Descriptives and Expected Impacts

Similar to all the previous estimates of this study, the endogeneity of education though acknowledged, because of possible correlation between the error terms of the structural relationships of education as well as search time and the mating function, is not solved for lack of instrumental variables. However, the application of a discrete choice proportional hazard model in the econometric estimations, controlling for unobserved heterogeneity is expected to be advantageous in this regard. For not only would it control for the endogeneity of education but also for all the unobserved characteristics of the woman including her "attractiveness" endowment as well as other unavailable information that influences search time such as bride price or dowry. Education here is also measured in categorical terms and as already explained, expected to have a positive relationship with the timing of cohabitation. Variables like age, current/regional location, and the socioeconomic status of family also act as controls in the absence of identifiable instruments.

In spite of this, they also have their own direct impacts on age at cohabitation. The woman's age, for example, reflects cohort effects. Younger cohorts are expected to delay cohabitation compared to the older ones due to increased enrolment in school in over the years. The younger generation are also more exposed to modern cultures, have higher educational achievements and better job opportunities that discourages early marital or non-marital sexual unions to a large extent. Women in rural residence and/or northern regional locations have less dispersed potential partners because they are relatively less densely populated and undeveloped. Thus women resident in these areas are expected to marry relatively earlier than their urban or southern counterparts. Religious and ethnic beliefs are also likely to contribute to the timing of cohabitation but probably with less influence than education and urbanisation. Different ethnic or religious groups have their own norms regarding consensual unions and family formation, but most are likely to be pro-natalists and hence encourage earlier cohabitation. The Akans for example have been noted to be more likely to have early or premarital sexual unions compared to the other ethnic groups because of their matrilineal lineage (Addai, 1999b cited in Gyimah, 2003).

The education and occupation of the woman's father is included in the model to capture the socioeconomic status of the woman's family. These are measured in dummies such as "1" if father is has had some education and "0" otherwise; and "1" if father is a farmer and "0" otherwise. The anticipation is that an educated father is more likely to educate as well as have higher aspirations for his child relating to better job opportunities and potential partners, thereby extending the age at which the child enters into cohabitation. The outcome on father being a farmer however cannot be determined a prior since some farming households may want to keep their offspring for longer to help with household chores or home productions; whilst others upon an anticipation of a dowry increasing the household wealth may encourage earlier cohabitation.

Community characteristics included in the estimations are access to health facilities and personnel's, distance to the nearest school (primary, middle, and secondary), and agricultural wage rates for men, women and children. The first two sets of community variables contribute to child "quality" and thus cost to parents who especially have desires to increase their offspring's human capital. They also act as additional controls to education. And the theory on the demand for children suggests that the higher the cost of childcare, the fewer the demand for children and a higher possibility of increased age at cohabitation. Boulier and Rosenzweig (1984) also find that women in areas where life expectancy is relatively high (possible in areas where the prevalence of health facilities is high) invest more and achieve higher levels of education, which consequently means later entry into cohabitation. Increase in the price of formal education, measured as distance to the various levels of schooling in the community, may also lower educational attainments and therefore possible early entry into cohabitation. The impact of the returns to agricultural labour for men and women cannot be determined a prior, however that of children has the probability of increasing the desire for a larger family size and hence decrease the age at cohabitation.

The results on the community variable should however be taken with caution because they might not entirely reflect the conditions of the community when the women understudy were being brought-up. The available information is only on current community residence. Table 3.29 presents the descriptive statistics of the variables used in the reduced form model. Following previous procedures in this study, the models are estimated in the full sample, as well as rural/urban and younger/older sub-samples. The impact of education is also first estimated with the controls of age and current residence, and then additional two models are estimated with one controlling for family background and the other community variables as well.

Table 3.29: Summary Statistics: Age at Cohabitation, 1987/88 (GLSS 1)

	Full		Rural		Urban		Age1534		Age3549	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Explanatory										
None	0.454	0.498	0.539	0.499	0.312	0.463	0.379	0.485	0.664	0.473
Primary	0.133	0.340	0.132	0.338	0.135	0.342	0.148	0.355	0.092	0.289
Middle/JSS	0.362	0.481	0.306	0.461	0.456	0.498	0.419	0.494	0.201	0.401
Sec. & above	0.051	0.220	0.024	0.152	0.097	0.296	0.054	0.226	0.043	0.202
Still in School	0.046	0.210	0.041	0.197	0.055	0.228	0.062	0.242	0.000	0.000
Age15-24	0.362	0.481	0.366	0.482	0.356	0.479	0.491	0.500	0.000	0.000
Age25-34	0.376	0.484	0.365	0.482	0.393	0.489	0.509	0.500	0.000	0.000
Age35-49	0.262	0.440	0.269	0.444	0.251	0.434				
Rural	0.627	0.484					0.621	0.485	0.644	0.479
Northern Region	0.142	0.349	0.189	0.392	0.062	0.242	0.127	0.333	0.184	0.388
Father Schooled	0.313	0.464	0.238	0.426	0.440	0.497	0.357	0.479	0.191	0.393
Father Farmer	0.614	0.487	0.713	0.452	0.446	0.497	0.562	0.496	0.758	0.429
Christian	0.624	0.484	0.584	0.493	0.692	0.462	0.635	0.482	0.595	0.491
Muslim	0.138	0.345	0.108	0.311	0.187	0.390	0.133	0.339	0.152	0.359
Traditional	0.172	0.378	0.232	0.422	0.071	0.257	0.166	0.372	0.189	0.392
Other	0.066	0.248	0.075	0.263	0.050	0.219	0.066	0.248	0.065	0.246
Non-Akan	0.533	0.499	0.526	0.500	0.544	0.498	0.513	0.500	0.588	0.493
Access to Health facilities/personnel	0.000	0.792	0.000	1.000			-0.019	0.760	0.053	0.873
Primary distance	0.629	1.820	1.002	2.215			0.619	1.829	0.656	1.795
Middle/JSS distance	2.261	4.946	3.606	5.845			2.159	4.830	2.548	5.251
Sec. distance	13.482	19.614	21.383	21.088			12.964	18.813	14.937	21.658
Log of real Men's Agric. Wage	2.811	2.710	4.264	2.204			2.826	2.716	2.770	2.695
Ratio of female to men's wage	0.301	0.435	0.461	0.463			0.309	0.438	0.278	0.425
Ratio of child to men's wage	0.307	0.408	0.469	0.423			0.306	0.406	0.311	0.412

Table 3.29 contd: Summary Statistics: Age at Cohabitation, 1987/88 (GLSS 1)

	Full		**Rural**		**Urban**		**Age1534**		**Age3549**	
Variable	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Dependent										
Age at Cohabitation1	16.922	2.431	16.598	2.136	17.468	2.776	16.800	2.232	17.266	2.894
Age at Cohabitation2	16.873	2.271	16.597	2.053	17.365	2.545	16.746	2.133	17.186	2.558
Cohabit	0.909	0.287	0.930	0.255	0.874	0.332	0.878	0.327	0.997	0.058
Censored	0.091	0.287	0.070	0.255	0.126	0.332	0.122	0.327	0.003	0.058
	2237		1403		834		1650		587	

Note: Age at Cohabitation1 includes current age of those not yet cohabitated and Age at Cohabitation2 involves only completed age of cohabitated

3.2.3.2.2 Dependent Variable: Definition and Descriptives

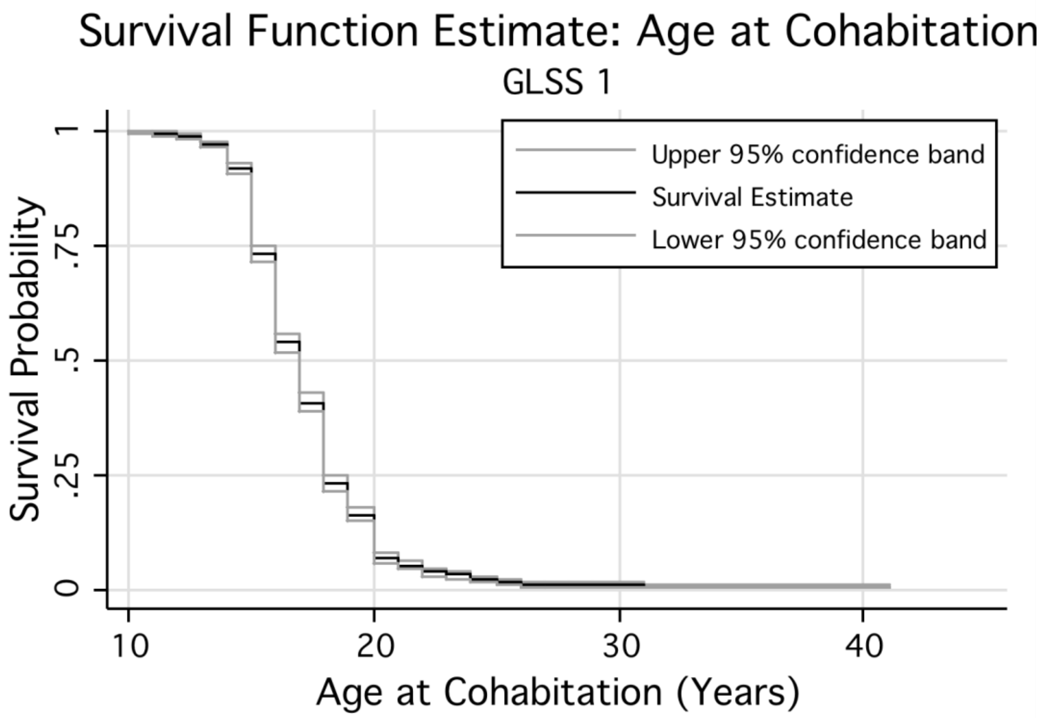
As already mentioned, age at cohabitation here is defined as all consensual marital and non-marital unions of women aged 15 to 49 inconclusive. The summary statistics show that the mean age at cohabitation is approximately 17 years and about 91 percent of the women understudy had cohabited at the time of the survey (Table 3.29: Full sample). The data lends support to the view that schooling and cohabitation is a relatively rare combination with less than 5 percent of the sampled women still in school. The data is also right censored because about 203 out of 2,237 women had not cohabited at the time of the survey; that is 9 percent censored. This makes the application of non-parametric proportional hazard model for the econometric estimations appropriate in achieving consistent results. It would also help to clear any possible underlying econometric bias resulting from the bunched-up responses observed in the sample. Table 3.30 shows estimates of the survival and hazard functions of age at cohabitation using the Kaplan-Meier estimator in equation (19). The survival and hazard are estimated given a particular time t_i (years) and the number of observation at risk (the number of women at age t_i or older who had not cohabited before that age), as well as those who failed (that is those who started cohabiting at age t_i) and those censored (women at age t_i, who have never cohabited or will not begin at that age).

It could be observed from the table that less than 5 percent of women in Ghana will reach the age of 22 without having ever cohabited. Indeed only 1 percent of the sampled women had not cohabited by age 26 and about half of that percentage will never cohabit if not done so by the age of 41. Also, the survivor function shows the median age of cohabitation as around 16 years with a survival probability of 54 percent. This is two years earlier than estimated for a neighbouring country, Cote d'Ivoire (Appleton, 1996) but similar to India (Bloom and Reddy, 1986). Figure 3.2 gives the graphic representation of the survival function with a 95 percent confidence interval.

Table 3.30: Age at Cohabitation: Survival Analysis; Failures, Censoring and the Kaplan Meier Empirical Hazard (GLSS 1 - 1987/88)

Years	Riskset	Failed	Censored	Survivor	N-A Cum. Hazard
10	2237	10	0	0.9955	0.0045
11	2227	3	0	0.9942	0.0058
12	2224	18	0	0.9861	0.0139
13	2206	34	0	0.9709	0.0293
14	2172	119	0	0.9177	0.0841
15	2053	413	66	0.7331	0.2853
16	1574	419	50	0.538	0.5515
17	1105	269	29	0.407	0.7949
18	807	354	16	0.2285	1.2336
19	437	127	8	0.1621	1.5242
20	302	181	5	0.0649	2.1235
21	116	23	7	0.0521	2.3218
22	86	25	6	0.0369	2.6125
23	55	11	4	0.0295	2.8125
24	40	12	4	0.0207	3.1125
25	24	10	1	0.0121	3.5292
26	13	2	2	0.0102	3.683
27	9	1	2	0.0091	3.7941
28	6	2	0	0.006	4.1275
29	4	0	1	0.006	4.1275
31	3	1	0	0.004	4.4608
40	2	0	1	0.004	4.4608
41	1	0	1	0.004	4.4608

Fig. 3.2



A comparison by school and residence also indicate that women with higher education as well as those residing in urban areas seems more likely to enter in cohabitation at a later age than those with no education and rural dwellers respectively (Table 3.31). Women with secondary and above level of education, for example, cohabit three years later than those with no education, at median survival rates. Women with middle/JSS level of education also appear to cohabit later, about year, compared to none or even primary education the quarter and 75th percentile survival rates. However, primary and no education seem to suggest roughly similar age at entry into cohabitation. It can also be observed that women who reside in urban areas cohabit about a year later than their counterparts in rural areas. Interestingly, women with no and those with secondary and above education behave similarly in both urban and rural locations, but those with primary as well as middle/JSS in urban cohabit later than those in rural areas.

There also seems to be no difference in the timing of cohabitation by age cohort. And a Log-rank test to check the null hypothesis of no subgroup differences in the survivor functions does not reject the hypothesis (Table 3.32). However, the null hypothesis is rejected at the 1 percent significance level with regard to the education and residence categories.

Table 3.31: Age at Cohabitation: Time at Risk; Incidence Rate, and Survival Time by School, Residence and Cohort (GLSS 1 - 1987/88)

	Time at risk	Incidence rate	No. of subjects	Survival 25%	time 50%	75%
Education						
None	16923	0.0570821	1016	15	16	18
Primary	4894	0.0529219	298	15	17	18
Mid/JSS	13873	0.0517552	809	16	17	19
Sec. & above	2165	0.0420323	114	17	19	21
Total	37855	0.0537313	2237	15	17	18
Residence						
Urban	14568	0.0500412	834	16	17	19
Rural	23287	0.0560399	1403	15	16	18
Total	37855	0.0537313	2237	15	17	18
Educ.;Res.						
None; Urban	4350	0.0556322	260	15	16	18
None; Rural	12573	0.0575837	756	15	16	18
Primary; Urban	1890	0.0481481	113	16	17	18
Primary; Rural	3004	0.0559254	185	15	16	18
Mid/JSS; Urban	6772	0.0490254	380	16	18	20
Mid/JSS; Rural	7101	0.0543585	429	15	16	18
Sec. & above; Urban	1556	0.0411311	81	17	19	22
Sec. & above; Rural	609	0.044335	33	17	19	20
Total	37855	0.0537313	2237	15	17	18
Woman's Age						
Age at/below 24	13304	0.0462267	810	15	17	18
Age between 25 &34	14416	0.0578524	840	15	17	18
Age between 35 & 49	10135	0.0577208	587	15	17	18
Total	37855	0.0537313	2237	15	17	18

Table 3.32: Log-Rank Test for Equality of Survivor Functions, 1987/88

	GLSS 1	
	Events Observed	Events Expected
Education		
None	966	845.08
Primary	259	220.77
Middle/JSS	718	789.99
Sec. & above	91	178.16
Total	2034	2034
chi2(3)		109.06
Pr>chi2		0.0000
Residence		
Urban	729	896
Rural	1305	1138
Total	2034	2034
chi2(1)		80.95
Pr>chi2		0.0000
Educ.;Res.		
None; Urban	242	223.47
None; Rural	724	621.61
Prim.; Urban	91	92.79
Prim.; Rural	168	127.98
Mid/JSS; Urban	332	448.78
Mid/JSS; Rural	386	341.21
Sec. & above; Urban	64	130.96
Sec. & above; Rural	27	47.2
Total	2034	2034
chi2(1)		166.6
Pr>chi2		0.0000
Woman's Age		
Age at/below 24	615	601.12
Age between 25 &34	834	834.96
Age between 35 & 49	585	597.92
Total	2034	2034
chi2(1)		0.85
Pr>chi2		0.6528

A discrete time proportional hazard specification is also applied in the estimation of covariates outlined in the theoretical framework. The application of this econometric model is due to the heavier cluster of responses around 14 to 20 years. The specification also allows for a flexible baseline hazard with no prior need for an assumption of a functional form as observed in the previous section on breastfeeding duration. And the maximum likelihood function, equation (32), employed here would give estimates on covariates with control for unobserved heterogeneity, as well as those without for comparison.

3.2.3.3 Estimation Results

The preferred results are presented in text showing coefficients only with stars to identify their level of significance. The full results can be found in the Appendix B-24 to B-28, giving details on t-statistics as well as results on estimates without the control of unobserved heterogeneity. Most of the estimates are observed with the same direction of impact but sometimes with different levels of significance in all the models. Also where statistically significant, the magnitudes are relatively larger in the models with controlled unobserved heterogeneity, suggesting that studies that do not control for them underestimate the influence of explanatory variables. The likelihood ratio test of the gamma variance finds unobserved heterogeneity statistically significant in all estimated samples except the sub-sample of women aged 15-34. The implication of a significant unobserved heterogeneity is that there exist unobserved characteristics in the sample under-study that also trigger the risk to cohabit in addition to the observed ones.

The Impact of Education

Analogous to other studies on the topic (inter alia Weinberger, 1987; Martin, 1995; Appleton, 1996; Singh and Samara, 1996; Billari and Philipov, 2004; Ikamari, 2005; Behrman et al., 2006), age at cohabitation is delayed with the rise in levels of education, especially from post-primary education (Table 3.33). Middle level education reduces the hazard of cohabitation by 23 percent relative to none, whilst secondary and above does so by about 99 percent, ceteris paribus (Variant 1: full sample). The magnitudes and statistical significance does not change much with the control of additional variables (Variant 2) but increases slightly more with the control of the community variables (Variant 3).

Table 3.33: Hazard Rate Models of Age at Cohabitation: the Impact of Education, 1987/88

GLSS 1	Full	Rural	Urban	Age15-34	Age35-49
Variant 1: Parsimonious					
Primary	0.083	0.161	-0.261	-0.012	0.382
Middle/JSS	-0.227**	-0.036	-0.802***	-0.189**	-0.38*
Sec. & above	-0.987***	-1.258***	-1.609***	-0.751***	-1.472***
Still in School	-1.083***	-1.394***	-0.897*	-0.986***	n.a
Variant 2: Full model					
Primary	0.074	0.095	-0.106	0.024	0.26
Middle/JSS	-0.225**	-0.138	-0.505**	-0.138*	-0.468*
Sec. & above	-0.922***	-1.426***	-1.086***	-0.636***	-1.555***
Still in School	-1.059***	-1.392***	-0.89*	-0.966***	n.a
Variant 3: Full model with rural community characteristics					
Primary	0.034	0.024		0.016	0.145
Middle/JSS	-0.298***	-0.271		-0.159*	-0.624**
Sec. & above	-1.053***	-1.874***		-0.644***	-1.976***
Still in School	-1.125***	-1.644***		-0.976***	n.a
Observation	2237	1403	834	1650	587

In the rural sub-sample however, only the highest level of education is found statistically significant; and women who reach that level show more than a 100 percent reduction in the hazard to cohabit early. The influence of education in urban areas on the other hand starts from middle/JSS, as do the remaining sub-samples. Interestingly, the educational impact in the older sub-group appears to be twice as large, or even more (Variant 3 & 4), as the younger sub-group. Women still in school also have lower risk to cohabit than otherwise. This corroborates the hypothesis that schooling is less compatible with marital or non-marital consensual unions.

Estimates of non-parametric baseline

Table 3.34 presents the estimated outcome on the non-parametric baseline hazard of Variant 1 for all the samples. These do not differ from the estimates of the other specifications. The results here suggest that compared to the base category of age 10-12, the hazard of entering into early cohabitation increases monotonically from 13 till 18 years, and then continues to increase but non-monotonically to beyond 25 years. Also, the highest hazard for cohabitation in the full sample occurs around 20 years. However amongst women living in rural areas, this occurs around age 22 and those in urban areas observe it around age 25 and above. Not surprisingly the estimated hazards in the older sub-sample appear higher, especially after age 17, than the younger sub-sample. This may be reflecting a less liberal view of women staying single for longer during the older era, when most women are encouraged to “settle”. Essentially, the clustered responses observed around 14 to 20 years in the descriptives are no longer present.

Table 3.34: Baseline Hazard Estimates of Age at Cohabitation from Model 1, GLSS 1.

Year	Hazard				
	Full	**Rural**	**Urban**	**Age15-34**	**Age35-49**
13	2.607***	2.441***	3.128***	2.676***	2.4***
14	3.91***	3.827***	4.288***	3.96***	3.741***
15	5.35***	5.317***	5.816***	5.327***	5.316***
16	5.766***	5.798***	6.449***	5.685***	5.768***
17	5.761***	5.797***	6.754***	5.679***	5.627***
18	6.643***	6.924***	7.687***	6.393***	6.789***
19	6.278***	6.707***	7.546***	5.961***	6.445***
20	7.498***	8.416***	8.814***	6.947***	8.022***
21	6.289***	7.017***	8.155***	5.707***	6.764***
22	6.828***	8.714***	8.131***	5.916***	7.809***
23	6.522***	8.232***	8.372***	5.788***	7.276***
24	7.076***	8.691***	9.177***	6.747***	6.841***
25plus	7.028***	8.583**	9.725***	5.985***	8.15***
constant	-6.791***	-6.299***	-6.906***	-6.826***	-6.724***
ln_varg (cons)	-1.33**	-0.662	-0.111	-3.638	-0.667
lltest	6.295	3.97	11.905	0.032	7.77
lltest_p	0.006	0.023	0.000	0.429	0.003

The Impact of Control Variables and Community Characteristics

Table 3.35 reports the estimates of the effects of the control variables in Variant 2 and the community variables in Variant 3. The coefficients of age cohorts show lower risk of cohabitation. For instance, compared to women between the ages 15 – 24 inclusive, those aged 25–34 and 35–49 are about 20 and 30 percent respectively less likely to cohabit if they had not done so by the time of the survey, ceteris paribus. The corresponding figures for the rural sub-sample are 32 and 44 percent. However the results of the urban and older sub-samples are not statistically significant.

As anticipated, women residing in rural areas are more likely to cohabit earlier than their urban counterparts, all else held constant. This may be reflecting the consequences of an "un-modernised" community as well as lack of job opportunities and/or relatively less dispersion of the population in these rural areas (Boulier and Rosenzweig, 1984). Younger women in rural residence are also noted as having greater risk to cohabit compared to those in urban areas; but this is not significant in the older women's sub-sample. In accordance to our expectation too, northern regional residence positively affects age at cohabitation but statistically significant mostly in specification Variant 3 (Appendix B-24 to B-28). Like rural residence, the area is less developed with lack of many infrastructures that promote investment in human capital.

With regard to the influence of family background, it is noted that women whose fathers are farmers are estimated as having higher risk of cohabitation than otherwise. This is also statistically significant in the urban but not the rural sub-sample. This probably is a reflection of migration upon cohabiting to increase the household wealth of parents; or the women from farming households move first to seek better socioeconomic lifestyle, which ends in an earlier cohabitation. Indeed it is not uncommon in the country for families to send their offspring to better-off relatives in towns for economic reasons as well as exposure to improved life-styles that might improve their chances of finding "better" partners. The lack of statistical significance in the rural sub-sample however may be due to a higher percentage of fathers who are farmers and thus lack of variation in the sample.

Also, the religious background of the family is only found significant in some sub-samples. The urban and younger sub-samples show that Muslims are more likely to cohabit earlier than Christians, all else held constant. However, women in families that practice the traditional religion cohabits later than Christians, as can be observed in rural and older sub-samples. Finally, the results also show that non-Akans tend to cohabit later than the Akans, which is expected as the matrilineal lineage encourage earlier births and has been observed to be more tolerant towards sexual behaviour and premarital sex (Fortes, 1978 and Addai, 1999b cited Gyimah, 2003).

Of the community variables controlled, only distance to the nearest primary and middle/JSS schools, as well as men's agricultural wage rate are found statistically significant in the study. As age at cohabitation is directly related to fertility decisions, it is expected that variables increasing the cost of child quality may delay cohabitation if they especially aspire to invest more in their offspring, that then reduce their desire for bigger family sizes. The converse will probably be the case if the family cares less about improvement in human capital or the opportunity to do so is unavailable. In our study, the former is more the case since the hazard to cohabit reduces by roughly 5 and 2 percentage points with a kilometre increase in the distance to primary and middle/JSS schools respectively, ceteris paribus. Distance to the various health facilities and personnel is however not found statistically significant. The returns to agricultural labour are only found relevant with regard to men, indicating that the risk of women entering into cohabitation increases as men's wage rates increase.

Table 3.35: Hazard Rate Models of Age at Cohabitation: the Impact of Control and Community Variables, 1987/88.

GLSS 1	**Full**	**Rural**	**Urban**	**Age15-34**	**Age35-49**
Variant 2: Full model					
Age25-34	-0.202**	-0.32**	-0.117	-0.138*	
Age35-49	-0.303***	-0.439***	-0.207		
Age40-49					-0.079
Rural	0.334***			0.335***	0.221
Northern Region	0.198	0.361	0.202	0.222	0.194
Father Schooled	-0.029	0.015	-0.104	-0.109	-0.094
Father Farmer	0.244***	0.149	0.471***	-0.014	0.136
Muslim	0.064	-0.252	0.392*	0.207**	0.083
Traditional	-0.121	-0.238*	0.061	0.048	-0.409*
Other	0.103	0.079	0.397	-0.003	-0.146
Non-Akan	-0.198**	-0.264**	-0.177	0.117	-0.377**
Variant 3: Full model with rural community characteristics					
Access to Health facilities/personnel	0.01	-0.071		0.06	-0.135
Primary distance	-0.049*	-0.065*		-0.017	-0.143**
Middle/JSS distance	-0.017*	-0.021		-0.012	-0.018
Sec. distance	0	0.005		-0.001	0.006
Log of real Men's Agric. Wage	0.041	0.102*		0.01	0.087
Ratio of female to men's wage	0.099	0.066		0.034	0.465
Ratio of child to men's wage	-0.031	-0.258		0.034	-0.254

3.3. Fertility: The Structural Model

This section models fertility adopting the theoretical framework of Bongaarts (1978), which proposes that changes in fertility are entirely the direct result of changes in proximate determinants; and that the effects of socioeconomic and cultural factors only work through these proximate determinants. This implies that introducing all proximate determinants in a model leaves no place for socioeconomic variables since their effects are already captured via the proximate determinants. Thus all the important variation in fertility is captured by variations of the proximate determinants of fertility and any residual direct effect is probably due to incomplete or inaccurate measurement of the proximate determinants (Bongaarts, 1982).

This chapter follows Appleton's (1996) method of modelling fertility because of the similarity of the datasets. Although the living standard data lacks month-by-month details of the DHS calendar data used by Baschieri and Hinde (2007), using two different sets of data in this chapter facilitates the observation of trends in fertility behaviour over a given period. The proposed structural equation model is tested on two independent samples in the same country. The first sample was collected in 1987/88 and the second in 1998/99.

Fertility is hypothesised to be a direct function of the proximate determinants: breastfeeding, contraceptive use and age at cohabitation, and an indirect function of education and other socioeconomic variables. These proximate determinants are selected on pragmatic grounds because of their strong correlation with fertility behaviour (Bongaarts in Bulatao and Lee, 1982) and data availability in the two surveys. They also cover two of the three principal proximate determinants of fertility outlined in Bongaarts et al., (1984) for SSA. Bongaarts et al., (1984) find that variations in postpartum infecundability and in age at marriage dominate the other sources of natural fertility variations. The former reflects differences in breastfeeding habits, as with an intermediate range of duration, each additional month of breastfeeding (without taking intensity to account) approximately adds over half a month to postpartum amenorrhea (ibid). Also, the norms of some cultures involves abstaining from sexual activities whilst breastfeeding, which greatly reduces the risk of conception.

This concurs with earlier studies like Nag et al., (1980) which found the four variables that increase fertility are: an occurrence of earlier resumption of ovulation and menstruation during the post-partum period as a result of decreased incidence and duration of breastfeeding; decline in the practice of postpartum abstinence; reduction in the loss of reproductive performance of women caused by early widowhood; and reduction in the incidence of sterility as a result of the improved treatment of venereal diseases. Also Jain (1981) focusing on the influence of education suggested that educated women's attitude towards breastfeeding, use of contraception and age at marriage affect fertility levels.

Contraception becomes crucial in fertility control when, upon exposure to modernisation or indeed education, women shorten traditional practices of breastfeeding as well as postpartum abstinence. In addition, contraceptive use can help in reducing or eliminating forced marriages due to unplanned pregnancies and subsequently big family sizes. Married couples are also able to avoid unwanted pregnancies and space births by using contraceptives, which in totality leads to controlled fertility levels and possibly set the demographic transition in motion. Martin (1995) and Martin and Juarez (1995) show how high variation in contraceptive use in some developing countries, like Latin America, Asia and

North Africa, determine variation in the total fertility of the educated and uneducated.

The timing of cohabitation (sexual activities) has also been noted as very influential in determining fertility levels. Delayed age at cohabitation for instance is highly effective in lowering fertility through lower exposure to intercourse in the early, more fecund years of the reproductive period (Bulatao and Lee, 1982). Empirical evidence of this negative association could be observed in studies such as Appleton (1996). However, the overall impact of these proximate determinants on fertility level could be negative, positive or insignificant depending on the direction of impact of the socioeconomic variables that influence them (Bongaarts et al., 1984). Thus Bongaarts et al., (1984) conclude that fertility decline will occur only in populations where increases in contraceptive use and age at marriage are sufficiently large to outpace the effects of the shortening of breastfeeding and the abandonment of postpartum abstinence as well as any declines in pathological sterility. Cleland et al., (1984) find that the greater fertility reducing effects of nuptiality and contraceptives use almost always compensate for the fertility increasing effects of shorter breastfeeding intervals among modern or enlightened populace.

Proximate determinants may be endogenous because of the act of self-selection (Bulatao and Lee, 1982) and/or have similar unobserved variables that may simultaneously determine the final outcome (Appleton, 1996). Couples may consciously control a proximate determinant with the aim of controlling fertility, which results in simultaneity and likely bias in estimated coefficients (ibid). Some examples include deliberate extension of breastfeeding or abstinence by more fecund women to reduce the risk of conception; fecund women marrying earlier because of their ease of reproduction[85]; deliberate delay of age at cohabitation to reduce fecund; and the possibility that fertile women may tend to use contraceptives to control their fertility.

These are some of the reasons behind this study's estimation of a "structural reproduction" model, of which the first stage involves the estimation of reduced form models of the proximate variables (as performed in section 3.2). Then the predicted values obtained are used in the second stage to estimate their influence on fertility. It is described as a structural model because it is the final of a two-stage regression procedure. However we do not have measures of all aspects of the proximate determinants controlled for, such as the intensity of breastfeeding and frequency of sexual intercourse. Consequently, there is likely to be a problem with omitted variables. The proximate determinants' endogeneity are therefore tested as well as the exclusion restrictions on the socioeconomic variables used as instruments.

The reproduction function thus estimated is:

$F = (A, C, B, \Lambda, \varepsilon)$ -- (42)

where F represents fertility defined variously as the probability of having at least one child, the number of children ever born, and the number of children conditional on least one birth[86]. The predicted median age at cohabitation is

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[85] An anecdotal evidence in Ghana for instance has indicated that some women are divorced because of their inability to bear children, whereas others have also been made to show their fecundity by conceiving or give birth before they are married or accepted as partners.

[86] The first two are estimated without including breastfeeding because not all the women have had children below the age of six to have information on that. However the outcome of the second is compared with the third that includes breastfeeding because the latter may be subjected to sample selectivity bias. But then breastfeeding duration would not influence the fertility of a woman who has

represented as A, predicted current contraceptive use as C, the predicted median duration of breastfeeding as B, and error term is ε. The woman's age $\mathbf{A}$ is controlled in all the estimations as well because it plays an important role in determining fecundity levels over the reproductive life span of the woman. All other things held constant, younger women are relatively less likely to have given birth or have had more births than older ones.

The analyses in section 3.2 so far give evidence to the premise that education influences the proximate determinants as anticipated, which consequently implies that it indirectly also influences fertility. Education, as noted, generally increases the use of contraception and the age at cohabitation, but reduces the duration of breastfeeding amongst women in the country. The impacts on the first two proximates are expected to possibly result in a reduction in fertility levels, whereas the last one may lead to an increase. For an overall negative impact on fertility, the negative influences of contraception use and age at cohabitation must be big enough to countermand the likely positive influence of shortened breastfeeding practices.

3.3.1 Estimation Results: Structural Determinants of Fertility

This sub-section examines the predicted impact of the proximate determinants on three different measures of fertility, and test for possible unobserved influences in the next sub-section. The three structural fertility models examined are: Model A – the probability of a woman having at least one child; Model B – the unconditional number of live births; and Model C – the number of live births conditional on one

never given birth, so in a way the impact of the proximates are being observed for different samples of the population, which we presume would also be of relevance to policy on the topic.

having already occurred. The first measure is estimated using a probit model, whereas the second and third are estimated using OLS regression methods. The presumption is that the proximate determinants may influence the onset of births and subsequent ones differently. There is also the econometric problem of sample selection bias. This is because only women who have ever given birth have information on the duration of breastfeeding. No attempt was made at controlling for this selectivity bias[87] that could affect Model C. This is due to lack of information on an exclusive variable or variables that might have effects on the probability of having at least one child but do not have any on the number of live births.

3.3.1.1 *The Probability of Having At Least One Child*

The probit model is estimated using predicted contraceptives[88] and predicted age at cohabitation for GLSS 1, but only predicted contraceptives for GLSS 4, as it does not have information on age at cohabitation. The model is also estimated without predicted age at cohabitation for GLSS 1 for robustness check; the difference in outcome between the two is quite negligible. This procedure is repeated with the estimations of the other fertility measures in this section, and the same patterns were observed. Table 3.36 presents the marginal effects of the proximate determinants on the probability of having at least one child in both survey years. Following earlier patterns in this study, only the coefficients of proximate

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[87] Appleton (1996) attempted at correcting the sample selection problem using a Heckman two stage procedure, but found the sample selection correction term insignificant. He explained it as being a possible consequence of using only a functional form as identification, so dropped it from the final estimations of the fertility models.

[88] All contraceptive methods are included in the fertility model as their current use.

determinants with their level of significance are presented in text for brevity. The relevant summary statistics and full results are given in Appendix B-29 to B-32.

The choice of a final model for analysis is based on a general-to-specific process. Two separate models consisting of actual and predicted values of proximate determinants are estimated to check their significance in predicting fertility. Subsequently, both the actual and predicted values are combined in an estimation to test for the exogeneity of the variables. A Hausman test with a null hypothesis that a particular proximate variable is exogenous is performed. If the predicted value is significant despite the inclusion of the actual values of the proximate determinant, the null is rejected. This implies the proximate determinant is endogenous, which is usually the outcome of our tests (not reported for brevity). Thus predicted values are used in all the analyses of the models in this section. Finally, age is included in all the models to control for exposure as well as fecundity. Although younger women are more fecund than older women, the latter are more likely to have given birth to at least one child by the time of the survey.

Table 3.36: Marginal Effects after Probit for Having a Child, 1987/88 &1998/99 (Structural Model A)

	Full	Rural	Urban	Age15-34	Age35-49
		GLSS 1			
Variant 1: Parsimonious					
Age at Cohabitation	-0.001	0.001	-2.58E-04	1.99E-04	5.79E-05
Traditional contraceptives	-0.152***	-0.176***	-0.209***	-0.236***	-0.002
Modern contraceptives	0.02	0.026*	-0.006	0.036*	-0.001
Variant 2: Full model					
Age at Cohabitation	-5.82E-05	4.31E-04	0.002	6.40E-05	2.60E-04
Traditional contraceptives	-0.133***	-0.106***	-0.153***	-0.198***	0.002
Modern contraceptives	0.026**	0.002***	-0.004*	0.041**	-2.89E-04
Variant 3: Full model with rural community characteristics					
Age at Cohabitation	-0.001	-5.04E-05	0.001	-1.57E-05	3.14E-04
Traditional contraceptives	-0.079***	-0.05***	-0.076***	-0.128***	-1.92E-04
Modern contraceptives	0.015*	0.002**	-0.002	0.03**	-2.85E-04
Observation	2237	1403	834	1650	587
		GLSS 4			
Variant 1: Parsimonious					
Traditional contraceptives	-0.038	-0.036	0.062*	0.103*	-0.003
Modern contraceptives	0.223***	0.193***	0.075	0.14*	-0.009
Variant 2: Full model					
Traditional contraceptives	0.037*	0.006	0.071**	0.132***	-0.002
Modern contraceptives	0.088***	0.106***	0.031	0.068*	0.003
Variant 3: Full model with rural community characteristics					
Traditional contraceptives	0.009	0.004	0.062**	0.03	0.001
Modern contraceptives	0.071***	0.061***	0.017	0.091***	0.001
Observation	5863	3657	2206	3921	1942

Note: These coefficients are marginal effects after estimating probit models. Variant 1 control for women currently in school, age, rural residence, and Northern regional location. Variant 2 controls for religion, ethnicity and household wealth in addition to those in Model 1. The final Variant 3 includes all the variables already mentioned as well as other determinants. See Appendix B-30. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. Sample weights are applied in the estimations of GLSS 4.

The estimated results of the proximate determinants regarding the probability of a woman having at least one child (Model A) are not consistent. As can be observed from the table above, age at cohabitation is found statistically insignificant. This is contrary to Appleton (1996) who found that age at cohabitation reduces this measure of fertility. However in GLSS 1, the probability of a woman having at least one child is strongly reduced by the use of traditional contraception. In the full sample for example, her chances at having at least one child are reduced by 15.2 percentage points in Variant 1, ceteris paribus. The corresponding figures for the rural, urban and younger women (age15 -34) sub-samples are 17.6, 20.9 and 23.6 percentage points respectively. The magnitudes however show a modest fall in Variant 2, and about half the size in Variant 3 where household wealth as well as community characteristics is included in the predictions.

The outcomes regarding traditional contraception here suggest that even though modern contraception is the more effective of the two, abstinence as traditional contraception surpasses all others (including modern contraception) in the effectiveness of achieving reduction in fertility. This may explain the results on traditional contraception in GLSS 1 where a higher proportion of women used the method (see table 3.1)

In contrast, GLSS 4 indicates a positive relationship between the use of traditional contraception and the probability of having at least one child. This is strongly significant mainly in urban areas and amongst younger women when household wealth is also controlled (Variant 2). The positive association is also observed in relation to modern contraception wherever statistically significant. This is not only in the case of GLSS 4 but also in GLSS 1 for all sub-samples except urban (Variant 2). Here modern and traditional contraception, tends to reduce the probability of having at least one child, ceteris paribus.

The results showing positive relationship between contraception (especially modern) and the probability of having at least one birth in both GLSS 1 and 4 seem perverse. However, a possible explanation is that most women in the study may be using contraceptives to space instead of prevent births. Moreover, the likelihood of first birth, right after marriage, is greater particularly in SSA, during which fewer women use contraceptives. Caldwell et al. (1992) find this outcome in their study where little practice of contraception between marriage and first birth is observed among married women. They note that the demand for contraception rather increased between subsequent births, which led them to conclude that the use of contraception for spacing is far more important than for stopping births in the region.

3.3.1.2 The Number of Children

This section discusses the estimation results of unconditional number of children born, as well as those born upon a woman having given birth to at least one child. Ordinary Least Squares (OLS) is used in these estimations. The exogeneity test explained in the previous section is also carried here. Similar to the probability of having at least one child, the number of births is estimated with the predicted values of the proximate determinants. Table 3.37 provides the effects of age at cohabitation and contraception on unconditional number of births (Model B), and table 3.38 presents the conditional model of at least one birth (Model C) that comprises the aforesaid proximate determinants as well as breastfeeding duration. Both "Models" are discussed concurrently. This is done first in GLSS 1, followed by GLSS 4. For each survey sample, the traditional method of Model B is initially discussed, and then followed by the corresponding outcome in Model C. The pattern is repeated for modern contraceptive use.

Table 3.37: Regression Results for Unconditional Number of Children Ever Born, 1987/88 &1998/99 (Structural Model B)

	Full	Rural	Urban	Age15-34	Age35-49
		GLSS 1			
Variant 1: Parsimonious					
Age at Cohabitation	-0.012**	-4.81E-04	-0.005	-0.001	0.008
Traditional contraceptives	-0.248***	-0.388***	-0.245**	-0.329***	-1.069***
Modern contraceptives	-0.263***	-0.044	-0.452***	-0.107*	-0.03**
Variant 2: Full model					
Age at Cohabitation	-0.004	0.003	0.005	-0.004	-0.02*
Traditional contraceptives	-0.327***	-0.383***	-0.624***	-0.329***	-0.307*
Modern contraceptives	-0.154***	0.007*	-0.036***	-0.041	-0.021**
Variant 3: Full model with rural community characteristics					
Age at Cohabitation	-0.011**	-0.012**	0.003	0.004	-0.02*
Traditional contraceptives	-0.143*	-0.088	-0.35***	-0.191***	0.02
Modern contraceptives	-0.115**	0.001	-0.033***	-0.062	-0.012**
Observation	2237	1403	834	1650	587
		GLSS 4			
Variant 1: Parsimonious					
Traditional contraceptives	-0.147	-0.412***	-0.119	0.336**	-0.382***
Modern contraceptives	0.064	0.399***	-0.04	-0.259	-1.963***
Variant 2: Full model					
Traditional contraceptives	-0.083	-0.319***	-0.095	0.19**	-0.331***
Modern contraceptives	-0.065	0.199*	-0.103	-0.109	-0.513***
Variant 3: Full model with rural community characteristics					
Traditional contraceptives	-0.096*	-0.14***	-0.051	-0.027	-0.267***
Modern contraceptives	0.027	0.14**	-0.078	0.089	-0.069
Observation	5863	3657	2206	3921	1942

Note: These coefficients are marginal effects of the OLS regression models. Variant 1 control for women currently in school, age, rural residence, and Northern regional location. Variant 2 controls for religion, ethnicity and household wealth in addition to those in Variant 1. The final Variant 3 includes all the variables already mentioned as well as other determinants. See Appendix B-31. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. Sample weights are applied in the estimations of GLSS 4.

Table 3.38: Regression Results for Number of Live Births Conditional on One, 1987/88 &1998/99 (Structural Model C)

	Full	Rural	Urban	Age15-34	Age35-49
		GLSS 1			
Variant 1: Parsimonious					
Age at cohabitation	-0.011**	-0.006	-0.004	-1.39E-04	-0.003
Traditional contraceptives	0.099	-0.017	0.326	-0.015	-0.23
Modern contraceptives	-0.275***	-0.08	-0.513***	-0.164**	-0.02
Breastfeeding duration	-0.004	0.002	-0.009	0.001	0.013
Variant 2: Full model					
Age at cohabitation	-0.007	3.22E-04	-0.01	-0.003	-0.02
Traditional contraceptives	-0.011	-0.398*	-0.436***	0.008	-0.183
Modern contraceptives	-0.204***	0.008	-0.036***	-0.14**	-0.021**
Breastfeeding duration	9.76E-05	0.001	0.014	-0.011***	0.014
Variant 3: Full model with rural community characteristics					
Age at cohabitation	-0.011*	-0.011*	-0.013	0.003	-0.038***
Traditional contraceptives	-0.041	-0.048	-0.259***	-0.033	0.056
Modern contraceptives	-0.1*	0.002	-0.034***	-0.112*	-0.009*
Breastfeeding duration	-0.001	0.007	-0.002	-0.009*	0.015
Observation	1409	936	473	1064	345
		GLSS 4			
Variant 1: Parsimonious					
Traditional contraceptives	0.059	-0.316**	-0.435***	0.407*	-0.134
Modern contraceptives	-1.485***	-0.487**	-0.861***	-1.499***	-2.046***
Breastfeeding duration	-0.002	0.001	0.008	0.001	0.014
Variant 2: Full model					
Traditional contraceptives	-0.265**	-0.382***	-0.435***	-0.055	-0.172
Modern contraceptives	-0.501***	-0.175	-0.712***	-0.508***	-0.327
Breastfeeding duration	-0.001	0.001	-0.007	0.004	0.036***
Variant 3: Full model with rural community characteristics					
Traditional contraceptives	-0.143**	-0.165***	-0.204*	-0.068**	-0.197*
Modern contraceptives	-0.148*	-4.54E-05	-0.468***	-0.137	-0.063
Breastfeeding duration	0.002	-0.006	-0.007	0.003	0.027*
Observation	2447	1746	701	1690	757

Note: These coefficients are marginal effects of the OLS regression models. Variant 1 control for women currently in school, age, rural residence, and Northern regional location. Variant 2 controls for religion, ethnicity and household wealth in addition to those in Variant 1. The final Variant 3 includes all the variables already mentioned as well as other determinants. See Appendix B-32. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. Sample weights are applied in the estimations of GLSS 4.

Age at cohabitation reduces both the number of children ever born as well as the number of births conditional on one having already occurred in GLSS 1. The reduction in the number of births, in both instances, is around 1.1 percentage point for all women in Variants 1 and 3, ceteris paribus. This outcome is analogous to Appleton (1996), but this study’s magnitude is comparatively smaller. Appleton (1996) finds that a delayed cohabitation by 3 years is predicted to reduce the number of births a woman has ever had by 1.

This study also finds women residing in rural areas, as well as older women (aged35-49), seem to have reduced number of births with delayed age at cohabitation, especially in Variant 3 of both Models B and C. The older sub-sample (aged35-49) for instance indicate that delaying age at cohabitation by one year will perhaps reduce the number of births and the number of births conditional on one by about 2.0 and 3.8 percentage points respectively, ceteris paribus. The older sub-sample is presumed to somewhat give a closer view of the actual impact of age at cohabitation and indeed all the other proximate determinants, since nearly all the women at this age had cohabitated and nearing the end of their fecundity or have completed number of births. Estimates of the urban and younger (aged15-34) sub-samples are statistically insignificant.

The general negative impact of age at cohabitation observed might be due to cultural values, which discourages cohabitation especially when it is not marital and reasons of childbirth (Caldwell and Caldwell, 1987). It also aids sexual abstinence, which is the primary contraceptive advocated by traditionalists (ibid).

All else held constant, traditional contraceptives use relative to modern or no contraceptives is also estimated as having lowering effects on fertility (Models B and C) whenever found statistically significant in GLSS 1. However, this is often observed in the former compared to the latter Model. What might probably be an explanation to the outcome in Model C is the inclusion of the duration of breastfeeding (another kind of traditional contraception), which obstructs the latter's statistical influence. Another reason might be that upon having already had a child, the women become more careful and opt for a more effective contraception (that is if abstinence is not an option). It could also be observed that the estimated magnitudes of the urban sub-samples are usually bigger than the rural ones where both are statistically significant in Models B and C. Disaggregating the samples into young and old show similar and strong limiting influence in the two sub-samples, but the older sub-sample have about three times the magnitude of the younger one (Model B, Variant 1). That is a percentage increase in traditional contraception has 0.33 reductions in the unconditional number of births by younger women whilst the analogous figure for the older women is one birth, ceteris paribus. Variants 2 and 3 in the same "Model" do not show such dramatic difference, and those in Model C do not show any statistical significance.

Meanwhile in GLSS 4, the estimates of traditional contraception show rather more inconsistent outcomes especially in Model B. For example, in the full sample, the negative association of traditional contraceptive use and fertility is only found statistically significant in Variant 3 at the 10 percent level. In contrast, the method is observed as having a stronger negative influence in all the specification models in the rural but none in the urban sub-sample. The results in the urban sub-sample are quite unexpected since we anticipate that the prevalence of contraceptive use in urban areas should be relatively high and significant. The younger sub-sample also indicates perverse results where significant whilst the older sub-sample suggests traditional contraceptives use reduces the number of births by approximately one child with a three percent increase in use, ceteris paribus. Upon conditioning on having given birth to at least one (Model C) in the last five years prior to the survey however, traditional contraceptive usage becomes more statistically significant in many of the specification variants. This includes the urban sub-sample, and they also show the expected sign in most of the samples where found statistically significant[89].

Modern contraception also appears to reduce the number of births in GLSS 1 whenever found statistically significant, except for the rural sub-sample of Variant 2 (Model B). In the urban sub-sample for instance, modern contraception is predicted as having about 45.2 percentage points' reduction in fertility whilst the figure for all women is 26.3 (Variant 1). Variants 2 and 3 however indicate a substantially lower impact in magnitudes amongst women in urban areas. Demarcation of the sample by age groups also shows statistically stronger support for modern contraception among the older age group, albeit with a much smaller magnitude. The association between contraceptive use and the number of births conditional on at least one having already occurred (Model C) is similarly negative and mostly statistically significant at the 1 percent level, except in rural areas (where none is significant).

In GLSS 4, there appears to be no relationship between modern contraceptive use and the unconditional number of live births in the full sample (Model B). Indeed the only significant sub-samples are the rural and the older sub-samples. These however have contrasting direction of impact. Women in rural areas seem to have increased number of births with contraceptive use, whilst the older women are observed as having fewer births. A plausible explanation to the increase in the number of births as a result of the use of modern contraception in rural areas is probably due to the lack of knowledge of correct usage leading to ineffective outcomes. The older sub-sample however indicates the anticipated outcome of a

[89] Except the younger aged sub-sample of Variant 1, which indicates a relatively weak positive association between traditional contraceptive use and fertility given that at least one birth had already occurred.

strong and considerable reduction in the number of births as a result of increased contraceptive use amongst women in the cohort. They experience up to two fewer births with a percentage increase in modern contraceptives use, ceteris paribus. The results in Model C show more statistically significant outcomes with similarly high magnitudes of impact amongst the older women. Generally, women who use modern contraception would have about one and a half fewer births conditional on having already had one, ceteris paribus (Full sample, Variant 1). This is more so in urban compared to rural areas, as well as amongst older compared to younger women.

So far it has been commonly observed that both traditional and modern contraceptive use limit fertility, whether unconditional or conditional on having had one birth. In samples where both are found significant however, modern contraceptives use appears to have a higher limiting control than the traditional methods in GLSS 4. The reverse is the case in GLSS 1. This fairly substantiates the premise that all else held constant, modern contraception is the more effective of the two methods, but only when abstinence (traditional method) is less practiced. Also as expected, the impacts observed amongst urban contraceptive users often appear relatively larger than those of rural women.

The generally negative association between contraceptive use and fertility to some extent gives support to the presumption made previously that contraceptive use is largely for the control of subsequent and hence total number of births but apparently not for first births. This is probably because women who already have children tend to be more conscious at controlling subsequent births, primarily with aim of spacing births; which could eventually lead to total fertility reduction. This is because of the fixed fecund phase of women in general.

In contrast to the other proximate determinants, this study finds estimates of breastfeeding duration statistically significant in only the younger (aged15-34) and older (aged35-49) sub-samples of GLSS 1 and 4 respectively (Variants 2 & 3). The former shows a negative association whilst the latter suggests a positive association between breastfeeding and number of births conditional on one birth. These conflicting outcomes are quite puzzling, since that of GLSS 1 for instance suggests that only women aged between 15 and 34 may experience the advantages of prolonged breastfeeding duration. But then again this could mean that the younger women who tend to breastfeed for shorter periods do so more intensively, which possibly triggers the hormones that inhibit early ovulation and hence the lower risk of conception. It may also explain why the results in the older sub-sample in GLSS 4 show that these women experienced increased births with breastfeeding. That is, although the older women might have breastfed for longer, it might not have been perhaps intensive, resulting in shortened period to ovulation.

However why it happens in the different sub-sample differently may possibly be explained by the different sampling methods of the two survey years. Appleton (1996) finds a similar confounding outcome in Cote d'Ivoire that indicated a negative association between breastfeeding and fertility amongst only women aged over 35. The estimated coefficients in this study is relatively small; as younger women extending their breastfeeding duration by 12 months are predicted as having 0.13 fall in fertility in GLSS 1, ceteris paribus. In contrast, an older woman acting in the same manner is associated with increased fertility by roughly 0.42 in GLSS 4.

3.3.2 Sensitivity Analysis

In order to examine whether the explained variation of the proximate determinants used in this study captures all the variations in the various fertility outcomes employed, education and the other socioeconomic variables are introduced into the structural models. This results in a semi-reduced form model where the socioeconomic variables are examined to see whether they still have direct impacts on fertility despite the presence of the proximate determinants earlier estimated. If the socioeconomic determinants are found significant despite the control of the proximates, then it means the structural models estimated earlier with only the proximate determinants have not accounted for all the variation in fertility. This subsequently makes the analysis conducted subjective to omitted variable bias. The converse outcome is what is anticipated because according to the proximate fertility model by Bongaarts (1982), almost all the critical variation in fertility is captured by variations in the proximate determinants. Any residual from the model is probably due to any unobserved or unmeasured proximate determinants excluded from the model. Thus there must be no direct impact of socioeconomic variables on fertility once all proximate determinants are controlled for, as in a perfect model.

This is however not the case in this section, as results from the sensitivity analyses show. The results are presented in tables 3.39 and 3.40 for GLSS 1 and 4 respectively. They show estimates of the full sample[90] for the three fertility measures: the probability of having at least one child (Model A), the unconditional number of births (Model B) and the number of births conditional on one having

[90] The sensitivity analysis was also conducted for the rural/urban, as well as the younger/older age groups but not reported for brevity. They give similar results patterns, albeit with slightly different coefficient sizes and statistical significance.

already occurred (Model C). The proximate determinants, contraceptives, age at cohabitation and breastfeeding duration, are controlled in the models as predicted values of the specification variant 3 estimated under the various proximate sub-sections under section 3.2.

They suggest that our structural fertility models do not account for all the variation in fertility. This is because some of the socioeconomic determinants still have direct impact on fertility despite the presence of the proximate determinants; some of which are also statistically significant. This implies that a proportion of the variation in fertility is still unexplained and may be found in the residuals; it seems plausible that this is correlated with the socioeconomic variables. The outcome is not surprising because information on some of the key proximate determinants outlined by Bongaarts and others including Bulatao and Lee (such as induced and spontaneous abortion, rate of sexual intercourse, and intra-uterine mortality) are not available for this study. Nonetheless, with the majority of recommended essentials (patterns of cohabitation and breastfeeding, as well as contraceptives and induced abortion) for SSA, we expected the model to capture a greater proportion of the variation to make the remainder inconsequential. Probably, this was also not achieved because there are still problems of measurement errors due to deficiencies such as limited information on the intensity of breastfeeding, consistency in contraceptive use and forms of cohabitation over time.

Table 3.39: Sensitivity Test Results for Structural Fertility Model, 1987/88 (GLSS 1)

Full Sample	Model A		Model B		Model C	
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	-0.047	-0.047	-0.257	-0.249	-0.081	-0.074
	-1.7	-1.68	-1.86	-1.79	-0.51	-0.47
Middle/JSS	-0.016	-0.034	-0.71	-0.879	-0.824	-0.894
	-0.55	-1.23	-4.79***	-6.34***	-4.99***	-5.77***
Sec. & above	-0.116	-0.191	-1.218	-1.61	-1.41	-1.607
	-1.69	-2.54*	-5.35***	-7.55***	-4.86***	-5.67***
Still in school	-0.623	-0.569	-0.44	-0.121	1.079	1.016
	-6.35***	-5.91***	-2.12*	-0.64	2.18*	2.18*
Age25-34	0.226	0.218	2.105	2.017	1.675	1.634
	13.33***	13.22***	22.61***	22.55***	16.64***	17.18***
Age35-49	0.249	0.243	4.98	4.851	4.849	4.803
	17.01***	17.10***	35.41***	35.81***	30.68***	31.35***
Rural	0.02	0.041	0.227	0.417	0.021	0.117
	0.92	2.03*	2.07*	4.15***	0.17	1.06
Northern Region	-0.033	-0.028	-0.389	-0.346	-0.317	-0.297
	-1.05	-0.9	-2.72**	-2.44*	-1.95	-1.84
Muslim	0.012	0.014	0.429	0.457	0.264	0.273
	0.46	0.54	2.88**	3.06**	1.62	1.69
Traditional	-0.022	-0.011	0.126	0.228	0.279	0.311
	-0.82	-0.41	0.97	1.79	1.91	2.15*
Other	-0.086	-0.083	-0.125	-0.111	0.036	0.034
	-1.76	-1.71	-0.68	-0.61	0.19	0.17
Non-Akan	-0.016	-0.017	-0.286	-0.305	-0.311	-0.319
	-0.92	-1	-3.23**	-3.43***	-2.95**	-3.03**
HAS- Basic	-0.026		-0.246		-0.126	
	-2.32*		-4.48***		-1.86	
HAS- High	-0.005		-0.009		-0.038	
	-0.81		-0.38		-0.86	
Traditional contraceptives	-0.005	-0.026	-0.134	-0.31	-0.31	-0.375
	-0.25	-1.32	-1.2	-3.09**	-2.42*	-3.18**
Modern contraceptives	-0.005	0.005	0.106	0.197	0.208	0.241
	-0.34	0.33	1.33	2.70**	2.28*	2.80**
Age at Cohabitation	-0.001	-0.001	-0.009	-0.009	-0.009	-0.009
	-1.88	-1.85	-2.58*	-2.56*	-2.20*	-2.22*
Breastfeeding duration					-0.002	-0.002
					-0.65	-0.68
Constant			1.825	1.985	2.911	2.975
			6.63***	7.51***	9.10***	9.53***
Observation	2237	2237	2237	2237	1409	1409

Note: - Model A presents the marginal effects after probit; Models B and C presents OLS regression results on number of births and number of births conditional on at least one respectively.
- Each Model is estimated with and without the control of household wealth.
- The predicted values based on specification model 3 of the proximate variables are used in these estimations.
- *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively.

Table 3.40: Sensitivity Test Results for Structural Fertility Model, 1998/99 (GLSS 4)

Full Sample	Model A		Model B		Model C	
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.014	0.01	-0.414	-0.447	-0.446	-0.498
	0.67	0.49	-4.98***	-5.28***	-4.34***	-4.79***
Middle/JSS	-0.06	-0.068	-0.809	-0.862	-0.916	-1.005
	-2.48*	-2.70**	-10.34***	-10.93***	-9.45***	-10.54***
Sec. & above	-0.204	-0.254	-1.473	-1.613	-1.64	-1.882
	-4.70***	-6.28***	-14.99***	-17.50***	-11.06***	-12.91***
Still in school	-0.592	-0.609	-0.314	-0.335	0.001	0.042
	-12.59***	-13.57***	-2.64**	-2.94**	0	0.16
Age25_34	0.333	0.334	2.147	2.115	1.81	1.761
	20.68***	20.74***	25.66***	24.80***	15.36***	15.18***
Age35_49	0.453	0.451	4.585	4.59	4.342	4.332
	34.42***	33.20***	54.65***	55.00***	31.75***	32.43***
Rural	0.032	0.058	0.233	0.476	0.203	0.485
	1.52	3.54***	3.53***	8.77***	1.92	5.76***
Northern Region	0.046	0.05	-0.114	-0.035	-0.379	-0.323
	2.00*	2.17*	-1.3	-0.41	-2.95**	-2.52*
Muslim	-0.044	-0.047	0.116	0.09	-0.016	-0.053
	-1.46	-1.56	1.36	1.05	-0.14	-0.46
Traditional	-0.104	-0.101	0.2	0.287	0.297	0.394
	-1.87	-1.83	1.21	1.76	1.52	2.03*
Other	0.016	0.025	0.188	0.23	0.191	0.229
	0.32	0.52	1.22	1.46	1.17	1.32
Non-Akan	0.037	0.034	-0.203	-0.156	-0.316	-0.258
	2.15*	1.91	-3.49***	-2.68**	-4.04***	-3.37***
HAS- Basic	-0.038		-0.171		-0.211	
	-3.75***		-6.01***		-4.22***	
HAS- High	-0.013		0.146		0.149	
	-1.6		4.63***		3.33***	
Traditional contraceptives	0.022	0.017	-0.009	-0.061	-0.081	-0.133
	1.24	0.93	-0.34	-2.13*	-1.94	-3.81***
Modern contraceptives	-0.016	-0.016	0.077	0.12	0.108	0.165
	-0.67	-0.65	1.36	2.09*	1.2	1.93
Breastfeeding duration					0.002	0.002
					0.64	0.58
Constant			1.244	1.012	2.006	1.817
			6.20***	5.34***	6.56***	6.55***
Observation	5863	5863	5863	5863	2454	2454

Note: - Model A presents the marginal effects after probit; Models B and C presents OLS regression results on number of births and number of births conditional on at least one respectively.
- Each Model is estimated with and without the control of household wealth.
- The predicted values based on specification model 3 of the proximate variables are used in these estimations.
- Sample weights are applied in the estimations of GLSS 4.
- *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively.

Some of the results of the proximate determinants here are quite different compared to the "proximate only" models in the previous section although few still give similar outcomes. For example regarding the probability of having at least one child, none of the proximate determinants here are found statistically significant in both GLSS 1 and 4, unlike the previous model. Age at cohabitation on the other hand is still negative and statistically significant, but at a reduced level, in determining the unconditional number of births (Model B) and births conditional on at least one (Model C), all else held constant.

Traditional contraceptives use is also estimated as having limiting impact on fertility in both models of GLSS 1 and 4 but mostly significant when household wealth is not controlled. In contrast, modern contraceptives use predicts the opposite outcome. Breastfeeding duration is not found statistically significant in both models of the two survey years. One possible explanation for the loss of statistical significance of some of the proximate determinants is that the socioeconomic variables may be picking much more details that explain variations in fertility compared to the available information on the proximate determinants in the current survey data used. In lieu of this, the next section focuses on only education and the other socioeconomic variables in a reduced form model. It is anticipated that the reduced form model would bring together the overall or full impact of education, with the control of the other socioeconomic variables, on fertility.

3.4. FERTILITY: THE REDUCED FORM MODEL

The reduced form fertility model is estimated based on the conceptual and empirical framework outlined under the section on contraception of this study. This is primarily because the demand for contraception is derived from that for children, which implies that the exogenous variables that determines the desired number of births by a woman would also determine her use of contraception. Hence fertility, measured as the total number of children ever born to a woman in the survey period understudy, is estimated as function of the variables in equation 3 under sub-section 3.2.1.2 and all the caveats therein. However, the anticipated outcomes of the variables are the opposite of those on contraception; as factors that tend to increase the use of contraception would reduce the number of children born to a woman. An additional difference to the model is that whereas multinomial logit was applied in the econometric estimation of contraception because of its categorical response, OLS regression method is applied here. Even though this may cause possible downward bias of estimates due to censoring from below at zero, because some women have not yet had children, empirical evidence from Ainsworth (1989) suggests using Tobit or Poisson econometric models that controls the impact of censoring does give identical results as OLS.

3.4.1 Descriptives

The fertility levels of the women understudy in the various age cohorts and current residence as well as levels of schooling is summarised in table 3.41. Also, the summary statistics of all the variables used in the estimations can be found in table 3.42. The descriptives indicate that roughly three-quarters of sampled women in both years have at least one child. The average number of live births per woman in GLSS 1 is 3.14 and that of GLSS 4 is 2.84, suggesting a likely decrease in fertility levels between the two survey years. The average levels in GLSS 1 and 4 also compares with those of DHS (1988): 3.17 and DHS (1998): 2.63 respectively. There are roughly the same proportion of women, about three-quarters of the total sample, living in rural areas in GLSS 1 and 4; but the former year constitute a more youthful sample than the later one. Age, which controls for fecundity or all biological factors that affects the supply of births, shows smaller family sizes by younger women in each school category compared to the older women. Women above age 34 for instance record the highest fertility levels (6.16 in GLSS 1 and 5.36 in GLSS 4). This is because they have experienced a longer fecundity period and most probably would have completed the phase. Also despite the first survey year having relatively more youthful sample, it still records a higher average fertility than the later year; giving an impression of a transitional change towards lower fertility levels in the country.

Separating the women by rural and urban dwellings also generally reveals lower fertility on average in urban compared to rural areas. Women with no education are observed as having the highest fertility levels, whereas the lowest are those of secondary and higher level of education in both surveys. With the primary level of education also showing a higher number of births than middle/JSS level, a clear pattern of a negative relationship between fertility and education can be observed in both GLSS 1 and 4. This and the pattern observed in the rural verses urban sub-samples are as expected because of the higher opportunity cost of time in urban areas and amongst higher educated women. The tangible cost of living in urban areas is also higher, making child services more expensive and hence fewer demanded. Other explanations include more media exposure and various infrastructures that aid in limiting family size if so desired in these areas, which also happen to have higher educated women. Also agricultural activities that usually require large family sizes are few in the urban centres; and the changed economic system of household as a unit of production to a unit of consumption and its outcome is better observed in urban areas.

Table 3.41: Cross-Tabulations of Fertility and Education, Age and Residence (1987/88 & 1998/99)

	Full	Rural	Urban	Age15-34	Age35-49
GLSS 1					
School					
None	4.028	4.046	3.973	2.436	6.569
Primary	2.956	3.119	2.690	2.180	6.463
Middle/JSS	2.291	2.467	2.092	1.801	5.169
Sec.& above	1.693	2.364	1.420	1.101	3.800
Age					
Age15-24	0.921	1.008	0.771	0.921	
Age25-34	3.160	3.393	2.796	3.160	
Age35_49	6.161	6.660	5.262		
Residence					
Urban	2.696			1.834	5.262
Rural	3.401			2.198	6.660
Total	3.138	3.401	2.696	2.060	6.161
GLSS 4					
School					
None	3.853	4.034	3.272	2.261	6.062
Primary	2.457	2.731	2.007	1.372	5.595
Middle/JSS	2.048	2.270	1.800	1.216	4.370
Sec.& above	1.491	1.533	1.475	0.657	3.284
Age					
Age15-24	0.439	0.537	0.303	0.439	
Age25-34	2.889	3.241	2.259	2.889	
Age35_49	5.360	5.811	4.518		
Residence					
Urban	2.179			1.143	4.518
Rural	3.231			1.866	5.811
Total	2.835	3.231	2.179	1.584	5.360

Table 3.42: Summary Statistics – Number of Live Births, 1987/88 & 1998/99

	GLSS 1		GLSS 4	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Child	0.798	0.402	0.709	0.454
Number of live births	3.138	2.805	2.835	2.766
None	0.454	0.498	0.418	0.493
Primary	0.133	0.340	0.185	0.389
Middle/JSS	0.362	0.481	0.322	0.467
Sec.& above	0.051	0.220	0.076	0.265
Still in school	0.046	0.209	0.124	0.330
Age15-24	0.362	0.481	0.356	0.479
Age25-34	0.375	0.484	0.313	0.464
Age35_49	0.263	0.440	0.331	0.471
Rural	0.627	0.484	0.624	0.484
Northern Region	0.142	0.349	0.135	0.341
Christian	0.625	0.484	0.776	0.417
Muslim	0.138	0.344	0.122	0.327
Traditional	0.172	0.377	0.062	0.240
Other	0.066	0.248	0.041	0.199
Non_Akan	0.533	0.499	0.490	0.500
HAS- Basic	0.000	1.000	0.000	1.000
HAS- High	0.000	1.000	0.000	1.000
Water distance (m)	1141	14587	511	11472
Primary school distance (km)	0.632	1.829	4.504	54.67
Middle/JSS school distance (km)	2.268	4.959	5.473	35.51
Secondary school distance (km)	13.492	19.63	15.43	56.26
Market distance (km)	5.015	10.26	8.58	33.42
Access to Health facilities/personnel	0.000	0.792	0.000	0.790
Price score of foodstuffs	0.000	0.792	0.000	0.790
Price score of cereals	0.000	0.792	0.000	0.790
Log of real Men's Agric. Wage	2.809	2.710	4.924	4.141
Ratio of female to men's wage	0.300	0.435	0.369	0.433
Ratio of child to men's wage	0.307	0.408	0.267	0.388
Observation	2240		5863	

3.4.2 Estimation Results

Following the same procedure as in all the previous sections of this study, estimates of the models are presented in an abridged version in the text. These constitute only the coefficients with their statistical significance. The entire results are presented in Appendix B-33. Estimations are also conducted for the full samples, as well as by the residence (rural/urban) and age (younger: 15-34 years/older: 35-49 years) cohorts.

The Impact of Education

The regression results obtained for the influence of education on the number of births while controlling for age, current residence, currently schooling, religion and ethnicity, household wealth as well as other community variables in three different models are presented in table 3.43 for GLSS 1 and 4. Similar to several studies in the area, this study generally finds the expected inverse association between education and fertility in all the models as well as both survey years, ceteris paribus. All the education categories also show a relatively high statistical significance except for the primary levels that are often found insignificant (mostly in GLSS 1). This is also consistent with the study of Benefo and Schultz (1996) on Ghana using GLSS 1 and 2 and Ainsworth et al (1996) using the 1993 GDHS data. Both studies suggest the pattern is likely to be a consequence of low content and quality of education at the primary levels. Another more common effect of education on fertility in SSA is an inverted U-shaped. This is where the number of children tends to increase at lower levels of education, especially at the primary levels, and then reverses beyond this threshold. Thus fertility eventually declines as women advance beyond the primary stage of education. This is also explained as being the result of the initial impact of education lowering infant mortality as well as healthier lifestyles subsequently making women more fecund. Studies that observed such outcomes include Martin (1995), Bankole (1995), Thomas and Maluccio (1996) and Handa (2000).

Table 3.43: The Impact of Education on Fertility (Reduced Form Model), by All Women, Residence & Age – 1987/88 & 1998/99

	Full	Rural	Urban	Age15-34	Age35-49
			GLSS 1		
Variant 1: Parsimonious					
Primary	-0.239	-0.08	-0.569*	-0.213	-0.017
Middle/JSS	-0.675***	-0.366**	-1.138***	-0.521***	-0.851**
Sec. & above	-1.378***	-1.185***	-1.771***	-1.036***	-2.107***
Variant 2: Full model					
Primary	-0.25	-0.119	-0.487*	-0.246	0.059
Middle/JSS	-0.578***	-0.371**	-0.867***	-0.499***	-0.512
Sec. & above	-1.047***	-1.001***	-1.312***	-0.853***	-1.477***
Variant 3: Full model with rural community characteristics					
Primary	-0.254	-0.129	-0.496*	-0.258	0.112
Middle/JSS	-0.558***	-0.34**	-0.881***	-0.499***	-0.467
Sec. & above	-1.02***	-0.922**	-1.316***	-0.843***	-1.55***
Observation	2240	1405	835	1651	589
			GLSS 4		
Variant 1: Parsimonious					
Primary	-0.427***	-0.355***	-0.474***	-0.287***	-0.468*
Middle/JSS	-0.861***	-0.859***	-0.817***	-0.565***	-1.432***
Sec. & above	-1.597***	-1.97***	-1.386***	-1.138***	-2.303***
Variant 2: Full model					
Primary	-0.384***	-0.339**	-0.4**	-0.266***	-0.357
Middle/JSS	-0.785***	-0.814***	-0.691***	-0.532***	-1.282***
Sec. & above	-1.423***	-1.781***	-1.188***	-1.04***	-2.049***
Variant 3: Full model with rural community characteristics					
Primary	-0.385***	-0.339**	-0.401**	-0.264***	-0.34
Middle/JSS	-0.782***	-0.807***	-0.691***	-0.524***	-1.245***
Sec. & above	-1.417***	-1.768***	-1.188***	-1.035***	-2.005***
Observation	5863	3657	2206	3921	1942

Note: These coefficients are marginal effects of the OLS regression models. Variant 1 control for women currently in school, age, rural residence, and Northern regional location. Variant 2 controls for religion, ethnicity and household wealth in addition to those in Variant 1. The final Variant 3 includes all the variables already mentioned as well as other determinants. See Appendix B-33. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. Sample weights are applied in the estimations of GLSS 4.

Results in GLSS 4 on the other hand suggest a monotonically decreasing effect of women's education on fertility, as observed in more developed countries. Akin (2005) found similar results in 14 Middle Eastern countries. The difference between the outcomes in the two survey years is found statistically significant, especially from the post-primary level when additional control variables are included as in Variants 2 and 3. This outcome thus suggests that women with post-primary education generally have at least half (middle/JSS) to one (secondary and above) fewer births than women with no education in GLSS 1, which increases to about three-quarters to one and a half fewer births respectively in GLSS 4, ceteris paribus. This gives a clear indication of possible fertility decrease over the years with post-primary education, conditional on religion, ethnicity, household wealth and some community variables.

Thus in order for the country to achieve its aim of reducing population and increasing economic growth, the policy of encouraging more girls in school should be continued and expanded to all parts of the country. Indeed there should be greater efforts at ensuring these girls remain in school, at least till secondary, if not the tertiary level. Because at these levels, all else held constant, (1) – women face higher opportunity cost of time and therefore total increase in child cost, (2) – obtain greater access to health facilities and therefore healthier children, (3) – exposure to other institutions like child's education or recreational activities that may not par well with many births, (4) – their higher literacy levels could help them to better understand their biological system and how to regulate its natural supply, and (5) – the mere length of time in school reduces the risk of exposure to conception and thus many births.

Separating the GLSS 1 sample into rural and urban sub-sample show not only differences such as primary level of education being statistically significant in urban areas whilst that of rural is not, but also suggests larger coefficient impacts in urban compared to rural areas, ceteris paribus. A Wald test finds the difference in outcome statistically significant at the 10 percent level for the primary and secondary and above levels, and at the1 percent level for middle/JSS level in specification Variant 1. The differences in coefficients lost their statistical significance for the primary and secondary and above levels of education as additional variables are controlled in Variants 2 and 3. The coefficient difference for the middle/JSS level remained significant but at the 5 percent level.

The outcome is slightly different in GLSS 4 though. The impact of the different education levels do not always appear larger in urban compared to rural areas in this survey, especially from the post-primary levels. However the Wald test finds all the differences statistically insignificant except for those with secondary and above level of education in all three specification Variants. And the impact is higher in rural compared to urban areas. Empirically, women with secondary and above level of education in rural areas are more likely to have 1.97 and 1.78 fewer births compared to those of urban women's – 1.39 and 1.19 – with the same level of education based on Variants 1 and 2, ceteris paribus. The outcome in Variant 3 is similar to that of 2. This means that having rural women reach the highest level of education could now drastically reduce fertility levels even more than urban women in the country. Ainsworth et al. (1996) note similar outcome in Cameroon, Kenya, Niger, Nigeria, Uganda and Zambia but not Ghana[91].

Across surveys, the magnitudes of the education categories beyond primary levels is found statistically smaller with women in rural areas of GLSS 1 compared to rural women in GLSS 4 in all three specification models. However, the differences in the urban sub-samples between the two surveys are not statistically significant. No apparent reasons could be given for the differences in the outcomes of the sub-samples (rural and urban) across the two surveys. However it is fairly obvious that some sort of fertility transition (decline), that seems to be related to

[91] Used the 1993 DHS survey data.

education has begun in the rural areas. Education appears to have in some cases nearly twice the decreasing impact it used to have in rural areas of the first survey now in the later one. This may either be due to the improved schooling qualities or the environment (relatively increased exposure to “modern” views especially through the media, and weakened cultural/ancestral links) or a bit of both over time.

Also, relatively more women might have been enrolled in school for longer over time, which may possibly culminate into an associated greater fertility decline; as would be observed later in the estimations that fertility increases with women’s age. Estimation by cohorts is thus performed in this study and the results generally show negative association between education and fertility amongst all the cohorts, with significantly greater negative impact amongst those with secondary and above education. Indeed, the pattern is similar to those of the full samples of each survey, especially amongst the younger cohorts. That is, primary levels have no statistical influence on fertility decline in GLSS 1 but the converse is more the case in GLSS 4. The older cohort also shows some statistical significance from post-primary levels in GLSS 1 (all levels in GLSS 4), but loses the significance of middle/JSS (primary in GLSS 4), as more control variables are included in the specification model (see Variants 2 and 3 in both surveys).

It is observed within each survey year that the negative relationship is larger in the older than the younger cohort in both surveys where coefficients are found statistically significant. According to a Wald test, the difference in the magnitudes are however statistically significant in only Variant 1 of GLSS 1 for the secondary and above category; but in all the variants in GLSS 4 for the post-primary education categories at the 1 percent level of significance. That is, for instance older women with secondary and above education, relative to none, have slightly more than double the negative impact on fertility compared to younger women, ceteris paribus. The differentials in the coefficient magnitudes of cohorts across surveys are however not statistically significant amongst the younger cohort. They are amongst the older group in relation to the middle/JSS level of education. The overall cohort results in effect suggest that the impact of women's education on fertility increases with woman's age; revealing that older educated women do not end up having higher number of births to compensate for the lack or lower births when they were young or catch-up with others in their cohort.

The Impact of Control Variables

This sub-section briefly discusses the influence of the control variables based on Variant 2 of all the samples in GLSS 1 and 4. The coefficients in magnitudes are fairly consistent across models, however some variables lose statistical significance with increased control variables. This would be mentioned during the discussion of such variables. The results are reported in Table 3.44 in the same abridged type mentioned previously.

The estimated results signify that being in school consistently lower the number of births by women in all the study samples. In the full sample, it is observed that women in school have 62 and 43 percent fewer births relative to those not in school in GLSS 1 and 4 respectively, ceteris paribus. The estimates are higher in rural areas, which are also significantly greater than urban areas. For instance being in school in rural areas reduce births by 91 percent in the former year and 61 percent in the later year compared to around 34 and 38 percent in urban areas respectively.

Table 3.44: The Impact of Control Variables on Fertility (Reduced Form Model), by All Women, Residence & Age – 1987/88 & 1998/99

	Full	Rural	Urban	Age15-34	Age35-49
			GLSS 1		
Still in School	-0.616***	-0.912***	-0.336*	-0.721***	
Age25-34	2.166***	2.255***	2.011***	2.144***	
Age35-49	5.036***	5.482***	4.235***		
Age40-49					1.566***
Rural	0.24*			0.061	0.811**
Northern Region	-0.43**	-0.306	-0.495	-0.36**	-0.702*
Muslim	0.396**	0.172	0.578**	0.063	1.287***
Traditional	0.049	-0.046	0.426	0.002	0.122
Other	-0.188	-0.175	-0.302	-0.288	0.076
Non-Akan	-0.264**	-0.28*	-0.267*	-0.237**	-0.203
HAS- Basic	-0.277***	-0.315*	-0.223***	-0.208***	-0.335**
HAS- High	0.006	0.039	-0.003	-0.006	0.019
			GLSS 4		
Still in School	-0.43***	-0.612***	-0.376***	-0.488***	
Age25-34	2.221***	2.426***	1.885***	2.221***	
Age35-49	4.631***	4.984***	4.005***		
Age40-49					1.139***
Rural	0.241***			0.165*	0.515***
Northern Region	-0.09	0.004	-0.245**	0.035	-0.351*
Muslim	0.117	0.08	0.115	-0.097	0.465*
Traditional	0.106	0.032	0.59	0.003	0.18
Other	0.119	0.126	0.01	0.088	0.14
Non-Akan	-0.208***	-0.324***	-0.013	-0.103	-0.297*
HAS- Basic	-0.169***	-0.161***	-0.19***	-0.119***	-0.203**
HAS- High	0.147***	0.137**	0.154***	0.061*	0.317***

Note: These coefficients are marginal effects of the OLS regression models. Variant 1 control for women currently in school, age, rural residence, and Northern regional location. Variant 2 controls for religion, ethnicity and household wealth in addition to those in Variant 1. The final Variant 3 includes all the variables already mentioned as well as other determinants. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. Sample weights are applied in the estimations of GLSS 4.

Younger[92] women in school also confirms the negative association between being in school and fertility, which overall supports the hypothesis that school and fertility are the least likely combination of socioeconomic outcomes. This supports the findings regarding completed education and also the fact that education delays cohabitation. Women in school may not have the time or sufficient socioeconomic requirements to support the combination of schooling and birth. It should send signals to policy makers to improve enrolment rates amongst all women but especially those in rural areas in their quest to lower fertility.

[92] Very few older women (about 2 in GLSS 4) were still in school at the time of the surveys, so the variable was not controlled in that sub-sample.

Findings on the age of the woman and fertility in this study also corroborate the findings of a lot of studies on the topic including Bollen et al. (2002). Age reflects the fecundity level of women at various stages of their lifetime. With all factors held constant, older women are expected to have more number of births relative to younger ones. This is because they have gone through a larger part of their reproductive lives. Estimates in this study is as anticipated, which is that fertility tends to generally increase with the various age cohorts relative to the base group of age 15-24; and the categories are statistically significant at the 1 percent level. Women aged 25-34 have around 2.2 more births than the base category in the full sample of both surveys whilst women aged 35-49 have 5.0 and 4.6 more births than the base in GLSS 1 and 4 respectively. The differential in the coefficients of the older age categories is statistically significant suggesting possibly fertility over time. A similar trend could be observed in the sub-samples but with more births among women in rural than urban areas, especially amongst the older cohorts. With older cohorts predicted on the whole as having more births than younger ones, it is a gain to population controllers that older educated women do not "catch-up" with the fertility levels of their cohorts.

Religious beliefs and ethnicity are also controlled not only to eliminate their influence through education but also to examine whether they have direct influence on fertility. The two are somewhat inter-linked but the effect of one could over-shadow the other, depending on the strength of the connection between the woman and her extended family or place of residence. It is possible that the influence of family norms through ethnicity is greatly felt by women in rural areas. Estimates of the religious categories in both survey years suggest insignificant influence on fertility except for the Muslim category. This indicates that Muslim women tend to have more children than Christians in GLSS 1 (full, urban and older sub-samples). The relationship is only significant amongst the older cohort of GLSS 4. The lack of a general statistical significance may be suggestive that religion is not important in determining fertility, especially in the presence of socioeconomic variables**.**

Ethnicity however is found mostly significant and shows that non-Akans often tend to have fewer births than the Akans, all else held constant. This may also be linked to the negative outcome regarding Northern residence, where although less developed than the South, are occupied mainly by non-Akans. The explanation, as mentioned somewhere in this study, is that the non-Akans are relatively less liberal with early sexual activities of women as well as extra marital affairs. The Akans also reward their women with a sheep at the birth of their 10th child in an organised ceremony, which feasibly encouraged more births in that ethnic group. But it appears to be less influential as the urban and younger cohorts no longer show it to be statistically significant in GLSS 4. This is indicative of the possible gradual loss of traditional/cultural control on women due to “modern” exposure, especially through the media and also the campaign against high fertility.

The current residence of the woman is also very important in determining her fertility level. It could influence her level of education attained and therefore fertility (hence its role as a control variable in the study); it shows the level of development and exposure to modern values as well as accessibility to infrastructures such as health facilities and other family planning activities; and finally it indicates the availability of institutions that may well determine job opportunities and weaken links to the extended family system, which does not only expect an individual to owe allegiance to living members but also to those dead (ancestors).

Based on the above outline, it was anticipated that women in rural residence would tend to have more children than those in urban areas, because of the lack of many of the institutions that promote otherwise. The opportunity cost of time for instance is lower in these areas, and fosterage in the cultural system allow without an acknowledged serious economic consequences. As expected, the results show women in the rural areas have relatively more children than their counterparts in urban centres. This supports findings by Benefo and Schultz (1996), Parr (1998) and Akin (2005). Prevalence of better schools and higher enrolment rates, which produce relatively more competitive women for the labour market, in the urban centres are some of the reasons for fewer births in urban areas. In addition, the social and economic environment in the rural areas that fosters early births does not feature prominently in urban areas. Urban women are also less fatalistic towards fertility decisions, especially with the rising cost of child services in the area. And finally, the probability of investing family wealth into having more children has changed in the urban areas of Ghana (Benefo and Schultz, 1996).

Of notable interest in this study however is that in GLSS 1, the level of significance in the full sample reduced from 1 percent (Variant 1) to 10 percent (Variant 2 shown in text) and finally to none (Variant 3). This may suggest that the availability of household hold wealth and increased access to relevant facilities in the various communities could make residence irrelevant in determining fertility levels. The pattern is similar among the different age cohorts but with varied levels of significance in Variant 2: the younger cohort indicate insignificance of the variable whilst the older cohort show 5 percent level of significance (Table 3.44).

The pattern in GLSS 4 is slightly different, in that the model that also controls the community variables does not make rural residence irrelevant (except for the younger cohort). It becomes less significant in the full sample but remains same in the older sub-sample.

Like urban residence, household wealth is included in the estimations as a control variable to education, because they are positively correlated and there may be observed or unmeasured variables that simultaneously affect both[93] and hence fertility levels of the women. In spite of this, it is also useful to ascertain whether the influence of education is that of itself or only picking some of the influence of wealth, which as already explained, is represented as "basics" and "high" in this study. The results on education discussed gives clear indication that its association with fertility is basically devoid of the influence of household wealth or indeed any other socioeconomic variables so far controlled in the estimations. In addition to this important clearance, the results here also indicate that household wealth also has direct impact on fertility despite the influence of education.

Based on the quantity-quality trade-off theory (Becker and Lewis, 1973), household wealth is expected to reduce the number of births per woman in the household. And the estimated results are as anticipated, but in relation to only "basic" household wealth in both GLSS 1 and 4. This result concurs with those of Bollen et al. (2002) on Ghana using GLSS 2, and Peru. However, the outcome regarding the higher standard of wealth "high" is either observed as statistically insignificant (GLSS 1) or positively associated with fertility levels (GLSS 4). This

[93] Details of this and method (PCA) used to derive the household wealth indicators are given under the section on contraceptives.

could conveniently be explained as a non-monotonic impact of overall household wealth on the number of children born. Thus fertility generally falls upon an increase in "basic" household wealth but rises with greater household wealth only observed in the later survey year, ceteris paribus. This implies the quality-quantity trade-off hypothesis could be observed only amongst the lesser-resourced households, which also happen to constitute the majority of the women understudy.

The Impact of Additional Control and Community Variables

This section discusses the influence of the additional control variables included in the estimation procedures as specification Variant 3. All the remaining variables are observed at community levels, with the exception of distance to the nearest water source. These variables are included in the model to control for some of the physical costs of child services and accessibility to infrastructures that may influence fertility. These include health facilities, markets, and schools as well as price scores of "foodstuffs" and "cereals", and cluster agricultural wage rates for men, women and children.

The variables could be separated into three segments. The first is the health related variables, which includes distance to the nearest water source and access to health facilities and personnel; the second is the physical child's cost involving distance to the nearest primary, middle/JSS, and secondary school, as well as price scores of "foodstuff" and "cereals"; and the third is the opportunity cost of time of the woman represented by distance to the nearest market, agricultural wage rates for men, ratio of women to men's agricultural wage and ratio of children to men's agricultural wage. Most of the community variables are not statistically significant.

However, at least one variable in each of the segments created is found significant. Table 3.45 reports the estimates of these variables.

For the health related segment, distance to the nearest water source (measured in metres) is predicted as increasing the number of births with each metre increase in distance. Accessibility of water reduces illness and increases the survival rate of children. Thus the need to have more children as replacements in case of infant mortality to meet the desired family size is reduced, which subsequently lowers fertility. Fetching water is also time consuming, and one of the main household chores of women in the households. Therefore with a closer source, some time is released for childcare, which may improve their overall wellbeing and survival.

Table 3.45: The Impact of Additional Control and Community Variables on Fertility (Reduced Form Model), by All Women, Residence & Age – 1987/88 & 1998/99

	GLSS 1				**GLSS 4**			
GLSS 1	**Full**	**Rural**	**Age 15-34**	**Age 35-49**	**Full**	**Rural**	**Age 15-34**	**Age 35-49**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Water distance (m)	6.40 E-06	6.58 E-06	7.20 E-06	-5.81 E-05	1.20 E-03	1.31 E-06	-3.13 E-06	2.45 E-06
	3.32***	3.54***	4.33***	-1.17	3.51***	2.65**	-1.98*	4.74***
Market distance (km)	0.006	0.005	0.003	0.017	0.001	0.001	0.002	-0.002
	1.27	1.06	0.69	1.34	0.87	0.4	1.54	-0.65
Primary school distance (km)	-0.013	-0.011	-0.005	-0.025	0.001	0.001	0.002	-4.13 E-04
	-0.52	-0.41	-0.16	-0.45	0.99	0.82	1.6	-0.26
Middle/JSS school distance (km)	0.001	0.005	0.002	0.013	-4.21 E-04	1.07 E-04	-0.002	0.003
	0.11	0.44	0.23	0.6	-0.31	0.08	-1.45	1.21
Secondary school distance (km)	0.007	0.008	0.003	0.009	-0.001	-0.001	-0.001	0.001
	2.16*	2.38*	1.1	1.24	-0.7	-0.65	-0.69	0.44
Access to Health facilities/personnel	-0.057	-0.072	-0.04	-0.051	-0.011	-0.018	0.004	-0.078
	-0.85	-1.04	-0.69	-0.32	-0.22	-0.38	0.07	-0.91
Price score of "foodstuffs"	-0.032	-0.056	-0.084	0.07	-0.033	-0.024	0.01	-0.076
	-0.53	-0.85	-1.37	0.44	-1.42	-0.97	1.03	-1.13
Price score of "cereals"	-0.04	-0.047	-0.07	0.104	0.01	0.009	0.004	-0.006
	-0.69	-0.79	-1.28	0.72	1.08	0.95	0.2	-0.23
Log of real men's Agric. Wage	-0.004	0.012	-0.007	-0.003	-0.01	-0.006	0.048	-0.078
	-0.14	0.36	-0.27	-0.04	-0.57	-0.31	2.30*	-2.31*

Table 3.45 contd: The Impact of Additional Control and Community Variables on Fertility (Reduced Form Model), by All Women, Residence & Age – 1987/88 & 1998/99

	GLSS 1				GLSS 4			
GLSS 1	**Full**	**Rural**	**Age 15-34**	**Age 35-49**	**Full**	**Rural**	**Age 15-34**	**Age 35-49**
Ratio of female to men's agric. wage	-0.028	-0.03	0.264	-0.905	0.112	0.09	-0.036	0.315
	-0.2	-0.2	2.00*	-2.51*	1.19	0.94	-0.34	1.58
Ratio of child to men's agric. wage	0.087	0.026	-0.045	0.457	-0.022	-0.018	-0.088	0.124
	0.52	0.15	-0.29	1.07	-0.22	-0.19	-0.88	0.67

Note: These coefficients are marginal effects of the OLS regression models. Variant 1 control for women currently in school, age, rural residence, and Northern regional location. Variant 2 controls for religion, ethnicity and household wealth in addition to those in Variant 1. The final Variant 3 includes all the variables already mentioned as well as other determinants. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. Sample weights are applied in the estimations of GLSS 4.

In relation to child's cost, only distance to the nearest secondary school is found statistically significant; and that is only in GLSS 1 (the full and rural sub-samples). The result indicates that a kilometre increase in distance will tend to increase fertility by approximately 0.7 percent, ceteris paribus. The outcome is contrary to the theory of the demand for children, which argues that increased cost of child's schooling would increase the general cost of children, and consequently reduce the number desired. However, the outcome here is not unexpected since due to the act of child fosterage in West Africa, parents may not be the ones who bear the child's cost. This may therefore increase fertility or make the variable insignificant (King, 1987 in Knodel et al., 1990), as observed in this study. Caldwell and Caldwell (1987) also suggest that the cost of children to biological parents and fertility is rendered meaningless due to one's household willingness to foster grandchildren, nephews and nieces.

The final segment gives log of real men's agricultural wage rates and the ratio of women to men's agricultural wage as relevant in determining fertility. The expected outcome of the former could not be determined a prior. The explanation being that fertility could rise if increased wage rates result in increased births, due to the economic returns of children. On the other hand, fertility may actually fall with the increased wages due to the opportunity cost of time, particularly in relation to women. As the results show, both outcomes are possible with the samples under-study. In GLSS 1, only the ratio of women to men's agricultural wages is found statistically significant in sub-samples of younger and older age cohorts. The former suggests a positive association between the proportion of women to men's agricultural wage whilst the latter indicates a converse outcome. In GLSS 4 however, it is the men's agricultural wage that is found significant. It also shows the same pattern of association like the proportion of women to men's and in the same sub-samples. It is not very clear why this is case, but the results of both variables presumably suggest that the younger women are enticed by the higher economic returns of increased births, whereas the opportunity cost of time deter the older women from increasing the number of births as the agricultural wage rates rise.

The Impact of Education on Fertility: The Pooled Sample

Table 3.46 presents the results (abridged version) of the pooled sample estimates of education in both GLSS 1 and 4, which show a strong negative association between education and fertility level. With the exception of the older (aged 35-49) sub-sample, the negative relationship found is statistically significant for all levels of education.

The dummy variable GLSS 1, which is one for the first survey year and zero otherwise, suggests a relatively higher fertility level in GLSS 1 than 4; this is after adjusting for education and the other socioeconomic variables included in the various models. All else held constant, the full sample approximately indicates 43-percentage points higher fertility in GLSS 1 relative to GLSS 4. The differential between the rural and urban sub-samples over the decade is less dramatic compared to the age cohorts. For instance, according to Variant 1 women in rural and urban areas in GLSS 1 show approximately 41 and 48-percentage points higher fertility respectively, whereas younger and older women show 31 and 66-percentage points higher compared to GLSS 4, ceteris paribus. This somewhat suggests that the possible fertility decline over the decade emanates largely from the older women's cohorts. Combining this outlook with the outcomes of the individual surveys' estimations that women do not appear to "catch up" with their age cohorts on fertility levels, then it seems appropriate for policy makers to introduce measures to delay births. Some of these measures should include encouraging higher female enrolment in school whilst ensuring that they remain till at least the secondary level or above; opening more job opportunities for women in the labour market; creating a mentoring scheme whereby accomplished female professionals become role models to young and upcoming girls; increase access to contraception and discourage early marriages.

Table 3.46: The Impact of Education on Fertility (Reduced Form Model), by All Women, Residence & Age – (Pooled: 1987/88 & 1998/99)

Pooled	**Full**	**Rural**	**Urban**	**Age15-34**	**Age35-49**
	Coef./t-ratio	**Coef./t-ratio**	**Coef./t-ratio**	**Coef./t-ratio**	**Coef./t-ratio**
Variant 1: Parsimonious					
Primary	-0.37	-0.273	-0.484	-0.276	-0.273
	-5.86***	-3.42***	-4.62***	-4.69***	-1.76
Middle/JSS	-0.852	-0.775	-0.931	-0.567	-1.328
	-17.05***	-12.39***	-10.99***	-11.70***	-11.41***
Sec. & above	-1.521	-1.745	-1.462	-1.067	-2.249
	-20.36***	-13.56***	-14.51***	-14.88***	-13.83***
GLSS 1	0.426	0.407	0.482	0.31	0.658
	9.18***	6.77***	6.78***	7.11***	5.74***
Variant 2: Full model					
Primary	-0.346	-0.272	-0.418	-0.273	-0.168
	-5.46***	-3.38***	-3.97***	-4.63***	-1.07
Middle/JSS	-0.781	-0.74	-0.793	-0.546	-1.121
	-15.03***	-11.30***	-9.04***	-10.84***	-9.13***
Sec. & above	-1.323	-1.57	-1.215	-0.959	-1.876
	-16.71***	-11.62***	-11.34***	-12.92***	-10.38***
GLSS 1	0.436	0.451	0.446	0.321	0.727
	9.20***	7.20***	6.11***	7.20***	6.31***
Variant 3: Full model with rural community characteristics					
Primary	-0.343	-0.267	-0.418	-0.273	-0.152
	-5.39***	-3.29***	-3.97***	-4.63***	-0.96
Middle/JSS	-0.775	-0.733	-0.793	-0.545	-1.1
	-14.91***	-11.17***	-9.04***	-10.83***	-8.92***
Sec. & above	-1.316	-1.555	-1.216	-0.955	-1.864
	-16.59***	-11.46***	-11.34***	-12.85***	-10.31***
GLSS 1	0.442	0.475	0.446	0.384	0.644
	8.38***	5.83***	6.11***	8.05***	4.87***
Observation	8103	5062	3041	5572	2531
R-squared	0.59	0.59	0.57	0.48	0.22

Note: These coefficients are marginal effects of the OLS regression models. Variant 1 control for women currently in school, age, rural residence, and Northern regional location. Variant 2 controls for religion, ethnicity and household wealth in addition to those in Variant 1. The final Variant 3 includes all the variables already mentioned as well as other determinants. See Appendix B-34. *, **, & *** represent statistical significance level at 10%, 5% and 1% respectively. Sample weights are applied in the estimations of GLSS 4.

Chapter 4: CONCLUSIONS

This chapter discusses the main findings and policy implications in the two thematic areas as well as possibilities for future research. The chapter is in three sections summarising conclusions on health and fertility in that order, and then finishing with plans for future research.

4.1. HEALTH

This study examines the relationship between education and health status (the incidence of illness and its duration as well as height-for-age and weight-for-height). The study analyses the effects on children and adult health separately because of their different capabilities as well as the fact that decisions for children are made by their parents or a responsible adult in the household. Hence it is the education of such household members like their parents or household heads that should be examined. The analysis on the health outcomes demonstrates several things. The premise that education affects health outcomes, as measured in this thesis, is confirmed. However, the results are very much mixed in relation to health status. The direction of impact is not always as expected albeit this is commonly noted in similar studies in developing countries, especially with regard to children's outcomes. Firstly with regard to illness, parental education is found to be positively associated with child's reported illness in the first survey year but has no influence in the later one. A two-stage instrumental variable (IV) approach indeed confirms the relationship regarding maternal education, and this time, in both surveys but statistically significant at only the primary levels. Paternal education, at the primary levels, however indicates a negative relationship with the IV approach in only GLSS 1. These results seem quite robust, as controlling for expenditure per capita does not alter the outcomes.

Secondly, parental education appears comparatively less influential on the duration of child's illness than on the incidence; many of the parental categories do not significantly influence the duration of illness unlike its incidence. But the pattern is similar, in that a positive relationship is observed between maternal education and illness duration in GLSS 1 (albeit only significant in urban areas) but none in GLSS 4. Generally where statistically significant, parental education is positively associated with the duration of illness in GLSS 1. In GLSS 4, only paternal education is found statistically significant and it has a negative association with illness duration. These results on paternal education are significant mainly when expenditure per capita is also controlled for. Therefore one could argue in this case that paternal education as well as wealth is possibly required to reduce the duration of illness. This however would only remain a conjecture since the overall result is ambiguous, which does not allow for any categorical conclusion on this health measure. However, it is generally quite apparent that parental education plausibly tends to be related more to the onset of illness than its duration, all other things remaining same.

A third health status indicator (the anthropometrics) is also examined for children. This is in a bid to check whether parental education influences these relatively more objective measurements differently from the subjective ones above. Unfortunately the estimations are conducted for only GLSS 1 due to lack of information in GLSS 4. The sample for estimations is divided into pre-school and school-aged children. Parental education is established as having a relatively more favourable influence on the anthropometric measures of pre-school children, especially in urban areas. Maternal secondary and above for instance seems to be positively related to the height-for-age and weight-for-height of pre-schoolers in the full sample. However the maternal influence is replaced by paternal when expenditure per capita is also controlled for in the model, but only for height-for-age. The urban sub-sample however still shows strong positive association between maternal education (post-primary) and the child's height. The weight-for-height is not influenced by any measure of the parental education, which is consistent with other similar studies on the country using the same data. The results on school-aged children are mixed but mostly insignificant.

With such results, it could be concluded that the mostly perverse pattern observed with the preceding health measures of reported illness and its duration may be attributed to systematic reporting bias or over-reporting due to the subjective nature of the measures. This is especially with regard to urban children; here parental education affects one kind of health status (height) favourably but not another (illness). With the anthropometrics being the more objective measurement of health of the two, this study could conclude that parent's education is beneficial to children's health status. This is not to say that analysing reported illness is wholly misleading in the study of health. Other health and policy related factors such as protected water sources as well as hygienic waste disposal have the same outcome in both reported illness and the anthropometrics. Therefore, in the absence of clinically tested or more objective measures of health especially for adults, reported illness may be informative.

The estimated results for adults reveal that the relationship between personal education and illness as well as its duration is positive in GLSS 1; but the converse is true in GLSS 4, ceteris paribus. Apart from the probability of a bias caused by different re-call periods of the two surveys, a likely explanation of this observed trend is a higher exposure to more advanced modern healthy behaviours that might have been adopted by the educated in the later survey year. Controlling for the household expenditure per capita or parental education of these adults does not produce any dramatic change in the results. The pooled sample of the two surveys also supports the mixed outcome regarding the incidence of illness, but seems to indicate shorter duration of illness amongst adults with secondary and above level of education relative to none. The pooled estimates suggest that the impacts on health outcomes are higher in the earlier survey year than the later.

The study does not support the hypothesis that education mainly picks up the influence of expenditure. Almost all the estimated models that include both education and expenditure still show some level of statistical significance of the former, and in many cases exhibit only small changes from models from models that do not control for expenditure. The estimated magnitudes of education change slightly when household expenditure is controlled for; but they do not make education totally irrelevant. This implies that education in itself has a direct relationship with health outcomes even though it is positively correlated with expenditure and might also indirectly work through it. A similar pattern is also observed with controls for other policy relevant variables such as household public goods.

The overall effect of education on health is somewhat ambiguous. However the favourable effects should not be dismissed as mostly it has been found very helpful in preventative care (see Elo, 1992; Joshi, 1994; Matthew and Diamond, 1997; Lindelöw, 2004). It is just that the influence is not as large or uniform as one might expect.

Another finding of this study is that education continues to have an influence on health even after controlling for household wealth (unearned income or expenditure). And in most cases the majority of households have better health when wealthier. This should guide to policy makers in the allocation of public funds. For in as much as investment in education is very important for the effective and efficient use of facilities that promote health, focus should also be geared towards advancing sectors that would help households to generate more income or wealth. This also involves improving infrastructure and removing unnecessary bureaucracies observed in many public institutions including the health sector.

In addition, actual medical facilities ought to be made more accessible as distance to health facilities is observed to be a prominent factor in the decision to seek treatment in Ghana (Bour, 2003) and other developing countries (see Mwabu et al., 1995; and Ssewanyana et al., 2004), and thereby health production. The unfavourable effects of long distances to health centres are not only observed in the demand for healthcare as noted by the above-mentioned authors but also in this study's models of illness and its duration. Thus if the aim of the health sector in the country is to "improve wealth through health" as stated in their policy programme, and also to achieve their millennium development goals, then more work is needed to improve the proximity to health services.

4.2. FERTILITY

Under this theme, the relation between women's education and fertility is analysed by estimating both structural and reduced form models. The former is estimated based on Bongaart's (1982) framework of the proximate determinants of fertility. All the variation in fertility is captured by variation in its proximate determinants, which thereby must serve as the channels through which education and the other socioeconomic determinants work. This framework is tested using some of the core proximate determinants in this study: contraceptives, age at cohabitation and the duration of breastfeeding. Due to the endogeneity of these proximate determinants, the impact of education and other socioeconomic variables on these proximates is first estimated, and then the predicted values of the determinants used as inputs in a structural fertility model. Regarding the proximate determinants, the results show that education, mostly post-primary, correlates positively with the use of contraception, delays the age at cohabitation and shortens the duration of breastfeeding amongst the women under study. However, the overall impact on fertility is not as consistent as one would have expected.

First, the fertility model estimated reveals that contraceptive use influences the various measures of fertility differently. The results show that contraceptives are associated with a higher probability of having at least one child, unless the method of contraception used is predominantly abstinence[94]. The positive association between contraceptives and the probability of having at least one child however is not surprising, since they are used for timing rather than preventing births.

[94] As observed in GLSS 1, where traditional method of contraception tends to reduce the probability of at least one birth; and a higher proportion of women in this survey year record abstinence as the traditional method used.

Caldwell et al., (1992) observed this especially amongst married women in SSA, who they note, are less likely to use contraceptives between marriage and the first birth. When fertility is measured as the total number of children a woman has ever given birth to though, the results mostly give the anticipated negative correlation between contraceptives use and fertility. This is also the case when the number of births is conditional on at least one having already occurred. This gives the indication that contraception may eventually limit fertility in the long run.

Secondly, age at cohabitation seems not to have any influence on the likelihood of having at least one birth but tends to reduce the overall number of births, particularly amongst rural and older women. However, the predicted effect of the duration of breastfeeding is ambiguous and should be cited with caution. This is because it is statistically significant in only one sub-sample in each survey year (the younger and older sub-samples in GLSS 1 and 4 respectively) with differing results. The estimated outcome of the first survey year implies that younger women who breastfeed for longer have fewer births whereas the converse is the case with older women in the later survey year. We could not ascertain whether latter perverse finding is a cohort or an age effect. It may reflect an omitted or unobserved variable that is highly correlated with breastfeeding and fertility that is overriding the true structural effect of breastfeeding.

A sensitivity analysis conducted to examine the validity of education working through only the included proximate determinants on fertility suggests the existence of further unexplained variation in the structural model. This is performed through the addition of education and other socioeconomic variables as controls in the structural model. Some of them including education and household wealth are still found statistically significant, which is contrary to the underlying premise of the model's framework. This suggests that there are still some unobserved proximate determinants of fertility that correlate with education, but have been excluded from the model. This is possible because not all the fundamental proximate determinants were included in the model, and even those included are not perfectly measured. Lack of control for possible extra proximate determinants and/or mis-measurement of the available ones is due to deficiency of information in the survey data used.

In spite of this, the results of the proximate determinants only model goes far to show that contraception and age at cohabitation are two major channels for lowering fertility levels in the country. Therefore it could be inferred that education lowers fertility, in this case, through increased contraceptive use and delayed age at cohabitation. Less emphasis however ought to be placed on breastfeeding since the outcome is too ambiguous. Promotion of the practice in the country should therefore be done mainly in the interest of promoting child nutrition as well as the health of mother and child but not as a kind of fertility control. Instead increased accessibility to contraception as well as enrolment and remaining in school for longer to delay births would give the nation a better chance of lowering fertility.

To further establish the influence of education on fertility and more completely capture its full influence, a reduced form model is estimated with education as the primary determinant and the other socioeconomic factors as control variables. As anticipated, education shows a strong negative association with the number of births in both GLSS 1 and 4, but is mostly found as statistically significant from the post-primary levels in the first survey. The outcome does not change even with the control for other socioeconomic variables, such as household wealth, age, residence, religion and ethnicity as well as some community indicators. Having such a robust impact of education on fertility suggests it must not be undervalued in the quest to control population growth.

Also one of the essential findings here is that there appears to be a structural shift whereby previously women had to have more than primary education to be associated with the lowering influence of fertility in the country. Currently, this has moved from the post-primary in GLSS 1 to primary in GLSS 4, which is indicative of a fallen threshold for when education reduces fertility. One explanation is plausible improvement in the content of primary education, or a gradual diffusion of ideas overtime from higher to lower grades, or a combination of both. However most importantly this chapter shows that education, either directly or indirectly, could reduce fertility levels in the country. A pooled sample estimation of the two survey years also suggests fertility levels are likely to be higher by roughly 40 percent in the first survey year compared to the later one, all else held same. This implies a fertility decline between the years in the country.

4.3. FUTURE RESEARCH

This study raises new questions even as it finds solutions to those previously outlined. Data limitations mean that the findings are not always conclusive. Future research in this area would seek to explore the robustness of the results using more recent household living standard survey data, and also, other available data on health and fertility indicators such as maternal health care, clinically tested disease measures and additional proximate determinants including post-partum abstinence, sterility and the frequency of abortion. These would give more understanding of the health and reproductive behaviour in the country. Some researches, like Agyei-Mensah (2005), suspect increased abortion may explain a considerably part of the decreased fertility levels. There are currently no nation-wide data on abortion, probably due to the sensitive nature of the indicator and the fact that it is currently illegal unless the pregnancy is life threatening and recommended by a medical practitioner. However a community-based study by Ahiadeke (cited in Agyei-Mensah, 2005) for instance reveals that women in southern Ghana abort 19 out of 100 pregnancies. Thus widespread pockets of such studies may contribute to finding variations in the fertility levels in the country.

Additional research on the supply side, especially in relation to health, would be useful for further explanation to the outcomes observed in the household data. Analysis of the recently introduced national health insurance as well as the role of private investors/care providers in the supply of health could be valuable in understanding the demand for health.

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APPENDIX A:

A-1: Summary of Literature Reviewed on Both Final Health Outcomes and Inputs

Author(s)/Area	**Dataset/Sample**	**Health Measures (D.V)**	**Educational Variables**	**Control of a. income[95] b. parental education[96]**	**Results: education**
Wolfe and Behrman (1984)/Nicaragua	Household survey/women	Women's health (days in the past 180 days too sick to work; woman having had parasitic; medically preventable: diphtheria &tetanus; and therapeutically treatable diseases: typhoid & high blood pressure)[97]	Women's schooling	Household income (not significant)	**Women's health:** women's schooling (not significant) Note: individually, ***literacy:*** parasitic (-); medically preventable (-); therapeutically treatable (not significant); days ill (not significant)

[95] Or any household wealth

[96] In the case of adults' samples

[97] Diseases established after medical doctor's consultations.

Behrman and Wolfe (1987)	Household survey/ children and mothers	**Child**: Child's health (defined as height-for-age, weight-for-height and bicep circumference) **Mothers**: Mother's health (defined as days too ill to work in the past half year, parasitic, medically preventable, and therapeutically treatable diseases)	**Child**: Mother's schooling **Mothers**: personal schooling	Household income: child's health indirectly through nutrition (+); Parental background	**Child's health:** mother's schooling (+) Note: becomes non-significant with the inclusion of mother's family endowments. **Mother's health**: personal schooling (Not significant)
[98]Wolfe and Behrman (1987)	Household survey/ children	Mortality Height-for-age Weight-for-height Bicep circumference	Mother's schooling	Income: **Bicep:** (+)	**Mortality:** (-) **HAZ**: (+) **WHZ**: (+) **Bicep:** (+)
Appleton (1991)/ Kenya, Tanzania & Cote D'Ivoire	Household surveys/children and adults	Illness	Adults: Personal education Children: Parental education	**ADULTS** **Kenya**: livestock pc (+); ***women***: land pc (-); trees pc (-) **Cote d'Ivoire**: ***urban***: predicted consumption (-)	**ADULTS** **Kenya**: ***women***: primary (+); secondary (-); ***men***: secondary (+) **Cote d'Ivoire**: ***rural***: male head's primary (-); senior female's primary (+)

[98] The education effects are no more significant with the control of the mother's childhood background related abilities, motivation, knowledge and tastes.

				CHILDREN **Kenya**: ***girls:*** land pc (+); trees pc (-)	**CHILDREN** **Kenya**: senior female's primary (+); ***girls:*** male head's primary (+); ***boys:*** senior female's secondary (-) **Tanzania**: ***girls:*** senior female's primary (+); ***boys:*** male head's primary (+) **Cote d'Ivoire**: ***rural***: father's secondary (+); ***urban* – *boys:*** mother's secondary (+); father's primary (+)
Appleton (1991)/ Kenya, Tanzania & Cote D'Ivoire	Household surveys/children and adults	Duration of illness.	Adults: Personal education Children: Parental education		**ADULTS** **Tanzania**: ***women***: senior female's primary (-) **Cote d'Ivoire**: ***rural***: personal primary (+); male head's primary (+); ***rural* – *women***: secondary (-) ***urban***: personal primary (-)
				CHILDREN **Kenya**: land pc (-); trees pc (-) **Tanzania:** land pc (+)	**CHILDREN** **Kenya**: male head's primary (-); senior female's primary (-) **Cote d'Ivoire**: ***rural***: father's primary (-)

Lawson (2004)/Uganda	Household survey (DHS): 1999/ children and adults	Self-reported illness over the last 30 days	Adults: Personal education Children: Parental education	Expenditure per adult equivalent (instrumented): **Adults – *male*** (+) **School-aged children – *female*** (-) **Pre-School children – *boys:*** (-)	**Adults** ***Men & Women***: secondary (-) **School-aged children**: ***male*** – father's primary (+); ***female*** – father's secondary (+); mother's primary (+) **Pre-School children – *boys:*** father's primary (+);
		Height-for-age (HAZ)	Pre-school children: Parental education	***boys:*** (+) ***girls:*** (+)	***boys:*** father's – primary (+); secondary (+) mother's – secondary (+) ***girls:*** mother's – secondary (+)
		Weight-for-height (WHZ)	Pre-school children: Parental education	***boys:*** (+) ***girls:*** (+)	***boys:*** father's – secondary (+) ***girls:*** father's – primary (+); mother's – secondary (+)
Jalan and Ravallion (2003)/ rural India	Household survey/ children under 5 years	Illness (diarrhoea) Duration	Adult female members of household	Income: illness (-); duration (-)	**Illness**: (-) **Duration**: (-)
Katahoire et al., (2004)/ Uganda	Household survey in a rural district of Samia Bugwe/ children below the age of 60months	Morbidity Mortality Immunisation Stunted Wasted	Maternal schooling Husband's schooling	Scores on family living conditions: includes iron roof, brick walls, cement floor, bicycle, radio, electricity and latrine.	***Morbidity; stunting; wasting:*** Not significant ***Mortality***: (-); ***Immunisation***: (+)

Cooper et al. (2006)/13 European countries: Germany, Denmark, Netherlands, Belgium, France, UK, Ireland, Italy, Greece, Spain, Portugal, Austria and Finland.	European Community Household Panel (1994-2002)/ adults	Duration of good health (where poor health is chronic physical or mental health problems, illness or disability)	Personal education	Household income (+) except Spain highest income quartile (-), Denmark, Belgium, Ireland, Italy, Greece, Austria and Finland (not significant for any income quartile)	***Education*: (+) in all countries except Denmark, the Netherlands and Belgium (not significant)

Doyle et al. (2007)/England	Health survey 1997-2002/ children aged 15 and below	Ill health status Chronic health condition (CHC)	Mother's schooling Father's schooling	Annual family income: ill health (-); CHC (-) *2SLS/IV* (income): ill health (-); CHC (-)	***Ill Health:*** mother's (-); father's (-) ***CHC***: mother & father's (not significant) *2SLS/IV (education)*: ***Ill Health:*** mother's (-); ***CHC***: mother (-) father's (not significant in all)
Blunch (2004)/ Ghana	Household survey – GLSS 4/ children and adults (for prenatal)	Illness Mortality (number of children dead) Vaccinations Prenatal care Postnatal care	Mother's education: Ghanaian reading Ghanaian writing English reading English writing Written calc. Adult literacy course participation Formal schooling[99]	Income of other household members Predicted maternal wage rates	***Illness***: English reading (-); English writing (+); literacy course (+) ***Mortality***: English writing (-); other education (-) ***Vaccinations***: literacy course (+); Middle/JSS (+) ***Postnatal care***: literacy course (+); secondary & above ***Prenatal care***: primary (+)

[99] This is in categorical terms such as: Primary, Middle/JSS, Secondary & above, Vocational and other

Blunch (2005)/ Ghana	Household survey – GLSS 4/ children	Mortality	Mother's: Literacy & numeracy Completed primary or more Adult literacy course participation	Income of other household members Predicted maternal wage rates	***Mortality***: *Full sample* *OLS*: Completed primary or more (-); Literacy & numeracy (-) *2SLS/IV*: none significant *Rural* *OLS*: Literacy & numeracy (-) *2SLS/IV*: Literacy & numeracy (-); literacy course (-); *Urban* *OLS*: Completed primary or more (-) *2SLS/IV*: none significant
		Postnatal care			***Postnatal care***: *Full sample* *OLS & 2SLS/IV*: Literacy course (+) *Rural* *OLS & 2SLS/IV*: Literacy course (+) *Urban* *OLS & 2SLS/IV*: Literacy course (+)

		Vaccinations			***Vaccinations***: *Full sample* *OLS*: Literacy course (+); Completed primary or more (+) *2SLS/IV*: Completed primary or more (+) *Rural* *OLS*: Literacy course (+); Completed primary or more (+) *2SLS/IV*: Completed primary or more (+) *Urban* *OLS* & *2SLS/IV*: none significant
Glewwe (1998)/ Morocco	Household survey/Children at the age of 5 and below.	Height-for-age (HAZ)	*Mothers' education (years of schooling; Arabic literacy; French literacy, numeracy; health knowledge). Fathers' schooling (years)	Household expenditure per capita: *OLS*: (+) *2SLS/IV*: (+)[100]	**HAZ**: *OLS*: Mothers' years of schooling (+)[101]. *2SLS/IV*: Mothers' years of schooling (not significant) *2SLS/IV*: Health knowledge (+)

[100] But not when the test scores (maths, French, Arabic and health knowledge) are included as endogenous.

[101] Not significant when test scores are added. None of the test scores too are found statistically significant, either on their own or jointly.

Thomas et al. (1990)/Brazil	Household expenditure data/children (0-107months)	Survival Height-for-age	Mothers' and fathers' education	Unearned income **HAZ**: (+) in only urban areas **Child survival**: (+) except urban south	**HAZ**: Mothers' (+); fathers' (+) **Child survival**: Mothers' (+); fathers' (+)
Thomas et al. (1991)/Brazil	Household surveys (DHS)/children (0-60months)	Height-for-age	Mothers' and fathers' education	Income (+)	**HAZ**: Mothers' (+); fathers' (+)
Joshi (1994)/ rural Nepal	Household survey/ children	Height-for-age Weight-for-height	Mother's schooling; and Husband's	Household economic status indicator comprising radio, television, presence of toilet, number of cows, buffaloes etc (not significant); Parental literacy (not significant)	**HAZ**: mother's (+) **WHZ**: husband's (+)
Alderman and Garcia (1994)/ rural Pakistan	Household survey/ children under 6 years of age	Height-for-age Weight-for-height	Mother's and father's education	Income (instrumented): **HAZ**: (-) **WHZ**: (-)	**HAZ**: Mothers' (+) **WHZ**: Mothers' (+) father's education is not significant
Lavy et al., (1996)/ Ghana	Household survey GLSS 2 (1988-89)/Children up to 11 years of age	Probability of child survival	Mother's education (years of education and its square)		Weak joint significance (individually insignificant)[102]

[102] The direction of effect depends on the sample: full(-); urban (+); rural (-); male (+); female (-)

		Height-for-age Weight-for-height	Mother and father's education (years of education and its square)	Expenditure per capita (instrumented) **HAZ**: (+) **WHZ**: Not significant	**HAZ**: Both significant (+) at higher levels of education **WHZ**: Only paternal
Asenso-Okyere et al., (1997)/ Ghana	Household survey GLSS 1 (1987-88)/Children up to 60 months	Height-for-age (HAZ) Weight-for-height (WHZ)	Mothers' education **HAZ**: years of schooling **WHZ:** literacy	Household expenditure per capita (only for) **WHZ:** not significant	**HAZ**: (not significant) **WHZ:** (not significant)
Glewwe and Desai (1999)/ Ghana	Household survey GLSS 2 (1988-89)/Children at the age of 5 and below.	Height-for-age (HAZ)	*Mothers' education (years of schooling; scores on cognitive achievement tests; Raven's test scores). Fathers' schooling (years)	Land (not significant)	**HAZ**: **-** Mothers' years of education (not significant) Cognitive skills (not significant) Father's years of schooling (not significant)
		Weight-for-height (WHZ)		Land (not significant)	**WHZ**: Mother's years of schooling (not significant) Mathematics (+) Raven's test scores (not significant)
Desai and Alva (1998)/22 developing	Household survey (DHS)/children	Infant mortality	*Mothers' education	a. No	Maternal education (-)

		Height-for-age (HAZ)			Maternal education (+) in only few countries when socio-economic variables are controlled.
		Immunisation status			Maternal education (+)

Note: star (*) in education column implies education is the primary focus of study.

A-2: The Impact of Parental Education on The Probability of Child Illness, 1987/88 (GLSS 1)

Sample:	**Variant 1:** parental education only		w/ water & sanitation		**Variant 2:** w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		**Variant 3:** w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 1	Marginal		Marginal		Marginal		Marginal		Marginal		Marginal	
Full	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Mother's Primary	0.068	3.15**	0.07	3.21**	0.065	2.92**	0.066	2.95**	0.064	2.95**	0.065	3.01**
Mother's Middle	0.033	2.07*	0.035	2.18*	0.035	2.15*	0.037	2.26*	0.031	1.94	0.033	2.03*
Mother's Sec & above	0.091	2.21*	0.094	2.28*	0.085	1.89	0.086	1.9	0.087	2.07*	0.088	2.11*
Father's Primary	0.014	0.51	0.013	0.48	0.028	0.93	0.029	0.96	0.017	0.61	0.016	0.58
Father's Middle	0.034	2.18*	0.034	2.17*	0.049	2.51*	0.051	2.60**	0.028	1.8	0.028	1.78
Father's Sec & above	0.048	1.97*	0.048	1.99*	0.065	2.32*	0.067	2.39*	0.041	1.7	0.041	1.71
Observation no.	6378											
Urban												
Mother's Primary	0.114	3.00**	0.104	2.77**	0.114	2.81**	0.106	2.68**	0.109	2.88**	0.101	2.69**
Mother's Middle	0.097	3.71***	0.089	3.38***	0.099	3.64***	0.092	3.38***	0.089	3.39***	0.083	3.13**
Mother's Sec & above	0.177	3.56***	0.169	3.39***	0.191	3.53***	0.184	3.39***	0.156	3.05**	0.152	2.97**
Father's Primary	-0.036	-0.65	-0.03	-0.55	-0.036	-0.64	-0.029	-0.51	-0.041	-0.74	-0.035	-0.63
Father's Middle	-0.028	-1.05	-0.021	-0.78	-0.029	-0.76	-0.018	-0.46	-0.034	-1.28	-0.027	-1.01
Father's Sec & above	-0.053	-1.53	-0.049	-1.41	-0.052	-1.18	-0.044	-0.97	-0.062	-1.78	-0.058	-1.65
Observation no.	2410											
Rural												
Mother's Primary	0.033	1.25	0.037	1.39	0.04	1.43	0.044	1.55	0.03	1.14	0.034	1.27
Mother's Middle	0.009	0.42	0.011	0.52	0.011	0.51	0.014	0.67	0.01	0.5	0.012	0.57
Mother's Sec & above	0.117	1.19	0.126	1.27	0.102	1.09	0.119	1.24	0.113	1.14	0.119	1.2
Father's Primary	0.042	1.29	0.043	1.32	0.042	1.18	0.046	1.3	0.044	1.36	0.046	1.41
Father's Middle	0.057	2.92**	0.059	3.02**	0.052	2.36*	0.056	2.53*	0.052	2.62**	0.053	2.70**
Father's Sec & above	0.119	3.48***	0.125	3.65***	0.116	3.13**	0.127	3.36***	0.111	3.27**	0.118	3.45***
Observation no.	3968											

*Refer to notes in text

A-3: The Impact of Parental Education on The Probability of Child Illness, 1998/99 (GLSS 4)

GLSS 4	**Variant 1:** parental education only		w/ water & sanitation		**Variant 2:** w/ expenditure & quadratic		w/ expenditure & quadratic & water and sanitation		**Variant 3:** w/ unearned income & quadratic		w/ unearned income & quadratic & water and sanitation	
Sample:	Marginal		Marginal		Marginal		Marginal		Marginal		Marginal	
Full	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Mother's Primary	0.009	0.59	0.011	0.76	0.006	0.49	0.009	0.76	0.005	0.35	0.008	0.53
Mother's Middle	0.013	0.97	0.016	1.17	0.004	0.38	0.008	0.68	0.01	0.7	0.013	0.92
Mother's Sec & above	0.01	0.35	0.014	0.5	0.006	0.26	0.01	0.42	0.005	0.2	0.01	0.35
Father's Primary	0.029	1.53	0.028	1.48	0.002	0.16	0.002	0.12	0.031	1.61	0.03	1.57
Father's Middle	-0.007	-0.57	-0.006	-0.51	-0.023	-2.15*	-0.021	-1.99*	-0.008	-0.64	-0.007	-0.56
Father's Sec & above	0.018	1	0.021	1.11	-0.01	-0.7	-0.007	-0.5	0.014	0.76	0.016	0.88
Observation no.	11660											
Urban												
Mother's Primary	-0.007	-0.29	-0.007	-0.31	-0.008	-0.4	-0.008	-0.37	-0.011	-0.46	-0.011	-0.46
Mother's Middle	-0.004	-0.18	-0.004	-0.2	-0.012	-0.66	-0.011	-0.62	-0.008	-0.4	-0.008	-0.39
Mother's Sec & above	0.011	0.35	0.011	0.33	0	0	0.001	0.02	0.007	0.21	0.007	0.21
Father's Primary	-0.017	-0.61	-0.017	-0.61	-0.014	-0.56	-0.015	-0.59	-0.013	-0.48	-0.013	-0.48
Father's Middle	-0.02	-0.94	-0.02	-0.95	-0.032	-1.56	-0.031	-1.54	-0.02	-0.95	-0.02	-0.94
Father's Sec & above	-0.022	-0.9	-0.023	-0.92	-0.023	-0.96	-0.022	-0.94	-0.029	-1.2	-0.028	-1.19
Observation no.	3547											
Rural												
Mother's Primary	0.015	0.82	0.019	1.04	0.017	1.13	0.021	1.38	0.011	0.64	0.016	0.87
Mother's Middle	0.024	1.35	0.03	1.65	0.02	1.38	0.025	1.72	0.021	1.17	0.026	1.48
Mother's Sec & above	0.019	0.4	0.027	0.55	0.021	0.52	0.029	0.72	0.012	0.26	0.019	0.4
Father's Primary	0.043	1.79	0.041	1.73	0.007	0.4	0.007	0.38	0.043	1.78	0.041	1.73
Father's Middle	-0.008	-0.5	-0.006	-0.43	-0.025	-1.92	-0.023	-1.8	-0.009	-0.63	-0.008	-0.55
Father's Sec & above	0.044	1.68	0.048	1.83	-0.004	-0.23	-0.001	-0.04	0.04	1.55	0.044	1.69
Observation no.	8113											

*Refer to notes in text

A-4: The Impact of Parental Education on The Probability of Child Illness, 1987/88 & 1998/99 (Pooled)

Pooled	**Variant 1:** parental education only		w/ water & sanitation		**Variant 2:** w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		**Variant 3:** w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
Sample:	Marginal		Marginal		Marginal		Marginal		Marginal		Marginal	
Full	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Mother's Primary	0.023	2.16*	0.026	2.37*	0.024	2.21*	0.027	2.45*	0.02	1.84	0.022	2.05*
Mother's Middle	0.015	1.69	0.018	1.98*	0.012	1.25	0.014	1.53	0.013	1.4	0.015	1.68
Mother's Sec & above	0.03	1.53	0.035	1.74	0.019	0.92	0.022	1.08	0.029	1.44	0.033	1.64
Father's Primary	0.013	0.94	0.012	0.87	0.005	0.37	0.003	0.23	0.013	0.93	0.012	0.87
Father's Middle	0.003	0.3	0.004	0.4	-0.007	-0.74	-0.007	-0.74	-0.001	-0.12	0	-0.01
Father's Sec & above	0.018	1.45	0.02	1.59	0.007	0.54	0.008	0.57	0.016	1.25	0.017	1.38
GLSS_1	0.093	12.71***	0.087	11.70***	0.287	3.09**	0.302	3.25**	0.09	10.57***	0.086	9.90***
Observation no.	18038											
Urban												
Mother's Primary	0.025	1.31	0.025	1.3	0.022	1.13	0.023	1.16	0.021	1.11	0.022	1.11
Mother's Middle	0.023	1.52	0.023	1.51	0.019	1.17	0.019	1.2	0.02	1.28	0.02	1.28
Mother's Sec & above	0.058	2.22*	0.057	2.21*	0.044	1.54	0.044	1.56	0.052	2.02*	0.052	2.02*
Father's Primary	-0.012	-0.48	-0.012	-0.48	-0.021	-0.84	-0.022	-0.86	-0.01	-0.39	-0.01	-0.39
Father's Middle	-0.017	-1.05	-0.017	-1.05	-0.029	-1.53	-0.029	-1.54	-0.018	-1.16	-0.018	-1.16
Father's Sec & above	-0.014	-0.71	-0.014	-0.71	-0.028	-1.25	-0.028	-1.25	-0.017	-0.85	-0.016	-0.85
GLSS_1	0.135	10.66***	0.135	10.66***	0.301	2.04*	0.304	2.02*	0.148	9.66***	0.148	9.66***
Observation no.	5957											
Rural												
Mother's Primary	0.023	1.77	0.027	2.08*	0.024	1.82	0.029	2.14*	0.02	1.53	0.024	1.84
Mother's Middle	0.014	1.24	0.018	1.59	0.009	0.76	0.013	1.05	0.012	1.07	0.016	1.4
Mother's Sec & above	0.022	0.63	0.032	0.88	0.008	0.23	0.015	0.41	0.021	0.59	0.03	0.82
Father's Primary	0.021	1.33	0.022	1.36	0.015	0.88	0.014	0.87	0.02	1.23	0.02	1.27
Father's Middle	0.004	0.36	0.006	0.53	-0.003	-0.29	-0.002	-0.2	-0.001	-0.1	0.001	0.07
Father's Sec & above	0.041	2.39*	0.045	2.62**	0.031	1.71	0.033	1.85	0.038	2.25*	0.042	2.47*
GLSS_1	-0.007	-0.36	-0.02	-0.94	0.195	1.29	0.206	1.36	-0.007	-0.31	-0.017	-0.81
Observation no.	12081											

A–5a: First-stage regression of endogenous parental education variables, 1987/88 (GLSS 1)

GLSS 1 **Full Sample:**	Mat.Primary Marginal Effects	t- ratio	Mat.Mid/JSS Marginal Effects	t- ratio	Mat.Sec Marginal Effects	t- ratio	Pat.Primary Marginal Effects	t- ratio	Pat.Mid/JSS Marginal Effects	t- ratio	Pat.Sec Marginal Effects	t- ratio
Age1629*Western	0.179	4.60***	0.21	3.67***	0.029	1.36	-0.095	-2.78**	0.132	2.05*	0.016	0.44
Age3039*Western	0.127	3.65***	0.262	4.62***	0.024	1.22	-0.041	-1.08	0.053	0.82	0.062	1.6
Age4049*Western	0.07	2.01*	-0.016	-0.32	0.013	0.75	-0.117	-3.46***	-0.128	-1.92	-0.016	-0.47
Age50pl*Western	0.008	0.26	0.104	1.64	-0.014	-0.85	0.007	0.16	-0.18	-2.50*	-0.013	-0.31
Age1629*Central	0.143	4.12***	0.023	0.37	0.019	0.94	0.003	0.11	0.097	1.36	0.011	0.25
Age3039*Central	0.112	3.47***	0.063	1.01	0.029	1.31	0.023	0.83	0.03	0.42	0.011	0.25
Age4049*Central	0.138	3.54***	-0.042	-0.69	0.03	1.34	0.044	1.21	-0.079	-1.07	-0.061	-1.63
Age50pl*Central	-0.003	-0.12	-0.101	-1.42	-0.022	-1.27	-0.031	-1.68	-0.142	-1.68	-0.106	-2.63**
Age1629*GtAccra	0.043	1.4	0.213	3.87***	0.016	0.63	-0.009	-0.32	0.072	1.26	0.086	1.86
Age3039*GtAccra	0.061	2.26*	0.073	1.48	0.118	4.19***	-0.043	-1.83	-0.031	-0.6	0.138	3.39***
Age4049*GtAccra	0.11	2.91**	-0.143	-2.69**	0.065	1.92	0.003	0.1	-0.042	-0.7	-0.013	-0.3
Age50pl*GtAccra	0.008	0.24	-0.003	-0.04	-0.011	-0.42	-0.045	-1.61	-0.053	-0.77	0.06	1.09
Age1629*Eastern	0.084	2.45*	0.315	5.92***	0.024	1.15	-0.031	-1	0.117	2.13*	0.038	0.91
Age3039*Eastern	0.117	3.32***	0.237	4.44***	0.019	0.84	-0.046	-1.49	0.159	2.88**	-0.033	-0.86
Age4049*Eastern	-0.014	-0.47	0.028	0.53	-0.009	-0.54	-0.025	-0.74	-0.081	-1.41	-0.004	-0.11
Age50pl*Eastern	-0.011	-0.35	0.011	0.19	-0.004	-0.19	-0.052	-1.66	-0.165	-2.62**	-0.064	-1.59
Age1629*Volta	0.089	2.27*	0.272	4.97***	0.012	0.64	-0.102	-2.70**	0.104	1.72	0.033	0.77
Age3039*Volta	0.024	0.7	0.133	2.44*	0.076	2.93**	-0.084	-2.14*	0.086	1.39	0.078	1.78
Age4049*Volta	0.057	1.5	0.167	2.98**	0.008	0.47	-0.105	-2.83**	-0.174	-2.97**	0.045	1.03
Age50pl*Volta	0.037	0.82	0.046	0.72	0.013	0.59	-0.096	-2.19*	-0.141	-1.97*	-0.027	-0.56
Age1629*Ashanti	0.132	4.72***	0.247	5.39***	0.044	4.47***	-0.018	-1.1	0.058	1.26	0.042	1.24
Age3039*Ashanti	0.067	2.79**	0.113	2.59**	0.064	5.08***	0.006	0.36	-0.075	-1.63	0.062	1.84
Age4049*Ashanti	0.08	2.79**	-0.065	-1.47	0.022	4.98***	0.036	1.73	-0.071	-1.43	-0.053	-1.71
Age50pl*Ashanti	0.038	1.45	0.019	0.41	0.031	3.36***	0.013	0.71	-0.113	-2.30*	-0.07	-2.31*
Age1629*Brong-Ahafo	0.126	2.93**	0.257	4.49***	0.049	2.55*	-0.078	-2.44*	0.122	1.84	0.032	0.68
Age3039*Brong-Ahafo	0.158	3.53***	0.238	4.15***	0.014	1.04	-0.057	-1.73	0.018	0.27	0.001	0.02
Age4049*Brong-Ahafo	0.069	1.58	0.065	1.16	0.019	1.48	-0.074	-2.20*	-0.108	-1.59	-0.049	-1.11
Age50pl*Brong-Ahafo	0.025	0.56	-0.073	-1.27	-0.004	-0.34	-0.072	-2.33*	-0.243	-3.42***	-0.099	-2.14*
Age1629*Northern	0.037	2.11*	0.128	4.24***	0.066	4.44***	-0.039	-2.18*	0.084	1.8	0.092	2.88**

Age3039*Northern	0.044	3.07**	0.163	5.43***	0.063	5.93***	-0.067	-8.62***	0.038	0.97	0.053	2.10*
Age4049*Northern	0.028	2.84**	0.105	4.00***	0.047	6.77***	-0.06	-8.15***	0.033	0.84	0.026	1.1
Age50pl*Northern	0.024	3.16**	0.143	3.63***	0.035	5.19***	-0.044	-5.92***	0.052	1.09	0.002	0.09
Age1629*Upper-West	0.019	1.59	0.133	2.52*	0.049	5.67***	-0.126	-1.89	0.024	0.26	0.068	1.35
Age3039*Upper-West	0.023	2.05*	0.126	2.85**	0.054	6.69***	-0.155	-2.57*	-0.009	-0.1	0.042	0.99
Age4049*Upper-West	0.084	1.44	0.125	2.78**	0.054	6.78***	-0.153	-2.55*	0.146	1.2	0.032	0.76
Age50pl*Upper-West	0.029	2.55*	0.135	3.04**	0.056	7.26***	-0.156	-2.60**	-0.023	-0.28	0.036	0.84
Age1629*Upper-East	0.099	2.04*	0.232	2.90**	0.09	2.36*	0.021	0.25	0.183	1.54	0.129	1.99*
Age3039*Upper-East	0.123	2.64**	0.107	2.47*	0.051	6.35***	-0.147	-2.58**	0.034	0.32	0.041	0.98
Age4049*Upper-East	0.009	0.83	0.115	2.04*	0.039	3.98***	-0.135	-2.36*	-0.089	-0.86	0.102	1.51
Age50pl*Upper-East	0.029	2.77**	0.116	2.43*	0.054	5.23***	-0.146	-2.55*	-0.121	-1.34	0.034	0.78
Grandfather's education	-0.002	-1.38	0.027	9.83***	0.007	4.31***	-0.002	-1.79	0.008	2.86**	0.019	7.58***
Grandmother's education	-0.004	-1.01	-0.007	-1.1	0.009	1.88	-0.006	-4.52***	0.006	0.87	-0.004	-0.78
Missing Grandparents education	0.03	2.91**	0.149	10.43***	0.044	6.63***	-0.058	-8.07***	0.124	8.17***	0.065	6.20***
Constant	0.049	1.49	0.31	4.11***	0.149	2.44*	0.051	1.59	0.574	7.02***	0.12	2.14*
Obs.	6378		6378		6378		6378		6378		6378	
R-sq.	0.043		0.171		0.089		0.039		0.159		0.083	
Adj. R-sq	0.035		0.164		0.081		0.03		0.151		0.075	
F-test of instruments	4.14		13.21		3.35		4.69		7.3		5.37	
P-value	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	

*Notes: (1) – Only the estimates of the instrumental variables are reported; the control variables are suppressed for brevity.
(2) – The first stage of models conditioning on expenditure (variant 2) are also estimated but not reported for brevity.
(3) – The over-identification test statistics and p-values of estimations are however reported beneath estimates' tables in text.

A–5b: First-stage regression of endogenous parental education variables, 1998/99 (GLSS 4)

GLSS 4 Full Sample:	Mat.Primary Marginal Effects	t- ratio	Mat.Mid/JSS Marginal Effects	t- ratio	Mat.Sec Marginal Effects	t- ratio	Pat.Primary Marginal Effects	t- ratio	Pat.Mid/JSS Marginal Effects	t- ratio	Pat.Sec Marginal Effects	t- ratio
Age1629*Western	0.056	1.73	0.115	2.92**	-0.007	-0.56	-0.105	-3.23**	0.044	0.96	0.024	0.83
Age3039*Western	0.053	1.84	0.068	1.93	0.031	2.25*	-0.102	-3.33***	-0.005	-0.13	0.097	3.47***
Age4049*Western	0.035	1.08	0.082	2.06*	0.01	0.67	-0.13	-4.14***	-0.122	-2.66**	0.103	3.13**
Age50pl*Western	0.023	0.6	-0.068	-1.61	0.047	2.02*	-0.076	-1.94	-0.176	-3.13**	0.02	0.53
Age1629*Central	0.001	0.02	0.094	2.46*	-0.024	-1.17	-0.089	-2.21*	0.109	2.09*	-0.071	-2.23*
Age3039*Central	0.027	0.72	0.065	1.94	0.006	0.28	-0.037	-0.94	0.042	0.87	-0.052	-1.68
Age4049*Central	-0.02	-0.54	0.086	2.35*	-0.017	-0.81	-0.135	-3.55***	-0.012	-0.24	-0.007	-0.2
Age50pl*Central	-0.063	-1.61	0.023	0.6	-0.001	-0.06	-0.13	-3.28**	-0.08	-1.47	-0.06	-1.75
Age1629*GtAccra	0.142	3.39***	0.056	0.97	0.068	2.83**	-0.045	-1.08	0.071	1.19	-0.099	-1.87
Age3039*GtAccra	0.076	2.20*	0.046	0.87	0.166	6.98***	-0.071	-1.89	-0.058	-1.11	0.048	0.94
Age4049*GtAccra	0.058	1.5	0.067	1.15	0.119	4.44***	-0.063	-1.54	-0.113	-1.97*	0.046	0.84
Age50pl*GtAccra	0.123	2.50*	0.043	0.66	0.068	2.40*	-0.104	-2.59**	-0.025	-0.38	-0.123	-2.12*
Age1629*Eastern	0.118	3.69***	-0.001	-0.02	-0.042	-2.52*	0.056	1.95	0.103	2.32*	-0.119	-3.59***
Age3039*Eastern	0.042	1.59	0.113	3.06**	0.022	1.24	0.011	0.44	0.038	0.93	-0.034	-1.07
Age4049*Eastern	0.092	3.00**	0.053	1.34	0.006	0.35	-0.016	-0.64	0.057	1.29	-0.068	-2.03*
Age50pl*Eastern	0.12	3.37***	-0.043	-1	0.031	1.39	0.021	0.73	-0.092	-1.94	-0.107	-3.12**
Age1629*Volta	0.067	2.12*	0.048	1.23	0.007	0.39	-0.056	-2.59**	0.07	1.56	-0.036	-1.13
Age3039*Volta	0.039	1.53	0.004	0.14	0.013	0.91	0.02	0.89	-0.079	-2.07*	0.058	1.86
Age4049*Volta	0.085	2.76**	0.002	0.05	0.041	2.25*	-0.026	-1.11	-0.073	-1.74	0.058	1.69
Age50pl*Volta	0.047	1.36	-0.057	-1.44	0.026	1.32	0.023	0.78	-0.142	-3.05**	-0.116	-3.79***
Age1629*Ashanti	0.064	2.02*	0.025	0.68	0	0	-0.008	-0.31	-0.024	-0.6	0.052	1.75
Age3039*Ashanti	0.089	3.03**	0.001	0.02	0.007	0.45	-0.007	-0.29	-0.028	-0.75	0.031	1.11
Age4049*Ashanti	0.1	3.02**	-0.017	-0.44	0.011	0.68	0.086	3.07**	-0.145	-3.58***	-0.027	-0.94
Age50pl*Ashanti	-0.023	-0.74	-0.011	-0.29	-0.027	-1.92	0.013	0.5	-0.22	-5.25***	-0.026	-0.86
Age1629*Brong-Ahafo	0.136	3.00**	0.143	2.63**	0.037	1.87	-0.072	-2.01*	0.091	1.45	0.009	0.24
Age3039*Brong-Ahafo	0.069	1.86	0.069	1.49	0.013	0.96	0.004	0.1	0.018	0.32	0.023	0.66
Age4049*Brong-Ahafo	-0.006	-0.15	-0.006	-0.11	-0.008	-0.63	-0.026	-0.69	-0.196	-3.22**	0.025	0.63
Age50pl*Brong-Ahafo	-0.052	-1.38	-0.067	-1.28	-0.005	-0.33	-0.059	-1.6	-0.284	-4.47***	-0.042	-1.04
Age1629*Northern	0.071	2.54*	0.074	3.66***	0.019	3.32***	-0.096	-1.91	0.025	0.55	0.112	3.28**

Age3039*Northern	0.062	2.52*	0.05	2.94**	0.017	3.61***	-0.089	-1.82	-0.025	-0.6	0.064	2.10*
Age4049*Northern	-0.016	-0.75	0.058	2.90**	0.016	3.28**	-0.145	-2.95**	-0.034	-0.76	0.005	0.18
Age50pl*Northern	0.019	0.61	0.075	2.44*	0.01	1.93	-0.075	-1.25	-0.083	-1.82	0.027	0.72
Age1629*Upper-West	0.007	1.32	0.077	1.18	0.005	0.11	-0.015	-0.42	-0.035	-0.37	0.195	3.01**
Age3039*Upper-West	0.023	2.18*	-0.001	-0.02	-0.032	-1.05	-0.023	-0.69	-0.118	-1.48	0	0
Age4049*Upper-West	0.089	2.35*	0.127	1.87	0.1	1.81	-0.047	-1.55	-0.005	-0.06	0.138	2.47*
Age50pl*Upper-West	0	-0.02	-0.061	-1.46	-0.027	-0.89	0.019	0.4	-0.215	-2.77**	-0.028	-1.01
Age1629*Upper-East	0.005	0.12	0.022	0.73	0.034	3.04**	-0.082	-1.85	-0.065	-1.12	-0.045	-0.96
Age3039*Upper-East	-0.001	-0.03	0.052	1.65	0.023	3.30***	-0.1	-2.40*	-0.086	-1.58	0.037	0.76
Age4049*Upper-East	-0.019	-0.51	0.024	0.78	0.023	2.99**	-0.099	-2.37*	-0.087	-1.58	-0.063	-1.4
Age50pl*Upper-East	-0.04	-1.01	0.012	0.35	0.015	2.55*	-0.038	-0.73	-0.089	-1.46	-0.088	-1.98*
Grandfather's education	0.006	4.62***	0.009	5.74***	0.005	5.72***	0.002	1.45	0.004	2.54*	0.015	10.60***
Missing Grandfather's education	0.039	2.53*	0.027	1.52	0.029	2.96**	-0.026	-1.88	0.049	2.31*	0.037	2.26*
Grandmother's education	-0.005	-2.23*	0.008	3.00**	0.013	6.12***	-0.005	-3.02**	-0.011	-4.00***	0.019	7.73***
Missing Grandmother's education	-0.013	-0.91	0.024	1.43	-0.016	-1.68	-0.009	-0.63	-0.015	-0.75	0.022	1.37
Constant	0.096	2.72**	0.32	7.08***	0.096	3.68***	0.05	2.59**	0.343	7.08***	0.235	5.67***
Obs.	11660		11660		11660		11660		11660		11660	
R-sq.	0.035		0.1		0.081		0.027		0.117		0.105	
Adj. R-sq	0.03		0.096		0.077		0.022		0.113		0.101	
F-test of instruments	4.38		4.16		5.06		3.96		6.08		11.48	
P-value	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	

*Notes: refer to A-5a

A–5c: First-stage regression of endogenous parental education variables, 1987/88 & 1998/99 (Pooled)

	Mat.Primary Marginal Effects	t- ratio	Mat.Mid/JSS Marginal Effects	t- ratio	Mat.Sec Marginal Effects	t- ratio	Pat.Primary Marginal Effects	t- ratio	Pat.Mid/JSS Marginal Effects	t- ratio	Pat.Sec Marginal Effects	t- ratio
Age1629*Western	0.099	3.86***	0.13	4.02***	0.003	0.28	-0.103	-4.15***	0.07	1.89	0.02	0.87
Age3039*Western	0.074	3.22**	0.114	3.82***	0.026	2.34*	-0.082	-3.37***	0.004	0.11	0.085	3.76***
Age4049*Western	0.045	1.83	0.028	0.89	0.008	0.7	-0.123	-5.11***	-0.136	-3.62***	0.061	2.48*
Age50pl*Western	0.012	0.45	-0.017	-0.48	0.019	1.26	-0.045	-1.49	-0.18	-4.11***	0.003	0.13
Age1629*Central	0.051	1.8	0.053	1.6	-0.014	-0.93	-0.054	-1.95	0.091	2.18*	-0.041	-1.62
Age3039*Central	0.057	2.15*	0.045	1.47	0.01	0.64	-0.01	-0.35	0.024	0.61	-0.036	-1.46
Age4049*Central	0.031	1.09	0.027	0.84	-0.007	-0.46	-0.073	-2.67**	-0.05	-1.2	-0.023	-0.9
Age50pl*Central	-0.038	-1.35	-0.03	-0.86	-0.008	-0.48	-0.091	-3.33***	-0.111	-2.43*	-0.074	-2.77**
Age1629*GtAccra	0.091	3.53***	0.113	2.87**	0.03	1.66	-0.024	-0.99	0.063	1.56	-0.014	-0.4
Age3039*GtAccra	0.062	2.91**	0.04	1.12	0.129	6.98***	-0.053	-2.51*	-0.057	-1.58	0.089	2.86**
Age4049*GtAccra	0.07	2.67**	-0.024	-0.6	0.081	3.80***	-0.031	-1.24	-0.098	-2.40*	0.035	1
Age50pl*GtAccra	0.074	2.37*	0.012	0.27	0.022	1.08	-0.071	-3.01**	-0.052	-1.1	-0.037	-0.97
Age1629*Eastern	0.1	4.27***	0.126	3.92***	-0.017	-1.27	0.024	1.13	0.098	2.86**	-0.05	-1.94
Age3039*Eastern	0.061	2.91**	0.147	4.85***	0.019	1.34	-0.009	-0.47	0.068	2.08*	-0.035	-1.4
Age4049*Eastern	0.053	2.36*	0.035	1.09	-0.002	-0.17	-0.017	-0.82	-0.002	-0.04	-0.046	-1.81
Age50pl*Eastern	0.074	2.82**	-0.028	-0.81	0.018	1.1	-0.003	-0.14	-0.129	-3.41***	-0.091	-3.47***
Age1629*Volta	0.072	2.91**	0.121	3.78***	0.004	0.32	-0.067	-3.41***	0.076	2.10*	-0.014	-0.53
Age3039*Volta	0.031	1.5	0.035	1.28	0.026	2.11*	-0.015	-0.75	-0.046	-1.42	0.063	2.50*
Age4049*Volta	0.073	3.04**	0.053	1.73	0.028	2.11*	-0.052	-2.58**	-0.11	-3.21**	0.053	1.97*
Age50pl*Volta	0.041	1.48	-0.031	-0.92	0.02	1.32	-0.015	-0.59	-0.15	-3.85***	-0.091	-3.57***
Age1629*Ashanti	0.092	4.23***	0.104	3.64***	0.014	1.33	-0.009	-0.56	0.002	0.05	0.045	2.02*
Age3039*Ashanti	0.086	4.25***	0.031	1.17	0.023	2.30*	0	0.02	-0.045	-1.58	0.036	1.7
Age4049*Ashanti	0.096	4.18***	-0.042	-1.46	0.013	1.27	0.073	3.85***	-0.123	-3.94***	-0.039	-1.83
Age50pl*Ashanti	0.002	0.1	-0.005	-0.17	-0.006	-0.64	0.018	1.03	-0.184	-5.79***	-0.043	-1.96*
Age1629*Brong-Ahafo	0.132	4.22***	0.18	4.55***	0.037	2.73**	-0.07	-2.90**	0.089	1.98*	0.021	0.68
Age3039*Brong-Ahafo	0.092	3.28**	0.13	3.63***	0.011	1.15	-0.019	-0.76	0.025	0.58	0.009	0.31
Age4049*Brong-Ahafo	0.025	0.85	0.015	0.41	0	0.02	-0.044	-1.71	-0.17	-3.77***	-0.008	-0.27
Age50pl*Brong-Ahafo	-0.023	-0.81	-0.073	-1.87	-0.008	-0.79	-0.065	-2.61**	-0.27	-5.70***	-0.069	-2.28*
Age1629*Northern	0.054	3.20**	0.095	5.10***	0.031	5.11***	-0.048	-1.85	0.049	1.53	0.105	4.52***

Age3039*Northern	0.051	3.62***	0.088	5.21***	0.03	6.28***	-0.053	-2.19*	-0.002	-0.08	0.06	3.03**
Age4049*Northern	-0.002	-0.24	0.069	4.01***	0.023	6.21***	-0.089	-3.74***	-0.011	-0.38	0.012	0.66
Age50pl*Northern	0.017	1.05	0.094	3.71***	0.015	4.12***	-0.043	-1.44	-0.036	-1.11	0.016	0.68
Age1629*Upper-West	0.015	2.34*	0.077	1.72	0.017	0.68	-0.05	-1.41	-0.038	-0.57	0.142	3.29**
Age3039*Upper-West	0.015	1.6	0.046	1.31	-0.005	-0.27	-0.073	-2.22*	-0.079	-1.33	0.014	0.55
Age4049*Upper-West	0.082	2.55*	0.146	2.81**	0.096	2.42*	-0.088	-2.81**	0.042	0.57	0.119	2.69**
Age50pl*Upper-West	-0.005	-0.82	-0.004	-0.11	-0.005	-0.25	-0.038	-0.87	-0.162	-2.78**	-0.014	-0.57
Age1629*Upper-East	0.027	0.88	0.079	2.57*	0.046	3.53***	-0.063	-1.59	-0.006	-0.1	0.004	0.1
Age3039*Upper-East	0.023	0.82	0.076	2.78**	0.028	5.01***	-0.121	-3.55***	-0.069	-1.43	0.05	1.35
Age4049*Upper-East	-0.012	-0.46	0.058	2.18*	0.027	4.09***	-0.121	-3.56***	-0.088	-1.8	-0.026	-0.75
Age50pl*Upper-East	-0.028	-0.99	0.048	1.62	0.021	4.25***	-0.067	-1.52	-0.097	-1.79	-0.056	-1.67
Grandfather's education	0.004	3.61***	0.014	10.16***	0.006	7.20***	0.001	0.7	0.006	4.13***	0.015	12.89***
Grandmother's education	-0.004	-2.32*	0.004	1.64	0.012	6.28***	-0.005	-3.83***	-0.009	-3.51***	0.015	6.59***
Missing Grandfather's education	0.038	2.55*	0.048	2.71**	0.035	3.71***	-0.03	-2.22*	0.067	3.23**	0.038	2.35*
Missing Grandmother's education	-0.013	-0.91	0.032	1.91	-0.014	-1.45	-0.012	-0.92	-0.001	-0.06	0.02	1.28
GLSS_1	-0.055	-10.64***	0.051	7.57***	-0.01	-3.43***	-0.046	-11.09***	0.019	2.56*	-0.031	-6.10***
Constant	0.109	3.92***	0.306	7.85***	0.109	4.44***	0.064	3.91***	0.394	9.28***	0.214	6.24***
Obs.	1.80E+04		1.80E+04		1.80E+04		1.80E+04		1.80E+04		1.80E+04	
R-sq.	0.034		0.115		0.079		0.028		0.124		0.093	
Adj. R-sq	0.031		0.112		0.076		0.024		0.121		0.09	
F-test of instruments	39.921		75.547		12.017		24.323		79.266		33.627	
P-value	0.0000		0.0000		0.0000		0.0000		-1.20E+04		-5.50E+03	

*Notes: refer to A-5a

A-6: Probability of Child Illness – Treating Parental Education as Endogenous (GLSS 1 & 4, and Pooled); with and without conditioning on Expenditure

2SLS/IV	**Variant 1:** parental education only						**Variant 2:** w/ expenditure & quadratic					
	GLSS 1		**GLSS 4**		**Pooled**		**GLSS 1**		**GLSS 4**		**Pooled**	
Full Sample:	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
Mother's Primary	0.659	7.14***	0.529	3.64***	0.568	4.37***	0.641	6.76***	0.548	3.84***	0.56	4.22***
Mother's Middle	-0.027	-0.22	-0.017	-0.11	0.161	1.13	-0.03	-0.27	-0.023	-0.17	0.123	0.98
Mother's Sec & above	0.03	0.09	0.064	0.29	-0.032	-0.16	0.174	0.5	0.066	0.29	0.111	0.5
Father's Primary	-0.265	-2.48*	-0.098	-1.02	-0.178	-2.42*	-0.291	-3.84***	-0.114	-1.26	-0.218	-4.00***
Father's Middle	-0.016	-0.16	-0.051	-0.6	-0.103	-1.3	-0.034	-0.35	-0.075	-0.89	-0.08	-1.06
Father's Sec & above	0.092	0.33	0.03	0.27	-0.035	-0.3	0.134	0.49	0.018	0.17	-0.091	-0.91
GLSS_1					0.104	6.66***					0.197	1.82
Observation no.	6378		11660		18038		6378		11660		18038	
Over-identification stats. (Chi-sq)	47.867 (36)		40.265 (38)		40.299 (38)		48.906 (39)		40.054 (41)		43.237 (41)	
P-value	0.0892		0.3703		0.3689		0.1329		0.5125		0.376	
Full Sample w/poor water & sanitation:												
Mother's Primary	0.657	7.03***	0.543	3.75***	0.568	4.36***	0.614	5.84***	0.572	4.09***	0.501	3.53***
Mother's Middle	-0.022	-0.19	-0.043	-0.3	0.164	1.15	-0.018	-0.16	-0.02	-0.15	0.13	1.05
Mother's Sec & above	0.061	0.17	0.068	0.31	-0.025	-0.12	0.276	0.84	0.047	0.21	0.255	1.11
Father's Primary	-0.269	-2.57*	-0.109	-1.17	-0.183	-2.54*	-0.294	-3.99***	-0.121	-1.37	-0.226	-4.41***
Father's Middle	-0.022	-0.22	-0.049	-0.57	-0.106	-1.34	-0.032	-0.33	-0.088	-1.05	-0.065	-0.87
Father's Sec & above	0.088	0.32	0.064	0.54	-0.015	-0.12	0.092	0.35	0.047	0.41	-0.108	-1.14
Prop. of 'others' in cluster with no water & toilet	0.056	2.38*	0.059	3.69***	0.063	5.25***	0.055	2.36*	0.066	4.50***	0.066	5.66***
GLSS_1					0.094	5.98***					0.189	1.77
Observation no.	6378		11660		18038		6378		11660		18038	
Over-identification stats. (Chi-sq)	47.224 (36)		41.039 (38)		40.328 (38)		50.166 (39)		42.150 (41)		49.186 (41)	
P-value	0.0998		0.3388		0.3677		0.1085		0.421		0.1781	

*Refer to notes in text

A-6 cont: Probability of Child Illness – Treating Parental Education as Endogenous (GLSS 1 & 4, and Pooled); with and without conditioning on Expenditure

	Variant 1: Parental education only				**Variant 2:** w/ expenditure & quadratic			
Urban sub-sample (GLSS 1 only)	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
Mother's Primary	0.708	14.18***	0.712	15.15***	0.66	8.22***	0.655	8.19***
Mother's Middle	0.038	0.31	0.049	0.39	0.035	0.28	0.02	0.16
Mother's Sec & above	0.444	1.8	0.441	1.77	0.705	17.35***	0.701	15.77***
Father's Primary	-0.344	-4.05***	-0.34	-3.73***	-0.347	-4.28***	-0.343	-3.91***
Father's Middle	-0.08	-0.6	-0.092	-0.69	-0.137	-0.99	-0.103	-0.76
Father's Sec & above	-0.188	-1.23	-0.186	-1.2	-0.292	-2.53*	-0.276	-2.26*
Prop. of 'others' in cluster with no water & toilet			-0.044	-0.77			-0.05	-0.74
Observation no.	2410							
Over-identification stats. (Chi-sq)	34.319 (34)		34.610 (34)		39.534 (37)		39.310 (37)	
P-value	0.4524		0.4387		0.3575		0.3668	
Rural sub-sample (GLSS 1 only)					Marginal		Marginal	
Community variables excluded					Effects	t- ratio	Effects	t- ratio
Mother's Primary					0.406	2.11*	0.395	2.04*
Mother's Middle					0.036	0.29	0.045	0.36
Mother's Sec & above					-0.038	-0.11	-0.012	-0.04
Father's Primary					-0.15	-1.3	-0.154	-1.35
Father's Middle					-0.05	-0.56	-0.05	-0.56
Father's Sec & above					0.053	0.29	0.091	0.47
Prop. of 'others' in cluster with no water & toilet							0.079	2.78**
Observation no.					3968			
Over-identification stats. (Chi-sq)					53.395 (39)		39.310 (37)	
P-value					0.0621		0.3668	

*Refer to notes in text

A-6 cont: Probability of Child Illness – Treating Parental Education as Endogenous (GLSS 1 & 4, and Pooled); with and without conditioning on Expenditure

	Variant 1: parental education only				**Variant 2:** w/ expenditure & quadratic			
Rural sub-sample (GLSS 4 only)	Marginal		Marginal		Marginal		Marginal	
Community variables included	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Mother's Primary					0.128	0.8		
Mother's Middle					0.008	0.07		
Mother's Sec & above					0.355	0.82		
Father's Primary					-0.035	-0.28		
Father's Middle					0.007	0.07		
Father's Sec & above					0.035	0.26		
Observation no.					8113			
Over-identification stats. (Chi-sq)					56.670 (41)			
P-value					0.0525			
Rural (Pooled)								
Community variables controlled								
Mother's Primary	0.241	1.39	0.254	1.45	0.258	1.52	0.291	1.69
Mother's Middle	0.24	1.59	0.225	1.5	0.204	1.46	0.205	1.46
Mother's Sec & above	-0.26	-5.73***	-0.252	-4.23***	-0.249	-3.70***	-0.245	-3.26**
Father's Primary	-0.104	-1.01	-0.112	-1.12	-0.145	-1.7	-0.157	-1.92
Father's Middle	-0.131	-1.63	-0.126	-1.57	-0.136	-1.71	-0.146	-1.83
Father's Sec & above	0.109	0.68	0.137	0.85	0.067	0.44	0.107	0.67
Prop. of 'others' in cluster with no water & toilet			0.071	4.75***			0.076	5.38***
GLSS_D	-0.014	-0.58	-0.031	-1.28	0.123	0.98	0.108	0.86
Observation no.	12081							

*Refer to notes in text

A-7: The Impact of Own Education on The Probability of Adult Illness, 1987/88 (GLSS 1)

Sample:	personal education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quad. & water & sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 1	Marginal		Marginal		Marginal		Marginal		Marginal		Marginal	
Full	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Primary	0.08	3.41***	0.082	3.47***	0.07	2.80**	0.08	3.33***	0.076	3.23**	0.078	3.29***
Middle	0.036	2.13*	0.039	2.29*	0.013	0.6	0.035	1.8	0.029	1.66	0.031	1.81
Sec. & above	-0.008	-0.29	-0.003	-0.11	-0.038	-1.22	-0.008	-0.26	-0.02	-0.78	-0.016	-0.61
Observation	6519											
Urban												
Primary	0.098	2.48*	0.098	2.49*	0.099	2.25*	0.106	2.44*	0.065	2.20*	0.095	2.42*
Middle	0.02	0.77	0.02	0.77	0.02	0.53	0.03	0.83	0.04	1.76	0.015	0.55
Sec. & above	-0.019	-0.55	-0.019	-0.54	-0.003	-0.06	0.008	0.18	-0.013	-0.32	-0.028	-0.8
Observation	2659											
Rural												
Primary	0.067	2.27*	0.07	2.37*	0.061	2.03*	0.065	2.15*	0.064	2.16*	0.067	2.26*
Middle	0.055	2.44*	0.058	2.56*	0.041	1.71	0.045	1.88	0.048	2.09*	0.051	2.22*
Sec. & above	0.007	0.16	0.013	0.3	-0.013	-0.3	-0.005	-0.11	-0.005	-0.12	0.001	0.02
Observation	3860											

A-8: The Impact of Own Education on The Probability of Adult Illness, 1998/99 (GLSS 4)

Sample:	personal education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quad. & water & sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 4	Marginal		Marginal		Marginal		Marginal		Marginal		Marginal	
Full	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Primary	0.021	1.34	0.023	1.44	0.01	0.67	0.013	0.87	0.02	1.23	0.021	1.33
Middle	-0.005	-0.39	-0.002	-0.18	-0.034	-2.70**	-0.03	-2.41*	-0.009	-0.68	-0.006	-0.46
Sec. & above	-0.034	-1.99*	-0.03	-1.74	-0.128	-4.43***	-0.129	-4.44***	-0.041	-2.47*	-0.037	-2.20*
Observation	13547											
Urban												
Primary	0.007	0.27	0.004	0.17	-0.019	-0.92	-0.02	-0.97	0.005	0.22	0.003	0.14
Middle	-0.005	-0.24	-0.009	-0.44	-0.02	-1.04	-0.022	-1.13	-0.01	-0.53	-0.013	-0.68
Sec. & above	-0.037	-1.67	-0.041	-1.86	-0.049	-2.34*	-0.051	-2.40*	-0.046	-2.09*	-0.049	-2.23*
Observation	4873											
Rural												
Primary	0.029	1.42	0.033	1.58	0.014	0.79	0.019	1.04	0.026	1.25	0.029	1.42
Middle	-0.011	-0.67	-0.004	-0.23	-0.042	-2.84**	-0.033	-2.24*	-0.015	-0.93	-0.008	-0.48
Sec. & above	-0.039	-1.55	-0.028	-1.07	-0.094	-3.81***	-0.082	-3.21**	-0.047	-1.85	-0.036	-1.4
Observation	8674											

A-9: The Impact of Own Education on The Probability of Adult Illness, 1987/88 & 1998/99 (Pooled)

Sample:	personal education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quad. & water & sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
Pooled	Marginal		Marginal		Marginal		Marginal		Marginal		Marginal	
Full	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Primary	0.023	1.96*	0.024	2.09*	0.021	1.82	0.022	1.9	0.02	1.7	0.021	1.84
Middle	2.90E-05	0	0.003	0.33	-0.002	-0.19	-4.70E-04	-0.05	-0.004	-0.45	-0.001	-0.12
Sec. & above	-0.025	-1.99*	-0.021	-1.65	-0.026	-1.79	-0.024	-1.71	-0.031	-2.42*	-0.027	-2.09*
GLSS_1	0.14	18.92***	0.133	17.65***	0.209	1.87	0.249	2.17*	0.145	17.02***	0.139	16.11***
Observation	20066											
Urban												
Primary	0.009	0.47	0.009	0.46	0.004	0.21	0.004	0.22	0.007	0.36	0.007	0.36
Middle	-0.006	-0.42	-0.007	-0.44	-0.012	-0.75	-0.012	-0.74	-0.009	-0.61	-0.009	-0.63
Sec. & above	-0.033	-1.88	-0.033	-1.9	-0.04	-2.04*	-0.04	-2.01*	-0.039	-2.22*	-0.039	-2.23*
GLSS_1	0.171	14.46***	0.171	14.46***	0.285	2.85**	0.282	2.68**	0.183	12.62***	0.183	12.61***
Observation	7532											
Rural												
Primary	0.028	1.95	0.032	2.19*	0.022	1.5	0.026	1.76	0.025	1.69	0.028	1.93
Middle	-0.003	-0.24	0.003	0.25	-0.014	-1.2	-0.008	-0.71	-0.008	-0.69	-0.002	-0.2
Sec. & above	-0.02	-1.03	-0.011	-0.54	-0.03	-1.5	-0.022	-1.08	-0.027	-1.36	-0.018	-0.88
GLSS_1	0.026	1.25	0.008	0.39	0.498	5.53***	0.48	5.27***	0.041	1.88	0.024	1.1
Observation	12534											

A-10: The Impact of Own Education on The Probability of Adult Illness, 1987/88 (GLSS 1); controlling Adult's Parental Education

Sample:	w/ parental education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend.& quad & water & sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 1	Marginal		Marginal		Marginal		Marginal		Marginal		Marginal	
Full	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Primary	0.075	3.15**	0.076	3.20**	0.071	2.94**	0.074	3.05**	0.071	3.02**	0.073	3.07**
Middle	0.028	1.58	0.03	1.72	0.021	1.03	0.025	1.27	0.021	1.21	0.024	1.34
Sec. & above	-0.022	-0.83	-0.018	-0.68	-0.029	-0.99	-0.023	-0.8	-0.032	-1.2	-0.029	-1.07
Mother's Primary	0.092	1.98*	0.093	2.00*	0.093	1.97*	0.093	1.97*	0.087	1.88	0.088	1.9
Mother's Middle	-0.038	-1.18	-0.037	-1.14	-0.04	-1.21	-0.039	-1.17	-0.04	-1.24	-0.039	-1.2
Mother's Sec & above	0.119	1.29	0.121	1.3	0.136	1.42	0.132	1.38	0.111	1.2	0.113	1.21
Father's Primary	0.006	0.16	0.007	0.18	0.009	0.22	0.009	0.22	0.002	0.04	0.002	0.06
Father's Middle	0.033	1.73	0.034	1.79	0.034	1.73	0.035	1.77	0.03	1.56	0.031	1.61
Father's Sec & above	0.038	1.04	0.042	1.15	0.042	1.14	0.045	1.2	0.032	0.87	0.036	0.98
Observation no.	6519											
Urban												
Primary	0.082	2.07*	0.082	2.07*	0.083	1.9	0.088	2.03*	0.08	2.03*	0.08	2.03*
Middle	-0.001	-0.02	-0.001	-0.02	-0.001	-0.04	0.006	0.16	-0.004	-0.15	-0.004	-0.15
Sec. & above	-0.054	-1.49	-0.054	-1.48	-0.039	-0.84	-0.031	-0.67	-0.059	-1.63	-0.059	-1.63
Mother's Primary	0.213	3.46***	0.213	3.46***	0.221	3.46***	0.223	3.48***	0.209	3.40***	0.209	3.39***
Mother's Middle	-0.008	-0.2	-0.008	-0.19	-0.01	-0.23	-0.006	-0.14	-0.011	-0.26	-0.01	-0.24
Mother's Sec & above	0.165	1.68	0.166	1.69	0.198	1.98*	0.192	1.91	0.16	1.63	0.161	1.64
Father's Primary	0.151	2.35*	0.152	2.35*	0.155	2.30*	0.151	2.24*	0.15	2.34*	0.15	2.34*
Father's Middle	0.027	1	0.027	1.01	0.033	1.12	0.035	1.23	0.025	0.95	0.026	0.96
Father's Sec & above	0.033	0.73	0.034	0.74	0.052	1.09	0.049	1.03	0.029	0.64	0.03	0.66
Observation no.	2659											
Rural												
Primary	0.066	2.21*	0.069	2.31*	0.071	2.28*	0.064	2.10*	0.063	2.12*	0.066	2.22*
Middle	0.055	2.38*	0.058	2.49*	0.056	2.16*	0.046	1.86	0.049	2.09*	0.051	2.20*
Sec. & above	0.003	0.08	0.009	0.21	0.017	0.33	-0.009	-0.19	-0.007	-0.17	-0.001	-0.03
Mother's Primary	-0.011	-0.16	-0.01	-0.14	-0.04	-0.59	-0.023	-0.34	-0.013	-0.2	-0.012	-0.18

Mother's Middle	-0.072	-1.32	-0.074	-1.37	-0.066	-1.18	-0.068	-1.22	-0.071	-1.29	-0.074	-1.35
Mother's Sec & above	-0.078	-0.32	-0.087	-0.36	-0.148	-0.59	-0.095	-0.35	-0.092	-0.37	-0.102	-0.42
Father's Primary	-0.078	-1.6	-0.077	-1.57	-0.097	-1.99*	-0.085	-1.72	-0.083	-1.7	-0.082	-1.67
Father's Middle	0.054	1.9	0.056	1.95	0.039	1.3	0.05	1.7	0.05	1.74	0.051	1.77
Father's Sec & above	0.038	0.61	0.046	0.72	0.028	0.43	0.036	0.57	0.034	0.53	0.041	0.65
Observation no.	3860											

A-11: The Impact of Own Education on The Probability of Adult Illness, 1998/99 (GLSS 4); controlling Adult's Parental Education

Sample:	w/ parental education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend.& quad & water & sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 4												
Full												
Primary	0.017	1.05	0.018	1.14	0.009	0.58	0.011	0.75	0.015	0.96	0.017	1.05
Middle	-0.01	-0.74	-0.007	-0.55	-0.031	-2.43*	-0.027	-2.17*	-0.012	-0.97	-0.01	-0.77
Sec. & above	-0.041	-2.32*	-0.038	-2.11*	-0.121	-4.59***	-0.122	-4.57***	-0.047	-2.67**	-0.044	-2.46*
Mother's Primary	-0.023	-1.13	-0.022	-1.09	-0.006	-0.31	-0.005	-0.29	-0.024	-1.2	-0.023	-1.15
Mother's Middle	0.006	0.27	0.007	0.35	-0.038	-2.10*	-0.037	-2.06*	0.004	0.2	0.006	0.27
Mother's Sec & above	0.034	0.9	0.036	0.95	-0.064	-1.62	-0.067	-1.71	0.03	0.82	0.032	0.86
Father's Primary	0.057	2.41*	0.057	2.40*	0.036	1.82	0.037	1.83	0.057	2.43*	0.057	2.42*
Father's Middle	0.022	1.51	0.023	1.62	0.002	0.17	0.004	0.34	0.018	1.29	0.02	1.4
Father's Sec & above	0.007	0.32	0.009	0.39	-0.018	-0.91	-0.017	-0.86	0.003	0.15	0.005	0.22
Observation no.	13547											
Urban												
Primary	0.008	0.32	0.006	0.24	-0.02	-0.93	-0.02	-0.97	0.008	0.3	0.006	0.23
Middle	-0.005	-0.24	-0.008	-0.39	-0.019	-0.96	-0.02	-1.03	-0.009	-0.44	-0.011	-0.56
Sec. & above	-0.038	-1.6	-0.041	-1.72	-0.049	-2.27*	-0.05	-2.30*	-0.045	-1.86	-0.047	-1.96
Mother's Primary	-0.064	-2.68**	-0.064	-2.67**	-0.026	-1.12	-0.026	-1.1	-0.065	-2.74**	-0.065	-2.73**
Mother's Middle	0.003	0.11	0.002	0.07	-0.012	-0.56	-0.012	-0.58	-0.001	-0.05	-0.002	-0.07
Mother's Sec & above	-0.002	-0.06	-0.004	-0.09	0.004	0.13	0.005	0.13	-0.009	-0.23	-0.01	-0.25
Father's Primary	0.049	1.43	0.047	1.39	0.046	1.63	0.044	1.58	0.048	1.43	0.047	1.4
Father's Middle	0.003	0.13	0.001	0.04	-0.001	-0.03	-0.002	-0.1	-0.002	-0.08	-0.003	-0.15
Father's Sec & above	0.014	0.46	0.011	0.37	0.01	0.44	0.009	0.38	0.008	0.29	0.006	0.21
Observation no.	4873											
Rural												
Primary	0.021	1.03	0.024	1.19	0.011	0.62	0.015	0.84	0.018	0.88	0.021	1.04
Middle	-0.016	-0.96	-0.009	-0.56	-0.042	-2.83**	-0.034	-2.29*	-0.019	-1.17	-0.013	-0.77
Sec. & above	-0.045	-1.73	-0.035	-1.31	-0.092	-3.71***	-0.081	-3.19**	-0.051	-1.97*	-0.042	-1.57

Mother's Primary	0.02	0.64	0.024	0.76	0.036	1.31	0.037	1.34	0.017	0.56	0.021	0.68
Mother's Middle	-0.006	-0.2	-0.001	-0.05	-0.028	-1.16	-0.025	-1.03	-0.005	-0.19	-0.001	-0.03
Mother's Sec & above	0.079	1.1	0.085	1.2	0.018	0.29	0.025	0.4	0.072	1.02	0.078	1.11
Father's Primary	0.067	2.10*	0.064	2.03*	0.04	1.58	0.039	1.53	0.066	2.09*	0.064	2.02*
Father's Middle	0.031	1.6	0.035	1.79	0.008	0.49	0.013	0.8	0.029	1.48	0.032	1.66
Father's Sec & above	-0.017	-0.57	-0.017	-0.55	-0.024	-0.92	-0.021	-0.78	-0.02	-0.64	-0.019	-0.62
Observation no.	8674											

A-12: The Impact of Own Education on The Probability of Adult Illness, 1987/88 & 1998/99 (Pooled); controlling Adult's Parental Education

Sample:	w/ parental education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend.& quad & water & sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
Pooled	Marginal		Marginal		Marginal		Marginal		Marginal		Marginal	
Full	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Primary	0.02	1.74	0.021	1.84	0.019	1.62	0.02	1.68	0.018	1.51	0.019	1.62
Middle	-0.002	-0.17	0.001	0.09	-0.003	-0.34	-0.002	-0.24	-0.005	-0.56	-0.003	-0.3
Sec. & above	-0.028	-2.12*	-0.025	-1.87	-0.028	-1.94	-0.028	-1.91	-0.032	-2.46*	-0.029	-2.22*
Mother's Primary	-0.003	-0.18	-0.002	-0.14	-0.003	-0.2	-0.003	-0.16	-0.005	-0.32	-0.005	-0.28
Mother's Middle	-0.027	-1.91	-0.026	-1.78	-0.025	-1.74	-0.024	-1.6	-0.028	-1.97*	-0.026	-1.84
Mother's Sec & above	0.026	0.91	0.028	0.95	0.031	1.01	0.031	1.04	0.026	0.9	0.027	0.94
Father's Primary	0.031	1.83	0.031	1.86	0.03	1.79	0.03	1.79	0.03	1.78	0.03	1.8
Father's Middle	0.013	1.32	0.016	1.54	0.013	1.22	0.014	1.39	0.011	1.12	0.014	1.35
Father's Sec & above	0.01	0.65	0.013	0.81	0.011	0.68	0.013	0.8	0.007	0.45	0.01	0.61
GLSS_1	0.141	18.62***	0.135	17.49***	0.206	1.85	0.246	2.14*	0.146	16.88***	0.14	16.06***
Observation no.	20066											
Urban												
Primary	0.005	0.27	0.005	0.26	0.001	0.05	0.001	0.05	0.004	0.18	0.003	0.18
Middle	-0.008	-0.52	-0.008	-0.53	-0.013	-0.8	-0.013	-0.79	-0.01	-0.66	-0.01	-0.67
Sec. & above	-0.037	-2.06*	-0.038	-2.07*	-0.044	-2.18*	-0.043	-2.16*	-0.042	-2.30*	-0.042	-2.31*
Mother's Primary	-0.003	-0.15	-0.003	-0.14	-0.005	-0.2	-0.005	-0.2	-0.007	-0.28	-0.006	-0.28
Mother's Middle	-0.016	-0.82	-0.016	-0.83	-0.015	-0.78	-0.015	-0.78	-0.018	-0.92	-0.018	-0.92
Mother's Sec & above	0.025	0.75	0.025	0.74	0.027	0.77	0.027	0.77	0.024	0.71	0.024	0.71
Father's Primary	0.062	2.36*	0.062	2.35*	0.06	2.25*	0.06	2.25*	0.063	2.39*	0.062	2.38*
Father's Middle	0.005	0.31	0.004	0.29	0.002	0.13	0.002	0.14	0.003	0.19	0.003	0.18
Father's Sec & above	0.018	0.85	0.018	0.83	0.016	0.72	0.016	0.73	0.015	0.7	0.015	0.69
GLSS_1	0.175	14.27***	0.175	14.28***	0.288	2.88**	0.286	2.72**	0.186	12.61***	0.186	12.60***
Observation no.	7532											
Rural												
Primary	0.026	1.79	0.029	2.00*	0.021	1.42	0.024	1.65	0.023	1.57	0.026	1.78

Middle	-0.004	-0.34	0.001	0.08	-0.015	-1.22	-0.01	-0.8	-0.009	-0.74	-0.004	-0.31
Sec. & above	-0.022	-1.06	-0.014	-0.66	-0.03	-1.47	-0.023	-1.13	-0.027	-1.32	-0.019	-0.94
Mother's Primary	0.005	0.23	0.008	0.35	3.47E-04	0.01	0.004	0.15	0.003	0.15	0.006	0.27
Mother's Middle	-0.04	-1.87	-0.036	-1.69	-0.037	-1.66	-0.033	-1.49	-0.041	-1.92	-0.037	-1.73
Mother's Sec & above	0.038	0.64	0.046	0.76	0.033	0.53	0.04	0.63	0.032	0.55	0.039	0.65
Father's Primary	0.016	0.72	0.016	0.71	0.007	0.33	0.007	0.33	0.014	0.61	0.013	0.61
Father's Middle	0.024	1.73	0.028	2.01*	0.018	1.23	0.022	1.51	0.022	1.55	0.026	1.83
Father's Sec & above	-0.003	-0.12	0.001	0.04	-0.003	-0.12	0.001	0.02	-0.006	-0.27	-0.003	-0.11
GLSS_1	0.026	1.26	0.009	0.43	0.498	5.54***	0.482	5.29***	0.04	1.86	0.075	6.09***
Observation no.	12534											

A–13a: Children – First-stage regression of endogenous expenditure per capita and its quadratic, 1987/88 (GLSS 1: Illness)

GLSS 1	Full				Urban				Rural			
	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio
Log of land per capita	-0.043	-6.62***	-0.914	-6.63***					-0.046	-6.02***	-0.954	-5.97***
Log of land per capita sq.	0.005	8.06***	0.104	8.02***					0.005	7.77***	0.114	7.71***
Missing land per capita	-0.055	-2.46*	-1.063	-2.25*					-0.127	-2.24*	-2.317	-1.99*
Log of durable goods per capita	-0.09	-12.70***	-2.05	-13.17***	-0.114	-10.87***	-2.626	-11.14***	-0.06	-6.03***	-1.305	-6.19***
Log of durable goods per capita sq	0.018	18.99***	0.4	18.96***	0.021	15.72***	0.467	15.55***	0.014	9.55***	0.291	9.59***
Formal employment (Head)					-0.096	-2.55*	-1.985	-2.43*				
Self-employment (Head)					-0.059	-1.6	-1.126	-1.41				
Mother's Primary	-0.064	-3.04**	-1.362	-3.07**	0.034	1.09	0.654	0.96	-0.097	-3.56***	-2.051	-3.61***
Mother's Middle	0.015	0.94	0.31	0.91	0.031	1.35	0.687	1.37	0.018	0.84	0.341	0.77
Mother's Sec & above	0.192	4.82***	4.348	4.89***	0.152	3.16**	3.522	3.25**	0.37	6.10***	7.708	5.90***
Father's Primary	0.15	5.56***	3.12	5.44***	0.119	2.38*	2.508	2.31*	0.173	5.72***	3.564	5.58***
Father's Middle	0.145	8.87***	2.99	8.68***	0.118	4.78***	2.427	4.59***	0.145	6.85***	3.014	6.79***
Father's Sec & above	0.156	6.88***	3.246	6.69***	0.151	4.45***	3.153	4.28***	0.167	5.74***	3.454	5.61***
Age (years)	-0.014	-2.69**	-0.292	-2.62**	-0.01	-1.36	-0.206	-1.27	-0.015	-2.16*	-0.309	-2.13*
Age squared (years)	0.001	2.39*	0.017	2.33*	0.001	1.4	0.014	1.3	0.001	1.8	0.017	1.79
Rural	-0.1	-6.65***	-2.013	-6.36***								
Female	0.011	0.85	0.234	0.87	-0.006	-0.3	-0.116	-0.29	0.028	1.7	0.6	1.72
Non-Akan	0.084	5.35***	1.774	5.27***	-0.006	-0.28	-0.127	-0.26	0.138	5.92***	2.932	5.93***
Western Region	-0.082	-3.31***	-1.93	-3.55***	-0.127	-3.69***	-2.8	-3.73***	-0.143	-2.54*	-3.279	-2.65**
Central Region	-0.419	-12.98***	-8.944	-13.08***	-0.579	-11.71***	-12.19	-11.82***	-0.511	-8.31***	-10.975	-8.22***
Eastern Region	-0.222	-9.01***	-4.894	-9.12***	-0.212	-6.96***	-4.71	-7.09***	-0.321	-5.78***	-6.958	-5.71***
Volta Region	-0.616	-20.05***	-13.067	-20.00***	-0.377	-7.80***	-8.064	-7.68***	-0.802	-13.41***	-16.962	-13.13***
Ashanti Region	-0.387	-16.89***	-8.426	-16.88***	-0.265	-9.34***	-5.822	-9.33***	-0.486	-8.56***	-10.531	-8.49***
Brong Ahafo Region	-0.274	-10.42***	-6.019	-10.61***	-0.292	-7.90***	-6.301	-7.95***	-0.335	-6.12***	-7.354	-6.13***
Upper West Region	-0.579	-4.51***	-11.279	-4.31***					-0.671	-4.56***	-13.371	-4.42***
Northern Region	-0.538	-17.32***	-11.407	-17.34***	-0.57	-14.50***	-12.061	-14.60***	-0.476	-8.02***	-10.183	-7.90***
Upper East Region	-0.822	-15.46***	-17.176	-15.80***	-0.222	-2.62**	-4.888	-2.68**	-0.947	-13.06***	-19.769	-12.91***

Price of Maize (kg)									0.03	5.31***	0.609	5.16***
Price of Anti-malarial pill									-0.05	-2.10*	-1.002	-1.99*
Missing price									0.087	1.9	1.809	1.88
Dist. to the nearest clinic									-0.004	-4.87***	-0.074	-4.77***
Male Agric. Wage									-0.024	-2.18*	-0.485	-2.06*
Ratio of female Wage									0.132	6.24***	2.808	6.29***
Ratio of child Wage									0.16	6.21***	3.366	6.17***
constant	10.756	331.22***	116.143	166.89***	10.87	188.41***	118.434	94.92***	10.656	114.09***	113.903	57.23***
Observation no.	6378		6378		2410		2410		3968		3968	
R-squared	0.324		0.327		0.403		0.406		0.271		0.268	
adjusted R-squared	0.322		0.324		0.398		0.401		0.266		0.263	
F	137.098		131.081		74.728		71.281		55.453		55.053	
ll	-4.70E+03		-2.40E+04		-1.50E+03		-8.90E+03		-3.00E+03		-1.50E+04	
F-test of instruments	F(5, 6352) = 150.45		F(5, 6352) = 140.94		F(4, 2387) = 108.25		F(4, 2387) = 101.20		F(5, 3936) = 64.32		F(5, 3936) = 62.65	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

*Notes: (1) – The first stage of models controlling water and sanitation, as well as for the duration of illness analyses, are also estimated but not reported for brevity; they are very much similar to this table. (2) – The over-identification test statistics and p-values of estimations are however reported beneath estimates' tables in text.

A–13b: Children – First-stage regression of endogenous expenditure per capita and its quadratic, 1998/99 (GLSS 4: Illness)

GLSS 4	Full				Urban				Rural			
	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio
Log of land per capita	-0.055	-10.66***	-1.469	-10.55***	-0.052	-3.33***	-1.419	-3.31***	-0.052	-9.51***	-1.382	-9.48***
Log of land per capita sq.	0.004	11.06***	0.108	10.88***	0.003	2.76**	0.088	2.72**	0.004	10.20***	0.106	10.14***
Missing land per capita	-0.005	-0.21	-0.239	-0.35	-0.135	-2.11*	-3.798	-2.22*	-0.004	-0.13	-0.165	-0.23
Log of durable goods per capita	-0.115	-22.92***	-3.268	-24.25***	-0.151	-13.45***	-4.328	-14.29***	-0.111	-17.68***	-3.083	-18.30***
Log of durable goods per capita sq	0.016	40.20***	0.445	41.12***	0.018	25.69***	0.499	26.57***	0.015	27.94***	0.424	28.18***
Mother's Primary	0.031	2.38*	0.82	2.31*	0.049	2.20*	1.298	2.10*	0.02	1.27	0.531	1.25
Mother's Middle	0.049	4.10***	1.331	4.10***	0.051	2.58**	1.386	2.57*	0.051	3.35***	1.37	3.35***
Mother's Sec & above	0.063	2.93**	1.823	3.06**	0.103	3.79***	2.878	3.79***	0.009	0.25	0.359	0.35
Father's Primary	0.019	1.17	0.474	1.06	0.013	0.46	0.344	0.43	0.011	0.56	0.271	0.51
Father's Middle	0.042	3.56***	1.067	3.37***	0.055	2.58**	1.447	2.47*	0.036	2.64**	0.933	2.53*
Father's Sec & above	0.122	7.96***	3.266	7.82***	0.125	5.19***	3.382	5.11***	0.118	5.72***	3.166	5.66***
Age (years)	-0.003	-0.69	-0.078	-0.77	-0.005	-0.8	-0.135	-0.77	-0.002	-0.44	-0.064	-0.54
Age squared (years)	0	1.7	0.011	1.76	0.001	1.34	0.014	1.32	0	1.32	0.011	1.39
Rural	-0.156	-14.29***	-4.184	-14.12***								
Female	0.017	1.99*	0.454	1.94	0.023	1.55	0.612	1.53	0.015	1.42	0.389	1.38
Non-Akan	-0.038	-3.35***	-1.101	-3.53***	-0.011	-0.62	-0.38	-0.76	-0.079	-5.49***	-2.166	-5.58***
Western Region	-0.164	-8.75***	-4.662	-8.96***	-0.127	-4.54***	-3.585	-4.54***	-0.169	-4.56***	-4.661	-4.56***
Central Region	-0.356	-18.05***	-9.901	-18.27***	-0.471	-16.86***	-12.972	-16.90***	-0.315	-8.58***	-8.59	-8.51***
Eastern Region	-0.322	-16.33***	-8.835	-16.37***	-0.363	-13.51***	-10.091	-13.65***	-0.319	-8.72***	-8.542	-8.47***
Volta Region	-0.274	-15.18***	-7.695	-15.43***	-0.407	-14.57***	-11.218	-14.60***	-0.269	-7.73***	-7.371	-7.66***
Ashanti Region	-0.244	-13.55***	-6.788	-13.59***	-0.154	-6.27***	-4.185	-6.12***	-0.312	-8.62***	-8.516	-8.51***
Brong Ahafo Region	-0.201	-9.17***	-5.661	-9.44***	0.06	1.73	1.59	1.66	-0.314	-8.37***	-8.587	-8.33***
Upper West Region	-0.816	-26.54***	-21.751	-27.21***	-0.615	-14.80***	-17.073	-15.19***	-0.913	-19.90***	-24.052	-19.68***
Northern Region	-0.547	-22.38***	-14.682	-22.23***	-0.475	-12.47***	-12.964	-12.57***	-0.6	-14.97***	-15.852	-14.48***
Upper East Region	-0.823	-35.67***	-21.895	-35.68***	-0.622	-13.40***	-17.243	-13.62***	-0.846	-22.51***	-22.305	-21.81***
Price of Maize (kg)									0	-0.06	-0.004	-0.05
Price of Anti-malarial pill									0.026	3.08**	0.683	3.02**

Missing price									0.023	0.59	0.477	0.46
Dist. to the nearest clinic									0.001	6.67***	0.017	6.55***
Male Agric. Wage									-0.006	-1.72	-0.185	-2.04*
Ratio of female Wage									-0.108	-7.00***	-2.813	-6.88***
Ratio of child Wage									-0.01	-0.6	-0.268	-0.63
constant	13.542	475.13***	184.241	240.13***	13.693	225.85***	188.265	115.16***	13.449	207.84***	181.836	104.01***
Observation no.	1.20E+04		1.20E+04		3547		3547		8113		8113	
R-squared	0.501		0.503		0.526		0.529		0.417		0.416	
adjusted R-squared	0.5		0.502		0.523		0.526		0.415		0.413	
F	597.377		595.003		221.805		222.453		226.231		225.104	
ll	-7.70E+03		-4.60E+04		-2.00E+03		-1.40E+04		-5.40E+03		-3.20E+04	
F-test of instruments	F(5, 11634) = 732.68		F(5, 11634) = 724.21		F(5, 3522) = 350.05		F(5, 3522) = 350.79		F(5, 8081) = 369.93		F(5, 8081) = 361.17	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

*Notes: refer to A-13a

A–13c: Children – First-stage regression of endogenous expenditure per capita and its quadratic, 1987/88 & 1989/99 (Pooled: Illness)

Pooled	Full				Urban				Rural			
	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio
Log of land per capita	-0.027	-7.51***	-0.676	-8.02***								
Log of land per capita sq.	0.002	8.70***	0.057	8.98***								
Missing land per capita	0.054	3.44***	0.981	2.66**								
Log of durable goods per capita	-0.078	-23.91***	-2.444	-31.32***	-0.085	-16.77***	-2.658	-21.71***	-0.074	-16.70***	-2.205	-20.52***
Log of durable goods per capita sq	0.013	43.77***	0.392	50.68***	0.014	31.86***	0.404	36.82***	0.013	28.44***	0.361	31.89***
Formal employment (Head)					0.012	0.56	0.368	0.65	0.139	4.14***	2.91	3.48***
Self-employment (Head)					0.019	0.9	0.5	0.9	0.12	3.76***	2.558	3.22**
Mother's Primary	0.007	0.61	0.29	1.01	0.044	2.40*	1.083	2.27*	-0.009	-0.66	-0.101	-0.29
Mother's Middle	0.044	4.55***	1.093	4.51***	0.052	3.39***	1.299	3.36***	0.05	4.02***	1.208	3.87***
Mother's Sec & above	0.119	6.08***	2.86	5.64***	0.145	5.89***	3.538	5.63***	0.107	3.08**	2.511	2.73**
Father's Primary	0.067	4.67***	1.46	3.98***	0.048	1.89	0.826	1.24	0.063	3.67***	1.365	3.15**
Father's Middle	0.082	8.46***	1.775	7.39***	0.099	5.89***	2.115	5.09***	0.071	5.90***	1.59	5.38***
Father's Sec & above	0.141	10.88***	3.395	10.29***	0.155	7.67***	3.63	7.07***	0.119	6.47***	2.925	6.26***
Age (years)	-0.006	-2.03*	-0.149	-1.93	-0.008	-1.65	-0.196	-1.58	-0.006	-1.42	-0.128	-1.33
Age squared (years)	0.001	2.65**	0.013	2.66**	0.001	2.08*	0.016	2.03*	0.001	2.06*	0.013	2.10*
Rural	-0.134	-15.13***	-3.305	-14.94***								
Female	0.017	2.27*	0.419	2.30*	0.015	1.29	0.416	1.41	0.018	1.94	0.43	1.89
Non-Akan	-0.038	-4.17***	-0.977	-4.39***	-0.023	-1.68	-0.503	-1.47	-0.07	-5.85***	-1.819	-6.23***
Western Region	-0.155	-10.13***	-3.869	-10.06***	-0.167	-7.65***	-4.127	-7.48***	-0.149	-4.70***	-3.856	-4.81***
Central Region	-0.411	-24.22***	-10.071	-23.90***	-0.544	-21.54***	-13.381	-21.90***	-0.432	-13.38***	-10.513	-12.93***
Eastern Region	-0.286	-18.50***	-7.257	-18.59***	-0.319	-15.80***	-8.2	-16.22***	-0.336	-10.88***	-8.43	-10.79***
Volta Region	-0.381	-24.70***	-9.059	-23.38***	-0.429	-18.15***	-10.813	-17.88***	-0.423	-13.68***	-10.113	-12.99***
Ashanti Region	-0.334	-23.48***	-8.003	-22.16***	-0.226	-12.34***	-5.429	-11.57***	-0.452	-14.48***	-11.006	-14.02***
Brong Ahafo Region	-0.241	-14.24***	-5.858	-13.78***	-0.165	-6.22***	-3.472	-5.32***	-0.346	-10.93***	-8.641	-10.85***
Upper West Region	-0.802	-20.75***	-19.841	-22.40***	-0.642	-14.36***	-17.202	-14.75***	-0.958	-19.60***	-23.613	-20.47***
Northern Region	-0.551	-28.31***	-13.364	-27.63***	-0.536	-19.45***	-12.753	-19.03***	-0.642	-18.79***	-15.844	-18.37***
Upper East Region	-0.833	-39.10***	-21.037	-40.19***	-0.507	-10.45***	-13.507	-10.89***	-0.961	-28.96***	-23.936	-28.80***

GLSS_1	-2.536	-213.64***	-59.935	-209.32***	-2.589	-135.36***	-62.569	-130.17***	-2.511	-96.28***	-58.388	-93.27***
Price of Maize (kg)									-0.002	-0.92	-0.043	-0.75
Price of Anti-malarial pill									0.049	6.74***	1.345	7.55***
Missing price									0.157	4.98***	4.385	6.09***
Dist. to the nearest clinic									0.001	8.25***	0.021	8.29***
Male Agric. Wage									-0.012	-3.59***	-0.301	-3.46***
Ratio of female Wage									-0.062	-4.97***	-1.751	-5.66***
Ratio of child Wage									0.079	6.00***	1.338	4.08***
constant	13.432	598.57***	180.66	323.44***	13.435	341.21***	181.368	181.69***	13.211	207.98***	175.128	111.82***
Observation no.	1.80E+04		1.80E+04		5957		5957		1.20E+04		1.20E+04	
R-squared	0.897		0.892		0.923		0.921		0.883		0.877	
adjusted R-squared	0.896		0.892		0.922		0.92		0.883		0.877	
F	6107.552		6502.396		3277.364		3435.272		2898.203		3096.681	
ll	-1.30E+04		-7.10E+04		-3.70E+03		-2.30E+04		-8.90E+03		-4.80E+04	
F-test of instruments	F(5, 18011) = 780.44		F(5, 18011) = 837.44		F(4, 5932) = 412.51		F(4, 5932) = 464.28		F(4, 12049) = 463.89		F(4, 12049) = 468.05	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

*Notes: refer to A-13a

A–14a: Adults – First-stage regression of endogenous expenditure per capita and its quadratic, 1987/88 (GLSS 1: Illness)

GLSS 1	Full				Urban				Rural			
	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio
log of land per capita	-0.084	-10.64***	-1.853	-10.69***	-0.073	-5.25***	-1.608	-5.24***	-0.076	-8.30***	-1.666	-8.36***
log of land per capita sq.	0.008	11.61***	0.186	11.56***	0.006	4.74***	0.138	4.70***	0.008	9.53***	0.176	9.55***
Missing land per capita	-0.015	-0.57	-0.171	-0.3	-0.025	-0.98	-0.575	-1.01	-0.177	-2.63**	-3.285	-2.34*
formal employment (Head)	0.087	2.55*	1.93	2.59**					0.166	2.64**	3.475	2.59**
Self-employment (Head)	-0.018	-0.55	-0.327	-0.46					0.113	1.97*	2.358	1.94
log of durable goods per capita					-0.162	-15.00***	-3.705	-15.29***	-0.14	-11.98***	-3.107	-12.13***
log of durable goods per capita sq					0.025	20.12***	0.57	20.02***	0.024	13.99***	0.521	13.91***
Primary	0.048	1.67	0.997	1.61	0.048	1.1	0.983	1.02	0.019	0.55	0.36	0.49
Middle	0.119	5.59***	2.503	5.41***	0.091	3.06**	1.917	2.92**	0.056	2.05*	1.15	1.94
Sec. & above	0.277	8.54***	6.051	8.33***	0.164	4.03***	3.553	3.89***	0.018	0.4	0.204	0.21
Age (years)	0.008	3.86***	0.183	3.95***	0.01	3.22**	0.23	3.23**	0.004	1.59	0.094	1.66
Age squared (years)	0	-3.46***	-0.002	-3.56***	0	-2.74**	-0.002	-2.76**	0	-1.48	-0.001	-1.56
Rural	-0.15	-8.02***	-3.191	-7.84***								
Female	-0.053	-3.31***	-1.224	-3.50***	-0.047	-2.14*	-1.099	-2.23*	-0.07	-3.39***	-1.587	-3.59***
Non-Akan	-0.006	-0.3	-0.188	-0.45	-0.085	-3.49***	-1.846	-3.40***	0.104	3.72***	2.185	3.57***
Western Region	-0.16	-5.13***	-3.693	-5.28***	-0.096	-2.45*	-2.222	-2.53*	-0.043	-0.68	-1.152	-0.82
Central Region	-0.519	-13.47***	-11.298	-13.46***	-0.474	-8.23***	-10.084	-8.22***	-0.451	-6.82***	-9.845	-6.70***
Eastern Region	-0.26	-8.61***	-5.8	-8.57***	-0.197	-4.78***	-4.401	-4.72***	-0.189	-3.29**	-4.194	-3.25**
Volta Region	-0.642	-18.03***	-13.915	-17.87***	-0.331	-5.76***	-7.226	-5.68***	-0.678	-10.76***	-14.571	-10.46***
Ashanti Region	-0.463	-16.53***	-10.254	-16.37***	-0.288	-9.39***	-6.468	-9.39***	-0.405	-6.49***	-8.923	-6.41***
Brong Ahafo Region	-0.442	-14.44***	-9.875	-14.59***	-0.353	-8.51***	-7.798	-8.63***	-0.307	-5.22***	-6.865	-5.22***
Upper West Region	-0.739	-7.17***	-15.375	-7.24***	0	.	0	.	-0.707	-5.47***	-14.94	-5.51***
Northern Region	-0.648	-17.96***	-14.002	-17.91***	-0.551	-11.62***	-11.862	-11.67***	-0.441	-7.08***	-9.49	-6.88***
Upper East Region	-0.852	-15.15***	-18.186	-15.27***	-0.15	-1.42	-3.465	-1.44	-0.887	-11.90***	-18.87	-11.75***
Price of Maize (kg)									0.02	2.79**	0.417	2.66**
Price of Anti-malarial pill									-0.061	-2.06*	-1.247	-1.95
Missing price									0.014	0.25	0.322	0.27

Dist. to the nearest clinic									-0.006	-6.32***	-0.123	-6.20***
Male Agric. Wage									-0.03	-2.15*	-0.625	-2.08*
Ratio of female Wage									0.104	4.05***	2.311	4.15***
Ratio of child Wage									0.108	3.39***	2.25	3.24**
constant	11.028	167.52***	122.102	85.04***	10.941	136.19***	120.204	67.65***	10.841	80.10***	118.137	40.48***
Observation no.	6519		6519		2659		2659		3860		3860	
R-squared	0.244		0.241		0.356		0.356		0.252		0.249	
adjusted R-squared	0.242		0.239		0.351		0.351		0.246		0.243	
F	92.837		89.109		86.175		82.1		42.428		40.832	
ll	-6.00E+03		-2.60E+04		-2.10E+03		-1.00E+04		-3.40E+03		-1.50E+04	
F-test of instruments	F(5, 6496) = 33.37		F(5, 6496) = 32.63		F(5, 2638) = 120.52		F(5, 2638) = 114.80		F(7, 3829) = 51.98		F(7, 3829) = 49.59	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

*Notes: refer to A-13a

A–14b: Adults – First-stage regression of endogenous expenditure per capita and its quadratic, 1998/99 (GLSS 4: Illness)

GLSS 4	Full				Urban				Rural			
	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio
Log of land per capita	-0.104	-17.09***	-2.843	-17.09***	-0.079	-5.26***	-2.188	-5.24***	-0.095	-14.41***	-2.602	-14.44***
log of land per capita sq.	0.007	16.89***	0.201	16.78***	0.005	4.85***	0.15	4.80***	0.007	14.76***	0.191	14.71***
Missing land per capita	-0.246	-10.92***	-6.569	-10.83***	-0.182	-2.56*	-5.255	-2.70**	-0.18	-6.86***	-4.756	-6.73***
Formal employment (Head)	0.095	3.90***	2.549	3.74***								
Self-employment (Head)	-0.023	-0.99	-0.642	-0.99								
Log of durable goods per capita					-0.183	-14.74***	-5.296	-15.42***				
Log of durable goods per capita sq					0.02	27.46***	0.567	28.04***				
Radio									0.003	0.21	0.042	0.09
Primary	0.042	2.57*	1.079	2.40*	0.042	1.74	1.107	1.63	0.027	1.35	0.67	1.23
Middle	0.137	9.86***	3.702	9.73***	0.077	3.80***	2.027	3.61***	0.108	6.34***	2.899	6.25***
Sec. & above	0.375	19.04***	10.484	18.95***	0.153	6.45***	4.282	6.41***	0.328	11.01***	9.004	10.81***
Age (years)	0.004	2.96**	0.113	3.07**	0	0.14	0.007	0.13	0.004	2.64**	0.121	2.75**
Age squared (years)	0	-1.75	-0.001	-1.86	0	0.58	0	0.6	0	-1.49	-0.001	-1.6
Rural	-0.263	-20.70***	-7.229	-20.51***							0	.
Female	0.012	1.09	0.27	0.92	0.014	0.94	0.327	0.8	-0.002	-0.18	-0.123	-0.34
Non-Akan	-0.06	-4.45***	-1.703	-4.55***	-0.022	-1.33	-0.659	-1.39	-0.05	-2.75**	-1.396	-2.79**
Western Region	-0.273	-12.56***	-7.784	-12.66***	-0.161	-6.34***	-4.576	-6.29***	-0.354	-7.36***	-9.963	-7.32***
Central Region	-0.496	-21.27***	-13.95	-21.39***	-0.496	-18.10***	-13.779	-18.08***	-0.429	-8.99***	-12	-8.90***
Eastern Region	-0.542	-24.59***	-15.054	-24.50***	-0.42	-15.41***	-11.651	-15.46***	-0.574	-12.32***	-15.808	-12.00***
Volta Region	-0.391	-19.19***	-11.078	-19.36***	-0.368	-13.76***	-10.222	-13.69***	-0.44	-9.85***	-12.339	-9.73***
Ashanti Region	-0.291	-13.98***	-8.177	-13.90***	-0.127	-5.45***	-3.414	-5.17***	-0.373	-7.93***	-10.421	-7.82***
Brong Ahafo Region	-0.301	-12.12***	-8.514	-12.24***	0.036	1.11	0.949	1.04	-0.441	-9.01***	-12.29	-8.89***
Upper West Region	-1.051	-32.78***	-28.534	-33.31***	-0.565	-11.27***	-15.802	-11.29***	-1.195	-22.93***	-32.251	-22.40***
Northern Region	-0.756	-28.35***	-20.711	-28.28***	-0.56	-15.86***	-15.413	-15.99***	-0.855	-17.23***	-23.228	-16.71***
Upper East Region	-1.072	-39.56***	-28.959	-39.55***	-0.725	-15.09***	-20.184	-15.35***	-1.143	-24.04***	-30.775	-23.15***
Price of Maize (kg)									0.005	1.66	0.138	1.67
Price of Anti-malarial pill									0.032	3.63***	0.887	3.70***

Missing price									0.032	0.72	0.838	0.71
Dist. to the nearest clinic									0	2.15*	0.005	1.98*
Male Agric. Wage									-0.025	-7.03***	-0.712	-7.13***
Ratio of female Wage									-0.07	-3.93***	-1.866	-3.85***
Ratio of child Wage									-0.126	-6.72***	-3.434	-6.72***
constant	14.127	361.48***	200.121	184.87***	13.925	188.54***	194.894	95.46***	14.053	183.02***	198.08	93.52***
Observation no.	1.40E+04		1.40E+04		4873		4873		8674		8674	
R-squared	0.355		0.351		0.495		0.495		0.277		0.27	
adjusted R-squared	0.354		0.35		0.492		0.492		0.274		0.268	
F	389.219		386.938		264.469		262.214		142.246		142.659	
ll	-1.20E+04		-5.70E+04		-3.40E+03		-2.00E+04		-7.60E+03		-3.60E+04	
F-test of instruments	F(5, 13524) = 95.79		F(5, 13524) = 94.23		F(5, 4851) = 425.81		F(5, 4851) = 419.31		F(4, 8646) = 65.44		F(4, 8646) = 64.13	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

*Notes: refer to A-13a

A–14c: Adults – First-stage regression of endogenous expenditure per capita and its quadratic, 1987/88 & 1998/99 (Pooled: Illness)

Pooled	Full				Urban				Rural			
	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio	Expend pc Marginal Effects	t- ratio	Expend pc sq. Marginal Effects	t- ratio
Log of durable goods per capita	-0.116	-33.86***	-3.455	-40.60***	-0.114	-20.46***	-3.477	-25.22***	-0.09	-19.68***	-2.649	-23.07***
Log of durable goods per capita sq	0.017	54.00***	0.478	60.24***	0.016	36.73***	0.474	40.70***	0.014	30.40***	0.391	33.22***
Formal employment (Head)	-0.004	-0.24	-0.612	-1.28								
Self-employment (Head)	-0.03	-1.72	-1.018	-2.23*								
Log of land per capita					-0.059	-6.58***	-1.268	-6.00***				
log of land per capita sq.					0.004	6.20***	0.091	5.40***				
Missing land per capita					0.047	2.14*	0.457	0.86				
Room per capita (household)									0.656	16.37***	16.613	16.40***
Primary	0.019	1.45	0.399	1.17	0.049	2.27*	1.113	1.97*	0.007	0.45	0.081	0.2
Middle	0.054	4.96***	1.236	4.50***	0.082	4.81***	2	4.60***	0.046	3.46***	1.035	3.12**
Sec. & above	0.11	7.32***	2.79	7.13***	0.167	7.96***	4.218	7.72***	0.047	2.18*	1.136	2.03*
Age (years)	0.003	2.47*	0.064	2.37*	0.004	2.04*	0.077	1.74	0.005	3.84***	0.128	3.93***
Age squared (years)	0	-0.58	0	-0.43	0	-1.08	0	-0.76	0	-3.80***	-0.001	-3.79***
Rural	-0.134	-14.29***	-3.349	-13.98***			0	.			0	.
Female	-0.022	-2.70**	-0.515	-2.47*	-0.008	-0.67	-0.173	-0.54	-0.012	-1.14	-0.261	-1.01
Non-Akan	-0.067	-6.78***	-1.593	-6.45***	-0.077	-5.53***	-1.774	-5.02***	-0.114	-8.70***	-2.862	-8.77***
Western Region	-0.161	-10.11***	-4.171	-10.13***	-0.182	-8.36***	-4.64	-8.17***	-0.135	-4.13***	-3.783	-4.46***
Central Region	-0.424	-23.29***	-10.589	-23.09***	-0.528	-19.79***	-13.473	-20.51***	-0.383	-11.98***	-9.52	-11.45***
Eastern Region	-0.324	-20.11***	-8.501	-20.61***	-0.322	-13.77***	-8.664	-14.62***	-0.34	-11.29***	-9.025	-11.43***
Volta Region	-0.379	-23.93***	-9.317	-22.88***	-0.386	-15.98***	-9.996	-15.83***	-0.387	-12.94***	-9.698	-12.39***
Ashanti Region	-0.309	-20.82***	-7.528	-19.57***	-0.212	-11.34***	-5.123	-10.43***	-0.358	-11.53***	-8.952	-11.06***
Brong Ahafo Region	-0.263	-14.68***	-6.416	-13.91***	-0.164	-6.10***	-3.609	-5.20***	-0.307	-9.71***	-7.84	-9.52***
Upper West Region	-0.847	-26.00***	-21.463	-27.49***	-0.545	-10.59***	-15.096	-10.63***	-1	-23.88***	-25.327	-24.54***
Northern Region	-0.631	-31.65***	-15.635	-31.23***	-0.559	-19.45***	-14.009	-19.72***	-0.711	-20.99***	-17.978	-20.58***
Upper East Region	-0.929	-41.30***	-23.761	-42.06***	-0.517	-9.09***	-14.242	-9.74***	-1.061	-32.75***	-26.978	-32.28***
GLSS_1	-2.523	-211.13***	-60.507	-204.51***	-2.486	-122.75***	-61.043	-118.49***	-2.522	-94.63***	-59.304	-90.62***

Price of Maize (kg)									-0.002	-0.73	-0.029	-0.45
Price of Anti-malarial pill									4.50E-02	6.10***	1.29E+00	7.16***
Missing price									0.127	3.98***	3.927	5.25***
Dist. to the nearest clinic									0	2.52*	0.009	2.74**
Male Agric. Wage									-0.015	-4.98***	-0.371	-4.62***
Ratio of female Wage									-3.20E-02	-2.46*	-1.01E+00	-3.08**
Ratio of child Wage									0.046	3.31***	0.473	1.36
constant	13.676	409.41***	187.322	217.94***	13.589	292.45***	186.115	156.46***	13.233	219.60***	175.306	115.77***
Observation no.	2.00E+04		2.00E+04		7532		7532		1.30E+04		1.30E+04	
R-squared	0.872		0.866		0.897		0.893		0.872		0.865	
adjusted R-squared	0.871		0.866		0.897		0.893		0.872		0.864	
F	6088.52		6479.418		3039.72		3229.959		3027.248		3216.009	
ll	-1.70E+04		-8.10E+04		-5.70E+03		-3.00E+04		-9.90E+03		-5.00E+04	
F-test of instruments	F(4, 20043) = 1147.21		F(4, 20043) = 1225.34		F(5, 7509) = 456.94		F(5, 7509) = 476.66		F(3, 12513) = 1043.30		F(3, 12513) = 1039.38	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

*Notes: refer to A-13a

A–15: Tobit Results – The Impact of Parental Education on The Duration of Child Illness, 1987/88 (GLSS 1)

Sample:	Parental Education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 1												
Full	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio
Mother's Primary	0.19	1.69	0.204	1.81	0.17	1.48	0.18	1.56	0.171	1.53	0.183	1.63
Mother's Middle	0.102	1.2	0.12	1.4	0.119	1.35	0.136	1.55	0.101	1.18	0.115	1.34
Mother's Sec & above	0.306	1.54	0.333	1.67	0.319	1.41	0.322	1.42	0.318	1.57	0.333	1.65
Father's Primary	-0.015	-0.1	-0.024	-0.16	0.076	0.47	0.083	0.51	0	0	-0.009	-0.06
Father's Middle	0.142	1.68	0.14	1.66	0.239	2.26*	0.256	2.41*	0.117	1.37	0.114	1.34
Father's Sec & above	0.201	1.6	0.204	1.63	0.312	2.18*	0.331	2.31*	0.171	1.36	0.173	1.37
Observation no.	6378											
Urban												
Mother's Primary	0.348	1.94	0.323	1.79	0.377	1.96	0.348	1.84	0.332	1.84	0.311	1.72
Mother's Middle	0.475	3.63***	0.453	3.44***	0.499	3.68***	0.473	3.52***	0.45	3.41***	0.433	3.26**
Mother's Sec & above	0.733	3.20**	0.713	3.10**	0.814	3.24**	0.796	3.15**	0.678	2.90**	0.667	2.85**
Father's Primary	-0.327	-1.12	-0.307	-1.06	-0.289	-0.95	-0.266	-0.87	-0.34	-1.17	-0.32	-1.1
Father's Middle	-0.174	-1.31	-0.155	-1.16	-0.128	-0.66	-0.097	-0.48	-0.192	-1.44	-0.173	-1.28
Father's Sec & above	-0.287	-1.58	-0.275	-1.51	-0.213	-0.93	-0.189	-0.8	-0.314	-1.72	-0.301	-1.65
Observation no.	2410											
Rural												
Mother's Primary	0.038	0.27	0.063	0.44	0.074	0.44	0.108	0.65	0.027	0.18	0.049	0.34
Mother's Middle	-0.068	-0.59	-0.057	-0.5	-0.01	-0.07	0.001	0	-0.054	-0.47	-0.047	-0.41
Mother's Sec & above	0.398	0.89	0.438	0.97	0.505	0.93	0.546	1.02	0.399	0.88	0.424	0.94
Father's Primary	0.126	0.71	0.134	0.75	0.233	1.09	0.23	1.09	0.134	0.75	0.145	0.82
Father's Middle	0.247	2.25*	0.261	2.38*	0.273	1.96*	0.283	2.06*	0.222	2.01*	0.233	2.11*
Father's Sec & above	0.503	2.88**	0.539	3.08**	0.595	2.76**	0.63	2.95**	0.464	2.65**	0.499	2.85**
Observation no.	3968											

A–16: Tobit Results – The Impact of Parental Education on The Duration of Child Illness, 1998/99 (GLSS 4)

Sample	parental education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 4												
Full												
Mother's Primary	0.061	0.54	0.083	0.74	0.036	0.44	0.061	0.74	0.033	0.31	0.056	0.52
Mother's Middle	0.016	0.18	0.04	0.43	-0.045	-0.58	-0.02	-0.26	-0.012	-0.13	0.012	0.14
Mother's Sec & above	-0.031	-0.17	0.003	0.02	-0.039	-0.25	-0.01	-0.06	-0.064	-0.35	-0.029	-0.16
Father's Primary	0.185	1.25	0.179	1.21	0.031	0.31	0.028	0.28	0.197	1.34	0.192	1.3
Father's Middle	-0.083	-0.8	-0.075	-0.73	-0.183	-2.46*	-0.169	-2.27*	-0.088	-0.85	-0.08	-0.78
Father's Sec & above	0.149	0.96	0.168	1.1	-0.026	-0.26	-0.005	-0.05	0.119	0.76	0.137	0.89
Observation no.	11660											
Urban												
Mother's Primary	-0.069	-0.37	-0.085	-0.47	-0.083	-0.53	-0.086	-0.54	-0.104	-0.57	-0.114	-0.64
Mother's Middle	-0.109	-0.71	-0.124	-0.82	-0.173	-1.25	-0.176	-1.27	-0.144	-0.92	-0.153	-1
Mother's Sec & above	0.019	0.09	-0.002	-0.01	-0.051	-0.25	-0.055	-0.26	-0.02	-0.09	-0.033	-0.16
Father's Primary	-0.13	-0.53	-0.122	-0.5	-0.067	-0.35	-0.061	-0.31	-0.098	-0.41	-0.093	-0.38
Father's Middle	-0.13	-0.86	-0.14	-0.92	-0.185	-1.2	-0.185	-1.2	-0.131	-0.87	-0.138	-0.91
Father's Sec & above	-0.09	-0.46	-0.104	-0.53	-0.022	-0.12	-0.021	-0.12	-0.142	-0.72	-0.15	-0.76
Observation no.	3547											
Rural												
Mother's Primary	0.111	0.82	0.145	1.06	0.114	1.18	0.144	1.5	0.088	0.68	0.121	0.92
Mother's Middle	0.072	0.63	0.115	0.99	0.045	0.49	0.085	0.92	0.048	0.42	0.091	0.79
Mother's Sec & above	-0.092	-0.28	-0.03	-0.09	-0.001	-0.01	0.061	0.24	-0.131	-0.39	-0.073	-0.22
Father's Primary	0.266	1.5	0.256	1.45	0.056	0.49	0.055	0.48	0.264	1.5	0.256	1.46
Father's Middle	-0.099	-0.75	-0.088	-0.68	-0.203	-2.38*	-0.189	-2.23*	-0.112	-0.85	-0.101	-0.78
Father's Sec & above	0.269	1.26	0.299	1.42	-0.027	-0.22	0.001	0.01	0.251	1.16	0.278	1.3
Observation no.	8113											

A–17: Tobit Results – The Impact of Parental Education on The Duration of Child Illness, 1987/88 & 1998/99 (Pooled)

Sample	parental education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
Pooled												
Full	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio
Mother's Primary	0.081	1.23	0.1	1.51	0.081	1.23	0.101	1.53	0.059	0.9	0.078	1.18
Mother's Middle	0.018	0.31	0.039	0.69	0.01	0.17	0.027	0.47	0.001	0.01	0.021	0.37
Mother's Sec & above	0.085	0.72	0.12	1.01	0.057	0.46	0.079	0.64	0.074	0.63	0.106	0.9
Father's Primary	0.054	0.67	0.047	0.57	0.038	0.45	0.024	0.29	0.055	0.68	0.048	0.59
Father's Middle	-0.026	-0.47	-0.019	-0.35	-0.046	-0.75	-0.047	-0.76	-0.047	-0.87	-0.04	-0.74
Father's Sec & above	0.107	1.41	0.119	1.58	0.084	1.02	0.085	1.03	0.092	1.22	0.104	1.38
GLSS_1	0.587	13.30***	0.541	11.99***	0.897	1.66	1.012	1.84	0.573	11.00***	0.535	10.18***
Observation no.	18038											
Urban												
Mother's Primary	0.067	0.58	0.067	0.58	0.063	0.54	0.064	0.55	0.044	0.38	0.044	0.38
Mother's Middle	0.083	0.89	0.082	0.88	0.076	0.79	0.077	0.8	0.063	0.67	0.063	0.67
Mother's Sec & above	0.241	1.62	0.24	1.61	0.222	1.36	0.223	1.37	0.21	1.41	0.211	1.41
Father's Primary	-0.099	-0.65	-0.098	-0.64	-0.118	-0.73	-0.117	-0.72	-0.085	-0.56	-0.086	-0.56
Father's Middle	-0.109	-1.11	-0.109	-1.11	-0.132	-1.12	-0.131	-1.1	-0.12	-1.22	-0.12	-1.22
Father's Sec & above	-0.046	-0.38	-0.046	-0.38	-0.063	-0.44	-0.061	-0.43	-0.063	-0.52	-0.063	-0.52
GLSS_1	0.762	10.05***	0.762	10.05***	0.937	1.07	0.915	1.03	0.839	9.00***	0.84	8.99***
Observation no.	5957											
Rural												
Mother's Primary	0.094	1.18	0.125	1.57	0.086	1.06	0.117	1.46	0.075	0.94	0.104	1.31
Mother's Middle	-0.007	-0.1	0.023	0.33	-0.017	-0.24	0.007	0.1	-0.019	-0.26	0.009	0.13
Mother's Sec & above	0.03	0.14	0.098	0.47	-0.015	-0.07	0.033	0.15	0.024	0.11	0.086	0.41
Father's Primary	0.105	1.09	0.109	1.14	0.1	0.99	0.101	1	0.096	1	0.102	1.06
Father's Middle	-0.032	-0.49	-0.018	-0.28	-0.035	-0.48	-0.027	-0.36	-0.062	-0.94	-0.048	-0.72
Father's Sec & above	0.207	2.07*	0.235	2.35*	0.187	1.74	0.204	1.91	0.192	1.92	0.219	2.19*
GLSS_1	0.053	0.4	-0.04	-0.3	0.081	0.09	0.16	0.18	0.056	0.42	-0.024	-0.18
Observation no.	12081											

A–18: Tobit Results – The Impact of Own Education on The Duration of Adult Illness, 1987/88 (GLSS 1)

Sample:	personal education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 1												
Full	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio
Primary	0.377	3.34***	0.386	3.42***	0.368	3.21**	0.384	3.35***	0.36	3.19**	0.369	3.27**
Middle	0.098	1.16	0.114	1.34	0.08	0.82	0.108	1.12	0.062	0.73	0.077	0.9
Sec. & above	-0.123	-0.93	-0.095	-0.72	-0.137	-0.95	-0.1	-0.7	-0.182	-1.37	-0.158	-1.19
Obs. No.	6519											
Urban												
Primary	0.516	2.81**	0.517	2.81**	0.54	2.69**	0.546	2.71**	0.501	2.72**	0.502	2.73**
Middle	0.061	0.47	0.062	0.48	0.087	0.5	0.096	0.54	0.032	0.24	0.032	0.25
Sec. & above	-0.16	-0.93	-0.158	-0.92	-0.027	-0.12	-0.018	-0.08	-0.221	-1.26	-0.219	-1.26
Obs no.	2659											
Rural												
Primary	0.273	1.91	0.294	2.06*	0.245	1.69	0.274	1.89	0.26	1.82	0.283	1.98*
Middle	0.143	1.27	0.163	1.45	0.078	0.66	0.111	0.93	0.107	0.94	0.126	1.11
Sec. & above	-0.05	-0.24	-0.006	-0.03	-0.128	-0.56	-0.062	-0.27	-0.104	-0.49	-0.061	-0.29
Obs no.	3860											

A–19: Tobit Results – The Impact of Own Education on The Duration of Adult Illness, 1998/99 (GLSS 4)

Sample:	personal education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 4												
Full												
Primary	0.047	0.49	0.059	0.6	0.016	0.17	0.035	0.37	0.036	0.36	0.048	0.49
Middle	-0.037	-0.34	-0.018	-0.16	-0.222	-2.74**	-0.2	-2.48*	-0.062	-0.59	-0.042	-0.39
Sec. & above	-0.345	-3.08**	-0.315	-2.76**	-0.934	-3.91***	-0.944	-3.91***	-0.402	-3.45***	-0.37	-3.13**
Obs no.	13547											
Urban												
Primary	0.095	0.52	0.075	0.42	-0.084	-0.56	-0.091	-0.61	0.085	0.46	0.07	0.38
Middle	-0.03	-0.13	-0.058	-0.25	-0.147	-1.08	-0.159	-1.17	-0.072	-0.34	-0.094	-0.44
Sec. & above	-0.338	-2.10*	-0.37	-2.33*	-0.396	-2.47*	-0.406	-2.54*	-0.41	-2.61*	-0.434	-2.78**
Obs no.	4873											
Rural												
Primary	0.029	0.25	0.051	0.43	0.002	0.02	0.027	0.26	0.01	0.08	0.032	0.27
Middle	-0.064	-0.6	-0.019	-0.17	-0.259	-2.79**	-0.205	-2.23*	-0.089	-0.82	-0.043	-0.39
Sec. & above	-0.406	-2.47*	-0.329	-2.00*	-0.689	-3.80***	-0.599	-3.32***	-0.457	-2.66**	-0.384	-2.24*
Obs no.	8674											

A–20: Tobit Results – The Impact of Own Education on The Duration of Adult Illness, 1987/88 & 1998/99 (Pooled)

Sample:	personal education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
Pooled												
Full	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio
Primary	0.094	1.44	0.103	1.57	0.096	1.44	0.1	1.51	0.079	1.21	0.088	1.35
Middle	-0.048	-0.91	-0.03	-0.58	-0.037	-0.64	-0.03	-0.52	-0.07	-1.33	-0.053	-1
Sec. & above	-0.24	-3.10**	-0.214	-2.76**	-0.203	-2.35*	-0.195	-2.28*	-0.273	-3.52***	-0.248	-3.19**
GLSS_1	0.85	20.59***	0.81	19.20***	0.732	1.2	0.936	1.48	0.891	18.51***	0.855	17.56***
Obs no.	20066											
Urban												
Primary	0.097	0.86	0.096	0.86	0.069	0.61	0.071	0.62	0.085	0.76	0.085	0.76
Middle	-0.07	-0.79	-0.071	-0.8	-0.098	-1.05	-0.096	-1.03	-0.088	-0.99	-0.088	-1
Sec. & above	-0.268	-2.46*	-0.27	-2.47*	-0.304	-2.46*	-0.3	-2.43*	-0.305	-2.79**	-0.306	-2.79**
GLSS_1	1.032	15.23***	1.033	15.23***	1.599	2.83**	1.579	2.66**	1.109	13.24***	1.109	13.24***
Obs no.	7532											
Rural												
Primary	0.083	1.04	0.103	1.28	0.052	0.63	0.163	1.61	0.066	0.82	0.085	1.06
Middle	-0.064	-0.97	-0.032	-0.49	-0.117	-1.72	-0.027	-0.33	-0.091	-1.38	-0.059	-0.9
Sec. & above	-0.21	-1.79	-0.154	-1.31	-0.242	-2.01*	-0.484	-2.81**	-0.247	-2.10*	-0.193	-1.64
GLSS_1	0.219	1.86	0.116	0.97	2.51	4.57***	-3.293	-1.67	0.301	2.50*	0.205	1.69
Obs no.	12534											

A–21: Tobit Results – The Impact of Own Education on The Duration of Adult Illness, 1987/88 (GLSS 1) – controlling Parental Education

Sample:	w/ Personal education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 1												
Full	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio
Primary	0.347	3.06**	0.355	3.13**	0.337	2.91**	0.352	3.05**	0.334	2.95**	0.343	3.02**
Middle	0.051	0.58	0.065	0.74	0.03	0.31	0.057	0.58	0.023	0.26	0.036	0.41
Sec. & above	-0.203	-1.5	-0.18	-1.33	-0.218	-1.48	-0.183	-1.26	-0.248	-1.82	-0.228	-1.67
Mother’s Primary	0.538	2.48*	0.541	2.50*	0.545	2.50*	0.544	2.50*	0.519	2.39*	0.52	2.40*
Mother’s Middle	-0.237	-1.38	-0.231	-1.34	-0.25	-1.45	-0.241	-1.4	-0.248	-1.44	-0.244	-1.42
Mother’s Sec & above	0.489	1.14	0.498	1.16	0.543	1.22	0.52	1.17	0.456	1.06	0.457	1.07
Father’s Primary	0.033	0.17	0.039	0.2	0.04	0.21	0.043	0.22	0.012	0.06	0.017	0.09
Father’s Middle	0.154	1.63	0.162	1.7	0.158	1.64	0.164	1.71	0.14	1.47	0.145	1.53
Father’s Sec & above	0.25	1.43	0.276	1.58	0.269	1.49	0.285	1.59	0.224	1.27	0.247	1.41
Observation no.	6519											
Urban												
Primary	0.425	2.30*	0.426	2.31*	0.445	2.23*	0.45	2.24*	0.417	2.26*	0.418	2.27*
Middle	-0.052	-0.39	-0.052	-0.39	-0.037	-0.22	-0.031	-0.18	-0.068	-0.51	-0.068	-0.51
Sec. & above	-0.348	-1.94	-0.348	-1.93	-0.229	-1.03	-0.223	-0.98	-0.382	-2.11*	-0.383	-2.11*
Mother’s Primary	0.985	3.49***	0.982	3.48***	1.032	3.58***	1.031	3.56***	0.972	3.44***	0.968	3.42***
Mother’s Middle	-0.04	-0.19	-0.037	-0.18	-0.055	-0.25	-0.049	-0.23	-0.055	-0.27	-0.052	-0.25
Mother’s Sec & above	0.726	1.64	0.732	1.65	0.887	1.92	0.885	1.9	0.689	1.56	0.697	1.57
Father’s Primary	0.724	2.51*	0.726	2.52*	0.724	2.44*	0.722	2.41*	0.71	2.46*	0.712	2.47*
Father’s Middle	0.13	1	0.132	1.02	0.169	1.23	0.173	1.26	0.119	0.92	0.122	0.94
Father’s Sec & above	0.25	1.19	0.254	1.21	0.356	1.61	0.356	1.59	0.223	1.05	0.228	1.08
Observation no.	2659											
Rural												
Primary	0.266	1.85	0.288	2.00*	0.243	1.66	0.271	1.85	0.257	1.79	0.28	1.95
Middle	0.143	1.25	0.161	1.41	0.085	0.7	0.115	0.94	0.111	0.97	0.129	1.12
Sec. & above	-0.059	-0.27	-0.016	-0.07	-0.133	-0.58	-0.069	-0.3	-0.106	-0.5	-0.064	-0.3

Mother’s Primary	0.114	0.34	0.118	0.35	0.044	0.13	0.046	0.14	0.101	0.3	0.103	0.31
Mother’s Middle	-0.548	-1.79	-0.566	-1.85	-0.504	-1.64	-0.527	-1.72	-0.55	-1.8	-0.572	-1.86
Mother’s Sec & above	-0.969	-0.61	-1.026	-0.65	-0.98	-0.62	-1.07	-0.68	-1.048	-0.67	-1.127	-0.72
Father's Primary	-0.493	-1.83	-0.484	-1.8	-0.538	-1.98*	-0.531	-1.96	-0.516	-1.91	-0.508	-1.89
Father's Middle	0.242	1.72	0.252	1.79	0.204	1.43	0.212	1.49	0.218	1.55	0.226	1.61
Father's Sec & above	0.228	0.74	0.276	0.89	0.183	0.59	0.233	0.75	0.21	0.68	0.262	0.85
Observation no.	3860											

A–22: Tobit Results – The Impact of Own Education on The Duration of Adult's Illness, 1998/99 (GLSS 4) – controlling Parental Education

Sample:	w/ Personal education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
GLSS 4												
Full												
Primary	0.025	0.26	0.035	0.37	0.016	0.17	0.032	0.33	0.016	0.17	0.027	0.28
Middle	-0.063	-0.62	-0.046	-0.44	-0.198	-2.43*	-0.178	-2.19*	-0.082	-0.83	-0.064	-0.64
Sec. & above	-0.399	-3.34***	-0.373	-3.10**	-0.886	-4.11***	-0.889	-4.10***	-0.443	-3.63***	-0.416	-3.39***
Mother's Primary	-0.187	-1.4	-0.181	-1.36	-0.08	-0.66	-0.079	-0.65	-0.197	-1.51	-0.191	-1.47
Mother's Middle	0.064	0.38	0.074	0.44	-0.239	-1.95	-0.237	-1.92	0.054	0.32	0.065	0.39
Mother's Sec & above	0.303	1.33	0.315	1.39	-0.336	-1.17	-0.362	-1.25	0.277	1.21	0.29	1.26
Father's Primary	0.311	1.86	0.31	1.86	0.181	1.52	0.186	1.55	0.31	1.87	0.309	1.88
Father's Middle	0.079	0.88	0.09	1.01	-0.018	-0.22	-0.005	-0.06	0.06	0.66	0.072	0.79
Father's Sec & above	0.055	0.48	0.065	0.56	-0.109	-0.84	-0.105	-0.8	0.031	0.27	0.041	0.36
Observation no.	13547											
Urban												
Primary	0.119	0.66	0.103	0.58	-0.066	-0.44	-0.072	-0.48	0.116	0.64	0.103	0.57
Middle	-0.019	-0.09	-0.041	-0.19	-0.118	-0.86	-0.128	-0.93	-0.048	-0.24	-0.066	-0.33
Sec. & above	-0.347	-2.10*	-0.369	-2.25*	-0.374	-2.26*	-0.379	-2.30*	-0.394	-2.40*	-0.412	-2.52*
Mother's Primary	-0.543	-2.23*	-0.541	-2.23*	-0.261	-1.46	-0.258	-1.45	-0.554	-2.29*	-0.551	-2.30*
Mother's Middle	0.065	0.22	0.057	0.2	-0.064	-0.42	-0.066	-0.43	0.032	0.11	0.026	0.09
Mother's Sec & above	0.051	0.18	0.044	0.15	0.077	0.32	0.078	0.33	0	0	-0.004	-0.02
Father's Primary	0.311	1.11	0.299	1.07	0.255	1.41	0.246	1.36	0.3	1.1	0.29	1.07
Father's Middle	-0.102	-0.75	-0.116	-0.85	-0.103	-0.85	-0.111	-0.92	-0.133	-0.96	-0.144	-1.04
Father's Sec & above	0.113	0.67	0.094	0.56	0.031	0.19	0.02	0.12	0.074	0.45	0.058	0.35
Observation no.	4873											
Rural												
Primary	-0.017	-0.16	0.003	0.03	-0.058	-0.57	-0.033	-0.33	-0.034	-0.31	-0.013	-0.12
Middle	-0.095	-0.9	-0.053	-0.5	-0.258	-2.84**	-0.208	-2.32*	-0.116	-1.08	-0.074	-0.68

Sec. & above	-0.447	-2.69**	-0.376	-2.26*	-0.505	-3.33***	-0.431	-2.86**	-0.49	-2.87**	-0.423	-2.49*
Mother's Primary	0.092	0.6	0.11	0.73	0.124	0.82	0.126	0.83	0.075	0.5	0.093	0.63
Mother's Middle	-0.017	-0.1	0.009	0.05	-0.158	-1.04	-0.14	-0.92	-0.013	-0.07	0.016	0.09
Mother's Sec & above	0.613	1.57	0.647	1.7	0.288	0.83	0.325	0.94	0.573	1.42	0.604	1.53
Father's Primary	0.349	1.76	0.335	1.72	0.163	1.14	0.158	1.11	0.344	1.78	0.33	1.74
Father's Middle	0.174	1.56	0.194	1.75	0.066	0.67	0.096	0.98	0.161	1.42	0.181	1.61
Father's Sec & above	-0.11	-0.65	-0.11	-0.65	-0.087	-0.54	-0.069	-0.43	-0.122	-0.72	-0.123	-0.73
Observation no.	8674											

A–23: Tobit Results – The Impact of Own Education on The Duration of Adult's Illness, 1987/88 & 1998/99 (Pooled) – controlling Parental Education

Sample:	w/ Personal education only		w/ water & sanitation		w/ expend. & quadratic		w/ expend. & quadratic & water and sanitation		w/ unearned income & quadratic		w/ unearned income & quad & water and sanitation	
Pooled												
Full	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio	Coef.	t- ratio
Primary	0.084	1.27	0.091	1.38	0.086	1.29	0.089	1.34	0.071	1.08	0.078	1.19
Middle	-0.054	-1.02	-0.04	-0.75	-0.044	-0.75	-0.039	-0.67	-0.074	-1.37	-0.059	-1.1
Sec. & above	-0.256	-3.19**	-0.237	-2.95**	-0.22	-2.51*	-0.217	-2.48*	-0.283	-3.52***	-0.264	-3.28**
Mother's Primary	-0.017	-0.18	-0.015	-0.15	-0.022	-0.22	-0.02	-0.21	-0.031	-0.32	-0.029	-0.29
Mother's Middle	-0.169	-1.91	-0.159	-1.79	-0.158	-1.77	-0.147	-1.65	-0.173	-1.96	-0.163	-1.85
Mother's Sec & above	0.201	1.2	0.208	1.25	0.226	1.33	0.229	1.35	0.198	1.18	0.204	1.22
Father's Primary	0.143	1.5	0.146	1.54	0.143	1.5	0.145	1.52	0.136	1.42	0.139	1.46
Father's Middle	0.052	0.89	0.065	1.11	0.056	0.95	0.066	1.11	0.041	0.7	0.054	0.93
Father's Sec & above	0.074	0.8	0.089	0.95	0.085	0.91	0.096	1.02	0.056	0.6	0.07	0.75
GLSS_1	0.855	20.29***	0.817	19.03***	0.708	1.16	0.912	1.45	0.893	18.36***	0.858	17.48***
Observation no.	20066											
Urban												
Primary	0.08	0.71	0.08	0.71	0.057	0.5	0.058	0.51	0.072	0.64	0.072	0.63
Middle	-0.072	-0.79	-0.072	-0.8	-0.095	-1.01	-0.094	-0.99	-0.084	-0.93	-0.085	-0.94
Sec. & above	-0.294	-2.57*	-0.295	-2.58**	-0.32	-2.56*	-0.318	-2.53*	-0.322	-2.81**	-0.322	-2.81**
Mother's Primary	-0.04	-0.28	-0.04	-0.28	-0.052	-0.36	-0.053	-0.37	-0.061	-0.42	-0.061	-0.42
Mother's Middle	-0.078	-0.66	-0.079	-0.66	-0.074	-0.62	-0.073	-0.62	-0.089	-0.75	-0.089	-0.75
Mother's Sec & above	0.195	0.99	0.195	0.99	0.203	1.02	0.203	1.02	0.187	0.95	0.187	0.95
Father's Primary	0.346	2.35*	0.345	2.34*	0.332	2.25*	0.333	2.26*	0.344	2.34*	0.344	2.34*
Father's Middle	-0.025	-0.28	-0.026	-0.29	-0.038	-0.43	-0.036	-0.41	-0.035	-0.4	-0.035	-0.4
Father's Sec & above	0.112	0.89	0.111	0.88	0.1	0.78	0.102	0.8	0.091	0.72	0.091	0.72
GLSS_1	1.052	15.10***	1.052	15.10***	1.6	2.84**	1.583	2.67**	1.124	13.26***	1.124	13.26***
Observation no.	7532											
Rural												
Primary	0.074	0.91	0.091	1.12	0.115	1.18	0.145	1.44	0.058	0.72	0.075	0.93

Middle	-0.071	-1.05	-0.043	-0.64	-0.075	-0.93	-0.031	-0.37	-0.095	-1.41	-0.067	-1
Sec. & above	-0.219	-1.83	-0.171	-1.43	-0.513	-3.09**	-0.462	-2.77**	-0.249	-2.08*	-0.203	-1.69
Mother's Primary	0.042	0.31	0.054	0.4	0.119	0.74	0.148	0.9	0.033	0.25	0.046	0.34
Mother's Middle	-0.278	-2.06*	-0.256	-1.9	-0.363	-2.30*	-0.336	-2.10*	-0.281	-2.09*	-0.259	-1.93
Mother's Sec & above	0.279	0.83	0.321	0.96	-0.069	-0.17	-0.03	-0.07	0.241	0.72	0.277	0.83
Father's Primary	0.032	0.26	0.033	0.26	0.129	0.85	0.138	0.88	0.019	0.15	0.021	0.17
Father's Middle	0.138	1.76	0.16	2.03*	0.101	1.1	0.133	1.42	0.125	1.59	0.147	1.87
Father's Sec & above	0.011	0.08	0.033	0.23	-0.148	-0.86	-0.126	-0.72	-0.008	-0.06	0.013	0.09
GLSS_1	0.22	1.86	0.119	1	-2.752	-1.48	-3.22	-1.65	0.298	2.47*	0.205	1.69
Observation no.	12534											

A-24a: The Effects of Parental Education on Health Status (Illness, Height-for-age Z-scores & Weight-for-height z-scores) of Pre-School Children, 1987/88 (GLSS 1)

Pre-School	**Variant 1: Education**						**Variant 3: Education conditioning on unearned income**					
	Illness		Haz		Whz		Illness		Haz		Whz	
	Marginal		Marginal		Marginal		Marginal		Marginal		Marginal	
Full Sample:	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Mother's Primary	0.049	1.35	-0.038	-0.4	0.003	0.05	0.04	1.12	-0.037	-0.38	3.60E-04	0.01
Mother's Middle	0.026	0.88	0.048	0.59	0.005	0.1	0.021	0.72	0.039	0.48	-0.006	-0.11
Mother's Sec & above	0.044	0.64	0.493	3.13**	0.299	2.22*	0.039	0.56	0.448	2.77**	0.25	1.87
Father's Primary	0.071	1.44	-0.064	-0.5	-0.016	-0.17	0.075	1.51	-0.066	-0.52	-0.017	-0.17
Father's Middle	0.081	2.72**	0.044	0.54	0.009	0.16	0.07	2.32*	0.04	0.48	-0.002	-0.04
Father's Sec & above	0.15	3.41***	0.157	1.36	0.09	1.06	0.138	3.11**	0.152	1.32	0.078	0.92
Observation no.	2168											
Urban sub-sample:												
Mother's Primary	-0.002	-0.03	0.199	1.19	0.028	0.22	-0.006	-0.09	0.183	1.08	0.022	0.18
Mother's Middle	0.112	2.20*	0.535	4.18***	-0.021	-0.23	0.102	1.96	0.494	3.85***	-0.035	-0.38
Mother's Sec & above	0.13	1.52	0.849	4.21***	0.249	1.55	0.122	1.39	0.806	3.90***	0.217	1.35
Father's Primary	-0.131	-1.43	-0.181	-0.68	-0.037	-0.19	-0.134	-1.45	-0.19	-0.73	-0.043	-0.22
Father's Middle	-0.053	-0.96	-0.092	-0.68	0.084	0.93	-0.06	-1.08	-0.116	-0.85	0.072	0.78
Father's Sec & above	-0.05	-0.71	-0.094	-0.53	0.074	0.55	-0.062	-0.87	-0.134	-0.75	0.058	0.42
Observation no.	757											
Rural sub-sample:												
Mother's Primary	0.06	1.34	-0.159	-1.32	0.019	0.24	0.054	1.21	-0.145	-1.2	0.016	0.2
Mother's Middle	-0.006	-0.16	-0.212	-2.09*	-0.009	-0.12	-0.008	-0.22	-0.215	-2.11*	-0.016	-0.22
Mother's Sec & above	0.147	0.77	0.192	0.61	0.829	2.48*	0.123	0.64	0.201	0.63	0.773	2.32*
Father's Primary	0.133	2.30*	-0.102	-0.7	0.019	0.17	0.137	2.39*	-0.109	-0.74	0.024	0.21
Father's Middle	0.118	3.22**	0.109	1.05	-0.036	-0.51	0.107	2.88**	0.129	1.23	-0.049	-0.69
Father's Sec & above	0.266	4.75***	0.276	1.77	0.165	1.49	0.257	4.54***	0.298	1.92	0.157	1.41
Observation no.	1411											

A-24b: The Effects of Parental Education on Health Status (Illness, Height-for-age Z-scores & Weight-for-height z-scores) of Pre-School Children, 1987/88 (GLSS 1), controlling expenditure

Pre-School	**Variant 2: Education conditioning on expenditure per capita**					
	Illness		Haz		Whz	
	Marginal		Marginal		Marginal	
Full Sample:	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Mother's Primary	0.049	1.35	-0.057	-0.52	0.02	0.29
Mother's Middle	0.026	0.87	0.07	0.74	-0.017	-0.31
Mother's Sec & above	0.029	0.38	0.357	1.02	0.206	1.37
Father's Primary	0.079	1.46	0.142	0.85	-0.1	-0.91
Father's Middle	0.09	2.34*	0.288	2.02*	-0.101	-1.26
Father's Sec & above	0.157	3.17**	0.36	2.16*	-0.02	-0.2
Observation no.	2168					
Urban sub-sample:						
Mother's Primary	-0.012	-0.16	0.037	0.18	-0.13	-0.75
Mother's Middle	0.113	2.09*	0.476	2.93**	0.007	0.05
Mother's Sec & above	0.141	1.24	0.717	2.24*	0.441	1.38
Father's Primary	-0.144	-1.43	-0.331	-0.99	-0.268	-0.82
Father's Middle	-0.086	-0.76	-0.528	-1.53	-0.434	-1.33
Father's Sec & above	-0.084	-0.69	-0.587	-1.55	-0.48	-1.36
Observation no.	757					
Rural sub-sample:						
Mother's Primary	0.068	1.45	-0.186	-1.41	0.103	1.03
Mother's Middle	9.43E-05	0	-0.173	-1.52	0.048	0.5
Mother's Sec & above	0.142	0.8	0.468	1.09	0.678	1.53
Father's Primary	0.133	2.09*	0.001	0	-0.006	-0.04
Father's Middle	0.116	2.62**	0.208	1.44	-0.094	-0.93
Father's Sec & above	0.26	4.25***	0.368	1.99*	0.067	0.44
Observation no.	1411					

A-25a: The Effects of Parental Education on Health Status (Illness, Height-for-age Z-scores & Weight-for-height z-scores) of School-Aged Children, 1987/88 (GLSS 1)

School-Aged	Variant 1: Education						Variant 3: Education conditioning on unearned income					
	Illness		Haz		Whz		Illness		Haz		Whz	
	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
Full Sample:												
Mother's Primary	0.077	2.09*	-0.079	-0.92	-0.032	-0.34	0.076	2.05*	-0.077	-0.9	-0.026	-0.28
Mother's Middle	0.025	0.87	-0.106	-1.49	-0.064	-0.93	0.028	0.99	-0.126	-1.76	-0.083	-1.21
Mother's Sec & above	0.119	1.73	0.23	1.65	0.043	0.25	0.127	1.78	0.133	0.94	-0.075	-0.42
Father's Primary	0.019	0.43	-0.053	-0.47	-0.093	-0.89	0.02	0.47	-0.052	-0.46	-0.093	-0.89
Father's Middle	-0.008	-0.31	-0.125	-1.84	-0.026	-0.39	-0.013	-0.5	-0.123	-1.8	-0.018	-0.27
Father's Sec & above	0.004	0.1	0.086	0.9	0.016	0.15	-0.002	-0.06	0.095	1.01	0.025	0.25
Observation no.	2207		2207		1268		2207		2207		1268	
Urban sub-sample:												
Mother's Primary	0.156	2.67**	0.171	1.25	0.009	0.06	0.156	2.66**	0.169	1.24	0.01	0.07
Mother's Middle	0.043	0.94	0.134	1.21	-0.073	-0.7	0.041	0.9	0.122	1.09	-0.088	-0.83
Mother's Sec & above	0.246	3.08**	0.443	2.66**	-0.002	-0.01	0.238	2.87**	0.376	2.21*	-0.111	-0.49
Father's Primary	0.19	1.92	-0.23	-1.21	-0.224	-1.13	0.187	1.89	-0.249	-1.3	-0.253	-1.29
Father's Middle	0.013	0.31	-0.029	-0.26	0.011	0.1	0.012	0.28	-0.04	-0.36	0.006	0.05
Father's Sec & above	-0.089	-1.51	0.14	0.97	0.108	0.66	-0.091	-1.53	0.128	0.9	0.1	0.61
Observation no.	866		866		465		866		866		465	
Rural sub-sample:												
Mother's Primary	0.004	0.09	-0.252	-2.27*	-0.05	-0.4	0.002	0.05	-0.251	-2.27*	-0.042	-0.33
Mother's Middle	0.038	1.01	-0.288	-3.08**	-0.108	-1.17	0.044	1.18	-0.306	-3.28**	-0.132	-1.44
Mother's Sec & above	0.019	0.13	-0.09	-0.26	-0.117	-0.3	0.035	0.23	-0.158	-0.44	-0.189	-0.48
Father's Primary	-0.009	-0.19	-0.014	-0.1	-0.096	-0.78	-0.011	-0.23	0.001	0.01	-0.08	-0.65
Father's Middle	-0.04	-1.28	-0.209	-2.34*	-0.03	-0.34	-0.047	-1.48	-0.202	-2.26*	-0.017	-0.2
Father's Sec & above	0.082	1.44	0.045	0.35	-0.002	-0.01	0.068	1.19	0.07	0.54	0.025	0.2
Observation no.	1341		1341		803		1341		1341		803	

A-25b: The Effects of Parental Education on Health Status (Illness, Height-for-age Z-scores & Weight-for-height z-scores) of School-Aged Children, 1987/88 (GLSS 1), controlling expenditure

School-Aged	**Variant 2: Education conditioning on expenditure**					
	Illness		Haz		Whz	
	Marginal		Marginal		Marginal	
Full Sample:	Effects	t- ratio	Effects	t- ratio	Effects	t- ratio
Mother's Primary	0.079	1.94	0.032	0.31	0.09	0.76
Mother's Middle	0.024	0.83	-0.118	-1.6	-0.086	-1.1
Mother's Sec & above	0.099	1.28	0	0	-0.108	-0.52
Father's Primary	0.021	0.45	-0.142	-1.2	-0.222	-1.76
Father's Middle	-0.008	-0.24	-0.286	-3.03**	-0.18	-1.71
Father's Sec & above	0.001	0.01	-0.137	-1.18	-0.171	-1.29
Observation no.	2207		2207		1268	
Urban sub-sample:						
Mother's Primary	0.146	2.40*	0.131	0.9	0.061	0.33
Mother's Middle	0.039	0.84	0.067	0.58	-0.188	-1.33
Mother's Sec & above	0.27	2.98**	0.214	1.05	-0.211	-0.71
Father's Primary	0.162	1.53	-0.382	-1.81	-0.768	-2.32*
Father's Middle	-0.027	-0.54	-0.208	-1.45	-0.185	-1.02
Father's Sec & above	-0.128	-2.04*	-0.118	-0.67	-0.183	-0.75
Observation no.	866		866		465	
Rural sub-sample:						
Mother's Primary	0.026	0.46	-0.105	-0.69	0.049	0.35
Mother's Middle	0.05	1.19	-0.311	-3.00**	-0.116	-1.18
Mother's Sec & above	-0.049	-0.39	-0.31	-0.78	-0.351	-0.8
Father's Primary	-0.013	-0.25	-0.108	-0.68	-0.169	-1.25
Father's Middle	-0.066	-1.75	-0.328	-2.79**	-0.115	-1.16
Father's Sec & above	0.041	0.64	-0.132	-0.77	-0.135	-0.91
Observation no.	1341		1341		803	

A–26a: Pre-school children – First-stage regression for expenditure per capita and its quadratic, 1987/88 (GLSS 1: The Anthropometrics)

Full	Illness				Haz				Whz			
	Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.	
	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
log of land per capita	-0.047	-3.99***	-0.987	-4.00***	-0.048	-3.98***	-1.01	-3.98***				
log of land per capita sq.	0.005	4.77***	0.113	4.77***	0.006	4.82***	0.116	4.80***				
Missing land per capita	-0.042	-1.1	-0.793	-0.98	-0.022	-0.55	-0.344	-0.41				
log of durable goods per capita	-0.076	-5.78***	-1.709	-5.92***					-0.073	-5.49***	-1.65	-5.66***
log of durable goods per capita sq	0.015	8.58***	0.34	8.49***					0.015	8.33***	0.334	8.26***
formal employment (Head)					0.146	2.43*	3.076	2.40*	0.097	1.68	2.046	1.66
Self-employment (Head)					0.145	2.50*	3.126	2.53*	0.131	2.34*	2.814	2.37*
Mother's Primary	-0.053	-1.52	-1.137	-1.55	-0.045	-1.26	-0.967	-1.28	-0.051	-1.48	-1.102	-1.51
Mother's Middle	0.034	1.22	0.732	1.22	0.068	2.35*	1.448	2.36*	0.029	1.03	0.626	1.04
Mother's Sec & above	0.159	2.44*	3.6	2.49*	0.334	4.67***	7.38	4.63***	0.147	2.23*	3.353	2.30*
Father's Primary	0.183	3.73***	3.818	3.65***	0.172	3.44***	3.577	3.35***	0.187	3.83***	3.898	3.76***
Father's Middle	0.205	6.99***	4.278	6.90***	0.232	7.66***	4.853	7.60***	0.214	7.14***	4.467	7.07***
Father's Sec & above	0.18	4.46***	3.767	4.41***	0.246	5.57***	5.2	5.51***	0.191	4.58***	4.024	4.54***
6-11months	0.005	0.09	0.079	0.07	0.022	0.4	0.444	0.38	0.001	0.02	0.004	0
12-23months	0.011	0.25	0.185	0.19	0.03	0.62	0.573	0.57	0.009	0.19	0.139	0.14
24-35months	-0.023	-0.52	-0.568	-0.6	-0.007	-0.15	-0.214	-0.22	-0.028	-0.62	-0.66	-0.69
36-47months	-0.058	-1.27	-1.294	-1.33	-0.034	-0.72	-0.761	-0.76	-0.062	-1.34	-1.372	-1.4
48-60months	-0.078	-1.8	-1.674	-1.83	-0.064	-1.43	-1.368	-1.44	-0.077	-1.75	-1.646	-1.77
Mother's Height	-0.001	-0.38	-0.014	-0.43	0	0.16	0.004	0.13	0	-0.16	-0.006	-0.19
Rural	-0.123	-4.85***	-2.53	-4.68***	-0.173	-6.49***	-3.615	-6.34***	-0.109	-4.41***	-2.245	-4.28***
Female	-0.013	-0.62	-0.296	-0.64	-0.014	-0.61	-0.301	-0.63	-0.014	-0.62	-0.297	-0.64
Non-Akan	0.085	3.25**	1.746	3.11**	0.079	2.93**	1.607	2.78**	0.071	2.76**	1.464	2.64**
Western Region	-0.083	-1.9	-1.914	-2.00*	-0.125	-2.78**	-2.812	-2.85**	-0.049	-1.14	-1.197	-1.27
Central Region	-0.363	-7.04***	-7.802	-7.09***	-0.436	-8.11***	-9.364	-8.16***	-0.363	-7.05***	-7.816	-7.12***
Eastern Region	-0.17	-3.97***	-3.766	-4.02***	-0.221	-5.08***	-4.86	-5.10***	-0.148	-3.53***	-3.338	-3.62***
Volta Region	-0.575	-11.02***	-12.174	-11.02***	-0.629	-11.71***	-13.346	-11.74***	-0.564	-10.82***	-11.97	-10.86***
Ashanti Region	-0.339	-8.62***	-7.427	-8.64***	-0.375	-9.27***	-8.18	-9.23***	-0.329	-8.34***	-7.23	-8.38***
Brong Ahafo Region	-0.248	-5.51***	-5.432	-5.60***	-0.298	-6.42***	-6.524	-6.51***	-0.216	-4.89***	-4.799	-5.02***

Upper West Region	-0.431	-2.39*	-8.53	-2.28*	-0.447	-2.44*	-8.852	-2.33*	-0.48	-2.70**	-9.512	-2.57*
Northern Region	-0.467	-8.12***	-9.849	-8.08***	-0.471	-7.89***	-9.962	-7.87***	-0.476	-8.30***	-10.073	-8.27***
Upper East Region	-0.795	-10.67***	-16.637	-10.79***	-0.818	-10.35***	-17.108	-10.45***	-0.802	-10.67***	-16.788	-10.81***
constant	10.818	43.54***	117.765	22.31***	10.633	41.36***	113.732	20.85***	10.645	41.63***	114.064	21.02***
Observation no.	2168		2168		2168		2168		2168		2168	
R-squared	0.308		0.306		0.269		0.266		0.298		0.296	
adjusted R-squared	0.299		0.297		0.259		0.256		0.289		0.287	
F	36.393		35.414		28.322		27.828		37.29		36.235	
ll	-1.60E+03		-8.20E+03		-1.60E+03		-8.30E+03		-1.60E+03		- 8.20E+03	
F-test of instruments	F(5, 2138) = 35.26		F(5, 2138) = 32.87		F(5, 2138) = 8.56		F(5, 2138) = 8.29		F(4, 2139) = 38.51		F(4, 2139) = 35.79	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

A–26b: Pre-school children – First-stage regression for expenditure per capita and its quadratic, 1987/88 (GLSS 1: The Anthropometrics)

Urban	Illness				Haz				Whz			
	Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.	
	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
log of land per capita	-0.036	-1.59	-0.78	-1.6					-0.037	-1.62	-0.791	-1.62
log of land per capita sq.	0.004	1.62	0.079	1.62					0.004	1.64	0.08	1.64
Missing land per capita	-0.042	-1.02	-0.919	-1.02					-0.043	-1.04	-0.932	-1.03
log of durable goods per capita	-0.125	-6.36***	-2.805	-6.35***	-0.126	-6.30***	-2.812	-6.30***	-0.124	-6.32***	-2.781	-6.31***
log of durable goods per capita sq	0.02	7.93***	0.444	7.75***	0.02	7.82***	0.444	7.65***	0.02	7.93***	0.442	7.74***
formal employment (Head)	0.05	0.62	1.084	0.63	0.053	0.67	1.152	0.67				
Self-employment (Head)	0.029	0.35	0.676	0.38	0.03	0.36	0.694	0.39				
Mother's Primary	0.063	1.19	1.338	1.17	0.068	1.29	1.439	1.27	0.061	1.14	1.286	1.12
Mother's Middle	0.053	1.27	1.224	1.35	0.049	1.17	1.137	1.25	0.052	1.25	1.188	1.33
Mother's Sec & above	0.107	1.32	2.563	1.42	0.105	1.3	2.504	1.4	0.107	1.33	2.555	1.42
Father's Primary	0.049	0.6	0.983	0.57	0.042	0.52	0.843	0.49	0.056	0.7	1.133	0.66
Father's Middle	0.183	4.01***	3.823	3.93***	0.181	4.01***	3.778	3.93***	0.185	4.09***	3.858	4.00***
Father's Sec & above	0.177	2.95**	3.667	2.84**	0.181	3.07**	3.756	2.95**	0.179	3.01**	3.704	2.90**
6-11months	-0.026	-0.35	-0.58	-0.36	-0.021	-0.28	-0.476	-0.3	-0.027	-0.37	-0.614	-0.39
12-23months	-0.024	-0.33	-0.541	-0.34	-0.015	-0.21	-0.358	-0.23	-0.024	-0.33	-0.545	-0.34
24-35months	-0.069	-1.04	-1.545	-1.06	-0.058	-0.88	-1.304	-0.9	-0.074	-1.11	-1.635	-1.13
36-47months	-0.087	-1.3	-1.924	-1.32	-0.084	-1.25	-1.847	-1.26	-0.088	-1.32	-1.948	-1.33
48-60months	-0.073	-1.12	-1.578	-1.11	-0.062	-0.94	-1.329	-0.93	-0.074	-1.14	-1.596	-1.12
Mother's Height	-0.004	-1.88	-0.088	-1.87	-0.004	-1.92	-0.088	-1.91	-0.004	-1.89	-0.088	-1.88
Female	-0.015	-0.46	-0.334	-0.47	-0.016	-0.5	-0.363	-0.51	-0.015	-0.47	-0.342	-0.48
Non-Akan	0.008	0.21	0.148	0.17	0.001	0.02	-0.017	-0.02	0.01	0.25	0.178	0.21
Western Region	-0.11	-1.83	-2.443	-1.84	-0.115	-1.94	-2.553	-1.94	-0.11	-1.84	-2.443	-1.84
Central Region	-0.609	-7.30***	-12.872	-7.33***	-0.613	-7.48***	-12.954	-7.53***	-0.612	-7.43***	-12.937	-7.47***
Eastern Region	-0.21	-3.65***	-4.677	-3.73***	-0.195	-3.70***	-4.361	-3.77***	-0.213	-3.71***	-4.737	-3.79***
Volta Region	-0.332	-4.17***	-7.151	-4.22***	-0.324	-4.07***	-6.977	-4.11***	-0.339	-4.28***	-7.302	-4.32***
Ashanti Region	-0.207	-4.17***	-4.592	-4.20***	-0.204	-4.13***	-4.535	-4.14***	-0.208	-4.27***	-4.629	-4.30***
Brong Ahafo Region	-0.184	-2.58*	-3.998	-2.61**	-0.163	-2.51*	-3.547	-2.54*	-0.19	-2.66**	-4.116	-2.68**
Northern Region	-0.612	-7.81***	-12.951	-7.89***	-0.601	-7.91***	-12.713	-7.99***	-0.619	-7.84***	-13.106	-7.92***

Upper East Region	-0.316	-2.42*	-6.769	-2.40*	-0.284	-2.20*	-6.065	-2.19*	-0.318	-2.45*	-6.813	-2.44*
constant	11.472	32.05***	131.708	16.84***	11.452	32.58***	131.26	17.09***	11.506	33.77***	132.479	17.72***
Observation no.	757		757		757		757		757		757	
R-squared	0.374		0.372		0.371		0.368		0.374		0.371	
adjusted R-squared	0.349		0.347		0.349		0.346		0.351		0.348	
F	15.178		15.039		16.823		16.69		16.211		16.054	
ll	-434.456		-2.80E+03		-436.443		-2.80E+03		-434.791		-2.80E+03	
F-test of instruments	F(7, 727) = 12.50		F(7, 727) = 11.62		F(4, 730) = 20.59		F(4, 730) = 19.09		F(5, 729) = 17.26		F(5, 729) = 15.99	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

A–26c: Pre-school children – First-stage regression for expenditure per capita and its quadratic, 1987/88 (GLSS 1: The Anthropometrics)

Rural	Illness				Haz				Whz			
	Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.	
	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
log of land per capita	-0.058	-4.12***	-1.217	-4.12***	-0.057	-3.93***	-1.196	-3.92***	-0.056	-4.00***	-1.185	-4.00***
log of land per capita sq.	0.006	4.86***	0.135	4.85***	0.006	4.69***	0.135	4.67***	0.006	4.70***	0.132	4.68***
Missing land per capita	-0.029	-0.33	-0.292	-0.16	-0.066	-0.73	-1.043	-0.55	-0.04	-0.44	-0.513	-0.27
log of durable goods per capita	-0.048	-2.70**	-1.032	-2.77**					-0.046	-2.60**	-0.995	-2.66**
log of durable goods per capita sq	0.012	4.71***	0.254	4.70***					0.012	4.62***	0.251	4.62***
formal employment (Head)					0.322	4.03***	6.777	4.08***	0.299	3.76***	6.293	3.80***
Self-employment (Head)					0.363	5.02***	7.718	5.17***	0.359	5.01***	7.625	5.15***
Mother's Primary	-0.079	-1.85	-1.701	-1.9	-0.081	-1.86	-1.747	-1.91	-0.081	-1.91	-1.742	-1.97*
Mother's Middle	0.034	0.93	0.658	0.86	0.057	1.52	1.125	1.43	0.027	0.73	0.506	0.66
Mother's Sec & above	0.432	5.37***	9.071	5.06***	0.627	6.73***	13.158	6.29***	0.438	5.38***	9.226	5.09***
Father's Primary	0.228	4.19***	4.744	4.09***	0.213	3.98***	4.424	3.89***	0.229	4.25***	4.766	4.16***
Father's Middle	0.195	5.24***	4.09	5.22***	0.222	5.71***	4.65	5.70***	0.201	5.33***	4.227	5.32***
Father's Sec & above	0.177	3.41***	3.735	3.44***	0.243	4.23***	5.136	4.27***	0.193	3.50***	4.115	3.55***
6-11months	0.018	0.25	0.381	0.25	0.017	0.23	0.363	0.24	0.024	0.34	0.519	0.34
12-23months	0.046	0.76	0.895	0.71	0.053	0.87	1.048	0.82	0.038	0.64	0.74	0.59
24-35months	0.002	0.03	-0.032	-0.03	0.004	0.06	0.008	0.01	-0.003	-0.06	-0.144	-0.12
36-47months	-0.049	-0.8	-1.088	-0.85	-0.045	-0.73	-0.999	-0.77	-0.054	-0.89	-1.187	-0.93
48-60months	-0.063	-1.1	-1.366	-1.14	-0.06	-1.04	-1.298	-1.07	-0.064	-1.12	-1.38	-1.15
Mother's Height	0.003	1.45	0.069	1.46	0.005	1.99*	0.098	2.00*	0.004	1.66	0.08	1.67
Female	0.005	0.2	0.114	0.19	0.01	0.36	0.213	0.36	0.011	0.39	0.227	0.39
Non-Akan	0.123	3.18**	2.554	3.10**	0.131	3.39***	2.722	3.31***	0.12	3.12**	2.492	3.05**
Price of Maize (kg)	0.027	2.89**	0.58	2.87**	0.025	2.57*	0.527	2.56*	0.028	2.95**	0.595	2.94**
Price of Anti-malarial pill	0.006	0.15	0.142	0.16	-0.004	-0.09	-0.078	-0.09	-0.007	-0.16	-0.138	-0.16
Missing price	0.135	1.78	2.794	1.75	0.106	1.38	2.213	1.36	0.15	1.99*	3.12	1.96
Dist. to the nearest clinic	-0.005	-3.87***	-0.098	-3.84***	-0.005	-4.27***	-0.107	-4.24***	-0.005	-4.05***	-0.102	-4.02***
Male Agric. Wage	-0.003	-0.17	-0.033	-0.08	-0.005	-0.28	-0.074	-0.2	-0.005	-0.26	-0.071	-0.18
Ratio of female Wage	0.117	3.16**	2.527	3.21**	0.105	2.78**	2.286	2.85**	0.115	3.10**	2.489	3.16**
Ratio of child Wage	0.11	2.50*	2.314	2.47*	0.142	3.19**	2.997	3.17**	0.129	2.94**	2.73	2.92**

Western Region	-0.115	-1.18	-2.668	-1.24	-0.075	-0.73	-1.796	-0.8	-0.101	-1.02	-2.34	-1.08
Central Region	-0.38	-3.75***	-8.255	-3.72***	-0.392	-3.71***	-8.491	-3.68***	-0.381	-3.72***	-8.285	-3.69***
Eastern Region	-0.228	-2.39*	-4.962	-2.35*	-0.19	-1.92	-4.148	-1.9	-0.212	-2.19*	-4.606	-2.16*
Volta Region	-0.744	-7.35***	-15.732	-7.13***	-0.731	-6.94***	-15.445	-6.75***	-0.736	-7.16***	-15.543	-6.96***
Ashanti Region	-0.408	-4.19***	-8.898	-4.15***	-0.392	-3.88***	-8.531	-3.84***	-0.404	-4.08***	-8.801	-4.04***
Brong Ahafo Region	-0.313	-3.35***	-6.886	-3.34***	-0.285	-2.90**	-6.263	-2.90**	-0.308	-3.23**	-6.761	-3.22**
Upper West Region	-0.583	-2.75**	-11.843	-2.66**	-0.514	-2.42*	-10.398	-2.34*	-0.592	-2.81**	-12.046	-2.73**
Northern Region	-0.38	-3.63***	-8.033	-3.52***	-0.288	-2.64**	-6.083	-2.56*	-0.34	-3.16**	-7.179	-3.07**
Upper East Region	-0.941	-8.43***	-19.642	-8.20***	-0.905	-7.84***	-18.852	-7.62***	-0.921	-8.15***	-19.206	-7.92***
constant	9.918	25.25***	98.484	12.04***	9.387	22.77***	87.17	10.17***	9.504	23.54***	89.645	10.68***
Observation no.	1411		1411		1411		1411		1411		1411	
R-squared	0.277		0.274		0.259		0.256		0.285		0.282	
adjusted R-squared	0.259		0.255		0.24		0.237		0.266		0.262	
F	18.331		18.092		18.396		18.111		19.816		19.484	
ll	-1.10E+03		-5.40E+03		-1.10E+03		-5.40E+03		-1.00E+03		-5.30E+03	
F-test of instruments	F(5, 1375) = 21.90		F(5, 1375) = 21.24		F(5, 1375) = 12.03		F(5, 1375) = 12.20		F(7, 1373) = 20.27		F(7, 1373) = 20.02	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

A–27a: School-aged children – First-stage regression for expenditure per capita and its quadratic, 1987/88 (GLSS 1: The Anthropometrics)

School-aged	Illness				Haz				Whz			
Full	Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.	
	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
log of land per capita	-0.052	-4.84***	-1.113	-4.84***								
log of land per capita sq.	0.006	5.96***	0.127	5.92***								
Missing land per capita	0.004	0.11	0.164	0.21								
log of durable goods per capita	-0.086	-7.57***	-1.993	-8.03***	-0.084	-7.14***	-1.954	-7.52***	-0.103	-6.51***	-2.368	-6.75***
log of durable goods per capita sq	0.018	12.15***	0.397	12.22***	0.018	11.64***	0.398	11.59***	0.02	9.77***	0.451	9.63***
formal employment (Head)					-0.059	-1.07	-1.307	-1.1	-0.055	-0.72	-1.173	-0.72
Self-employment (Head)					-0.012	-0.22	-0.157	-0.14	-0.002	-0.03	0.091	0.06
Mother's Primary	-0.134	-3.54***	-2.788	-3.53***	-0.135	-3.53***	-2.803	-3.52***	-0.127	-2.57*	-2.643	-2.57*
Mother's Middle	-0.022	-0.76	-0.436	-0.72	-0.03	-1.02	-0.597	-0.97	-0.006	-0.14	-0.094	-0.12
Mother's Sec & above	0.221	3.39***	5.129	3.49***	0.231	3.50***	5.368	3.60***	0.166	1.88	3.951	1.96
Father's Primary	0.109	2.40*	2.25	2.36*	0.105	2.31*	2.19	2.28*	0.159	2.55*	3.385	2.56*
Father's Middle	0.124	4.44***	2.502	4.23***	0.136	4.75***	2.782	4.59***	0.126	3.20**	2.574	3.11**
Father's Sec & above	0.182	4.75***	3.766	4.57***	0.19	4.82***	3.963	4.67***	0.13	2.50*	2.672	2.39*
Age (years)	0.025	0.81	0.56	0.85	0.026	0.83	0.578	0.86	0.176	1.73	3.714	1.71
Age squared (years)	-0.001	-0.82	-0.027	-0.86	-0.001	-0.83	-0.028	-0.87	-0.011	-1.83	-0.24	-1.81
Mother's Height	0	-0.07	-0.004	-0.11	0	0.24	0.007	0.22	0	-0.04	-0.007	-0.16
Rural	-0.144	-5.61***	-2.962	-5.44***	-0.126	-4.96***	-2.593	-4.82***	-0.136	-4.06***	-2.803	-3.92***
Female	0.026	1.17	0.536	1.16	0.019	0.84	0.381	0.82	-0.042	-1.37	-0.902	-1.39
Non-Akan	0.147	5.65***	3.163	5.68***	0.128	4.97***	2.759	5.00***	0.129	3.88***	2.78	3.89***
Western Region	0.014	0.3	0.111	0.11	0.04	0.91	0.684	0.71	0.046	0.79	0.841	0.67
Central Region	-0.383	-6.78***	-8.16	-6.85***	-0.384	-6.79***	-8.17	-6.86***	-0.403	-5.56***	-8.505	-5.57***
Eastern Region	-0.188	-4.52***	-4.225	-4.68***	-0.19	-4.67***	-4.262	-4.84***	-0.174	-3.17**	-3.84	-3.21**
Volta Region	-0.522	-9.43***	-11.119	-9.44***	-0.527	-9.56***	-11.242	-9.59***	-0.48	-6.56***	-10.202	-6.48***
Ashanti Region	-0.349	-8.98***	-7.616	-8.99***	-0.353	-8.99***	-7.685	-9.00***	-0.319	-6.21***	-6.912	-6.16***
Brong Ahafo Region	-0.269	-6.17***	-5.943	-6.33***	-0.249	-5.65***	-5.515	-5.83***	-0.224	-3.90***	-4.921	-3.99***
Upper West Region	-0.762	-3.61***	-14.878	-3.46***	-0.789	-3.76***	-15.414	-3.61***	-0.354	-1.2	-6.417	-1.03
Northern Region	-0.489	-9.34***	-10.462	-9.44***	-0.523	-10.05***	-11.205	-10.16***	-0.51	-7.22***	-10.851	-7.26***
Upper East Region	-0.855	-10.60***	-18.014	-10.97***	-0.868	-10.37***	-18.329	-10.72***	-0.869	-8.52***	-18.324	-8.83***

constant	10.568	37.56***	112.301	18.91***	10.53	36.51***	111.372	18.30***	10.08	20.60***	102.514	9.84***
Observation no.	2207		2207		2207		2207		1268		1268	
R-squared	0.365		0.372		0.353		0.359		0.333		0.34	
adjusted R-squared	0.357		0.364		0.345		0.352		0.319		0.327	
F	57.414		54.33		54.803		51.788		30.142		28.239	
ll	-1.70E+03		-8.40E+03		-1.70E+03		-8.40E+03		-958.034		-4.80E+03	
F-test of instruments	F(5, 2180) = 70.83		F(5, 2180) = 65.25		F(4, 2181) = 71.08		F(4, 2181) = 65.62		F(4, 1242) = 40.79		F(4, 1242) = 37.09	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

A–27b: School-aged children – First-stage regression for expenditure per capita and its quadratic, 1987/88 (GLSS 1: The Anthropometrics)

Urban	Illness				Haz				Whz			
	Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.	
	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
log of land per capita					-0.055	-3.02**	-1.286	-3.13**	-0.076	-3.48***	-1.826	-3.72***
log of land per capita sq.					0.006	3.52***	0.141	3.58***	0.008	4.10***	0.194	4.26***
Missing land per capita					0.076	1.94	1.619	1.88	-0.012	-0.23	-0.428	-0.37
log of durable goods per capita	-0.127	-7.56***	-2.929	-7.85***	-0.125	-7.67***	-2.908	-8.06***	-0.146	-6.74***	-3.41	-7.12***
log of durable goods per capita sq	0.022	10.80***	0.494	10.89***	0.021	11.09***	0.494	11.26***	0.024	9.36***	0.554	9.57***
log of business assets per capita	0.008	0.25	-0.026	-0.04								
log of business assets per capita sq	0.001	0.42	0.038	0.72								
Missing business assets per capita	0.012	0.11	-0.163	-0.06								
Mother's Primary	-0.021	-0.44	-0.525	-0.5	-0.031	-0.63	-0.752	-0.72	-0.062	-0.99	-1.381	-1.03
Mother's Middle	0.042	1.04	0.938	1.08	0.033	0.83	0.748	0.88	0.056	1.09	1.27	1.14
Mother's Sec & above	0.23	2.67**	5.235	2.71**	0.191	2.29*	4.451	2.37*	0.079	0.73	1.931	0.79
Father's Primary	0.118	1.19	2.569	1.19	0.101	1.03	2.161	1.01	0.323	2.32*	7.032	2.30*
Father's Middle	0.026	0.68	0.443	0.53	0.015	0.38	0.146	0.17	0.007	0.13	0.014	0.01
Father's Sec & above	0.131	2.20*	2.808	2.16*	0.134	2.29*	2.813	2.20*	0.061	0.79	1.181	0.7
Age (years)	0.036	0.85	0.775	0.83	0.041	0.96	0.87	0.93	0.119	0.79	2.594	0.79
Age squared (years)	-0.002	-0.72	-0.032	-0.72	-0.002	-0.82	-0.036	-0.8	-0.007	-0.79	-0.16	-0.8
Mother's Height	-0.003	-1.42	-0.064	-1.46	-0.003	-1.69	-0.077	-1.74	-0.005	-1.97*	-0.107	-1.97*
Female	-0.017	-0.55	-0.33	-0.49	-0.009	-0.28	-0.144	-0.21	-0.04	-0.87	-0.853	-0.85
Non-Akan	0.04	1.17	0.954	1.28	0.042	1.19	1.006	1.32	0.013	0.28	0.385	0.39
Western Region	-0.036	-0.64	-0.843	-0.68	-0.043	-0.75	-0.968	-0.76	-0.08	-1.09	-1.775	-1.12
Central Region	-0.55	-6.29***	-11.435	-6.27***	-0.582	-6.64***	-12.157	-6.65***	-0.636	-5.57***	-13.351	-5.58***
Eastern Region	-0.176	-3.32***	-3.914	-3.40***	-0.199	-3.50***	-4.398	-3.57***	-0.232	-2.98**	-5.109	-3.01**
Volta Region	-0.237	-2.65**	-5.004	-2.54*	-0.249	-2.77**	-5.309	-2.68**	-0.225	-1.68	-4.706	-1.58
Ashanti Region	-0.169	-3.54***	-3.736	-3.53***	-0.21	-4.68***	-4.627	-4.67***	-0.194	-3.15**	-4.269	-3.11**
Brong Ahafo Region	-0.267	-4.48***	-5.66	-4.43***	-0.306	-5.05***	-6.564	-5.08***	-0.327	-3.94***	-7.035	-3.96***
Northern Region	-0.603	-7.71***	-12.809	-7.84***	-0.632	-8.08***	-13.437	-8.25***	-0.669	-6.04***	-14.22	-6.06***
Upper East Region	-0.497	-3.70***	-10.831	-3.86***	-0.553	-4.52***	-12.186	-4.93***	-0.551	-3.95***	-12.357	-4.39***
constant	11	27.45***	122.125	14.04***	11.124	29.76***	124.494	15.42***	11.174	16.45***	125.446	8.40***

Observation no.	866	866	866	866	465	465
R-squared	0.45	0.457	0.452	0.46	0.476	0.487
adjusted R-squared	0.434	0.441	0.437	0.445	0.447	0.459
F	29.877	28.604	31.236	29.916	19.736	18.8
ll	-520.539	-3.20E+03	-518.546	-3.20E+03	-266.602	-1.70E+03
F-test of instruments	F(5, 841) = 44.53	F(5, 841) = 42.10	F(5, 841) = 48.35	F(5, 841) = 45.73	F(5, 440) = 36.11	F(5, 440) = 33.86
P-value	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000	Prob > F = 0.0000

A–27c: School-aged children – First-stage regression for expenditure per capita and its quadratic, 1987/88 (GLSS 1: The Anthropometrics)

Rural	Illness				Haz				Whz			
	Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.		Expend per cap		Expend per cap sq.	
	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio	Marginal Effects	t- ratio
log of land per capita	-0.058	-4.58***	-1.179	-4.44***					-0.042	-2.47*	-0.828	-2.35*
log of land per capita sq.	0.007	5.59***	0.134	5.45***					0.005	3.43***	0.108	3.31***
Missing land per capita	-0.163	-1.99*	-3.216	-1.92					-0.06	-0.59	-1.06	-0.51
log of durable goods per capita	-0.051	-3.21**	-1.093	-3.24**	-0.042	-2.58**	-0.897	-2.64**	-0.045	-2.04*	-0.969	-2.08*
log of durable goods per capita sq	0.013	5.71***	0.268	5.65***	0.012	5.19***	0.245	5.16***	0.011	3.33***	0.227	3.32***
formal employment (Head)					0.158	1.5	3.29	1.5				
Self-employment (Head)					0.208	2.13*	4.439	2.18*				
log of business assets per capita									-0.116	-2.63**	-2.356	-2.52*
log of business assets per capita sq									0.011	2.98**	0.234	2.89**
Missing business assets per capita									-0.178	-1.31	-3.349	-1.16
Mother's Primary	-0.214	-4.01***	-4.362	-3.99***	-0.211	-3.86***	-4.3	-3.84***	-0.154	-2.21*	-3.157	-2.20*
Mother's Middle	-0.044	-1.12	-0.94	-1.14	-0.053	-1.3	-1.109	-1.31	-0.015	-0.28	-0.308	-0.29
Mother's Sec & above	0.358	4.77***	7.396	4.72***	0.352	4.24***	7.304	4.22***	0.345	3.30**	7.051	3.23**
Father's Primary	0.128	2.65**	2.581	2.56*	0.119	2.47*	2.417	2.41*	0.125	1.91	2.558	1.87
Father's Middle	0.181	4.69***	3.725	4.60***	0.186	4.60***	3.839	4.53***	0.162	3.12**	3.383	3.11**
Father's Sec & above	0.231	4.55***	4.737	4.41***	0.235	4.23***	4.854	4.13***	0.214	3.04**	4.456	2.97**
Age (years)	0.027	0.63	0.577	0.65	0.031	0.71	0.661	0.74	0.114	0.87	2.302	0.84
Age squared (years)	-0.001	-0.7	-0.031	-0.73	-0.002	-0.78	-0.035	-0.8	-0.008	-0.97	-0.156	-0.93
Mother's Height	0.003	1.64	0.069	1.68	0.004	2.01*	0.085	2.05*	0.006	1.81	0.115	1.79
Female	0.047	1.64	0.97	1.63	0.042	1.46	0.873	1.45	-0.013	-0.32	-0.268	-0.32
Non-Akan	0.215	5.20***	4.577	5.22***	0.19	4.63***	4.061	4.65***	0.241	4.47***	5.14	4.50***
Price of Maize (kg)	0.028	2.78**	0.558	2.64**	0.019	1.9	0.383	1.77	0.019	1.46	0.396	1.42
Price of Anti-malarial pill	-0.067	-1.64	-1.26	-1.48	-0.058	-1.38	-1.055	-1.21	-0.051	-0.93	-0.977	-0.84
Missing price	0.053	0.72	1.149	0.75	0.066	0.9	1.446	0.95	0.025	0.28	0.476	0.25
Dist. to the nearest clinic	-0.004	-2.92**	-0.078	-2.83**	-0.003	-2.64**	-0.07	-2.56*	-0.004	-2.23*	-0.078	-2.21*
Male Agric. Wage	-0.059	-2.58**	-1.205	-2.52*	-0.063	-2.90**	-1.3	-2.84**	-0.034	-1.16	-0.675	-1.12
Ratio of female Wage	0.189	5.24***	3.94	5.21***	0.179	4.86***	3.752	4.84***	0.192	4.09***	4.031	4.10***
Ratio of child Wage	0.169	3.94***	3.631	4.10***	0.195	4.44***	4.182	4.62***	0.164	2.98**	3.497	3.07**

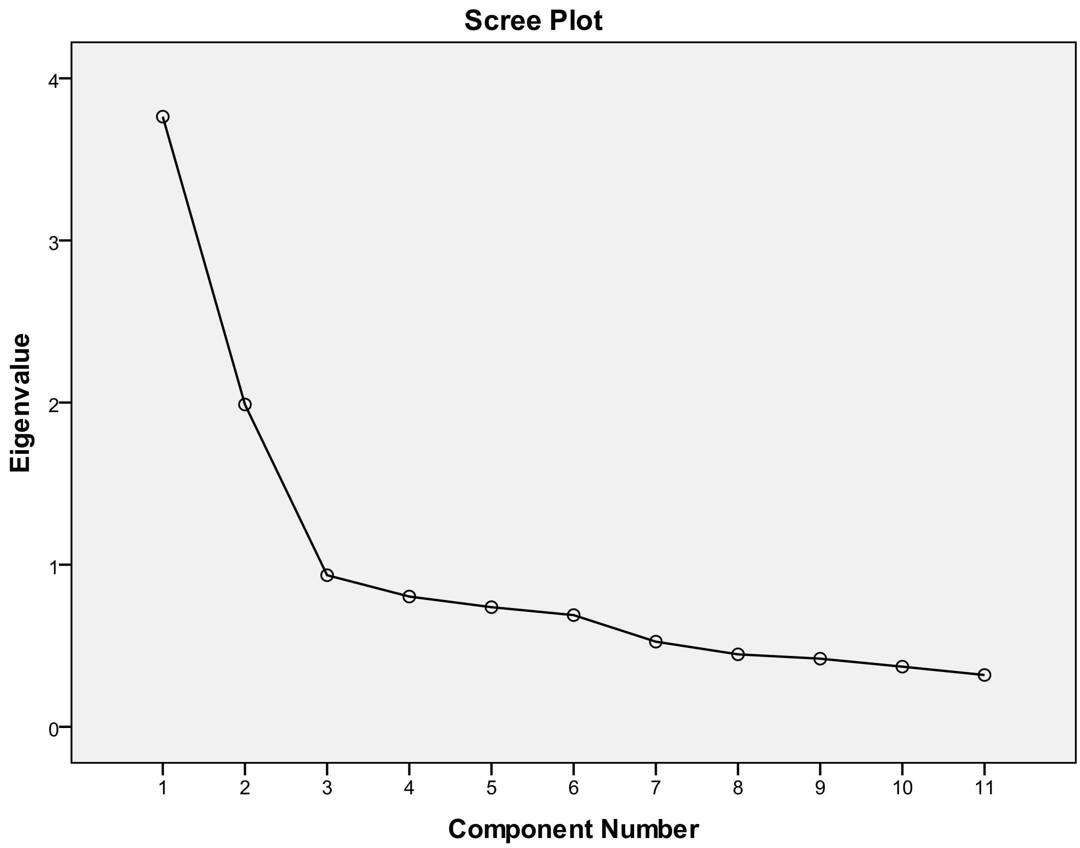
Western Region	-0.217	-1.99*	-4.735	-1.99*	-0.187	-1.68	-4.094	-1.69	-0.103	-0.73	-2.209	-0.73
Central Region	-0.623	-5.39***	-13.274	-5.31***	-0.622	-5.22***	-13.214	-5.15***	-0.525	-3.48***	-11.071	-3.43***
Eastern Region	-0.462	-4.34***	-9.92	-4.27***	-0.459	-4.20***	-9.815	-4.13***	-0.331	-2.38*	-7.032	-2.33*
Volta Region	-0.895	-7.67***	-18.852	-7.55***	-0.879	-7.35***	-18.492	-7.24***	-0.741	-5.09***	-15.581	-5.01***
Ashanti Region	-0.63	-5.86***	-13.498	-5.77***	-0.639	-5.79***	-13.66	-5.71***	-0.464	-3.30**	-9.92	-3.28**
Brong Ahafo Region	-0.493	-4.71***	-10.704	-4.69***	-0.484	-4.48***	-10.486	-4.47***	-0.34	-2.50*	-7.341	-2.50*
Upper West Region	-0.914	-3.67***	-18.014	-3.51***	-1.138	-4.77***	-22.557	-4.58***	-0.443	-1.31	-8.171	-1.14
Northern Region	-0.561	-5.20***	-12.071	-5.15***	-0.617	-5.64***	-13.198	-5.57***	-0.448	-3.11**	-9.507	-3.07**
Upper East Region	-1.029	-7.86***	-21.566	-7.79***	-1.097	-8.21***	-22.946	-8.14***	-0.958	-5.64***	-19.983	-5.59***
constant	10.229	24.53***	104.63	12.09***	9.95	22.87***	98.74	10.94***	9.509	13.44***	89.806	6.04***
Observation no.	1341		1341		1341		1341		803		803	
R-squared	0.288		0.287		0.27		0.269		0.273		0.274	
adjusted R-squared	0.271		0.27		0.252		0.252		0.24		0.241	
F	23.139		23.147		21.551		21.301		12.886		12.8	
ll	-1.00E+03		-5.10E+03		-1.00E+03		-5.10E+03		-611.182		-3.10E+03	
F-test of instruments	F(5, 1308) = 26.23		F(5, 1308) = 25.31		F(4, 1309) = 22.81		F(4, 1309) = 22.17		F(8, 767) = 10.33		F(8, 767) = 9.98	
P-value	Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000		Prob > F = 0.0000	

APPENDIX B:

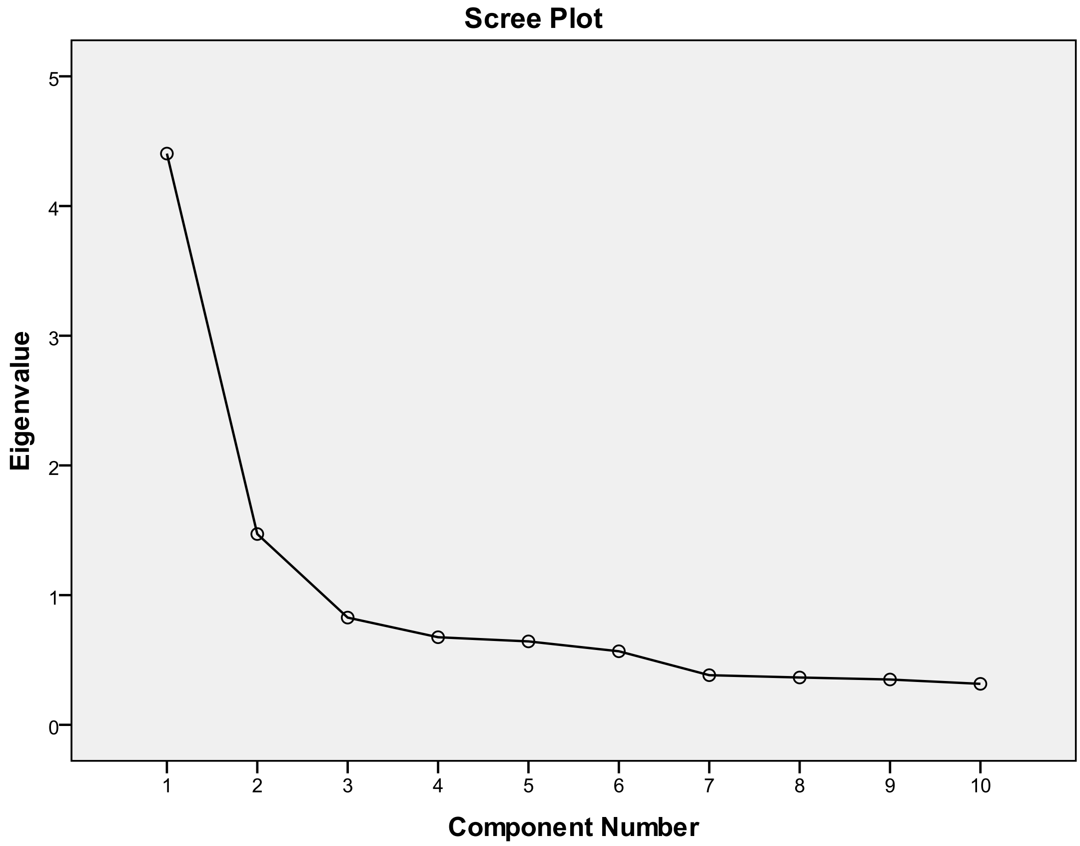
B-1: Summary Statistics of Variables Used in PCA (Household Wealth)

GLSS 1			**GLSS 4**	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
Piped Water	0.31	0.463	0.43	0.495
Flush Toilet	0.06	0.236		
Electricity	0.27	0.445	0.42	0.493
Stove	0.09	0.283	0.14	0.352
Fridge-Freeze	0.07	0.251	0.19	0.392
Air conditioner	0.01	0.073		
Fans	0.12	0.319	0.25	0.434
Video equipment	0.01	0.073	0.05	0.218
Washing Machine	0.00	0.047		
Black & White TV	0.07	0.252		
Colour TV	0.01	0.082		
TV			0.27	0.442
Electric iron			0.26	0.439
House			0.34	0.472
Room Greater than 1			0.55	0.497
Observations	2240		5863	

B-2: A Scree plot 1– Household Wealth (GLSS 1)



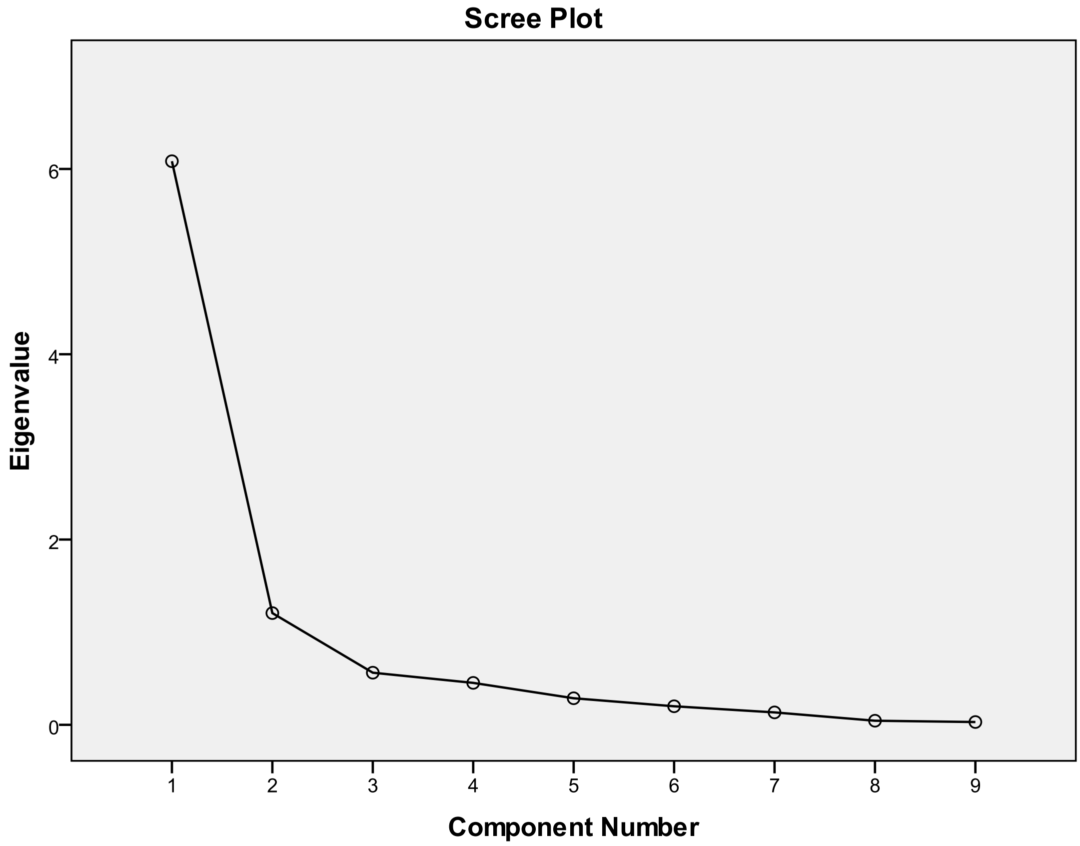
B-3: A Scree Plot 2–Household Wealth (GLSS 4)



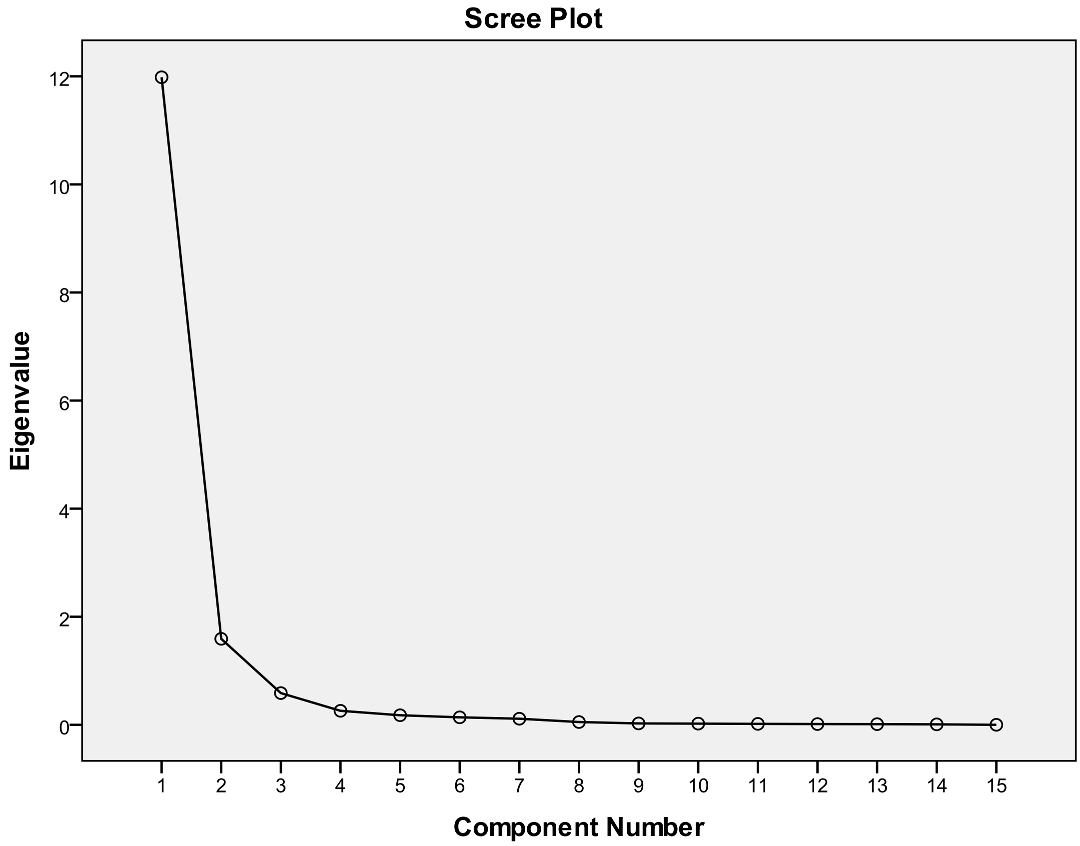
B-4: Summary Statistics of Variables Used in PCA (Distance to health facilities and personnel)

GLSS 1			GLSS 4	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
Hospital	25.599	26.855	35.699	83.967
Doctor	25.790	26.203	30.623	72.528
Clinic	10.996	12.584	14.210	58.327
Nurse	13.471	13.676	14.957	54.023
Pharmacy	23.078	25.929	41.625	78.528
Pharmacist	24.517	27.802	39.419	78.369
Fam. Pl. clinic	21.012	24.742	14.140	58.334
Fam. Pl. worker	21.668	24.566	15.388	54.020
Com. Health worker	13.853	16.307	14.902	54.430
Midwife			16.756	60.049
TBA			7.821	52.615
Trad. Healer			5.985	49.767
Medical Asst.			15.784	53.670
Drug store			13.340	55.371
Maternity home			23.737	73.964
Observations	1405		3657	

B-5: A Scree plot 3–Distance to health facilities and personnel (GLSS 1)



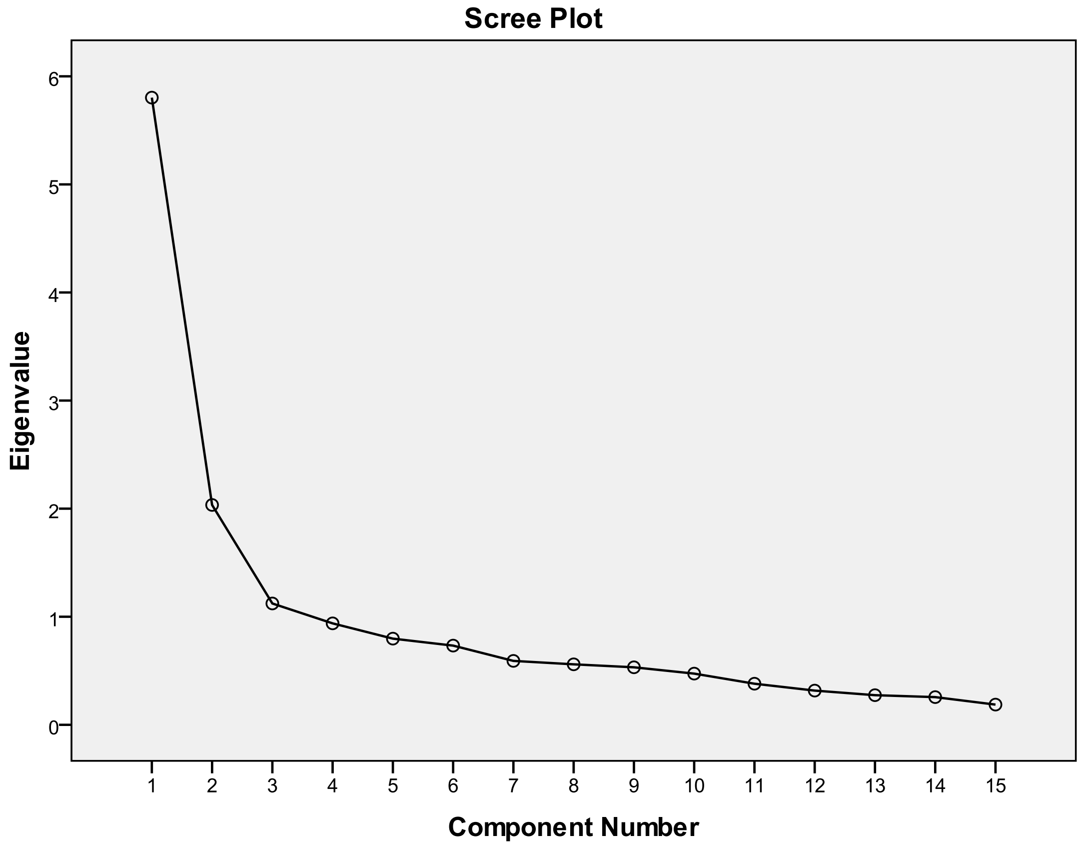
B-6: A Scree plot 4–Distance to health facilities and personnel (GLSS 4)



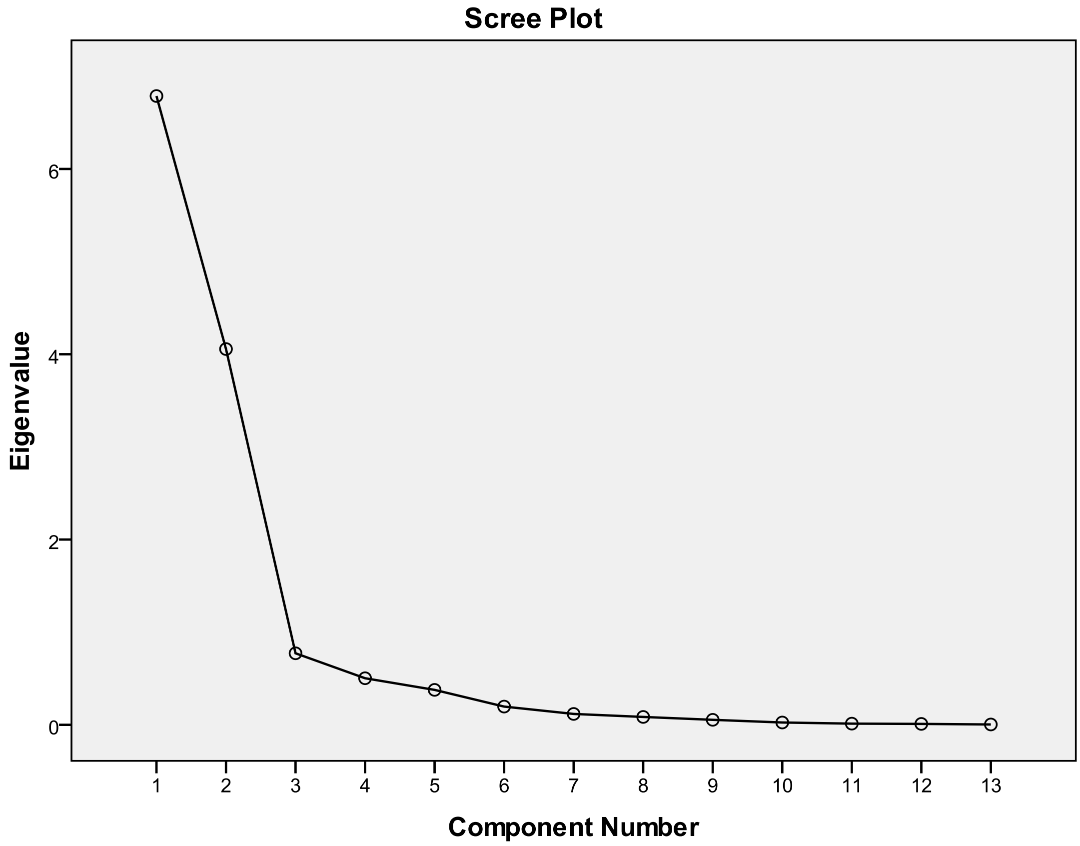
B-7: Summary Statistics of Variables Used in PCA (Price of commodities)

	GLSS 1		GLSS 4	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
Guinea corn	22.02	38.84	2493.98	20455.63
Millet	23.31	39.52	2649.64	19903.16
Bread	153.43	100.23	9559.51	18530.32
Gari	80.75	54.12	5268.58	27373.94
Garden egg	74.81	52.76	4153.24	8461.89
Tomatoes	96.93	69.09	9301.00	24994.34
Sugar	130.97	68.65	8175.73	24809.27
Cassava	17.35	11.85		
Egg	16.91	10.34		
Tilapia	282.85	254.41		
Palm oil	117.71	82.10		
Groundnut oil	66.67	97.80		
Milk	326.11	162.38		
Soap	38.39	18.54		
Missing price	0.09	0.29		
Maize			2420.26	13632.27
Plantain			3641.68	8874.82
Fish			18174.41	55156.33
Yam			2599.94	4072.68
Cocoyam			2510.98	6330.63
Onion			8425.00	10562.35
Observations	1405		3657	

B-8: A Scree plot 5: Price of commodities (GLSS 1)



B-9: A Scree plot 6: Price of commodities (GLSS 4)



B-10a: Marginal Effects: Multinomial Logit Regression of Contraceptive Use by All Women, 1987/88.

Full			**GLSS 1**			
	Model 1		**Model 2**		**Model 3[a]**	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.068	0.014	0.06	0.01	0.046	0.007
	1.95	0.75	1.69	0.64	1.26	0.54
Middle/JSS	0.042	0.06	0.017	0.049	0.009	0.042
	1.61	3.86***	0.62	3.56***	0.32	3.37***
Sec. & Higher	0.021	0.14	-0.038	0.093	-0.04	0.079
	0.39	2.33*	-0.77	1.9	-0.82	1.91
Still in School	0.469	-0.006	0.478	-0.006	0.503	-0.002
	8.95***	-0.47	8.88***	-0.57	9.22***	-0.14
Age25-34	-0.098	0.004	-0.1	0.002	-0.118	0.001
	-4.29***	0.49	-4.37***	0.31	-5.06***	0.1
Age35-49	-0.176	-0.012	-0.19	-0.014	-0.209	-0.013
	-7.56***	-1.53	-8.23***	-1.93	-9.12***	-2.25*
Rural	-0.156	-0.014	-0.116	-0.014	-0.038	-0.007
	-6.96***	-1.92	-4.14***	-1.89	-0.97	-0.75
Northern Region	-0.046	-0.021	-0.061	-0.018	0.009	-0.014
	-1.38	-1.87	-1.7	-1.63	0.19	-1.25
Muslim			-0.113	-0.02	-0.085	-0.013
			-3.74***	-2.55*	-2.61**	-1.76
Traditional			0.033	-0.012	-0.009	-0.013
			0.97	-1.32	-0.27	-1.82
Other			-0.182	-0.028	-0.157	-0.022
			-5.95***	-4.84***	-4.42***	-3.90***
Non-Akan			0.052	0.012	0.006	0.007
			2.27*	1.96	0.26	1.21
HAS- Basic			0.049	-0.001	0.015	-0.004
			3.57***	-0.3	1.02	-1.38
HAS- High			0.004	0.004	0.01	0.004
			0.38	1.97*	0.81	2.39*
Ext. Contr. Use					0.645	0.068
					12.31***	4.94***
Observation	2240		2240		2240	
chi2	266.872		319.588		474.204	
r2_p	0.097		0.119		0.182	
ll	-1.60 E+03		-1.60 E+03		-1.50 E+03	

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.15 in main text.

B-10b: Marginal Effects: Multinomial Logit Regression of Contraceptive Use by Rural Women, 1987/88.

Rural			**GLSS 1**			
	Model 1		**Model 2**		**Model 3[a]**	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.023	0.025	0.014	7.02E-06	0.012	1.96E-05
	0.58	1.14	0.35	1.08	0.3	1.09
Middle/JSS	0.027	0.043	0.016	1.29E-05	0.018	3.54E-05
	0.89	2.46*	0.5	2.37*	0.53	2.30*
Sec. & Higher	-0.022	0.212	-0.046	1.02E-04	-0.046	2.36E-04
	-0.27	1.87	-0.51	1.32	-0.54	1.4
Still in School	0.521	0.005	0.549	1.71E-06	0.578	1.64E-05
	7.71***	0.32	7.56***	0.31	7.56***	0.72
Age25-34	-0.05	-3.03E-04	-0.049	-4.38E-07	-0.058	-3.95E-08
	-1.89	-0.04	-1.83	-0.18	-2.17*	-0.01
Age35-49	-0.15	-0.01	-0.155	-3.49E-06	-0.16	-1.23E-05
	-5.51***	-1.26	-5.69***	-1.52	-6.08***	-1.97*
Northern Region	-0.011	-0.016	-0.029	-4.62 E-06	0.016	-1.01E-05
	-0.34	-1.47	-0.75	-1.33	0.31	-0.84
Muslim			-0.092	-0.001	-0.081	-0.001
			-2.58**	-4.60***	-2.16*	-4.00***
Traditional			-0.017	-8.41 E-07	-0.048	-7.29E-06
			-0.5	-0.29	-1.5	-0.99
Other			-0.201	-1.96 E-04	-0.172	-3.05E-04
			-7.18***	-4.60***	-5.44***	-4.05***
Non-Akan			0.04	1.77E-06	-0.008	1.85E-07
			1.46	0.85	-0.27	0.03
HAS- Basic			0.052	-5.28E-06	0.028	-1.43E-05
			1.55	-1.28	0.87	-1.22
HAS- High			0.043	5.31E-07	0.044	7.41E-07
			0.72	0.22	0.67	0.08
Ext. Contr. Use					0.584	6.67E-05
					9.32***	4.20***
Observation	1405		1405		1405	
chi2	118.293		.		4.00E+04	
r2_p	0.076		0.101		0.166	
ll	-914.041		-889.492		-824.6	

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.15 in main text.

B-10c: Marginal Effects: Multinomial Logit Regression of Contraceptive Use by Urban Women, 1987/88.

Urban			**GLSS 1**			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.16	-0.019	0.145	-0.002	0.105	-0.003
	2.62**	-0.64	2.24*	-0.81	1.55	-1.04
Middle/JSS	0.071	0.079	0.064	0.008	0.03	0.008
	1.57	2.93**	1.22	2.46*	0.53	2.23*
Sec. & Higher	0.051	0.127	0.025	0.009	0.001	0.009
	0.68	1.72	0.32	1.18	0.02	1.13
Still in School	0.381	-0.037	0.365	-0.004	0.371	-0.005
	4.70***	-2.13*	4.22***	-2.67**	4.35***	-2.63**
Age25-34	-0.181	0.011	-0.198	0.001	-0.241	2.35E-04
	-4.49***	0.71	-4.58***	0.44	-5.30***	0.13
Age35-49	-0.215	-0.019	-0.274	-0.003	-0.318	-0.003
	-5.03***	-1.03	-6.24***	-1.45	-7.20***	-1.61
Northern Region	-0.214	-0.03	-0.188	-0.003	-0.015	-0.001
	-2.96**	-1.18	-2.17*	-0.88	-0.14	-0.12
Muslim			-0.144	-0.003	-0.106	-0.002
			-2.45*	-1.16	-1.69	-0.85
Traditional			0.2	-0.053	0.161	-0.053
			2.48*	-5.19***	1.89	-4.95***
Other			-0.153	-0.004	-0.118	-0.004
			-2.00*	-2.59**	-1.26	-1.91
Non-Akan			0.081	0.002	0.036	0.002
			1.87	1.53	0.81	1.17
HAS- Basic			0.061	-7.35E-05	0.026	-0.001
			3.32***	-0.13	1.32	-1.25
HAS- High			0.003	0.001	0.007	0.001
			0.19	2.18*	0.53	2.66**
Ext. Contr. Use					0.788	0.012
					8.54***	3.15**
N	835		835		835	
chi2	101.931		2.40E+04		2.00E+04	
r2_p	0.088		0.121		0.182	
ll	-676.188		-651.838		-606.733	

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.15 in main text.

B-10d: Marginal Effects: Multinomial Logit Regression of Contraceptive Use by Women Aged 15 – 34, 1987/88.

Age1534			**GLSS 1**			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.054	0.028	0.046	0.022	0.037	0.015
	1.32	0.99	1.11	0.93	0.87	0.72
Middle/JSS	0.033	0.075	0.008	0.063	-0.001	0.052
	1.07	3.64***	0.24	3.45***	-0.02	3.11**
Sec. & Higher	0.034	0.124	-0.037	0.084	-0.044	0.068
	0.53	1.82	-0.59	1.5	-0.69	1.42
Still in School	0.454	-0.008	0.463	-0.009	0.481	-0.004
	9.60***	-0.54	9.58***	-0.66	9.95***	-0.34
Age25-34	-0.108	0.006	-0.112	0.004	-0.133	0.003
	-4.22***	0.7	-4.32***	0.54	-4.97***	0.39
Rural	-0.159	-0.017	-0.119	-0.021	-0.044	-0.008
	-5.99***	-1.84	-3.53***	-2.04*	-0.92	-0.6
Northern Region	-0.036	-0.026	-0.046	-0.023	0.031	-0.016
	-0.83	-1.73	-0.98	-1.49	0.5	-0.83
Muslim			-0.121	-0.021	-0.093	-0.014
			-3.21**	-2.03*	-2.27*	-1.24
Traditional			0.026	-0.02	-0.008	-0.021
			0.65	-1.73	-0.2	-2.20*
Other			-0.206	-0.034	-0.186	-0.028
			-5.42***	-4.55***	-4.31***	-3.53***
Non-Akan			0.038	0.013	-0.01	0.007
			1.37	1.67	-0.33	0.89
HAS- Basic			0.055	-0.004	0.024	-0.007
			3.08**	-0.94	1.27	-1.71
HAS- High			0.014	0.005	0.019	0.005
			0.75	1.89	1.03	2.27*
Ext. Contr. Use					0.638	0.084
					9.73***	4.59***
Observation	1651		1651		1651	
chi2	172.57		220.786		336.869	
r2_p	0.085		0.108		0.164	
ll	-1.30E+03		-1.20E+03		-1.20 E+03	

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.15 in main text.

B-10e: Marginal Effects: Multinomial Logit Regression of Contraceptive Use by Women Aged 35 – 49, 1987/88.

Age3549			**GLSS 1**		
	Model 1		**Model 2**		**Model 3**[a]
	Tradition	***Modern***	***Tradition***	***Modern***	***Current use***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.102	-0.015	0.094	-1.90E-05	0.06
	1.55	-2.84**	1.42	-3.48***	0.93
Middle/JSS	0.053	4.97E-04	0.029	4.76E-07	0.033
	1.15	0.79	0.62	0.51	0.63
Sec. & Higher	-0.021	0.007	-0.031	6.14E-06	0.054
	-0.25	1.24	-0.39	0.88	0.61
Age40-49	-0.043	-0.001	-0.047	-1.21E-06	-0.063
	-1.23	-1.48	-1.39	-1.48	-1.78
Rural	-0.125	-2.29E-04	-0.063	4.27E-09	-0.029
	-3.29**	-0.51	-1.42	0.01	-0.5
Northern Region	-0.059	-4.31E-04	-0.077	-6.09E-07	-0.029
	-1.37	-0.9	-1.83	-0.69	-0.47
Muslim			-0.082	-1.29E-04	-0.064
			-1.99*	-3.08**	-1.41
Traditional			0.057	4.67E-07	-0.008
			1.05	0.33	-0.16
Other			-0.106	-8.03E-06	-0.057
			-2.11*	-3.58***	-0.77
Non-Akan			0.076	5.66E-07	0.05
			2.32*	0.88	1.48
HAS- Basic			0.043	2.49E-07	0.001
			2.40*	0.86	0.03
HAS- High			-0.172	2.20E-07	-0.025
			-1.68	1.03	-0.89
Ext. Contr. Use					0.571
					7.78***
Observation	589		589		589
chi2	1.20E+04		1.30E+04		98.944
r2_p	0.07		0.109		0.204
ll	-331.781		-317.804		-248.329

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.15 in main text.

B-11a: Marginal Effects: Multinomial Logit Regression of Contraceptive Use by All Women, 1998/99.

Full			GLSS 4			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.017	0.059	0.015	0.046	0.008	0.031
	1.63	3.05**	1.45	2.76**	1.07	2.31*
Middle/JSS	0.03	0.046	0.024	0.033	0.019	0.027
	2.62**	3.18**	2.18*	2.44*	2.10*	2.06*
Sec. & Higher	0.048	0.094	0.034	0.075	0.024	0.062
	2.16*	3.21**	1.59	2.64**	1.36	2.41*
Still in School	-0.04	-0.092	-0.04	-0.089	-0.032	-0.085
	-6.51***	-7.97***	-6.56***	-8.07***	-7.26***	-8.91***
Age25-34	0.037	0.102	0.034	0.1	0.028	0.098
	3.39***	5.55***	3.29**	5.54***	3.16**	5.75***
Age35-49	0.026	0.062	0.025	0.061	0.022	0.061
	2.80**	4.04***	2.84**	4.09***	2.88**	4.29***
Rural	0.016	0.011	0.022	0.016	0.011	-0.041
	1.99*	0.97	2.27*	1.25	1.8	-2.14*
Northern Region	-0.023	0.016	-0.016	0.029	-0.006	0.031
	-2.41*	0.58	-1.34	1.12	-0.64	1.65
Muslim			-0.005	0.005	-0.009	-0.002
			-0.45	0.24	-1.05	-0.16
Traditional			2.41E-04	-0.07	0.015	-0.059
			0.01	-6.10***	0.86	-5.43***
Other			0.015	-0.055	0.012	-0.054
			0.82	-3.78***	0.83	-4.32***
Non-Akan			-0.008	-0.008	-0.001	-0.004
			-1.12	-0.75	-0.26	-0.41
HAS- Basic			0.006	0.002	0.006	0.01
			1.41	0.37	1.84	1.67
HAS- High			-0.003	2.67E-04	-0.002	-0.005
			-0.71	0.05	-0.81	-0.96
Ext. Contr. Use					0.149	0.256
					8.19***	10.69***
Observation	5863					

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.16 in main text.

-- Survey sample weights are used in GLSS 4.

B-11b: Marginal Effects: Multinomial Logit Regression of Contraceptive Use by Rural Women, 1998/99.

Rural	**GLSS 4**					
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.005	0.092	0.003	0.073	-0.001	0.053
	0.41	3.82***	0.24	3.75***	-0.13	3.28**
Middle/JSS	0.029	0.036	0.023	0.025	0.017	0.02
	1.78	1.88	1.43	1.41	1.41	1.16
Sec. & Higher	0.054	0.051	0.034	0.043	0.026	0.039
	1.48	1.3	1.04	1.09	0.92	1
Still in School	-0.041	-0.096	-0.041	-0.091	-0.031	-0.084
	-4.52***	-6.77***	-4.62***	-6.76***	-4.70***	-7.02***
Age25-34	0.034	0.106	0.031	0.105	0.023	0.103
	2.34*	4.23***	2.25*	4.28***	2.10*	4.50***
Age35-49	0.012	0.058	0.012	0.059	0.011	0.059
	1.22	2.77**	1.18	2.89**	1.27	3.09**
Northern Region	-0.032	0.008	-0.023	0.021	-0.006	0.029
	-2.33*	0.25	-1.43	0.74	-0.46	1.37
Muslim			-0.007	0.011	-0.016	-0.009
			-0.44	0.42	-1.49	-0.73
Traditional			-0.002	-0.072	0.011	-0.062
			-0.12	-5.39***	0.6	-5.04***
Other			0.01	-0.049	0.007	-0.05
			0.45	-2.66**	0.41	-3.25**
Non-Akan			-0.007	-0.008	0.001	-0.007
			-0.54	-0.52	0.08	-0.61
HAS- Basic			0.007	-0.005	0.005	0.004
			1.15	-0.53	1.31	0.56
HAS- High			-0.005	-0.004	-0.004	-0.008
			-0.88	-0.56	-0.84	-1.34
Ext. Contr. Use					0.165	0.258
					7.00***	8.73***
Observation	3657					

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.16 in main text.

-- Survey sample weights are used in GLSS 4.

B-11c: Marginal Effects: Multinomial Logit Regression of Contraceptive Use by Urban Women, 1998/99.

Urban			**GLSS 4**			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.051	-0.01	0.049	-0.014	0.036	-0.019
	2.06*	-0.37	2.14*	-0.56	2.16*	-0.81
Middle/JSS	0.034	0.047	0.031	0.037	0.024	0.031
	2.67**	2.16*	2.64**	1.74	2.58*	1.52
Sec. & Higher	0.051	0.094	0.045	0.067	0.033	0.06
	1.97	2.35*	1.74	1.83	1.54	1.73
Still in School	-0.032	-0.087	-0.031	-0.087	-0.027	-0.088
	-4.57***	-4.95***	-4.38***	-5.01***	-4.61***	-5.94***
Age25-34	0.044	0.088	0.042	0.086	0.038	0.086
	2.55*	3.41***	2.54*	3.34**	2.50*	3.38**
Age35-49	0.051	0.058	0.051	0.055	0.045	0.057
	2.32*	2.69**	2.44*	2.59*	2.60*	2.64**
Northern Region	-0.007	0.035	-0.001	0.044	-0.001	0.037
	-1	1.23	-0.07	1.21	-0.18	1.3
Muslim			7.71E-05	0.001	0.004	0.008
			0.01	0.02	0.31	0.31
Traditional			0.034	-0.033	0.052	-0.023
			0.57	-0.75	0.72	-0.48
Other			0.023	-0.066	0.022	-0.063
			0.8	-3.13**	0.81	-3.14**
Non-Akan			-0.011	-0.005	-0.005	0.001
			-1.79	-0.35	-1.05	0.09
HAS- Basic			0.003	0.011	0.004	0.013
			0.58	1.08	1.3	1.48
HAS- High			0.001	0.001	-0.001	-0.001
			0.19	0.14	-0.46	-0.14
Ext. Contr. Use					0.112	0.242
					4.80***	5.81***
Obs.	2206					

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.16 in main text.

-- Survey sample weights are used in GLSS 4.

B-11d: Marginal Effects: Multinomial Logit Regression of Contraceptive Use by Women Aged 15 – 34, 1998/99.

Age1534			**GLSS 4**			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.03	0.047	0.027	0.037	0.017	0.022
	2.38*	2.22*	2.24*	2.04*	1.83	1.47
Middle/JSS	0.025	0.047	0.022	0.039	0.015	0.03
	2.22*	2.68**	1.96	2.27*	1.62	1.96
Sec. & Higher	0.033	0.091	0.025	0.085	0.017	0.071
	1.34	2.75**	1.1	2.48*	0.89	2.37*
Still in School	-0.04	-0.088	-0.038	-0.085	-0.03	-0.08
	-6.21***	-7.35***	-6.09***	-7.27***	-4.79***	-7.81***
Age25-34	0.03	0.084	0.026	0.082	0.021	0.079
	3.96***	6.03***	3.75***	5.94***	3.15**	6.02***
Rural	0.021	0.014	0.029	0.02	0.021	-0.024
	2.56*	1.24	2.88**	1.56	2.82**	-1.2
Northern Region	-0.013	0.022	-0.006	0.025	-2.59E-04	0.029
	-1.1	0.71	-0.4	0.91	-0.02	1.35
Muslim			0.008	0.031	0.001	0.021
			0.56	1.29	0.06	1.17
Traditional			0.007	-0.056	0.023	-0.046
			0.32	-4.24***	0.93	-3.46***
Other			0.024	-0.048	0.02	-0.049
			1.01	-2.84**	1	-3.48***
Non-Akan			-0.006	-0.009	-0.001	-0.002
			-0.61	-0.64	-0.21	-0.21
HAS- Basic			0.005	-0.002	0.005	0.004
			1.41	-0.29	1.47	0.77
HAS- High			-0.008	-0.006	-0.006	-0.012
			-1.75	-1.02	-1.6	-2.10*
Ext. Contr. Use					0.123	0.234
					4.36***	8.15***
Observation	3921					

Note: HAS represents Household Asset Score
a. Results on community variables are reported in table 3.16 in main text.
-- Survey sample weights are used in GLSS 4.

B-11e: Marginal Effects: Multinomial Logit Regression of Contraceptive Use by Women Aged 35 – 49, 1998/99.

Age3549			**GLSS 4**			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
Variable	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	-0.017	0.078	-0.017	0.062	-0.015	0.039
	-1.26	2.45*	-1.37	2.10*	-1.67	1.37
Middle/JSS	0.038	0.032	0.028	0.018	0.025	0.013
	1.77	1.17	1.53	0.66	1.69	0.52
Sec. & Higher	0.063	0.088	0.042	0.055	0.033	0.043
	1.57	1.56	1.13	1.09	1.1	0.94
Age40-49	-0.017	-0.117	-0.016	-0.112	-0.017	-0.112
	-1.49	-5.61***	-1.53	-5.76***	-2.23*	-6.21***
Rural	0.006	-0.004	0.001	-0.006	-0.019	-0.089
	0.44	-0.21	0.09	-0.28	-1.31	-1.87
Northern Region	-0.047	0.003	-0.033	0.042	-0.016	0.04
	-3.79***	0.1	-2.00*	1.3	-0.97	1.47
Muslim			-0.036	-0.042	-0.029	-0.045
			-2.90**	-2.08*	-3.19**	-2.78**
Traditional			-0.009	-0.091	0.005	-0.08
			-0.41	-5.95***	0.24	-5.73***
Other			-0.016	-0.06	-0.012	-0.058
			-0.91	-2.37*	-0.83	-2.57*
Non-Akan			-0.014	-0.011	-0.003	-0.011
			-1.21	-0.57	-0.36	-0.59
HAS- Basic			0.002	0.005	0.004	0.015
			0.37	0.39	0.97	1.34
HAS- High			0.007	0.015	0.005	0.011
			1.59	1.42	1.27	1.06
Ext. Contr. Use					0.164	0.305
					6.55***	5.70***
Observation			1942			

Note: HAS represents Household Asset Score
a. Results on community variables are reported in table 3.16 in main text.
-- Survey sample weights are used in GLSS 4.

B-12a: Marginal Effects: Multinomial Logit Regression of Ever Use of Contraceptives by All Women, 1987/88.

GLSS 1			Full			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.01	0.092	0.003	0.085	0.011	0.048
	0.29	2.77**	0.1	2.60**	0.31	1.72
Middle/JSS	-0.042	0.177	-0.068	0.162	-0.051	0.119
	-1.66	7.33***	-2.52*	6.40***	-1.71	5.01***
Sec. & Higher	-0.121	0.314	-0.168	0.254	-0.149	0.22
	-2.61**	5.09***	-3.94***	3.88***	-2.99**	3.49***
Still in School	0.446	-0.101	0.455	-0.104	0.46	-0.085
	9.34***	-4.29***	9.62***	-4.57***	10.02***	-4.23***
Age25-34	-0.126	0.095	-0.128	0.094	-0.134	0.087
	-5.37***	4.65***	-5.41***	4.58***	-5.26***	4.44***
Age35-49	-0.144	0.032	-0.154	0.025	-0.161	0.02
	-5.82***	1.33	-6.12***	1.05	-5.99***	0.92
Rural	-0.095	-0.071	-0.026	-0.073	0.015	-0.017
	-4.17***	-4.15***	-0.91	-3.58***	0.36	-0.68
Northern Region	0.007	-0.142	0.003	-0.137	0.022	-0.059
	0.22	-7.49***	0.08	-6.64***	0.44	-1.88
Muslim			-0.044	-0.072	-0.034	-0.044
			-1.28	-3.38***	-0.92	-2.13*
Traditional			0.035	-0.039	0.016	-0.051
			1.04	-1.62	0.45	-2.42*
Other			-0.121	-0.077	-0.099	-0.029
			-3.06**	-3.21**	-2.13*	-1.05
Non-Akan			0.009	0.03	0.005	0.011
			0.38	1.86	0.18	0.68
HAS- Basic			0.077	0.002	0.057	-0.018
			5.07***	0.23	3.52***	-2.06*
HAS- High			0.002	0.017	0.003	0.016
			0.18	2.39*	0.23	2.54*
Ext. Contr. Use					0.398	0.407
					7.93***	12.50***
Observation	2240		2240		2240	
chi2	375.285		425.919		657.131	
r2_p	0.096		0.111		0.191	
ll	-2.10E+03		-2.10E+03		-1.90E+03	

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.17 in main text.

B-12b: Marginal Effects: Multinomial Logit Regression of Ever Use of Contraceptives by Rural Women, 1987/88.

GLSS 1			**Rural**			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	-0.013	0.069	-0.025	0.06	-0.014	0.035
	-0.32	1.97*	-0.6	1.81	-0.32	1.34
Middle/JSS	-0.03	0.149	-0.048	0.138	-0.014	0.092
	-0.95	4.98***	-1.47	4.64***	-0.37	3.72***
Sec. & Higher	-0.176	0.417	-0.241	0.434	-0.226	0.424
	-2.90**	3.99***	-5.24***	3.75***	-3.91***	3.55***
Still in School	0.522	-0.071	0.534	-0.072	0.545	-0.051
	9.21***	-2.96**	9.49***	-3.14**	9.76***	-2.84**
Age25-34	-0.071	0.068	-0.067	0.063	-0.065	0.059
	-2.42*	3.14**	-2.23*	2.98**	-2.02*	3.15**
Age35-49	-0.092	0.001	-0.092	-0.003	-0.091	-0.002
	-2.94**	0.02	-2.87**	-0.14	-2.65**	-0.08
Northern Region	0.02	-0.107	0.033	-0.095	0.02	-0.032
	0.57	-5.72***	0.75	-4.60***	0.34	-1.23
Muslim			-0.016	-0.085	-0.009	-0.055
			-0.36	-4.29***	-0.17	-3.27**
Traditional			-0.001	-0.022	-0.011	-0.028
			-0.02	-0.99	-0.29	-1.65
Other			-0.107	-0.062	-0.078	-0.023
			-2.37*	-2.90**	-1.52	-0.98
Non-Akan			-0.025	0.004	-0.027	-0.002
			-0.84	0.26	-0.84	-0.13
HAS- Basic			0.112	-0.045	0.096	-0.063
			2.89**	-1.98*	2.32*	-2.90**
HAS- High			0.319	0.107	0.249	0.071
			1.6	1.5	1.17	1.32
Ext. Contr. Use					0.471	0.279
					7.59***	9.19***
Observation	1405		1405		1405	
chi2	187.584		203.489		375.68	
r2_p	0.076		0.09		0.182	
ll	-1.30E+03		-1.20E+03		-1.10E+03	

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.17.

B-12c: Marginal Effects: Multinomial Logit Regression of Ever Use of Contraceptives by Urban Women, 1987/88.

GLSS 1			**Urban**			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.049	0.113	0.045	0.117	0.04	0.067
	0.81	1.76	0.71	1.79	0.63	1.07
Middle/JSS	-0.06	0.212	-0.101	0.196	-0.114	0.159
	-1.38	5.24***	-2.05*	4.22***	-2.23*	3.25**
Sec. & Higher	-0.117	0.291	-0.165	0.23	-0.169	0.204
	-1.81	3.92***	-2.59**	2.80**	-2.49*	2.39*
Still in School	0.336	-0.172	0.332	-0.185	0.326	-0.178
	4.03***	-3.32***	3.75***	-3.60***	3.85***	-3.62***
Age25-34	-0.224	0.138	-0.239	0.137	-0.253	0.128
	-5.91***	3.46***	-6.20***	3.38***	-6.27***	3.08**
Age35-49	-0.224	0.079	-0.261	0.058	-0.279	0.046
	-5.72***	1.62	-6.63***	1.19	-6.64***	0.92
Northern Region	-0.103	-0.208	-0.061	-0.204	0.035	-0.082
	-1.33	-4.43***	-0.68	-3.69***	0.31	-0.77
Muslim			-0.075	-0.079	-0.077	-0.048
			-1.35	-1.65	-1.33	-0.95
Traditional			0.178	-0.101	0.143	-0.113
			2.38*	-1.84	1.93	-2.15*
Other			-0.161	-0.09	-0.145	-0.03
			-2.20*	-1.42	-1.67	-0.38
Non-Akan			0.057	0.066	0.056	0.022
			1.41	1.91	1.34	0.61
HAS- Basic			0.074	0.007	0.069	-0.024
			4.25***	0.49	3.79***	-1.58
HAS- High			-0.012	0.021	-0.012	0.023
			-1.04	2.51*	-1.04	2.64**
Ext. Contr. Use					0.152	0.596
					1.75	7.39***
Observation	835		835		835	
chi2	134.739		176.807		246.204	
r2_p	0.088		0.121		0.184	
ll	-831.913		-801.028		-744.136	

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.17.

B-12d: Marginal Effects: Multinomial Logit Regression of Ever Use of Contraceptives by Women Aged 15 – 34, 1987/88.

GLSS 1			**Age15-34**			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.001	0.113	-0.008	0.107	0.007	0.059
	0.02	2.77**	-0.19	2.63**	0.16	1.7
Middle/JSS	-0.033	0.183	-0.066	0.174	-0.042	0.118
	-1.08	6.57***	-2.02*	5.96***	-1.18	4.30***
Sec. & Higher	-0.113	0.303	-0.178	0.259	-0.155	0.196
	-1.92	4.13***	-3.37***	3.33***	-2.52*	2.69**
Still in School	0.432	-0.111	0.44	-0.116	0.441	-0.095
	9.32***	-4.35***	9.55***	-4.59***	10.05***	-4.36***
Age25_34	-0.137	0.1	-0.142	0.101	-0.147	0.092
	-5.37***	5.13***	-5.48***	5.11***	-5.34***	4.95***
Rural	-0.11	-0.06	-0.032	-0.073	-0.008	-0.008
	-4.10***	-2.99**	-0.93	-3.00**	-0.15	-0.26
Northern Region	0.026	-0.167	0.034	-0.163	0.055	-0.087
	0.6	-7.55***	0.71	-6.59***	0.88	-2.39*
Muslim			-0.056	-0.068	-0.048	-0.036
			-1.37	-2.54*	-1.08	-1.33
Traditional			0.03	-0.038	0.022	-0.05
			0.75	-1.31	0.52	-1.88
Other			-0.146	-0.079	-0.133	-0.022
			-3.15**	-2.67**	-2.47*	-0.66
Non-Akan			-0.007	0.017	-0.012	-0.007
			-0.23	0.84	-0.38	-0.37
HAS- Basic			0.091	-0.005	0.078	-0.021
			4.93***	-0.42	3.94***	-1.93
HAS- High			0.014	0.023	0.013	0.02
			0.53	1.84	0.52	2.04*
Ext. Contr. Use					0.322	0.444
					5.29***	10.85***
N	1651		1651		1651	
chi2	276.821		315.476		493.763	
r2_p	0.099		0.116		0.194	
ll	-1.60E+03		-1.50E+03		-1.40E+03	

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.17.

B-12e: Marginal Effects: Multinomial Logit Regression of Ever Use of Contraceptives by Women Aged 35 – 49, 1987/88.

GLSS 1			Age35-49			
	Model 1		**Model 2**		**Model 3**[a]	
	Tradition	***Modern***	***Tradition***	***Modern***	***Tradition***	***Modern***
	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio	M.E/ t-ratio
Primary	0.045	0.015	0.047	0.008	0.028	0.005
	0.68	0.28	0.69	0.16	0.38	0.14
Middle/JSS	-0.09	0.149	-0.101	0.115	-0.093	0.089
	-2.03*	3.06**	-2.13*	2.26*	-1.78	2.12*
Sec. & Higher	-0.165	0.345	-0.166	0.238	-0.145	0.261
	-2.72**	2.93**	-2.60**	1.96	-1.8	2.16*
Age4049	-0.087	0.011	-0.087	0.012	-0.089	0.012
	-2.23*	0.42	-2.21*	0.47	-2.08*	0.61
Rural	-0.039	-0.101	0.016	-0.074	0.078	-0.04
	-0.97	-3.10**	0.33	-2.08*	1.24	-1
Northern Region	-0.021	-0.085	-0.053	-0.079	-0.026	-0.008
	-0.44	-2.66**	-1	-2.33*	-0.34	-0.19
Muslim			-0.02	-0.074	-0.011	-0.04
			-0.34	-2.40*	-0.16	-1.64
Traditional			0.051	-0.044	-0.001	-0.039
			0.88	-1.14	-0.02	-1.47
Other			-0.07	-0.066	-0.012	-0.027
			-1	-1.56	-0.14	-0.64
Non-Akan			0.048	0.066	0.052	0.047
			1.16	2.45*	1.11	2.13*
HAS- Basic			0.055	0.014	0.019	-0.009
			2.17*	1.02	0.69	-0.81
HAS- High			-0.091	0.017	-0.11	0.013
			-1.91	1.03	-1.74	1.09
Ext. Contr. Use					0.579	0.235
					6.75***	4.92***
Observation	589		589		589	
chi2	73.162		96.056		186.886	
r2_p	0.067		0.088		0.2	
ll	-520.567		-508.48		-445.956	

Note: HAS represents Household Asset Score

a. Results on community variables are reported in table 3.17.

B-13a: Summary Statistics – the Duration of Breastfeeding, by Women's Residence and Age (GLSS 1)

	Rural		**Urban**		**Age 15_34**		**Age 35_49**	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Breastfeed	0.99	0.11	0.99	0.09	0.99	0.11	0.99	0.11
Months Breastfeed[1]	14.1	9.03	13.2	7.77	13.5	8.58	15.0	8.74
Completed Months Breastfeeding[2]	17.3	7.93	15.0	5.98	16.3	7.17	16.7	7.62
Censored	0.54	0.50	0.40	0.49	0.52	0.50	0.42	0.49
None	0.55	0.50	0.35	0.48	0.42	0.49	0.68	0.47
Primary	0.13	0.34	0.12	0.33	0.14	0.35	0.10	0.29
Middle/JSS	0.30	0.46	0.46	0.50	0.41	0.49	0.19	0.40
Sec. & above	0.01	0.12	0.07	0.25	0.03	0.18	0.03	0.18
Age15_24	0.29	0.45	0.26	0.44	0.37	0.48		
Age25_34	0.45	0.50	0.53	0.50	0.63	0.48		
Age35-49	0.27	0.44	0.20	0.40				
Rural					0.64	0.48	0.73	0.45
Female child	0.47	0.50	0.44	0.50	0.46	0.50	0.46	0.50
Northern Region	0.20	0.40	0.08	0.27	0.14	0.35	0.21	0.41
Child's birth82-84	0.21	0.41	0.20	0.40	0.17	0.37	0.32	0.47
Child's birth85-86	0.40	0.49	0.45	0.50	0.44	0.50	0.35	0.48
Child's birth87-88	0.34	0.47	0.33	0.47	0.36	0.48	0.27	0.44
Missing birth year	0.05	0.22	0.02	0.14	0.03	0.18	0.06	0.24
Christian	0.59	0.49	0.66	0.47	0.63	0.48	0.56	0.50
Muslim	0.11	0.31	0.21	0.41	0.14	0.35	0.16	0.36
Traditional	0.24	0.42	0.08	0.27	0.17	0.38	0.22	0.41
Other	0.07	0.25	0.05	0.22	0.06	0.24	0.06	0.24
Non-Akan	0.53	0.50	0.53	0.50	0.51	0.50	0.62	0.49
HAS- Basic	-0.49	0.30	0.60	1.10	-0.09	0.89	-0.24	0.72
HAS- High	-0.07	0.15	-0.03	1.03	-0.05	0.69	-0.07	0.25
Water distance	1946	20271	213	454	1587	18976	681	2786.71
Market distance	8.15	12.09			5.37	10.52	5.57	10.78
Access to Health facilities/personnel	0.01	0.98			-0.01	0.75	0.07	0.93
Price score of foodstuffs	-0.01	1.01			0.00	0.82	-0.01	0.82
Price score of cereals	0.03	1.01			0.01	0.81	0.07	0.85
Log of real Men's Agric. Wage	4.24	2.21			2.94	2.70	2.97	2.69
Ratio of female to men's wage	0.45	0.46			0.31	0.44	0.29	0.43
Ratio of child to men's wage	0.47	0.42			0.32	0.41	0.33	0.42
	937		473		1064		346	

Note: 1. Includes current age of babies who are still breastfeeding; 2. Only babies who have completed breastfeeding.

B-13b: Summary Statistics – the Duration of Breastfeeding, by Women's Residence and Age (GLSS 4)

	Rural		**Urban**		**Age 15_34**		**Age 35_49**	
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Breastfeed	0.99	0.09	0.99	0.09	0.99	0.09	0.99	0.10
Months Breastfeed[1]	16.52	9.11	14.82	7.87	15.39	8.72	17.47	8.83
Completed Months Breastfeeding[2]	20.98	7.34	17.64	6.98	19.66	7.07	20.17	7.91
Censored	0.51	0.50	0.38	0.48	0.51	0.50	0.37	0.48
None	0.59	0.49	0.34	0.47	0.48	0.50	0.62	0.49
Primary	0.15	0.36	0.18	0.38	0.18	0.38	0.13	0.34
Middle/JSS	0.23	0.42	0.38	0.48	0.30	0.46	0.21	0.41
Sec. & above	0.02	0.14	0.10	0.31	0.04	0.20	0.04	0.21
Age15-24	0.19	0.40	0.18	0.39	0.28	0.45		
Age25-34	0.49	0.50	0.53	0.50	0.72	0.45		
Age35-49	0.32	0.47	0.29	0.45				
Rural					0.70	0.46	0.73	0.44
Female child	0.50	0.50	0.52	0.50	0.51	0.50	0.50	0.50
Northern Region	0.20	0.40	0.09	0.29	0.16	0.36	0.20	0.40
Child's birth92-94	0.09	0.28	0.13	0.34	0.08	0.28	0.14	0.34
Child's birth95-96	0.20	0.40	0.24	0.43	0.22	0.41	0.20	0.40
Child's birth97-99	0.33	0.47	0.28	0.45	0.36	0.48	0.23	0.42
Missing birth year	0.38	0.49	0.35	0.48	0.34	0.47	0.43	0.50
Christian	0.73	0.44	0.76	0.43	0.76	0.43	0.70	0.46
Muslim	0.10	0.31	0.18	0.39	0.12	0.33	0.13	0.34
Traditional	0.10	0.30	0.01	0.12	0.06	0.24	0.11	0.32
Other	0.06	0.24	0.04	0.20	0.05	0.23	0.05	0.22
Non-Akan	0.52	0.50	0.48	0.50	0.49	0.50	0.54	0.50
HAS- Basic	-0.49	0.63	0.56	1.02	-0.17	0.91	-0.23	0.87
HAS- High	0.20	0.91	-0.54	0.93	-0.09	0.96	0.16	0.99
Water distance	998	20056	183	725	329	1179	1735	30406
Market distance	14.55	43.18			9.97	35.03	11.65	41.20
Access to Health facilities/personnel	-0.04	0.53			-0.03	0.46	-0.03	0.41
Price score of cereals	0.01	1.17			0.02	1.08	-0.02	0.73
Price score of foodstuffs	-0.01	1.03			0.02	0.95	-0.06	0.65
Log of real Men's Agric. Wage	7.98	1.82			5.66	3.94	5.98	3.79
Ratio of female to men's wage	0.59	0.41			0.42	0.44	0.45	0.44
Ratio of child to men's wage	0.44	0.41			0.30	0.40	0.35	0.41
	1750		704		1695		759.00	

Note: 1. Includes current age of babies who are still breastfeeding; 2. Only babies who have completed breastfeeding.

B-14a: Hazard Model Estimates of the Duration of Breastfeeding, 1987/88

Full	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.293	0.264	0.252	0.221	0.236	0.197
	2.40*	1.86	2.03*	1.57	1.88	1.36
Middle/JSS	0.482	0.54	0.379	0.418	0.376	0.405
	5.19***	4.92***	3.84***	3.70***	3.75***	3.52***
Sec.& above	0.959	1.079	0.644	0.721	0.617	0.699
	4.71***	4.46***	2.91**	2.82**	2.76**	2.68**
Age25-34	-0.146	-0.152	-0.169	-0.177	-0.196	-0.206
	-1.5	-1.36	-1.73	-1.6	-1.99*	-1.83
Age35-49	-0.068	-0.069	-0.046	-0.056	-0.087	-0.101
	-0.61	-0.54	-0.41	-0.44	-0.77	-0.78
Rural	-0.494	-0.599	-0.324	-0.401	-0.263	-0.361
	-6.05***	-5.74***	-3.28**	-3.34***	-2.02*	-2.26*
Female child	-0.177	-0.188	-0.165	-0.174	-0.17	-0.172
	-2.26*	-2.07*	-2.08*	-1.94	-2.13*	-1.89
Northern Region	-0.661	-0.806	-0.502	-0.581	-0.467	-0.532
	-5.16***	-5.01***	-3.61***	-3.58***	-2.87**	-2.84**
Child's birth85-86	-0.318	-0.414	-0.292	-0.363	-0.305	-0.38
	-3.74***	-3.86***	-3.40***	-3.45***	-3.53***	-3.52***
Child's birth87-88	-0.755	-0.845	-0.73	-0.801	-0.722	-0.798
	-3.76***	-3.97***	-3.63***	-3.79***	-3.58***	-3.74***
Missing birth year	0.255	0.281	0.233	0.264	0.259	0.289
	1.48	1.37	1.32	1.29	1.44	1.38
Muslim			-0.174	-0.203	-0.173	-0.208
			-1.38	-1.42	-1.36	-1.43
Traditional			-0.101	-0.113	-0.1	-0.114
			-0.86	-0.84	-0.84	-0.84
Other			0.228	0.302	0.242	0.321
			1.43	1.59	1.51	1.66
Non-Akan			-0.134	-0.166	-0.158	-0.19
			-1.55	-1.68	-1.75	-1.82
HAS- Basic			0.237	0.244	0.23	0.241
			4.45***	3.94***	4.24***	3.80***
HAS- High			0.059	0.053	0.061	0.053
			1.01	0.84	1.04	0.84
Water distance					-8.52E-06	-9.98E-06
					-1.14	-1.26
Market distance					0.002	0
					0.33	-0.01
Access to Health facilities/personnel					-0.037	-0.046
					-0.59	-0.66
Price score of foodstuffs					0.083	0.105
					1.31	1.47
Price score of cereals					-0.009	-0.014
					-0.16	-0.21
Log of real Men's Agric. Wage					0.013	0.026
					0.44	0.75
Ratio of female to men's wage					-0.241	-0.231
					-1.79	-1.51
Ratio of child to men's wage					-0.078	-0.127
					-0.48	-0.69

B-14b: Baseline Hazard Estimates of the Duration of Breastfeeding, GLSS 1.

FullTm	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
Month	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
2	-1.826	-1.823	-1.826	-1.824	-1.826	-1.823
	-4.50***	-4.49***	-4.50***	-4.50***	-4.50***	-4.49***
3_4	-3.048	-3.044	-3.048	-3.045	-3.047	-3.043
	-5.85***	-5.84***	-5.85***	-5.84***	-5.84***	-5.84***
5	-3.026	-3.023	-3.027	-3.023	-3.026	-3.021
	-4.19***	-4.18***	-4.19***	-4.18***	-4.19***	-4.18***
6	-2.311	-2.306	-2.308	-2.303	-2.307	-2.301
	-4.43***	-4.42***	-4.43***	-4.42***	-4.42***	-4.41***
7	-1.469	-1.462	-1.465	-1.459	-1.463	-1.455
	-4.03***	-4.00***	-4.02***	-4.00***	-4.01***	-3.99***
8	-0.687	-0.675	-0.681	-0.669	-0.678	-0.665
	-2.51*	-2.47*	-2.49*	-2.44*	-2.48*	-2.43*
9	-0.878	-0.857	-0.868	-0.849	-0.865	-0.844
	-2.94**	-2.87**	-2.91**	-2.84**	-2.90**	-2.83**
10	-0.82	-0.793	-0.802	-0.777	-0.798	-0.77
	-2.75**	-2.65**	-2.68**	-2.59**	-2.67**	-2.57*
11	-2.403	-2.373	-2.383	-2.356	-2.379	-2.348
	-4.03***	-3.98***	-3.99***	-3.95***	-3.99***	-3.93***
12	1.149	1.201	1.179	1.227	1.184	1.239
	6.29***	6.50***	6.44***	6.60***	6.47***	6.64***
13	-1.085	-1.01	-1.041	-0.973	-1.034	-0.957
	-2.96**	-2.74**	-2.84**	-2.63**	-2.82**	-2.59**
14	0.5	0.59	0.548	0.629	0.555	0.646
	2.30*	2.65**	2.51*	2.80**	2.54*	2.85**
15	0.262	0.374	0.317	0.415	0.326	0.437
	1.09	1.51	1.31	1.67	1.35	1.74
16	-0.113	0.013	-0.052	0.059	-0.041	0.083
	-0.4	0.05	-0.18	0.2	-0.14	0.28
17	-1.155	-1.022	-1.094	-0.978	-1.084	-0.953
	-2.65**	-2.31*	-2.51*	-2.21*	-2.48*	-2.15*
18	2.494	2.695	2.563	2.734	2.574	2.766
	14.52***	13.49***	14.81***	13.41***	14.86***	13.13***
19	0.174	0.438	0.252	0.475	0.265	0.514
	0.53	1.24	0.77	1.33	0.81	1.42
20	1.007	1.29	1.085	1.323	1.1	1.365
	3.98***	4.45***	4.27***	4.50***	4.33***	4.51***
21	-1.438	-1.141	-1.358	-1.11	-1.343	-1.066
	-1.99*	-1.54	-1.88	-1.5	-1.85	-1.43
22	-0.31	-0.008	-0.23	0.022	-0.215	0.066
	-0.71	-0.02	-0.53	0.05	-0.49	0.14
23	-1.361	-1.056	-1.282	-1.028	-1.267	-0.983
	-1.88	-1.43	-1.77	-1.39	-1.75	-1.32
24	3.357	3.779	3.441	3.786	3.459	3.842
	18.59***	13.69***	18.88***	13.47***	18.93***	12.83***
25	-0.054	0.494	0.035	0.483	0.054	0.546
	-0.07	0.64	0.05	0.62	0.07	0.69
26	0.701	1.265	0.789	1.249	0.813	1.319
	1.34	2.13*	1.5	2.09*	1.55	2.16*
27	0.056	0.633	0.141	0.612	0.168	0.686
	0.08	0.81	0.2	0.78	0.23	0.87
28	0.586	1.18	0.671	1.154	0.69	1.225

	0.98	1.77	1.12	1.72	1.15	1.79
29	-0.4	0.209	-0.317	0.176	-0.301	0.246
	-0.4	0.2	-0.31	0.17	-0.3	0.23
30	2.115	2.771	2.219	2.743	2.243	2.824
	5.96***	5.79***	6.23***	5.70***	6.29***	5.58***
31plus	0.251	1.148	0.392	1.097	0.463	1.225
	0.78	2.18*	1.21	2.06*	1.42	2.17*
Constant	-2.84	-2.742	-2.852	-2.765	-2.8	-2.71
	-14.52***	-12.73***	-13.55***	-11.98***	-13.19***	-11.53***
ln_varg (cons)		-1.371		-1.568		-1.462
		-2.69**		-2.49*		-2.34*
N_spell		1410		1410		1410
gammav		0.254		0.209		0.232
se_gammav		0.13		0.131		0.145
ll_nofr		-2.10E+03		-2.10E+03		-2.10E+03
lltest		5.421		3.154		2.965
lltest_p		0.01		0.038		0.043

B-15a: Hazard Model Estimates of the Duration of Breastfeeding, 1987/88

Rural	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.206	0.202	0.193	0.182	0.182	0.154
	1.35	1.28	1.25	1.08	1.16	0.85
Middle/JSS	0.481	0.489	0.44	0.469	0.443	0.481
	3.97***	3.68***	3.52***	3.25**	3.44***	3.21**
Sec.& above	0.488	0.512	0.348	0.445	0.293	0.492
	1.4	1.32	0.97	1.01	0.79	1.01
Age35-49	0.146	0.147	0.14	0.149	0.117	0.13
	1.35	1.33	1.27	1.26	1.05	1.04
Female child	-0.256	-0.26	-0.263	-0.275	-0.262	-0.277
	-2.50*	-2.44*	-2.55*	-2.46*	-2.51*	-2.36*
Northern Region	-0.706	-0.722	-0.622	-0.652	-0.528	-0.579
	-4.85***	-4.05***	-3.75***	-3.47***	-2.58**	-2.46*
Child's birth85-86	-0.26	-0.27	-0.246	-0.277	-0.26	-0.317
	-2.36*	-2.13*	-2.21*	-2.06*	-2.32*	-2.23*
Child's birth87-88	-0.924	-0.932	-0.892	-0.917	-0.855	-0.899
	-3.24**	-3.21**	-3.11**	-3.12**	-2.96**	-3.01**
Missing birth year	0.09	0.091	0.081	0.088	0.094	0.111
	0.45	0.45	0.4	0.4	0.46	0.46
Muslim			-0.13	-0.148	-0.147	-0.186
			-0.74	-0.77	-0.83	-0.9
Traditional			-0.07	-0.071	-0.051	-0.059
			-0.53	-0.5	-0.38	-0.38
Other			0.108	0.194	0.117	0.26
			0.53	0.71	0.57	0.94
Non-Akan			-0.036	-0.058	-0.038	-0.077
			-0.32	-0.45	-0.32	-0.56
HAS- Basic			0.187	0.186	0.141	0.127
			1.1	1.03	0.8	0.65
HAS- High			-0.974	-0.929	-1.188	-1.146
			-0.93	-0.83	-1.09	-0.93
Water distance					-9.24E-06	-1.02E-05
					-1.21	-1.3
Market distance					0.001	-0.001
					0.17	-0.09
Access to Health facilities/personnel					-0.046	-0.052
					-0.68	-0.72
Price score of foodstuffs					0.076	0.091
					1.12	1.2
Price score of cereals					-0.027	-0.025
					-0.42	-0.36
Log of real Men's Agric. Wage					0.035	0.045
					1.05	1.13
Ratio of female to men's wage					-0.25	-0.263
					-1.72	-1.61
Ratio of child to men's wage					-0.01	-0.04
					-0.06	-0.21

B-15b: Baseline Hazard Estimates of the Duration of Breastfeeding, GLSS 1.

Rural Tm	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
2	-2.076	-2.075	-2.075	-2.072	-2.073	-2.068
	-3.93***	-3.93***	-3.92***	-3.92***	-3.92***	-3.91***
3_4	-3.435	-3.434	-3.435	-3.432	-3.432	-3.426
	-4.72***	-4.72***	-4.72***	-4.72***	-4.72***	-4.71***
5	-3.414	-3.414	-3.413	-3.41	-3.411	-3.404
	-3.36***	-3.36***	-3.36***	-3.36***	-3.36***	-3.35***
6	-2.707	-2.706	-2.706	-2.702	-2.702	-2.695
	-3.72***	-3.72***	-3.72***	-3.71***	-3.71***	-3.70***
7	-1.992	-1.991	-1.991	-1.986	-1.986	-1.977
	-3.76***	-3.76***	-3.76***	-3.75***	-3.75***	-3.74***
8	-0.95	-0.948	-0.949	-0.942	-0.943	-0.931
	-2.73**	-2.72**	-2.73**	-2.71**	-2.71**	-2.67**
9	-2.618	-2.616	-2.616	-2.608	-2.611	-2.596
	-3.59***	-3.59***	-3.59***	-3.58***	-3.59***	-3.56***
10	-1.192	-1.189	-1.189	-1.18	-1.182	-1.164
	-3.02**	-3.01**	-3.01**	-2.99**	-2.99**	-2.94**
11	-3.251	-3.249	-3.249	-3.239	-3.239	-3.22
	-3.20**	-3.20**	-3.20**	-3.19**	-3.19**	-3.17**
12	0.73	0.734	0.735	0.752	0.745	0.779
	3.23**	3.23**	3.25**	3.29**	3.29**	3.38***
13	-2.388	-2.382	-2.38	-2.357	-2.368	-2.32
	-3.28**	-3.26**	-3.27**	-3.23**	-3.25**	-3.17**
14	-0.211	-0.204	-0.203	-0.177	-0.189	-0.136
	-0.7	-0.67	-0.68	-0.58	-0.63	-0.44
15	-0.406	-0.397	-0.399	-0.368	-0.382	-0.319
	-1.23	-1.19	-1.21	-1.09	-1.16	-0.94
16	-0.698	-0.688	-0.69	-0.655	-0.673	-0.603
	-1.85	-1.8	-1.83	-1.7	-1.78	-1.55
17	-1.738	-1.728	-1.729	-1.692	-1.712	-1.639
	-2.88**	-2.84**	-2.86**	-2.78**	-2.83**	-2.68**
18	1.983	1.999	2.001	2.06	2.019	2.134
	9.69***	8.81***	9.75***	8.64***	9.81***	8.57***
19	-0.399	-0.377	-0.375	-0.293	-0.354	-0.197
	-0.95	-0.86	-0.89	-0.65	-0.84	-0.43
20	0.289	0.313	0.315	0.402	0.336	0.503
	0.87	0.87	0.95	1.07	1.01	1.3
21	-1.521	-1.496	-1.494	-1.403	-1.474	-1.299
	-2.08*	-2.01*	-2.05*	-1.86	-2.02*	-1.71
22	-0.799	-0.774	-0.773	-0.681	-0.753	-0.575
	-1.5	-1.4	-1.45	-1.21	-1.41	-1
23	-1.449	-1.422	-1.425	-1.331	-1.403	-1.222
	-1.98*	-1.9	-1.95	-1.76	-1.92	-1.6
24	3.008	3.048	3.031	3.174	3.055	3.33
	14.45***	9.40***	14.51***	8.81***	14.55***	8.52***
25	-0.144	-0.087	-0.118	0.079	-0.099	0.273
	-0.2	-0.11	-0.16	0.1	-0.13	0.32
26	0.644	0.703	0.667	0.872	0.695	1.081
	1.21	1.1	1.25	1.29	1.3	1.53
27	-0.683	-0.623	-0.664	-0.454	-0.633	-0.237
	-0.67	-0.58	-0.65	-0.41	-0.62	-0.21
28	0.561	0.622	0.576	0.791	0.599	1.008

	0.92	0.87	0.95	1.06	0.99	1.29
29plus	0.662	0.742	0.683	0.956	0.744	1.258
	2.30*	1.31	2.36*	1.53	2.55*	1.88
Constant	-2.983	-2.977	-2.933	-2.912	-3.017	-2.993
	-14.18***	-13.86***	-11.64***	-10.91***	-10.54***	-9.56***
ln_varg (cons)		-3.435		-2.184		-1.545
		-0.56		-1.07		-1.29
N_spell		937		937		937
gammav		0.032		0.113		0.213
se_gammav		0.197		0.23		0.255
ll_nofr		-1.30E+03		-1.30E+03		-1.30E+03
lltest		0.028		0.238		0.685
lltest_p		0.434		0.313		0.204
N	1.30E+04	1.30E+04	1.30E+04	1.30E+04	1.30E+04	1.30E+04
N_clust						
ll	-1.30E+03	-1.30E+03	-1.30E+03	-1.30E+03	-1.30E+03	-1.30E+03
chi2	1228.657		1233.251		1241.449	

B-16a: Hazard Model Estimates of the Duration of Breastfeeding, 1987/88

Urban	Model 1		Model 2	
	A	**B**	**A**	**B**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Primary	0.281	0.281	0.241	0.241
	1.36	1.36	1.12	1.13
Middle/JSS	0.407	0.407	0.273	0.273
	2.72**	2.73**	1.67	1.69
Sec.& above	1.283	1.283	0.932	0.932
	4.73***	4.73***	3.08**	3.09**
Age35-49	-0.091	-0.091	-0.033	-0.033
	-0.57	-0.57	-0.2	-0.2
Female child	0.036	0.036	0.052	0.052
	0.28	0.28	0.4	0.41
Northern Region	-0.652	-0.652	-0.503	-0.503
	-2.25*	-2.25*	-1.69	-1.69
Child's birth85-86	-0.367	-0.367	-0.332	-0.332
	-2.71**	-2.73**	-2.43*	-2.44*
Child's birth87-88	-0.543	-0.543	-0.521	-0.521
	-1.91	-1.91	-1.83	-1.84
Missing birth year	0.924	0.924	1.094	1.094
	2.54*	2.54*	2.95**	2.96**
Non-Akan	-0.229	-0.229	-0.27	-0.27
	-1.76	-1.77	-1.92	-1.93
Muslim			-0.077	-0.077
			-0.4	-0.4
Traditional			-0.077	-0.077
			-0.29	-0.29
Other			0.274	0.274
			1.04	1.05
HAS- Basic			0.231	0.231
			3.86***	3.90***
HAS- High			0.053	0.053
			0.9	0.9
Water distance			-1.09E-04	-1.09E-04
			-0.76	-0.77

B-16b: Baseline Hazard Estimates of the Duration of Breastfeeding, GLSS 1.

Urban Tm	Model 1		Model 2	
	A	**B**	**A**	**B**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
2	-1.334	-1.334	-1.336	-1.336
	-2.07*	-2.07*	-2.07*	-2.09*
3_4	-2.394	-2.394	-2.397	-2.397
	-3.13**	-3.14**	-3.14**	-3.16**
5	-2.372	-2.372	-2.376	-2.376
	-2.28*	-2.28*	-2.28*	-2.29*
6	-1.647	-1.647	-1.645	-1.645
	-2.16*	-2.15*	-2.15*	-2.17*
7	-0.691	-0.691	-0.687	-0.687
	-1.3	-1.3	-1.29	-1.31
8	-0.18	-0.18	-0.169	-0.169
	-0.39	-0.39	-0.37	-0.38
9	0.361	0.361	0.377	0.377
	0.9	0.9	0.94	0.96
10	-0.179	-0.179	-0.145	-0.145
	-0.38	-0.38	-0.3	-0.31
11	-1.391	-1.391	-1.355	-1.355
	-1.82	-1.82	-1.77	-1.78
12	1.859	1.859	1.913	1.913
	5.65***	5.68***	5.79***	6.01***
13	0.157	0.157	0.232	0.232
	0.33	0.33	0.48	0.49
14	1.5	1.5	1.581	1.581
	4.18***	4.20***	4.39***	4.53***
15	1.274	1.274	1.373	1.373
	3.28**	3.29***	3.52***	3.62***
16	0.851	0.851	0.966	0.966
	1.9	1.91	2.15*	2.19*
17	-0.192	-0.192	-0.08	-0.08
	-0.3	-0.3	-0.12	-0.12
18	3.414	3.414	3.524	3.524
	10.55***	10.62***	10.81***	11.28***
19	1.205	1.205	1.326	1.326
	2.24*	2.24*	2.45*	2.49*
20	2.239	2.239	2.36	2.36
	5.36***	5.38***	5.62***	5.77***
21_22	-0.11	-0.11	0.019	0.019
	-0.14	-0.14	0.02	0.02
23_24	2.874	2.874	3.013	3.013
	8.13***	8.18***	8.45***	8.75***
25plus	0.042	0.042	0.32	0.32
	0.07	0.07	0.54	0.55
Constant	-3.61	-3.61	-3.72	-3.72
	-10.35***	-10.54***	-10.37***	-11.18***
ln_varg (cons)		-12.552		-12.866
		-0.03		-0.02
N_spell		473		473
gammav		0.000		0.000
se_gammav		0.001		0.002
ll_nofr		-830.728		-821.293
lltest		0.000		0.000
lltest_p		0.5		0.5

N	6264	6264	6264	6264
N_clust				
ll	-830.728	-830.728	-821.293	-821.293
chi2	662.807		681.678	

B-17a: Hazard Model Estimates of the Duration of Breastfeeding, 1987/88

Age 15-34	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.367	0.361	0.346	0.309	0.329	0.23
	2.56*	2.05*	2.38*	1.7	2.23*	1.16
Middle/JSS	0.515	0.617	0.408	0.466	0.392	0.424
	4.69***	4.44***	3.51***	3.20**	3.30***	2.70**
Sec.& above	1.509	1.574	1.181	1.187	1.127	1.089
	6.16***	5.44***	4.44***	3.76***	4.20***	3.24**
Age25-34	-0.143	-0.162	-0.176	-0.215	-0.204	-0.262
	-1.46	-1.35	-1.78	-1.73	-2.04*	-1.95
Rural	-0.524	-0.702	-0.358	-0.52	-0.241	-0.483
	-5.47***	-5.30***	-3.11**	-3.35***	-1.56	-2.18*
Female child	-0.159	-0.169	-0.158	-0.167	-0.172	-0.18
	-1.69	-1.48	-1.67	-1.44	-1.79	-1.45
Northern Region	-0.841	-1.106	-0.698	-0.899	-0.691	-0.918
	-4.99***	-4.82***	-3.82***	-3.80***	-3.29***	-3.25**
Child's birth85-86	-0.266	-0.403	-0.241	-0.371	-0.246	-0.422
	-2.54*	-2.91**	-2.30*	-2.64**	-2.30*	-2.75**
Child's birth87-88	-0.595	-0.724	-0.555	-0.692	-0.544	-0.724
	-2.67**	-2.97**	-2.49*	-2.81**	-2.44*	-2.84**
Missing birth year	0.397	0.437	0.454	0.493	0.467	0.524
	1.74	1.54	1.97*	1.7	2.01*	1.68
Muslim			-0.263	-0.388	-0.278	-0.459
			-1.76	-2.02*	-1.85	-2.22*
Traditional			-0.263	-0.376	-0.252	-0.399
			-1.8	-2.01*	-1.72	-1.98*
Other			0.097	0.215	0.096	0.286
			0.54	0.89	0.53	1.06
Non-Akan			0.009	-0.023	0.006	-0.029
			0.09	-0.18	0.06	-0.21
HAS- Basic			0.207	0.226	0.191	0.226
			3.47***	2.94**	3.13**	2.72**
HAS- High			0.043	0.038	0.048	0.043
			0.74	0.56	0.83	0.6
Water distance					-9.35E-06	-1.29E-05
					-1.03	-1.29
Market distance					-4.14E-04	-0.006
					-0.06	-0.65
Access to Health facilities/personnel					-0.089	-0.17
					-1.13	-1.69
Price score of foodstuffs					0.068	0.127
					0.89	1.28
Price score of cereals					0.017	0.034
					0.23	0.36
Log of real Men's Agric. Wage					0.002	0.032
					0.05	0.64
Ratio of female to men's wage					-0.173	-0.096
					-1.06	-0.44
Ratio of child to men's wage					-0.153	-0.319
					-0.78	-1.22

B-17b: Baseline Hazard Estimates of the Duration of Breastfeeding, GLSS 1.

Age 15-34	Model 1		Model 2		Model 3	
Tm	**A**	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
2	-1.542	-1.538	-1.543	-1.539	-1.543	-1.535
	-3.45***	-3.44***	-3.45***	-3.44***	-3.45***	-3.43***
3_4	-2.603	-2.595	-2.603	-2.595	-2.603	-2.59
	-4.89***	-4.87***	-4.89***	-4.87***	-4.89***	-4.86***
5	-2.576	-2.568	-2.575	-2.567	-2.575	-2.561
	-3.53***	-3.52***	-3.53***	-3.51***	-3.53***	-3.51***
6	-2.145	-2.136	-2.141	-2.131	-2.14	-2.123
	-3.54***	-3.52***	-3.53***	-3.52***	-3.53***	-3.50***
7	-1.415	-1.402	-1.41	-1.395	-1.408	-1.385
	-3.16**	-3.13**	-3.15**	-3.11**	-3.14**	-3.09**
8	-0.766	-0.746	-0.76	-0.737	-0.757	-0.723
	-2.17*	-2.11*	-2.15*	-2.08*	-2.14*	-2.04*
9	-0.55	-0.517	-0.541	-0.502	-0.538	-0.483
	-1.65	-1.55	-1.62	-1.5	-1.61	-1.44
10	-0.483	-0.436	-0.464	-0.408	-0.46	-0.38
	-1.45	-1.3	-1.39	-1.22	-1.38	-1.13
11	-2.322	-2.269	-2.301	-2.239	-2.296	-2.206
	-3.17**	-3.10**	-3.15**	-3.06**	-3.14**	-3.01**
12	1.358	1.447	1.392	1.496	1.396	1.548
	6.13***	6.40***	6.26***	6.54***	6.28***	6.68***
13	-0.977	-0.85	-0.926	-0.779	-0.922	-0.709
	-2.17*	-1.87	-2.06*	-1.71	-2.05*	-1.55
14	0.472	0.617	0.522	0.689	0.526	0.766
	1.7	2.15*	1.87	2.38*	1.89	2.60**
15	0.634	0.806	0.688	0.885	0.695	0.977
	2.30*	2.81**	2.49*	3.03**	2.51*	3.28**
16	0.323	0.52	0.386	0.611	0.394	0.717
	1.03	1.59	1.22	1.84	1.25	2.11*
17	-0.591	-0.379	-0.526	-0.284	-0.519	-0.171
	-1.31	-0.82	-1.16	-0.61	-1.15	-0.36
18	2.763	3.08	2.828	3.184	2.836	3.347
	13.04***	12.05***	13.26***	11.88***	13.28***	11.58***
19	0.4	0.816	0.471	0.931	0.486	1.141
	0.99	1.84	1.17	2.06*	1.2	2.41*
20	1.263	1.709	1.336	1.828	1.351	2.047
	4.07***	4.65***	4.29***	4.80***	4.34***	5.05***
21	-0.788	-0.319	-0.712	-0.196	-0.695	0.032
	-1.08	-0.42	-0.97	-0.25	-0.95	0.04
22	0.163	0.641	0.24	0.764	0.256	0.995
	0.33	1.21	0.49	1.41	0.52	1.78
23	-0.704	-0.219	-0.625	-0.094	-0.609	0.14
	-0.96	-0.29	-0.85	-0.12	-0.83	0.18
24	3.668	4.343	3.758	4.482	3.785	4.804
	16.35***	11.78***	16.60***	11.42***	16.66***	10.81***
25	0.678	1.557	0.772	1.709	0.806	2.109
	0.92	1.89	1.05	2.03*	1.1	2.40*
26	0.025	0.921	0.114	1.068	0.152	1.481
	0.02	0.85	0.11	0.97	0.15	1.31
27	0.055	0.96	0.141	1.105	0.18	1.522
	0.05	0.88	0.14	1	0.18	1.34
28	0.818	1.749	0.902	1.891	0.939	2.317

	1.11	2.10*	1.23	2.22*	1.28	2.59**
29	0.214	1.169	0.308	1.315	0.341	1.75
	0.21	1.07	0.3	1.18	0.33	1.53
30	2.406	3.434	2.524	3.592	2.56	4.058
	5.62***	5.61***	5.87***	5.64***	5.94***	5.76***
31plus	0.41	1.833	0.583	2.02	0.678	2.63
	1.05	2.64**	1.48	2.79**	1.71	3.28**
Constant	-3.141	-2.999	-3.164	-2.975	-3.101	-2.845
	-13.32***	-11.31***	-12.49***	-10.12***	-12.16***	-9.20***
ln_varg (cons)		-0.954		-0.885		-0.544
		-2.14*		-1.96		-1.44
N_spell		1064		1064		1064
gammav		0.385		0.413		0.58
se_gammav		0.172		0.187		0.219
ll_nofr		-1.50E+03		-1.50E+03		-1.50E+03
lltest		7.546		6.883		9.11
lltest_p		0.003		0.004		0.001
N	1.40E+04	1.40E+04	1.40E+04	1.40E+04	1.40E+04	1.40E+04
N_clust						
ll	-1.50E+03	-1.50E+03	-1.50E+03	-1.50E+03	-1.50E+03	-1.50E+03
chi2	1400.367		1419.647		1429.542	

B-18a: Hazard Model Estimates of the Duration of Breastfeeding, 1987/88

Age 35-49	Model 1		Model 2	Model 3
	A	**B**	**A**	**A**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Primary	0.037	0.023	0.066	0.163
	0.15	0.04	0.26	0.62
Middle/JSS	0.373	0.358	0.526	0.574
	1.99*	0.78	2.55*	2.73**
Sec.& above	0.185	0.168	0.197	-0.015
	0.46	0.24	0.44	-0.03
Age	-0.374	-0.409	-0.194	-0.138
	-0.98	-22.80***	-0.49	-0.34
Age sq.	0.005	0.005	0.003	0.002
	1.04	14.10***	0.57	0.42
Rural	-0.359	-0.371	-0.261	-0.225
	-2.16*	-0.44	-1.32	-0.87
Female child	-0.169	n.a	-0.132	-0.17
	-1.15		-0.87	-1.06
Northern Region	-0.401	-0.377	-0.14	-0.142
	-1.97*	-0.68	-0.62	-0.51
Child's birth85-86	-0.394	-0.393	-0.364	-0.313
	-2.52*	-2.24*	-2.26*	-1.91
Child's birth87-88	-1.378	-1.377	-1.406	-1.4
	-2.64**	-2.49*	-2.67**	-2.64**
Missing birth year	0.111	0.161	0.001	-0.009
	0.41	0.21	0	-0.03
Muslim			0.086	0.1
			0.36	0.41
Traditional			0.271	0.277
			1.3	1.29
Other			0.653	0.701
			1.8	1.89
Non-Akan			-0.433	-0.494
			-2.49*	-2.58**
HAS- Basic			0.288	0.327
			2.29*	2.57*
HAS- High			-0.236	-0.377
			-0.34	-0.51
Water distance				0
				0.84
Market distance				-0.003
				-0.39
Access to Health facilities/personnel				0.13
				1.3
Price score of foodstuffs				0.078
				0.67
Price score of cereals				-0.103
				-0.87
Log of real Men's Agric. Wage				0.047
				0.94
Ratio of female to men's wage				-0.402
				-1.61
Ratio of child to men's wage				-0.016
				-0.05

B-18b: Baseline Hazard Estimates of the Duration of Breastfeeding, GLSS 1.

Age 35-49	Model 1		Model 2	Model 3
	A	**B**	**A**	**A**
Months	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
2_6	-3.639	-3.639	-3.64	-3.64
	-4.85***	-2.57*	-4.85***	-4.85***
7	-1.587	-1.586	-1.585	-1.584
	-2.52*	-1.83	-2.52*	-2.52*
8	-0.581	-0.581	-0.573	-0.573
	-1.34	-0.38	-1.32	-1.32
9	-1.927	-1.93	-1.911	-1.913
	-2.57*	-1.58	-2.55*	-2.55*
10	-1.906	-1.907	-1.887	-1.887
	-2.54*	-0.8	-2.51*	-2.51*
11	-2.584	-2.585	-2.565	-2.562
	-2.51*	-1.41	-2.49*	-2.48*
12	0.672	0.671	0.701	0.708
	2.07*	0.28	2.15*	2.17*
13	-1.304	-1.305	-1.267	-1.256
	-2.07*	-0.52	-2.01*	-1.99*
14	0.511	0.507	0.563	0.582
	1.45	0.2	1.6	1.65
15	-0.847	-0.851	-0.782	-0.753
	-1.51	-0.35	-1.39	-1.34
16	-1.509	-1.512	-1.448	-1.417
	-2.01*	-0.55	-1.92	-1.88
17_18	1.122	1.121	1.201	1.234
	3.84***	0.44	4.07***	4.18***
19	-0.288	-0.285	-0.139	-0.092
	-0.51	-0.1	-0.25	-0.16
20	0.481	0.484	0.621	0.669
	1.1	0.19	1.41	1.52
21_22	-2.227	-2.224	-2.095	-2.046
	-2.16*	-0.81	-2.03*	-1.98*
23_24	1.778	1.778	1.906	1.953
	5.95***	0.68	6.29***	6.42***
25plus	0.227	0.228	0.402	0.413
	0.58	0.09	1.01	1.03
Constant	4.703	5.338	0.869	-0.296
	0.61	5.57***	0.11	-0.04
ln_varg (cons)		-16.275		
		-0.01		
N_spell		346		
gammav		0		
se_gammav		0		
ll_nofr		-654.159		
lltest		-0.007		
lltest_p		0.5		
ll	-654.159	-654.163		
chi2	400.299			
N	5204	5204	5204	5204

B-19a: Hazard Model Estimates of the Duration of Breastfeeding, 1998/99

Full	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.218	0.323	0.128	0.174	0.124	0.162
	2.62**	2.92**	1.5	1.56	1.44	1.44
Middle/JSS	0.374	0.431	0.227	0.213	0.231	0.209
	5.17***	4.62***	2.97**	2.14*	3.00**	2.07*
Sec.& above	0.92	1.268	0.592	0.853	0.579	0.84
	6.89***	7.22***	4.05***	4.59***	3.95***	4.47***
Age25-34	0.178	0.234	0.111	0.151	0.127	0.165
	2.10*	2.17*	1.29	1.39	1.47	1.51
Age35-49	0.134	0.212	0.088	0.162	0.091	0.164
	1.51	1.87	0.97	1.41	1.01	1.41
Rural	-0.452	-0.659	-0.167	-0.281	-0.188	-0.381
	-7.11***	-7.29***	-2.12*	-2.78**	-1.33	-2.10*
Female child	-0.015	-0.054	-0.006	-0.066	0.015	-0.052
	-0.27	-0.74	-0.11	-0.9	0.26	-0.71
Northern Region	-0.678	-0.996	-0.416	-0.648	-0.462	-0.708
	-8.04***	-7.78***	-4.26***	-4.86***	-4.58***	-5.11***
Child's birth95-96	-0.194	-0.211	-0.17	-0.233	-0.2	-0.268
	-2.32*	-1.92	-2.01*	-2.09*	-2.35*	-2.37*
Child's birth97-99	-0.76	-0.795	-0.759	-0.81	-0.771	-0.825
	-5.10***	-4.69***	-5.08***	-4.75***	-5.15***	-4.81***
Missing birth year	-0.081	-0.017	-0.088	-0.04	-0.123	-0.088
	-1.03	-0.16	-1.1	-0.38	-1.54	-0.82
Muslim			-0.038	-0.035	-0.034	-0.026
			-0.39	-0.28	-0.35	-0.2
Traditional			-0.196	-0.305	-0.153	-0.255
			-1.54	-1.88	-1.19	-1.55
Other			-0.027	-0.042	-0.017	-0.034
			-0.19	-0.23	-0.12	-0.18
Non-Akan			-0.215	-0.292	-0.221	-0.292
			-3.19**	-3.33***	-3.23**	-3.28**
HAS- Basic			0.251	0.343	0.264	0.373
			6.20***	6.64***	6.22***	6.76***
HAS- High			-0.11	-0.147	-0.115	-0.156
			-3.22**	-3.36***	-3.27**	-3.47***
Water distance					2.24E-06	2.61E-06
					1.79	1.72
Market distance					0.003	0.004
					2.58**	2.75**
Access to Health facilities/personnel					-0.082	-0.075
					-0.77	-0.61
Price score of cereals					0.082	0.11
					3.18**	3.29***
Price score of foodstuffs					0	-0.032
					-0.01	-0.65
Log of real Men's Agric. Wage					0.014	0.025
					0.76	1.05
Ratio of female to men's wage					-0.223	-0.245
					-2.30*	-2.01*
Ratio of child to men's wage					0.028	0.023
					0.3	0.19

B-19b: Baseline Hazard Estimates of the Duration of Breastfeeding, GLSS 4.

Full	Model 1		Model 2		Model 3	
Time	**A**	**B**	**A**	**B**	**A**	**B**
(Months)	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
2	-1.484	-1.482	-1.484	-1.482	-1.485	-1.483
	-3.56***	-3.55***	-3.56***	-3.55***	-3.56***	-3.55***
3	-0.767	-0.762	-0.768	-0.762	-0.769	-0.764
	-2.39*	-2.38*	-2.40*	-2.38*	-2.40*	-2.38*
4	-1.083	-1.074	-1.082	-1.071	-1.079	-1.063
	-2.99**	-2.96**	-2.99**	-2.96**	-2.98**	-2.93**
5	-1.98	-1.969	-1.979	-1.966	-1.972	-1.948
	-3.73***	-3.71***	-3.73***	-3.71***	-3.72***	-3.67***
6	-1.399	-1.388	-1.397	-1.383	-1.391	-1.366
	-3.35***	-3.33***	-3.35***	-3.31***	-3.33***	-3.27**
7	-3.326	-3.314	-3.324	-3.308	-3.317	-3.291
	-3.28**	-3.26**	-3.27**	-3.26**	-3.27**	-3.24**
8	-0.809	-0.794	-0.805	-0.785	-0.799	-0.768
	-2.39*	-2.34*	-2.38*	-2.32*	-2.36*	-2.27*
9	-0.621	-0.598	-0.615	-0.584	-0.608	-0.567
	-1.94	-1.86	-1.92	-1.82	-1.9	-1.77
10	-1.032	-1.004	-1.026	-0.99	-1.018	-0.969
	-2.73**	-2.66**	-2.72**	-2.62**	-2.70**	-2.56*
11	-1.417	-1.387	-1.412	-1.372	-1.403	-1.351
	-3.19**	-3.11**	-3.17**	-3.08**	-3.15**	-3.03**
12	1.545	1.602	1.551	1.618	1.561	1.642
	7.67***	7.92***	7.70***	7.99***	7.74***	8.08***
13	-0.432	-0.348	-0.425	-0.33	-0.414	-0.302
	-1.35	-1.08	-1.32	-1.02	-1.29	-0.94
14	0.634	0.729	0.644	0.753	0.654	0.782
	2.65**	3.03**	2.69**	3.13**	2.73**	3.23**
15	0.776	0.892	0.789	0.923	0.799	0.952
	3.30***	3.76***	3.35***	3.88***	3.39***	3.99***
16	0.393	0.53	0.407	0.563	0.417	0.594
	1.5	2.01*	1.55	2.13*	1.59	2.23*
17	-0.372	-0.221	-0.358	-0.189	-0.347	-0.157
	-1.1	-0.65	-1.06	-0.55	-1.02	-0.46
18	2.882	3.112	2.909	3.167	2.925	3.208
	15.26***	15.80***	15.39***	16.06***	15.47***	16.13***
19	0.397	0.702	0.441	0.782	0.464	0.835
	1.32	2.27*	1.46	2.53*	1.54	2.68**
20	1.436	1.764	1.485	1.851	1.508	1.904
	6.17***	7.20***	6.38***	7.56***	6.47***	7.72***
21	-0.499	-0.152	-0.449	-0.062	-0.426	-0.008
	-1.12	-0.34	-1.01	-0.14	-0.96	-0.02
22	0.695	1.054	0.749	1.148	0.778	1.206
	2.39*	3.48***	2.57*	3.79***	2.67**	3.97***
23	-0.127	0.242	-0.074	0.336	-0.045	0.395
	-0.32	0.6	-0.19	0.83	-0.11	0.97
24	4.332	4.948	4.402	5.071	4.44	5.15
	23.17***	21.19***	23.49***	21.98***	23.65***	21.96***
25	1.07	1.899	1.146	2.035	1.189	2.125
	2.70**	4.34***	2.89**	4.69***	3.00**	4.87***
26	2.576	3.448	2.649	3.583	2.692	3.674
	10.21***	10.84***	10.49***	11.47***	10.65***	11.61***
27	1.322	2.239	1.396	2.376	1.441	2.469

	3.33***	5.02***	3.52***	5.38***	3.63***	5.56***
28	2.704	3.667	2.773	3.802	2.82	3.899
	10.36***	10.86***	10.62***	11.49***	10.78***	11.64***
29	-0.527	0.472	-0.457	0.605	-0.407	0.704
	-0.52	0.45	-0.45	0.58	-0.4	0.68
30	3.657	4.742	3.751	4.884	3.803	4.984
	15.68***	14.08***	16.02***	14.98***	16.21***	15.06***
31 plus	2.46	3.758	2.533	3.898	2.59	4.004
	11.13***	10.50***	11.45***	11.32***	11.66***	11.45***
Constant	-4.044	-4.049	-4.037	-4.015	-4.06	-4.044
	-18.96***	-17.19***	-18.42***	-16.41***	-18.39***	-16.35***
ln_varg (cons)		-0.882		-0.88		-0.842
		-3.76***		-4.13***		-4.02***
N_spell		2454		2454		2454
gammav		0.414		0.415		0.431
se_gammav		0.097		0.088		0.09
ll_nofr		-3.70E+03		-3.60E+03		-3.60E+03
lltest		29.745		39.711		41.322
lltest_p		0.000		0.000		0.000

B-20a: Hazard Model Estimates of the Duration of Breastfeeding, 1998/99

Rural	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ -ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.236	0.272	0.152	0.155	0.147	0.141
	2.33*	2.27*	1.45	1.24	1.39	1.12
Middle/JSS	0.423	0.465	0.295	0.29	0.288	0.277
	4.65***	4.36***	3.11**	2.57*	2.99**	2.42*
Sec.& above	1.598	1.675	1.098	1.193	1.035	1.148
	6.80***	6.39***	4.24***	4.05***	3.95***	3.85***
Age25-34	0.171	0.227	0.135	0.199	0.162	0.222
	1.61	1.86	1.26	1.59	1.51	1.77
Age35-49	0.195	0.235	0.196	0.241	0.2	0.243
	1.78	1.87	1.78	1.85	1.8	1.85
Female child	-0.09	-0.112	-0.106	-0.146	-0.082	-0.127
	-1.28	-1.38	-1.51	-1.75	-1.16	-1.51
Northern Region	-0.724	-0.886	-0.439	-0.57	-0.497	-0.625
	-7.48***	-6.51***	-3.74***	-3.96***	-4.06***	-4.19***
Child's birth95-96	-0.199	-0.212	-0.213	-0.227	-0.266	-0.281
	-1.89	-1.72	-1.99*	-1.78	-2.46*	-2.18*
Child's birth97-99	-0.891	-0.923	-0.885	-0.919	-0.899	-0.935
	-4.31***	-4.24***	-4.27***	-4.16***	-4.33***	-4.22***
Missing birth year	0	0.024	-0.041	-4.19E-04	-0.098	-0.07
	0	0.21	-0.41	0	-0.97	-0.57
Muslim			0.005	0.004	0.01	0.011
			0.04	0.03	0.07	0.07
Traditional			-0.154	-0.214	-0.094	-0.152
			-1.11	-1.32	-0.67	-0.93
Other			0.073	0.068	0.081	0.071
			0.42	0.34	0.47	0.35
Non-Akan			-0.27	-0.354	-0.29	-0.36
			-3.14**	-3.39***	-3.30***	-3.43***
HAS- Basic			0.291	0.328	0.334	0.388
			5.06***	4.87***	5.31***	5.21***
HAS- High			-0.124	-0.163	-0.136	-0.176
			-2.98**	-3.26**	-3.18**	-3.42***
Water distance					2.46E-06	2.63E-06
					1.91	1.81
Market distance					0.003	0.004
					2.67**	2.76**
Access to Health facilities/personnel					-0.09	-0.083
					-0.81	-0.71
Price score of cereals					0.082	0.095
					3.17**	3.04**
Price score of foodstuffs					0.006	-0.017
					0.16	-0.38
Log of real Men's Agric. Wage					0.028	0.038
					1.3	1.5
Ratio of female to men's wage					-0.258	-0.259
					-2.55*	-2.23*
Ratio of child to men's wage					0.038	0.028
					0.4	0.24

B-20b: Baseline Hazard Estimates of the Duration of Breastfeeding, GLSS 4.

Rural	Model 1		Model 2		Model 3	
Time	**A**	**B**	**A**	**B**	**A**	**B**
(Months)	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
2	-2.405	-2.405	-2.406	-2.405	-2.406	-2.406
	-3.26**	-3.26**	-3.26**	-3.26**	-3.26**	-3.26**
3	-0.998	-0.998	-0.999	-0.998	-1	-0.999
	-2.43*	-2.43*	-2.43*	-2.43*	-2.44*	-2.43*
4	-1.269	-1.267	-1.266	-1.262	-1.258	-1.25
	-2.77**	-2.76**	-2.76**	-2.75**	-2.74**	-2.73**
5	-2.349	-2.347	-2.345	-2.339	-2.329	-2.313
	-3.19**	-3.18**	-3.18**	-3.17**	-3.16**	-3.14**
6	-2.331	-2.329	-2.325	-2.319	-2.309	-2.293
	-3.16**	-3.16**	-3.15**	-3.15**	-3.13**	-3.11**
7	-3.007	-3.005	-3	-2.994	-2.984	-2.968
	-2.94**	-2.94**	-2.94**	-2.93**	-2.92**	-2.91**
8	-2.984	-2.982	-2.976	-2.97	-2.961	-2.946
	-2.92**	-2.92**	-2.91**	-2.91**	-2.90**	-2.88**
9	-1.571	-1.569	-1.559	-1.552	-1.545	-1.528
	-2.90**	-2.89**	-2.88**	-2.86**	-2.85**	-2.82**
10	-1.547	-1.543	-1.536	-1.526	-1.517	-1.497
	-2.85**	-2.85**	-2.83**	-2.82**	-2.80**	-2.76**
11	-2.223	-2.219	-2.212	-2.2	-2.193	-2.17
	-3.01**	-3.01**	-3.00**	-2.98**	-2.97**	-2.94**
12	1.266	1.278	1.276	1.298	1.297	1.332
	5.17***	5.22***	5.21***	5.29***	5.29***	5.40***
13	-0.722	-0.702	-0.713	-0.68	-0.69	-0.643
	-1.76	-1.71	-1.73	-1.65	-1.68	-1.56
14	0.227	0.25	0.238	0.276	0.261	0.313
	0.74	0.81	0.78	0.9	0.85	1.01
15	0.23	0.259	0.243	0.289	0.267	0.327
	0.74	0.83	0.78	0.93	0.86	1.04
16	-0.021	0.014	-0.011	0.042	0.013	0.08
	-0.06	0.04	-0.03	0.12	0.04	0.23
17	-0.834	-0.797	-0.826	-0.768	-0.8	-0.729
	-1.82	-1.73	-1.8	-1.67	-1.74	-1.58
18	2.564	2.628	2.589	2.686	2.622	2.733
	11.36***	11.50***	11.46***	11.71***	11.59***	11.79***
19	0.008	0.099	0.051	0.185	0.096	0.245
	0.02	0.26	0.13	0.48	0.25	0.63
20	1.232	1.332	1.282	1.43	1.326	1.489
	4.47***	4.74***	4.65***	5.07***	4.80***	5.23***
21	-1.466	-1.359	-1.411	-1.252	-1.365	-1.193
	-1.99*	-1.84	-1.91	-1.69	-1.85	-1.61
22	0.277	0.388	0.335	0.498	0.39	0.564
	0.75	1.04	0.91	1.33	1.06	1.5
23	-0.293	-0.178	-0.236	-0.067	-0.18	0
	-0.64	-0.38	-0.51	-0.14	-0.39	0
24	4.148	4.374	4.239	4.551	4.31	4.631
	18.81***	17.43***	19.14***	18.13***	19.37***	18.06***
25	1.132	1.461	1.238	1.681	1.32	1.768
	2.74**	3.27**	3.00**	3.78***	3.19**	3.94***
26	2.537	2.887	2.638	3.11	2.719	3.195
	8.90***	8.54***	9.23***	9.30***	9.48***	9.39***
27	1.153	1.526	1.256	1.758	1.342	1.845

	2.50*	3.05**	2.72**	3.54***	2.91**	3.69***
28	2.681	3.077	2.79	3.316	2.88	3.407
	9.07***	8.56***	9.42***	9.37***	9.68***	9.47***
29	-0.386	0.029	-0.283	0.269	-0.189	0.362
	-0.38	0.03	-0.28	0.26	-0.18	0.35
30	3.34	3.798	3.448	4.05	3.54	4.139
	11.92***	10.36***	12.27***	11.33***	12.54***	11.37***
31 plus	2.356	2.959	2.425	3.231	2.515	3.317
	9.29***	7.64***	9.53***	8.70***	9.82***	8.73***
Constant	-4.275	-4.318	-3.955	-3.946	-4.083	-4.149
	-17.08***	-16.39***	-15.44***	-14.42***	-13.75***	-12.74***
ln_varg (cons)		-1.571		-1.353		-1.358
		-3.01**		-3.58***		-3.48***
N_spell		1750		1750		1750
gammav		0.208		0.259		0.257
se_gammav		0.109		0.098		0.1
ll_nofr		-2.40E+03		-2.40E+03		-2.30E+03
lltest		4.754		10.75		9.913
lltest_p		0.015		0.001		0.001

B-21a: Hazard Model Estimates of the Duration of Breastfeeding, 1998/99

Urban	Model 1		Model 2	
	A	**B**	**A**	**B**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Primary	0.205	0.382	0.106	0.21
	1.39	1.75	0.7	0.97
Middle/JSS	0.301	0.329	0.128	0.041
	2.44*	2.04*	0.96	0.21
Sec.& above	0.718	1.043	0.415	0.616
	4.25***	3.96***	2.22*	2.38*
Age35-49	-0.068	-0.039	-0.095	-0.065
	-0.64	-0.28	-0.87	-0.44
Female child	0.09	0.086	0.142	0.113
	0.9	0.66	1.39	0.83
Northern Region	-0.649	-1.016	-0.516	-0.881
	-3.58***	-3.09**	-2.51*	-2.56*
Child's birth95-96	-0.147	-0.169	-0.095	-0.212
	-1.07	-0.91	-0.67	-1.05
Child's birth97-99	-0.503	-0.554	-0.503	-0.65
	-2.29*	-2.11*	-2.28*	-2.35*
Missing birth year	-0.164	-0.114	-0.14	-0.121
	-1.21	-0.62	-1.02	-0.63
Muslim			-0.138	-0.308
			-0.9	-1.3
Traditional			-0.464	-0.503
			-0.98	-0.81
Other			-0.236	-0.413
			-0.84	-1.06
Non-Akan			-0.096	-0.082
			-0.84	-0.52
HAS- Basic			0.23	0.349
			3.90***	3.89***
HAS- High			-0.078	-0.118
			-1.2	-1.36
Water distance			1.18E-04	1.83E-04
			1.5	1.73

B-21b: Baseline Hazard Estimates of the Duration of Breastfeeding, GLSS 4.

Urban	Model 1		Model 2	
Time	**A**	**B**	**A**	**B**
(Months)	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
2	-0.556	-0.552	-0.557	-0.552
	-1	-0.99	-1	-0.99
3	-0.346	-0.337	-0.349	-0.34
	-0.66	-0.64	-0.66	-0.64
4	-0.726	-0.712	-0.73	-0.715
	-1.21	-1.18	-1.21	-1.19
5	-1.398	-1.382	-1.403	-1.385
	-1.79	-1.77	-1.79	-1.77
6	-0.456	-0.439	-0.46	-0.441
	-0.82	-0.79	-0.83	-0.79
7_8	-0.315	-0.293	-0.318	-0.293
	-0.7	-0.65	-0.71	-0.65
9	0.35	0.388	0.351	0.399
	0.76	0.84	0.76	0.87
10	-0.304	-0.259	-0.302	-0.244
	-0.54	-0.46	-0.54	-0.44
11	-0.501	-0.452	-0.5	-0.437
	-0.83	-0.75	-0.83	-0.72
12	2.037	2.119	2.04	2.147
	5.59***	5.75***	5.60***	5.82***
13	0.08	0.197	0.086	0.237
	0.15	0.37	0.16	0.45
14	1.286	1.421	1.296	1.472
	3.17**	3.43***	3.19**	3.55***
15	1.565	1.733	1.579	1.799
	3.97***	4.24***	4.01***	4.41***
16	1.063	1.263	1.082	1.341
	2.45*	2.79**	2.49*	2.97**
17	0.361	0.579	0.38	0.661
	0.68	1.06	0.72	1.21
18	3.465	3.797	3.5	3.926
	9.91***	9.37***	10.00***	9.80***
19	1.111	1.557	1.166	1.735
	2.20*	2.71**	2.31*	3.06**
20	1.811	2.289	1.868	2.476
	4.16***	4.37***	4.28***	4.81***
21	0.726	1.231	0.787	1.431
	1.2	1.82	1.31	2.14*
22	1.464	1.99	1.53	2.199
	3.00**	3.41***	3.13**	3.84***
23	0.134	0.676	0.2	0.888
	0.17	0.8	0.26	1.05
24	4.62	5.482	4.693	5.778
	13.03***	8.62***	13.22***	9.51***
25_26	1.531	2.67	1.606	3.027
	2.54*	2.92**	2.66**	3.46***
27	1.621	2.813	1.698	3.179
	2.07*	2.64**	2.17*	3.10**
28	2.424	3.654	2.474	4.012
	4.02***	3.80***	4.10***	4.37***
29_30	3.368	4.658	3.442	5.035

	8.00***	5.23***	8.16***	6.04***
31 plus	2.259	3.792	2.375	4.243
	4.46***	3.53***	4.66***	4.24***
Constant	-4.371	-4.469	-4.444	-4.513
	-11.91***	-11.24***	-11.72***	-10.70***
ln_varg (cons)		-0.796		-0.625
		-1.3		-1.36
N_spell		704		704
gammav		0.451		0.535
se_gammav		0.275		0.245
ll_nofr		-1.30E+03		-1.20E+03
lltest		3.033		6.829
lltest_p		0.041		0.004

B-22a: Hazard Model Estimates of the Duration of Breastfeeding, 1998/99

Age 15-34	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.303	0.425	0.18	0.246	0.194	0.262
	2.98**	3.08**	1.71	1.81	1.83	1.91
Middle/JSS	0.513	0.57	0.359	0.317	0.395	0.355
	5.64***	4.85***	3.72***	2.57*	4.05***	2.84**
Sec.& above	1.274	1.394	0.848	0.846	0.852	0.847
	7.40***	6.42***	4.58***	3.72***	4.59***	3.68***
Age25-34	0.179	0.238	0.092	0.135	0.108	0.151
	2.10*	2.17*	1.06	1.25	1.24	1.38
Rural	-0.513	-0.72	-0.182	-0.272	-0.187	-0.341
	-6.63***	-6.15***	-1.93	-2.22*	-1.06	-1.49
Female child	-0.075	-0.112	-0.053	-0.112	-0.026	-0.09
	-1.04	-1.2	-0.73	-1.22	-0.36	-0.96
Northern Region	-0.627	-0.93	-0.392	-0.6	-0.428	-0.663
	-5.79***	-5.55***	-3.16**	-3.58***	-3.39***	-3.79***
Child's birth95-96	-0.129	-0.152	-0.09	-0.186	-0.12	-0.232
	-1.2	-1.08	-0.83	-1.3	-1.1	-1.6
Child's birth97-99	-0.632	-0.651	-0.596	-0.659	-0.612	-0.686
	-3.65***	-3.22**	-3.42***	-3.27**	-3.50***	-3.36***
Missing birth year	-0.006	0.021	0.046	0.033	0.007	-0.032
	-0.06	0.15	0.43	0.24	0.06	-0.23
Muslim			-0.135	-0.173	-0.134	-0.162
			-1.11	-1.12	-1.09	-1.03
Traditional			-0.147	-0.19	-0.096	-0.116
			-0.85	-0.88	-0.55	-0.53
Other			-0.192	-0.261	-0.196	-0.272
			-1.04	-1.15	-1.05	-1.18
Non-Akan			-0.13	-0.197	-0.141	-0.205
			-1.53	-1.84	-1.63	-1.87
HAS- Basic			0.334	0.418	0.359	0.457
			6.72***	6.50***	6.88***	6.71***
HAS- High			-0.127	-0.181	-0.139	-0.2
			-2.93**	-3.32***	-3.11**	-3.53***
Water distance					2.08E-05	2.35E-05
					0.77	0.79
Market distance					0.004	0.005
					2.98**	2.90**
Access to Health facilities/personnel					-0.042	-0.043
					-0.38	-0.34
Price score of cereals					0.074	0.1
					2.48*	2.53*
Price score of foodstuffs					-3.04E-04	-0.026
					-0.01	-0.48
Log of real Men's Agric. Wage					0.019	0.029
					0.79	0.98
Ratio of female to men's wage					-0.351	-0.42
					-2.73**	-2.64**
Ratio of child to men's wage					0.111	0.137
					0.91	0.9

B-22b: Baseline Hazard Estimates of the Duration of Breastfeeding, GLSS 4.

Age 15-34	Model 1		Model 2		Model 3	
Time	**A**	**B**	**A**	**B**	**A**	**B**
(Months)	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
2	-1.464	-1.462	-1.465	-1.462	-1.465	-1.463
	-2.65**	-2.64**	-2.65**	-2.64**	-2.65**	-2.65**
3	-1.032	-1.027	-1.033	-1.029	-1.034	-1.03
	-2.19*	-2.18*	-2.19*	-2.18*	-2.19*	-2.18*
4	-1.192	-1.184	-1.19	-1.181	-1.188	-1.175
	-2.36*	-2.34*	-2.35*	-2.34*	-2.35*	-2.32*
5	-1.685	-1.676	-1.683	-1.672	-1.678	-1.659
	-2.70**	-2.69**	-2.70**	-2.68**	-2.69**	-2.66**
6	-1.146	-1.136	-1.143	-1.13	-1.138	-1.117
	-2.27*	-2.25*	-2.26*	-2.24*	-2.25*	-2.21*
7	-2.733	-2.721	-2.729	-2.714	-2.723	-2.7
	-2.66**	-2.65**	-2.66**	-2.64**	-2.65**	-2.63**
8	-0.494	-0.477	-0.486	-0.464	-0.481	-0.45
	-1.21	-1.17	-1.19	-1.14	-1.18	-1.1
9	-0.35	-0.325	-0.337	-0.304	-0.332	-0.291
	-0.89	-0.82	-0.85	-0.77	-0.84	-0.74
10	-0.535	-0.503	-0.519	-0.479	-0.512	-0.461
	-1.26	-1.18	-1.22	-1.12	-1.2	-1.08
11	-1.201	-1.165	-1.184	-1.139	-1.177	-1.121
	-2.17*	-2.11*	-2.14*	-2.06*	-2.13*	-2.02*
12	1.726	1.785	1.746	1.817	1.755	1.84
	6.52***	6.71***	6.59***	6.82***	6.62***	6.88***
13	-0.36	-0.276	-0.336	-0.239	-0.325	-0.21
	-0.85	-0.65	-0.79	-0.56	-0.76	-0.49
14	0.902	0.998	0.932	1.042	0.941	1.072
	2.96**	3.25**	3.05**	3.38***	3.08**	3.47***
15	0.855	0.97	0.887	1.017	0.898	1.048
	2.73**	3.07**	2.84**	3.21**	2.87**	3.30***
16	0.575	0.708	0.608	0.755	0.619	0.788
	1.69	2.06*	1.79	2.20*	1.82	2.29*
17	0.098	0.245	0.133	0.293	0.145	0.326
	0.25	0.61	0.34	0.73	0.37	0.81
18	3.159	3.394	3.211	3.459	3.229	3.504
	12.65***	12.92***	12.84***	13.16***	12.91***	13.19***
19	0.91	1.229	0.985	1.314	1.011	1.371
	2.54*	3.29**	2.75**	3.52***	2.82**	3.65***
20	1.716	2.059	1.8	2.153	1.823	2.209
	5.68***	6.37***	5.94***	6.69***	6.02***	6.79***
21	-1.565	-1.205	-1.482	-1.113	-1.457	-1.055
	-1.52	-1.16	-1.44	-1.08	-1.42	-1.02
22	1.118	1.489	1.203	1.582	1.236	1.647
	3.12**	3.93***	3.35***	4.19***	3.44***	4.33***
23	-0.085	0.299	0.002	0.392	0.034	0.457
	-0.15	0.53	0	0.69	0.06	0.8
24	4.586	5.206	4.713	5.317	4.763	5.407
	18.40***	16.22***	18.81***	17.15***	18.97***	17.13***
25	1.37	2.187	1.514	2.298	1.579	2.403
	2.70**	3.83***	2.98**	4.11***	3.10**	4.27***
26	3.215	4.089	3.351	4.188	3.424	4.3
	10.42***	9.81***	10.82***	10.55***	11.04***	10.68***
27	1.708	2.641	1.84	2.732	1.921	2.853

	3.36***	4.48***	3.62***	4.77***	3.77***	4.94***
28	2.946	3.914	3.062	3.996	3.15	4.124
	8.33***	8.31***	8.64***	8.88***	8.87***	9.07***
29	0.306	1.313	0.423	1.392	0.512	1.523
	0.3	1.22	0.41	1.3	0.5	1.42
30	4.04	5.147	4.179	5.221	4.271	5.353
	13.09***	10.93***	13.48***	11.87***	13.73***	12.00***
31 plus	2.663	4.09	2.75	4.128	2.852	4.276
	8.89***	7.77***	9.15***	8.44***	9.45***	8.62***
Constant	-4.373	-4.346	-4.452	-4.381	-4.515	-4.446
	-15.85***	-14.41***	-15.63***	-14.11***	-15.73***	-14.18***
ln_varg (cons)		-0.827		-0.929		-0.893
		-2.53*		-3.02**		-2.96**
N_spell		1695		1695		1695
gammav		0.437		0.395		0.409
se_gammav		0.143		0.121		0.123
ll_nofr		-2.30E+03		-2.30E+03		-2.30E+03
lltest		13.106		16.318		16.868
lltest_p		0.000		0.000		0.000

B-23a: Hazard Model Estimates of the Duration of Breastfeeding, 1998/99

Age 35-49	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.063	0.117	0.066	0.053	0.039	0.014
	0.42	0.63	0.43	0.27	0.25	0.07
Middle/JSS	0.156	0.173	0.071	0.029	0.033	-0.033
	1.24	1.14	0.53	0.17	0.24	-0.19
Sec.& above	0.506	0.876	0.447	0.837	0.419	0.821
	2.27*	2.89**	1.79	2.58**	1.67	2.50*
Age40-49	-0.18	-0.172	-0.16	-0.142	-0.16	-0.14
	-1.86	-1.46	-1.64	-1.15	-1.63	-1.11
Rural	-0.396	-0.534	-0.161	-0.285	-0.228	-0.381
	-3.45***	-3.63***	-1.1	-1.59	-0.91	-1.28
Female child	0.085	0.077	0.059	0.063	0.073	0.075
	0.9	0.68	0.62	0.52	0.75	0.61
Northern Region	-0.785	-1.027	-0.437	-0.646	-0.483	-0.707
	-5.79***	-5.21***	-2.68**	-2.96**	-2.77**	-3.06**
Child's birth95-96	-0.332	-0.348	-0.3	-0.335	-0.309	-0.344
	-2.38*	-2.05*	-2.13*	-1.87	-2.16*	-1.88
Child's birth97-99	-1.125	-1.164	-1.119	-1.171	-1.103	-1.156
	-3.48***	-3.41***	-3.46***	-3.37***	-3.40***	-3.32***
Missing birth year	-0.131	-0.087	-0.202	-0.164	-0.22	-0.185
	-1.08	-0.58	-1.63	-1.02	-1.75	-1.12
Muslim			0.1	0.167	0.089	0.142
			0.62	0.78	0.53	0.64
Traditional			-0.258	-0.389	-0.223	-0.352
			-1.35	-1.61	-1.13	-1.42
Other			0.326	0.422	0.345	0.462
			1.35	1.35	1.39	1.44
Non-Akan			-0.317	-0.44	-0.311	-0.423
			-2.73**	-2.91**	-2.65**	-2.76**
HAS- Basic			0.145	0.209	0.149	0.217
			2.01*	2.37*	1.94	2.28*
HAS- High			-0.089	-0.097	-0.088	-0.104
			-1.55	-1.35	-1.51	-1.4
Water distance					1.88E-06	2.23E-06
					1.45	1.45
Market distance					0.003	0.003
					1.07	1.17
Access to Health facilities/personnel					-0.133	-0.136
					-0.58	-0.52
Price score of cereals					0.154	0.157
					2.86**	2.52*
Price score of foodstuffs					-0.032	-0.062
					-0.35	-0.55
Log of real Men's Agric. Wage					0.011	0.014
					0.35	0.36
Ratio of female to men's wage					-0.059	-0.02
					-0.38	-0.11
Ratio of child to men's wage					-0.102	-0.177
					-0.68	-0.9

B-23b: Baseline Hazard Estimates of the Duration of Breastfeeding, GLSS 4.

Age 35-49	Model 1		Model 2		Model 3	
Time	**A**	**B**	**A**	**B**	**A**	**B**
(Months)	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
2	-1.513	-1.511	-1.512	-1.509	-1.513	-1.51
	-2.38*	-2.38*	-2.38*	-2.37*	-2.38*	-2.37*
3	-0.513	-0.508	-0.511	-0.504	-0.513	-0.505
	-1.16	-1.15	-1.15	-1.14	-1.16	-1.14
4	-0.965	-0.956	-0.961	-0.946	-0.946	-0.93
	-1.85	-1.83	-1.85	-1.82	-1.81	-1.78
5	-2.554	-2.543	-2.55	-2.531	-2.518	-2.498
	-2.47*	-2.46*	-2.46*	-2.44*	-2.43*	-2.41*
6	-1.855	-1.843	-1.85	-1.83	-1.817	-1.797
	-2.45*	-2.44*	-2.45*	-2.42*	-2.40*	-2.37*
7_8	-2.124	-2.113	-2.119	-2.1	-2.086	-2.066
	-3.34***	-3.32***	-3.33***	-3.30***	-3.27**	-3.24**
9	-1.112	-1.097	-1.105	-1.076	-1.073	-1.042
	-1.96*	-1.93	-1.95	-1.9	-1.89	-1.83
10	-2.483	-2.464	-2.478	-2.446	-2.445	-2.412
	-2.40*	-2.38*	-2.39*	-2.36*	-2.36*	-2.33*
11	-1.781	-1.761	-1.777	-1.744	-1.745	-1.71
	-2.36*	-2.33*	-2.35*	-2.31*	-2.31*	-2.26*
12	1.252	1.293	1.254	1.313	1.286	1.348
	4.01***	4.13***	4.02***	4.19***	4.10***	4.27***
13	-0.551	-0.488	-0.55	-0.465	-0.519	-0.43
	-1.13	-1	-1.13	-0.95	-1.06	-0.87
14	0.178	0.249	0.179	0.276	0.21	0.312
	0.45	0.63	0.45	0.7	0.53	0.78
15	0.65	0.741	0.654	0.778	0.685	0.815
	1.82	2.06*	1.83	2.16*	1.91	2.25*
16	0.118	0.226	0.123	0.271	0.154	0.309
	0.28	0.54	0.3	0.65	0.37	0.73
17	-1.455	-1.338	-1.451	-1.293	-1.419	-1.254
	-1.92	-1.76	-1.92	-1.7	-1.87	-1.65
18	2.445	2.611	2.46	2.689	2.497	2.736
	8.43***	8.66***	8.48***	8.87***	8.54***	8.94***
19	-0.699	-0.488	-0.673	-0.38	-0.627	-0.321
	-1.1	-0.76	-1.06	-0.59	-0.98	-0.5
20	1.026	1.249	1.051	1.361	1.098	1.422
	2.79**	3.26**	2.86**	3.53***	2.97**	3.67***
21	-0.073	0.166	-0.045	0.286	0.003	0.348
	-0.14	0.31	-0.09	0.53	0	0.65
22	-0.036	0.212	-0.006	0.335	0.041	0.398
	-0.07	0.4	-0.01	0.62	0.08	0.74
23	-0.228	0.026	-0.2	0.15	-0.152	0.214
	-0.4	0.04	-0.35	0.26	-0.27	0.37
24	3.998	4.437	4.04	4.642	4.094	4.724
	14.11***	12.63***	14.25***	12.98***	14.31***	12.99***
25	0.704	1.307	0.751	1.571	0.806	1.663
	1.1	1.88	1.18	2.24*	1.26	2.36*
26	1.278	1.899	1.33	2.173	1.382	2.265
	2.44*	3.18**	2.54*	3.61***	2.63**	3.72***
27	0.834	1.473	0.89	1.756	0.94	1.846
	1.31	2.09*	1.39	2.48*	1.47	2.59**
28	2.435	3.111	2.489	3.402	2.542	3.497

	6.27***	6.23***	6.41***	6.73***	6.52***	6.81***
29_30	2.37	3.09	2.427	3.388	2.48	3.485
	6.66***	6.32***	6.81***	6.85***	6.92***	6.92***
31 plus	2.205	3.022	2.301	3.358	2.348	3.449
	6.71***	6.02***	6.98***	6.65***	7.05***	6.69***
Constant	-3.354	-3.322	-3.349	-3.277	-3.361	-3.286
	-10.87***	-10.08***	-10.49***	-9.30***	-10.37***	-9.11***
ln_varg (cons)		-1.239		-0.993		-0.953
		-2.61**		-2.67**		-2.60**
N_spell		759		759		759
gammav		0.29		0.371		0.386
se_gammav		0.138		0.138		0.141
ll_nofr		-1.30E+03		-1.30E+03		-1.30E+03
lltest		4.868		9.015		9.471
lltest_p		0.014		0.001		0.001

B-24a: Hazard Model Estimates of the Age at Cohabitation, 1987/88

Full	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.091	0.083	0.081	0.074	0.07	0.034
	1.25	0.94	1.08	0.82	0.93	0.34
Middle/JSS	-0.162	-0.227	-0.161	-0.225	-0.186	-0.298
	-2.96**	-3.19**	-2.65**	-2.88**	-3.03**	-3.39***
Sec. & above	-0.745	-0.987	-0.682	-0.922	-0.689	-1.053
	-6.51***	-5.66***	-5.66***	-5.23***	-5.72***	-5.37***
Still in School	-0.994	-1.083	-0.966	-1.059	-0.976	-1.125
	-4.92***	-4.90***	-4.78***	-4.77***	-4.83***	-4.83***
Age25-34	-0.096	-0.15	-0.137	-0.202	-0.128	-0.215
	-1.76	-2.15*	-2.47*	-2.80**	-2.30*	-2.76**
Age35-49	-0.193	-0.246	-0.23	-0.303	-0.225	-0.328
	-3.15**	-3.17**	-3.70***	-3.73***	-3.60***	-3.73***
Rural	0.333	0.383	0.286	0.334	0.264	0.26
	6.68***	6.09***	5.47***	5.09***	3.36***	2.57*
Northern Region	0.138	0.146	0.157	0.198	0.288	0.392
	1.47	1.27	1.56	1.58	2.50*	2.52*
Father Schooled			-0.02	-0.029	-0.035	-0.052
			-0.32	-0.39	-0.58	-0.64
Father Farmer			0.206	0.244	0.198	0.25
			3.59***	3.40***	3.46***	3.23**
Muslim			0.078	0.064	0.092	0.078
			1.01	0.68	1.19	0.78
Traditional			-0.066	-0.121	-0.04	-0.103
			-0.98	-1.43	-0.58	-1.09
Other			0.063	0.103	0.041	0.079
			0.69	0.89	0.44	0.62
Non-Akan			-0.17	-0.198	-0.164	-0.18
			-3.41***	-3.22**	-3.16**	-2.65**
Access to Health facilities/personnel					0.036	0.01
					0.88	0.2
Primary distance					-0.031	-0.049
					-2.10*	-2.51*
Middle/JSS distance					-0.011	-0.017
					-1.84	-2.05*
Sec. distance					-0.001	0
					-0.31	0.09
Log of real men's agric. wage					0.023	0.041
					1.38	1.82
Ratio of female to men's wage					0.038	0.099
					0.5	0.95
Ratio of child to men's wage					-0.015	-0.031
					-0.16	-0.25

B-24b: Baseline Hazard Model Estimates of the Age at Cohabitation, 1987/88

Full	Model 1		Model 2		Model 3	
Time	**A**	**B**	**A**	**B**	**A**	**B**
(Years)	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
13	2.6	2.607	2.6	2.607	2.601	2.614
	10.47***	10.50***	10.47***	10.50***	10.48***	10.52***
14	3.892	3.91	3.893	3.912	3.895	3.927
	19.30***	19.37***	19.30***	19.38***	19.31***	19.43***
15	5.288	5.35	5.292	5.359	5.297	5.406
	28.39***	28.34***	28.41***	28.38***	28.44***	28.35***
16	5.624	5.766	5.631	5.785	5.638	5.883
	30.20***	29.01***	30.24***	29.09***	30.27***	28.50***
17	5.533	5.761	5.545	5.791	5.554	5.94
	29.15***	26.23***	29.21***	26.39***	29.25***	25.32***
18	6.293	6.643	6.311	6.686	6.322	6.904
	33.51***	26.32***	33.60***	26.61***	33.65***	24.75***
19	5.804	6.278	5.83	6.335	5.84	6.618
	28.90***	20.71***	29.01***	21.10***	29.06***	19.52***
20	6.86	7.498	6.888	7.565	6.898	7.936
	34.92***	20.64***	35.04***	21.14***	35.08***	19.12***
21	5.516	6.289	5.542	6.359	5.553	6.803
	19.96***	13.63***	20.04***	14.00***	20.08***	13.12***
22	5.989	6.828	6.015	6.9	6.025	7.38
	22.09***	14.09***	22.17***	14.47***	22.21***	13.42***
23	5.634	6.522	5.666	6.6	5.675	7.11
	15.95***	11.75***	16.04***	12.08***	16.06***	11.44***
24	6.118	7.076	6.158	7.162	6.168	7.712
	17.83***	12.26***	17.93***	12.62***	17.96***	11.81***
25plus	5.535	7.028	5.634	7.152	5.643	7.866
	17.83***	9.74***	18.08***	10.24***	18.07***	9.96***
constant	-6.815	-6.791	-6.807	-6.777	-6.816	-6.793
	-35.97***	-34.95***	-34.46***	-32.89***	-34.46***	-32.22***
ln_varg (cons)		-1.33		-1.28		-0.857
		-2.75**		-2.86**		-2.40*
N	3.80E+04	3.80E+04	3.80E+04	3.80E+04	3.80E+04	3.80E+04
ll	-4.60E+03	-4.60E+03	-4.50E+03	-4.50E+03	-4.50E+03	-4.50E+03
chi2	6739.766		6772.622		6787.752	
N_spell		2237		2237		2237
gammav		0.265		0.278		0.424
se_gammav		0.128		0.124		0.151
ll_nofr		-4.60E+03		-4.50E+03		-4.50E+03
lltest		6.295		6.897		13.353
lltest_p		0.006		0.004		0.000

B-25a: Hazard Model Estimates of the Age at Cohabitation, 1987/88

Rural	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.148	0.161	0.102	0.095	0.1	0.024
	1.66	1.3	1.12	0.71	1.08	0.14
Middle/JSS	-0.012	-0.036	-0.062	-0.138	-0.091	-0.271
	-0.17	-0.38	-0.83	-1.22	-1.2	-1.87
Sec. & above	-0.785	-1.258	-0.799	-1.426	-0.798	-1.874
	-3.94***	-3.34***	-3.92***	-3.77***	-3.90***	-4.07***
Still in School	-1.155	-1.394	-1.1	-1.392	-1.11	-1.644
	-4.21***	-4.17***	-4.00***	-4.13***	-4.03***	-4.19***
Age25-34	-0.17	-0.261	-0.207	-0.32	-0.205	-0.346
	-2.50*	-2.60**	-2.99**	-3.03**	-2.95**	-2.73**
Age35-49	-0.256	-0.362	-0.285	-0.439	-0.284	-0.501
	-3.36***	-3.21**	-3.68***	-3.63***	-3.65***	-3.47***
Northern Region	0.11	0.128	0.216	0.361	0.303	0.607
	0.98	0.8	1.8	1.92	2.06*	2.29*
Father Schooled			-0.038	0.015	-0.067	-0.003
			-0.47	0.12	-0.83	-0.02
Father Farmer			0.119	0.149	0.109	0.151
			1.62	1.36	1.48	1.11
Muslim			-0.101	-25%	-0.085	-0.282
			-0.98	-1.61	-0.81	-1.5
Traditional			-0.127	-0.238	-0.125	-0.256
			-1.68	-2.01*	-1.58	-1.77
Other			-0.003	0.079	-0.018	0.039
			-0.03	0.48	-0.16	0.2
Non-Akan			-0.183	-0.264	-0.201	-0.273
			-2.91**	-2.77**	-2.99**	-2.34*
Access to Health facilities/personnel					0.028	-0.071
					0.68	-0.94
Primary distance					-0.03	-0.065
					-2.03*	-2.50*
Middle/JSS distance					-0.008	-0.021
					-1.19	-1.85
Sec. distance					0.001	0.005
					0.54	1.41
Log of real men's Agric. Wage					0.021	0.102
					1.12	2.40*
Ratio of female to men's wage					-0.004	0.066
					-0.05	0.45
Ratio of child to men's wage					-0.076	-0.258
					-0.8	-1.42

B-25b: Baseline Hazard Model Estimates of the Age at Cohabitation, 1987/88

Rural	Model 1		Model 2		Model 3	
Time	**A**	**B**	**A**	**B**	**A**	**B**
(Years)	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
13	2.428	2.441	2.428	2.444	2.429	2.467
	8.40***	8.45***	8.40***	8.46***	8.41***	8.53***
14	3.79	3.827	3.79	3.837	3.793	3.898
	16.68***	16.76***	16.68***	16.81***	16.69***	16.89***
15	5.188	5.317	5.193	5.36	5.198	5.546
	24.90***	23.89***	24.92***	24.31***	24.94***	22.80***
16	5.5	5.798	5.507	5.889	5.514	6.276
	26.34***	21.12***	26.38***	22.34***	26.41***	18.64***
17	5.322	5.797	5.334	5.936	5.342	6.514
	24.73***	16.40***	24.78***	18.01***	24.82***	14.41***
18	6.182	6.924	6.2	7.136	6.212	8.011
	29.21***	14.23***	29.28***	16.18***	29.33***	12.40***
19	5.681	6.707	5.708	6.992	5.723	8.157
	24.47***	10.38***	24.57***	12.13***	24.63***	9.59***
20	6.911	8.416	6.936	8.816	6.947	10.533
	30.51***	9.13***	30.60***	10.79***	30.63***	8.33***
21	5.111	7.017	5.131	7.496	5.131	9.578
	11.92***	5.87***	11.95***	7.03***	11.95***	6.13***
22	6.511	8.714	6.541	9.268	6.539	11.718
	19.48***	6.43***	19.51***	7.70***	19.51***	6.42***
23	5.728	8.232	5.737	8.857	5.721	11.657
	9.29***	5.02***	9.31***	5.99***	9.28***	5.39***
24	5.934	8.691	5.968	9.378	5.942	12.444
	7.97***	4.70***	7.98***	5.58***	7.93***	5.10***
25plus	4.427	8.583	4.548	9.626	4.543	13.78
	6.01***	3.00**	6.14***	3.85***	6.11***	4.30***
constant	-6.368	-6.299	-6.279	-6.145	-6.278	-6.409
	-30.86***	-29.37***	-28.57***	-25.03***	-26.80***	-21.30***
ln_varg (cons)		-0.662		-0.451		0.185
		-1.11		-1.08		0.55
	2.30E+04	2.30E+04	2.30E+04	2.30E+04	2.30E+04	2.30E+04
ll	-2.80E+03	-2.80E+03	-2.80E+03	-2.80E+03	-2.80E+03	-2.80E+03
chi2	4471.297		4489.059		4498.216	
N_spell		1403		1403		1403
gammav		0.516		0.637		1.204
se_gammav		0.307		0.266		0.41
ll_nofr		-2.80E+03		-2.80E+03		-2.80E+03
lltest		3.97		7.612		18.39
lltest_p		0.023		0.003		0.000

B-26a: Hazard Model Estimates of the Age at Cohabitation, 1987/88

Urban	Model 1		Model 2	
	A	**B**	**A**	**B**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Primary	-0.067	-0.261	-0.015	-0.106
	-0.52	-1.19	-0.12	-0.54
Middle/JSS	-0.416	-0.802	-0.297	-0.505
	-4.64***	-3.80***	-2.86**	-2.86**
Sec. & above	-0.871	-1.609	-0.646	-1.086
	-6.01***	-4.16***	-3.99***	-3.56***
Still in School	-0.796	-0.897	-0.786	-0.89
	-2.66**	-2.30*	-2.62**	-2.36*
Age25-34	0.037	-0.056	-0.007	-0.117
	0.4	-0.37	-0.08	-0.8
Age35-49	-0.04	-0.183	-0.073	-0.207
	-0.38	-1.04	-0.69	-1.24
Northern Region	0.237	0.387	0.099	0.202
	1.38	1.27	0.52	0.67
Father Schooled			-0.026	-0.104
			-0.28	-0.73
Father Farmer			0.308	0.471
			3.45***	3.30***
Muslim			0.283	0.392
			2.29*	2.10*
Traditional			0.174	0.061
			1.13	0.27
Other			0.3	0.397
			1.75	1.48
Non-Akan			-0.144	-0.177
			-1.73	-1.42

B-26b: Baseline Hazard Model Estimates of the Age at Cohabitation, 1987/88

Urban	Model 1		Model 2	
Time	**A**	**B**	**A**	**B**
(Years)	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
13	3.108	3.128	3.108	3.125
	6.12***	6.16***	6.12***	6.16***
14	4.236	4.288	4.239	4.285
	9.54***	9.64***	9.55***	9.64***
15	5.636	5.816	5.645	5.802
	13.47***	13.51***	13.49***	13.61***
16	6.038	6.449	6.053	6.406
	14.47***	13.68***	14.50***	14.16***
17	6.096	6.754	6.128	6.69
	14.53***	12.44***	14.60***	13.41***
18	6.691	7.687	6.732	7.576
	16.01***	11.58***	16.11***	13.10***
19	6.224	7.546	6.271	7.381
	14.44***	9.39***	14.54***	10.91***
20	7.095	8.814	7.152	8.577
	16.66***	8.96***	16.78***	10.76***
21	6.107	8.155	6.176	7.857
	12.73***	7.03***	12.86***	8.43***
22	5.898	8.131	5.97	7.801
	11.39***	6.45***	11.52***	7.72***
23	5.99	8.372	6.07	8.016
	11.06***	6.23***	11.19***	7.47***
24	6.565	9.177	6.648	8.78
	12.65***	6.31***	12.80***	7.67***
25plus	6.173	9.725	6.26	9.22
	12.58***	5.54***	12.73***	6.74***
constant	-7.164	-6.906	-7.364	-7.269
	-17.19***	-15.74***	-17.24***	-16.09***
ln_varg (cons)				
_cons		-0.111		-0.319
		-0.21		-0.67
N	1.50E+04	1.50E+04	1.50E+04	1.50E+04
N_clust				
ll	-1.70E+03	-1.70E+03	-1.70E+03	-1.70E+03
chi2	2307.704		2331.762	
N_spell		834		834
gammav		0.895		0.727
se_gammav		0.466		0.349
ll_nofr		-1.70E+03		-1.70E+03
lltest		11.905		12.495
lltest_p		0.000		0.000

B-27a: Hazard Model Estimates of the Age at Cohabitation, 1987/88

Age15-34	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	-0.012	-0.014	0.024	0.023	0.016	0.003
	-0.14	-0.16	0.28	0.24	0.18	0.03
Middle/JSS	-0.189	-0.195	-0.138	-0.157	-0.159	-0.201
	-2.91**	-2.58*	-1.99*	-1.97*	-2.26*	-2.27*
Sec. & above	-0.751	-0.772	-0.636	-0.707	-0.644	-0.778
	-5.49***	-4.27***	-4.43***	-3.88***	-4.48***	-3.95***
Still in School	-0.986	-0.997	-0.966	-1.008	-0.976	-1.058
	-4.87***	-4.69***	-4.76***	-4.65***	-4.81***	-4.70***
Age25-34	-0.104	-0.109	-0.138	-0.166	-0.131	-0.178
	-1.89	-1.7	-2.48*	-2.34*	-2.34*	-2.39*
Rural	0.386	0.392	0.335	0.358	0.338	0.362
	6.54***	5.55***	5.40***	4.87***	3.55***	3.31***
Northern Region	0.237	0.24	0.222	0.238	0.365	0.423
	1.97*	1.93	1.77	1.72	2.47*	2.42*
Non-Akan	-0.108	-0.112	-0.109	-0.123	-0.107	-0.125
	-1.92	-1.8	-1.87	-1.86	-1.78	-1.76
Father Schooled			-0.014	-0.012	-0.024	-0.021
			-0.21	-0.16	-0.35	-0.27
Father Farmer			0.207	0.233	0.204	0.25
			3.17**	2.97**	3.13**	3.01**
Muslim			0.048	0.044	0.055	0.049
			0.53	0.45	0.6	0.47
Traditional			-0.003	-0.011	0.035	0.025
			-0.04	-0.12	0.43	0.26
Other			0.117	0.144	0.108	0.147
			1.1	1.16	0.99	1.11
Access to Health facilities/personnel					0.06	0.057
					1.25	1.04
Primary distance					-0.017	-0.022
					-0.98	-1.1
Middle/JSS distance					-0.012	-0.015
					-1.55	-1.67
Sec. distance					-0.001	-0.001
					-0.55	-0.45
Log of real men's Agric. Wage					0.01	0.018
					0.52	0.76
Ratio of female to men's wage					0.034	0.031
					0.38	0.29
Ratio of child to men's wage					0.034	0.039
					0.32	0.31

B-27b: Baseline Hazard Model Estimates of the Age at Cohabitation, 1987/88

Age15-34	Model 1		Model 2		Model 3	
Time	**A**	**B**	**A**	**B**	**A**	**B**
(Years)	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
13	2.675	2.676	2.675	2.678	2.676	2.681
	9.24***	9.24***	9.24***	9.24***	9.24***	9.25***
14	3.958	3.96	3.958	3.966	3.959	3.974
	16.64***	16.63***	16.64***	16.66***	16.65***	16.68***
15	5.321	5.327	5.323	5.35	5.326	5.377
	24.09***	23.80***	24.09***	23.87***	24.11***	23.86***
16	5.671	5.685	5.674	5.736	5.678	5.795
	25.67***	24.10***	25.69***	24.20***	25.71***	23.93***
17	5.656	5.679	5.659	5.76	5.666	5.853
	25.18***	21.67***	25.20***	21.83***	25.23***	21.33***
18	6.357	6.393	6.362	6.516	6.369	6.656
	28.48***	20.94***	28.50***	21.17***	28.53***	20.34***
19	5.911	5.961	5.922	6.131	5.928	6.313
	24.75***	16.13***	24.79***	16.48***	24.81***	15.83***
20	6.882	6.947	6.896	7.171	6.901	7.406
	29.27***	15.76***	29.32***	16.18***	29.33***	15.40***
21	5.629	5.707	5.647	5.975	5.654	6.257
	17.05***	10.23***	17.10***	10.72***	17.12***	10.44***
22	5.832	5.916	5.839	6.192	5.843	6.492
	16.55***	9.98***	16.57***	10.36***	16.59***	10.07***
23	5.702	5.788	5.712	6.075	5.72	6.389
	13.05***	8.80***	13.07***	9.15***	13.08***	8.98***
24	6.655	6.747	6.653	7.044	6.671	7.391
	17.12***	10.30***	17.12***	10.56***	17.14***	10.18***
25plus	5.877	5.985	5.86	6.326	5.877	6.736
	10.71***	7.21***	10.68***	7.41***	10.71***	7.29***
constant	-6.829	-6.826	-6.941	-6.948	-6.946	-6.961
	-30.15***	-29.96***	-29.83***	-29.39***	-29.84***	-29.03***
ln_varg (cons)						
_cons		-3.638		-2.208		-1.598
		-0.64		-1.6		-1.91
N	2.80E+04	2.80E+04	2.80E+04	2.80E+04	2.80E+04	2.80E+04
N_clust						
ll	-3.20E+03	-3.20E+03	-3.20E+03	-3.20E+03	-3.20E+03	-3.20E+03
chi2	4884.885		4898.969		4906.466	
N_spell		1650		1650		1650
gammav		0.026		0.11		0.202
se_gammav		0.15		0.151		0.17
ll_nofr		-3.20E+03		-3.20E+03		-3.20E+03
lltest		0.032		0.587		1.722
lltest_p		0.429		0.222		0.095

B-28a: Hazard Model Estimates of the Age at Cohabitation, 1987/88

Age35-49	Model 1		Model 2		Model 3	
	A	**B**	**A**	**B**	**A**	**B**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	0.408	0.382	0.294	0.26	0.269	0.145
	2.69**	1.88	1.88	1.24	1.71	0.57
Middle/JSS	-0.266	-0.38	-0.312	-0.468	-0.354	-0.624
	-2.23*	-2.30*	-2.32*	-2.47*	-2.60**	-2.69**
Sec. & above	-0.834	-1.472	-0.868	-1.555	-0.889	-1.976
	-3.91***	-3.46***	-3.83***	-3.41***	-3.87***	-3.42***
Age40-49	-0.09	-0.08	-0.088	-0.079	-0.098	-0.11
	-1.01	-0.65	-0.98	-0.63	-1.09	-0.74
Rural	0.184	0.234	0.181	0.221	0.163	-0.054
	1.92	1.78	1.8	1.58	1.14	-0.21
Northern Region	0.066	0.077	0.067	0.194	0.197	0.439
	0.43	0.35	0.39	0.76	1.02	1.28
Father Schooled			-0.016	-0.094	-0.029	-0.145
			-0.12	-0.5	-0.21	-0.65
Father Farmer			0.174	0.136	0.164	0.139
			1.43	0.8	1.32	0.69
Muslim			0.161	0.083	0.195	0.123
			1.11	0.41	1.33	0.52
Traditional			-0.177	-0.409	-0.196	-0.469
			-1.43	-2.07*	-1.5	-2.01*
Other			-0.076	-0.146	-0.143	-0.32
			-0.43	-0.57	-0.8	-1.04
Non-Akan			-0.315	-0.377	-0.328	-0.32
			-3.26**	-2.74**	-3.14**	-1.89
Access to Health facilities/personnel					-0.012	-0.135
					-0.15	-1.08
Primary distance					-0.066	-0.143
					-2.47*	-2.81**
Middle/JSS distance					-0.016	-0.018
					-1.44	-1.06
Sec. distance					0.003	0.006
					0.71	1.03
Log of real men's agric. Wage					0.046	0.087
					1.6	1.61
Ratio of female to men's wage					0.085	0.465
					0.56	1.64
Ratio of child to men's wage					-0.215	-0.254
					-1.16	-0.86

B-28b: Baseline Hazard Model Estimates of the Age at Cohabitation, 1987/88

Age35-49	Model 1		Model 2		Model 3	
Time	**A**	**B**	**A**	**B**	**A**	**B**
(Years)	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
13	2.389	2.4	2.39	2.404	2.392	2.425
	4.92***	4.94***	4.92***	4.95***	4.92***	4.99***
14	3.711	3.741	3.714	3.748	3.72	3.804
	9.72***	9.79***	9.73***	9.81***	9.75***	9.89***
15	5.207	5.316	5.215	5.334	5.231	5.493
	15.03***	15.11***	15.05***	15.12***	15.09***	14.82***
16	5.511	5.768	5.528	5.805	5.553	6.112
	15.91***	15.44***	15.96***	15.42***	16.02***	14.05***
17	5.226	5.627	5.259	5.687	5.286	6.115
	14.67***	13.52***	14.76***	13.53***	14.83***	11.74***
18	6.174	6.789	6.223	6.872	6.259	7.484
	17.77***	14.19***	17.90***	14.22***	17.99***	11.43***
19	5.605	6.445	5.661	6.534	5.708	7.323
	15.09***	11.12***	15.23***	11.21***	15.34***	9.00***
20	6.839	8.022	6.914	8.114	6.968	9.168
	19.02***	11.11***	19.18***	11.28***	19.30***	8.60***
21	5.299	6.764	5.392	6.856	5.444	8.109
	10.48***	7.35***	10.64***	7.52***	10.73***	6.19***
22	6.186	7.809	6.285	7.9	6.33	9.283
	13.87***	8.07***	14.05***	8.28***	14.14***	6.51***
23	5.494	7.276	5.602	7.368	5.638	8.868
	9.09***	6.49***	9.24***	6.67***	9.30***	5.52***
24	4.949	6.841	5.073	6.94	5.102	8.513
	6.32***	5.37***	6.46***	5.53***	6.50***	4.85***
25plus	5.334	8.15	5.495	8.272	5.521	10.172
	12.03***	5.96***	12.25***	6.22***	12.24***	5.28***
constant	-6.712	-6.724	-6.64	-6.516	-6.655	-6.616
	-19.29***	-18.68***	-17.94***	-16.22***	-17.83***	-15.44***
ln_varg (cons)		-0.667		-0.659		-0.083
		-1.25		-1.27		-0.18
N	1.00E+04	1.00E+04	1.00E+04	1.00E+04	1.00E+04	1.00E+04
N_clust						
ll	-1.30E+03	-1.30E+03	-1.30E+03	-1.30E+03	-1.30E+03	-1.30E+03
chi2	1878.84		1898.957		1912.183	
N_spell		587		587		587
gammav		0.513		0.517		0.921
se_gammav		0.273		0.268		0.416
ll_nofr		-1.30E+03		-1.30E+03		-1.30E+03
lltest		7.77		7.425		14.759
lltest_p		0.003		0.003		0.000

B-29a: Summary Statistics – Woman has at least one Child and Number of Births, 1987/88

	Full		**Rural**		**Urban**		**Age15-34**		**Age35-49**	
GLSS 1										
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Child	0.798	0.402	0.823	0.382	0.757	0.429	0.732	0.443	0.983	0.130
Number of live births	3.136	2.806	3.401	2.927	2.695	2.526	2.061	1.916	6.164	2.693
Age15-24	0.362	0.481	0.366	0.482	0.356	0.479	0.491	0.500		
Age25-34	0.376	0.484	0.365	0.482	0.393	0.489	0.509	0.500		
Age35-49	0.262	0.440	0.269	0.444	0.251	0.434				
Age40-49									0.595	0.491
Trad. Cont (M1)	-0.723	0.829	-1.037	0.689	-0.198	0.805	-0.475	0.784	-1.443	0.540
Mod. Cont (M1)	-3.022	1.239	-3.502	1.154	-2.311	1.051	-2.728	1.201	-7.081	9.901
Trad. Cont (M2)	-0.743	0.946	-1.076	0.833	-0.205	0.950	-0.484	0.907	-1.538	0.891
Mod. Cont (M2)	-3.129	1.438	-11.661	17.901	-4.669	8.719	-2.825	1.395	-13.644	15.983
Trad. Cont (M3)	-0.788	1.247	-1.150	1.125	-0.204	1.271	-0.500	1.182	-1.734	1.324
Mod. Cont (M3)	-3.334	1.807	-10.670	15.122	-4.544	8.250	-2.967	1.707	-32.596	30.318
Age at Cohab (M1)	18.696	10.839	18.962	10.993	18.833	11.033	18.442	10.894	20.034	11.244
Age at Cohab (M2)	16.763	12.253	18.853	10.974	18.423	10.647	18.601	10.783	19.426	10.817
Age at Cohab (M3)	18.170	10.772	17.896	10.771			18.784	11.000	19.313	10.615
Observations	2237		1403		834		1650		587	

Note: Predicted values of the proximates are used. Sample weights are applied in the calculations for GLSS 4.
M1, M2, and M3 represent Models 1, 2 and 3 respectively.

B-29a contd: Summary Statistics – Woman has at least one Child and Number of Births, 1998/99

	Full		Rural		Urban		Age15-34		Age35-49	
GLSS 4										
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Child	0.709	0.454	0.753	0.432	0.636	0.481	0.573	0.495	0.981	0.135
Number of live births	2.835	2.766	3.231	2.895	2.179	2.398	1.584	1.853	5.360	2.573
Age15-24	0.356	0.479	0.333	0.471	0.395	0.489	0.533	0.499		
Age25-34	0.313	0.464	0.322	0.467	0.298	0.457	0.467	0.499		
Age35-49	0.331	0.471	0.346	0.476	0.307	0.461				
Age40-49									0.596	0.491
Trad. Cont (M1)	-3.090	0.990	-2.922	0.837	-3.546	1.406	-3.251	1.108	-2.920	0.877
Mod. Cont (M1)	-2.185	0.831	-2.165	0.826	-2.269	0.907	-2.322	0.967	-2.029	0.627
Trad. Cont (M2)	-3.114	1.005	-2.946	0.849	-3.590	1.426	-3.302	1.134	-3.015	1.039
Mod. Cont (M2)	-2.230	0.891	-2.228	0.911	-2.297	0.947	-2.363	1.013	-2.108	0.778
Trad. Cont (M3)	-3.451	1.317	-3.382	1.276	-3.763	1.603	-3.634	1.493	-3.452	1.449
Mod. Cont (M3)	-2.352	1.048	-2.392	1.085	-2.339	1.042	-2.503	1.169	-2.233	0.996
Observations	5863		3657		2206		3921		1942	

Note: Predicted values of the proximates are used. Sample weights are applied in the calculations for GLSS 4.
M1, M2, and M3 represents Models 1, 2 and 3 respectively

B-29b: Summary Statistics – Number of Births conditional on at Least One Birth, 1987/88

	Full		Rural		Urban		Age15-34		Age35-49	
GLSS 1										
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Number of live births	3.824	2.529	4.002	2.626	3.480	2.277	2.854	1.676	6.826	2.341
Age15-24			0.287	0.453	0.264	0.441	0.370	0.483		
Age25-34	0.476	0.500	0.446	0.497	0.535	0.499	0.630	0.483		
Age35-49	0.245	0.430	0.267	0.443	0.201	0.401				
Age40-49									0.536	0.499
Trad. Cont (M1)	-0.887	0.592	-1.154	0.390	-0.379	0.603	-0.690	0.491	-1.498	0.512
Mod. Cont (M1)	-3.148	1.168	-3.601	1.019	-2.344	1.065	-2.888	1.137	-7.236	10.069
Trad. Cont (M2)	-0.925	0.711	-1.192	0.576	-0.426	0.766	-0.717	0.625	-1.561	0.704
Mod. Cont (M2)	-3.263	1.344	-11.525	17.697	-4.919	8.984	-2.992	1.302	-13.912	15.909
Trad. Cont (M3)	-0.981	1.031	-1.258	0.918	-0.460	1.104	-0.752	0.928	-1.730	1.196
Mod. Cont (M3)	-3.481	1.696	-10.552	14.958	-4.816	8.494	-3.155	1.599	-33.622	29.611
Age at Cohab (M1)	18.573	10.971	19.098	11.036	18.863	11.143	18.477	10.865	20.696	11.749
Age at Cohab (M2)	16.874	12.360	18.932	11.347	18.564	10.652	18.640	10.824	19.081	10.868
Age at Cohab (M3)	18.043	10.887	17.983	11.047	n.a		18.892	11.136	18.852	10.665
Breastfeeding (M1)	18.097	12.852	18.772	12.754	18.712	12.372	17.230	9.440	19.333	9.976
Breastfeeding (M2)	18.174	12.806	19.535	10.198	15.518	8.442	18.455	12.693	n.converge	
Breastfeeding (M3)	18.496	13.070	19.632	10.027	n.a		18.000	12.270	n.converge	
Observations	1409		936		473		1064		345	

Note: Predicted values of the proximates are used. Sample weights are applied in the calculations for GLSS 4.
M1, M2, and M3 represent Models 1, 2 and 3 respectively

B-29b contd: Summary Statistics – Number of Births conditional on at Least One Birth, 1998/99

	Full		Rural		Urban		Age15-34		Age35-49	
GLSS 4										
Variable	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Number of live births	3.942	2.410	4.185	2.500	3.337	2.052	2.946	1.679	6.166	2.307
Age15-24	0.189	0.391	0.193	0.395	0.178	0.383	0.273	0.446		
Age25-34	0.502	0.500	0.489	0.500	0.534	0.499	0.727	0.446		
Age35-49	0.309	0.462	0.318	0.466	0.288	0.453				
Age40-49									0.421	0.494
Trad. Cont (M1)	-2.747	0.648	-2.689	0.625	-2.981	0.872	-2.682	0.666	-2.948	0.911
Mod. Cont (M1)	-1.852	0.494	-1.862	0.525	-1.870	0.511	-1.807	0.563	-1.887	0.635
Trad. Cont (M2)	-2.773	0.665	-2.711	0.629	-3.032	0.935	-2.729	0.698	-3.039	1.036
Mod. Cont (M2)	-1.910	0.630	-1.927	0.679	-1.916	0.629	-1.851	0.663	-1.993	0.819
Trad. Cont (M3)	-3.125	1.129	-3.145	1.185	-3.158	1.133	-3.081	1.308	-3.492	1.468
Mod. Cont (M3)	-2.012	0.828	-2.062	0.886	-1.934	0.710	-1.962	0.870	-2.102	1.032
Breastfeeding (M1)	19.051	13.212	20.029	12.897	15.979	8.224	18.193	9.654	18.466	9.660
Breastfeeding (M2)	19.041	13.214	19.532	13.241	18.693	12.079	17.880	9.864	18.174	9.914
Breastfeeding (M3)	19.298	12.893	19.341	13.060	n.a		18.193	9.654	18.070	9.389
Observations	2447		1746		701		1690		757	

Note: Predicted values of the proximates are used. Sample weights are applied in the calculations for GLSS 4.
M1, M2, and M3 represent Models 1, 2 and 3 respectively

B-30a: Marginal Effects after Probit: Woman has a Child, 1987/88 &1998/99

	GLSS 1						GLSS 4		
Full	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	0.173	0.18	0.201	0.174	0.181	0.201	0.206	0.258	0.293
	10.98***	11.39***	12.81***	11.03***	11.43***	12.86***	12.11***	16.54***	18.87***
Age35-49	0.193	0.204	0.224	0.194	0.205	0.225	0.394	0.417	0.435
	13.57***	14.76***	16.74***	13.55***	14.81***	16.80***	25.16***	25.54***	28.17***
Traditional Contraceptives	-0.152	-0.133	-0.079	-0.152	-0.132	-0.078	-0.038	0.037	0.009
	-8.95***	-8.82***	-7.12***	-8.93***	-8.77***	-7.08***	-1.67	2.42*	0.63
Modern Contraceptives	0.02	0.026	0.015	0.019	0.026	0.015	0.223	0.088	0.071
	1.93	2.77**	2.01*	1.87	2.73**	1.94	7.45***	4.83***	3.74***
Age at Cohabitation	-0.001	-5.82E-05	-0.001						
	-1.09	-0.1	-1.73						
Observation	2237	2237	2237	2240	2240	2240	5863	5863	5863
ll	-753.784	-759.751	-778.094	-755.458	-760.837	-780.574			
chi2	552.462	498.17	476.299	557.221	499.389	476.232			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-30b: Marginal Effects after Probit: Woman has a Child, 1987/88 &1998/99

	GLSS 1						GLSS 4		
Rural	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	0.143	0.154	0.167	0.146	0.155	0.167	0.165	0.21	0.251
	7.63***	8.08***	8.40***	7.74***	8.12***	8.44***	8.95***	12.14***	13.30***
Age35-49	0.16	0.179	0.204	0.163	0.18	0.205	0.313	0.342	0.363
	9.46***	11.04***	12.54***	9.67***	11.07***	12.59***	17.18***	17.50***	17.88***
Traditional Contraceptives	-0.176	-0.106	-0.05	-0.174	-0.105	-0.05	-0.036	0.006	0.004
	-5.53***	-6.81***	-6.21***	-5.41***	-6.80***	-6.19***	-1.68	0.34	0.32
Modern Contraceptives	0.026	0.002	0.002	0.026	0.002	0.002	0.193	0.106	0.061
	2.31*	4.61***	2.94**	2.26*	4.56***	2.91**	7.30***	6.40***	4.55***
Age at Cohabitation	0.001	4.31E-04	-5.04E-05						
	1.59	0.59	-0.07						
Observation	1403	1403	1403	1405	1405	1405	3657	3657	3657
ll	-422.627	-431.472	-447.575	-424.926	-432.619	-448.598			
chi2	271.224	288.892	254.992	269.371	290.705	255.643			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-30c: Marginal Effects after Probit: Woman has a Child, 1987/88 &1998/99

	GLSS 1						GLSS 4		
Urban	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	0.163	0.202	0.255	0.162	0.204	0.254	0.307	0.333	0.352
	4.22***	6.11***	8.72***	4.22***	6.20***	8.74***	10.78***	12.91***	14.46***
Age35-49	0.177	0.212	0.263	0.176	0.214	0.263	0.507	0.516	0.528
	4.56***	7.37***	10.71***	4.56***	7.46***	10.74***	19.38***	20.10***	22.15***
Traditional Contraceptives	-0.209	-0.153	-0.076	-0.209	-0.151	-0.076	0.062	0.071	0.062
	-6.22***	-6.87***	-5.66***	-6.24***	-6.87***	-5.69***	2.15*	3.15**	2.66**
Modern Contraceptives	-0.006	-0.004	-0.002	-0.006	-0.004	-0.002	0.075	0.031	0.017
	-0.37	-2.40*	-1.29	-0.37	-2.36*	-1.29	1.73	0.96	0.53
Age at Cohabitation	-2.58E-04	0.002	0.001						
	-0.2	1.43	1.01						
Observation	834	834	834	835	835	835	2206	2206	2206
ll	-316.203	-316.41	-327.481	-316.244	-317.592	-328.057			
chi2	232.298	210.483	198.537	232.3	210.788	199.342			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-30d: Marginal Effects after Probit: Woman has a Child, 1987/88 &1998/99

	GLSS 1						GLSS 4		
Age1534	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	0.27	0.288	0.32	0.272	0.289	0.321	0.361	0.412	0.491
	10.90***	12.09***	14.18***	10.98***	12.16***	14.26***	12.17***	17.09***	23.02***
Traditional Contraceptives	-0.236	-0.198	-0.128	-0.234	-0.197	-0.128	0.103	0.132	0.03
	-9.28***	-8.94***	-7.65***	-9.25***	-8.92***	-7.64***	2.34*	4.89***	1.73
Modern Contraceptives	0.036	0.041	0.03	0.036	0.04	0.03	0.14	0.068	0.091
	2.52*	3.14**	2.62**	2.46*	3.10**	2.61**	2.52*	2.26*	4.17***
Age at Cohabitation	1.99E-04	6.40E-05	-1.57E-05						
	0.19	0.06	-0.02						
Observation	1650	1650	1650	1651	1651	1651	3921	3921	3921
ll	-704.461	-709.104	-727.283	-705.566	-710.148	-728.239			
chi2	395.506	365.34	342.066	396.596	366.153	342.776			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-30e: Marginal Effects after Probit: Woman has a Child, 1987/88 &1998/99

	GLSS 1						GLSS 4		
	Model 1	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age40-49	2.63E-04	0.02	0.016	2.07E-04	0.02	0.016	-0.018	-0.006	-0.006
	0.11	1.7	1.44	0.09	1.7	1.48	-1.49	-0.71	-0.83
Traditional Contraceptives	-0.002	0.002	-1.92E-04	-0.002	0.001	-3.14E-04	-0.003	-0.002	0.001
	-0.46	0.4	-0.08	-0.45	0.33	-0.11	-0.72	-0.71	0.27
Modern Contraceptives	-0.001	-2.89E-04	-2.85E-04	-0.001	-2.71E-04	-2.86E-04	-0.009	0.003	0.001
	-0.88	-0.95	-1.78	-0.84	-0.87	-1.73	-0.85	0.52	0.15
Age at Cohabitation	5.79E-05	2.60E-04	3.14E-04						
	0.47	0.57	0.88						
Observation	587	587	587	589	589	589	1942	1942	1942
ll	-44.04	-48.289	-46.921	-44.454	-48.516	-47.258			
chi2	10.829	5.681	8.421	10.605	3.635	6.448			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-31a: Regression Results for Number of Children Ever Born, 1987/88 &1998/99 (Structural Model)

	GLSS 1						GLSS 4		
Full	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	2	1.957	2.084	2	1.959	2.086	2.569	2.665	2.549
	22.65***	22.36***	24.33***	22.78***	22.45***	24.38***	29.96***	30.98***	30.52***
Age35-49	4.569	4.585	4.841	4.554	4.58	4.839	5.057	5.123	5.042
	34.39***	35.34***	37.35***	34.34***	35.31***	37.39***	55.35***	58.52***	57.79***
Traditional Contraceptives	-0.248	-0.327	-0.143	-0.259	-0.327	-0.143	-0.147	-0.083	-0.096
	-3.89***	-5.29***	-2.51*	-4.08***	-5.29***	-2.50*	-1.45	-1.23	-2.31*
Modern Contraceptives	-0.263	-0.154	-0.115	-0.261	-0.154	-0.119	0.064	-0.065	0.027
	-5.33***	-3.51***	-2.94**	-5.29***	-3.51***	-3.05**	0.5	-0.79	0.52
Age at Cohabitation	-0.012	-0.004	-0.011						
	-3.22**	-1.38	-3.05**						
Constant	0.428	0.547	0.793	0.215	0.474	0.573	0.059	-0.077	0.126
	2.96**	4.28***	5.96***	1.69	4.01***	5.08***	0.49	-0.56	0.78
Observation	2237	2237	2237	2240	2240	2240	5863	5863	5863
	-4.60E+03	-4.60E+03	-4.60E+03	-4.60E+03	-4.60E+03	-4.60E+03			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-31b: Regression Results for Number of Children Ever Born, 1987/88 &1998/99 (Structural Model)

	GLSS 1						GLSS 4		
Rural	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	2.156	2.172	2.344	2.158	2.176	2.325	2.552	2.74	2.609
	20.36***	20.81***	22.42***	20.48***	20.87***	22.29***	21.47***	23.68***	24.39***
Age35-49	5.109	5.179	5.549	5.114	5.189	5.524	5.2	5.344	5.285
	32.93***	31.42***	34.41***	33.29***	31.53***	34.30***	46.48***	50.52***	52.39***
Traditional Contraceptives	-0.388	-0.383	-0.088	-0.386	-0.382	-0.095	-0.412	-0.319	-0.14
	-6.14***	-7.89***	-1.71	-6.14***	-7.88***	-1.85	-4.24***	-3.89***	-3.65***
Modern Contraceptives	-0.044	0.007	0.001	-0.046	0.007	0.001	0.399	0.199	0.14
	-0.74	2.03*	0.22	-0.78	2.01*	0.29	3.72***	2.49*	2.97**
Age at Cohabitation	-4.81E-04	0.003	-0.012						
	-0.11	0.64	-2.66**						
Constant	0.691	0.822	1.181	0.674	0.875	0.968	0.274	0.013	0.449
	3.90***	7.83***	11.80***	4.44***	16.31***	16.41***	1.6	0.07	2.68**
Observation	1403	1403	1403	1405	1405	1405	3657	3657	3657
ll	-2.90E+03	-2.90E+03	-2.90E+03	-2.90E+03	-2.90E+03	-2.90E+03			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-31c: Regression Results for Number of Children Ever Born, 1987/88 &1998/99 (Structural Model)

	GLSS 1						GLSS 4		
Urban	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	1.74	1.373	1.633	1.73	1.383	1.639	2.335	2.378	2.248
	11.06***	9.71***	12.65***	11.01***	9.84***	12.75***	25.11***	24.65***	22.22***
Age35-49	3.609	3.503	3.86	3.59	3.503	3.854	4.538	4.567	4.441
	15.19***	16.09***	18.49***	15.15***	16.14***	18.50***	31.21***	32.01***	31.32***
Traditional Contraceptives	-0.245	-0.624	-0.35	-0.249	-0.618	-0.347	-0.119	-0.095	-0.051
	-2.61**	-7.96***	-6.13***	-2.66**	-7.90***	-6.08***	-1.61	-1.56	-0.88
Modern Contraceptives	-0.452	-0.036	-0.033	-0.45	-0.036	-0.033	-0.04	-0.103	-0.078
	-6.24***	-4.81***	-4.13***	-6.22***	-4.84***	-4.16***	-0.39	-1.2	-0.88
Age at Cohabitation	-0.005	0.005	0.003						
	-0.97	0.86	0.53						
Constant	0.111	0.88	0.807	0.021	0.97	0.862	-0.398	-0.486	-0.202
	0.53	6.51***	6.06***	0.11	11.43***	10.58***	-2.51*	-3.09**	-1.41
Observation	834	834	834	835	835	835	2206	2206	2206
ll	-1.70E+03	-1.70E+03	-1.70E+03	-1.70E+03	-1.70E+03	-1.70E+03			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-31d: Regression Results for Number of Children Ever Born, 1987/88 &1998/99 (Structural Model)

	GLSS 1						GLSS 4		
Age1534	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	1.979	1.983	2.057	1.981	1.984	2.065	2.314	2.311	2.342
	23.24***	23.24***	24.49***	23.30***	23.28***	24.47***	28.34***	25.64***	27.89***
Traditional Contraceptives	-0.329	-0.329	-0.191	-0.328	-0.328	-0.191	0.336	0.19	-0.027
	-6.22***	-6.22***	-3.74***	-6.20***	-6.20***	-3.76***	2.86**	2.96**	-0.91
Modern Contraceptives	-0.107	-0.041	-0.062	-0.108	-0.043	-0.06	-0.259	-0.109	0.089
	-2.48*	-1.05	-1.72	-2.51*	-1.11	-1.67	-1.75	-1.25	1.88
Age at Cohabitation	-0.001	-0.004	0.004						
	-0.33	-1.13	1.06						
Constant	0.627	0.851	0.663	0.602	0.771	0.736	1.004	0.881	0.618
	4.89***	6.73***	5.08***	5.28***	7.23***	7.01***	9.42***	6.62***	4.34***
Observation	1650	1650	1650	1651	1651	1651	3921	3921	3921
ll	-3.00E+03	-3.00E+03	-3.00E+03	-3.00E+03	-3.00E+03	-3.00E+03			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-31e: Regression Results for Number of Children Ever Born, 1987/88 &1998/99 (Structural Model)

	GLSS 1						GLSS 4		
Age3549	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age40-49	1.396	1.771	1.87	1.371	1.735	1.827	-1.247	0.41	0.92
	6.33***	8.28***	9.02***	6.26***	8.05***	8.82***	-4.64***	2.38*	5.90***
Traditional Contraceptives	-1.069	-0.307	0.02	-1.094	-0.311	0.023	-0.382	-0.331	-0.267
	-5.18***	-2.22*	0.26	-5.33***	-2.17*	0.31	-4.97***	-4.39***	-4.24***
Modern Contraceptives	-0.03	-0.021	-0.012	-0.03	-0.021	-0.012	-1.963	-0.513	-0.069
	-2.71**	-3.03**	-3.06**	-2.75**	-3.09**	-3.22**	-7.98***	-3.80***	-0.66
Age at Cohabitation	0.008	-0.02	-0.02						
	0.86	-2.13*	-2.09*						
Constant	3.424	4.753	5.095	3.555	4.364	4.715	1.041	3.081	3.805
	9.19***	16.09***	18.96***	11.14***	19.68***	23.82***	3.63***	15.23***	18.56***
Observation	587	587	587	589	589	589	1942	1942	1942
ll	-1.40E+03	-1.40E+03	-1.40E+03	-1.40E+03	-1.40E+03	-1.40E+03			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-32a: Regression Results for Number of Live Births Conditional on One, 1987/88 &1998/99 (Structural Model)

	GLSS 1						GLSS 4		
Full	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	1.811	1.755	1.752	1.797	1.758	1.742	3.312	2.592	2.108
	17.42***	18.50***	19.75***	17.41***	18.64***	19.75***	19.55***	20.04***	18.94***
Age35-49	4.867	4.824	4.903	4.848	4.819	4.891	5.354	4.931	4.648
	27.32***	29.75***	33.20***	27.32***	29.68***	33.05***	39.90***	43.20***	40.03***
Traditional Contraceptives	0.099	-0.011	-0.041	0.074	-0.01	-0.048	0.059	-0.265	-0.143
	0.62	-0.09	-0.47	0.46	-0.08	-0.55	0.44	-2.92**	-3.13**
Modern Contraceptives	-0.275	-0.204	-0.1	-0.265	-0.203	-0.101	-1.485	-0.501	-0.148
	-3.96***	-3.50***	-2.05*	-3.83***	-3.47***	-2.07*	-6.82***	-4.72***	-1.98*
Breastfeeding Duration	-0.004	9.76E-05	-0.001	-0.005	0	-0.001	-0.002	-0.001	0.002
	-1.25	0.03	-0.43	-1.38	0.02	-0.43	-0.73	-0.27	0.48
Age at Cohabitation	-0.011	-0.007	-0.011						
	-2.76**	-1.81	-2.43*						
Constant	1.278	1.242	1.617	1.103	1.138	1.428	-1.95	-0.589	0.662
	7.32***	7.85***	10.09***	6.82***	7.53***	10.18***	-5.55***	-1.87	2.54*
Observation	1409	1409	1409	1409	1409	1409	2447	2447	2447
ll	-2.70E+03	-2.70E+03	-2.70E+03	-2.70E+03	-2.70E+03	-2.70E+03			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-32b: Regression Results for Number of Children Ever Born Conditional on One Birth, 1987/88 &1998/99 (Structural Model)

	GLSS 1						GLSS 4		
Rural	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	1.872	1.798	1.917	1.876	1.798	1.896	2.68	2.391	2.05
	15.18***	15.72***	18.05***	15.15***	15.74***	17.86***	14.76***	16.36***	16.09***
Age35-49	5.133	4.88	5.24	5.148	4.88	5.206	5.069	4.902	4.769
	17.90***	19.84***	30.01***	17.83***	19.90***	29.74***	34.91***	35.48***	34.25***
Traditional Contraceptives	-0.017	-0.398	-0.048	0.004	-0.398	-0.061	-0.316	-0.382	-0.165
	-0.06	-2.03*	-0.6	0.01	-2.03*	-0.77	-2.67**	-3.53***	-4.53***
Modern Contraceptives	-0.08	0.008	0.002	-0.083	0.008	0.002	-0.487	-0.175	-4.54E-05
	-1.07	1.56	0.43	-1.12	1.56	0.55	-3.28**	-1.59	0
Breastfeeding Duration	0.002	0.001	0.007	0.003	0.001	0.007	0.001	0.001	-0.006
	0.57	0.21	1.12	0.62	0.21	1.18	0.28	0.32	-1.51
Age at Cohabitation	-0.006	3.22E-04	-0.011						
	-1.13	0.07	-2.28*						
Constant	1.556	1.49	1.779	1.447	1.497	1.577	-0.572	0.011	1.242
	6.47***	7.47***	9.80***	6.59***	8.46***	10.21***	-1.25	0.03	4.81***
Observation	936	936	936	936	936	936	1746	1746	1746
ll	-1.80E+03	-1.80E+03	-1.80E+03	-1.80E+03	-1.80E+03	-1.80E+03			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-32c: Regression Results for Number of Children Ever Born Conditional on One Birth, 1987/88 &1998/99 (Structural Model)

	GLSS 1						**GLSS 4**		
Urban	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	1.761	1.256	1.378	1.77	1.236	1.356	2.963	2.923	2.333
	7.90***	8.21***	10.03***	8.08***	8.23***	10.00***	15.94***	14.65***	12.93***
Age35-49	4.368	4.007	4.21	4.362	3.974	4.201	4.997	4.992	4.451
	12.37***	13.28***	15.68***	12.45***	13.06***	15.48***	26.91***	28.94***	25.24***
Traditional Contraceptives	0.326	-0.436	-0.259	0.333	-0.465	-0.268	-0.435	-0.435	-0.204
	1.31	-3.43***	-3.44***	1.35	-3.64***	-3.55***	-4.21***	-4.87***	-2.32*
Modern Contraceptives	-0.513	-0.036	-0.034	-0.518	-0.036	-0.033	-0.861	-0.712	-0.468
	-4.93***	-4.25***	-4.01***	-5.05***	-4.19***	-3.90***	-5.16***	-5.37***	-3.49***
Breastfeeding Duration	-0.009	0.014	-0.002	-0.009	0.014	-0.001	0.008	-0.007	-0.007
	-1.62	1.68	-0.33	-1.62	1.7	-0.2	1.02	-1.26	-1.26
Age at Cohabitation	-0.004	-0.01	-0.013						
	-0.64	-1.39	-1.72						
Constant	0.826	1.616	1.888	0.741	1.431	1.647	-2.734	-2.216	-0.619
	2.72**	7.78***	10.20***	2.72**	9.12***	12.57***	-6.12***	-5.13***	-1.53
Observation	473	473	473	473	473	473	701	701	701
ll	-888.948	-890.415	-888.254	-885.53	-888.188	-889.977			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-32d: Regression Results for Number of Children Ever Born Conditional on One Birth, 1987/88 &1998/99 (Structural Model)

	GLSS 1						GLSS 4		
Age1534	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age25-34	1.759	1.781	1.754	1.759	1.779	1.76	3.008	2.393	2.023
	17.54***	19.54***	20.36***	17.55***	19.51***	20.31***	16.35***	16.23***	16.68***
Traditional Contraceptives	-0.015	0.008	-0.033	-0.015	0.006	-0.033	0.407	-0.055	-0.068
	-0.1	0.07	-0.41	-0.1	0.06	-0.41	2.27*	-0.68	-2.81**
Modern Contraceptives	-0.164	-0.14	-0.112	-0.164	-0.141	-0.109	-1.499	-0.508	-0.137
	-2.72**	-2.87**	-2.58*	-2.72**	-2.89**	-2.53*	-5.26***	-3.79***	-1.55
Breastfeeding Duration	0.001	-0.011	-0.009	0.001	-0.011	-0.009	0.001	0.004	0.003
	0.12	-3.39***	-2.50*	0.12	-3.38***	-2.49*	0.37	0.89	0.68
Age at Cohabitation	-1.39E-04	-0.003	0.003						
	-0.03	-0.8	0.81						
Constant	1.255	1.591	1.475	1.253	1.527	1.537	-0.884	0.034	0.94
	7.43***	9.84***	9.70***	8.22***	11.40***	12.23***	-2.19*	0.1	3.48***
Observation	1064	1064	1064	1064	1064	1064	1690	1690	1690
ll	-1.90E+03	-1.90E+03	-1.90E+03	-1.90E+03	-1.90E+03	-1.90E+03			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-32e: Regression Results for Number of Children Ever Born Conditional on One Birth, 1987/88 &1998/99 (Structural Model)

	GLSS 1						**GLSS 4**		
Age3549	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio	Coef./t-ratio
Age40-49	1.967	2.002	2.128	1.944	1.994	2.089	-0.831	1.103	1.341
	8.11***	8.60***	9.56***	8.08***	8.51***	9.28***	-1.85	3.73***	4.97***
Traditional Contraceptives	-0.23	-0.183	0.056	-0.255	-0.172	0.077	-0.134	-0.172	-0.197
	-0.89	-1.02	0.6	-1	-0.97	0.84	-1.33	-1.94	-2.55*
Modern Contraceptives	-0.02	-0.021	-0.009	-0.02	-0.022	-0.01	-2.046	-0.327	-0.063
	-1.8	-2.87**	-2.16*	-1.82	-3.01**	-2.53*	-5.69***	-1.86	-0.45
Breastfeeding Duration	0.013	0.014	0.015	0.015	0.016	0.016	0.014	0.036	0.027
	1.14	1.25	1.31	1.26	1.35	1.34	1.58	3.71***	2.40*
Age at Cohabitation	-0.003	-0.02	-0.038						
	-0.31	-1.91	-3.58***						
Constant	5.088	5.279	5.909	4.977	4.885	5.19	1.934	3.822	4.236
	9.73***	12.96***	16.15***	10.86***	13.36***	15.92***	3.49***	11.18***	14.78***
Observation	345	345	345	346	345	345	757	757	759
ll	-741.572	-735.131	-733.312	-743.673	-737.014	-739.811			

Note: Predicted values of the proximates are used. Sample weights are applied in the estimations of GLSS 4.

B-33a: Regression Results for Number of Children Ever Born, 1987/88 &1998/99 (Reduced Form Model)

	GLSS 1			**GLSS 4**		
Full	**Model 1**	**Model 2**	**Model 3**[a]	**Model 1**	**Model 2**	**Model 3**[a]
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	-0.239	-0.25	-0.254	-0.427	-0.384	-0.385
	-1.75	-1.82	-1.84	-5.37***	-4.77***	-4.74***
Middle/JSS	-0.675	-0.578	-0.558	-0.861	-0.785	-0.782
	-6.94***	-5.74***	-5.44***	-12.37***	-10.98***	-10.93***
Sec.& above	-1.378	-1.047	-1.02	-1.597	-1.423	-1.417
	-8.20***	-5.93***	-5.68***	-19.71***	-16.40***	-16.36***
Still in school	-0.607	-0.616	-0.59	-0.427	-0.43	-0.426
	-7.59***	-6.91***	-6.60***	-9.42***	-9.01***	-8.92***
Age25-34	2.155	2.166	2.154	2.191	2.221	2.225
	28.09***	28.20***	27.98***	35.30***	36.01***	36.03***
Age35-49	4.995	5.036	5.036	4.629	4.631	4.627
	42.37***	42.91***	42.81***	60.85***	60.96***	60.42***
Rural	0.514	0.24	0.054	0.475	0.241	0.266
	6.18***	2.31*	0.38	8.47***	3.59***	2.14*
Northern Region	-0.392	-0.43	-0.484	-0.005	-0.09	-0.084
	-3.26**	-3.16**	-2.98**	-0.07	-1.06	-0.95
Muslim		0.396	0.388		0.117	0.124
		2.82**	2.76**		1.38	1.43
Traditional		0.049	0.016		0.106	0.096
		0.41	0.12		0.75	0.67
Other		-0.188	-0.237		0.119	0.115
		-1.18	-1.47		0.8	0.77
Non-Akan		-0.264	-0.249		-0.208	-0.204
		-3.04**	-2.83**		-3.49***	-3.36***
HAS- Basic		-0.277	-0.27		-0.169	-0.169
		-5.67***	-5.43***		-5.98***	-5.55***
HAS- High		0.006	0.002		0.147	0.145
		0.26	0.09		4.76***	4.58***
Water distance			6.40E-06			1.20E-03
			3.32***			3.51***
Constant	1.124	1.326	1.312	0.866	1.055	1.048
	11.33***	11.04***	10.80***	12.35***	12.87***	12.22***
Observation	2240	2240	2240	5863	5863	5863
ll	-4.60E+03	-4.50E+03	-4.50E+03			

Note: Sample weights are applied in the estimations of GLSS 4.

a. Results on community variables are reported in table 3.45.

B-33b: Regression Results for Number of Children Ever Born, 1987/88 &1998/99 (Reduced Form Model)

	GLSS 1			GLSS 4		
Rural	**Model 1**	**Model 2**	**Model 3[a]**	**Model 1**	**Model 2**	**Model 3[a]**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	-0.08	-0.119	-0.129	-0.355	-0.339	-0.339
	-0.46	-0.68	-0.72	-3.47***	-3.30**	-3.24**
Middle/JSS	-0.366	-0.371	-0.34	-0.859	-0.814	-0.807
	-2.99**	-2.90**	-2.61**	-10.07***	-9.64***	-9.53***
Sec.& above	-1.185	-1.001	-0.922	-1.97	-1.781	-1.768
	-4.36***	-3.31***	-2.92**	-17.10***	-14.32***	-14.36***
Still in school	-0.919	-0.912	-0.861	-0.625	-0.612	-0.604
	-10.86***	-10.05***	-9.11***	-10.47***	-9.66***	-9.53***
Age25-34	2.267	2.255	2.239	2.408	2.426	2.432
	22.47***	22.28***	22.00***	27.60***	27.42***	27.43***
Age35-49	5.484	5.482	5.488	4.99	4.984	4.983
	37.59***	37.46***	37.39***	51.52***	51.32***	50.41***
Northern Region	-0.386	-0.306	-0.4	-0.032	0.004	0.017
	-2.81**	-1.81	-1.92	-0.32	0.04	0.15
Muslim		0.172	0.125		0.08	0.088
		0.82	0.59		0.69	0.73
Traditional		-0.046	-0.101		0.032	0.018
		-0.33	-0.7		0.21	0.12
Other		-0.175	-0.248		0.126	0.117
		-0.93	-1.3		0.69	0.63
Non-Akan		-0.28	-0.255		-0.324	-0.325
		-2.41*	-2.16*		-4.11***	-3.93***
HAS- Basic		-0.315	-0.229		-0.161	-0.162
		-2.34*	-1.64		-3.80***	-3.30**
HAS- High		0.039	-0.033		0.137	0.135
		0.34	-0.3		3.24**	3.13**
Water distance			6.58E-06			1.31E-06
			3.54***			2.65**
Constant	1.357	1.359	1.135	1.17	1.195	1.192
	13.89***	9.83***	5.99***	17.10***	13.99***	6.88***
Observation	1405	1405	1405	3657	3657	3657
ll	-2.90E+03	-2.90E+03	-2.90E+03			

Note: Sample weights are applied in the estimations of GLSS 4.

a. Results on community variables are reported in table 3.45.

B-33c: Regression Results for Number of Children Ever Born, 1987/88 &1998/99 (Reduced Form Model)

	GLSS 1			GLSS 4		
Urban	**Model 1**	**Model 2**	**Model 3**	**Model 1**	**Model 2**	**Model 3**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	-0.569	-0.487	-0.496	-0.474	-0.4	-0.401
	-2.56*	-2.18*	-2.21*	-3.89***	-3.25**	-3.27**
Middle/JSS	-1.138	-0.867	-0.881	-0.817	-0.691	-0.691
	-7.24***	-5.30***	-5.32***	-6.98***	-5.52***	-5.53***
Sec.& above	-1.771	-1.312	-1.316	-1.386	-1.188	-1.188
	-8.35***	-5.91***	-5.91***	-12.25***	-9.12***	-9.14***
Still in school	-0.373	-0.336	-0.35	-0.36	-0.376	-0.375
	-2.97**	-2.30*	-2.38*	-6.81***	-6.15***	-6.09***
Age25-34	1.972	2.011	2.003	1.831	1.885	1.885
	17.21***	17.42***	17.35***	23.54***	25.28***	25.30***
Age35-49	4.135	4.235	4.229	3.997	4.005	4.005
	21.63***	22.02***	22.00***	38.22***	38.53***	38.62***
Northern Region	-0.209	-0.495	-0.463	0.044	-0.245	-0.223
	-0.81	-1.84	-1.71	0.57	-2.62**	-2.56*
Muslim		0.578	0.562		0.115	0.13
		3.01**	2.91**		0.88	0.98
Traditional		0.426	0.441		0.59	0.579
		1.59	1.64		1.5	1.47
Other		-0.302	-0.312		0.01	0.01
		-1.04	-1.07		0.04	0.04
Non-Akan		-0.267	-0.266		-0.013	-0.015
		-2.12*	-2.11*		-0.17	-0.19
HAS- Basic		-0.223	-0.24		-0.19	-0.193
		-4.25***	-4.43***		-4.63***	-4.75***
HAS- High		-0.003	-0.002		0.154	0.158
		-0.16	-0.08		3.49***	3.62***
Water distance			-1.51E-04			-3.78E-05
			-1.11			-1.35
Constant	1.681	1.673	1.727	1.11	1.206	1.212
	12.20***	9.93***	9.75***	11.14***	9.74***	9.86***
Observation	835	835	835	2206	2206	2206
ll	-1.60E+03	-1.60E+03	-1.60E+03			

Note: Sample weights are applied in the estimations of GLSS 4.

B-33d: Regression Results for Number of Children Ever Born, 1987/88 &1998/99 (Reduced Form Model)

	GLSS 1			GLSS 4		
Age15-34	**Model 1**	**Model 2**	**Model 3[a]**	**Model 1**	**Model 2**	**Model 3[a]**
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	-0.213	-0.246	-0.258	-0.287	-0.266	-0.264
	-1.58	-1.83	-1.9	-3.93***	-3.73***	-3.80***
Middle/JSS	-0.521	-0.499	-0.499	-0.565	-0.532	-0.524
	-5.49***	-4.97***	-4.91***	-7.68***	-6.96***	-6.81***
Sec.& above	-1.036	-0.853	-0.843	-1.138	-1.04	-1.035
	-6.16***	-4.95***	-4.84***	-11.62***	-10.33***	-10.22***
Still in school	-0.724	-0.721	-0.719	-0.496	-0.488	-0.482
	-10.39***	-9.61***	-9.40***	-12.18***	-11.84***	-11.79***
Age25-34	2.141	2.144	2.13	2.205	2.221	2.225
	28.06***	28.05***	27.89***	35.67***	36.03***	36.48***
Rural	0.299	0.061	-0.105	0.319	0.165	-0.099
	3.88***	0.67	-0.82	5.38***	2.20*	-0.74
Northern Region	-0.418	-0.36	-0.341	0.027	0.035	0.091
	-3.40***	-2.72**	-2.23*	0.25	0.33	0.89
Muslim		0.063	0.046		-0.097	-0.09
		0.5	0.37		-1.05	-1.01
Traditional		0.002	-0.043		0.003	-0.009
		0.02	-0.35		0.02	-0.05
Other		-0.288	-0.335		0.088	0.08
		-1.88	-2.18*		0.63	0.57
Non-Akan		-0.237	-0.226		-0.103	-0.096
		-2.97**	-2.77**		-1.87	-1.69
HAS- Basic		-0.208	-0.198		-0.119	-0.091
		-4.70***	-4.37***		-3.78***	-2.50*
HAS- High		-0.006	-0.009		0.061	0.039
		-0.34	-0.53		2.17*	1.29
Water distance			7.20E-06			-3.13E-06
			4.33***			-1.98*
Constant	1.189	1.447	1.443	0.794	0.925	0.875
	12.11***	12.31***	12.13***	10.84***	10.53***	9.67***
Observation	1651	1651	1651	3921	3921	3921
ll	-3.00E+03	-3.00E+03	-3.00E+03			

Note: Sample weights are applied in the estimations of GLSS 4.

a. Results on community variables are reported in table 3.45.

B-33e: Regression Results for Number of Children Ever Born, 1987/88 &1998/99 (Reduced Form Model)

Age35-49	**GLSS 1**			**GLSS 4**		
	Model 1	**Model 2**	**Model 3**[a]	**Model 1**	**Model 2**	**Model 3**[a]
	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio	Coef./ t-ratio
Primary	-0.017	0.059	0.112	-0.468	-0.357	-0.34
	-0.05	0.16	0.3	-2.41*	-1.86	-1.73
Middle/JSS	-0.851	-0.512	-0.467	-1.432	-1.282	-1.245
	-3.14**	-1.84	-1.67	-11.00***	-9.60***	-9.48***
Sec.& above	-2.107	-1.477	-1.55	-2.303	-2.049	-2.005
	-5.43***	-3.46***	-3.62***	-12.85***	-10.64***	-10.29***
Age40-49	1.587	1.566	1.563	1.171	1.139	1.153
	7.84***	7.82***	7.80***	11.68***	11.51***	11.19***
Rural	1	0.811	0.69	0.841	0.515	0.823
	4.46***	2.68**	1.84	7.08***	3.65***	3.39***
Northern Region	-0.342	-0.702	-1.036	-0.06	-0.351	-0.427
	-1.35	-2.23*	-2.74**	-0.41	-1.98*	-2.22*
Muslim		1.287	1.355		0.465	0.471
		3.52***	3.65***		2.39*	2.35*
Traditional		0.122	0.045		0.18	0.183
		0.41	0.14		0.76	0.78
Other		0.076	0.145		0.14	0.095
		0.19	0.35		0.44	0.29
Non-Akan		-0.203	-0.205		-0.297	-0.301
		-0.88	-0.86		-2.36*	-2.38*
HAS- Basic		-0.335	-0.348		-0.203	-0.238
		-2.78**	-2.84**		-3.03**	-3.35***
HAS- High		0.019	0.019		0.317	0.327
		0.15	0.14		4.69***	4.80***
Water distance			-5.81E-05			2.45E-06
			-1.17			4.74***
Constant	4.9	4.889	4.932	4.78	5.026	5.042
	20.26***	15.84***	15.73***	36.13***	30.56***	30.08***
Observation	589	589	589	1942	1942	1942
ll	-1.40E+03	-1.30E+03	-1.30E+03			

Note: Sample weights are applied in the estimations of GLSS 4.

a. Results on community variables are reported in table 3.45.

B-34a: The Impact of Control Variables on Fertility (Reduced Form Model), by All Women, Residence & Age – 1987/88 & 1998/99 (Pooled)

Pooled	**Full Coef./t-ratio**	**Rural Coef./t-ratio**	**Urban Coef./t-ratio**	**Age15-34 Coef./t-ratio**	**Age35-49 Coef./t-ratio**
Model 2					
Still in school	-0.456	-0.652	-0.32	-0.538	
	-12.19***	-13.16***	-6.53***	-16.53***	
Age25-34	2.193	2.385	1.876	2.189	
	53.55***	43.95***	30.89***	53.88***	
Age35-49	4.686	5.044	4.062		
	86.19***	72.23***	48.12***		
Age4049					1.256
					13.91***
Rural	0.271			0.169	0.559
	5.40***			3.78***	4.46***
Northern Region	-0.171	-0.116	-0.213	-0.078	-0.377
	-2.38*	-1.32	-1.65	-1.13	-2.45*
Muslim	0.152	0.096	0.197	-0.062	0.6
	2.13*	0.95	1.87	-0.99	3.51***
Traditional	0.021	-0.058	0.42	-0.038	0.077
	0.25	-0.61	1.99*	-0.46	0.43
Other	-0.009	-0.01	-0.108	-0.046	0.078
	-0.09	-0.08	-0.59	-0.47	0.34
Non-Akan	-0.198	-0.244	-0.115	-0.141	-0.234
	-4.41***	-3.99***	-1.8	-3.49***	-2.20*
HAS- Basic	-0.203	-0.195	-0.196	-0.152	-0.274
	-8.73***	-4.94***	-6.50***	-7.36***	-4.71***
HAS- High	0.103	0.12	0.073	0.038	0.276
	4.91***	3.51***	2.84**	2.25*	4.99***
Constant	1.001	1.118	1.203	0.975	4.748
	16.32***	17.09***	13.16***	17.12***	31.73***
Observation	8103	5062	3041	5572	2531
Log-likelihood	-1.60E+04	-1.00E+04	-5.70E+03	-9.60E+03	-5.70E+03

B-34b: The Impact of Additional Control/Community Variables on Fertility (Reduced Form Model), by All Women, Residence & Age – 1987/88 & 1998/99 (Pooled)

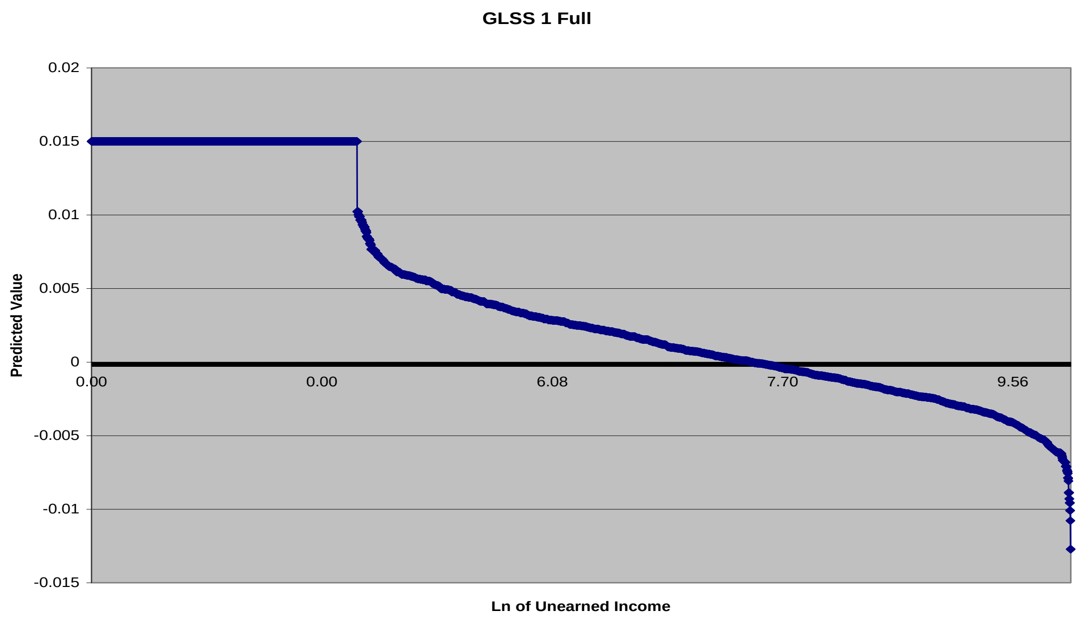
Pooled **Model 3**	**Full** **Coef./** **t-ratio**	**Rural** **Coef./** **t-ratio**	**Urban** **Coef./** **t-ratio**	**Age15-34** **Coef./** **t-ratio**	**Age35-49** **Coef./** **t-ratio**
Water distance	2.57E-06	2.46E-06	-3.18E-05	5.51E-06	1.34E-06
	1.88	1.75	-0.66	2.76**	1.38
Market distance	0.001	0.001		0.002	-0.001
	0.71	0.42		1.57	-0.3
Primary school distance	0.001	0.001		0.001	0.001
	0.75	0.65		1.25	0.3
Middle/JSS school distance	-2.06E-04	1.56E-04		-0.001	0.002
	-0.1	0.07		-0.65	0.48
Secondary school distance	-0.001	-0.001		-0.001	-0.001
	-1.4	-1.31		-1.51	-0.3
Access to Health facilities/personnel	0.01	0.005		-0.005	0.008
	0.23	0.12		-0.14	0.08
Price score of cereals	-0.023	-0.019		-1.90E-02	0.046
	-0.79	-0.65		-0.67	0.66
Price score of foodstuffs	-0.004	-0.003		-0.013	-0.042
	-0.22	-0.14		-0.67	-0.56
Log of real Men's Agric. Wage	-0.001	0.002		0.026	-0.041
	-0.09	0.16		2.34*	-1.42
Ratio of female to men's wage	0.113	0.112		0.092	0.105
	1.64	1.59		1.42	0.69
Ratio of child to men's wage	0.074	0.064		-0.025	0.274
	1.07	0.9		-0.38	1.73
Constant	0.983	1.013	1.209	0.931	4.766
	15.60***	8.33***	13.12***	16.01***	30.74***
Observation	8103	5062	3041	5572	2531
Log-likelihood	-1.60E+04	-1.00E+04	-5.70E+03	-9.60E+03	-5.70E+03
R-squared	0.592	0.594	0.57	0.478	0.227

APPENDIX C:

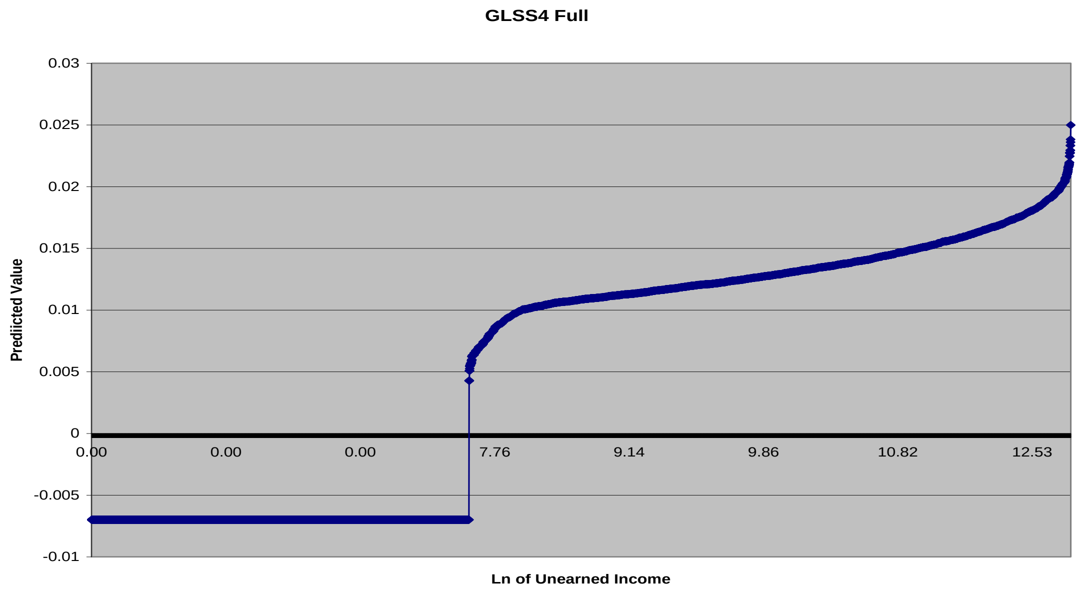
Unearned Income

Illness: Children

GLSS1



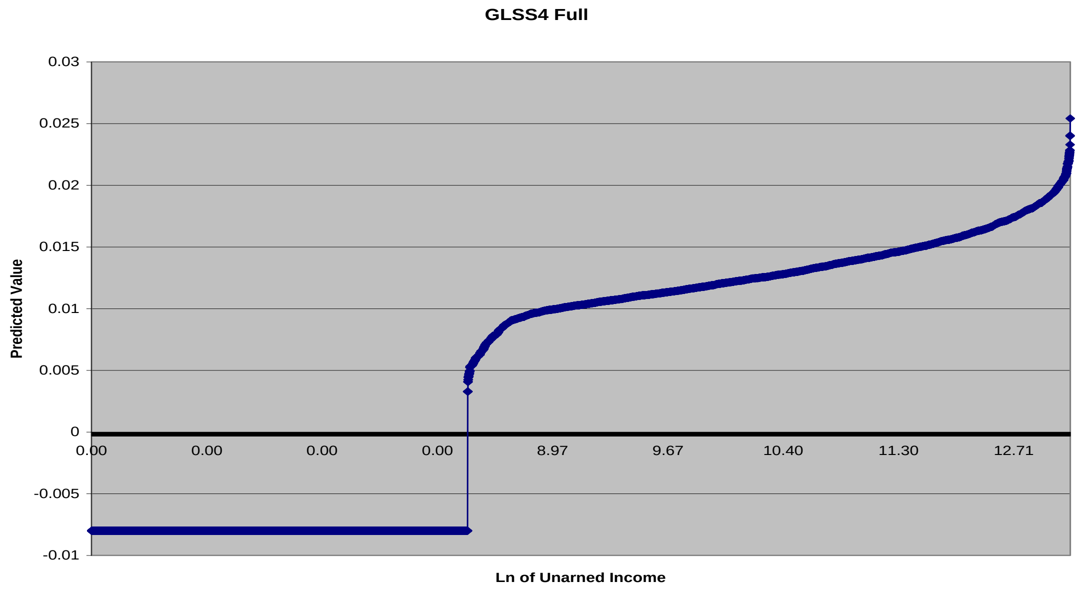
GLSS 4



Unearned Income

Illness: Adults

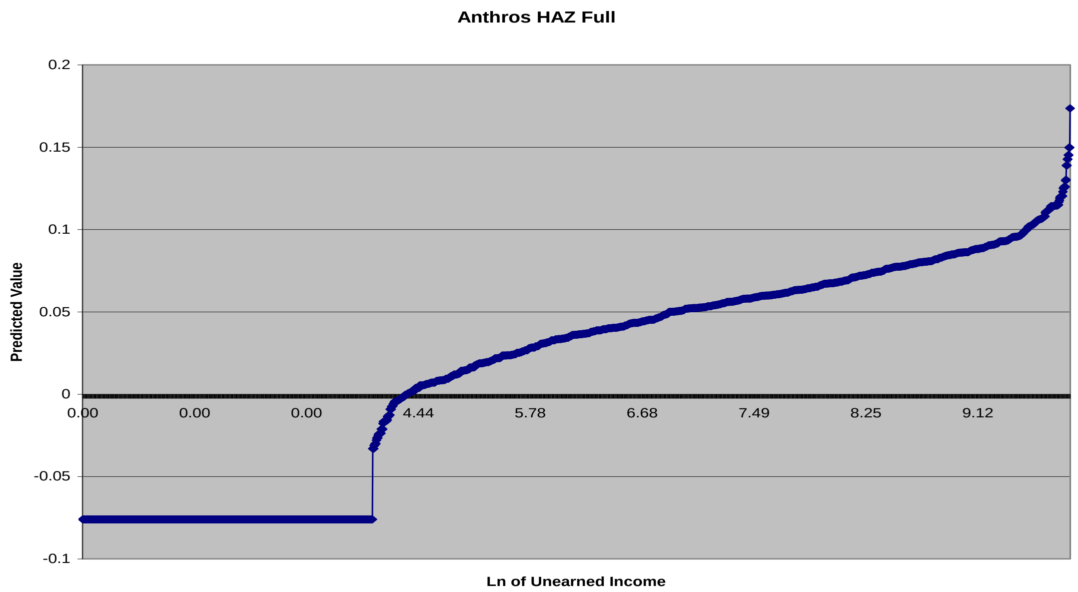
GLSS 4

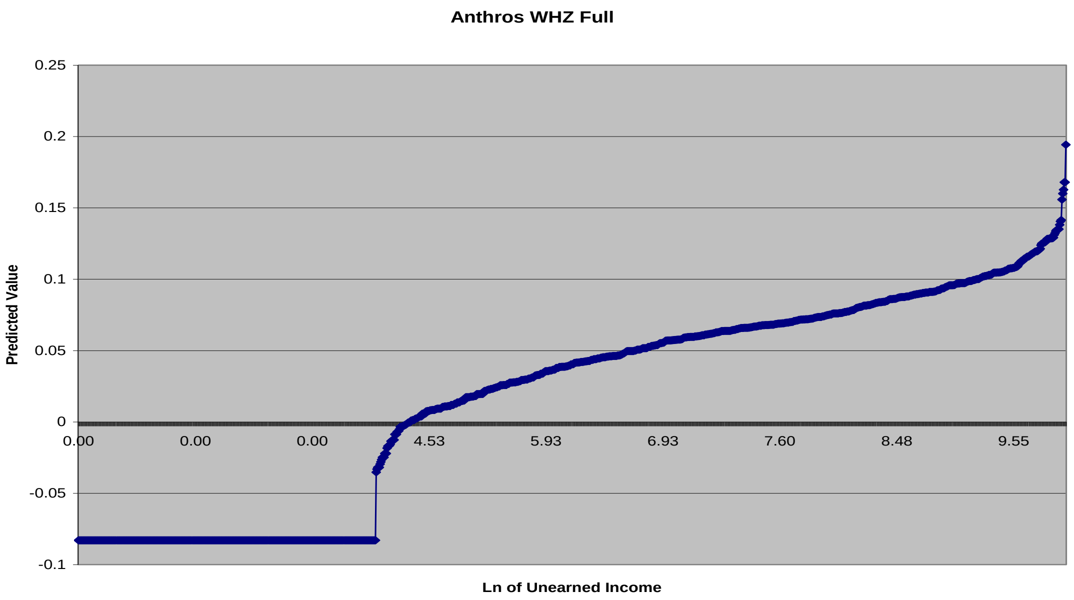


Unearned Income

Anthropometric Measure

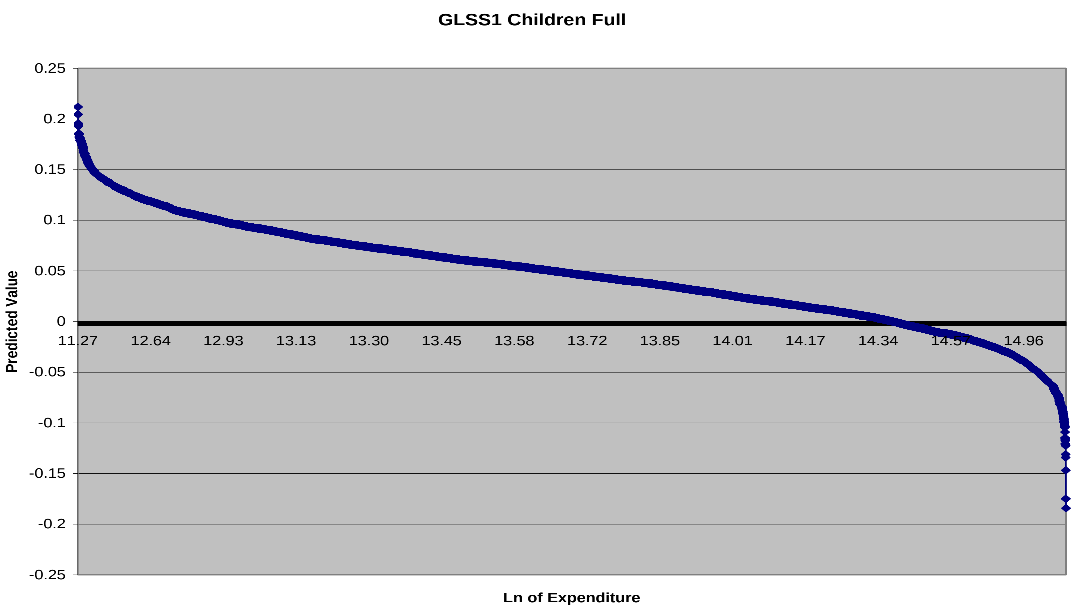
GLSS 1





Expenditure

GLSS 1: Children



GLSS 4: Adults