ESSAYS ON AID, GROWTH AND WELFARE

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To Mama, Pitaji

and Didi

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ABSTRACT

As from early 1960s, the question of whether aid works has been a central theme in development economics. The continued effort to analyse the effects of aid only now appears to be nearing consensus. A close examination of the literature suggests that there are certain aspects that are critical to this strand of studies that have not been fully addressed. In this thesis, we make a contribution by throwing light on three such issues that relate to the macroeconomic effectiveness of aid.

Aid does not have a direct effect on growth; it operates via transmission mechanisms. Their role has not been given due consideration in the empirical literature. Our first objective is to revisit the question of aid effectiveness while taking into account the important effects through these mechanisms. Using generated regressors, we purge aid effect on these various mediators and obtain a coefficient on aid that gives a measure of the total effect aid has on growth. Our results consistently show that aid has had a positive effect on growth, largely through aid-financed investment and that Africa's poor growth record should not be attributed to aid ineffectiveness.

Our second objective relates to the non-linear aspects that would seem to characterise the aid-growth link. This has consistently been represented by an 'aid squared' term and recently been referred to as the aid Laffer effect as proposed by Lensink and White (2001). Using a threshold model, we directly test the assumptions underlying this hypothesis. Contrary to an aid Laffer curve, we find that aid becomes effective beyond a certain critical level and human capital enhances its effects at higher aid levels. Hence, we find no evidence of diminishing returns in aid. Although, marginal impact of aid on growth does become weaker as human capital exceeds some high level. Overall, it seems that an 'aid squared' term is not an appropriate representation of the non-linearity in aid-growth link.

Finally, we contribute to the limited literature on aid and welfare of the poor. Our findings consistently show that aid is associated with increases in welfare indicators. We highlight the role of pro-poor public spending as the channel through which aid improves welfare. These indirect effects are captured using residual generated regressors. Quantile regression estimates suggest that aid effects on human development vary across the welfare distribution; effects are more significant in economies located at the lower end of this distribution. Finally, we find that improving welfare may just be another way to promote growth in developing countries.

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CHAPTER 1
INTRODUCTION

Since World War II, starting with the Marshall Plan, aid has been the main instrument of development finance and the cornerstone of development policy. The issue of aid effectiveness has been of concern to donors and researchers. While findings from early studies varied on whether aid works or not, analysis conducted during the last few years is nearing consensus that 'aid works'. Yet, the question of aid effectiveness remains a recurring theme in development economics. The focus has recently inclined towards identifying factors that enhance or hamper the favourable effects of aid.

At the beginning of the twenty-first century, poverty remains a pressing problem in sub-Saharan Africa (SSA). It is not only widespread across the region but severe in most countries. Slow growth is part of the explanation. Thus, it is desirable to achieve growth that is both sustainable and rapid. However, the continuous generous aid efforts offered by donor countries have not been matched by high growth performance in SSA. Not surprisingly, this is usually interpreted as a case where aid has failed. The accuracy of such an interpretation is however an empirical question.

The publication of the World Bank report (1998) on '*Assessing Aid: What Works, What Doesn't, and Why*' marked a watershed in perceptions of aid effectiveness and has had profound effect on donor aid policies. The World Bank view that has become the 'accepted wisdom' to many observers of aid effectiveness promotes the idea that aid works only if good policies are in place. This is principally based on the now famous Burnside and Dollar (2000) paper. Despite failing to withstand rigorous robustness analysis, this paper does contribute to improving understanding of what makes aid work. Several papers, which have not attracted the spotlight, have identified factors other than domestic policies (e.g, environmental factors in Guillaumont and Chauvet (2001)).

However, the foremost question should be *how* does aid work. Only a good understanding on the workings of aid can allow advances on how to improve its effectiveness. Theoretical work does provide some answers. Investment, imports and fiscal behaviour are identified as the routes through which the ultimate objective of speeding up the transition to self-sustainable growth can be achieved. Nonetheless, empirical work has not fully taken that into consideration.

What has gained credence is the assertion that too much aid can do more harm than good. This permits donors to take a policy decision to reduce aid support to developing countries receiving large amounts of aid. Owing to this implication, which is of critical importance for the development of aid-dependent Third World countries, it is imperative to probe into the validity of this claim. The belief that high aid levels generate diminishing or negative returns has been incorporated in the empirical literature by a 'squared aid' variable. A significant negative coefficient on this quadratic term has been taken to support this hypothesis. What seems to have been neglected is how appropriate is this approach to introduce non-linearity in studies looking at the relationship between aid and growth. This becomes especially necessary given that the theoretical grounds on which it stands is not as incontestable as it may appear.

In his well-known survey paper, White (1992) pointed out that 'the combination of weak theory with poor econometric methodology makes it difficult to conclude anything about the relationship between...aid and growth...' (pg 121). Recent work has been marked with impressive improvements in both areas. Theoretical modelling of the macroeconomic impact of aid now is rooted on modern growth theory and econometric sophistication (Hansen and Tarp have made exemplary contributions in that direction). However, less has been done with regards to the objective of reducing poverty using aid flows. The empirical question of how to capture and influence the effect of aid on welfare is yet to be answered.

OUTLINE OF THESIS

In this thesis, we seek to contribute to the literature on aid by addressing the concerns raised above. Prior to that, in ***Chapter 2*** we give an overview of the developments that have taken place in aid literature at the theoretical level. Using various growth frameworks – Harrod Domar, Neo-classical and endogenous - we assess how aid inflow is predicted to have a macroeconomic impact on the recipient economy and what happens when the aid flow discontinues. This exercise provides helpful insights for our empirical investigation on transmission mechanisms. Useful information can also be drawn regarding how can aid be used to save poor countries from a low-level equilibrium trap.

Chapter 3 presents an assessment of the empirical literature on aid and growth. Rather than reviewing the massive existing quantitative work on aid effectiveness, we focus on aspects of a few prominent papers (comprehensive reviews can be found in White (1992) and Tarp (2000)). A comparison of findings and methodology follows. This exercise principally serves to highlight treatment of issues we address in our empirical work.

In ***Chapter 4***, we conduct a preliminary data analysis. We first define alternative forms of capital flows before examining the trends in each component over the years 1970 to 1997 (as our empirical work is based on that period). Questions with regards to source and destination of aid flows are also covered. This chapter further demonstrates why the focus of our first empirical study is on aid in SSA economies. Also discussed is the motivation behind the need for a measure of aid that is tailored to study the effect of aid on growth

The next four chapters constitute the empirical contributions of this thesis. The significance of transmission mechanisms in determining aid effectiveness is given due consideration in ***Chapter 5*** using a panel data set for SSA and seven four-year period averages over 1970 to 1997. Omitting these mechanisms (for example, investment) from the model results in misspecification, yet including them gives rise to an inaccurate measure of total effect of aid – for example, investment in growth regression would include part of the indirect effects of aid so that aid coefficient would underestimate its impact on growth. In this chapter, we shed light on the treatment of transmission mechanisms in aid-growth regressions and show how using generated regressors only non-aid financed part of the mechanism can be introduced in the model so that all indirect effects of aid on growth would be accumulated in the aid coefficient. ***Chapter 6*** supplements this regression analysis, considering implications for individual countries and providing a sensitivity analysis of the findings.

The issue of non-linearity is addressed in ***Chapter*** *7*. The validity of using an aid squared term, that has recently become a tradition, is challenged. We draw attention to the limitations of this practice – it imposes the number of threshold (one) and form of non-linearity (inverted U-shape). A preliminary data analysis assesses its appropriateness. Also, we test the hypothesis of negative returns to aid as formalised by Lensink and White (2001) aid Laffer curve. Various alternative threshold identification procedures are discussed before selecting which one would be the best option. The threshold model developed by Hansen (2000) is applied to the aid-growth relationship; this represents the novel feature of the chapter. It allows us to endogenise both the number and location of thresholds while uncovering the form of non-linearity and enables us to draw statistical inferences on the estimated threshold. To some extent, it also endogenises the explanatory variable that triggers a threshold in aid-growth link We apply this technique to a sample of all the countries for which Effective Development Assistance (EDA) data are available.

Chapter 8 contributes to the limited literature on aid and welfare of the poor[1]. We use a panel of 57 countries over the period 1980 to 1998 to study the role of government spending in evaluating aid effectiveness against the criterion of welfare improvement. A vital component is the construction of indices that capture the degree to which government spending is 'pro-poor'. A brief attempt is made to link the two objectives of aid - growth and welfare improvement. We also allow for different effects of aid on recipient economies located at different quantiles of the welfare distribution by using conditional quantile regression. To our knowledge, this method of estimation has not been applied in the aid-welfare literature. As stressed, the need to expand on the literature (both theoretical and empirical) that looks at the link between aid and welfare cannot be overemphasised.

A summary of the main findings is provided in the concluding ***Chapter*** *9*. Based on what we find in this thesis, we draw some implications for policy as well as empirical work in the area. Finally, limitations of this study are discussed and suggestions are made for future research.

[1] Owing to limited data on poverty, we use indicators of deprivation (Human Development Index and infant mortality rate) and therefore interpret our results as being effects on welfare of the poor rather than poverty.

CHAPTER 2

AID AND GROWTH: THEORETICAL CONSIDERATIONS

2.1 INTRODUCTION

As Ruttan (1989) suggests, all donors have mixed objectives in providing aid to developing countries. No single motive is paramount at all times. Whilst some would refer to 'international aid doctrine' according to which advanced countries are under the obligation to assist poorer ones simply as a matter of moral principle and international solidarity. Others are governed by concerns of how efficiently recipient economies manage aid resources and whether aid works or not. This is where the contribution of empirical aid studies lies.

Whilst significant amounts of aid is specifically directed at reducing poverty, donors have paid overwhelming attention to effectiveness of aid in promoting growth. Growth seems to be the objective of concern. In response to that, numerous studies examine the empirical link between aid and per capita growth. Aid allocation policy is increasingly reflecting donors' confidence in these findings. For example, in respect to the recent claim that aid is more effective in stimulating growth in good policy environment (Burnside and Dollar, 2000), donors are in favour of countries with stable policies.

With regards to the emphasis on growth, we find it useful to review the various growth theories that have evolved. We also aim to evaluate the impact of aid in the context of each growth model. Early aid studies were based on the two-gap model of Chenery and Strout (1966). The empirical findings generally varied and in some cases were even pessimistic. With developments at the theoretical level, endogenous growth theory provided a new framework to analyse aid effectiveness. Resulting empirical studies have commonly reached more encouraging conclusions. Note however, that this change in findings is not entirely attributed to the new growth theory used as more advanced econometric techniques have been used as well. The latter is however not of direct concern in this chapter.

The rest of this chapter is organised as follows. The logical starting point seems to be the Harrod-Domar growth model, as presented in *Section 2.2*. We then turn to the Neo-classical growth model, developed by Solow and Swan (1956), in *Section 2.3*, including some extensions. *Section 2.4* looks at the recent endogenous growth theory. In *Section 2.5*, we consider models that allow optimisation behaviour to determine savings. The impact of foreign aid is explicitly considered in each model. Finally, we conclude in *Section 2.6* with some observations.

2.2 AID IN HARROD DOMAR GROWTH MODEL

The dual gap model, as pioneered by Chenery and Strout (1966), is the traditional approach to examine role of foreign aid in growth process. It is based on the Harrod Domar growth model. National output is represented by a fixed-proportion Leontief production function, as given by:

$$Y = F(K,L) = min\ (bK,\ cL) \qquad (2.1)$$

Where Y is output (equals income), K is capital, L is labour and the constants b and c represent capital and labour productivity respectively, such that b>0 and c>0. If K and L are such that $bK = cL$, then all workers and machines are fully employed. Otherwise, the level of output is determined by whichever is less (bK or cL). If $bK > cL$ then only $(c/b).L$ units of capital is used and the remainder is idle. While if $bK < cL$, then capital is fully used whilst labour units used amounts to $(b/c).K$ and the rest is unemployed. It is reasonable to believe that in developing countries, the latter possibility is the most likely to occur. In other words, rather than being labour constrained, bK is binding in low-income countries. Foreign inflows, aid, can relax this constraint by providing (funding for) capital. An underlying assumption is that savings are too low to provide adequate investment.

Savings (S) is given by some constant proportion (s) of national income such that:

$$S = sY \qquad (2.2)$$

Investment (I), as defined by a change in capital stock, can alternatively be expressed as a proportion of growth of output:

$\Delta Y = b\Delta K = bI$

$\Rightarrow \quad I = \kappa\Delta Y \qquad (2.3)$

Define the capital-output ratio $\kappa = 1/b$.

In terms of growth, $\frac{I}{Y} = \kappa \frac{\Delta Y}{Y}$ so that rate of growth is given as:

$$g = \frac{1}{\kappa} \cdot \frac{I}{Y} \qquad (2.4)$$

Based on the fixed-proportions assumption, we now formally obtain that investment, hence, capital is the binding constraint to growth. Furthermore, from the assumption that investment is determined by savings (that is *ex ante* investment is equal to *ex ante* savings ($I=sY$)), one can rewrite Equation 2.4 as:

$$g = s / \kappa \qquad (2.5)$$

This is the fundamental relation of two-gap models. The growth rate is determined by two factors – savings rate (hence, investment) and productivity of capital. This would imply that economies that are capable of saving a higher proportion of their income would achieve a higher growth rate than those who save less, for given κ.

Given Equation 2.5, a planner can identify the required level of investment to achieve a certain target growth rate, denoted by g^*. If domestic savings are insufficient to finance that level of investment, there exists a savings-investment gap or savings constraint, as generally observed in developing countries. Traditionally, the role of foreign assistance is seen as a supplement to domestic savings to bridge the savings-investment gap. If a is the share of foreign aid in national income, then the targeted growth rate to be achieved is given by:

$$g^* = (s+a) / \kappa \qquad (2.6)$$

And this target growth rate is higher than the one permitted by domestic savings only.

Aid flows can also relax a foreign exchange gap if that is the binding constraint to higher growth (where export earnings are insufficient to finance imports of capital goods). Dual gap model, in some sense therefore, synthesise the traditional and modern views on trade, aid and development. On one hand, it recognises the traditional view that aid is an additional source of savings. On the other, it also embraces the modern view that aid resources assist developing countries in financing their imports, on which they rely heavily (especially imports of capital goods) to achieve higher growth rates. More recently, Bacha (1990) has proposed a three-gap model. Particularly in highly indebted developing countries, it is believed that government budget limitations is the main constraint to growth. By assisting economies with their fiscal constraints, aid can affect growth (directly) through public investment and (indirectly due to complementarity) private investment. This partly justifies foreign assistance in the form of debt relief.

In this framework, it should be noted that aid flows are perceived as filling binding gaps and thereby helping countries attain self-sustaining economic growth. In other words, foreign aid is only a short run tool to realise a target growth rate. It would not increase long run growth rates. With time, it is expected that the recipient economy reduces its dependence on foreign assistance. This can be accomplished if it succeeds in increasing the savings rate (therefore investment potentially), productivity of capital and foreign exchange earnings capacity. Otherwise, once foreign aid stops flowing in, growth will revert back to its previous lower level.

In some instances, it would appear that aid contradicts its purpose to enhance growth. One could think of cases where aid is not used for its intended purposes, that is, aid becomes fungible and consequently the intended positive effects are not seen. Additional foreign aid may also reduce the government's tax effort. Morrissey and White (1996) further recognise that tied aid is sometimes associated with imposition of inappropriate technology hence low capital productivity and increased reliance on imports to maintain the imported technology. This would reduce the effectiveness of aid and limit a country's ability to reduce aid dependence.

2.3 AID IN NEO-CLASSICAL GROWTH MODEL

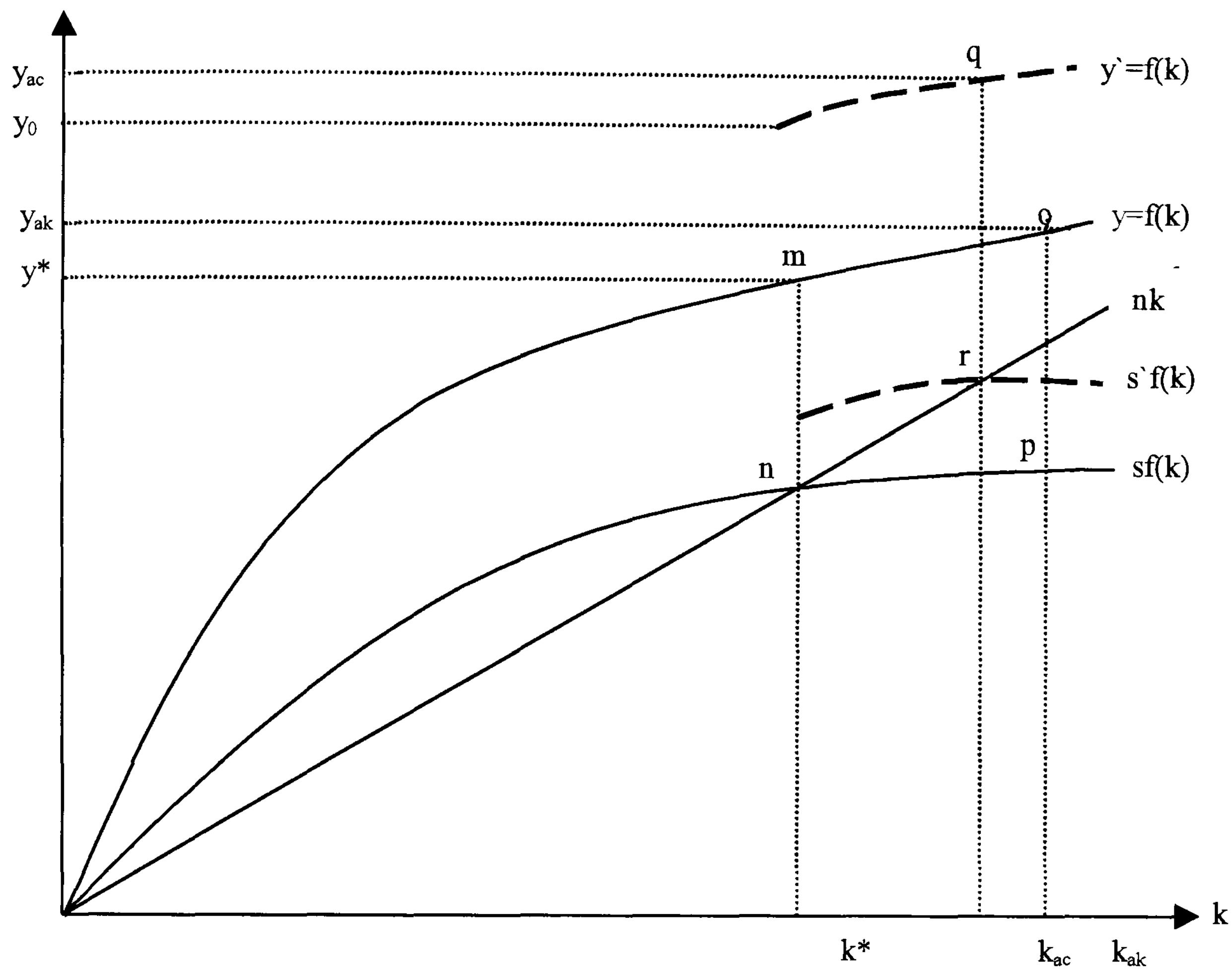
The distinguishing feature of the Solow and Swan (1956) growth model is the possibility of substitution between capital and labour as captured in the Cobb Douglas constant returns production function. As before, output is a function of capital and labour and the marginal propensity to save is s. Population grows at the rate n, and capital depreciation occurs at a rate δ. The fundamental equation for growth in this model is given by:

$$\Delta k = s.f(k) - (\delta + n)k \qquad (2.7)$$

Ignoring depreciation, one can see that rate of change in k (capital per worker) is the difference between savings per capita and per capita investment requirement (to preserve capital-labour ratio as labour force grows). Since $0<s<1$ and $f(k)$ is well-behaved, at any point $sf(k)$ lies below $f(k)$ and is also well-behaved. The term nk is diagramatically given as a line that goes through origin with a positive slope n. Steady-state growth occurs where $sf(k) = nk$, such that equilibrium level of output and capital per worker are respectively given by y^* and k^* as shown in Figure 2.1. Consumption per capita is mn. If $k>k^*$, then it would fall to k^* since savings per capita would be less than the capital required to maintain the higher k ratio and vice versa if $k<k^*$. Thus, the steady state in this model exists and is both unique and stable.

Crouch (1973) examines the impact of foreign aid in this growth model. We start with the first case he considers where aid is given in the form of capital goods. The economy moves to a higher capital-labour ratio and income per capita as denoted by k_{ak} and y_{ak}. Aid-supported per capita consumption is given by the distance op. The economy stays at this higher equilibrium point as long as aid flows in. As soon as it stops, the economy slumps back to k^*, y^* and mn. In the absence of foreign aid, the domestic savings per capita is too low to meet the investment per capita required to stay at k_{ak}. Now consider the case if that aid flow was disbursed in the form of consumer goods such that income per capita increases to y_o. The aid-supported production and per capita savings function shift to $y' = f(k)$ and $s'f(k)$. At k^*,

FIGURE 2.1: Aid in Neo Classical Growth Model



savings per capita exceeds the required per capita investment, therefore the economy is able to reach a higher capital-labour ratio, k_{ac}. Income and consumption per capita correspondingly rise to y_{ac} and qr. This situation will also hold only as long as aid is received. As soon as it stops flowing in, the economy will revert back to its non-aid equilibrium. Hence, the recipient country finds itself in a low-equilibrium trap from where it can only temporarily move to higher equilibriums with the assistance of foreign aid. Thus, like Harrod-Domar model, the neo-classical model predicts that aid flows (whether in the form of investment or consumption goods) will have positive but only transitory impact on capital-labour ratio, income and consumption per capita unless the recipient country succeeds in increasing its domestic saving rate.

Crouch (1973) attributes these pessimistic conclusions to the assumptions made with regards to n and s in the neo-classical framework. By introducing population growth as a function of income, a concept that has for long been asserted by demographers, Crouch (1973) shows that foreign aid can have permanent long-run benefits. The idea is that at subsistence levels of income, death rate soars whilst birth rate declines to zero so that population does not grow. As income grows, the discounted present value of raising children falls short of the discounted present value of the material benefits the latter would bring to their parents. Hence, population grows until it reaches a maximum. Population growth thereafter declines because at any higher level of income, having children is no longer a 'profitable' form of capital accumulation[1]. The savings function changes as well, reflecting the pattern of population growth over various income levels. At income per capita below subsistence level, savings are very low. It stays low and may even decrease at above subsistence levels of income per capita, since population growth is high in that range of income. However, savings pick up once income per capita rises beyond the point where having a large family stops being 'profitable'. Finally, at very high per capita incomes and k, marginal physical product of capital declines and so does the propensity to save.

With these modified functions, as illustrated in Figure 2.2, a steady state is reached at three different values of capital-labour ratio. Steady state growth at k_1^* and k_3^* are stable whilst the one occurring at k_2^* is not. Any disturbance that causes k to increase (decrease) from k_2^* will cause k to diverge to the steady state k_3^* (k_1^*) rather than converging back to k_2^*. It is worth noting that it would not be unreasonable to believe that developing countries are most likely to be in steady state at k_1^*. Taking that as the initial position of the recipient, we now examine the effect of aid flows.

Suppose aid flows manage to boost the capital-labour ratio to k_2^* in the recipient economy. As long as aid lasts, the economy would stay at that point and benefit from a higher income per capita, as given by y_2^*. When the donor stops giving aid, the economy will slump back in the low-level equilibrium trap with $k = k_1^*$.

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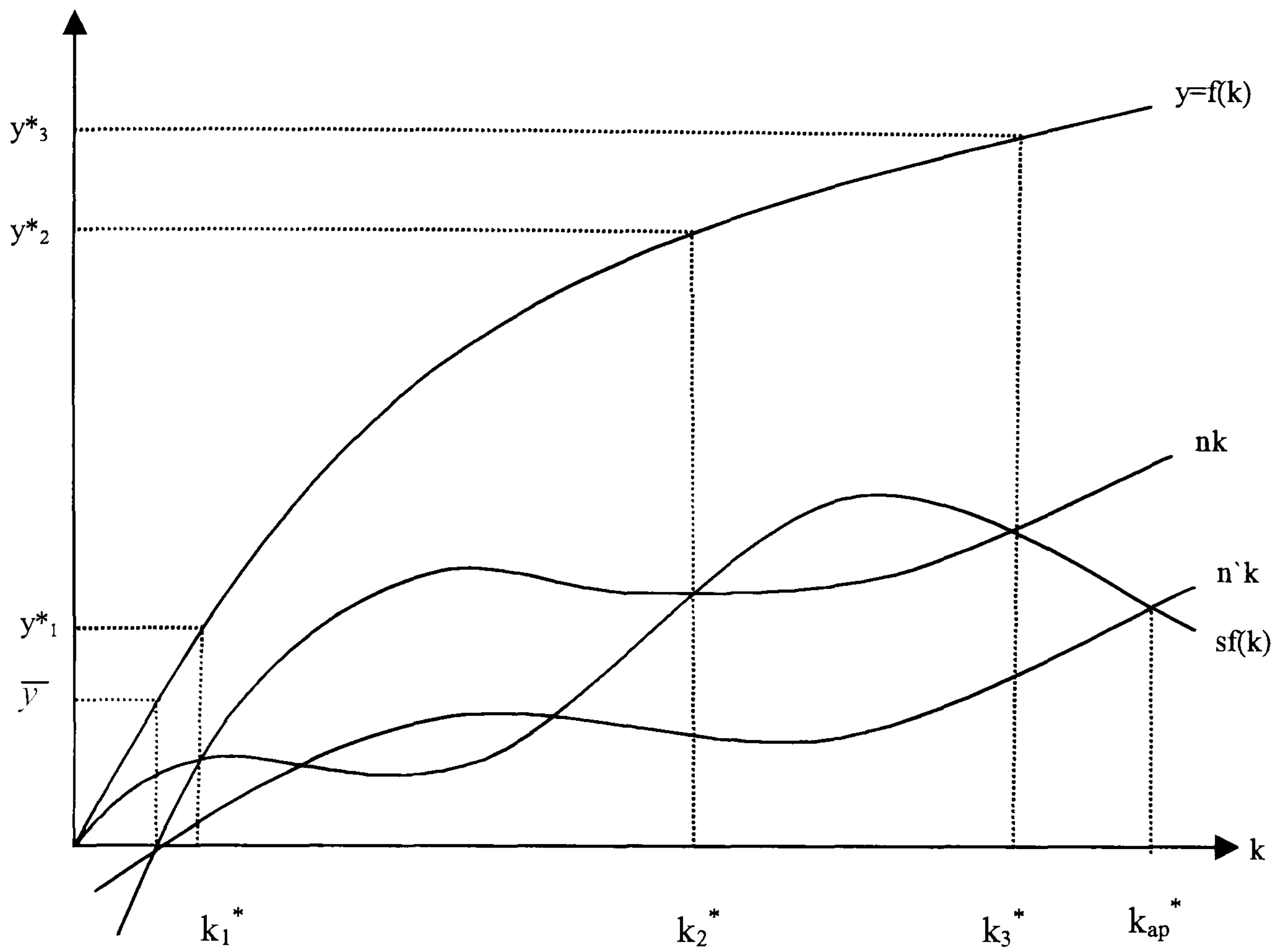
[1] At these high income levels, it becomes more expensive to support children. At the same time, the material benefits (household and retirement support) expected from them declines. Owing to longer schooling years, they leave home or are mobile therefore become an uncertain source of support.

FIGURE 2.2: Aid in Neo-classical Growth Model under Alternative Assumptions for Population Growth



This is the type of temporary effects discussed earlier. However, if aid flows are generous enough and succeed in pushing the capital-labour ratio above k_2^*, the recipient economy would enjoy the permanent benefits from aid. In this scenario, when aid is withdrawn, the economy would be able to reach the higher steady state k_3^* on its own since savings per capita exceeds investment per capita required to stay at the aid-supported position at some point above k_2^*. These results are observed irrespective of whether aid is given in the form of capital or consumption goods.

Hence, what is required in the context of neo-classical growth model to help developing countries *permanently* out of the low-level equilibrium trap is some minimum level of aid that is sufficient to give them a big push so they land outside the concave portion of *nk* curve, that is above k_2^*. Once aid stops, the recipient will converge to k_3^* if *sf(k)>nk* while aid lasts or revert back to k_3^* if *nk>sf(k)* with aid support. Crouch adds that these permanent gains from aid can be improved if aid is given in the form of population control assistance as well. The idea is that *n* can be reduced so that the new *n`k* has a lower slope and lies everywhere below *nk*. With this new curve, once aid (given for capital or consumer goods) is stopped the recipient can land in a steady state that would be to the right of k_3^*, say k_{ap}^*

The Solow-Swan model with Technological Progress

So far, in the neo-classical model it has been assumed that there is no technological progress. As a consequence, all per capita variables are constant once they reach the steady state. This feature is somewhat unrealistic. In particular, developed countries have experienced positive per capita growth rate over years. It is hard to imagine that this has been achieved only by accumulating capital per worker – presence of diminishing returns makes this implausible. Technological progress seems to be the explanation. It enables countries to counteract the effects of diminishing returns and achieve positive per capita growth rate in the long run.

The neo-classical economists amended the Solow-Swan model and introduced exogenous labour-augmenting technology progress as given by *A(t)*, that grows at the constant rate *x*. The production function therefore becomes:

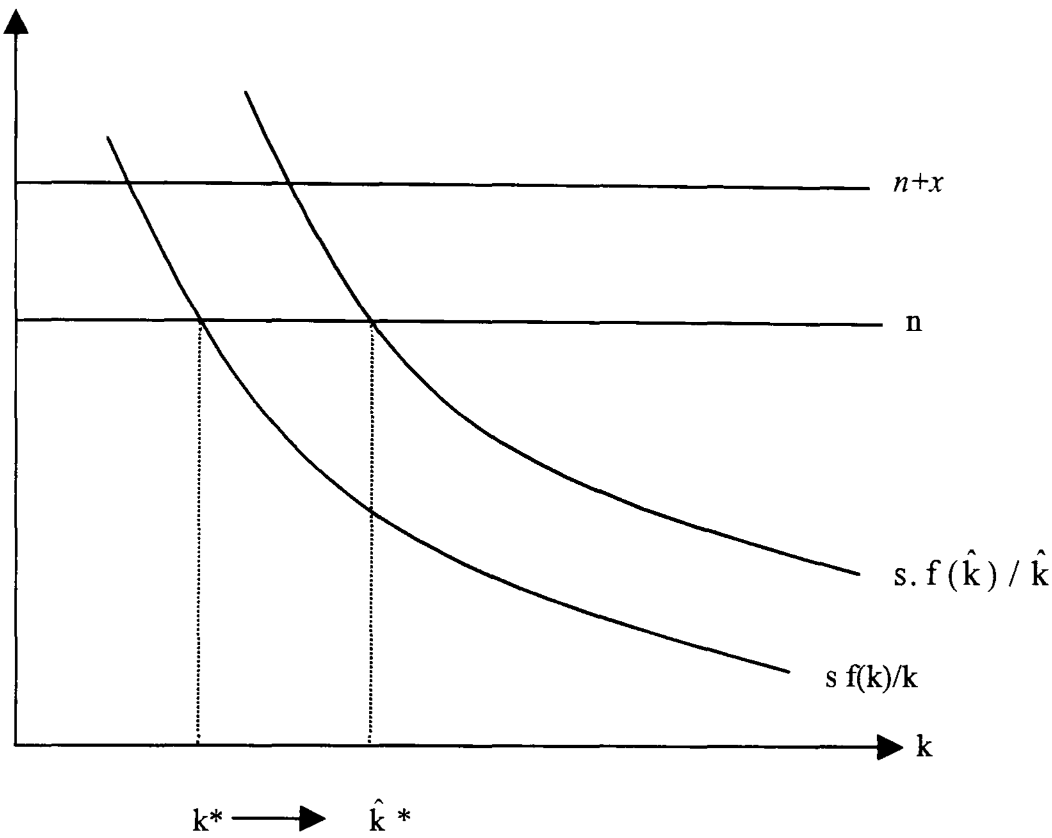
$$Y = F[K, L.\ A(t)] \qquad (2.8)$$

And, $\Delta k = s.\ f[k, A(t)] - (\delta + n).\ k \qquad (2.9)$

It follows that in the steady state $s.\ f(\hat{k}) = (\delta + n + x).\ \hat{k}$ where $\hat{k} = k\ /\ A(t) = K\ /[L.A(t)]$ and refers to the quantity of capital per unit of effective labour.

Again assuming zero depreciation rate, one can notice from Figure 2.3 that the level of k at which the downward sloping curve $s.\ f(\hat{k})/\hat{k}$ intersects the line $n + x$ shifts to the right. Hence, labour-augmenting foreign assistance would imply a higher

FIGURE 2.3: Aid in Neo Classical Model with Labour-Augmenting Technological Progress



steady state than otherwise possible. Note that by definition, the steady state growth rate of k is constant. Because of constant returns to scale, this implies that k should grow at the same rate as technological progress which is equal to x. It also follows that both per capita output and consumption would grow at the rate x in the steady state. The level of these variables (capital stock, consumption and income) which were growing at the constant rate n, in the absence of labour-augmenting technological progress, would now be able to grow at a higher rate $n+x$. Though once again with the end of aid disbursement, the economy will go back to its original position unless the basic assumptions on behaviour of n and s are modified or aid-financed technical assistance had some permanent positive spillovers in the recipient economy. This in turn depends on the capability of the recipient to learn and adapt the new technology.

2.4 AID IN ENDOGENOUS GROWTH MODEL

In response to the dissatisfaction regarding exogenous technological progress as an explanation of productivity growth in the neoclassical model, there emerged new growth theory, mainly stemming from Romer (1986). The latter explained growth within the model, hence the name *endogenous growth*. The key chararacteristic of this new class of models is the absence of diminishing returns to capital, the fundamental reason why per capita growth could not be sustained once in the steady state in the Solow-Swan model. The common and simplest version of a production function that does not exhibit diminishing returns is of the AK type (first used by von Neumann (1937)):

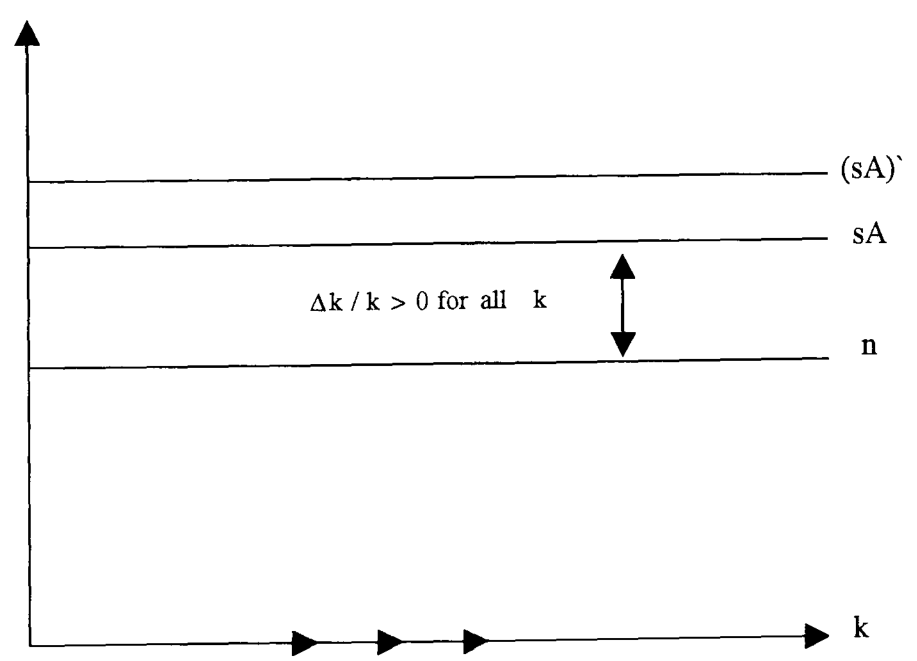
$$Y=AK \qquad (2.10)$$

Where A reflects the constant level of technology such that $A>0$. Note that in this context, average and marginal products of capital are constant and are given by A. With the assumption of an exogenous and fixed saving rate (s), one can write $f(k)/k=A$ and the fundamental equation for growth (Equation 2.7) can now be rewritten as:

$$\frac{\Delta k}{k}=s.A-(\delta+n) \qquad (2.11)$$

The downward sloping curve, $s.f(k)/k$, is now replaced by the horizontal line corresponding to the level sA.

FIGURE 2.4: Aid in Endogenous Growth Model



Consequently, as Figure 2.4 depicts, growth rate in k is obtained as the difference between the two lines, sA and n (again ignoring depreciation). Also, growth in k would be constant (since these two lines are parallel) and is independent of the level of k. As long as $sA>n$, the economy will attain positive per capita growth, in terms of capital, output and consumption. Unlike the neo-classical model, the AK formulation of endogenous growth predicts that the economy would display positive long-run per capita growth even in the absence of labour-augmenting technological progress. The outcome of these two models differs mainly due to the assumption of diminishing returns in the neo-classical model and its absence in endogenous growth model. Note however that if diminishing returns set in slowly then the convergence period in the former model is long. In these circumstances, an increase in saving rate affects growth for a long time and this would approximate to the AK model in the short run.

If the parameters in an economy satisfy the condition $sA>n$, then with aid disbursement it would be able to achieve an even higher growth rate, say as given by $(sA)`-n$. On the other hand, if this condition does not hold (that is, $sA<n$) then aid flows can potentially raise the line sA such that it lies everywhere above n. Foreign aid can achieve these positive effects either by supplementing domestic savings and therefore raising the savings rate (s) or if granted in the form of technical assistance by affecting the parameter A. Alternatively, if foreign aid flows in the form of population control assistance then n can be reduced and higher growth rates are attainable. With the end of aid flows, one can imagine that the line sA would revert back to pre-aid level and so would the temporarily higher growth rate. However, it is interesting to note that the tendency for diminishing returns has been eliminated from this growth model by the introduction of the notion of learning-by-doing (Arrow, 1962). This concept is closely linked to a process of spillovers of knowledge. Hence, if aid succeeds in improving the level of technology in the recipient country, then the potential spillover effects would stop the economy from slumping back to pre-aid levels. In other words, aid can potentially have permanent positive effects on per capita growth rate.

2.5 AID IN GROWTH MODELS WITH CONSUMER OPTIMISATION

One shortcoming of the class of models discussed here is that savings rate is exogenous and constant. Subsequent growth models have endogenised savings by allowing for optimising households and firms to interact on competitive markets. One of the popular growth models in this category was constructed by Ramsey (1928) and refined by Cass (1965) and Koopmans (1965). Infinitely lived households is among its key components. In this set up, households determine consumption and saving such that their dynastic utility is maximised subject to an intertemporal budget constraint. Recent empirical work on aid effectiveness is rooted in this growth framework. Allowing for consumer optimisation, we reconsider the impact of aid on growth by making specific reference to a few prominent cases in the empirical literature.

2.5.1 Aid in Neo-Classical Growth Model

Burnside and Dollar (2000) use a one-sector neoclassical model to motivate the use of an aid-policy interaction term in their empirical growth equation. They assume that production is undertaken by each (infinitely lived) household which combines a single unit of labour and technology as given by $Y_t = AK_t^{\alpha}$, where A>0 and $0 < \alpha \leq 1$. Their lifetime utility is given by

$$\sum_{t=0}^{\infty} \beta^t \frac{(C_t - \bar{C})^{1-\gamma}}{1-\gamma}$$

where $0<\beta<1$ is the discount factor and $\gamma>0$ is the coefficient of relative risk aversion. C_t and $\bar{C}$ represent consumption at time t and subsistence level, respectively. Households receive income from production process and government in the form of lump-sum transfers (T_t). This income is taxed at the rate τ. Hence, assuming no international private capital mobility, the household faces the budget constraint $C_t + I_t - \delta K_t \leq (1-\tau)(Y_t - \delta K_t) + T_t$ while the government budget constraint is $G_t \leq \tau(Y_t - \delta K_t) - T_t + F_t$ where F_t represents foreign aid. Assuming different values for α and $\bar{C}$, Burnside and Dollar (2000) analyse the effect of aid.

First, they consider the case where α =1 and $\overline{C}$=0, that is, marginal product of capital is constant and subsistence consumption plays no role in the model. Under these circumstances, the authors show that initial consumption is

$$C_0 = (R-g)K_0 + \frac{R-g}{R}\sum_{t=0}^{\infty} R^{-t}(F_t - G_t) \qquad \text{where} \qquad R = A - \delta + 1$$

And, consumption growth is constant at

$$\frac{C_{t+1}}{C_t} = g = (\beta\widetilde{R})^{1/\gamma} \qquad \text{where} \quad \widetilde{R} = (1-\tau)(A-\delta)+1$$

In the absence of aid, $C_0 = (R-g)K_0$ and growth rate of GDP equals to g in every period (assuming G_t=0 for all t). If a lump-sum aid is received at t=0, then $C_0 = (R-g)K_0 + (R-g)F_0 / R$. It can be seen that households consume $(R-g)F_0 / R$ share of aid and the rest gF_0 / R is the additional investment induced by aid. As a result, the aid-supported growth rate is higher though it returns to its lower pre-aid level (g) when aid stops. An interesting point noted by Burnside and Dollar (2000) is that output growth (g) depends not only on size of aid inflow but also on level of distortionary taxes. The higher the tax rate, the lower is aid effectiveness, other things held equal.

Allowing the subsistence consumption to be non zero, Burnside and Dollar (2000) again find that aid raises output directly, an effect that depends on how much of aid is invested rather than consumed. Aid also has an indirect effect - it moves the country onto a higher transition path with higher growth rates. Both of these effects are found to be a negative function of distortions. Similar observations are made when diminishing returns to capital is assumed (α<1). This finding motivates the introduction of an aid interaction term such that aid effectiveness depends on the quality of policies (that would capture market distortions).

2.5.2 Aid in Endogenous Growth Model

Model with Infinitely Lived Individuals

Lensink and White (2001) study the implications of aid using a simple endogenous growth model that allows optimising behaviour to determine savings. ***Households*** decide the fraction of their income to consume and save such that they maximise their dynastic constant intertemporal elasticity of substitution (CIES) utility as given by

$$U = \int_0^{\infty} e^{-\sigma t}\left(\frac{c^{1-\theta}-1}{1-\theta}\right)dt \quad \text{subject to the budget constraint} \quad \frac{dz_t}{dt} = w_t + r_t a_t - c_t .$$

Where σ stands for the rate of time preference, c for consumption, θ for the inverse of the elasticity of substitution, z for the net assets owned per household, w for the real wage rate, r for the rental price of capital and a for assets[2]. The solution to the optimisation problem faced by household, is given by the intertemporal Euler condition: $\frac{dc}{c} = \frac{1}{\theta}(r-\sigma)$ (2.12)

Firms are assumed to be driven by a Cobb-Douglas production function as given by: $Y = AL^{1-\alpha}K^{\alpha}G^{1-\alpha}$; $\alpha < 1$ where Y is the output produced, A is a measure of total factor productivity, L is the size of labour force, K is the capital stock and G is government purchases[3]. The profits earned by a representative firm at any point in time is expressed as: $\pi = AL^{1-\alpha}K^{\alpha}G^{1-\alpha} - (r+\delta)K - wL$ where δ and w refer to the depreciation rate of capital and the wage rate. Profit is maximised where marginal product of capital equals the rental price and marginal product of labour equals the real wage rate. This former first order condition is given by: $\alpha AL^{1-\alpha}K^{\alpha-1}G^{1-\alpha} = (r+\delta)$ (2.13)

[2] It is assumed that households are indifferent to the composition of their wealth, so that all assets pay the same real rate of return, r.

[3] This form of the production function implies that public services complement private inputs in the sense that an increase in G would raise the marginal products of L and K. Note also that the exponent on G exactly equals 1-α, so that the economy faces constant returns to K and G for fixed L and hence

Government provides public infrastructure to private investors rather than getting engaged in the production process itself. It purchases the goods produced by private investors and provides them as free public services. Foreign aid is introduced as a source of finance for the government. For simplicity, foreign aid flows, F, are taken to be the only way to finance government purchases, G. Hence, $G=F$ *or* $G=\phi Y$ where ϕ represents aid disbursement as a fixed share of the output produced by the recipient firm. Substituting the Cobb-Douglas production function, this can be rewritten as $G=(\phi A)^{1/\alpha} L^{(1-\alpha)/\alpha} K$

The first order condition, Equation 2.13, can now be respecified as $\alpha A^{1/\alpha} (L\phi)^{(1-\alpha)/\alpha} = r+\delta$. Consumption, capital stock and income will all grow at the same rate. This growth rate, g, can be obtained by substituting the equality condition of marginal product of capital and its rental price (Equation 2.13) in the intertemporal Euler condition which maximises consumer's dynastic utility (Equation 2.12). Hence,

$$\frac{dc}{c} = g = \frac{1}{\theta}\left(\alpha A^{1/\alpha} (L\phi)^{(1-\alpha)/\alpha} - \delta - \sigma\right)$$

We take the first derivative of growth rate with respect to aid as a share of recipient output to evaluate the effect of aid flows on growth rates, as given by:

$$\frac{dg}{d\phi} = \frac{1-\alpha}{\theta\phi}\left(A^{1/\alpha} (L\phi)^{(1-\alpha)/\alpha}\right) \qquad > 0$$

Drawing from this result, Lensink and White (2001) make the observation that an increase in foreign aid unambiguously promotes growth rate of recipient country. They then endogenise the level of technology in their model such that it given by $A=(1-\beta\phi)A_0$ where A_0 is the level of technology with no aid and $0<\beta<1$. Impact of aid on growth can now be assessed using:

endogenous growth is possible. If it were less than 1-α, then diminishing returns would apply and these would rule out endogenous growth.

$$\frac{dg}{d\phi}=\left(\frac{1-\alpha}{a}\;\frac{\beta}{1-\beta\phi}\right)\cdot\frac{1}{\theta}\left(((1-\beta)A_0)^{1/\alpha}\;(L\phi^{(1-\alpha)/\alpha}\right)$$

$$=\left(\frac{1-\beta\phi(2-\alpha)-\alpha}{(1-\beta\phi)\phi}\right)\cdot\frac{1}{\theta}\left(((1-\beta)A_0)^{1/\alpha}\;(L\phi)^{(1-\alpha)/\alpha}\right)$$

Whether aid flows affect growth positively or negatively now depends on the first term in the expression above. Note that since its denominator is always positive, it is the numerator which will effectively determine the sign of the derivative. For small values of ϕ, it will be positive, that is, aid flows will promote growth. However, if ϕ exceeds a certain level, the derivative will turn negative, that is, negative returns to aid set in. Based on these findings, Lensink and White (2001) believe that existence of an aid Laffer curve is a possibility.

Model with Finite Horizons

Recently, Dalgaard *et al* (2002) provide some further theoretical discussion of how aid may affect growth in the context of an endogenous growth model that allows for consumer optimising behaviour. For this purpose, they use a two-period growth model rather than making the traditional assumption of infinitely lived individuals. Hence, they shift from the frequently used Ramsey-Cass-Koopmans model to the overlapping generations Diamond framework to study aid effectiveness. Whilst individuals live over two periods only in this set up, activity still extends infinitely in the future. The standard Cobb-Douglas production technology is applied: $Y_t=\Omega^{\alpha}K_t^{\alpha}(E_tL)^{1-\alpha}$ where same definitions as before apply to all variables other than Ω and E_t. Ω is a time-invariant constant that captures productivity differences attributed to country specific factors like climate (Sachs, 2001) and institutional environment to cite a few. E_t is an index of labour efficiency, which owing to learning-by-doing effect[4], increases over time as output per worker rises (Kaldor, 1957). Hence, formally $E_t = y_t$. Substituting this expression, the production function can be rewritten as $Y_t = \Omega K_t$. The equilibrium factor prices, which is conventionally

[4] It is assumed that firms do not internalise the productive effects of learning.

reached when marginal product of capital and labour equals real rate of interest (r) and wage rate (w_t) respectively[5], are given as:

$$r=\alpha\Omega \qquad w_t=(1-\alpha)\Omega\, k_t \qquad (2.14)$$

Firms engage in this production process for an infinite length of time. Consumers receive wages and an equal amount of aid per capita (f_t)[6] during their youth (the first period). They spend part of this income on consumption and save the remaining. In the second period, they earn interest on the savings and continue to receive aid which is allowed to grow over time such that $f_{t+1}=(1+\Phi)\, f_t$ The budget constraint for period 1 and 2 are respectively:

$$c_t^1+s_t \le w_t+\pi f_t \qquad ; \quad c_{t+1}^2 \le (1+r)s_t+\pi f_{t+1}$$

It is assumed that a representative young individual has logarithmic preferences, $U(c_t^1, c_{t+1}^2)=ln(c_t^1)+\frac{1}{1+\rho}(c_{t+1}^2)$ Consumers aim to maximise discounted lifetime utility subject to the budget constraints faced in the two periods. The solution to this optimisation problem is given by:

$$s_t=\bar{s}w+\bar{s}\left(1-\frac{1+\rho}{1+r}(1+\alpha)\right)\pi f_t \qquad (2.15)$$

where the savings rate $\bar{s}$ is equal to 1/(2+ρ). Note that the savings in the first period of life is used to accumulate capital stock, i.e, $K_{t+1} = s_t L$. Hence, substituting for s_t,w and r using Equations 2.14 and 2.15, we obtain the growth rate of capital per worker:

[5] The real rate of interest is assumed to be constant over time so that $r_t = r$ for all t. While, real wage rate is positively related to capital per worker.

[6] To take into account the share of aid flows diverted to unintended uses, it is assumed that individuals receive only the fraction $\pi \in (0,1)$ of aid whilst (1-π) is put to other uses.

$$\frac{k_{t+1}}{k_t} = \bar{s}\Omega\,(1-\alpha) + \bar{s}\left(\frac{\alpha\Omega - \rho - \alpha(1+\rho)}{1+\alpha\Omega}\right)\frac{\pi f_t}{k_t} \qquad (2.16)$$

From this equation, we can now find the implications of foreign aid for growth. Suppose aid inflow in successive periods stays constant, that is, Φ=0. In this case, restating Equation 2.16 in terms of output growth using $y_t = \Omega\, k_t$, we obtain:

$$\frac{y_{t+1}}{y_t} = \bar{s}\Omega\,(1-\alpha) + \bar{s}\Omega\left(\frac{\alpha\Omega - \rho}{1+\alpha\Omega}\right)\frac{\pi f_t}{y_t}$$

It can be seen that aid is likely to spur growth if $\alpha\Omega > \rho$. This underlines the vital importance of country specific structural characteristics – they have a positive influence on marginal effect of aid on growth. This point is reiterated when allowing for growing aid (Φ>0). Hence, theoretical support is obtained for the recent practice of aid interaction terms in empirical work. Moreover, the model implies that although government rent-seeking activities dampens aid effectiveness, as long as some fraction of aid flows into consumers' budget (that is, $\pi > 0$), aid will stimulate growth provided $\alpha\Omega > \rho$. The higher the share of fungible aid, the lower will be aid effectiveness.

2.6 CONCLUSION

Under the assumption of exogenous savings, the neo-classical model predicts positive per capita growth in the transitory period. Once in the steady state, then the economy grows at the constant population growth rate to keep per capita ratios constant. Endogenous growth model on the other hand predicts perpetual positive per capita growth at the same rate as technological progress in the steady state. Our basic conclusion is that despite the different implications reached on growth in steady state, both models commonly identify a number of ways in which aid can effectively impact on development process in a temporary or permanent fashion.

Aid has been modelled to help growth performance in developing countries by adding to domestic savings and foreign exchange earnings. This in turn stimulates investment and increases their capacity to import the required capital goods. Aid, if given in the form of technical assistance (or imported capital goods), enhances the level of technology in the recipient country; for example, through labour-augmenting technological progress. Hence, foreign aid not only aims at assisting with (human and physical) capital accumulation but it also contributes to improving productivity of capital. Economies should aim to increase their domestic savings rate and absorb technology if they intend to enjoy permanent benefits from aid. This would be a necessary step to achieve the long term goal of self–sustaining growth. It is clear that theoretical growth models treat aid as working through indirect routes to promote growth. These routes are what we refer to as 'transmission mechanisms'. They include investment (savings), imports and technology. Accounting for the role of these mechanisms when studying the relationship between aid and growth is important.

Since foreign aid largely enters the economy through the government budget, fiscal behaviour becomes an equally important matter. To some extent, this has been conceptualised in Bacha's (1990) three-gap model. Note that the recent theoretical contributions have commonly introduced aid in the model as a source of funding for government sector (Burnside and Dollar (2000), Lensink and White (2001)). Additionally, they highlight factors that are believed to be of significance in determining aid effectiveness - Burnside and Dollar (2000) emphasise on the quality of policies while Dalgaard *et al* (2002) draw attention to structural characteristics. These papers seem to suggest that other than promoting domestic savings and absorbing technology transfer, recipient economies should also try to change structural factors and quality of policies as aid alone is unlikely to ensure convergence.

Another interesting point that emerges from this review of growth theories relates to a minimum requirement of aid. It would seem that aid disbursement is not the answer to poverty. *Adequate* aid finance is more likely to hold the key. What developing countries need is aid flows that are generous enough to give them the push needed to escape from low-equilibrium trap. Only then can these economies stand on their feet. This gives interesting insights to those who argue that aid has failed. If aid is unsuccessful in pulling countries out of the poverty trap then in some sense aid has failed. The beneficial effects are temporary and the recipient is no closer to a self-sustainable position. Based on the theoretical review, it would seem that suspending aid, as some may argue for, would only exacerbate the situation. The appropriate solution would tend to be more generous aid flows. However, Lensink and White (2001) conclusions contradict this observation. Careful thought should thus be given to validate their argument that too much aid can be harmful.

CHAPTER 3

SELECTIVE EMPIRICAL LITERATURE REVIEW

3.1 INTRODUCTION

Knowledge about the effectiveness of aid is a matter of major interest to both donors and recipients. It provides important insights about how far aid is worthwhile. Also, informed donors are more likely to make better decisions about aid allocation. Of course, record of successful cases of aid are encouraging. That may be reason enough to incentivise donors to help today's low income nations. Nonetheless, donors are increasingly seeking information from empirical literature.

First, we want to note that the definition of aid effectiveness is not an objective one. It is subject to the criteria against which aid impact is evaluated. Most commonly, when referring to the term aid effectiveness, the instinctive assumption is that it is an indicator of how helpful aid is in rendering performance of an economy more efficient in terms of per capita income growth rates. However, allocation of aid reflects multiple objectives. For instance, aid agencies have displayed much concern for reducing poverty in developing and underdeveloped countries. In this case, it would therefore be more appropriate to focus on how effective aid is in bringing about poverty reduction. Even if a recipient country has not performed well in terms of per capita income, aid will still be judged effective if it has succeeded in reducing infant mortality rates or brought improvements in some other poverty indicators. These alternative definitions of aid effectiveness are not entirely separate issues. Success in improving living standards may make further aid flows more growth inducing – for example, more skilled/healthy population will make aid more productive. Similarly, improvements in growth rates may increase national income and thereby help a country reduce poverty.

Nevertheless, we here concentrate on the empirical literature that looks at the relationship between aid and growth for two main reasons. First, few studies examine aid effectiveness in reducing poverty (but see Section 3.4). This is in part owing to limited availability of data on poverty, especially time series data. Also, a theoretical framework to examine this link is yet to be strong. Second, this collection of essays on aid effectiveness predominantly looks at growth rate as the objective.

Empirical studies on aid effectiveness in promoting growth have undergone several rounds of development (See Hansen and Tarp (1999) for a detailed review). Early studies were mainly based on cross-country regressions within the Harrod-Domar growth framework. They concentrated on an aggregate foreign inflow indicator. Only in a few cases was aid treated as a separate source of finance. Corresponding to the development of Solow neo-classical and endogenous growth theory, there emerged a second and third generation of aid studies which allowed for aid as a separate explanatory variable. Also, the latter group of studies breaks new ground as it makes room for work using panel data and advanced econometric methods of estimation. For this reason, we here want to concentrate on studies belonging to the last generation of empirical work in aid literature. We make reference to a few prominent studies (Hadjimichael *et al* (1995), Boone (1996), Guillaumont and Chauvet (2001), Burnside and Dollar (2000), Hansen and Tarp (2001) and Dalgaard-Hansen-Tarp (2002)). From an analytical perspective, this generation of work have very commonly allowed for non-linearity, almost as a tradition, though the rationale for this approach differs across studies. The various explanations offered for this practice relate to diminishing returns, quality of policy, political regime, vulnerability to shocks and climatic conditions.

The rest of this chapter is organised as follows. *Section 3.2* elaborates on the numerous reasons that motivate non-linear aid effectiveness studies. An evaluation of some of the pertinent results in aid literature is provided in *Section 3.3*. We briefly comment on the empirical results regarding aid and poverty reduction in *Section 3.4* before concluding with some final observations in *Section 3.5*.

3.2 RATIONALES FOR NON-LINEARITY

To our knowledge, the first paper that triggered the discussion of a non-linear relationship between aid and growth is by Hadjimichael *et al* (1995). Their argument is that aid may enhance growth unless the recipient country has surpassed the capacity of absorbing aid and using it productively. In other words, diminishing returns to aid is likely to set in at high levels of aid owing to limited absorptive capacity of recipients. This notion, which is introduced as an aid squared term at the empirical level, is later formalised by Lensink and White (2001). Reference is made to the concept of an aid Laffer curve.

The impact of aid has subsequently often been recognised to be non-linear, though the motivating reasons are other than diminishing returns to aid. Often, this has been expressed in terms of an aid interaction term in the empirical literature. The papers we now mention are therefore similar in terms of the methodological approach to incorporate non-linearity in their model.

Boone (1996) argues that public choice of how well aid funds are used is conditional on the type of political institution. He considers three distinct types of regimes: an elitist, egalitarian and laissez-faire government. Aid inflows allow the former two governments to increase transfers so they maximise welfare of the ruling coalition or a fixed group of citizens with low endowments respectively. The laissez-faire government uses aid to reduce tax distortions (and therefore encourage investment) by the same amount as the increase in their transfers. Hence, this framework predicts that as the government becomes more egalitarian, aid is transferred to the poor and can be more effective in promoting poverty reduction and capital accumulation (hence growth potentially). This gives rise to an interaction term between aid and a proxy for political regime.

The work done by Burnside and Dollar (1997 and later revised in 2000, henceforth BD) has attracted substantial speculation. Consistent with Hadjimichael *et al* (1995) and other recent growth studies, BD do include a range of economic policy variables. However, they take one step forward by suggesting that aid effectiveness is not only enhanced but conditional on a good policy environment – hence the use of an aid-policy interaction term. While other studies can support that aid works even in presence of less favourable policies, BD do not. The idea is that if recipient economies have poor policies, they tend to divert aid from growth-conducive projects to government consumption.

Guillaumont and Chauvet (2001) appreciate the step taken by BD to allow for a heterogenous response of growth to aid depending on specific features (in their case policy) of the recipient country. However, they are not convinced that public management of funds provides unequivocal grounds for aid to work only in a good policy environment. Their concerns are twofold. First, even in the presence of fungibilty, the quality of aid-financed projects is superior owing to the transfer of knowledge through 'aid dialogue'. Second, they argue that the poorer the initial public allocation of resources, the more room for improvement by aid hence the higher would be its effectiveness. Instead, they propose an alternative factor that can potentially influence aid effect on growth. Their hypothesis is that aid is not only more in need in countries vulnerable to shocks (mainly external and exogenous) but also more effective in that environment. There is more scope for aid to improve the situation in vulnerable economies by dampening the negative effects of shocks on growth. They test this hypothesis by interacting aid with a vulnerability indicator.

Recently, Dalgaard-Hansen-Tarp (2002) take a fresh look at the role of vulnerability in explaining non-linear effects of aid on growth. Their focus is on the geographical position or to be precise climate-related features that affect the extent to which aid can be effective. One of the possible explanations they identify as to why climate matters is linked to mortality rates. Drawing from Sachs (2001), they are inclined to believe that individuals in temperate climate zones live longer than those in non-temperate climate zones (after income is controlled for). Hence, the high mortality rate in the latter environment limits the benefits to be derived by investing aid in human capital accumulation. On these grounds, the regression includes aid interacted with a measure for exposure to tropical climate.

3.3 OVERVIEW OF EMPIRICAL RESULTS

Motivated by these various rationales, each of the above papers allow for non-linearity in studying the aid-growth link. Table 3.1 and 3.2 summarises their results[1]. Hadjimichael *et al* (1995) use a panel of 39 countries over the period 1986 to 1992. Boone (1996) employs a panel of 96 countries and ten-year averaged data over the period 1971 to 1990. Guillaumant and Chauvet (2001) construct two twelve-year averages for the 66 countries in their sample covering 1970 to 1993. Over the same period, BD paper is based on a panel of 55 countries and six four-year periods.

[1] We only present the aid coefficients from Boone (1996) as the coefficients on other regressors are not reported for all regressions in that paper.

Finally, Dalgaard-Hansen-Tarp (2002) obtain data from BD to construct a panel of 54 countries over five four-year epochs from 1974 to 1993. As can be noticed, all of these papers are based on post-1970 data and use a panel data approach. Not only does this increase their sample size but it also allows studying several countries over a long period of time. Period averages have been commonly computed in an attempt to reduce correlation and endogeneity concerns.

In a generation where most obtain results in favour of aid, Boone (1996) concludes that aid is not effective. Aid enters with a significant positive sign in consumption regressions but not in investment regressions, as shown in Table 3.2. Boone (1996) interprets these findings as an indication that most of the aid in that period has fed consumption and thus had little impact on investment. Moreover, an insignificant response of investment to aid has been assumed to imply aid is not growth-promoting. While this way of carrying over the results regarding effect of aid on investment to growth is quite natural, it should be noted that Boone (1996) has not explicitly examined the impact of aid on growth. Also, it is generally ignored that aid does have a significant effect on investment when the full sample is considered. These findings do not change when a differential impact of aid depending on type of political regime is allowed for. The interaction term between aid and type of regime enters with an insignificant coefficient and is robust across FE and IV estimates (using population, strategic interests and lagged aid alternatively as instruments for aid). In other words, contrary to their prior belief, the findings suggest that a liberal political regime does not use aid any differently from a repressive regime.

The remaining papers all commonly agree on one point: aid works. Each paper is built on a model that explicitly specifies policy variables. It seems to be widely acknowledged that the quality of policies matters in determining aid effectiveness. However, it is less clear how to model the impact of aid and policies on growth. While BD is the first and only paper that contends that aid is significant only when interacted with policy which has an effect on its own as well. Others estimate aid contribution by allowing for both aid and policies to have an independent effect on growth.

Table 3.1 : Aid-Growth Regressions in Third Generation Studies

	Hadjimichael *et al* (1995)	Burnside and Dollar (2000)	Guillaumont and Chauvet (2001)	Dalgaard-Hansen-Tarp (2002)
Aid Variables				
Aid	**0.098 (2.22)**	0.49(0.12)	**0.303 (0.003)**	**1.480(3.61)**
Aid^2	**-0.002(2.57)**			-0.018(0.76)
Aid*Political				
Aid*Policy		**0.20(0.09)**		
Aid^2 *Policy		**-0.019(0.01)**		
Aid*Tropics				**-1.402(3.29)**
Aid*Vulnerability			**-0.05 (0.004)**	
Policy Variables				
Budget	**-0.168 (4.61)**			0.047(1.23)
Inflation	**-0.034 (1.94)**			**-1.139(2.65)**
Real Effective Exchange Rate (% change)	**-0.045(2.94)**			
Terms of Trade	**0.029 (1.99)**			
Financial Depth		0.016(0.01)	**0.043(0.027)**	
Policy Index		**0.78(0.20)**		
Openness				**1.968(3.89)**
Government Consumption				
Investment Variables				
Private Investment / GDP	0.014(0.53)			
Government Investment/ GDP	**0.178 (3.43)**			
Education			**2.66(0.003)**	
Other Variables				
Political Instability			**-3.28(0.036)**	
Ethnic Fraction		-0.42(0.73)	-1.109(0.211)	0.021(0.03)
Assassinations		**-0.45(0.26)**		-0.365(1.46)
Ethnf*Assassination		**0.80(0.44)**		0.725(1.66)
Institutional Quality		**0.67(0.17)**		**0.701(3.64)**
Fraction of land in tropics				**-1.101(2.06)**
Low Vulnerability			**1.071(0.00)**	
Observations	186	275	95	231

Notes: Figures in brackets are absolute value of t-ratios except for BD and Guillaumont and Chauvet (2001) who report standard errors and p-values, respectively. Coefficients in bold are significant at least at 10% level.
Source: Hadjimichael *et al* (1995, Table 25), BD (2000, Table 4), Guillaumont and Chauvet (2001, Table 2) and Dalgaard-Hansen-Tarp (2002, Table 2)

Table 3.2: Summarised version of Boone's results

	Estimated Aid coefficients in	
	Public & Private Investment Regression	Total Consumption Regression
Independent Variables include:		
No Political Regime Proxy	0.030 (0.17)	**1.016 (4.83)**
Political Proxy * AIDGNP	-0.055 (0.09)	0.583 (0.81)

Note: T-statistics reported in parentheses.
Source: Boone(1996, Tables 4 and 7)

Hadjimichael *et al* (1995) obtain a significant negative coefficient on their innovative aid squared term, in support of their argument for diminishing returns to aid. This result has been robust across numerous studies. Likewise, BD attempts to break new grounds by constructing a policy index and incorporating an aid-policy interaction term in aid-growth regressions. The index[2], which is based on regression coefficients, is a composite measure of three economic policies – budget deficit, trade openness and inflation rate. This allows them to study the interaction between aid and economic policies without losing degrees of freedom which would result if each policy variable were interacted separately with aid. From Table 3.1, it can be seen that aid on its own enters with an insignificant coefficient (this holds in all the regressions they report) whilst a significant positive coefficient is obtained on the aid-policy interaction (though it turns insignificant in two out of the eight regressions it appears in). BD also include an interaction term between aid squared and policy which enters with a negative sign and is attributed to diminishing returns. In general, BD conclude that making aid systematically conditional on quality of policies is likely to increase its effectiveness in developing nations.

This result, which forms the basis of World Bank (1998) recommendations, has been subject to much controversy. There are two main concerns. First, it is quite unclear as to how to interpret an aid-policy interaction term. Does a positive coefficient suggest that policy makes aid effective or does it imply that aid makes policies more effective (through reforms for example)? Another interpretation issue is highlighted by Hansen and Tarp (1999: HT hereafter). They argue that an aid-squared and aid-policy interaction term are likely to be proxy for each other. This is based on their assertion that a BD type policy index is made up of two components: $policy = \kappa aid + (policy|aid)$, where the first part is correlated with aid as given by factor κ and the second part is uncorrelated with aid. Appropriate substitution results in: $aid*policy = \kappa aid^2 + aid*(policy|aid)$. Hence, it would appear that a significant coefficient on aid-policy interaction term may simply be capturing the effect of an omitted aid-squared term.

[2] Policy Index = 1.3 – 1.4 inflation + 2.1 openness – 5.4 budget surplus where the constant is the impact of all the omitted variables when they are at their mean value. The reliability of this index has been questioned by HT.

Second, BD results have yet to be regarded as robust. The aid-policy interaction term is insignificant in most of the regressions reported by Guillaumont and Chauvet (2001) and do not withstand the rigorous re-assessment by HT. Using almost the same data set[3] and exact specification as BD, they find aid-policy interaction term to be insignificant unless five observations are excluded. Hence, it would appear that BD results rely heavily on these five observations which they deem as outliers (those observations with extreme residuals) but are more likely to be leverage points (those which have an above-average influence on the fitted value) according to Dalgaard and Hansen (2000). Of course, this distinction still allows them to delete these observations but it does not justify why they limit this deletion rule to aid variable only. Also, there are other observations with higher leverage points, as identified by Dalgaard and Hansen (2000), that are retained in the sample. BD conclusions are also sensitive to the estimation method used. Although, BD findings hold even where they endogenise aid and use 2SLS (population, infant mortality rate and arms imports as a share of total imports (proxy for donor's interest) are used as instruments, inspired by Boone (1996)), they disappear in the GMM estimates HT provide. Interestingly, aid squared is statistically significant in all HT regressions. Overall, results regarding aid squared tend to be robust while aid-policy does not. This might justify why aid squared now appears very commonly in aid-growth empirical models. It tends to be a rule rather than an exception in recent studies.

The interaction terms included by Guillaumont and Chauvet (2001) and Dalgaard-Hansen-Tarp (2002) can be seen as being at an early stage of development. They mainly explore the hypothesis that vulnerability and climate exert some influence on how effective aid is in promoting growth. They both find evidence in support of their belief that aid is more effective in vulnerable and temperate climate zones. Their results are robust across estimation methods that account for endogeneity through instrumenting (and differencing for Dalgaard-Hansen-Tarp (2002)). At the outset, these two papers would seem to be equivalent as they both focus on vulnerability of an economy as an influence on aid effectiveness. However, their

[3] BD used newly constructed data on foreign aid (EDA) where grant component of each concessional loan is added to outright grants. Also, different measures of GDP have been used when expressing aid, on one hand, and fiscal variables on the other, as ratios. HT in their turn choose to rely on ODA flows instead and they also treat the relevant variables relative to a common GDP measure - as provided in World Bank database.

motivation for this focus is quite distinct from each other and this becomes clear as we take a closer look at their measure of vulnerability. Dalgaard-Hansen-Tarp (2002) concentrate on climatic features and use fraction of land in tropics as an indicator. Guillaumont and Chauvet (2001) compose an index, using same methodology as BD, made up of two components – climatic or ecological and trade shocks. Unlike Dalgaard-Hansen-Tarp (2002), they use instability of agricultural value added (weighted by GDP) as a proxy for climatic shocks. Terms of trade and other trade related variables are used to measure trade shocks. The rationales in these two papers for a non-linear relationship between aid and growth are more like promising avenues for future research especially for Africa as its overall poor economic performance has been partly attributed to disadvantageous geography and heavy dependence on primary sector that makes it susceptible to shocks.

3.4 NOTE ON EMPIRICS ON AID AND POVERTY

Despite limited availability of data on poverty, there have been a few studies that concentrate on poverty reduction rather than growth as an objective of aid allocation. Boone (1996) makes some propositions regarding what mediates effect of aid on poverty. First, he recognises that capital market imperfection, which according to early literature imposes a limit on the number of profitable investment projects poor countries undertake, does not seem plausible in the light of recent high capital mobility. Second, he suggests that aid reduces poverty through fiscal policy. The planner compares the social cost of higher taxation to the benefits of more public goods in order to choose an optimal tax rate. As a result, proxies for political regime together with aid are included in poverty regressions. No significant results are however obtained.

The role of public choices again becomes the central focus in Ranis *et al* (2000) as a mechanism to reduce poverty. The former conclude that high social public expenditure, especially through female education, improves human development. However, they use a restrictive definition of social expenditure and human development such that a more precise interpretation of their findings is that for every percentage point increase in share of GDP invested in education and health, life expectancy shortfall decreases by about 1.75 % points. An interesting feature of their paper is that they attempt to show how improvement in human development is good for growth. They find significant estimates indicating the beneficial effects of both literacy rate and life expectancy on growth. Dollar and Kraay (2001) is yet another paper that looks at how faster growth benefits quality of life of the poor.

Evidence in support of positive effect of health and education on poverty is again obtained in Verschoor (2002). Kalwij and Verschoor (2002) extend this analysis by looking at a wider definition of public social expenditure that includes spending on health, education, housing, social security among several others. Also, they use both monetary and non-monetary poverty indicators. Most importantly however, they include an aid measure in poverty regressions. Surprisingly, their estimates suggest that on their own aid and social expenditure are associated with higher poverty. However, in accordance to their hypothesis, they find that both aid and social spending increases the elasticity of poverty to growth. It would appear that growth can mediate effects of aid on poverty level.

3.5 CONCLUSION

This brief survey of the empirical literature in aid studies consistently emphasise the importance of accounting for policy environment, though the nature of its interaction with aid is an unresolved issue. Equally important seems to be the issue of non-linearity which is a recurring theme in addressing the relationship between aid and growth. We limit attention to these studies to highlight the issues to be addressed in our empirical analysis (Chapters 5-8)

Notice that a dummy for SSA is significant in BD as well as in the broad aid literature. Ethnic fractionalisation and assassination which are quite predominant characteristics of this region have also been very consistently used in the empirical literature in the hope to account for some of the features specific to SSA. It would appear that there is empirical evidence suggesting that SSA is a region that warrants a case study. The fact that it has been receiving a large share of foreign aid, as we show in the following chapter, makes such a focussed study of more value.

Based on growth theory discussed in previous chapter, we identify investment/savings as an important transmission mechanism for aid to impact on growth. Note however, not much effort has been devoted to explore these indirect effects. In fact, only one of the papers reviewed here includes an investment variable in their model. In general, investment does not appear as an explanatory variable in most papers in aid literature. Rather, aid is used as a proxy for investment – an approach that creates problems of its own (we elaborate on these issues in Chapter 5). In this volume, we want to explore these indirect mechanisms and pay particular attention to their treatment in aid literature.

Overall, evidence supports aid effectiveness. This is in contrast to earlier generations of aid studies. Estimated coefficients on aid were insignificant, negative and positive. Recent work has the merit of not only nearing consensus but also attempts to identify factors that affect how effective aid is, policies being only one of them. Interestingly, research is now demonstrating how the objectives of aid with respect to higher growth and poverty reduction are not as distinct as it may first seem, although theoretical justification for this link is yet to be developed.

CHAPTER 4
PRELIMINARY DATA ANALYSIS: DEFINITIONS AND TRENDS IN CAPITAL FLOWS

4.1 INTRODUCTION

In general, developing countries are unable to generate sufficient resources to fuel their aspirations for economic growth. They have historically sought finance from other countries to supplement domestic savings. Foreign capital has flown in recipient economies in more than just one form. Each category has very distinctive features. In an empirical study of effectiveness of capital flows, there are therefore two issues that arise: which type of capital flow is relevant and how to measure it?

We here want to give an overview of the range of capital flows and make some observations on the recent trends. For this purpose, we use data from the OECD Development Assistance Committee (DAC) which is widely recognised to offer the most comprehensive and internationally comparable data on financial flows. We look at how various types of capital flows have evolved over 1970 to 1997 both at world level as well as for Africa. In the process, we pay particular attention to SSA countries as this is the sample under study in the next chapter. This exercise identifies the type of foreign transfers of more relevance to SSA economies, strengthening the case to concentrate exclusively on foreign aid when studying the effect of capital flows in developing economies.

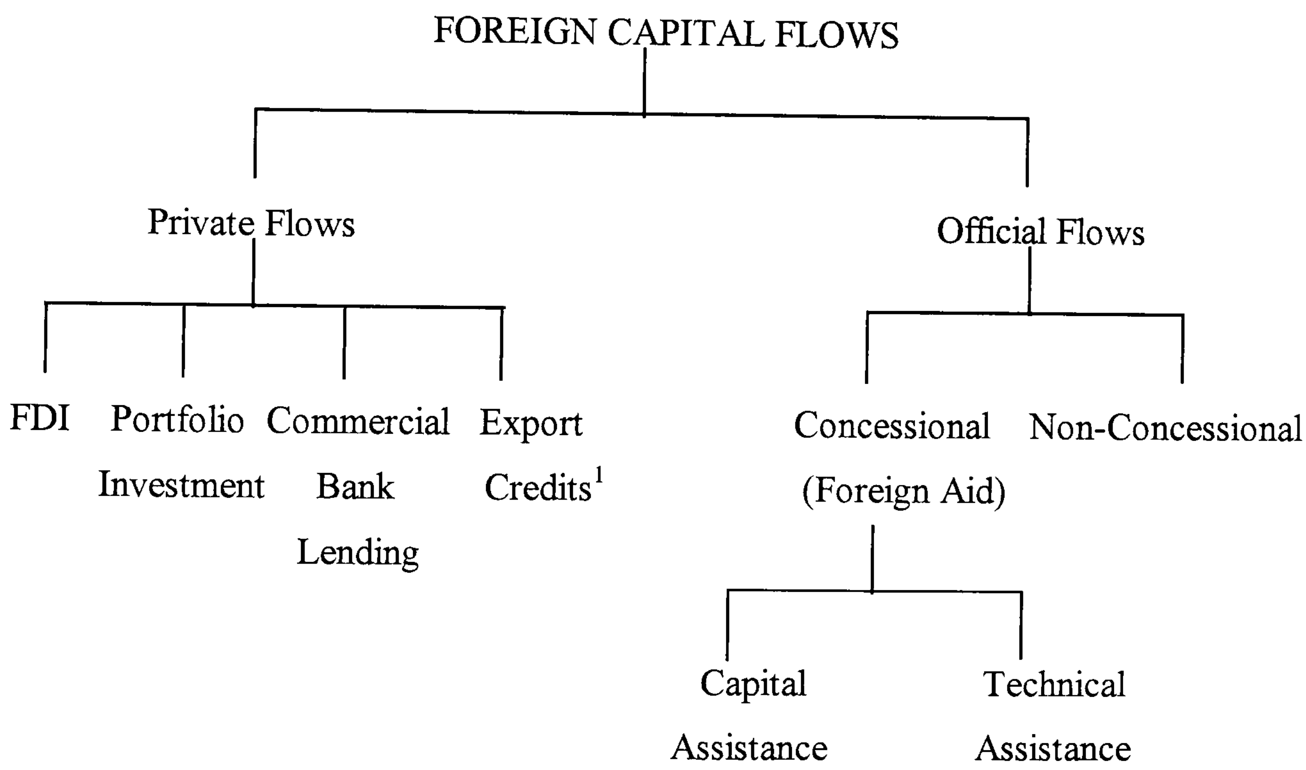
Importance of foreign aid can be captured in numerous ways and this can affect the probability of getting a significant or insignificant coefficient on aid. Choosing an appropriate aid measure is consequently of crucial value. We here highlight the need to construct an aid measure tailored to capture its effects on growth.

The structure of this chapter is as follows. *Section 4.2* offers a brief overview of alternative forms of foreign savings and highlight their distinctive characteristics. We look at the evolution of each type of capital flow at global and regional level in *Section 4.3*. In *Section 4.4* and *4.5*, we address questions with regards to where does aid come from and where does it go. The motivation behind the aid measure we construct, that will form the basis of the empirical work in the following chapter, is presented in *Section 4.6* (Appendix 4 provides the constructed data). Finally, *Section 4.7* summarises this chapter.

4.2 DEFINITIONS

Foreign flows can be decomposed into two components: private and official. Private transfers comprise transactions undertaken by individual entrepreneurs, whilst official flows involve the government. We look at each of these two categories in turn. Figure 4.1 summarises the different types of capital flows that fall under these two headings.

FIGURE 4.1: Types of Capital Flows



Official foreign transfers is partly made available on concessional terms. They are issued either as grants which are outright gifts or as 'soft loans'. There are two ways in which the concessionality or 'softness' of a loan can be measured. First, in terms of the benefits accruing to the recipient as a result of the difference between the interest charged by donors and prevailing rate in the private international capital

[1] Export credits may be extended by official and private sector. If extended by private sector, they tend to be supported by official guarantees (OECD 1999).

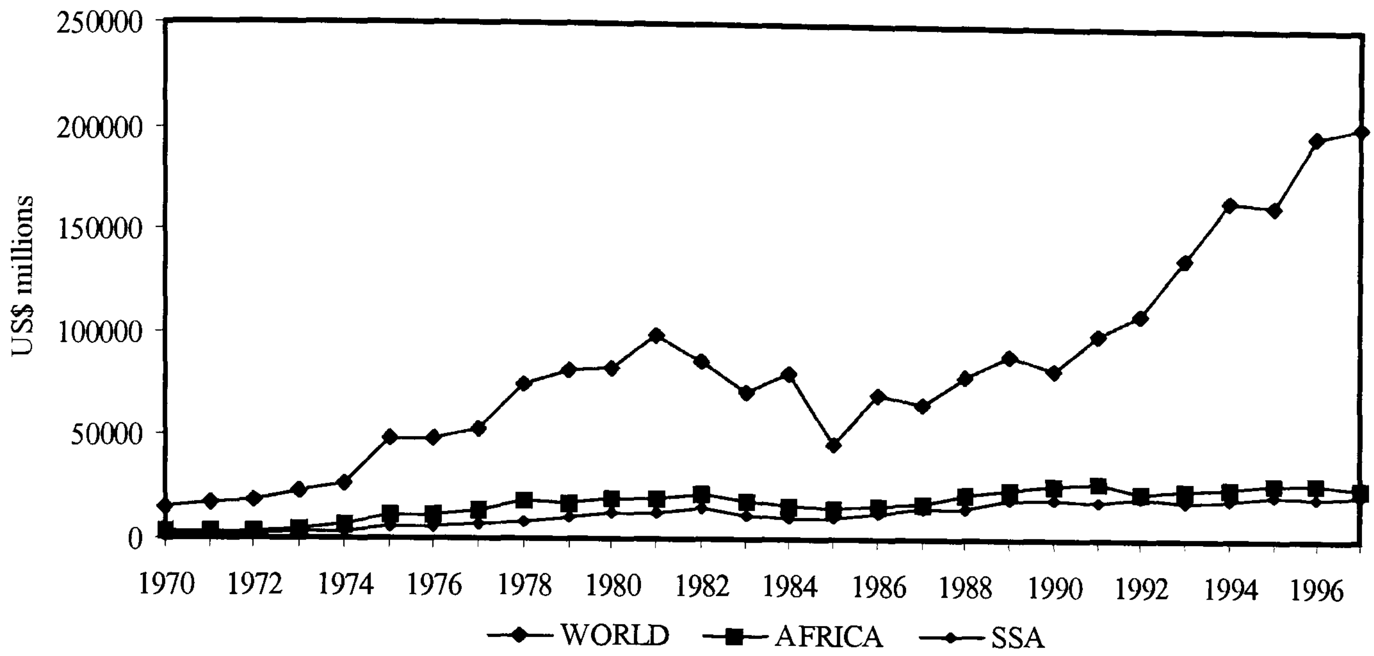
market. Second, the opportunity cost to donor as given by the expected returns on the next best way of investing that capital is an alternative indicator. The latter approach is employed by the Development Assistance Committee (DAC). Technically, concessional flows are referred to as official development assistance (ODA) but more popularly known as foreign aid. A formal definition of aid would be resource flow '...to developing countries and multilateral institutions *provided by official agencies*...administered with the *promotion of economic development and welfare of developing countries as its main objective*, and it is concessional in character and contains *a grant element of at least 25 per cent*' (DAC, 1985, pp. 171). Other official flows (OOF) include those transfers whose main objective is other than development or if development-motivated are on commercial terms, known as 'hard loans'.

We now turn to foreign private flows. They consist of four elements. Foreign direct investment (FDI), which is becoming popular, is made by non-residents in the enterprises located in host countries. The large amounts of finance, management expertise, new technology and access to world markets are the features which make this type of capital transfers attractive. FDI implies either full or partial management control by foreign entrepreneurs. On the other hand, portfolio investments which refer to the purchase of host country bonds by foreigners, have no implications on managerial control. Two other sources of private capital flows are commercial bank lending and export credits.

4.3 TRENDS IN CAPITAL FLOWS

The trend in total net receipts flows in the period 1970 to 1997 is depicted in Figure 4.2 At the global level, the observed trend in net resource flows may be classified into three distinct episodes. During the 1970s and beginning of 1980s, there have been extensive capital flows from both multilateral and bilateral sources. The two oil price shocks during this period created a temporary surge in savings in oil-producing countries. These surplus funds contributed to the massive increase in resource flows from US$ 15171.6 millions in 1970 to reach its peak, US$ 98931.6 millions in 1981. The first half of 1980s (post 1981) can be recorded as a second

FIGURE 4.2: Nominal Total Net Receipt Flows



period where aggregate net receipts plunged to US$ 45895.4 millions in 1985, corresponding to an approximately 53.6 % decline from 1981 values. This downfall in foreign resource flows has been associated with the debt crisis which hit the world in early 1980s. Anti-inflationary macroeconomic policies in industrial countries led to a rapid increase in nominal interest rates. At the same time, falling oil prices drained the savings surplus in oil-exporting countries. The combination of rising debt service and cuts in lending led to the observed reversal of net resources flows, both in real and nominal terms, during this period. The final stage is marked by the end of the international debt crisis. Aggregate net resource flows re-embarked on an increasing trend and by early 1990s they surpassed the nominal pre-debt crisis peak level in 1981. What is interesting to observe is that the flow of nominal net total receipts to African countries displays a fairly smooth increasing trend throughout the period. Inflow of foreign savings to this region did experience a decline in the debt crisis period but the effect was not as dramatic as at the world level. This is not surprising given that Latin America was the most importantly affected economy by this event.

We now focus separately on the different types of (nominal) net resource flows. Figure 4.3 and 4.4 give a visual presentation of the trends in the period 1970 to 1997. Table 4.1 provides additional information.

Table 4.1: Trends in nominal capital flows (in US$ millions)

	WORLD		SSA	
	1970	**1997**	**1970**	**1997**
(A)OFFICIAL FLOWS				
Concessional :				
• ODA Grants	4098.5	40968.4	871.2	11886.8
-Multilateral Donors	667.7	9550.4	230.5	3409.5
-DAC Donors	3068.1	31192.6	640.8	8468.7
• ODA Net Loans	2710.3	9162.4	281.9	3163
Non-concessional:				
• Other Official Flows (Net)	1762.3	17228.1	80.1	-218.3
TOTAL OFFICIAL FLOWS (NET)	8628.4	67540.5	1233.3	14848.2
(B) PRIVATE FLOWS				
• FDI	9205.8	442131.9	427.5	7734.1
• Portfolio Equity Investment	-	-	-	1510
TOTAL RECEIPTS	15171.6	203341.9	1680.4	21747.6

Source: OECD (1999)

As Table 4.1 shows foreign direct investment (FDI), the major category of foreign private investment, has been expanding in spite of very short periods of decline in late 1970 and early 1980 and 1990[2]. In fact, an impressive rise in FDI has been witnessed towards the end of the century. However, it seems that this burst in FDI flows has not been especially directed to SSA countries, although they did receive a share of the rising FDI. In fact, as shown in Table 4.1, while at world level FDI was 48 times higher in 1997 than in 1970, for SSA countries FDI increased by about 18 times only. This recent surge in FDI can be explained by the fact that official lending has recently helped developing host countries with the implementation of

[2] We do not plot the time series of FDI in Figure 4.3 because the overwhelming increase would graphically swamp the trend in other capital flows.

FIGURE 4.3: Net Official and Private Flows to All Recipients

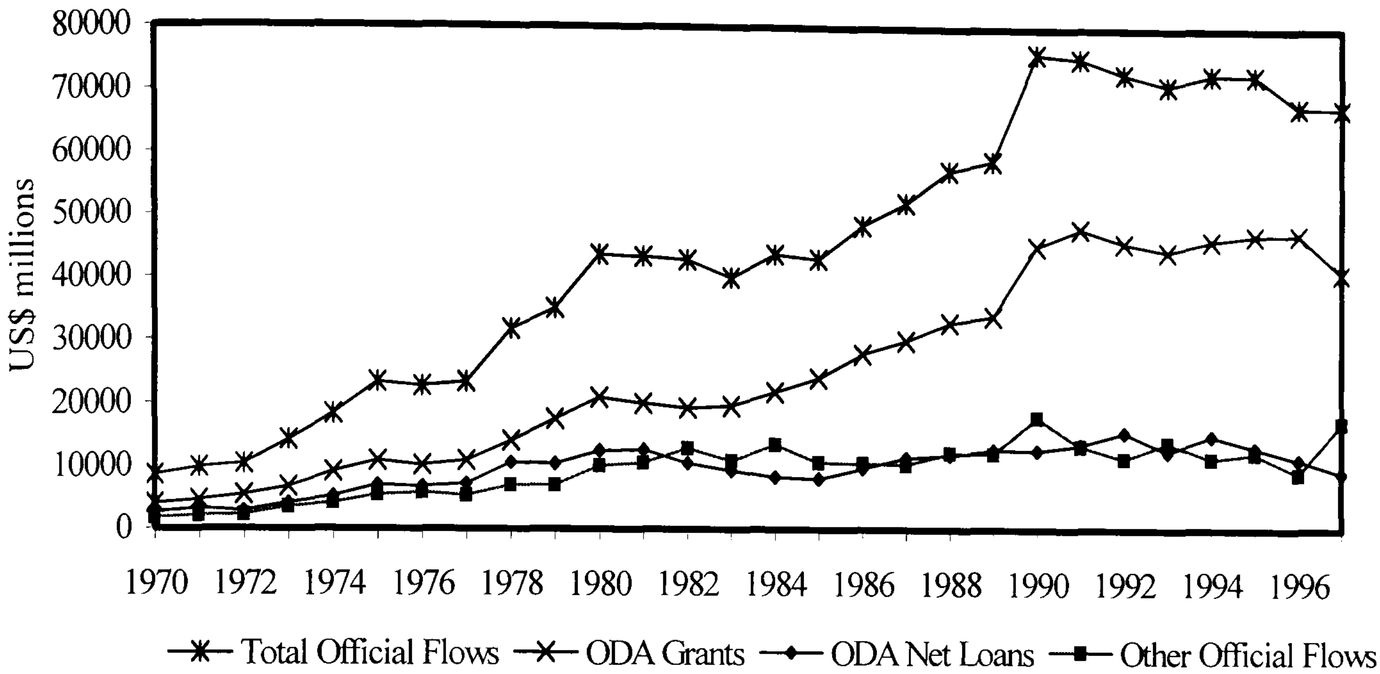
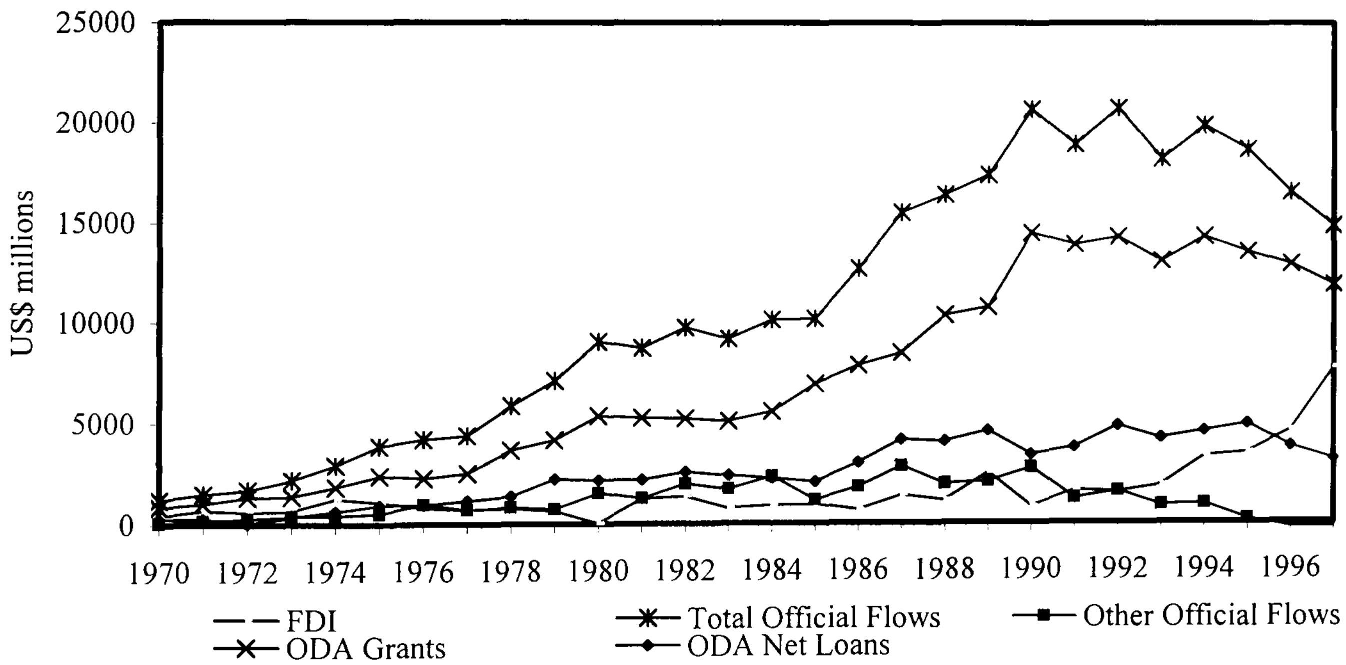


FIGURE 4.4: Net Official and Private Flows to SSA countries



structural and stabilisation projects, thereby improving the potential for profitable FDI. Portfolio equity investment is another form of foreign private saving. This was a very important form of supplementary saving in the nineteenth and early twentieth century but it dropped in the post World War II period. However, developed country investors are nowadays showing interest in emerging stock markets. SSA countries have attracted about US$ 1510 millions of portfolio equity investment in 1997.

though the main source of private savings remains FDI, about US$ 7734.1 millions in 1997.

From Figures 4.3 and 4.4, it can also be noticed that in contrast to FDI, the 1990s is characterised by a mild declining trend in (net) total official flows. SSA countries seem to be experiencing an especially sharp reduction in official flows. On aggregate, there has been about 7.2% decrease in official flows between 1994 and 1997. However, this corresponds to an important 25.2% decline for the SSA countries in nominal terms (even more in real terms). The data series therefore tend to suggest that the last decade may be signalling a preference for private transfers over official transfers from donors' point of view. In fact, whilst the share of official flows in total net receipts was about 56.9% in 1970, it dropped to 33.2% in 1997, at the global level. The time series graph also reveals that although FDI has generally been more important than official flows globally, SSA countries have relied more heavily on official foreign transfers throughout the period 1970 to 1997. Its official transfers as a share of net total receipts was about 73.4% in 1970 and in spite of the sharp decline at the global level in 1997, it still remains an important source of foreign resources, at about 68.3%.

Having identified official transfers as the vital source of foreign resources in SSA countries, we now take a closer look at the trends in its different components, as identified in Figure 4.1. It can be seen from Table 4.1 that concessional foreign resources represent a substantial share of total official flows – in 1970, it accounts for about 78.9 % of aggregate net official flows at the world level and nearly 93% for SSA countries. In the period 1970 to 1997, though concessional flows continue to dominate net official flows, its share has reduced by about 5% at the world level. This however is not reflected in SSA countries where this ratio increased (by about 8%) over the same period. This suggests that foreign aid flows may be disproportionately allocated to SSA countries. Furthermore, as one can notice, ODA grants seem to be the most important element of foreign aid. They accounted for 60.2% and 75.6% of net ODA (sum of grants and ODA net loans) flows in the world and SSA countries, respectively, in 1970. In 1997, their share in foreign aid respectively increased to 81.7% and 79%.

Drawing from Figures 4.3 and 4.4, we can also make some observations on the trend in ODA grants and net loans during the past three decades. The latter displays a reasonably smooth pattern whilst sharper fluctuations have been experienced with regards to grant allocations. After the end of the debt crisis, ODA grants resumed its increasing path to reach its peak in 1990 amounting to US$ 14509.5 millions. However, subsequent years have been characterised by a declining trend, both in nominal and real terms. ODA grants and net loans in SSA countries fell by about US$ 2.62 billions and US$ 0.25 billions or 18.1% and 7.4% in nominal terms between 1990 and 1997. This is equivalent to a 62.5% and 57.7% decline in real terms[3]. At the aggregate level, there was a decrease of only 9.5% and 28.2% in nominal terms, corresponding to 54% and 63.6% decline in real terms. It would therefore seem that SSA countries have suffered more sharply from this decline, as opposed to the debt crisis period when they were almost unaffected. One is led to believe that aid flows will decrease further in real terms, perhaps substantially, over the next decade. O'Connell and Soludo (1999) cite 'continued absence (since the late 1980s) of the traditional strategic and ideological props to bilateral aid, the cumulative effects of fiscal stringency in the donor countries, the deepening recession in Japan, and the resource pulls exerted by the transition economies and the Asian financial crisis' as possible reasons (pg 2). However, Department For International Development has recently been taking actions to concentrate on helping both African and Asian countries, an example which the United Nations is encouraging others to follow. This suggests that aid to SSA will rise.

4.4 WHO ARE THE DONORS?

Depending on its source, foreign aid can either be bilateral (given directly from one government to the other) or multilateral (from an international agency which collects contributions from member countries). Table 4.1 conveys some indication on this aspect as well. A substantial share of grants has been disbursed by members of DAC. They contributed to about 74.9% and 73.6 % of total ODA grants flowing across the world and to SSA region only, in 1970. Though this share slightly declines in 1997 for SSA countries, DAC remains the main donor. On the other hand, multilateral agencies increased their share in total grant disbursement between 1970 and 1997. Nevertheless, they still represent only about one fifth of globally available

[3] We use consumer price index (1995=100) to deflate the nominal flows.

ODA grants. It would seem that multilateral agencies are taking initiatives to be a more important supplier of foreign aid.

Given the significant contribution of DAC members to foreign aid flows in SSA countries, we take a closer look at this group of donors. Figure 4.5 and 4.6 demonstrate the individual contributions of member countries. In the early post-war period, the United States, the United Kingdom and France were the most important contributors. As the other industrial countries recovered, they became more generous (most particularly, Japan) and coordinated their aid disbursement programs through the DAC. While DAC has 21 members, it should be noted that 64% of aid flows in 1997 is accounted for by four countries: the United States (16%), Japan (21%), Germany (12%) and France (15%) (Figure 4.5). The United Kingdom has become a less important donor with a share of 6% of foreign aid flows. From Figure 4.6, we observe that in spite of being the dominant DAC donor of foreign aid, Japan becomes less important in SSA countries by contributing to only a 10% share of ODA flows. On the other hand, it would seem that aid flows from France are concentrated in this region, amounting to about 25% of aid disbursements from DAC countries. This however represents only 0.16% of its GDP in 1997 and its aid efforts have decreased from 1970 when it dispensed 0.20% of its GDP as aid flows to SSA countries. The importance of France as a donor seems to be consistent with the belief that its colonial past plays a significant role in aid allocation decisions. In fact, Alesina and Dollar (2000) find that being an ex-colony is relatively more important than political freedom and openness of an economy. In the same paper, they also find that the United States and the United Kingdom strongly respond to degree of democracy. This may partly explain why the share of foreign aid from United States to SSA countries amounts to only 10% (strategic interests might be a more important alternative explanation). It also sheds some light as to why in contrast to France, the United Kingdom disburses only 8% of the aid flows to SSA countries, despite they both had 18 past colonies in that area. This has however changed since 1997 – UK is now as important a DAC donor as France and Germany, also about 55% of British bilateral aid is to SSA.

FIGURE 4.5: Foreign Aid Flows from DAC donors to All Recipients in 1997

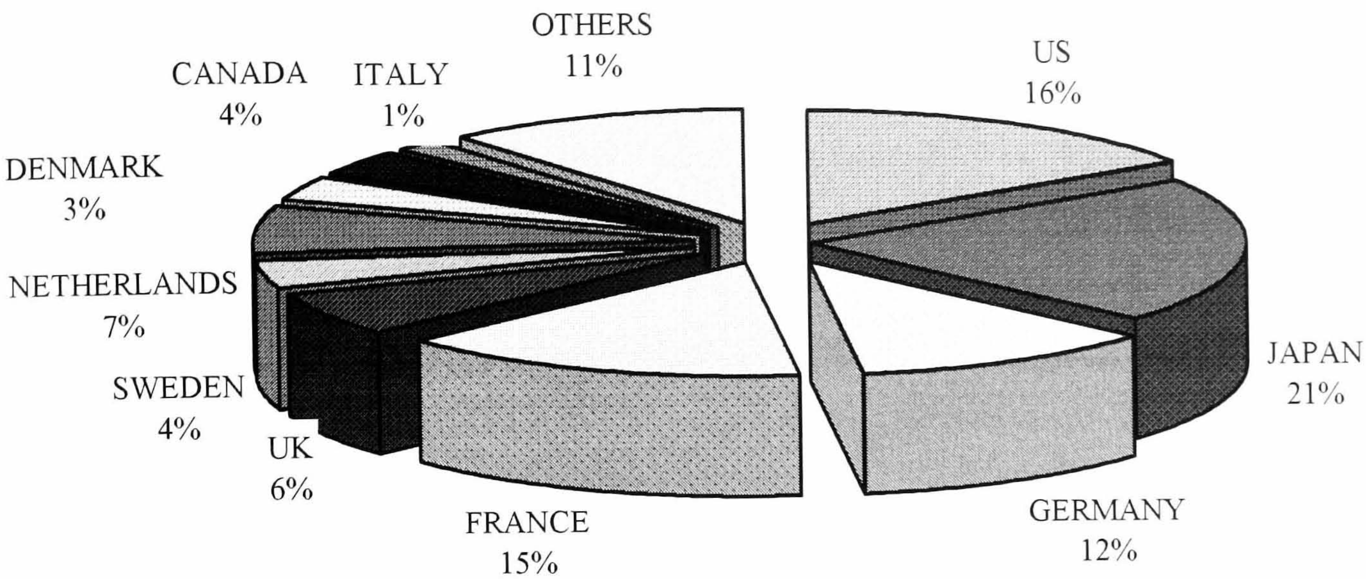
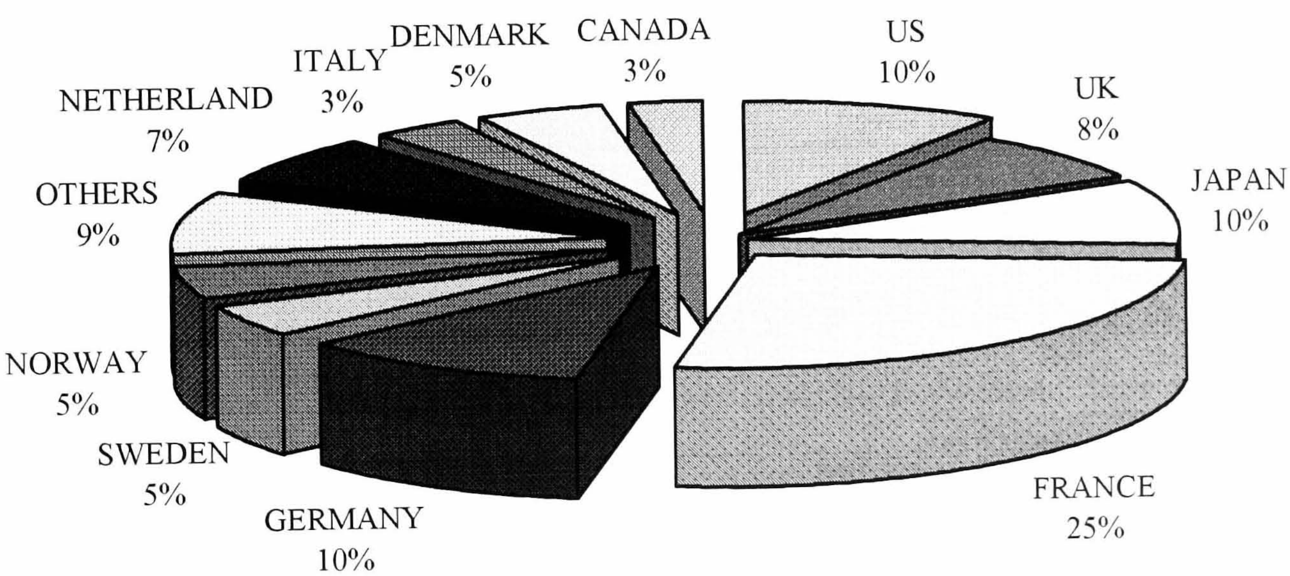


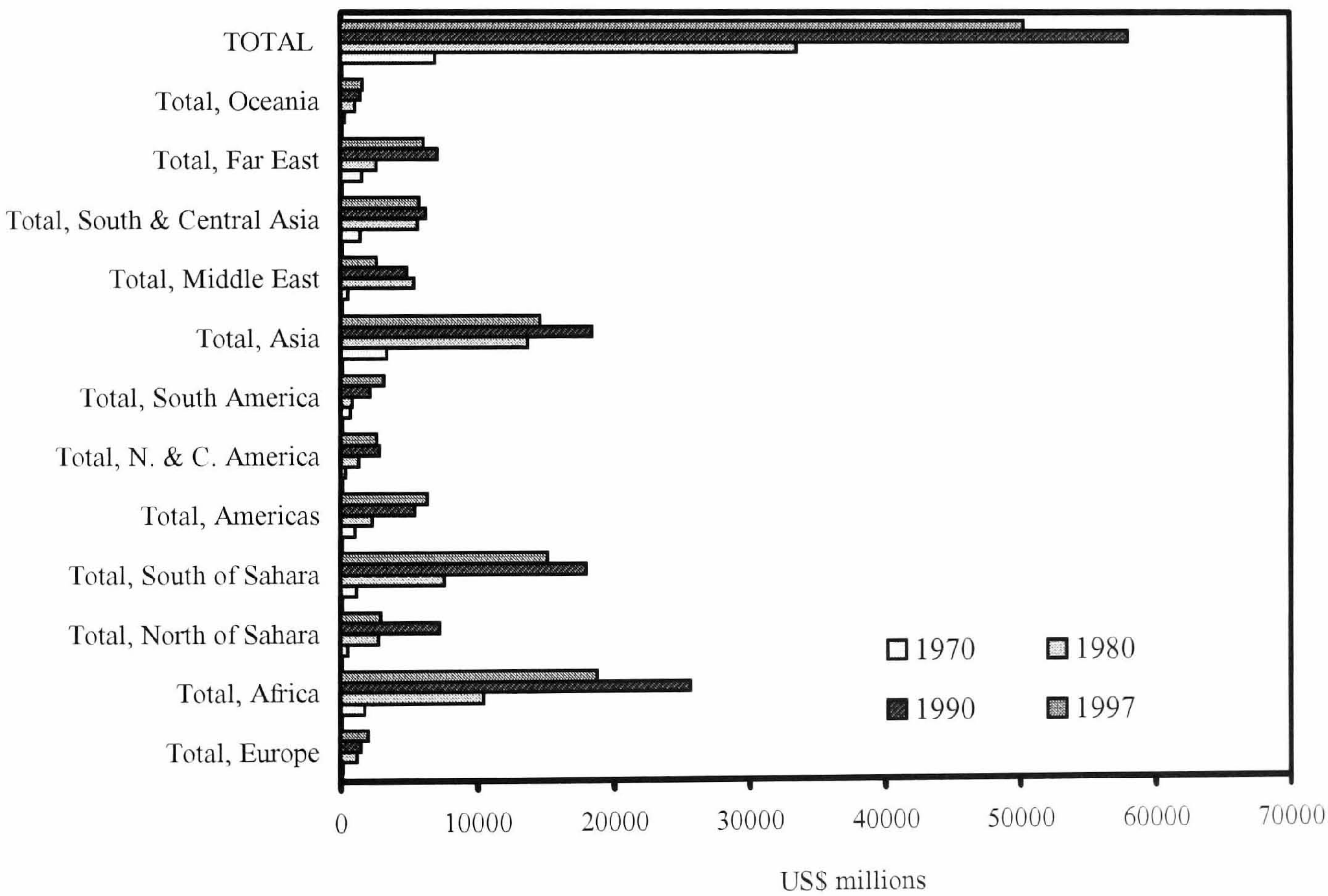
FIGURE 4.6: Foreign Aid Flows from DAC Donors to SSA countries in 1997



4.5 WHO ARE THE RECIPIENTS?

The need for aid varies across recipients. At one end of the spectrum are the newly industrialised and upper middle income countries which can also borrow from international capital markets at the prevailing rate. Such countries may need some technical assistance. At the other end are the poorest developing countries which need aid to survive. They lack the basic infrastructures needed for development. In between these two types lie the lower middle income country who have the basic requirements for development but need access to official assistance to complement them. The bar chart in Figure 4.7 provides some information on the distribution of foreign aid across different regional recipients.

FIGURE 4.7: Regional Distribution of Foreign Aid Flows



First, we find that the disbursement of net ODA flows increased successively from 1970 to 1980 and 1990 both at the global and regional level. The only exception is Middle East countries who experienced a decline in aid flows from 1980 to 1990. In contrast, all regions received less aid flows in 1997, although America witnessed a slight increase (exclusively to South America). Figure 4.7 shows that Africa and Asia received the largest shares of aid flows throughout the last three decades. Prior to 1990, donors favoured Asia in allocating foreign aid resources. However, by 1997 they have started to direct larger share of disbursement to Africa and most especially to SSA countries. One possible explanation is that the success of some Asian countries may have reduced their need for aid in the period covered here.

In general, our discussion has shown that SSA countries receive a large share of aid flows to African countries. It is however worth noting that there are major systematic variations within this group. There (understandably) seems to be a strong tendency for low income countries to receive more aid flows than middle income countries, both in absolute terms and as a fraction of GNP. Whilst for the middle income countries aid flows averaged less than 1% of their GNP in 1997, low income countries received an average of 9%. This suggests that donors are inclined to issue concessional aid in favour of the poorest countries, other things being equal. Aid studies often tend to believe that donors show a preference for less populous nations as recipients (Burnside and Dollar, 2000:850). Consistent to their belief, we notice that though both Rwanda (less populous) and Senegal are in the low income group, they respectively received US$ 63 and US$ 30.2 aid per capita in 1997. However, aid per capita was US$ 49.4 in Madagascar, in spite of its larger population than Senegal[4]. Consequently, we cannot clearly identify population as a criterion for aid allocation.

4.6 AID MEASURES

Based on this examination of trends in capital flows, we find that foreign aid is the most important component of foreign savings, especially in African countries. This lends further justification to our focus here on foreign aid when studying the effect of capital inflows in SSA countries. Note that, for the purpose of estimating growth regressions, we shall use disbursement flows rather than commitments. Commitment is just the promised flow whilst disbursement represents the actual transfer of financial flows. The difference between these two flows can be either positive or negative. For example, in 1987 grant disbursed to Botswana outweighed grant commitment, whilst in 1988, the reverse occurred.

It can be seen from Table 4.2 that throughout 1970 to 1997, SSA countries have received over half the share of ODA grants and net loans directed to African countries. It is worth noting that a general measure of net ODA (sum of ODA grants and net loans) has one important limitation. It includes technical cooperation (TC) grants. These comprise flows in kind which essentially involve supply of human resources financed by the donor. There is some debate over its inclusion in calculation of foreign aid owing to some doubt over its developmental value. A close inspection of Table 4.2 shows that large amounts of grants are directed to technical cooperation

Table 4.2: Computation of Foreign Aid Measure

	1970		1980		1990		1997	
	SSA	**%[a]**	**SSA**	**%[a]**	**SSA**	**%[a]**	**SSA**	**%[a]**
ODA Grants	871.2	66.8	5355	84.5	14509.5	68.7	11886.8	78.6
ODA Net Loans	281.9	71.9	2171.9	53.3	3416.2	76.5	3163	88
AID (Net ODA)	1153.1	68	7526.9	72.3	17925.7	70	15049.8	80.4
Technical Cooperation (% of ODA Grants)	507.1 (58.2)	76.6	2240.5 (41.8)	80.1	3960.6 (27.3)	71.2	4021.7 (33.8)	74.6
Food Aid (% of ODA Grants)	-		490 (9.2)	58.9	732.9 (5.1)	60.5	445.6 (3.8)	72.3
TAID (% of GNP)	646 (1.15)	62.5	4796.4 (2.02)	70.7	13232.2 (4.71)	70.3	10582.5 (3.21)	83.2
Per Capita	2.24		12.6		26.0		17.3	

[a] Percentage of flows to Africa allocated to SSA countries.
TAID is equal to net ODA minus technical cooperation minus food aid. All values are expressed in millions of US$.

In absolute terms TC to SSA countries has increased between 1970 and 1997 from US$ 507.1 millions to US$ 4021.7 millions. Our objective is to determine the effectiveness of foreign aid in promoting growth, we therefore want a measure of financial flows that, in principle, makes a measurable contribution to growth (effective TC may build institutional capacity and contribute to human capital but it would take some time for this to translate into growth). Hence, we deduct TC grants from net ODA. The large share of TC in ODA grants suggests that their inclusion in our measure of aid flows creates an upward bias. In the study of growth regressions, the aid measure should preferably also exclude food aid as this contributes to

[4] The reliability of population as an instrument for aid in empirical work may be questionable.

consumption rather than to growth (see Appendix 4 for aid data). Failure to deduct food aid grants will again inflate the aid measure and thereby increase the probability of obtaining an insignificant coefficient or bias the coefficient. Food aid would be of more relevance when assessing effectiveness of aid in enhancing welfare – an issue we shall explore at a later stage (Chapter 8).

Analysing the efficiency of aid flows requires a measure of the *importance* of foreign aid in each recipient country rather than simply aid volume. Two alternative ways to capture this feature are aid per capita and aid as a share of GNP. The latter measures the real value of aid resources available to a country. We can notice from Table 4.2 that both measures indicate an increase in aid intensity in the last three decades before a decline in 1997. In spite of this recent downfall, aid is still more important than in 1970 and 1980. Also, aid in per capita terms points to a much higher degree of aid dependence than indicated by aid as a ratio of GNP. The choice of indicators is therefore critical. In our study, we choose to rely on aid as a percentage of GNP for the following reasons. First, it is inherent in the notion of aid per capita that foreign aid resources are distributed equally among residents. With regards to the increasing levels of inequality, this measure would not adequately reflect the true picture. Second, donors issue aid to governments who then invest in projects which should benefit the population as a whole. Aid is unlikely to be invested based on how much is available per head. Third, aid per capita may reflect changes in population with aid flows constant, rather than changes in aid itself. Though, aid share in GNP suffers from the same limitation, it has got the merit of defining importance of aid relative to an indicator of overall economic performance rather than the demographic features. Consequently, this definition of aid seems more appropriate given that we aim to assess effectiveness of aid in promoting economic development.

4.7 SUMMARY

In this chapter, we have provided a general outlook on the various forms in which international capital flows to a recipient country. They range from official to private, concessional to non-concessional and bilateral to multilateral. We describe each of these aspects before drawing observations on the recent trends.

Several facts emerge from this preliminary data analysis. First, we notice that despite the declining tendency of official flows, overall capital flows are on the increase both at global and regional (Africa) level. This is mainly attributed to a surge in FDI. That might be indicative to an improvement in world environment such that it is conducive to profitable FDI projects. We also find (as one could expect) that Africa, especially SSA economies, compares favourably to other regions in terms of aid receipts. This lends support to the emphasis on SSA as a region and foreign aid as a source of capital inflow for our empirical study in the next chapter.

Finally, this exercise sheds some light as to where does most of the aid comes from. United States, Japan and France are the main donors. Aid effectiveness studies that would give consideration to donor-specific cases may be insightful. Related to this issue would be donor interests. Developed countries disburse aid for a whole spectrum of reasons that includes moral and humanitarian aspirations as well as motives like ties with ex-colonies, commercial benefit, military and strategic advantage among others. No single motive is however paramount at all times. Rather, donors have mixed objectives. Donor-specific aid effectiveness studies would help find out more about a possible linkage between source (and possibly objective) of aid and its chances to be successful. This provides scope for future research.

APPENDIX 4: DATA

Table 4A: Aid Data (expressed as a % of GNP)

COUNTRY	YEAR	AID	GRANTS	TAID
Benin	1970/73	7.280	6.237	4.516
Benin	1974/77	8.831	5.912	5.885
Benin	1978/81	8.333	6.305	6.046
Benin	1982/85	7.789	4.963	5.207
Benin	1986/89	11.704	7.884	8.573
Benin	1990/93	14.145	9.841	11.263
Benin	1994/97	14.014	10.144	10.532
Botswana	1970/73	20.615	9.819	16.469
Botswana	1974/77	15.850	11.015	11.040
Botswana	1978/81	15.514	16.428	9.307
Botswana	1982/85	10.032	9.048	6.126
Botswana	1986/89	10.506	9.701	6.445
Botswana	1990/93	4.020	3.689	2.224
Botswana	1994/97	2.177	1.821	1.098
Burkina Faso	1970/73	9.279	9.069	6.235
Burkina Faso	1974/77	14.864	11.879	10.025
Burkina Faso	1978/81	15.986	13.850	10.848
Burkina Faso	1982/85	13.065	10.378	8.366
Burkina Faso	1986/89	12.897	9.939	8.405
Burkina Faso	1990/93	15.345	12.026	10.711
Burkina Faso	1994/97	18.957	15.012	13.886
Burundi	1970/73	9.105	8.923	4.054
Burundi	1974/77	10.846	10.178	5.492
Burundi	1978/81	13.039	9.701	8.048
Burundi	1982/85	12.442	7.879	8.356
Burundi	1986/89	16.757	8.876	12.270
Burundi	1990/93	24.180	18.098	17.926
Burundi	1994/97	24.135	23.005	20.185
Cameroon	1970/73	4.588	3.743	2.811
Cameroon	1974/77	4.672	2.905	2.902
Cameroon	1978/81	4.111	1.696	2.914
Cameroon	1982/85	2.049	1.202	1.294
Cameroon	1986/89	2.711	1.896	1.730
Cameroon	1990/93	5.291	3.283	4.091
Cameroon	1994/97	6.612	4.362	5.206
Central Africa	1970/73	9.617	9.640	4.738
Central Africa	1974/77	12.061	11.211	7.271

Central Africa	1978/81	12.535	10.119	7.935
Central Africa	1982/85	14.427	10.315	9.864
Central Africa	1986/89	18.402	11.304	13.208
Central Africa	1990/93	15.863	11.413	11.389
Central Africa	1994/97	14.942	13.914	10.854
Chad	1970/73	8.557	8.822	4.772
Chad	1974/77	12.639	10.290	8.737
Chad	1978/81	10.844	9.329	8.029
Chad	1982/85	15.985	15.338	12.546
Chad	1986/89	25.283	19.865	19.343
Chad	1990/93	22.629	16.042	16.881
Chad	1994/97	22.786	16.298	17.557
Congo Dem	1970/73	2.785	2.471	1.359
Congo Dem	1974/77	3.066	2.358	1.559
Congo Dem	1978/81	3.731	2.393	2.222
Congo Dem	1982/85	3.197	2.009	2.038
Congo Dem	1986/89	7.271	3.630	5.262
Congo Dem	1990/93	5.651	4.407	4.416
Congo Dem	1994/97	3.171	3.378	2.305
Congo Rep	1970/73	5.849	6.020	2.539
Congo Rep	1974/77	7.816	5.589	4.582
Congo Rep	1978/81	7.425	4.668	4.673
Congo Rep	1982/85	4.227	2.505	2.737
Congo Rep	1986/89	5.678	2.869	3.550
Congo Rep	1990/93	6.165	3.946	4.177
Congo Rep	1994/97	17.288	13.662	15.088
Cote D'Ivoire	1970/73	3.233	2.633	1.649
Cote D'Ivoire	1974/77	2.715	1.991	1.287
Cote D'Ivoire	1978/81	1.903	1.154	0.970
Cote D'Ivoire	1982/85	1.866	1.020	1.015
Cote D'Ivoire	1986/89	3.435	2.329	2.476
Cote D'Ivoire	1990/93	8.335	4.205	6.798
Cote D'Ivoire	1994/97	12.782	7.108	11.473
Ethiopia	1970/73	2.453	1.467	1.178
Ethiopia	1974/77	4.427	2.692	3.246
Ethiopia	1978/81	4.746	3.414	3.720
Ethiopia	1982/85	8.457	6.722	6.726
Ethiopia	1986/89	13.034	10.769	9.882
Ethiopia	1990/93	16.047	13.185	12.922

Ethiopia	1994/97	14.500	10.877	11.697
Gabon	1970/73	2.463	2.070	1.634
Gabon	1974/77	1.159	0.952	0.554
Gabon	1978/81	1.272	0.959	0.438
Gabon	1982/85	1.843	1.510	1.055
Gabon	1986/89	3.111	1.700	1.990
Gabon	1990/93	2.526	1.762	1.596
Gabon	1994/97	2.941	3.213	1.945
Gambia	1970/73	6.787	4.702	4.580
Gambia	1974/77	9.772	6.789	7.363
Gambia	1978/81	23.798	15.706	18.572
Gambia	1982/85	25.163	20.083	16.469
Gambia	1986/89	60.320	44.199	43.961
Gambia	1990/93	30.203	21.412	22.084
Gambia	1994/97	13.801	11.481	8.099
Ghana	1970/73	2.309	0.966	1.631
Ghana	1974/77	2.837	1.452	1.942
Ghana	1978/81	3.780	1.692	2.807
Ghana	1982/85	3.767	2.146	3.061
Ghana	1986/89	9.489	3.760	8.549
Ghana	1990/93	10.953	7.017	9.549
Ghana	1994/97	10.340	5.250	8.634
Kenya	1970/73	3.739	2.586	1.875
Kenya	1974/77	4.323	2.908	2.456
Kenya	1978/81	5.803	3.792	3.997
Kenya	1982/85	6.583	4.348	4.742
Kenya	1986/89	9.163	5.966	7.013
Kenya	1990/93	13.394	10.057	9.955
Kenya	1994/97	7.480	5.203	5.162
Lesotho	1970/73	10.968	11.103	8.369
Lesotho	1974/77	9.825	8.578	6.582
Lesotho	1978/81	13.475	11.777	9.053
Lesotho	1982/85	13.613	11.191	8.981
Lesotho	1986/89	17.006	13.768	10.213
Lesotho	1990/93	12.598	9.494	8.635
Lesotho	1994/97	9.042	6.742	6.225
Madagascar	1970/73	5.086	5.028	2.818
Madagascar	1974/77	4.018	3.072	2.379
Madagascar	1978/81	6.348	2.997	4.860
Madagascar	1982/85	5.983	2.738	4.753

Madagascar	1986/89	11.691	5.986	9.383
Madagascar	1990/93	14.023	12.117	10.913
Madagascar	1994/97	13.422	11.752	9.862
Malawi	1970/73	9.501	4.571	6.637
Malawi	1974/77	9.479	3.808	6.919
Malawi	1978/81	12.454	10.115	9.396
Malawi	1982/85	10.770	6.235	7.801
Malawi	1986/89	24.797	16.918	18.616
Malawi	1990/93	28.126	19.767	21.814
Malawi	1994/97	29.237	19.308	23.798
Mali	1970/73	9.401	8.862	6.872
Mali	1974/77	15.772	12.432	12.747
Mali	1978/81	14.668	11.428	10.858
Mali	1982/85	23.520	13.983	18.703
Mali	1986/89	23.559	15.660	18.288
Mali	1990/93	17.149	12.409	12.445
Mali	1994/97	21.065	15.100	15.474
Mauritania	1970/73	7.034	5.802	4.547
Mauritania	1974/77	29.316	20.723	26.524
Mauritania	1978/81	31.645	19.589	27.454
Mauritania	1982/85	25.407	15.632	20.848
Mauritania	1986/89	25.776	16.574	20.191
Mauritania	1990/93	25.277	17.353	19.983
Mauritania	1994/97	24.812	19.297	20.056
Mauritius	1970/73	3.456	2.654	2.451
Mauritius	1974/77	3.593	2.510	2.610
Mauritius	1978/81	3.774	2.045	2.795
Mauritius	1982/85	3.249	2.008	2.417
Mauritius	1986/89	3.568	2.272	2.442
Mauritius	1990/93	2.109	1.319	1.371
Mauritius	1994/97	0.607	0.967	0.023
Niger	1970/73	6.734	5.688	4.875
Niger	1974/77	11.872	9.763	9.272
Niger	1978/81	8.530	7.092	6.048
Niger	1982/85	12.861	10.424	9.037
Niger	1986/89	17.726	12.774	12.861
Niger	1990/93	16.137	14.679	10.953
Niger	1994/97	17.602	16.490	12.203
Nigeria	1970/73	0.898	0.575	0.558
Nigeria	1974/77	0.211	0.144	0.093

Nigeria	1978/81	0.057	0.073	-0.009
Nigeria	1982/85	0.042	0.052	-0.005
Nigeria	1986/89	0.467	0.320	0.300
Nigeria	1990/93	0.930	0.707	0.590
Nigeria	1994/97	0.698	0.398	0.408
Rwanda	1970/73	11.899	11.607	5.612
Rwanda	1974/77	16.222	13.685	9.501
Rwanda	1978/81	12.950	10.810	8.463
Rwanda	1982/85	10.429	8.106	6.838
Rwanda	1986/89	11.288	8.050	7.414
Rwanda	1990/93	18.199	14.516	13.226
Rwanda	1994/97	59.960	57.317	50.712
Senegal	1970/73	5.649	5.849	3.023
Senegal	1974/77	7.744	6.175	4.601
Senegal	1978/81	11.769	7.251	7.562
Senegal	1982/85	12.353	7.967	8.355
Senegal	1986/89	16.908	8.851	13.481
Senegal	1990/93	11.951	10.258	8.646
Senegal	1994/97	13.156	12.004	9.306
Seychelles	1970/73	26.671	25.551	22.744
Seychelles	1974/77	17.438	17.475	12.354
Seychelles	1978/81	19.094	12.927	12.959
Seychelles	1982/85	11.383	9.308	7.060
Seychelles	1986/89	10.867	7.053	6.750
Seychelles	1990/93	6.388	5.213	3.701
Seychelles	1994/97	2.935	2.993	1.244
Sierra Leonne	1970/73	2.346	1.527	1.212
Sierra Leonne	1974/77	2.774	1.877	1.463
Sierra Leonne	1978/81	6.367	3.595	4.518
Sierra Leonne	1982/85	5.139	4.085	3.581
Sierra Leonne	1986/89	9.708	7.784	6.492
Sierra Leonne	1990/93	17.738	12.469	13.981
Sierra Leonne	1994/97	24.011	12.195	20.904
South Africa	1970/73	..	..	..
South Africa	1974/77	..	..	..
South Africa	1978/81	..	..	..
South Africa	1982/85	..	..	..
South Africa	1986/89	..	..	..
South Africa	1990/93	0.060	0.060	0.029
South Africa	1994/97	0.307	0.292	0.143

Swaziland	1970/73	4.959	3.541	2.626
Swaziland	1974/77	7.011	4.581	3.666
Swaziland	1978/81	10.609	5.931	7.004
Swaziland	1982/85	5.094	4.655	1.968
Swaziland	1986/89	6.847	6.609	2.285
Swaziland	1990/93	5.956	5.621	2.552
Swaziland	1994/97	3.849	3.579	1.807
Tanzania	1970/73	4.483	2.696	2.510
Tanzania	1974/77	9.900	6.469	7.393
Tanzania	1978/81	12.566	11.252	9.395
Tanzania	1982/85	9.208	6.984	6.590
Tanzania	1986/89	21.563	17.470	16.862
Tanzania	1990/93	37.592	30.263	30.351
Tanzania	1994/97	21.883	17.254	16.120
Togo	1970/73	6.737	6.556	3.439
Togo	1974/77	7.708	5.999	4.881
Togo	1978/81	9.465	4.566	6.781
Togo	1982/85	12.728	10.878	9.105
Togo	1986/89	15.870	9.188	11.645
Togo	1990/93	12.982	9.564	9.447
Togo	1994/97	12.475	9.187	10.103
Uganda	1970/73	1.558	1.025	0.826
Uganda	1974/77	1.012	0.719	0.696
Uganda	1978/81	2.733	2.358	2.020
Uganda	1982/85	5.972	3.756	4.565
Uganda	1986/89	7.966	4.634	6.409
Uganda	1990/93	21.198	12.920	17.629
Uganda	1994/97	14.442	9.170	11.768
Zambia	1970/73	1.362	1.334	0.298
Zambia	1974/77	3.025	2.058	1.648
Zambia	1978/81	8.002	4.079	5.738
Zambia	1982/85	8.774	5.281	6.401
Zambia	1986/89	20.834	15.280	15.543
Zambia	1990/93	26.482	22.120	21.957
Zambia	1994/97	30.610	13.945	26.178
Zimbabwe	1970/73	0.044	0.044	0.003
Zimbabwe	1974/77	0.136	0.136	0.003
Zimbabwe	1978/81	1.831	1.773	1.035
Zimbabwe	1982/85	4.000	2.715	3.180
Zimbabwe	1986/89	5.020	3.882	3.405

Zimbabwe	1990/93	9.451	6.746	6.802
Zimbabwe	1994/97	6.767	5.256	5.016

Source: Computed

CHAPTER 5

AID AND GROWTH: ACCOUNTING FOR TRANSMISSION MECHANISMS IN SUB-SAHARAN AFRICA

5.1 INTRODUCTION

Whilst foreign aid programs were launched in the post World War era, prior to any sturdy evidence in its favour, the last decades have been marked by a large number of studies on aid effectiveness. Nevertheless, whether aid works or not is indeed still a persistent question in development economics. While addressing this issue in 'Assessing Aid: What Works, What Doesn't and Why', World Bank (1998) recommendations are driven by Burnside and Dollar (2000, hereafter BD). They argue that aid stimulates growth only in good policy environments. However, this result does not withstand the rigorous assessment conducted by Dalgaard and Hansen (2000) and Hansen and Tarp (2001, hereafter HT). Using the same data set as the original study, Dalgaard and Hansen (2000) demonstrate that BD conclusion relies heavily on the exclusion of a few observations, which they deem as possible leverage points but are treated as outliers by BD. Using different specifications and estimators, HT also find that aid makes a positive contribution to growth and this result is not conditional on policy. While the jury is still out on this matter, the majority of recent studies find evidence of aid effectiveness (Morrissey, 2001).

This chapter is not an attempt to resolve disputes in the literature. Rather, we want to focus on a particular issue – the treatment of investment in an aid-growth specification. BD argue that aid adds to investment whereas policy determines the productivity of investment and therefore include an 'aid×policy' interaction term but exclude investment. While acknowledging that the implicit growth theory will have investment and not aid as an argument, HT include both variables in some regressions. In general, aid is not significant in those cases. However, they do find that aid is a significant determinant of investment.

It is therefore not very clear how to approach investment when aid and growth is the link under study. This represents a deficiency in the existing aid effectiveness literature. Studies recognise that aid can affect growth via its effect on investment, but few include an investment term. If one excludes investment, the regression is misspecified and the estimated coefficient on aid is biased. However, not all aid is intended for investment, and not all investment is financed by aid. If one includes aid *and* investment, there is double counting (as some aid is used for investment), and the coefficient is again biased (clearly downwards in this case). We propose the technique of generated regressors to address this problem.

The analysis is conducted for a sample of 25 sub-Saharan African (SSA) countries over the period 1970 to 1997. There is considerable evidence in the empirical growth literature that SSA countries are different. It is generally the case that in cross-country growth regressions an 'Africa' dummy is negative and significant. 'Africa's slow growth is thus partly explicable in terms of particular variables that are globally important for the growth process but are low in Africa' (Collier and Gunning, 1999: 65). Furthermore, they tend to be major aid recipients. Despite large aid inflows, SSA countries on average experienced only 0.7% growth in real per capita GDP per annum over the period 1970 to 1997, and only six of the 25 in our sample have managed to 'upgrade' to the group of middle income countries.[1] *A priori*, this may appear to be a case of aid ineffectiveness. If aid has been misused and ineffective, we should find evidence of this in a sample comprising SSA countries.

Whilst our specific focus is on the treatment of aid and investment, it is clear from the aid effectiveness literature that any effect of aid on growth is indirect. *Section 5.2* presents a brief discussion of the various factors that mediate the effect of aid on growth, what we refer to as the transmission mechanisms. The data used and econometric methods are discussed in *Section 5.3* (with further details in the Appendices). *Section 5.4* presents the empirical results and discusses the implications. *Section 5.5* concludes with some final observations.

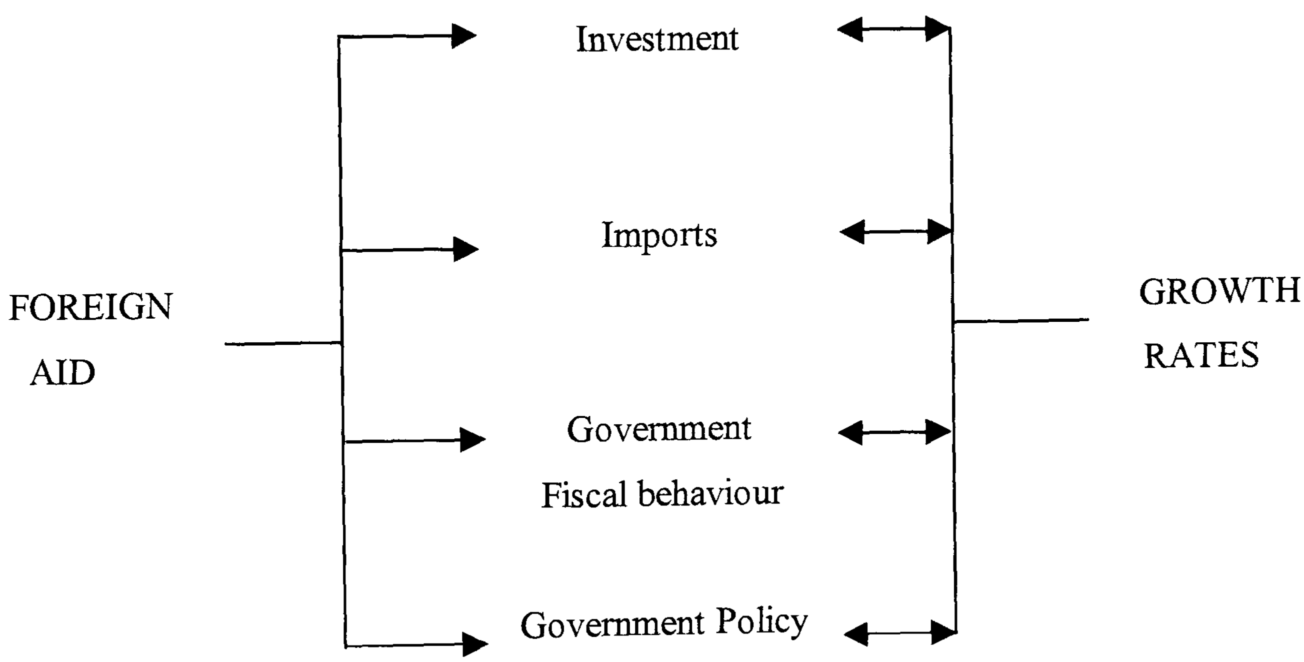
5.2 TRANSMISSION MECHANISMS

The conceptual underpinning of the link between aid and growth is traditionally rooted in the two-gap model pioneered by Chenery and Strout (1966). The analytical framework is grounded in a Harrod Domar growth model where aid flows are

[1] Botswana, Gabon, Mauritius, Seychelles, South Africa and Swaziland according to World Bank (2000) classification.

perceived as filling in the gaps which otherwise act as binding constraint on the target growth rate. Poor countries lack sufficient resources to finance investment and a need to import capital goods and technology. Aid for investment purposes can fill the savings-investment gap (directly) and the foreign exchange gap (indirectly, as it is in the form of hard currency). As official aid is issued to government, it can also fund government spending. In fact, Bacha (1990) demonstrates that government fiscal behaviour represents an important channel through which aid flows can influence growth. Finally, recent studies highlight the potential importance of government policy as a determinant of the effects of aid. Figure 5.1 summarises the potential linkages between aid and growth.

FIGURE 5.1: Transmission Mechanisms from Aid to Growth



A proper framework to study how aid works should address all of these interactions. The analysis here focuses on the effect of aid on growth taking into account the transmission mechanisms of investment, trade (imports) and fiscal behaviour (government consumption spending). Aid can contribute to growth through investment, conditional on the productivity of investment (which may of course be related to policy). Also, low income countries often face low and volatile export earnings, hence an uncertain source of finance for import (capital goods and intermediate inputs). Aid can finance necessary imports, so this is a potential transmission mechanism. If funds intended for investment are diverted to recurrent expenditures, that is aid is treated as fungible, its effectiveness should be reduced. This is addressed by considering government consumption as a (constraining) transmission mechanism. The basic approach is to identify if aid determines the transmission variables. If it does, this effect is accounted for in estimating the aid-growth relationship.

The transmission mechanism via government policy is however not as simple as it may first seem. The nature of this mechanism and how to model it is not well understood. The conventional view, at least in the context of cross-country growth regressions, is that it is difficult to establish that aid affects policy (BD; World Bank, 1998). We would therefore expect this mechanism to be weak in cross-country regressions[2]. Also, it is an empirical question as to whether one can identify an effect of aid controlling for policy variables, or an aid×policy term is required. Owing to these ambiguities, we do not pursue this mechanism. However, in accordance with recent work on aid effectiveness, we incorporate policy indicators as control variables.

Another issue we do not address is the tendency for SSA countries to be subject to economic and political instability. Relative to other regions, SSA is especially susceptible to climatic and agricultural risk and vulnerable to terms of trade shocks, famines, political conflict, droughts and, more recently, floods. Empirical evidence is supportive of this distinct regional feature. Guillaumont *et al* (1999) acknowledge that compared to other developing country regions, these instabilities (political, climatic and terms of trade) are higher in SSA and reduce growth by distorting economic policy. Gyimah-Brempong and Traynor (1999) find that political instability has a direct negative effect on growth and also an indirect effect via discouraging investment. Such vulnerability is a source of 'economic uncertainty' that may reduce growth rates and help to explain aid ineffectiveness. Recently, Lensink and Morrissey (2000) control for uncertainty in the aid-growth regression by

[2] The point is that the way in which aid affects policy is complex and will depend on specific, usually unmeasurable, features of the recipient. Furthermore, aid may affect some policies and not others, and may affect policies over varying time spans (often of five and more years). This is a complex research topic in its own right, beyond the scope of this chapter.

using an aid instability measure for a sample of SSA countries. They obtain a positive and significant coefficient on aid whereas aid instability enters with a significant negative sign. Note that they also find that the principal (positive) impact of aid is via its impact on investment, a result corroborated by HT. As discussed in the next section, by including policy indicators (notably inflation), a political variable and investment in our specification we hope to pick up some of these effects of uncertainty. Nevertheless, our specification is likely to omit some factors that explain the poor growth performance in SSA countries.

The specific aim of this paper is to account for the transmission mechanism of aid on growth. Although we concentrate on a sample of SSA countries, we want to relate the results to the recent contributions on aid effectiveness (BD and HT). Consequently, we choose a specification close in spirit to that used in these studies. It is well known that there are many variables that might be significant in cross-country growth regressions, but degrees of freedom considerations and data constraints require choices to be made. The data used here and the estimation techniques are discussed in the next section.

5.3 DATA AND ESTIMATION ISSUES

Estimation is conducted in a panel of seven four-year periods over 1970-97. Our dependent variable (*GROWTH*) is (period) growth of real per capita GDP (data definitions and sources are provided in Appendix 5A). Real GDP per capita in the year preceding the period (*GDP0*) is included to capture initial country specific effects[3]. The percentage of population aged 15 or above who have completed primary education (*PRIC15*) and investment as a share of GDP (*INV*) are included as indicators of (additions to) human and physical capital. We use two measures of aid, both expressed as a percentage of GNP and taken from OECD (1999).[4] The first is simply the total of grant aid (*GRANTS*) while total aid (*TAID*) is net ODA (the sum of ODA grants and net loans) excluding food aid and technical cooperation (see

[3] Many studies, such as BD, use *lnGDP0* rather than *GDP0*, essentially as the log specification is a test for convergence. As our sample is restricted to SSA and initial GDP is used to control for initial country conditions rather than to test for convergence, we use *GDP0*. The transformation *GDP0* to *lnGDP0* reduces the variance of the series. We did include *lnGDP0* in the regressions and the results are similar although significance levels on all variables are reduced.

[4] BD use the World Bank EDA aid data, that adds the grant element of concessional loans to pure grants. However, HT demonstrate that OECD and EDA data yield similar results.

Chapter 4 for a discussion of aid measure). Squared aid terms (*GRANTSQ* and *TAIDSQ*) are included to account for diminishing returns. Most studies of aid effectiveness posit a non-linear relationship and therefore include a squared term (see Morrissey, 2001).

We include a number of indicators of political and economic policy features of the countries. Alesina *et al* (1992) construct a democracy index *DEM* taking values between 1 and 3 based on information on electoral systems[5]. Higher values indicate weaker political rights. Three policy variables are included: the inflation rate (*INFL*), government consumption as a share of GDP (*GCON*) and imports as a percentage of GDP (*MGDP*) as an indicator of openness.[6] The latter two variables also represent potential transmission mechanisms. As we report and discuss later, however, the effect of aid on growth is not mediated by these variables. Hence in the regressions, all three can be interpreted as policy indicators.

The base specification in general terms is therefore (suppressing country and time subscripts, and designating the error term as *U*):

$$g = \beta_C'c + \beta_A A + \beta_E'e + \beta_P'p + U \qquad (5.1)$$

The dependent variable is growth (*g*) and the measure of aid is designated by *A*. There are three vectors of other variables. The vector of conditioning variables (*c*) includes initial income, investment and human capital. The economic policy indicators (*e*) are inflation, government consumption and imports. The political indicator (*p*) is democracy. Descriptive statistics for the data are provided in Appendix 5A

Two core issues that characterise any empirical study based on panel data are endogeneity and country-specific effects. The former relates to problems which arise from the time series dimension whilst the latter results from observing several

[5] 1 for democratic regimes (countries with free competitive general elections with more than 1 party running), 2 for mixed democratic and authoritarian features (countries with some form of elections but with severe limits in the competitiveness of such ballots) and 3 for authoritarian regimes (countries in which their leaders are not elected).

countries together. We consider each briefly (details are in Appendix 5B) before discussing the generated regressor technique employed in the analysis.

A critical assumption of OLS is that there is zero correlation between the error term and any explanatory variable. If this is violated, the latter is endogenous and OLS estimates will not be consistent. The standard solution is to perform a two stage procedure whereby instruments are used for the endogenous variable and obtain IV estimators. GMM estimators, that have recently gained popularity, present an alternative. Results are generally very sensitive to the choice of instruments as can be observed by a comparison of BD and HT results.

We use the Hausman test to investigate whether investment and aid terms are endogenous. This involves comparing the results of OLS and IV regressions (we also use the Sargan test for the validity of instruments). The test strongly fails to reject the null hypothesis that regressors and error term are uncorrelated (Appendix 5B, Table 5B1). Consequently, in our sample, we find no evidence of the need to use instruments. We report results using lagged aid, on the basis that aid via investment will take time to impact on growth, and this can be interpreted as an instrument (in the spirit of HT).

Another problem frequently encountered in estimation relates to outliers, values of the dependent variable that are unusual, given the values of the explanatory variables (response outliers), or unusual values of an explanatory variable (design outliers). The inclusion or exclusion of outliers, especially if the sample size is small, can substantially alter the results of regression analysis. If useful generalisations are to be drawn, it becomes important to ensure that the results reflect what is going on in the majority of the sample rather than being driven by a few outlying observations only.

In the empirical literature, various approaches have been used to address the issue of outliers. In some cases, the regression model is re-estimated iteratively omitting one observation at a time with the aim of identifying that which exerts a significant

[6] The difficulty of measuring openness is recognised in the literature. This measure is however chosen as it also reflects a transmission mechanism.

influence on the set of estimates. In other cases, observations with high residuals are excluded from the sample. Both procedures can be seen as part of a sensitivity analysis after the main results have been obtained. It is also quite common to omit data points with extreme values of the explanatory variables. Several standard deviations away from the mean value can define extreme values. There is an element of subjectivity associated with this definition. For example, BD dropped observations that are five standard deviations away from the average data point, whereas HT dropped those which are two standard deviations away. We have here chosen an alternative method – robust regression (Rousseeuw and Leroy, 1987), detailed in Appendix 5B.

Gabon and Botswana are identified as outliers when the 'data points taking extreme values' approach is used and they both receive the lowest weights when robust estimation is performed. This could be anticipated as both are countries that have used effectively their natural resources, oil in the case of Gabon and diamonds in the case of Botswana. The advantage with the robust estimation procedure is that it minimises the influence of outlying observations on the estimated equation rather than omitting them altogether from an already small sample of which they are part.

Another inherent problem in panel growth regressions is that one is observing a relationship across countries, hence there is potential heterogeneity. SSA countries are similar to each other in respect to some structural characteristics, relating mainly to their stage of economic and political development and climatic conditions. However, they comprise a heterogeneous group of countries in terms of size, population, level of GDP, institutional arrangements, resource endowments and so on. While we try to control for many of these variables (and robust estimation accounts for some of the problems), we cannot discount the possibility of country-specific effects due to omitted variables.

In a dynamic panel model, like the growth equation we consider, the basic difficulty with fixed (country) effects lies in the fact that the presence of the latter renders the lagged dependent variable (*GDPO*) correlated with the equation disturbance. The standard "within" transformation typically used in static models fails to deliver consistent estimators. A popular way of circumventing this problem is to remove the fixed effects via first differencing and then use an instrumental variable estimation technique (e.g. GMM). We tried using lagged values of GDP and other covariates as instruments in the first-differenced (i.e. growth rate of growth) equations in the spirit of Arellano and Bond (1991), but results were not robust - small changes in the instrumental variables set produced dramatic variations in the estimated coefficients. Furthermore, in addition to reducing the sample size, the first difference transformation seems to result in loss of most of the variation in the data (see Appendix 5A). It can also be argued that first differencing exacerbates measurement error problems in the data (by increasing the ratio of noise to signal).

We abandoned the GMM approach on theoretical grounds also. Recently, Robertson and Symons (1992) and Pesaran and Smith (1995) demonstrate that standard GMM estimators of the type discussed above lead to invalid inference if the response parameters are characterised by heterogeneity[7]. For example, suppose that the response to a percentage increase in aid differs systematically across countries (a realistic assumption). In a pooled regression, the aim is of course to identify the average (across countries) effect of aid on growth. What Robertson and Symons (1992) and Pesaran and Smith (1995) have convincingly demonstrated is that in these circumstances standard panel GMM estimators will not deliver unbiased estimates of the mean effect. The latter went on to argue that since valid instruments are hard to come by for heterogeneous dynamic panels, it is better to average parameters from individual time series regressions. This is not feasible in our context, as the individual countries' time series lengths are not adequate (we only have seven time periods, due to the period averaging).

Another theoretical reason why GMM is not suitable for our purpose has to do with the fact that we are using a generated regressor to account for the transmission mechanisms in the aid-growth relationship. It is not obvious how standard panel GMM estimators could handle generated regressors, and to our knowledge the problem has not yet been addressed in the econometric literature. For these reasons, we do not employ GMM techniques.

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[7] Same applies to the system GMM estimator (which uses a combination of level and first-differenced information) suggested by Blundell and Bond (1998).

Residual Generated Regressors

It has become common practice to estimate regression equations in which constructed variables appear. The most popular method to generate regressors is to use predicted values or residuals from a supplementary regression (indeed, IV is an example of the former). Given the prevalence of such models, Pagan (1984) presented 'a fairly complete treatment' of the econometric issues underlying regressions with generated variables. As this is the method we use to incorporate transmission mechanisms, a brief discussion is in order. Formally, the approach is a special case of the following general model (in matrix form):

$$Y = \mu X^* + \gamma (X - X^*) + U \qquad (5.2a)$$

$$X = X^* + \eta = \omega Z + \eta \qquad (5.2b)$$

The expression $(X\text{-}X^*)$ represents that part of X which is explained by factors other than Z. Equation 5.2b estimates the relationship between Z and X such that ω gives a measure of the strength of the link that exists between them. Pagan (1984) shows that the two-step procedure, of estimating Equation 5.2b and using the results in Equation 5.2a, gives asymptotically efficient coefficient estimates ($\hat{\mu}$ and $\hat{\gamma}$). Turning to the question of a consistent estimator of covariance matrix of $\hat{\mu}$ and $\hat{\gamma}$, Pagan (1984) suggests 2SLS estimates will provide the correct values for the standard error of $\hat{\mu}$ whilst OLS would produce correct estimates for the standard error of $\hat{\gamma}$. In our study, $\mu = 0$, i.e, we construct the generated regressor using only the residuals from a supplementary equation. This implies that OLS gives us the correct estimates of variance as well as efficient coefficient estimates. This conclusion is independent of whether Equation 5.2a includes additional regressors or/and the latter appear in the matrix Z – in our case, aid appears in Equation 5.2b. Hence, the use of residuals does not invalidate the inferences made and coefficient estimates are efficient.

We construct the variable representing that part of investment that is not attributed to aid (*INVRES*) using residuals from an aid-investment bivariate regression (capturing the transmission from aid to investment). *INVRES* is the estimate of κ_1 from the regression $INV = \kappa_1 + \kappa_2\ AID$. We then substitute *INVRES* for *INV* in the growth regression. It is worth noting that this transformation affects only the estimated coefficient on the aid variables. This can easily be demonstrated in general terms. Suppose the initial regression is:

$$g = \beta_1 X + \beta_2 A + \beta_Z' z + U \qquad (5.3a)$$

where **z** is the vector of other variables, substituting $X = \kappa_1 + \kappa_2 A$:

$$g = \beta_1(X - \kappa_2 A) + \beta_1(\kappa_2 A) + \beta_2 A + \beta_Z' z + U$$

or

$$g = \beta_1 \kappa_1 + (\beta_1 \kappa_2 + \beta_2)A + \beta_Z' z + U \qquad (5.3b)$$

Thus, it is clear that only the coefficient on the aid variable is altered. In cases where the 'transmission' variable (X) has a positive effect on growth, and aid has a positive effect on the variable, this method will provide for a larger coefficient on aid. If the variable has a negative effect on growth, and aid is a positive determinant of the variable, the coefficient on aid is reduced. If it transpires that aid is not a determinant of the variable, there is no effect and the method is not used.

5.4 RESULTS AND DISCUSSION

Our basic specification is:

$$\begin{aligned} GROWTH_{it} &= \delta_0 + \delta_1 GDP0_{i,t-1} + \delta_2 PRIC15_{it} + \delta_3 INV_{it} + \delta_4 DEM_i + \delta_5 INFL_{it} \\ &\quad + \delta_6 GCON_{it} + \delta_7 MGDP_{it} + \delta_8 AID_{it} + \delta_9 AIDSQ_{it} + u_{it} \qquad (5.4) \end{aligned}$$

The variables are discussed in Section 5.3 above. Three potential transmission variables are included (*INV*, *GCON* and *MGDP*). We first test if these are indeed transmission mechanisms for the effect of aid, and the results are reported below. It transpires that aid is only a significant determinant of investment and imports, among these variables, but only investment is a significant determinant of growth. We then present and discuss our final set of results.

5.4.1 Transmission Mechanisms

The investment regression is given as:

$$INV_{it} = \beta_0 + \beta_1 INV_{i,t-1} + \beta_2 PRIC15_{it} + \beta_3 INFL_{it} + \beta_4 GASTILS_i + \beta_5 LNCRED_{it} + \beta_6 AID_{it} + \beta_7 AIDSQ_{it} + \varepsilon_{it} \qquad (5.5)$$

We use *INV* as the dependent variable to investigate if this transmission mechanism is operational. To account for the dependence of current investment levels on physical and human capital stock, we include one period lagged investment and percentage of population aged 15 or above who have completed primary education (*PRIC15*). The policy and political indicators comprise the inflation rate (*INFL*) and Gastils index of rights (*GASTILS*). The latter takes values between 1 and 7, where higher values indicate less freedom. With regards to the widely acknowledged view that finance is the key to investment, we include the logarithm of credit available to the private sector (measured relative to total domestic credit) in addition to foreign aid as an alternative source of finance. Table 5.1 presents the set of estimates.

Table 5.1: Pooled OLS Investment regressions

	INV	INV
INV_1	**0.785**	**0.799**
	(5.51)* **	**(5.69)*** **
GASTILS	**-0.902**	**-0.984**
	(2.59) **	**(2.94)*** **
PRIC15	**0.275**	**0.290**
	(1.80)*	**(1.94)***
LNCRED	**1.773**	**2.005**
	(2.79)* **	**(3.04)*** **
INFL	**-0.003**	**-0.002**
	(2.43) **	**(1.69)***
GRANTS	**0.333**	
	(2.09) **	
GRANTSQ	**-0.007**	
	(2.77)* **	
TAID		**0.528**
		(3.04)* **
TAIDSQ		**-0.012**
		(3.56)* **
Constant	-2.074	-4.341
	(0.54)	(1.06)
Observations	126	126
R-squared	0.65	0.66
F-Stat	27.17	22.91

Notes: All regressions run in a panel of seven four-year periods over 1970-97. Time dummies included in all regressions. Absolute t-values based on White heteroscedasticity-consistent standard errors are reported in brackets. * Significant at 10% level. ** 5% level. *** 1% level. F-Stat rejects the null that all the coefficients are jointly equal to zero.

The regressions generate coefficient estimates with the expected signs. We obtain evidence of a highly significant positive effect of aid on investment. On average, an increase in *GRANTS* and *TAID* by one percentage point raises the investment share in GDP by about 0.33 and 0.53 percentage points respectively. As expected, *TAID* is more important both in terms of magnitude and significance. Results appear to suggest that investment is a significant transmission mechanism and therefore it is necessary to consider the 'double-counting' problem.

The import regression is given as:

$$MGDP_{it} = \eta_0 + \eta_1 XGDP_{it} + \eta_2 AID_{it} + \eta_3 TOT_{it} + \eta_4 RER_{it} + \eta_5 BMP_{it} + \eta_6 CFA_i + e_{it} \qquad (5.6)$$

We use *MGDP* as the dependent variable. Exports are introduced as an additional source of financing imports, other than aid flows. Three indicators of the trade environment are included: terms of trade (*TOT*), real exchange rate (*ER*), black market premium (*BMP*) and a dummy (*CFA*) that takes a value of 1 for countries which are members in CFA franc zone.

Overall, the regressions perform well (Table 5.2). The chosen specification explains at least 31% of the variation in the dependent variable. Aid flows seem to be a significant source of finance for imports (as would be expected). On average, a one percentage point increase in *GRANTS* increases imports by 0.9 percentage points, whilst each extra percentage point of *TAID* adds 0.7 percentage points to the share of imports in GDP. Based on these estimates, it would appear that imports present a potential transmission mechanism.

Table 5.2: Pooled OLS Imports regressions

	MGDP	MGDP
XGDP	**0.614**	**0.610**
	(5.51)***	**(5.50)*****
GRANTS	**0.921**	
	(3.24)***	
TAID		**0.713**
		(3.42)***
TOT	**-0.045**	**-0.049**
	(2.04)**	**(2.14)****
RER	**-0.003**	**-0.004**
	(1.96)*	**(2.07)****
BMP	**-0.027**	**-0.029**
	(2.02)**	**(2.07)****
CFA	**-6.236**	**-6.187**
	(1.80)*	**(1.75)***
Constant	**22.095**	**25.115**
	(3.16)***	**(3.24)*****
Observations	131	131
R-squared	0.33	0.31
F-Stat	13.36	14.01

Notes: As for Table 5.1.

We use government consumption as a share of GDP (*GCON*) as our dependent variable to estimate the following equation:

$$GCON_{it} = \lambda_0 + \lambda_1 TRGDP_{it} + \lambda_2 INFL_{it} + \lambda_3 EXTDEBT_{it} + \lambda_4 AID_{it} + \lambda_5 STATE_i + u_{it} \qquad (5.7)$$

Public sector decision-makers allocate revenue among various expenditure categories. Stated differently, government revenue determines government expenditure. Thus, we consider both domestic and foreign sources of government revenue as determinants of government consumption – total tax revenue as share of GDP (*TRGDP*), inflation (*INFL*) to represent seignorage, external debt as a share of GDP (*EXTDEBT*) and foreign aid flows (*AID*). Finally, in recognition of the fact that features of the existing political institution influences allocation of government resources, we introduce *STATE* (Englebert, 2000). The latter takes value of 1 for legitimate countries which are believed to have more efficient governments owing to the lack of clash between pre-colonial and post-colonial political institutions. Governments in non-legitimate countries (that is, when STATE takes value of 0) tend to invest in strengthening their leadership at the expense of long term investment in infrastructure. Table 5.3 presents the estimation results.

Table 5.3: Government Consumption Regressions

	GCON	GCON
TRGDP	**0.524**	**0.516**
	(8.97)* **	**(8.89)*** **
INFL	**0.003**	**0.003**
	(4.47)* **	**(4.19)*** **
EXTDEBT	-0.001	0.000
	(0.09)	(0.03)
GRANTS	0.106	
	(1.38)	
TAID		0.076
		(1.02)
STATE	**-1.508**	-1.296
	(1.71)*	(1.56)
Constant	**4.809**	**5.187**
	(3.12)* **	**(3.48)*** **
Observations	138	138
R-squared	0.51	0.50
F-Stat	10.89	11.51

Notes: As for Table 5.1.

In general, the regressions perform reasonably well. They explain about 50% of the variation in government consumption. All variables enter with the expected signs. However, the results suggest that aid flows do not tend to finance government non-productive expenditure. Instead, it seems that governments in SSA countries rely quite significantly on distortionary taxes and seignorage to finance their recurrent spending. Consequently, we assume that the coefficient on *GCON* in aid-growth regressions does not include any substantial indirect effect of aid. Note that these results do not support the common assertion that aid is fungible (although the regressions are not a direct test of this), at least for this sample.

5.4.2 Aid-Growth Regressions

Having identified that investment and imports are the main transmission mechanisms through which aid affects growth rates, we now report the estimation results of the growth model as specified by Equation 5.1 Table 5.4 presents the robust aid-growth regressions.

Table 5.4: Robust Aid-Growth Regressions

	Effect of current aid		Effect of lagged aid	
GDPO	**0.001**	**0.001**	**0.001**	**0.001**
	(2.38)**	**(2.35)****	**(2.22)****	**(2.07)****
PRIC15	**0.212**	**0.205**	**0.182**	**0.177**
	(3.09)***	**(2.99)*****	**(2.34)****	**(2.27)****
INV	**0.109**	**0.111**	**0.105**	**0.106**
	(4.42)***	**(4.49)*****	**(4.01)*****	**(4.02)*****
DEM	**-1.261**	**-1.328**	**-1.287**	**-1.231**
	(3.52)***	**(3.69)*****	**(3.34)*****	**(3.19)*****
INFL	**-0.004**	**-0.004**	**-0.004**	**-0.004**
	(2.50)**	**(2.50)****	**(2.55)****	**(2.68)*****
GCON	**-0.149**	**-0.143**	**-0.151**	**-0.134**
	(2.64)***	**(2.58)****	**(2.59)****	**(2.33)****
MGDP	0.002	0.002	-0.001	0.000
	(0.22)	(0.21)	(0.12)	(0.02)
GRANTS	**0.161**			
	(1.89)*			
GRANTSQ	-0.003			
	(1.65)			
TAID		**0.174**		
		(1.85)*		
TAIDSQ		**-0.004**		
		(1.69)*		
GRANTS_1			**0.265**	
			(2.59)**	
GRANTS_1SQ			**-0.006**	
			(2.22)**	
TAID_1				**0.242**
				(2.25)**
TAID_1SQ				**-0.006**
				(1.99)**
Constant	0.525	0.655	0.477	0.310
	(0.32)	(0.39)	(0.28)	(0.17)
Observations	149	149	135	135
R-squared	0.46	0.46	0.44	0.43
F-Stat	7.40	7.47	6.64	6.40

Notes: As for Table 5.1 except that t-statistics are not based on White-heteroscedasticity consistent standard errors, as a weighting system is used for the robust regression.

All variables enter with the expected sign except for *GDPO*. Since *TAID* excludes food aid (which does not directly affect growth) and technical cooperation (which might influence growth but with a long time lag), as expected it has a slightly larger impact on growth than *GRANTS*. An extra percentage point of *GRANTS* and *TAID* disbursed is estimated to increase growth rates by about 0.16 and 0.17 percentage points respectively. Interestingly, we find that the lagged effect of aid on growth is more important than its immediate impact. The negatively signed aid squared terms are consistent with the proposition of an aid Laffer curve (Lensink and White, 2001), or more generally diminishing returns to aid.

By including both transmission mechanisms and aid in our regressions, the total effect of aid on growth is spread out across the coefficients on these variables. The coefficient on our aid term will be an incorrect measure of overall aid effectiveness. Thus, we use the residual-generated regressor to overcome this problem. The results suggest that the significant impact of aid on imports does not translate into any important growth effects. Consequently, the investment term is the only relevant transmission mechanism. Table 5.5 reports the aid-growth regressions in which *INVRES*[8], which can be thought of as that part of *INV* which is not a function of aid, has been introduced.

Table 5.5: Robust Aid-Growth Regressions with *INVRES*

	Effect of current aid		Effect of lagged aid	
GDPO	**0.001**	**0.001**	**0.001**	**0.001**
	(2.38)**	**(2.35)****	**(2.22)****	**(2.07)****
PRIC15	**0.212**	**0.205**	**0.182**	**0.177**
	(3.09)***	**(2.99)*****	**(2.34)****	**(2.27)****
INVRES	**0.109**	**0.111**	**0.105**	**0.106**
	(4.42)***	**(4.49)*****	**(4.01)*****	**(4.02)*****
DEM	**-1.261**	**-1.328**	**-1.287**	**-1.231**
	(3.52)***	**(3.69)*****	**(3.34)*****	**(3.19)*****
INFL	**-0.004**	**-0.004**	**-0.004**	**-0.004**
	(2.50)**	**(2.50)****	**(2.55)****	**(2.68)*****
GCON	**-0.149**	**-0.143**	**-0.151**	**-0.134**
	(2.64)***	**(2.58)****	**(2.59)****	**(2.33)****
MGDP	0.002	0.002	-0.001	0.000
	(0.22)	(0.21)	(0.12)	(0.02)
GRANTS	**0.306**			
	(3.46)***			
GRANTSQ	**-0.003**			
	(1.65)			
TAID		**0.319**		
		(3.31)***		
TAIDSQ		**-0.004**		
		(1.69)*		
GRANTS_1			**0.431**	
			(4.08)***	
GRANTS_1SQ			**-0.006**	
			(2.22)**	
TAID_1				**0.402**
				(3.66)***
TAID_1SQ				**-0.006**
				(1.99)**
Constant	0.525	0.655	0.477	0.310
	(0.32)	(0.39)	(0.28)	(0.17)
Observations	149	149	135	135
R-squared	0.46	0.46	0.44	0.43
F-Stat	7.40	7.47	6.64	6.40

Notes: As for Table 5.4.

[8] *INVRES* is recovered from the following regressions (t-ratios in brackets):
INV=1.33GRANTS (12.78) R^2=0.41 ; INV=1.58GRANTS_1 (13.2) R^2=0.46
INV=1.30TAID (12.17) R^2=0.39 ; INV=1.51TAID_1 (12.16) R^2=0.42

The new set of coefficient estimates for aid variables are greater than in the original model, both in terms of magnitude and significance. This supports our hypothesis that the aid coefficient in a regression including an investment term will be an underestimate of the true effect of aid on growth. An additional percentage point of *GRANTS* and *TAID* disbursed is now estimated to increase growth rates by about 0.31 and 0.32 percentage points respectively. Again, we find that the lagged effect of aid on growth is more important than its immediate impact.

In line with previous studies we find evidence of diminishing returns to aid. In contrast to studies such as Burnside and Dollar (2000), we find no evidence that aid revenues are used to finance government consumption spending, although we do find that such expenditures have a negative effect on growth. Inflation is included as a (macroeconomic) policy control, and has the expected negative sign. More democratic regimes appear to have higher growth performance (the coefficient on *DEM* is negative). The variables with positive effects on growth are aid, investment, education and initial GDP (i.e, divergence in the sample as countries with higher incomes at the start of the period tend to have higher subsequent growth rates)

Our results suggest that aid flows significantly stimulate growth in recipient countries. This continues to hold once diminishing returns are accounted for - only two countries in the sample received aid beyond the threshold level[9]. Based on the point estimates obtained in previous section, Table 5.6 reports the marginal aid effects by bringing together all the estimates of the derivative of growth with respect to aid:

$$\frac{\partial GROWTH}{\partial AID} = \delta_8 + 2\delta_9(AID)$$

[9] Based on first two regressions from Table 5.5, GRANTS and TAID would have to surpass 51% and 40% for diminishing returns to set in. Only Rwanda (in 1994/97) and Gambia (in 1986/89) received aid in excess of this optimal level.

Table 5.6: Marginal Effect of Aid on Growth

	At GRANTS=8.16	At TAID=7.96
In Model with *INV*	0.112 (1.02)	0.110 (0.87)
In Model with *INVRES*	**0.257** **(2.34)****	**0.255** **(1.96)***

Note: t-ratios in parentheses.

Evaluated at mean aid level, we again find that once the indirect effect through investment is included, the impact of aid on growth is positive and significant. We recognise that these effects are observed on average. We address this concern in the next chapter.

5.5 CONCLUSION

Our concern has been to address the question of aid effectiveness in sub-Saharan Africa. Empirical studies of the impact of aid on growth fail to take into account that aid does not have a direct effect; it operates via transmission mechanisms, such as investment or government spending. The contribution of this chapter lies in throwing some light on this neglected aspect.

Investment, the most important transmission mechanism, is often omitted from aid-growth regressions. As a result, estimated aid coefficients in typical growth regressions suffer from omitted variable bias. However, including an investment term in the regression would lead to identification problems as some of aid finances investment (there will be double-counting). In this chapter we use the technique of generated regressors to address this problem. This enables us to identify that part of investment that is not due to aid, so that double counting and omitted variable bias problems are avoided.

We apply this method to examine the relationship between aid and growth using a panel of 25 SSA countries over the period 1970 to 1997. Despite large aid inflows. SSA countries on average experienced only 0.7% growth in real per capita GDP per annum over the period. On the face of it, this may appear to be a case of aid ineffectiveness. Our econometric results, which are robust regarding outliers, endogeneity and country-specific effects, show that aid has had a positive effect on growth, largely through aid-financed investment. On average, each one percentage point increase in the aid/GNP ratio adds one-third of one percentage point to the growth rate.

One inference we draw from the results is that it may not be correct to take poor growth performance in SSA as an indicator of aid ineffectiveness. Aid contributes to growth but may not itself ensure high (or positive) growth. One cannot ignore the possibility that had SSA countries not received aid they might have experienced even slower, or in some cases more severe negative, growth. We do not know what would have happened in the absence of aid, but the inference from our results is that growth performance would have been even worse. Africa's poor growth record should not therefore be attributed to aid ineffectiveness.

APPENDIX 5A: DESCRIPTION OF DATA

Definitions and sources of data

GROWTH	growth of real GDP per capita
GDPO	real GDP per capita (in the year preceding the period)
PRIC15	population aged 15 or above having completed primary education.(%), at beginning of each period. *Source:* Barro and Lee Data Set, (Harvard CID-World Bank)
INV	gross domestic investment (% of GDP)
DEM	democracy index, in 1970 and 1982; values between 1 and 3 with lower values being more democratic. *Source:* Alesina *et al* (1992)
INFL	inflation rate
GCON	government consumption (% of GDP)
MGDP	imports (% of GDP)
XGDP	exports (% of GDP)
TOT	terms of trade
RER	real exchange rate, calculated from the nominal exchange rate figures
BMP	black market premium. *Source:* Global Development Data
CFA	dummy takes value of 1 for CFA franc zone member countries and 0 otherwise
CRED	credit available to private sector (% of total domestic credit)
GASTILS	Gastils Rights index. *Source*: Easterly and Levine data, downloaded from the World Bank Data Surfer website
GRANTS	ODA grants (% of GNP). *Source:* OECD(1999)
TAID	ODA grants+net loans-technical cooperation-food aid (% of GNP) *Source:* OECD(1999)
TRGDP	total tax revenue (% of GDP)
EXTDEBT	external debt (% of GDP)
STATE	dummy takes value of 1 for legitimate countries and 0 otherwise *Source:* Englebert (2000)

Unless otherwise stated, the source for all variables is World Bank Africa Database (2000, available on CD-ROM). All variables refer to period averages 1970-73, 1974/77, 1978/81, 1982/85, 1986/89, 1990/93 and 1994/97 except *GDPO* and the time invariant regressors.

List of 25 countries in the sample for regressions

Benin	Madagascar	Tanzania
Botswana	Malawi	Togo
Cameroon	Mali	Uganda
Central Africa	Mauritius	Zambia
Congo Republic	Niger	Zimbabwe
Congo Democratic Republic	Rwanda	
Gambia	Senegal	
Ghana	Sierra Leone	
Kenya	South Africa	
Lesotho	Swaziland	

Table 5A1: Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	Max	Std. Dev. of first difference
GROWTH	34	0.660	3.750	-12.618	18.510	4.572
GDPO	34	1242.382	1096.644	247	6409.000	330.913
INV	34	19.547	10.518	3.268	84.551	6.662
PRIC15	25	7.257	3.710	1	19.900	1.560
DEM	32	2.656	0.644	1	3	0
GRANTS	34	8.161	6.992	0.044	57.317	5.158
TAID	34	7.960	7.188	-0.009	50.712	5.286
INFL	34	50.631	428.068	-3.574	6287.344	325.801
GCON	34	15.461	5.749	5.859	43.938	3.855
MGDP	34	38.317	22.411	8.333	142.697	7.984

Note: Descriptive statistics reported for the variables in levels, unless stated otherwise.

Table 5A1 shows that the standard deviation of many of the variables is quite high, suggesting that fixed or country-specific effects may be pronounced. Robust regression accounts for some, but not all, of the difficulties. In the discussion of correcting for fixed effects in Section 5.3, we note that first differencing creates its own problems. This data transformation obviously reduces the sample size (especially if several lags are required to form instruments), but also seems to result in loss of most of the variation in the data. Furthermore, Table 5A2 shows that the significance and even sign of partial correlations between growth and explanatory variables is altered if a first difference model is used rather than a specification of variables in levels. These features of the data might explain why GMM techniques do not give robust results.

Table 5A2: Partial correlation of growth and first-difference growth with some key variables

	Level	First Difference		Level	First Difference
GDPO	0.070	-0.383	*GDPO*	0.063	-0.380
	(0.386)	(0.00)		(0.435)	(0.00)
INV	0.383	0.112	*INV*	0.383	0.113
	(0.00)	(0.209)		(0.00)	(0.206)
PRIC15	0.177	-0.100	*PRIC15*	0.175	-0.097
	(0.028)	(0.259)		(0.03)	(0.276)
GRANTS	0.004	-0.028	*TAID*	-0.017	0.003
	(0.961)	(0.755)		(0.839)	(0.977)
INFL	-0.199	-0.004	*INFL*	-0.200	0.002
	(0.014)	(0.962)		(0.013)	(0.979)
GCON	-0.163	-0.143	*GCON*	-0.162	-0.137
	(0.044)	(0.107)		(0.045)	(0.123)

Notes: p-values for significance are reported in parentheses. Partial correlations vary when the set of explanatory variables is changed. The first set of columns are partial correlation with growth when GRANTS is the aid variable, and the second set of columns when TAID is the aid variable.

APPENDIX 5B: ECONOMETRIC ISSUES

In this Appendix we first detail the tests for endogeneity and then describe the robust estimation method adopted to account for outliers.

5B.1 The Hausman test for Endogeneity

Testing for endogeneity is essentially a test of whether a regressor (X_{it}) is correlated with the error term (U_{it}). If it is, the IV method will produce consistent estimates. Otherwise, both OLS and IV estimators will be consistent although the latter is less efficient, i.e, the two sets of estimates will not be systematically different. This forms the intuition behind the Hausman (1978) specification test which tests appropriateness of OLS estimates based on the difference between OLS and IV estimates. The hypothesis tested is formally given as:

H_0: Cov (X_{it}, U_{it}) = 0 $\Rightarrow$ OLS consistent
IV consistent but less efficient.

H_1: Cov (X_{it}, U_{it}) $\neq$ 0 $\Rightarrow$ OLS inconsistent
IV consistent

Table 5B1 presents the results obtained when the Hausman test is performed to investigate whether investment and aid terms are endogenous. The probability that the critical value exceeds the test statistic is high in all cases. The test therefore strongly fails to reject the null hypothesis, i.e, we can accept that regressors and error term are uncorrelated and OLS estimators are valid.

Table 5B1: Standard OLS Growth regressions

	GROWTH	GROWTH
GDPO	**0.001**	**0.001**
	(2.44)**	**(2.58)****
PRIC15	**0.201**	**0.197**
	(2.89)***	**(2.85)*****
INV	**0.133**	**0.131**
	(5.33)***	**(5.29)*****
DEM	**-1.556**	**-1.579**
	(4.29)***	**(4.36)*****
INFL	**-0.001**	**-0.001**
	(1.88)*	**(1.72)***
GCON	**-0.184**	**-0.171**
	(3.25)***	**(3.07)*****
MGDP	0.009	0.010
	(0.90)	(0.97)
GRANTS	**0.204**	
	(2.37)**	
GRANTSQ	**-0.004**	
	(2.04)**	
TAID		**0.237**
		(2.51)**
TAIDSQ		**-0.005**
		(2.20)**
Constant	0.695	0.347
	(0.42)	(0.20)
Observations	150	150
R^2	0.49	0.49
F-Stat	8.48	8.56
Testing for endogeneity of aid:		
R^2 of first stage regression	0.54	0.55
χ^2(k)	0.15	0.02
Prob>χ^2(k)	1.00	1.00
Testing for endogeneity of investment:		
R^2 of first stage regression	0.33	0.33
χ^2(k)	7.40	9.60
Prob>χ^2(k)	0.918	0.791

Notes : All regressions run in a panel of seven four-year periods over 1970-97. Time dummies included in all regressions. Absolute t-values are reported in brackets. * Significant at 10% level. ** 5% level. *** 1% level. F-Stat rejects the null that all the coefficients are jointly not different from zero. χ^2(k) represents the chi-squared statistic for Hausman test.

Sargan test for validity of instruments

The comparison of OLS to IV estimates using the Hausman test assumes that valid instruments are used. Sargan (1958) provides a test for the validity of instruments. Sargan's test statistic χ^2 (V) follows a chi-squared distribution with V = $(P\text{-}K)$ degrees of freedom, where P is the number of instruments and K the total number of regressors.

Based on the results obtained by instrumenting investment in our growth regression we obtain χ^2 (*V*) = 1.38 and χ^2 (*V*) = 1.45 when *GRANTS* and *TAID* are used respectively. Using the 1% critical value (6.63), this statistic fails to reject our null hypothesis. Thus, credit available to private sectors as a share of total domestic credit and Gastils rights variable prove to be valid instruments for investment. We obtain similar support for using lagged aid terms as instruments for the aid variable.

Breusch Pagan test (1980)

Can we rely on the Hausman test result in the presence of country specific effects? As standard panel tests for fixed effects are not valid in the presence of lagged dependent variables we perform the test without the term *GDPO*. If we fail to reject the absence of fixed effects (that is a term capturing the combined effects of omitted time-invariant variables), it is (almost certainly) true to say there will not be any fixed effects when we include the lagged dependent term. We therefore carry out the Breusch and Pagan (1980) Lagrange Multiplier test of the null hypothesis that σ_v^2 is equal to zero. If the null hypothesis holds, it implies that v_i is always zero, that is, there is no serious risk of omitted country-specific effects. In this case, the Hausman test result is valid and we can use OLS to estimate our growth regression. This test produces chi-squared values equal to 3.20 and 3.32 when *GRANTS* and *TAID* are the relevant aid variables, respectively. The 1% critical value from the chi-squared distribution with one degree of freedom is 6.63, so the statistic falls in the acceptance region. Hence, we can safely assume that the included time-invariant control variables have sufficiently captured cross-country differences. Also, the result of the Hausman test is valid.

5B.2 Robust Estimation to Account for Outliers

Our results are obtained using robust regression (Rousseeuw and Leroy, 1987), a three-step procedure to deal with outliers. The first step involves estimating the regression and calculating Cook's (1977) Distance measure of influence. Cook's *D* for the i^{th} observation is a measure of the distance between the coefficient estimates when observation *i* is included and when it is not. In the first stage, robust regression screens data points in search of such outliers and eliminates observations for which Cook's distance exceeds 1 – these are the gross outliers. Thereafter, robust regression involves an iterative weighted least squares method whereby the outliers are identified and weights are assigned.

We use the method proposed by Huber (1964) cases where small residuals receive weights of 1 while those with larger residuals (outliers) receive gradually smaller weights. This process of calculating weights and re-estimating regression is repeated. Iterations stop when weights from two consecutive iterations converge. The third step in robust regression involves calculating bi-weights, as proposed by Beaton and Tukey (1974). This assigns a weight to all cases with non-zero residuals according to a smoothly decreasing bi-weight function. The procedure is conducted using routines in *STATA* that allow robust regression to produce estimates with properties corresponding to 95% of the efficiency of OLS (Hamilton, 1991).

CHAPTER 6

FURTHER ANALYSIS ON AID AND GROWTH

6.1 INTRODUCTION

This chapter is intended to supplement the work done in the preceding one. We found evidence in support of aid effectiveness and investment consistently appeared to be the vital link between aid flows and growth. The *observed* poor growth performance in SSA may however tend to cast doubt on the legitimacy of our *regression generated* estimates. If aid has really not been ineffective then why is the development process in SSA slow. We here try to clarify this apparent puzzle.

Despite our finding that aid works, we recognise that these effects are observed on average. Although the focus is on a sample restricted to SSA countries only (which are fairly homogenous in many ways), it is reasonable to believe that estimates on average mask both within and across country variance in aid effects. For practical purposes, what would hold more appeal is the extent to which our estimates are useful in providing information on individual country experiences.

'A fragile inference is not worth taking seriously' (Leamer 1985: 308). Not surprising is the customary wariness as regards to the reliability of estimates in the empirical literature. This is especially the case when an inference matters, for example, BD results which have had an overwhelming influence on World Bank recommendations concerning aid allocations, has been subject to rigorous tests conducted by others. Testing robustness of results has consequently become a natural step following regression estimation. Various types of sensitivity analysis have been routinely employed in the empirical literature. Some are complex and lengthy procedures, for instance, Leamer's extreme bound analysis. Others are fairly straightforward and more practical – minor changes are made to the set of explanatory variables, specification, estimation technique and sample data. In general, the idea is that conclusions are robust if they do not fundamentally alter as a result of these changes.

The rest of this chapter is organised as follows. In *Section 6.2*, drawing from estimates obtained in the previous chapter, we explore the implications for individual country cases. Closely related is an exercise that estimates the growth model for two subsamples of SSA countries. We then address concerns on robustness of our findings to changes in the conditioning set of variables in *Section 6.3*. *Section 6.4* assesses the effect of varying the time period under study. *Section 6.5* concludes with some final observations.

6.2 IMPLICATIONS FOR INDIVIDUAL SSA ECONOMIES

Our results pertaining to aid effectiveness have so far allowed us to comment on the experience in SSA as a region. However, we now want to see what can be learnt about individual countries as this would be of more relevance for policy debates at a disaggregated level. With this in mind, we calculate the predicted contribution of aid to growth, $\delta_8 AID - \delta_9 AID^2$, where *GRANTS* and *TAID* are the relevant aid definitions (Table 6.1a and 6.1b). Obviously, as we are using the estimated coefficients from the panel regressions (Table 5.5), aid is predicted to have a positive effect on growth (and the magnitude will depend on the amount of aid received). We cannot estimate the actual effect of aid for each country (nor can we calculate significance levels). We can however compare cases where the regression performed well (the lowest residuals) with those where it performed poorly (the two panels in each table).

In the upper panel of each table, we list the 10 observations for which unexplained growth is lowest in absolute terms. The idea is that our chosen set of explanatory variables explains reasonably well the growth experience of those countries in that particular period. In the bottom panel of each table, the 10 observations with the largest residual (unexplained growth) are listed. These are mostly countries that experienced negative growth. Consider the two panels in Table 6.1a. In the top panel, simple mean growth (excluding the Congo) is 1% whereas aid is estimated to contribute 1.6% to growth as a simple mean. For the lower panel, simple mean growth (excluding Botswana) is –1.8% whereas the mean contribution of aid to growth is 1.9%. The predicted contribution of aid to growth is not very different in the two panels, but growth performance is dramatically different. One way of interpreting this is that aid was ineffective in the lower panel group of countries (implicitly assuming that the outcome would have been no worse in the absence of

Table 6.1a: Regressions with GRANTS

Country	Time Period	Unexplained Growth	GRANTS	Growth	Contribution of Aid (δ_8AID-δ_9AID^2)
10 lowest absolute values of unexplained GROWTH					
South Africa	1994-1997	0.07	0.29	1.20	0.09
Gambia	1978-1981	0.10	15.71	0.60	4.07
Zimbabwe	1990-1993	0.12	6.75	**-1.47**	1.93
Congo Dem	1990-1993	0.13	4.41	**-12.62**	1.29
Zimbabwe	1994-1997	0.13	5.26	1.98	1.53
Senegal	1982-1985	0.14	7.97	1.43	2.25
Congo Dem	1970-1973	0.16	2.47	0.75	0.74
Mauritius	1994-1997	0.17	0.97	3.62	0.29
Togo	1974-1977	0.19	6.00	0.44	1.73
Togo	1970-1973	0.25	6.56	0.53	1.88
10 highest absolute values of unexplained GROWTH					
Botswana	1970-1973	10.99	9.82	18.51	2.72
Togo	1994-1997	6.81	9.19	6.29	2.56
Cameroon	1986-1989	6.38	1.90	**-3.99**	0.57
Sierra Leone	1994-1997	6.23	12.20	**-7.78**	3.29
Niger	1970-1973	6.01	5.69	**-5.78**	1.64
Congo Rep	1994-1997	5.87	13.66	**-2.07**	3.62
Senegal	1978-1981	5.84	7.25	**-3.14**	2.06
Swaziland	1986-1989	5.77	6.61	7.29	1.89
Cameroon	1990-1993	5.62	3.28	**-6.69**	0.97
Mauritius	1978-1981	5.52	2.05	**-0.73**	0.61

Note: Residuals are from first regression of Table 5.5.

Table 6.1b: Regressions with TAID

Country	Time Period	Unexplained Growth	TAID	Growth	Contribution of Aid (δ_8AID-δ_9AID^2)
10 lowest absolute values of unexplained GROWTH					
Senegal	1982-1985	0.01	8.36	1.43	2.39
Zimbabwe	1994-1997	0.02	5.02	1.98	1.50
South Africa	1994-1993	0.03	0.14	1.20	0.05
Togo	1970-1973	0.10	3.44	0.53	1.05
Congo Dem	1990-1993	0.12	4.42	**-12.62**	1.33
Lesotho	1978-1981	0.13	9.05	2.22	2.56
Togo	1974-1977	0.14	4.88	0.44	1.46
Mauritius	1994-1997	0.17	0.02	3.62	0.01
Congo Dem	1970-1973	0.19	1.36	0.75	0.43
Mali	1982-1985	0.26	18.70	**-0.89**	4.57
10 highest absolute values of unexplained GROWTH					
Botswana	1970-1973	10.00	16.47	18.51	4.17
Sierra Leone	1994-1997	6.74	20.90	**-7.78**	4.92
Togo	1994-1997	6.67	10.10	6.29	2.81
Swaziland	1986-1989	6.44	2.29	7.29	0.71
Cameroon	1986-1989	6.31	1.73	**-3.99**	0.54
Niger	1970-1973	6.14	4.87	**-5.78**	1.46
Congo Rep	1994-1997	6.12	15.09	**-2.07**	3.90
Senegal	1978-1981	5.96	7.56	**-3.14**	2.18
Cameroon	1990-1993	5.82	4.09	**-6.69**	1.24
Rwanda	1978-1981	5.60	8.46	5.35	2.41

Note: Residuals are from second regression of Table 5.5.

aid). Another interpretation, or perhaps qualification, is that other factors undermined the effectiveness of aid in the poor performing countries. Although our analysis cannot identify these (growth-retarding) factors, it can suggest countries (and periods) that may warrant further investigation. Such a case study complement is beyond the scope of this empirical investigation.

Estimation using subsamples of SSA countries

Although conducting case studies is not feasible within this volume, we here go for the next best alternative – carry out inference on subsamples. Drawing on Tables 6.1a and 6.1b, the point we make is that the regression model performs better for countries that grew than for those that did not. The hypothesis is therefore an aid coefficient that will vary across the group of countries that achieved a positive and negative growth. Difference might be in terms of sign, size or/and significance. A positive aid coefficient in economies with good performance and an insignificant aid coefficient in remaining economies would seem a plausible possibility. We here intend to test this proposition.

With this aim, we split the SSA sample into two: those that have experienced positive growth in the period 1970 to 1997 and the others (countries belonging to these subgroups are listed in Appendix 6). We then re-estimate the base model for each of these subsamples. Table 6.2 reports the coefficient estimates. This analysis indirectly also serves as a sensitivity test to change in sample (countrywise).

Results are generally consistent with our prior supposition. Aid enters with a positive sign in almost all regressions, though on average it is significant and larger in the group of economies with good growth record[1]. Using *INVRES* produces similar estimates. It is evident that aid is more effective in some countries and less in others. Insignificant aid coefficients do not necessarily imply aid ineffectiveness or cast doubt on the strength and validity of our prior conclusion that aid works. Rather

[1] We do not use INVRES in any of the regressions reported in this chapter as it not very clear how we can extend its use to aid interaction terms (which we include later). Hence, for consistency we use INV in all regressions here.

Table 6.2: Robust Aid-Growth Regressions for Subsamples

	Negative Growth in 1970-97				Positive Growth in 1970-97			
GDPO	-0.0005	0.001	-0.001	-0.0002	0.001	0.001	0.001	0.001
	(0.23)	(0.40)	(0.29)	(0.09)	(1.89)*	(1.84)*	(2.32)**	(1.73)*
PRIC15	-0.128	-0.122	-0.081	-0.072	0.273	0.272	0.325	0.305
	(1.10)	(0.97)	(0.53)	(0.47)	(3.07)***	(2.98)***	(3.39)***	(3.12)***
INV	0.134	0.131	0.102	0.100	0.075	0.083	0.041	0.065
	(2.24)**	(2.19)**	(1.42)	(1.41)	(2.49)**	(2.74)***	(1.26)	(2.03)**
DEM	-1.266	-0.718	-0.899	-0.690	-1.533	-1.644	-1.406	-1.591
	(1.39)	(0.77)	(0.79)	(0.61)	(3.08)***	(3.25)***	(2.70)***	(3.01)***
INFL	-0.003	-0.003	-0.004	-0.004	0.002	0.001	0.005	0.000
	(2.57)**	(2.35)**	(2.62)**	(2.52)**	(0.12)	(0.07)	(0.27)	(0.03)
GCON	-0.100	-0.100	-0.044	-0.048	-0.176	-0.173	-0.202	-0.193
	(1.06)	(1.04)	(0.41)	(0.45)	(2.45)**	(2.41)**	(2.87)***	(2.72)***
MGDP	-0.010	-0.012	-0.008	-0.004	0.001	0.002	-0.007	-0.003
	(0.26)	(0.29)	(0.17)	(0.08)	(0.05)	(0.17)	(0.59)	(0.28)
GRANTS	-0.161				0.232			
	(0.69)				(1.72)*			
GRANTSQ	0.015				-0.006			
	(1.33)				(1.61)			
TAID		0.382				0.214		
		(1.38)				(1.54)		
TAIDSQ		-0.011				-0.005		
		(1.19)				(1.42)		
GRANTS_1			0.224				0.569	
			(0.80)				(3.11)***	
GRANTS_1SQ			-0.010				-0.019	
			(0.70)				(2.66)***	
TAID_1				0.373				0.313
				(1.12)				(2.39)**
TAID_1SQ				-0.015				-0.008
				(0.99)				(2.33)**
Constant	4.221	-0.214	2.181	0.023	1.921	1.998	1.312	2.263
	(0.88)	(0.04)	(0.37)	(0.00)	(0.92)	(0.92)	(0.60)	(0.99)
Observations	64	64	56	56	84	84	78	79
R-squared	0.57	0.54	0.50	0.49	0.41	0.42	0.42	0.39
F-Stat	4.33	3.83	2.97	2.86	3.14	3.28	3.24	2.91

Notes: All regressions run in a panel of seven four-year periods over 1970-97. Time dummies included in all regressions. Absolute t-values are reported in brackets.
* Significant at 10% level. ** 5% level. *** 1% level. F-Stat rejects the null that all the coefficients are jointly equal to zero..

they perhaps highlight the presence of factors (such as weak/failing transmission) that might be hampering positive effects of aid to translate into higher growth in certain countries.

6.3 SENSITIVITY TO CONDITIONING SET OF VARIABLES

Often, regression results are challenged as being specific to the conditioning set of variables. Our results may face similar reservations. We therefore address this concern by re-estimating our base model under various specification. First, we run a parsimonious version of the model. Then, we specify a second version that includes variables that have recently appeared in empirical work but not been represented in Equation 5.1 Finally, we test the robustness of our results to the introduction of aid interaction terms. We present each of these results in turn.

6.3.1 A Parsimonious Model

Advances in growth literature suggest the importance of a wide range of explanatory variables that are potentially important for growth. As a result, we incorporate political and policy variables among others in our base model. However, we want to demonstrate whether our findings rest on this exact specification. With this aim, we estimate a very simple model that will include only *GDPO*, *PRIC15*, *INV* and aid variables. Several aid effectiveness studies do not introduce investment in their regressions. While we argue that this would be an inappropriate approach as investment is a principal determinant of growth, we want our results to be comparable to other empirical studies on aid. Hence, we estimate this parsimonious model with and without INV. Table 6.3 presents the estimates.

Table 6.3: Robust Aid-Growth Regressions - A Parsimonious Model

	With INV				Without INV			
GDPO	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(2.68)***	(2.84)***	(2.68)***	(2.76)***	(3.39)***	(4.02)***	(3.33)***	(3.98)***
PRIC15	0.169	0.137	0.161	0.141	0.248	0.224	0.236	0.232
	(2.41)**	(1.74)*	(2.32)**	(1.80)*	(3.68)***	(3.02)***	(3.49)***	(3.13)***
INV	0.087	0.079	0.088	0.082				
	(3.53)***	(3.05)***	(3.62)***	(3.21)***				
GRANTS	0.154				0.213			
	(1.87)*				(2.59)**			
GRANTSQ	-0.003				-0.004			
	(1.46)				(2.12)**			
GRANTS_1		0.261				0.508		
		(2.58)**				(3.81)***		
GRANTS_1SQ		-0.005				-0.015		
		(1.71)*				(2.65)***		
TAID			0.171				0.227	
			(1.87)*				(2.45)**	
TAIDSQ			-0.003				-0.004	
			(1.51)				(2.06)**	
TAID_1				0.257				0.527
				(2.40)**				(3.69)***
TAID_1SQ				-0.005				-0.016
				(1.65)				(2.72)***
Constant	-4.282	-4.826	-4.248	-4.828	-3.819	-5.138	-3.691	-5.244
	(3.86)***	(4.09)***	(3.69)***	(3.92)***	(3.39)***	(4.28)***	(3.12)***	(4.12)***
Observations	164	146	164	146	164	145	164	145
R-squared	0.31	0.30	0.31	0.30	0.25	0.28	0.23	0.27
F-Stat	6.16	5.85	6.13	5.76	5.02	5.97	4.63	5.53

Note: Same applies as for Table 6.2

Aid enters with a significant and positive sign in all regressions. Note however. coefficient on aid is on average more important both in terms of size and significance in regressions without INV. This result is not surprising given that our core finding does suggest that aid impacts on growth mainly via investment. In the absence of an investment term, aid coefficient captures this effect. When investment is included together with an aid term (the first set of regressions), significant aid coefficient suggests that aid has an influence on growth additional to the effect through investment. This echoes the conclusions reached by Lensink and Morrissey (2000).

6.3.2 An Encompassing Model

As mentioned, there are numerous factors that may be important for growth. In spite of having introduced variables belonging to various dimensions of the economy, we do not claim to have specified a complete or 'true' model of growth. We now attempt to see how sensitive our results are to omitted variables. Rather than drawing variables from a large pool of potential determinants of growth, we prefer to introduce variables that are absent from our model but have appeared in recent aid-growth regressions. For this purpose, we refer to two prominent papers in this literature - BD and Dalgaard-Hansen-Tarp (2002). We augment our aid-growth specification by regressors that have been commonly used in these two studies. These are ethnic fractionalisation (*ETHNF*), assassination (*ASSASS*) and institutional quality (*INST*). Table 6.4 displays the regression estimates.

In line with Dalgaard-Hansen-Tarp (2002), ethnic fractionalisation surprisingly enters with a positive sign, while the other additional regressors are in general insignificant. It would appear that these characteristics do not contribute to explain growth in a sample restricted to SSA countries only. Though, they are certainly important in wider data sets like the one used by BD and Dalgaard-Hansen-Tarp (2002). Turning to coefficients on aid, they are significant in some cases and insignificant in others. This does not necessarily have implications with regards to robustness of our results. Once the indirect effect on growth through investment is taken into account, aid enters with a significant positive sign in all regressions[2].

[2] If *INVRES* is included the coefficients on GRANTS=0.333 (t =2.28) and TAID=0.410 (t=2.93). Coefficients on their lagged counterparts are 0.392 (t=3.40) and 0.358 (2.78), respectively.

Table 6.4: Robust Aid-Growth Regressions - An Encompassing Model

	Effect of current aid		Effect of lagged aid	
GDPO	0.001	0.001	**-0.001**	-0.001
	(0.59)	(1.00)	**(1.81)***	(1.56)
PRIC15	**0.254**	**0.283**	**0.299**	**0.275**
	(2.38)**	**(2.84)*****	**(3.08)*****	**(2.49)****
INV	**0.155**	**0.133**	**0.127**	**0.150**
	(3.26)***	**(2.94)*****	**(2.76)*****	**(2.89)*****
DEM	**-1.442**	**-1.468**	**-2.240**	**-2.042**
	(2.87)***	**(3.02)*****	**(5.32)*****	**(4.40)*****
INFL	-0.002	-0.003	-0.004	-0.003
	(0.17)	(0.31)	(0.45)	(0.25)
GCON	**-0.204**	**-0.228**	**-0.223**	**-0.204**
	(2.99)***	**(3.67)*****	**(4.14)*****	**(3.49)*****
MGDP	-0.012	-0.012	-0.014	-0.014
	(1.01)	(1.05)	(1.31)	(1.23)
ETHNF	**0.030**	**0.037**	**0.027**	0.023
	(1.84)*	**(2.37)****	**(1.82)***	(1.40)
ASSASS	6.233	7.711	0.612	0.689
	(0.96)	(1.23)	(0.12)	(0.12)
*ETHNF*ASSASSIN*	-0.113	-0.138	0.001	-0.002
	(1.17)	(1.47)	(0.02)	(0.02)
INST	0.424	0.510	**0.549**	0.541
	(1.23)	(1.61)	**(1.76)***	(1.60)
GRANTS	0.126			
	(0.93)			
GRANTSQ	-0.004			
	(1.20)			
TAID		**0.237**		
		(1.76)*		
TAIDSQ		**-0.006**		
		(1.97)*		
GRANTS_1			**0.192**	
			(1.78)*	
GRANTS_1SQ			**-0.006**	
			(2.31)**	
TAID_1				0.131
				(1.05)
TAID_1SQ				-0.005
				(1.60)
Constant	-4.532	-6.105	1.569	0.901
	(1.35)	(1.74)*	(0.63)	(0.32)
Observations	86	86	78	78
R-squared	0.58	0.62	0.65	0.58
F-Stat	5.10	6.15	6.44	4.93

Note: Same applies as in Table 6.2

6.3.3 Issue of Aid and Policy Interaction

BD marked a milestone in aid literature. Their work has had a profound effect on the perceptions of aid effectiveness, especially at the World Bank. They claim that aid works only in the presence of good policies. They find in support a positively signed aid-policy interaction term. However, HT challenge this conclusion with a rigorous econometric analysis. An important issue that arises in their critical assessment is that aid-policy and aid-squared term act as proxy for each other. This lends support to their specification which includes aid, aid^2 and aid-policy terms[3]. BD result tends to be fragile across these specifications. We intend to adopt a similar specification here. The purpose of this analysis is threefold. First, if aid-squared is picking up only the effects of an omitted interaction term in our regression, we will find evidence for this. Second, it will allow us to examine if our regressions support BD conclusion. Third, it will demonstrate if our findings are sensitive to this specification. We explore the effect of policy on aid effectiveness by employing three indicators of policy regime – inflation, openness (OPEN) and a BD-type policy index (PI)[4]. Results are provided in Table 6.5

The positive effect of aid holds on average. Aid and aid-squared terms remain significant in most cases, especially when lagged aid is introduced. The nature of the correlation between aid effectiveness and policy is however not very clear – insignificant, positive or negative. BD conclusion may be sensitive to the policy indicator used. Ambiguity on this issue stresses the complexity of studying this transmission mechanism and therefore our resolution not to fully investigate it within this volume.

[3] See Chapter 3 for more details.

[4] PI= 0.47-0.001 INFL – 0.158 GOV + 0.01 MGDP

Table 6.5a : Robust Aid-Policy Augmented Regressions with GRANTS

	Effect of current GRANTS				Effect of lagged GRANTS			
GDPO	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**
	(2.38)**	**(2.34)****	**(2.13)****	**(2.25)****	**(2.22)****	**(2.19)****	**(2.14)****	**(2.23)****
PRIC15	**0.212**	**0.207**	**0.134**	**0.220**	**0.182**	**0.180**	**0.155**	**0.182**
	(3.09)***	**(2.91)*****	**(1.87)***	**(3.23)*****	**(2.34)****	**(2.21)****	**(1.89)***	**(2.39)****
INV	**0.109**	**0.110**	**0.144**	**0.111**	**0.105**	**0.106**	**0.133**	**0.104**
	(4.42)***	**(4.40)*****	**(3.78)*****	**(4.54)*****	**(4.01)*****	**(3.92)*****	**(3.08)*****	**(4.02)*****
DEM	**-1.261**	**-1.282**	**-1.496**	**-1.247**	**-1.287**	**-1.298**	**-1.285**	**-1.280**
	(3.52)***	**(3.51)*****	**(3.94)*****	**(3.52)*****	**(3.34)*****	**(3.29)*****	**(3.21)*****	**(3.40)*****
INFL	**-0.004**	**-0.005**	**-0.003**	**-0.004**	**-0.004**	**-0.004**	-0.003	-0.004
	(2.50)**	**(0.93)**	**(2.46)****	**(2.77)*****	**(2.55)****	**(0.65)**	**(2.40)****	**(2.98)*****
GCON	**-0.149**	**-0.151**	**-0.162**	**-0.249**	**-0.151**	**-0.152**	**-0.158**	**-0.302**
	(2.64)***	**(2.66)*****	**(2.89)*****	**(2.80)*****	**(2.59)****	**(2.57)****	**(2.70)*****	**(3.34)*****
MGDP	0.002	0.002	0.000	0.010	-0.001	-0.001	-0.007	0.010
	(0.22)	(0.23)	(0.01)	(0.85)	(0.12)	(0.11)	(0.60)	(0.89)
GRANTS	**0.161**	0.150	0.086	-0.021				
	(1.89)*	(1.65)	(0.97)	(0.14)				
GRANTSQ	-0.003	-0.003	-0.002	-0.001				
	(1.65)	(1.64)	(0.89)	(0.76)				
*GRANTS*INFL*		0.000						
		(0.32)						
*GRANTS*OPEN*			**0.130**					
			(2.12)**					
*GRANTS*PI*				-0.064				
				(1.40)				
GRANTS_1					**0.265**	**0.260**	**0.398**	-0.057
					(2.59)**	**(2.30)****	**(2.78)*****	(0.32)
GRANTS_1SQ					**-0.006**	**-0.006**	**-0.016**	-0.004
					(2.22)**	**(2.17)****	**(2.43)****	(1.27)
*GRANTS_1*INFL*						0.000		
						(0.11)		
*GRANTS_1*OPEN*							**0.152**	
							(1.97)*	
*GRANTS_1*PI*								**-0.124**
								(2.03)**
Constant	0.525	0.697	1.276	0.543	0.477	0.543	-0.295	2.899
	(0.32)	(0.41)	(0.71)	(0.30)	(0.28)	(0.30)	(0.15)	(1.45)
Observations	149	149	133	135	135	135	121	135
R-squared	0.46	0.45	0.50	0.44	0.44	0.44	0.48	0.46
F-Stat	7.40	6.86	7.33	7.20	6.64	6.12	6.52	6.89

Note: Same applies as in Table 6.2

Table 6.5b : Robust Aid-Policy Augmented Regressions with TAID

	Effect of current TAID				Effect of lagged TAID			
GDPO	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(2.35)**	(2.30)**	(2.05)**	(2.18)**	(2.07)**	(1.98)**	(2.29)**	(2.00)**
PRIC15	0.205	0.197	0.128	0.209	0.177	0.168	0.144	0.185
	(2.99)***	(2.77)***	(1.81)*	(3.04)***	(2.27)**	(2.02)**	(1.79)*	(2.40)**
INV	0.111	0.113	0.148	0.113	0.106	0.109	0.118	0.107
	(4.49)***	(4.48)***	(3.87)***	(4.56)***	(4.02)***	(3.99)***	(2.75)***	(4.15)***
DEM	-1.328	-1.355	-1.574	-1.321	-1.231	-1.279	-1.358	-1.233
	(3.69)***	(3.70)***	(4.14)***	(3.67)***	(3.19)***	(3.20)***	(3.40)***	(3.24)***
INFL	-0.004	-0.006	-0.003	-0.004	-0.004	-0.008	-0.003	-0.004
	(2.50)**	(1.04)	(2.48)**	(2.62)***	(2.68)***	(0.72)	(2.52)**	(2.99)***
GCON	-0.143	-0.146	-0.159	-0.197	-0.134	-0.140	-0.128	-0.238
	(2.58)**	(2.60)**	(2.89)***	(2.19)**	(2.33)**	(2.35)**	(2.20)**	(2.69)***
MGDP	0.002	0.002	0.001	0.006	0.000	0.000	-0.005	0.008
	(0.21)	(0.24)	(0.07)	(0.54)	(0.02)	(0.01)	(0.41)	(0.69)
TAID	0.174	0.157	0.089	0.065				
	(1.85)*	(1.58)	(0.90)	(0.41)				
TAIDSQ	-0.004	-0.004	-0.002	-0.003				
	(1.69)*	(1.67)*	(0.99)	(1.10)				
*TAID*INFL*		0.001						
		(0.43)						
*TAID*OPEN*			0.118					
			(2.16)**					
*TAID*PI*				-0.035				
				(0.75)				
TAID_1					0.242	0.219	0.439	0.030
					(2.25)**	(1.79)*	(2.89)***	(0.17)
TAID_1SQ					-0.006	-0.006	-0.018	-0.004
					(1.99)**	(1.85)*	(2.78)***	(1.36)
*TAID_1*INFL*						0.001		
						(0.37)		
*TAID_1*OPEN*							0.192	
							(2.58)**	
*TAID_1*PI*								-0.079
								(1.45)
Constant	0.655	0.871	1.454	1.554	0.310	0.670	-0.811	1.922
	(0.39)	(0.50)	(0.81)	(0.78)	(0.17)	(0.34)	(0.40)	(0.93)
Observations	149	149	133	149	135	135	121	135
R-squared	0.46	0.46	0.51	0.46	0.43	0.43	0.49	0.44
F-Stat	7.47	6.93	7.56	7.01	6.40	5.87	6.64	6.32

Note: Same applies as in Table 6.2

6.4 SENSITIVITY TO SAMPLE PERIOD

To test the possibility that change in sample period is the reason that BD conclusions do not hold in our model, we re-estimate aid-policy augmented regressions using data from 1970 to 1993 only. Since most of the significant aid studies are based in this time period (BD, HT, Durbarry *et al* (1998)), this exploration would also allow direct comparison of our results and test its sensitivity to sample period. Results are reported in Table 6.6.

Table6.6a:Robust Aid-Policy Augmented Regressions with GRANTS in 1970-93

	Effect of current GRANTS				Effect of lagged GRANTS			
GDPO	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(2.79)***	(2.71)***	(2.55)**	(2.66)***	(2.37)**	(2.37)**	(1.92)*	(2.37)**
PRIC15	0.214	0.209	0.142	0.227	0.209	0.212	0.164	0.220
	(2.89)***	(2.76)***	(1.90)*	(3.11)***	(2.42)**	(2.39)**	(1.86)*	(2.60)**
INV	0.114	0.116	0.180	0.114	0.094	0.093	0.160	0.092
	(3.71)***	(3.73)***	(4.22)***	(3.76)***	(2.73)***	(2.66)***	(3.06)***	(2.72)***
DEM	-1.584	-1.614	-1.583	-1.545	-1.444	-1.416	-1.222	-1.387
	(3.90)***	(3.89)***	(3.89)***	(3.86)***	(3.29)***	(3.19)***	(2.76)***	(3.21)***
INFL	0.003	0.000	0.007	-0.002	0.004	0.007	0.009	-0.004
	(0.29)	(0.02)	(0.64)	(0.19)	(0.35)	(0.36)	(0.84)	(2.81)***
GCON	-0.187	-0.191	-0.206	-0.299	-0.178	-0.174	-0.185	-0.327
	(3.07)***	(3.06)***	(3.54)***	(2.96)***	(2.81)***	(2.67)***	(2.96)***	(3.37)***
MGDP	0.004	0.004	-0.002	0.012	0.001	0.001	-0.007	0.011
	(0.40)	(0.40)	(0.21)	(0.99)	(0.12)	(0.13)	(0.55)	(0.87)
GRANTS	0.265	0.257	0.219	0.077				
	(2.41)**	(2.20)**	(2.06)**	(0.46)				
GRANTSQ	-0.006	-0.006	-0.006	-0.005				
	(2.00)**	(2.00)**	(2.03)**	(1.55)				
*GRANTS*INFL*		0.000						
		(0.22)						
*GRANTS*OPEN*			0.153					
			(2.03)**					
*GRANTS*PI*				-0.068				
				(1.35)				
GRANTS_1					0.325	0.338	0.443	0.001
					(2.88)***	(2.57)**	(1.97)*	(0.01)
GRANTS_1SQ					-0.007	-0.007	-0.018	-0.004
					(2.34)**	(2.30)**	(1.43)	(1.33)
*GRANTS_1*INFL*						0.000		
						(0.18)		
*GRANTS_1*OPEN*							0.178	
							(1.72)*	
GRANTS_1PI								-0.119
								(1.79)*
Constant	-1.949	-1.724	-1.997	-0.162	-1.708	-1.945	-3.206	0.674
	(1.04)	(0.85)	(1.00)	(0.07)	(0.87)	(0.91)	(1.44)	(0.32)
Observations	124	124	111	124	110	110	99	111
R-squared	0.45	0.45	0.53	0.47	0.41	0.41	0.47	0.50
F-Stat	6.44	5.99	7.19	6.26	5.13	4.70	5.23	6.93

Note: Same applies as in Table 6.2

Table 6.6b :Robust Aid-Policy Augmented Regressions with TAID in 1970-93

	Effect of current TAID				Effect of lagged TAID			
GDPO	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**
	(2.89)***	**(2.78)*****	**(2.87)*****	**(2.76)*****	**(2.28)****	**(2.17)****	**(2.20)****	**(2.21)****
PRIC15	**0.206**	**0.201**	**0.137**	**0.212**	**0.189**	**0.183**	**0.158**	**0.204**
	(2.77)***	**(2.62)****	**(1.85)***	**(2.83)*****	**(2.13)****	**(2.00)****	**(1.77)***	**(2.36)****
INV	**0.122**	**0.123**	**0.191**	**0.123**	**0.097**	**0.099**	**0.142**	**0.097**
	(3.94)***	**(3.91)*****	**(4.47)*****	**(3.95)*****	**(2.75)*****	**(2.75)*****	**(2.63)****	**(2.83)*****
DEM	**-1.698**	**-1.726**	**-1.770**	**-1.684**	**-1.374**	**-1.404**	**-1.273**	**-1.344**
	(4.14)***	**(4.11)*****	**(4.34)*****	**(4.10)*****	**(3.07)*****	**(3.09)*****	**(2.85)*****	**(3.06)*****
INFL	0.003	-0.003	0.008	0.001	0.004	-0.001	0.010	**-0.004**
	(0.29)	(0.13)	(0.73)	(0.10)	(0.39)	(0.02)	(0.89)	**(2.91)*****
GCON	**-0.185**	**-0.190**	**-0.212**	**-0.230**	**-0.152**	**-0.158**	**-0.156**	**-0.269**
	(3.09)***	**(3.06)*****	**(3.70)*****	**(2.21)****	**(2.39)****	**(2.39)****	**(2.47)****	**(2.78)*****
MGDP	0.005	0.005	0.000	0.008	0.002	0.002	-0.005	0.009
	(0.45)	(0.43)	(0.02)	(0.63)	(0.18)	(0.18)	(0.38)	(0.75)
TAID	**0.302**	**0.283**	**0.288**	0.218				
	(2.58)**	**(2.27)****	**(2.55)****	(1.23)				
TAIDSQ	**-0.007**	**-0.007**	**-0.007**	**-0.006**				
	(2.19)**	**(2.16)****	**(2.49)****	**(1.91)***				
*TAID*INFL*		0.001						
		(0.31)						
*TAID*OPEN*			**0.148**					
			(2.05)**					
*TAID*PI*				-0.027				
				(0.52)				
TAID_1					**0.443**	**0.421**	**0.538**	0.221
					(2.01)**	**(1.83)***	**(2.45)****	(0.89)
TAID_1SQ					-0.016	-0.015	**-0.023**	-0.015
					(1.36)	(1.33)	**(2.01)****	(1.31)
*TAID_1*INFL*						0.001		
						(0.27)		
*TAID_1*OPEN*							**0.235**	
							(2.24)**	
*TAID_1*PI*								-0.086
								(1.44)
Constant	-2.121	-1.762	-2.410	-1.327	-2.451	-2.107	**-4.085**	-0.539
	(1.07)	(0.81)	(1.19)	(0.56)	(1.13)	(0.89)	**(1.75)***	(0.24)
Observations	124	124	111	124	109	109	99	110
R-squared	0.47	0.47	0.57	0.47	0.39	0.39	0.47	0.48
F-Stat	6.90	6.34	8.26	6.36	4.65	4.25	5.34	6.14

Note: Same applies as in Table 6.2

The base model performs well. Aid (as an additive term) is significant in almost all regressions and aid-squared turns significant in more regressions than before. This suggests that our finding that aid has a positive effect on growth in SSA is robust to sample period. With regards to the aid-interaction terms, there is no change in results. They enter with an insignificant coefficient in some cases and positive/negative in others, hence making this result difficult to interpret. It would therefore appear that fragility of BD conclusion is not attributed to the sample period used. The nature of the interaction between indicators of policy and aid remains an open question. Even more so, it is yet an unresolved issue how to model this link. Though, it should be noted that there is yet no strong reason to prefer this specification.

6.5 CONCLUSION

An inherent limitation of cross-country panel regressions is that one estimates the average value of a coefficient, and this might not be an estimate valid for any particular country. However, what one is seeking is patterns or empirical regularities. In this respect we identify a tendency for aid to contribute to growth through investment. In this chapter, we speculate on individual country experience based on the estimated growth regression. We also conduct a stability analysis to test how sturdy our findings are.

The stability analysis in this chapter examines how persistent our results are to changes in the sample. Using different sets of explanatory variables by adding/deleting regressors from our base growth model and varying the time period, we study the robustness of our estimates. In most cases the estimated aid coefficient is positive and significant. In a few cases, when the specification includes an aid-policy interaction term, the coefficient becomes insignificant. However, it is yet an empirical question whether such a specification is necessary (or preferable). The balance of the results is that aid is effective.

Although we find aid to be effective on average, this does not imply that aid ensures growth. Indeed, most SSA countries have had a very poor growth performance (and this is one reason why they continue to be large recipients of aid). The potential positive effect of aid can be offset by factors that are detrimental to growth. In many cases this is partly due to bad policy. However, this is not the whole explanation - our results suggest that aid can be effective even if policies are bad (we do include variables to capture policy). The variables in our aid-growth model capture sources of positive growth better than explaining the forces behind negative growth performance. Stated differently, the negative growth in SSA countries appears to be due to factors other than those represented in our regressions. This supports our belief that the observed combination of generous aid flows and slow growth in SSA does not necessarily imply aid ineffectiveness. Aid performance lower than could otherwise be possible in the absence of shocks would seem to be a more plausible explanation.

This is not to claim that aid to Africa has been a success – evidently it has not. However, there is more than a pedantic difference between claiming that aid is ineffective because growth performance has not matched aid receipts and claiming that aid has been effective although its potential contribution to growth has not been fully realised. The former claim permits the policy conclusion of reducing aid whereas the latter does not. The latter emphasises, implicitly at least, the desirability of maintaining aid while identifying and addressing the factors that explain Africa's poor growth performance. Our conclusion is that aid has been beneficial to African countries, but much needs to be done to ensure that these benefits lead to growth.

APPENDIX 6 : DESCRIPTION OF DATA

Definitions and sources of data

OPEN	dummy takes value of 1 if economy is open at the beginning of the period and 0 otherwise. *Source*: Sachs and Warner (1995)
ETHNF	ethnic fractionalisation index. *Source*: Easterly dataset
ASSASSIN	assassinations. *Source*: Easterly dataset
PI	BD-type policy index. *Source*: constructed.

List of countries

Countries with negative growth over 1970-97:

Central Africa
Chad
Congo Democratic Republic
Cote D'Ivoire
Ghana
Madagascar
Mauritania
Niger
Rwanda
Senegal
Sierra Leonne
Togo
Zambia

Countries with positive growth over 1970-97:

Benin
Botswana
Burkina Faso
Burundi
Cameroon
Congo Republic
Ethiopia
Gabon
Gambia
Kenya
Lesotho
Malawi
Mali
Mauritius
Nigeria
Seychelles
South Africa
Swaziland
Tanzania
Uganda
Zimbabwe

CHAPTER 7

AID AND GROWTH: IDENTIFYING THRESHOLD EFFECTS

7.1 INTRODUCTION

Concerns regarding aid has undergone various distinct changes. Not only has allocation policy shifted from project aid to conditional aid (for structural adjustment) in the 1980s and to aid selectivity more recently, but the basic growth theory underlying aid effectiveness studies has changed as well. An endogenous growth model framework has gained in popularity rather than the traditional Harrod-Domar model. In this chapter, we are however concerned with one particular development in the empirical approach.

In recent years, empirical literature on the relationship between aid and growth has witnessed a strong tendency towards a non-linear specification. The justification for this class of models is inherent in the form of the non-linear term. There have been two specific ways of introducing this non-linearity in aid studies. First, an aid squared term, which represents the novel feature of Hadjimichael *et al.* (1995), is used to capture the possibility that aid flows display diminishing returns beyond a certain 'optimal' level. They find a significantly negative coefficient on the aid-squared term, in support of their hypothesis. The inclusion of squared aid has since emerged as a tradition in aid-growth regressions (Durbarry *et al.*(1998), Hansen and Tarp(2001), Lensink and White (2001)).

Second, interaction terms have been introduced to capture possible non-linearities in the aid-growth linkage[1]. On one hand, Burnside and Dollar (2000) rely on aid interacted with a policy index to argue that aid effectiveness is conditional on good quality of policies. On the other, Guillaumont and Chauvet (2001) emphasise the role of uncertainty – the more vulnerable a country is, the more room for improvement to be brought by aid, therefore the higher is aid effectiveness. Hence, they introduce an aid-uncertainty interaction term. Recently, Dalgaard *et al* (2002) have argued for an interaction between aid and climatic conditions.

Whilst the use of interaction terms is still a subject of debate, we here do not attempt to resolve disputes. Rather, we want to investigate the first category of models where the coefficient on aid squared term is interpreted as capturing diminishing returns to aid. Lensink and White (2001) have gone one step further in modelling it as an aid Laffer curve. In this context, the assumptions are that aid effectiveness is non-linear in aid and that this non-linearity takes a very specific form (inverted U-shape). We here employ a threshold econometric model, as developed by Hansen (2000), to directly test these assumptions. The development of this technique is fairly recent and has been applied in only a few empirical studies, none of which covers the aid-growth literature. Its application is the novel feature of this chapter.

We conduct this analysis for a sample of 131 aid recipients for which Effective Development Assistance data are available over the period 1975 to 1995. While this is the first demonstration of identifying regimes using the threshold model in aid literature, we make no claim of efficiency. Other estimators can potentially be more efficient, as acknowledged by Hansen (2000). However, one would appreciate that consistent estimation of the threshold in this class of model is still a matter of current research.

The rest of this chapter is organised as follows. *Section 7.2* briefly examines the concept on an Aid Laffer curve. *Section 7.3* reviews the different techniques used in the empirical literature to address the issue of threshold effects. A preliminary data analysis is conducted in *Section 7.4*. An outline of the econometric method follows in *Section 7.5*. In *Section 7.6*, we discuss the estimation results. Finally, *Section 7.7* concludes with some observations.

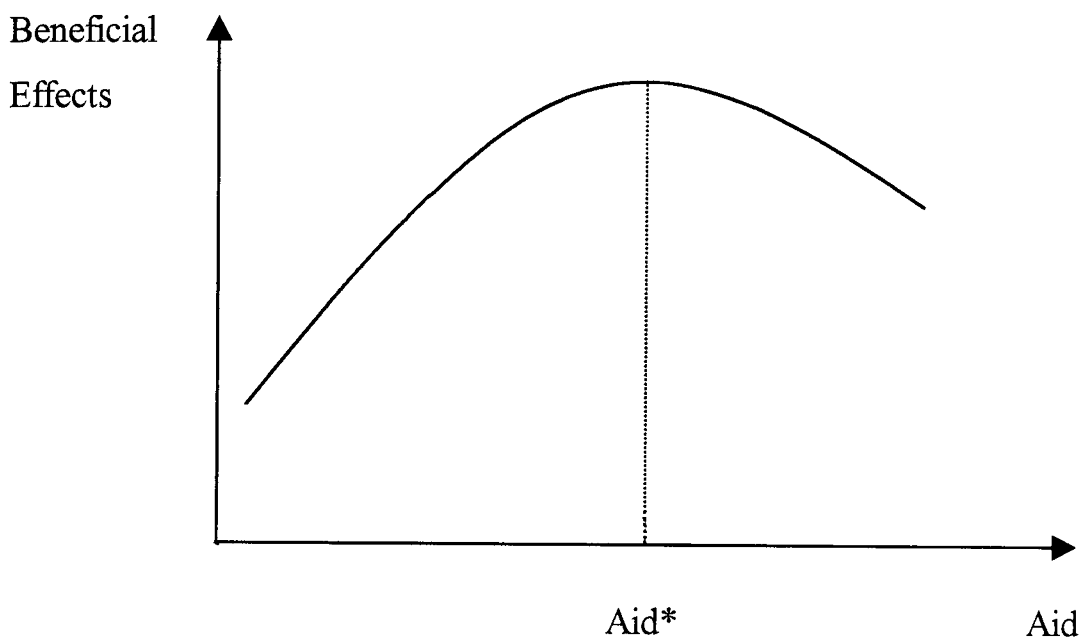
7.2 AID LAFFER CURVE

The notion of a threshold in the relationship between aid and growth was first formalised by an Aid Laffer curve as presented by Lensink and White (2001) (Figure 7.1). Their motivation to formulate this concept is that

[1] See Chapter 3 for more details.

'.... aid may have not merely decreasing returns (a proposition which everyone would surely accept) but that, after a certain level, the returns to further aid inflows are negative. This idea, i.e, that a country can get "too much aid", can be shown by an aid Laffer curve....' (Lensink and White (2001:48))

FIGURE 7.1: Aid Laffer Curve



In which case, they suggest that the recipient economy will be better off without any further aid disbursements hence prescribe the imposition of a ceiling in aid flows at around the top of the aid Laffer curve. They recommend that any country receiving foreign aid beyond this level should lose this excess which will consequently be redistributed to countries which are still somewhere before the maximum point in the Laffer curve. This result is based on an endogenous growth model where savings is determined through an optimisation process[2]. Lensink and White (2001) finding is motivated by a derivative of growth with respect to aid that is predicted to be positive only when aid share is within a certain range. In this chapter, we also want to test this hypothesis of negative returns to aid.

It is also worth noting that this conclusion is based on one critical assumption: the level of technology is negatively related to amounts of aid received, an argument

[2] See Chapter 2 for a detailed presentation of this theoretical work.

prompted by Griffin (1970) who suggest that aid dampens the productivity of investment projects. This inverse relationship between aid and productivity is associated with the absorptive capacity of an economy. Aid inflows are believed to have the desirable effect of promoting investment, however high levels of investment are sometimes beyond the country's 'management capability'. In other words, it is suggested that recipients have the ability to implement aid successfully only in a certain number of development projects. From these explanations, it appears that though aid is crucial for development in poor countries, low absorptive capacity of an economy may limit returns to aid flows. Consistent with these findings, a review by ODC[3] '*Strenthening Aid in Africa*' emphasises the need for aid allocation decisions to take into consideration the absorptive capacity of recipient countries rather than focusing on some arbitrary share of GNP of donor countries. Note that these arguments are suggesting that only if this unfavourable effect of aid on productivity is substantial that aid would lead to reductions in growth rate. Lensink and White (2001) further argue that the recipient economy by diverting its resources to manage the aid programme exacerbates the decreasing returns to foreign aid resources.

With respect to the increasing importance of aid-supported technological transfer (labour or/and capital-augmenting) that has been argued to promote the quality of aid-financed projects (indeed an old justification for project aid, see Guillaumont 1975), one may want to reparameterise Lensink and White (2001) model and explore the effects that would have on their conclusions. We leave that for future research. We now proceed to present the different methods used in the literature to address threshold effects.

7.3 REVIEW OF THRESHOLD IDENTIFICATION PROCEDURES

In the empirical literature, very often we find that in order to study the relationship between two economic variables, the regression model needs to be estimated on appropriately selected subsamples. Sometimes, the full sample is divided based on categorical variables, such as gender, age and so on. Alternatively, sample splitting is sometimes based on continuous variables, such as income, firm size and so on. In

[3] van der Walle and Johnston (1996:98).

such cases, it becomes important to determine at which point to divide the sample (for example, how large must the income level be to be classified as 'high'). So far, various methods have been used to find this unknown value of a continuous variable at which a subsample is selected. We briefly review a few of these practices.

7.3.1 Exogenously imposed data splits

Durlauf and Johnson (1995) applied this technique to study the existence of a multiple steady state model. Each subgroup of countries, identified by initial conditions, converges to a steady state and exhibits a distinct Solow-type regression. This consequently produces a number of locally stable steady states. To study this non-linear relationship between per capita income and growth, Durlauf and Johnson (1995) mechanically divide the sample into two and three so that the observations belong to different production function and therefore converge to different steady states. They use level of initial per capita output (Y/L) and adult literacy rate (LR) as the split variables. The threshold levels have been exogenously selected as follows: a two-way split based on output depends on whether Y/L is below or above \$1950 while the three-way split depends on whether Y/L is less than \$1150, between \$1150 and \$2750 or exceeds \$2750. For initial literacy rate, the two-way split is based on LR≤54% and LR>54%, while the three-way split is based on LR<26%, 26%≤ LR≤ 72% and LR>72%. These exogenously imposed data splits are appealing in the sense that they represent a straightforward technique to select subsamples. However they face one major drawback. They do not stand on strong grounds since both the number of regimes and location of sample splits are arbitrarily selected and not based on prior economic guidance. Credible sample split would result if there is economic evidence suggesting, for instance, all economies with output per capita less than \$1150 are in the low category and potentially have a different production function. Another serious limitation of this approach to sample splitting is that it is not possible to draw any inference on the location of the threshold as it is not determined within the model.

7.3.2 Regression tree analysis

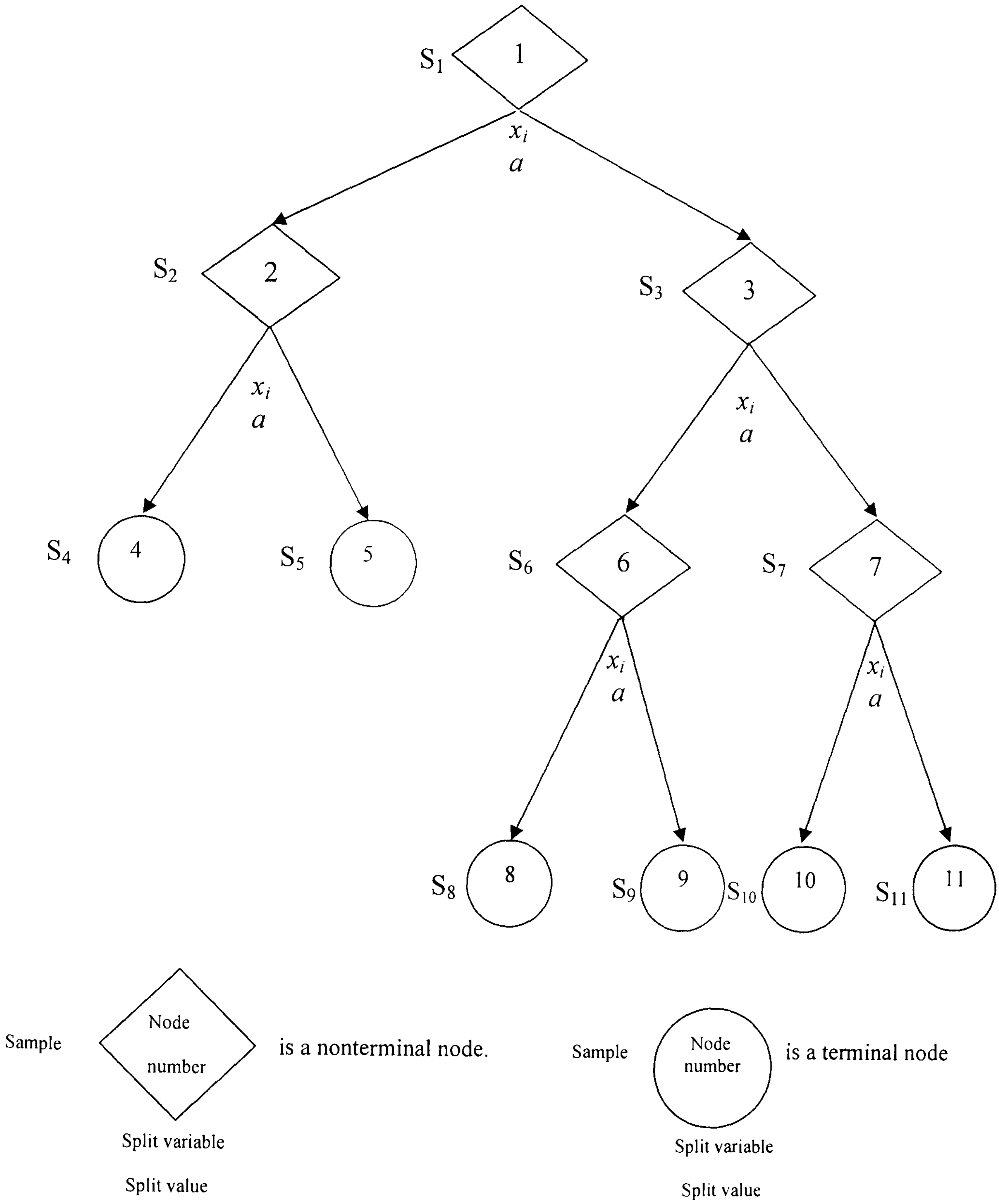
This technique, as described by Breiman *et al* (1984), provides a non-parametric way of identifying different regimes based on a set of control variables. Its appeal lies in the fact that it is a data-sorting method which allows multiple control variables to endogenously determine the number and location of thresholds rather than imposing these features exogenously.

Suppose X_j is the vector of control variables such that $X_j = (x_{1,j},.........,x_{r,j})$. The support of each $x_{i,j}$ (where i = 1......r) is given as the union of M intervals as follows: $\{ a_{i,0} \leq x_{i,j} < a_{i,1} ,..........., a_{i,M-1} \leq x_{i,j} < a_{i,M} \}$. At an initial stage, for each control variable x_i, the sample is split into two subgroups namely $S_{(a,i)}$ and $S_{(a',i)}$. If $x_{i,j} < a$ for observation *j*, it is assigned to sample $S_{(a,i)}$ otherwise it is assigned to $S_{(a',i)}$. This is performed for the whole range of values for *a* as given by the support of x_i. At the end of this procedure, we shall have traced out all the possible binary splits in the sample when x_i is used as the segregating control variable. Repeating this procedure for each control variable will give all the two-way splits possible in the sample using the whole set of control variables. Using OLS to estimate the regression of y_j on X_j for each subsample $S_{(a,i)}$ and $S_{(a',i)}$ gives the estimates $\hat{\beta}_{(a,i)}$ and $\hat{\beta}_{(a',i)}$ respectively. The sum of squared residuals (*SSR*) is given as:

$$\sum_{j \in S_{(a,i)}} \left(y_j - X_j \hat{\beta}_{(a,i)}\right)^2 + \sum_{j \in S_{(a',i)}} \left(y_j - X_j \hat{\beta}_{(a',i)}\right)^2$$

The control variable x_i and value *a* that minimise the *SSR* determines the initial two-way split in the dataset. T_1 denotes the first set of subgroups, S_2 and S_3. This procedure is performed all over again on each subsample S_2 and S_3 and *SSR* is obtained for each one. The second stage splits are again identified where *SSR* is minimised. Subsample S_2 is accordingly divided into two new groups, S_4 and S_5 while S_3 is split into S_6 and S_7. This new set of splits are referred to as T_2. This technique of sample splitting is performed sequentially on each subset created in previous iterations until the number of observations in a subgroup is less than or equal to twice the number of regressors. Note that the split variable may vary across iterations. The regression tree analysis can be diagrammatically seen as Figure 7.2 (see Breiman *et al* (1984)).

FIGURE 7.2: Regression Tree



This procedure has the advantage of allowing the data to uncover the number and location of thresholds as well as the relevant control variable to split the sample. However, its downside lies in the fact that it does not have any known distributional theory to test the statistical significance of multiple regimes. This tends to overshadow its contribution to identification of threshold(s) through an endogenous process.

7.3.3 Use of quadratic term

Existence of a threshold implies a non-linear relationship. One approach to account for this non-linearity has been to specify the relevant explanatory variable in quadratic term. Generally, a squared term has been used to identify the location of a threshold. The turning point denotes the threshold level of the control variable. This technique has been widely used in the aid literature (Hadjimichael *et al* (1995), Durbarry *et al* (1998), Hansen and Tarp (2001), Lensink and White (2001)). By relying on an aid squared term, they have all commonly identified the threshold in aid flows as given by the solution to the first order differential of growth with respect to aid, equated to zero. In other words, the threshold in the aid-growth link is perceived to occur where aid level reaches the value given by the ratio $\frac{-\beta_1}{2\beta_2}$, where β_1 *and* β_2 refer to the regression coefficients on aid and aid-squared, respectively. Easterly and Levine (1997) employ the same approach to investigate the link between growth and initial per capita income.

With regards to the wide use of this approach, we find it important to draw attention to some of its limitations. The specification of a squared term implicitly assumes that the empirical link under study follows a two-regime model. Hence, even if the data are allowed to determine the threshold level, the *number* of thresholds has been exogenously determined. Also, a specific form of non-linearity underlying the relationship has been imposed on the model at the outset itself. For instance, the aid squared term, which is expected to be negatively signed, already perceives the relationship between aid flows and growth rate as an inverted U-shaped curve. In other words, it is presumed that the effect of aid on growth displays increasing then diminishing/negative returns to additional aid flows. However, various curvatures may be possible from different theoretical assumptions and parameterisations. Also, specific to the aid literature, Hansen and Tarp (2000) have recently raised some doubts on the interpretation of a squared term. They suggest that significant coefficients on an aid squared term does not necessarily imply diminishing returns to aid, it may instead be signalling the importance of an omitted interaction term[4].

The above discussion sheds some light on the range of techniques available to investigate multiple regime models. It also brings to attention both the merits and drawbacks of each of these techniques. What is required is a technique that satisfies four characteristics: the sample data are allowed to determine (1) the number of threshold(s), (2) the location of threshold(s), (3) the specific form of non-linearity and (4) it offers some asymptotic theory to test the statistical significance of the findings on thresholds. Consequently, we propose to use the Hansen (2000) econometric technique of sample splitting as it satisfies all these requirements. First, we want to see if our data support the use of this new approach to threshold effects.

7.4 PRELIMINARY DATA ANALYSIS

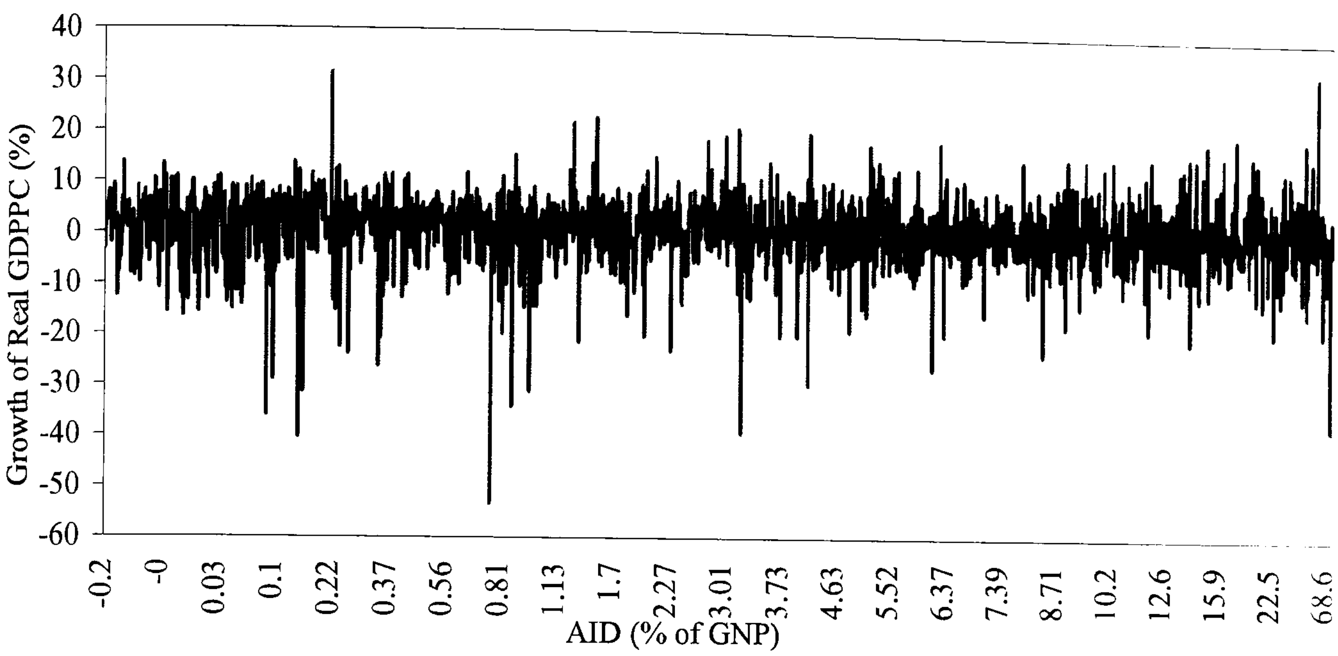
For our empirical study, we use Effective Development Assistance (EDA) as a percentage of GNP to measure aid flows (*AID*). EDA is a new database on foreign aid compiled by Chang *et al* (1998) for the World Bank. EDA flows differ from OECD ODA flows in that it is the sum of grants and grant equivalents of official loans, whilst ODA includes grants and concessional loans with a grant component above 25%. Hence, ODA is somewhat higher than EDA. However, Hansen and Tarp (2000) report that using ODA or EDA does not have any substantial effect on estimation results, as suggested by the strong Pearson correlation between these two definitions. We could have used *TAID* as in previous chapter, but unavailability of data on food aid and technical co-operation would have significantly reduced the sample size. The composition of the sample, both timewise and countrywise, is determined by availability of annual data on EDA flows. Hence, the sample period starts in 1975, the first year in EDA series and all aid recipients are included.

By way of a preliminary analysis, using annual data from 1975 to 1995, we plot the graph of aid series against growth rates of recipients countries, as provided by Figure7.3. The graph shows that growth experience of aid recipients varies considerably, and does not convey any clear indication of the form of curvature that characterise the aid-growth link. Also, it makes no distinction between growth that is

[4] See Chapter 3 for more details.

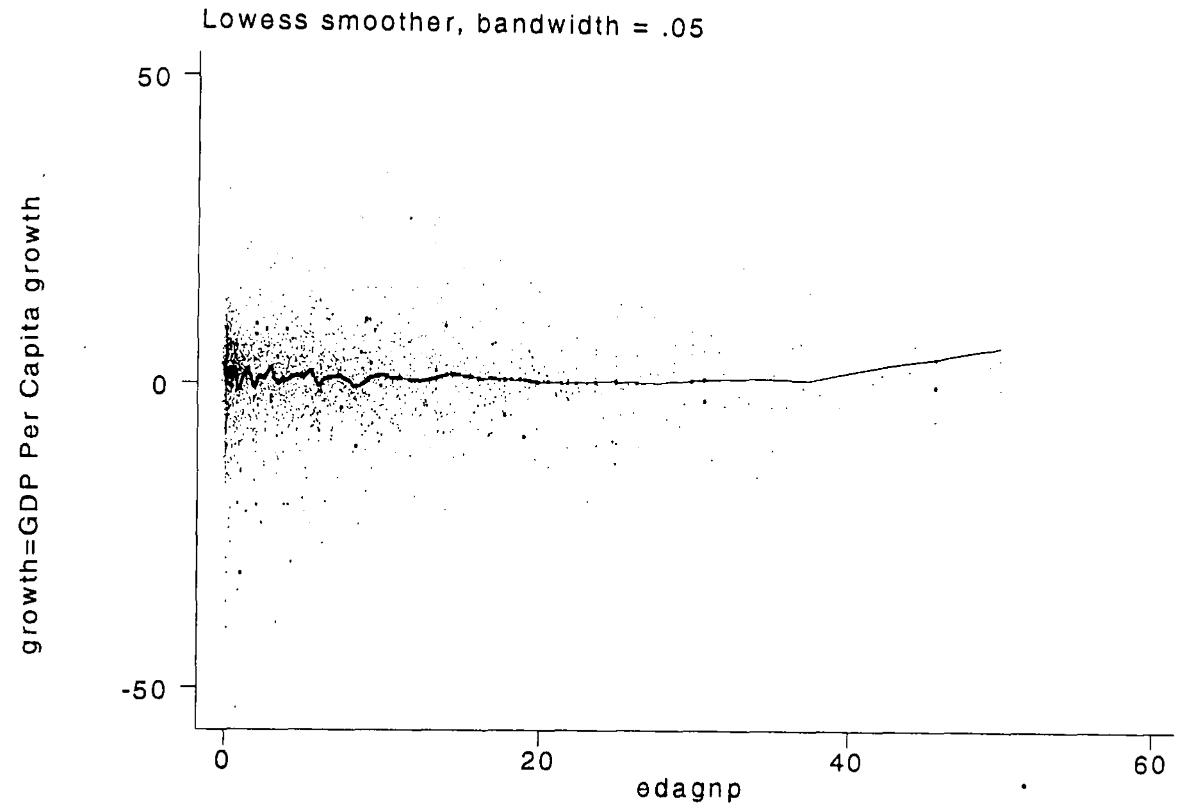
attributed to aid flows and other control variables. Our prime interest lies in the relationship between foreign aid and aid-induced growth.

FIGURE 7.3: Plot of actual values



To uncover any underlying non-linearity we need to smooth the plot. For this purpose, we carry out locally weighted smoothing of growth on aid flows (Cleveland, 1979). The smoothed values are obtained by running a regression of growth rates on aid. A small amount of data surrounding a point, as can be observed from a scatterplot, is used for this regression. The regression is weighted such that the central point (x_i, y_i) gets the highest weight and points farther away receive less. The estimated regression then provides the smoothed predicted values of the y_i used. A separate weighted regression is estimated for every point in the data to obtain the remaining smoothed values. This smoothing technique is desirable because of its locality which enables it to follow the data. A global smoother would be less desirable since, for instance, what happens on the extreme left of a scatterplot can affect the fitted values on the extreme right. The amount of smoothing is affected by the bandwidth. For example, 80% of the data are used in smoothing each point if a bandwidth of 0.8 is specified. Hence, smaller bandwidths would follow the original data more closely. Figure 7.4 displays the graph of smoothed values using a bandwidth of 0.05

FIGURE 7.4: Plot of smoothed predicted values



The locally weighted regression smoothing approach seems to reveal that the correlation between aid and growth is positive at very high aid levels. On the one hand, this contradicts the predictions of an aid Laffer aspect according to which high aid flows generate negative returns to growth. On the other, this revelation in some way reflects the implications of a neo-classical model - the belief that only generous aid flows succeed in helping economies permanently out of the poverty trap. The nature of this correlation is somewhat uncertain at lower aid levels. Whilst the smoothing approach has been helpful in suggesting that the aid-growth link may not necessarily be an inverted U-shaped one, one should recognise that it is only an exploratory tool. An empirical examination would be more informative.

In sum, the above exploratory analysis validates our argument that use of a quadratic term to account for non-linearity is not entirely appropriate since the form of non-linearity itself is still a blurred subject. Instead, the application of a threshold model that is allowed to endogenously uncover the curvature is desirable.

7.5 THRESHOLD MODEL

Threshold regression models have been used in cases where observations fall into classes/regimes depending on an unknown value of an observed variable. The structural equation is given as:

$$y_{it} = \beta_0 + \beta_{a1} A_{it} I(A_{it} \leq \gamma) + \beta_{a2} A_{it} I(A_{it} > \gamma) + \beta_z Z_{it} + u_{it} \qquad (7.1)$$

where I(.) is the indicator function which sorts the data to create various subsamples. A and Z refer to aid and other regressors, respectively. The seminal contribution of Hansen (2000) is to allow one to estimate and make valid statistical inference of the threshold. There are three statistical issues that need to be addressed in a threshold model: (1) how to jointly estimate the threshold value γ and the slope parameters (2) how to test the hypothesis that a threshold exists, that is, $H_0 : \beta_{a1} = \beta_{a2}$ and (3) how to construct confidence intervals for γ and β. We briefly discuss each in turn.

7.5.1 Estimation of threshold value

Chan (1993) and Hansen (1999)[5] recommend obtaining the least squares estimate $\hat{\gamma}$ - the value that minimises the concentrated sum of squared errors for Equation 7.1, that is,

$$\hat{\gamma} = \underset{\gamma}{\arg\min}\, S_n(\gamma)$$

Notice that the sum of squared error function $S_n(\gamma)$ depends on γ only through the indicator function. Hence, the minimisation problem is a step procedure where each step occurs at distinct values of the observed threshold variable (A_{it}). Suppose A_{it} takes n values. For each of these n values, the threshold regression model is estimated and the sum of squared errors, $S_n(\gamma)$, is obtained. $\hat{\gamma}$ is the one which will minimise this function. As it stands, Equation 7.1 is non-linear. However, by fixing the value of γ at each step, Equation 7.1 becomes linear, so OLS estimation is appropriate. Once $\hat{\gamma}$ is obtained, the slope coefficient estimate $\hat{\beta} = \hat{\beta}(\hat{\gamma})$.

[5] Published in Econometrica in 2000.

7.5.2 Testing existence of a threshold

Having found a threshold, it is important to investigate whether it is statistically significant. Is aid performance effectively conditional on aid level? In other words, we test the following hypothesis:

$$H_0 : \beta_{a1} = \beta_{a2}$$
$$H_1 : \beta_{a1} \neq \beta_{a2} \qquad (7.2)$$

Under the null, the two coefficient estimates do not differ therefore a linear regression model is appropriate. Under the alternative, there is a systematic difference between the coefficients on aid across the two regimes, hence supporting a threshold regression model. One complication with what first appears to be a simple test is that the threshold γ is not identified under the null. Therefore, the classical tests do not have standard distributions which means that critical values cannot be read off standard distribution tables[6]. Hence, we follow Hansen (1996) to bootstrap the p-value of the above hypothesis test (details in Appendix 7B).

7.5.3 Asymptotic distribution of threshold and slope coefficient estimates

If evidence is in support of a threshold effect (that is, $\beta_{a1} \neq \beta_{a2}$), what is needed is some certainty on $\hat{\gamma}$. In other words, we need to find where does $\hat{\gamma}$ lie in the confidence interval that contains the correct estimate of the threshold. Usually, the confidence interval for a parameter is formed by inversion of the Wald or t statistics. However, Dufour(1997) argues that the Wald statistics have poorly-behaved sampling distribution in cases where the parameter is unidentified in a certain region. Since in our endogenous sample splitting scheme, the parameter γ fails to be identified when $\beta_{a1} = \beta_{a2}$, the asymptotic distribution of $\hat{\gamma}$ is highly non-standard. To address this issue, Hansen (2000) derives the correct distribution function and provides the appropriate critical values to test the hypothesis that

$$H_0 : \gamma = \gamma_0 \qquad (7.3)$$

We reject the null if the likelihood ratio statistic as given by $LR_n(\gamma) = n\frac{S_n(\gamma)-S_n(\hat{\gamma})}{S_n(\hat{\gamma})}$ exceeds the critical value[7], $c(\alpha)$. Hence, the confidence interval of the threshold estimate $\hat{\gamma}$ would be all those values of γ for which the likelihood ratio statistic is less than $c(\alpha)$. Stated differently, it would be equivalent to finding the 'no-rejection' region of the test. A graphical way to find this region is to plot the likelihood ratio $LR_n(\gamma)$ against γ and draw a flat line at the critical value. The segment of the curve which lies below the flat line will give the confidence interval of the threshold estimate[8]. Hansen (2000) also shows a normalised likelihood ratio statistic, $LR_n^*(\gamma)$, can be obtained using an estimable constant to make this test robust to heteroscedasticity.

As far as the asymptotic distribution of slope coefficients are concerned, Chan (1993) and Hansen (1999) argue that even if the estimator $\hat{\beta}$ depends on the threshold estimate $\hat{\gamma}$, since $\hat{\beta} = \hat{\beta}(\hat{\gamma})$, the usual asymptotically normal distribution theory can be used to draw inferences on estimated slope coefficients.

So far, we have discussed a single threshold model. In some instances, there may be multiple thresholds. In which case, estimation and inference on higher-order threshold models would be a straightforward extension of the methodology discussed in this section.

[6] This is typically called the ''Davies' Problem' (Davies, 1977 and 1987) and has been investigated by Andrews and Ploberger (1994) and Hansen (1996).

[7] Throughout the paper, we use the 90% critical value, tabulated in Hansen (2000) which is equal to 5.94

[8] Alternatively, one could plot the residual sum of squared errors $S_n(\gamma)$ against γ and find the region that lies below the flat line at $S_n(\hat{\gamma})+\hat{\sigma}^2c(\alpha)$.

7.6 ESTIMATION RESULTS

7.6.1 Single Threshold Model

In the context of aid-growth relationship, we specify the following threshold model:

$$GROWTH_{it} = \beta_0 + \beta_1 GDPO_i + \beta_2 SEC_i + \beta_3 INV_{it} + \beta_4 DEM_{it} + \beta_5 INFL_{it} + \beta_6\ GCON_{it} + \beta_7\ TRADE_{it} + \beta_8 EXTDEBT_{it} + \beta_9 BMP_{it} + \beta_{a1} AID_{it}\ I(AID_{it} \leq \gamma) + \beta_{a2} AID_{it}\ I(AID_{it} > \gamma) + u_{it} \quad (7.4)$$

The dependent variable is growth in real GDP per capita. We use initial level of GDP per capita (*GDPO*) and human capital (as proxied by secondary-school enrolment rate (*SEC*)) to account for initial conditions. We introduce three additional regressors: external debt as a ratio of GDP (*EXTDEBT*), black market premium (*BMP*) and trade as a share of GDP (*TRADE*). A number of transmission channels[9] have been identified in the literature to explain the negative effect of large debt ratios. We include black market premium, *BMP* as an indicator of degree of trade distortions (Levine and Renelt, 1992). Large values are associated with higher degree of trade intervention. A negative sign is therefore expected since trade literature advocates the beneficial effects of liberalisation. We include *TRADE* to capture the effects of openness. Description of data is provided in Appendix 7A.

The observations are divided into two 'regimes' depending on whether the threshold variable, AID_{it}, is smaller or larger than the value γ. Observations belonging to these two regimes would also differ in terms of the coefficient on aid. The effect of aid on growth is given by β_{a1} in the sample with observations below the threshold level and β_{a2} in the sample containing observations beyond the threshold. The Laffer curve would suggest that β_{a1} is positive and β_{a2} negative.

[9] First, large debts imply that a significant share of domestic resources goes into debt servicing, thereby crowding out public investment. Furthermore, because of the complementarity between public and private investment, high debts also discourage private investment. Second, the external debt ratio could be indicative of a 'debt overhang'. In the presence of heavy debts, economic agents anticipate future tax liabilities for its servicing, to which their response is to transfer funds abroad in an attempt to escape the domestic tax base. This raises the domestic cost of capital which in turn discourages investment. (Borenzstein, 1990a and 1990b; Eaton, 1987). Since it is widely acknowledged that investment is the engine for growth, both of these effects are expected to adversely affect growth.

We estimate the growth model using a sample of 131 countries with annual data from 1975 to 1995. Availability of data on EDA determines the choice of countries and sample period. As proposed by Hansen (2000), OLS is used to estimate the regression model (see Appendix 7B for tests of appropriateness of this technique for our model). We have also employed the residual generated regressor, *INVRES*[10], as discussed in previous chapter so as to capture the indirect effect of aid on growth via investment[11].

It is undesirable that the threshold estimation strategy categorises too few observations into any one of the regimes. Consequently, we restrict the minimisation problem to values of γ such that at least 1% of the observations lie in both regimes. Table 7.1 reports the results obtained when searching for $\hat{\gamma}$ in the grid formed by values of aid as a share of GNP {1, 1.5, 2........50}.

We perform 1000 bootstrap replications to test the hypothesis that a threshold effectively exists (Equation 7.2). We find that the test for a single threshold based on aid level is significant with a bootstrap p-value of 0.056, that is, the null of no threshold effect is rejected. We therefore conclude that there is adequate evidence for a threshold in the relationship between aid flows and growth rates.

All the control variables enter with expected signs. The point estimate of the threshold, $\hat{\gamma}$, is equal to 2%. Our results seem to suggest that if donors want aid to be effective they should aim to disburse amounts which are equivalent to more than 2% of GNP in recipient country. Aid flows below this level do not appear to have any significant effect on growth rates. We find that each additional percentage point of aid flows above 2% of GNP will promote growth rate by about 0.32 percentage points[12]. Hence, we obtain evidence of positive returns to aid when aid levels are beyond the threshold estimate. These estimates seem to support the hypothesis that

[10] INVRES refers to that part of investment that is not due to aid and it is recovered from the following regression (t-ratio in brackets): $INV=1.07AID$ $R^2=0.25$
(15.76)

[11] To be able to focus on threshold, we have here preferred to take into account the indirect effects of aid through investment only (as investment is acknowledged to be the most important transmission mechanism).

[12] One may find it interesting to note that in Chapter 5, aid was predicted to increase growth by a third of a percentage point in SSA.

Table 7.1: Single Threshold Model

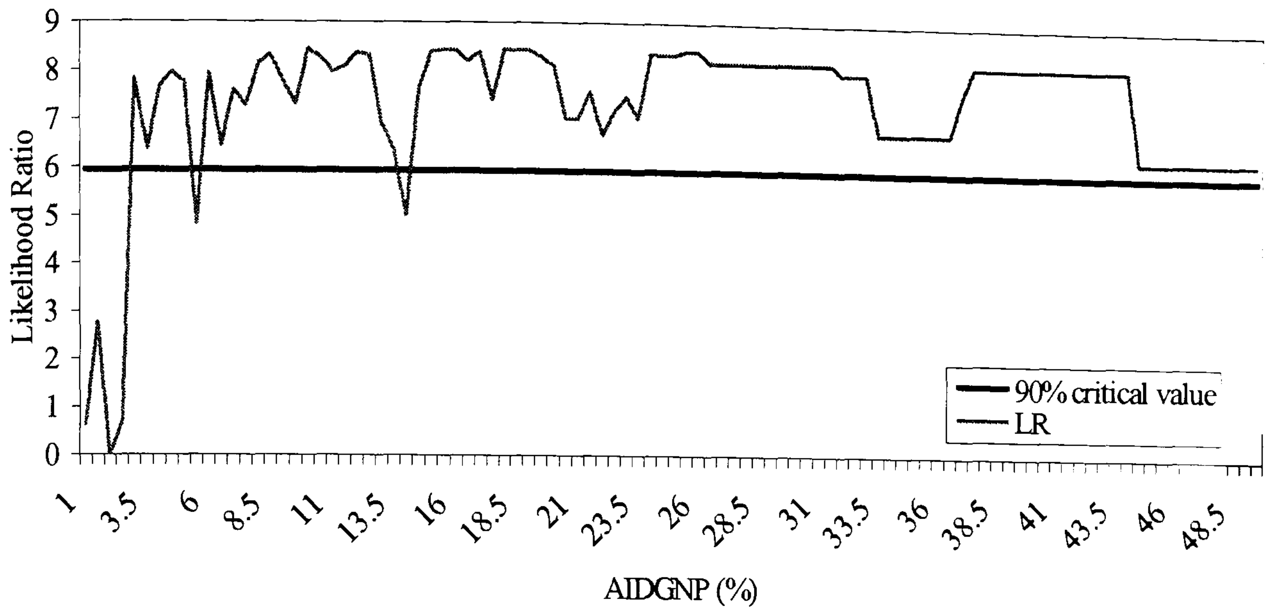
	GROWTH
GDPO	**-0.0005**
	(3.04)* **
SEC	**0.041**
	(3.00)* **
INVRES	**0.231**
	(6.65)* **
DEM	0.009
	(0.05)
INFL	**-0.001**
	(3.52)* **
GCON	**-0.169**
	(4.61)* **
TRADE	**0.048**
	(2.52) **
AID I(AID<=2)	-0.295
	(0.82)
AID I(AID>2)	**0.323**
	(4.92)* **
EXTDEBT	**-0.082**
	(2.33) **
BMP x 10^2	-0.002
	(0.56)
Constant	**-2.096**
	(2.09) **
Observations	1115
R-squared	0.15
F-Stat	16.51

Notes: The t-values in brackets are based on White heteroscedasticity-consistent standard errors. *Significant at the 10 percent level. **Significant at the 5 percent level. ***Significant at the 1 percent level. F-Stat rejects the null that all coefficients are jointly equal to zero

there exists a non-linear relationship between aid and growth however unlike Lensink and White (2001) Laffer curve it seems aid becomes effective rather than generate negative returns beyond the threshold value. In other words, the relationship between aid and growth does not seem to take an inverted U-shape.

Next, we obtain a confidence interval for the threshold estimate. As discussed in Section 7.5.3, this is represented by the region where $LR_n^*(\gamma) \leq c(\alpha)$. Following this procedure, we obtain Figure 7.5 which displays the graph of the normalised likelihood ratio.

FIGURE 7.5: Confidence Interval for Estimated First Threshold



The likelihood ratio sequence hits the zero axis at the point estimate of the threshold, $\hat{\gamma}$. In our case, the estimated threshold occurs at aid share in GNP equal to 2% with a 90% asymptotic confidence interval [1%, 14%]. Hence, in 90 out of 100 cases, such intervals will contain the true value of the threshold level of aid flows. Although, it cannot be decisively determined whether the observations in this interval fall into the first or second regime, it is certain (with 90 % confidence) that all countries with aid flows above 14% of GNP are in the second regime.

7.6.2 Double Threshold Model

We shall now investigate whether there exists a second threshold. Equation 7.1 is therefore re-specified as:

$$y_{it} = \beta_0 + \beta_{a1} A_{it} I\,(AID_{it} \leq \gamma_1) + \beta_{a2} A_{it} I\,(\gamma_1 < AID_{it} \leq \gamma_2) + \beta_{a3} A_{it} I\,(AID_{it} > \gamma_2)$$
$$+\beta_z Z_{it} + u_{it} \qquad (7.5)$$

such that $\gamma_1 < \gamma_2$. For this purpose, we fix γ_1 at 2% (estimated first threshold) and aim to further split the sample of countries with aid more than 2% of GNP. A sample split based on aid as a share of GNP produces an insignificant p-value of 0.592 using 1000 bootstrap replications. In other words, the null that a second threshold exists on the basis of aid level is rejected. This finding suggests there is no evidence for diminishing returns in aid, that is, aid effectiveness does not decrease as aid flows increase. This contradicts the aid Laffer curve but is consistent with the preliminary data analysis in Section 7.4

A review of the reasons motivating the theoretical rationale for an Aid Laffer curve (in Section 7.2) seems to suggest that absorptive capacity holds the key to multiple thresholds. We therefore proceed to investigate if this could be the criterion to split the subsample with aid above 2% of GNP[13]. Based on the logic that an economy with higher level of human capital will have a higher capacity to absorb aid flows and use them in an efficient manner, we select secondary school enrolment rate (*SECR*) as a proxy for absorptive capacity. Using 1000 bootstrap replications, the p-value is now significant at 0.031, suggesting a second threshold exists in the aid-growth relationship and is triggered by human capital level. Applying the same technique we used earlier, we search for this second threshold in the grid {13, 13.5, ...90} of SECR values. Table 7.2 presents the results of this search.

All the non-aid explanatory variables enter with the expected sign. The point estimate of the second threshold occurs at SECR equal to 45 % It would seem that though countries receiving aid flows more than 2% of their GNP benefit from positive returns, the impact on growth rate depends on whether the secondary school enrolment rate is below or above 45 % With aid share in GNP above 2% and secondary school enrolment rate less than or equal to 45%, each extra percentage point of aid share in GNP would on average increase growth rate by 0.3% point. For countries beyond the aid threshold and school enrolment rate above 45%, with the same increase in aid flows, the growth rate is raised by 0.2% points only. Note that the mean value of aid is on average higher in the second regime than in the third regime; hence, the lower marginal effect of aid on growth in the latter cannot be attributed to high aid levels. There is no obvious way to explain why aid is less effective in countries with higher education levels. Although, the evidence is clearly against Lensink and White (2001) argument that high aid inflows are detrimental to growth and the more general belief that diminishing returns to aid set is at high aid

[13] With respect to Burnside and Dollar results, we tried using a policy index to locate the second threshold. The resulting threshold estimate was however very uncertain – no confidence interval could be obtained.

Table 7.2: Double Threshold Model

	GROWTH
GDPO	**-0.0003**
	(1.91)*
SEC	**0.030**
	(2.05)**
INVRES	**0.238**
	(7.19)***
DEM	0.186
	(0.91)
INFL	**-0.001**
	(3.35)***
GCON	**-0.144**
	(3.71)***
TRADE	**0.071**
	(3.96)***
AID I(AID<=2)	-0.508
	(1.24)
AID I(AID<=2/SECR<=45)	**0.340**
	(5.35)***
AID I(AID<=2/SECR>45)	**0.200**
	(2.32)**
EXTDEBT	**-0.117**
	(3.73)***
BMP	-0.00001
	(0.57)
Constant	**-3.372**
	(3.03)***
Observations	720
R-squared	0.18
F-Stat	18.55

Notes: Same applies as in Table 7.2

levels. Our estimates suggest that aid is most effective when aid is high and human capital low.

Again, we want to attach some degree of certainty to this estimate for the second threshold. Hence, we plot the likelihood ratio sequence and find the 'non-rejection' region. The graph of the normalised likelihood ratio statistic is displayed in Figure7.6. The 90% confidence interval of the threshold estimate is {16, 90}.

FIGURE 7.6: Confidence Interval for Estimated Second Threshold

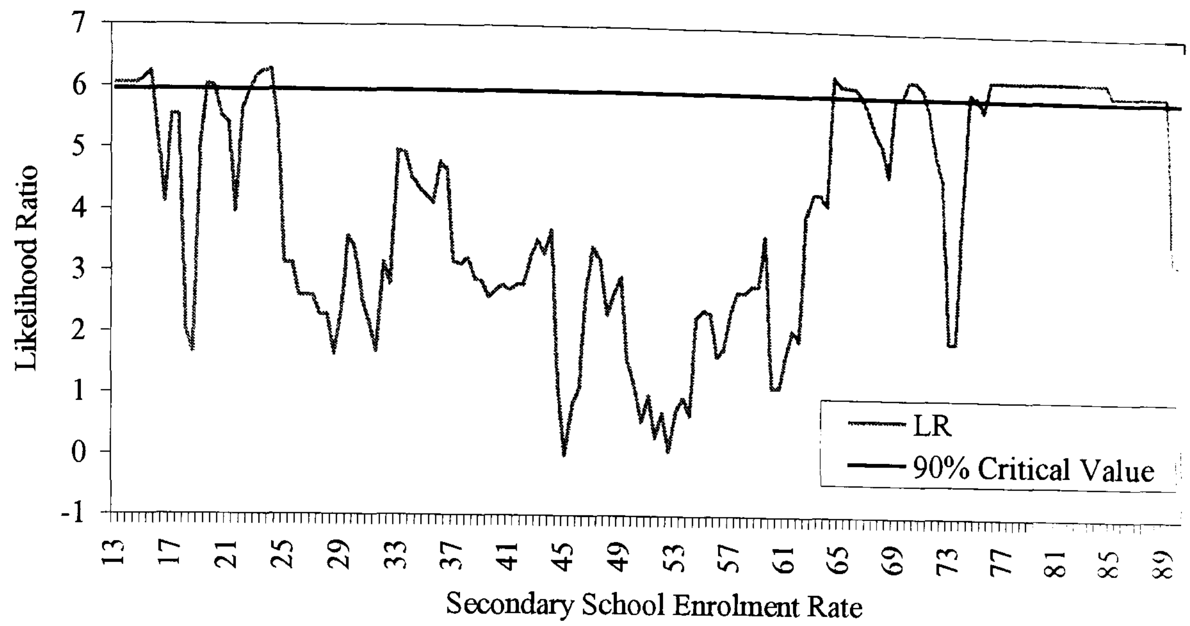


Table 7.3 reports the number of occurrences which fall in each regime quinquennially and provides some summary statistics.

Table 7.3: Descriptive summary statistics by regime and variable

	Percentage of observations in each regime by year				
REGIME	1975	1980	1985	1990	1995
Aid/GNP ≤ 2%	57.1	45.6	46.3	38	48.2
Aid/GNP>2% and SECR ≤45	39.3	38	35.4	35.2	30.1
Aid/GNP>2% and SECR > 45	3.6	16.5	18.3	26.8	21.7
VARIABLE	Mean Value by year				
Aid/GNP (%)	3.936	5.760	5.572	9.868	6.424
SECR	29.672	49.752	52.434	53.413	55.832

It is observed from this table that aid-recipients have been mostly in the first and second regime, where foreign aid flows (according to our estimates) are ineffective and have a high positive effect on growth, respectively. The mid-nineties has witnessed an increase in the number of cases which fall in the third regime where aid is found to be less effective but continues to be growth-conducive. The mean values indicate that increases in average secondary-school enrolment rate have mostly contributed to this shift.

7.7 CONCLUSION

In this chapter, we address concerns of non-linearity that seem to characterise the relationship between aid inflows and growth rates. The common approach in aid effectiveness studies has been to introduce an aid-squared term. This routine unfortunately has limitations. With regards to the importance attached to a threshold effect in aid literature, we have here therefore made an attempt to shed some light on this aspect.

The use of an aid squared term has been based on the assumption that a non-linearity in aid and growth relationship is triggered by aid level and it specifically takes an inverted U-shape. Lensink and White (2001) have gone one step further in modelling it as an aid Laffer curve. In this chapter, we have directly tested these assumptions by applying a newly developed sample splitting technique to aid literature. This process allows the data to endogenously determine both the number and location of threshold(s), as well as offers appropriate inference tests.

We conduct this analysis on a sample of 131 aid recipient countries over the period 1975 to 1995. A preliminary data analysis casts doubt on the proposition of aid Laffer curve and the appropriateness of using an aid squared term. Our empirical investigation suggests an initial sample split based on aid share in GNP and a second split based on secondary school enrolment rate. We find that aid is effective in promoting growth only after a certain critical level which occurs at aid equal to 2% of GNP. This effect gets stronger if human capital is high. We obtain no evidence of diminishing returns in aid but do find that impact of aid on growth declines when secondary school enrolment rate exceeds 45%.

Our estimates tell the same story as aid Laffer curve, in the sense that they both show that the returns on aid flows are not constant. However, while the aid Laffer curve proposed by Lensink and White (2001) starts from the point where positive returns on aid flows are generated, our first threshold estimate indicates that there is a phase prior to this point where aid flows are so low that they are ineffective. Stated differently, our study seems to point to an aid-growth relationship characterised by three stages rather than two as in the Laffer curve. Our finding that high aid levels bring additional boost to economic performance is in accord with the theoretical predictions of growth models – the belief that generous aid inflow is a necessary condition for sustained growth.

We also find that aid continues to be effective at high aid levels, that is, we find no evidence of diminishing returns in aid. Hence, our results are not consistent with the proposition of an aid Laffer curve. We do find that aid does eventually have a smaller effect on growth however this is triggered by human capital level rather than aid level. In conclusion, aid is most effective in countries where aid is high and human capital low.

The general implication of our conclusion is that aid-growth link is indeed non-linear but aid-squared term is not an appropriate representation of this non-linearity. Hence, a negative coefficient on such a term is not necessarily indicative of diminishing or negative returns to aid. It may instead be signalling the importance of an omitted interaction term as suggested by Hansen and Tarp (2001). It may be capturing the negative effects of volatility in aid flows as identified by Lensink and Morrissey (2000)

APPENDIX 7A: DESCRIPTION OF DATA

Definitions and sources of data

GROWTH	growth in real GDP per capita
GDPO	initial GDP per capita
SEC	initial secondary school enrolment rate
SECR	secondary school enrolment rate
INV	gross domestic investment (% of GDP)
DEM	democracy index, taking values between 1 and 3 with lower values being more democratic. Source: Alesina *et al* (1992)
INFL	inflation rate
GCON	government consumption (% of GDP)
TRADE	total trade (% of GDP)
AID	Effective Development Assistance. Source: Chang *et al* (1998)
EXTDEBT	external debt (% of GDP)
BMP	black market premium. Source: Easterly and Levine data set

Unless otherwise stated, the source of all variables is World Development Indicators (2000) and they represent annual series over the period 1975 to 1995.

List of countries

Albania	Congo, Rep.	Honduras	Morocco	St. Vincent and the Grenadine
Algeria	Costa Rica	Hungary	Mozambique	Sudan
Angola	Cote d'Ivoire	India	Myanmar	Swaziland
Argentina	Czech Republic	Indonesia	Nepal	Syrian Arab Republic
Armenia	Djibouti	Iran, Islamic Rep.	Nicaragua	Tajikistan
Azerbaijan	Dominica	Jamaica	Niger	Tanzania
Bangladesh	Dominican Republic	Jordan	Nigeria	Thailand
Barbados	Kenya	Kazakhstan	Oman	Togo
Belarus	Ecuador	Korea, Rep.	Pakistan	Trinidad and Tobago
Belize	Egypt, Arab Rep.	Kyrgyz Republic	Panama	Tunisia
Benin	El Salvador	Lao PDR	Papua New Guinea	Turkey
Bhutan	Equatorial Guinea	Latvia	Paraguay	Turkmenistan
Bolivia	Eritrea	Lebanon	Peru	Uganda
Botswana	Estonia	Lesotho	Philippines	Ukraine
Brazil	Ethiopia	Liberia	Poland	Uruguay
Bulgaria	Fiji	Lithuania	Romania	Uzbekistan
Burkina Faso	Gabon	Madagascar	Russian Federation	Vanuatu
Burundi	Gambia, The	Rwanda	Sao Tome and Principe	Venezuela, RB
Cambodia	Malawi	Malaysia	Senegal	Vietnam
Cameroon	Georgia	Maldives	Seychelles	Yemen, Rep.
Cape Verde	Ghana	Mali	Sierra Leone	Zaire
Central African Rep	Grenada	Malta	Slovak Republic	Zambia
Chad	Guatemala	Mauritania	Solomon Islands	Zimbabwe
Chile	Guinea	Mauritius	Somalia	
China	Guinea-Bissau	Mexico	Sri Lanka	
Colombia	Guyana	Moldova	St. Kitts and Nevis	
Comoros	Haiti	Mongolia	St. Lucia	

Table 7A1: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GROWTH	2239	0.798	6.667	-53.250	35.520
GDPO	2247	2035.738	1605.061	306	7990
SEC	2478	36.617	31.204	1.200	126.600
INV	2237	23.521	9.803	-5.740	83.186
DEM	1764	2.517	0.809	1	3
INFL	1769	78.143	759.601	-36.740	23773.130
GCON	2210	15.730	7.318	0.897	63.549
TRADE	2215	69.756	39.275	3.147	282.402
AID	2232	6.718	10.127	-0.209	108.421
EXTDEBT	2209	39.558	23.538	1.930	148.580
BMP	1605	124.046	1290.645	-57.360	49990

APPENDIX 7B: ECONOMETRIC ISSUES

7B.1 Constructing P-value for Hypothesis Testing

Having found a threshold, it is important to investigate whether it is statistically significant. Is there really a threshold effect in aid effectiveness? As mentioned, this involves the following hypothesis test:

$$H_0 : \beta_{a1} = \beta_{a2}$$
$$H_1 : \beta_{a1} \neq \beta_{a2} \qquad (7.2)$$

Given that the threshold γ is not identified under the null, this test would have a non-standard distribution. Hence, critical values cannot be read off standard distribution tables. Hansen (1996) therefore suggests bootstrapping to obtain the p-value of this test.

First, the model is estimated under the null and alternative. This gives the actual value of the likelihood test ratio, F_1.

$$F_1 = \frac{S_0 - S_1(\hat{\gamma})}{\hat{\sigma}^2} \qquad \text{where} \qquad \hat{\sigma}^2 = \frac{1}{n(t-1)} S_1(\hat{\gamma})$$

Then, a bootstrap sample is created by drawing from the normal distribution of the residuals of the estimated threshold model (Equation 7.1). Note that Hansen (2000) recommends that the regressors are held fixed in repeated bootstrap samples. Using this generated sample, the model is estimated under the null (of no threshold) and alternative (threshold occurs at the estimated value of γ) to obtain the likelihood ratio F_1. This procedure is repeated a large number of times. The bootstrap estimate of the p-value for F_1 under the null is given by the percentage of draws for which the simulated statistic F_1 exceeds the actual one. According to Hansen(1996), this procedure provides asymptotically correct p-values for the above hypothesis test. We perform 1000 bootstrap replications throughout the chapter.

7B.2 The Hausman test for Endogeneity

The theory of estimation and inference used in this chapter is confined to regression models that have exogenous explanatory variables. As a way to verify that this technique is applicable to our aid-growth specification, we test for endogeneity. First, we check the validity of the instruments used by conducting Sargan test[14]. The 1% critical value from the chi-squared distribution with one degree of freedom is 6.63, so the Sargan test statistic fails to reject the null that the instruments are valid. We therefore use lagged aid and a regional dummy for SSA to instrument for aid and credit available to private sectors and Gastil rights for investment. The 1% chi-squared critical values when aid and investment are instrumented in Equation 7.4 is equal to 23.21 In both cases, as shown in Table 7B1 the Hausman test fails to reject the null that regressors and error term are uncorrelated. Note that this does not imply that aid and growth or investment and growth have not got a bi-directional link. The Hausman test result rather suggests that having controlled for factors like initial GDP per capita, education level and government consumption, aid and investment in our model are not correlated with the unexplained part of growth. Consequently, we find support for the appropriateness of a threshold model to our specification and data.

[14] See Appendix 5B for details on Hausman and Sargan tests.

Table 7B1 : OLS Growth Regression

	GROWTH
GDPO x 10^2	**-0.0004**
	(3.40)* **
SEC	**0.041**
	(3.38)* **
INV	**0.231**
	(10.08)* **
DEM	-0.013
	(0.07)
INFL	**-0.001**
	(3.46)* **
GCON	**-0.163**
	(4.73)* **
TRADE	**0.045**
	(3.10)* **
AID	**0.094**
	(2.72)* **
EXTDEBT	**-0.078**
	(3.26)* **
BMP x 10^2	-0.002
	(0.21)
Constant	**-2.346**
	(2.87)* **
Observations	1115
R-squared	0.15
F-Stat	19.63
Testing for endogeneity of aid:	
R^2 of first stage regression	0.84
Hausman χ^2_k	10.18
Sargan χ^2_v	2.62
Testing for endogeneity of investment:	
R^2 of first stage regression	0.45
Hausman χ^2_k	3.88
Sargan χ^2_v	4.17

Notes: Absolute t-values are reported in brackets. *Significant at the 10% level. ** 5 % level. *** 1% level. F-Stat rejects the null that all coefficients are jointly equal to zero

CHAPTER 8
AID AND WELFARE OF THE POOR

8.1 INTRODUCTION

Aid is an important source of finance for most of the developing countries. It has helped to lay the foundations for growth and development, even if it is no guarantee that anything solid is built. In recent years, the range of aid policy and objectives has widened. On the policy front, donors have adopted aid conditionality for several decades. Conditionality has prevailed in various forms. However, it is now emerging that conditionality may not be the best aid policy. Divergence in viewpoints of donors and recipients has largely contributed to explaining failures of conditionality, and that partly explains the eagerness with which selectivity aid has been favoured by some. The World Bank Report (1998), which is principally based on Burnside and Dollar (2000), propagates the idea that aid be allocated to countries with favourable policies since it is most effective in that environment. Whether the allocation policy is one of conditionality or selectivity, the truth remains that what is important is what constitutes a favourable environment to make aid work.

On the objective front, the traditional aim of promoting economic growth undoubtedly remains a desirable aspiration as well as economic justification for aid. The conventional way to evaluate aid effectiveness in this respect is to examine if aid inflows improve growth performance on average. On balance, empirical evidence has been optimistic. In recent years, the objective of reducing poverty (and targeting aid to benefit the poor) has gained increasing emphasis. Assessing effectiveness of aid against a poverty reduction criterion is however a problematic exercise. How can one measure poverty and the effect of aid on the poor? Whilst there are various existing measures, internationally comparative data on poverty over time are extremely scarce. Consequently, we use Human Development Index and infant mortality rate as indicators of deprivation or welfare of the poor. Promoting welfare helps alleviate poverty but this is not necessarily equivalent to reducing income poverty and may not show on income poverty measures[1]. Our results are hence interpreted as the impact on welfare rather than poverty.

The dual purpose of this chapter is therefore to shed some light on how can one capture effects of aid on welfare of the poor and at the same time identify factors that will enhance effectiveness of aid in this respect. Only in rare cases, such as aid-financed rural works programme, would one expect to see any direct effect of aid on incomes of the poor. Aid may indirectly benefit the poor by promoting growth that reduces income poverty. Alternatively, it is possible to directly aim at reducing non-income dimensions of poverty by adopting appropriate government policies. For example, by financing expenditures that improve access to education and health care, aid improves the welfare of the poor. Thus, we try to capture the effect of aid on the poor via its effect on government spending. At the same time, we posit that certain types of government spending are most likely to improve the welfare of the poor (Verschoor, 2002, provides a discussion). Hence, aid would be more effective in promoting welfare in economies that are characterised by these specific allocations of government spending.

Our methodological approach is to estimate cross-country regressions of aid effectiveness, where an indicator of welfare is the dependent variable. This analysis is conducted for the 57 countries included in the World Bank Poverty Monitoring Database over the period 1980 to 1998. It is useful to note that our approach is not without problems. In fact, the difficulties encountered in aid-growth studies are exacerbated when aid-welfare is the link under study. First, if regressions fail to account fully for all determinants of the dependent variable (growth or welfare), the estimated coefficient on aid will be biased. This difficulty is inherent in aid studies given that aid flows to countries that are characterised by features that retard development and, most importantly, are hard to completely specify. When welfare is the dependent variable, this problem is even more pronounced. Second, it is difficult to identify that share of aid that is directed to the poor; usually the aid variable is

[1] In principle, consumption of public goods could be included as imputed income for households. However, such consumption is not uniformly or consistently covered in the household surveys on which money metric measures of poverty are based.

overestimated and estimates would be biased. Both observations taken together imply that it is quite likely to incorrectly draw the conclusion that aid is ineffective.

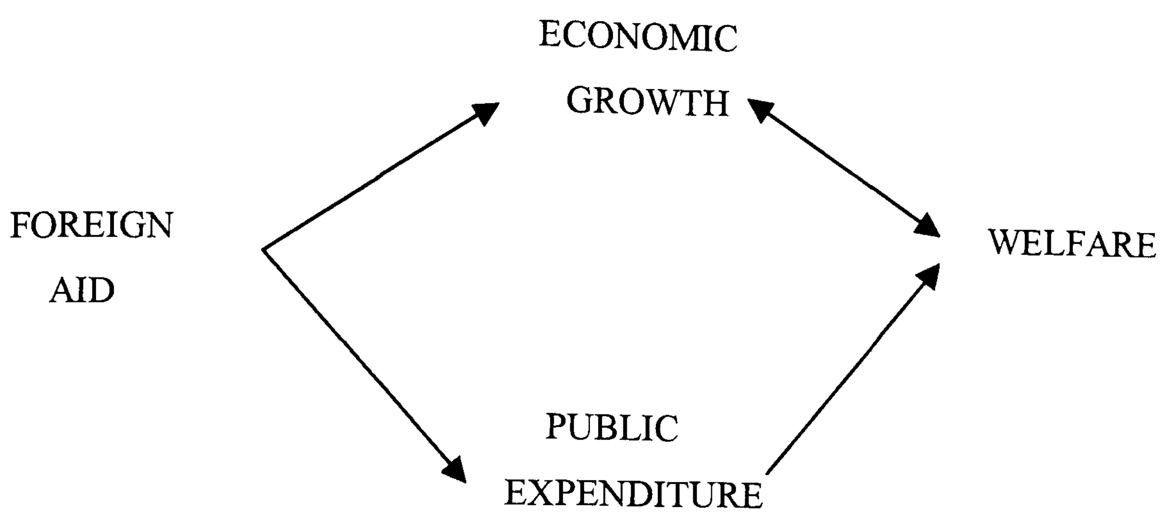
The rest of the paper is organised as follows. *Section 8.2* discusses the various routes through which aid can affect welfare of the poor. The empirical approach is outlined in *Section 8.3*, with a discussion of the choice of welfare indicators and a full description of the construction of the index of pro-poor expenditures. *Section 8.4* reviews some estimation issues and discusses the econometric results. Quantile regressions are presented in *Section 8.5*, they allow us to examine aid effectiveness at different points of the welfare distribution. In *Section 8.6*, we make an attempt to map effects of promoting welfare on growth performance. *Section 8.7* concludes with some observations.

8.2 AID AND WELFARE

Empirical literature on aid effectiveness in promoting growth is based on a fairly clear theoretical framework and wide availability of data. However deficiencies in both areas make it difficult to evaluate effectiveness of aid against the criterion of promoting welfare (or reducing poverty). Nonetheless, a number of studies have investigated the link (Boone, 1996; Kalwij and Verschoor, 2002; Mosley *et al*, 2002). Our approach is in line with the more recent studies.

Early literature focussed on capital market imperfections to explain how aid flows could alleviate poverty. Owing to immobility of capital, poor countries are bound to have a set of potentially profitable investment projects that would not be undertaken due to a shortage of domestic savings. Aid resources could promote national savings, investment and growth and indirectly promote welfare. It is plausible that enhanced growth has high potential for reducing poverty. That would explain why a focus on factors that are conducive to growth may be the right direction to take even if the objective is to promote welfare (Dollar and Kraay, 2001). As foreign aid is largely disbursed to government, concentrating on public expenditure (which represent the direct measures taken to address poverty issues) as a transmission mechanism is only natural. Figure 8.1 summarises the potential linkages between aid and welfare/poverty reduction.

FIGURE 8.1: Links between Aid and Welfare



It is generally accepted that high growth facilitates promoting welfare. However, the notion that increased welfare can enhance growth possibilities (as represented by the bi-directional arrow) has not received much attention. Investigating this possibility in depth is beyond the scope of this chapter. We however do try to shed some light on this aspect.

Just as aid does not affect growth directly, aid may not affect welfare directly. One (indirect) mechanism through which aid can affect welfare is pro-poor public spending. Reference is made to those government expenditures that target the non-income dimensions of poverty. While we acknowledge possibilities for poverty reduction arising from higher growth rates, our hypothesis is that by financing these pro-poor public spending patterns, aid is more likely to increase welfare of the poor. Growth has a potential to promote welfare only with a long time lag (and especially if aid-induced, since growth itself will then take time to appear). Whilst pro-poor expenditures that are directly targeted to areas of deprivation (for example, access to education and health services) may not necessarily have a positive effect on growth, they can enhance welfare in a more effective manner. This is not to suggest that the non-poor do not benefit even more. We abstract from issues of policy incidence. We now proceed to formalise the framework within which we shall investigate how aid flows may promote welfare levels.

8.3 EMPIRICAL APPROACH

We assume that at a national level, welfare is determined by income, pro-poor expenditures and aid. Our specification can be outlined as follows.

$$W_{it} = \beta_0 + \beta_1 Y_{it} + \beta_2 G_{p_{it}} + \beta_3 A_{it} + \varepsilon_{it} \qquad (8.1)$$

where W is a measure of welfare.

Y is a measure of income.

G_P is an indicator of pro-poor public expenditures.

A is level of aid.

As discussed, aid inflows influence welfare levels by determining the composition of public expenditures. Thus, we posit that pro-poor expenditures may be a function of aid flows as well as other sources of government revenue (G_r) and income.

$$G_{p_{it}} = \alpha_0 + \alpha_1 Y_{it} + \alpha_2 A_{it} + \alpha_3 G_{r_{it}} + u_{it} \qquad (8.2)$$

One way to approach the hypothesis that public spending channels aid to enhance welfare is to estimate Equation 8.1 and examine the aid coefficient. However, as revealed by Equation 8.2, aid influences PPE. Hence, we use a constructed regressor ($\widetilde{G}_p$) rather than G_p. and estimate the following:

$$W_{it} = \beta_0 + \beta_1 Y_{it} + \beta_2 \widetilde{G}_{p_{it}} + \beta_3 A_{it} + \varepsilon_{it} \qquad (8.3)$$

where $\widetilde{G}_p$ represents pro-poor public expenditures that are not financed by aid. There are a number of different categories of public spending recognised in the literature as being pro-poor (for a review see Verschoor, 2002), and we include the main ones although our choice of variables is dependent on data availability. We include public expenditure on social services[2], education, health and agriculture

[2] Public expenditure on social services includes expenditure on housing, community development, sanitation services, care for the aged, disabled, unemployed and children as well as expenditures relevant to environmental defense (eg pollution abatement, water supply, refuse collection).

(each of them expressed as a share of GNP). These data, which are mainly from various issues of Government Financial Statistics, is available for all the 57 countries included in the World Bank Poverty Monitoring Database over 1980 to 1998. We use four four-year and one three-year period averages to create a panel. For each type of government spending, there will be a constructed regressor. In practice, it is difficult to estimate all these coefficients with accuracy. For this reason, we prefer to construct a public expenditure index as the basis for a single generated regressor. We now briefly discuss the choice of dependent variable before elaborating on the construction of this index.

8.3.1 Welfare Indicators

Research on poverty is impeded by the paucity of time series data on poverty. Most studies rely on monetary poverty measures, namely percentage of the population living on less than \$1 a day (corrected for purchasing power) and percentage of population that lies below the national poverty line. While claimed as internationally comparable, one can question how reliable these measures are. Would a person earning over a dollar per day be better off than someone who earns less but has free access to efficient health, education and other social services? Income level is a means to better life, it indicates the possibilities open to a person but not the use the person makes of those possibilities – 'it is the lives that [human beings] lead that is of intrinsic importance, not the commodities or income they possess' (Anand and Sen, 1992). Also, substantial conceptual flaws associated with construction of poverty lines have recently been brought to attention (see Reddy and Pogge (2002) for a fuller discussion).

Ideally, one would complement these poverty measures with non-monetary indicators, such as the infant mortality rate, that capture the material hardship aspect of poverty. We use the infant mortality rate as data availability is good. Note also that the correlation between infant mortality and the \$1 a day measure is as high as 0.78 in the subsample for which we have poverty data, suggesting an overlap in informational value (infant mortality may be a correlate of poverty incidence).

An alternative measure is given by the Human Development Index (HDI), an unweighted average (between 0 and 1) of measures of a country's relative distance from the theoretical optimum of different dimensions of quality of life, notably longevity, education and income. Longevity as measured by life expectancy at birth is intended to capture the capability of leading a long and healthy life. Adult literacy rate (and mean years of schooling from 1991 to 1994 and secondary school enrolment rates thereafter) is an indicator of educational attainment and a proxy of the capability of acquiring knowledge, communicating and participating in community life. Real per capita GDP in purchasing power parity dollars represents access to resources needed for a decent standard of living. The inclusion of this monetary component suggests that the HDI will be inversely correlated with income measures of poverty (to the extent that welfare is lower in countries with higher real GDP). Note that the inappropriateness of PPP measures to develop poverty lines, which is the backbone of Reddy and Pogge (2002) paper, can to some extent be carried over to HDI though it is not of as critical importance since HDI is also based on measures of deprivation. In fact, the nature of components that comprise HDI make it an indicator of welfare rather than poverty. Hence, making this chapter an empirical exercise on welfare of the poor rather than poverty.

8.3.2 Constructing A Pro-Poor Public Expenditure Indicator (PPE)

- ***Unweighted PPE***

The first step to construct such an indicator is to determine what constitutes a pro-poor expenditure - that effectively has an impact on welfare. For each category of public social expenditure, we estimate a simple regression of welfare indicator on income per capita and government expenditure. Note that what is of prime interest is the percentage increase in welfare due to a one-percent increase in social expenditures. Stated differently, we focus our analysis on estimation of elasticity of welfare to public expenditures which is given by:

$$\beta_2 = \frac{\partial \ln (W)}{\partial \ln (G_p)}$$

In this respect, we regress welfare indicators on each government spending category (in logarithms). The larger the absolute size of this elasticity, the more responsive is welfare to the corresponding public expenditure. Table 8.1 presents the estimation results[3].

The regressions perform rather well. Income per capita and government spending explain at least 53% of variation in welfare indicators. Higher income is consistently associated with improved welfare levels, irrespective of the indicator used. Also, higher expenditure on social services, education and health do have a significant favourable impact on welfare - although each percentage increase in public social expenditure has a less than proportionate effect on welfare level. As one would expect, infant mortality rates are more responsive than HDI to changes in public expenditure on health services. Each extra percent of health public expenditure reduces infant mortality rates by over twice its positive effects on HDI.

[3] See Appendix 8B (Table 8B4) for a re-estimation of these regressions using poverty headcount as dependent variable.

Table 8.1: Welfare Regressions to determine weights

	Log (Human Development Index)	**Log (Infant Mortality Rate)**
GDPO	**0.0001**	**-0.0003**
	(4.41)	**(7.51)**
Log(Public expenditure on Social Services/GDP)	**0.055**	**-0.152**
	(2.60)	**(1.98)**
R^2	0.60	0.69
Observations	65	65
GDPO	**0.0001**	**-0.0003**
	(7.75)	**(7.79)**
Log(Public expenditure on Education/GNP)	**0.213**	**-0.174**
	(3.39)	**(3.04)**
R^2	0.60	0.64
Observations	186	231
GDPO	**0.0002**	**-0.0003**
	(6.88)	**(6.23)**
Log(Public expenditure on first-level Education/GDP)	0.031	-0.117
	(0.69)	(1.49)
R^2	0.59	0.63
Observations	100	130
GDPO	**0.0001**	**-0.0002**
	(7.08)	**(7.04)**
Log(Public expenditure on Health /GDP)	**0.179**	**-0.416**
	(2.84)	**(4.28)**
R^2	0.58	0.78
Observations	145	145
GDPO	**0.0001**	**-0.0003**
	(3.10)	**(5.75)**
Log(Public expenditure on Primary Health /GDP)	0.036	**-0.073**
	(1.37)	**(2.06)**
R^2	0.65	0.78
Observations	33	43
GDPO	**0.0001**	**-0.0003**
	(7.27)	**(7.35)**
Log(Public expenditure on Agriculture/GDP)	0.052	-0.009
	(1.60)	(0.17)
R^2	0.58	0.57
Observations	125	157
GDPO	**0.0001**	**-0.0003**
	(7.81)	**(10.46)**
Log(Public expenditure on Military/GDP)	0.047	0.019
	(1.13)	(0.34)
R^2	0.53	0.63
Observations	149	150

Notes: Regional Dummies and constants included in all OLS regressions. Absolute values of White-heteroscedastic-consistent standard errors in brackets.

In the light of these findings, we construct a pro-poor expenditure index (PPE) composed as follows:

$$PPE = P_s + P_e + P_h$$

where P_s is public expenditure on social services (share of GDP)
P_e is public expenditure on education (share of GNP)
P_h is public expenditure on health services (share of GDP)

This index has the merit of being constituted of only those expenditures that have a statistically significant impact on welfare. However, it tends to imply that the effect of public expenditure on welfare is uniform across the three public expenditure components. This would be a naïve assumption and is not supported by Table 8.1 so our unweighted index is an inadequate representation of effective social policies. A weighting system is therefore in order.

- *Beta Coefficient weighted PPE*

We intend to assign weights to each component of this index based on their relative importance in enhancing welfare. We therefore propose to use beta coefficients, which are unit-free, as weights. We recover these weights from a regression of each welfare indicator on social services, education and health expenditure and obtain two beta-weighted PPEs, PPE_{bh} and PPE_{bm}, where HDI and infant mortality are the respective dependent variables. The beta coefficient of expenditure category X is obtained by multiplying the regression coefficient on X by the standard deviation of X and then dividing this product by the standard deviation of the dependent variable.

$$PPE_{bh} = 0.1276\ P_s + 0.1084\ P_e + 0.2177\ P_h$$
$$PPE_{bm} = 0.1036\ P_s + 0.1569\ P_e + 0.2290\ P_h$$

- *First Principal Component Weighted PPE*

According to Putnam (1993), the most 'reliable and valid' means of combining multiple indicators into a single index is principal component analysis. This technique produces a linear combination of correlated variables such that it maximises the joint variance of its components. In a sense, it extracts from a matrix of indicators only a small number of variables that in some sense account for most of the variation in that matrix. We therefore generate the first principal component of the three types of public expenditures. Table 8.2 shows the scoring coefficient of each component, that is, its individual weight in the index.

Table 8.2: Weights for PPE

Policy Indicators	Scoring coefficients
Public Expenditure on Social Services (share of GDP)	0.5782
Public Expenditure on Education (share of GNP)	0.5285
Public Expenditure on Health (share of GDP)	0.6216

Note: Scoring coefficient is the weight assigned to each expenditure and is based on first principal component.

8.4 ESTIMATION AND RESULTS

In an attempt to capture the extent to which a government pursues pro-poor policies, as discussed we include various categories of social public spending as a share of domestic resources. We also include government spending on military expenditure as a fraction of GDP (G_m). Income, an important argument in welfare improvement objective, is measured by real GDP per capita in the year preceding the period. Finally, we express total aid flows (net ODA) as a share of GNP. All control variables are expected to be positively associated with the welfare indicator. The sign on military expenditure is unclear. It captures spending diverted from productive or pro-poor uses, and is also associated with high instability, but can enter positively as it represents maintaining security. Our data set covers a panel of four four-year and one three-year period averages over 1980 to 1998 for all the 57 countries included in the World Bank Poverty Monitoring Database. Descriptive statistics and list of countries are provided in Appendix 8A.

We do not incorporate any other macroeconomic variables like openness and inflation because these indicators are of more direct relevance when growth rather than welfare of the poor is the objective of interest. Any impact they might have on welfare would be through growth performance and this is already represented by income per capita.

Country specific characteristics are of importance in explaining variations in the level of welfare. In this respect, we include three regional dummies - sub-Saharan Africa (SSA), Latin America and Caribbean (LAC) and Asia. We also carry out the Breusch and Pagan (1980) Lagrange Multiplier test of the null hypothesis that σ^2_v is equal to zero where v_i is the country-specific error term. The chi-squared statistic rejects the null (absence of fixed effects) in all regressions, suggesting that OLS estimates would be biased. The Hausman (1978) specification test further suggests that a random effect specification would be most appropriate to study the relationship between aid and welfare (details in Appendix 8B). We therefore report the random effect coefficient estimates in Table 8.4.

Endogeneity concerns arise with regard to the aid variable as one expects that more aid resources are allocated to poorer countries. Following Hansen and Tarp (2001), we therefore use one-period lagged aid levels (on the basis that lagged aid is predetermined with respect to current welfare levels).

We estimate the following model

$$Ln(W_{it}) = \delta_0 + \delta_1 Y_{it} + \delta_2 Ln(PPE_{it}) + \delta_3 Ln(G_{m,it}) + \delta_4 Ln(A_{i,t-1}) + \varepsilon_{it} \qquad (8.4)$$

where the various measures of the pro-poor public expenditure index will be used in turn. First we want to test the hypothesis that public expenditures are potential transmission mechanisms through which aid inflows operate to influence welfare levels (see results in Appendix 8B). Having obtained supportive evidence, we now proceed to the random effect estimates of Equation 8.4.

Table 8.4: Welfare Regressions with PPE

	Log(HDI) regressions		
	Unweighted Index	Beta coefficients weighted index	First principal components weighted index
GDPO	**0.0001**	**0.0001**	**0.0001**
	(2.41)**	**(1.98)****	**(2.46)****
LN(PPE)	0.072	**0.148**	0.065
	(1.35)	**(2.30)****	(1.28)
LN(AIDGNP_1)	-0.004	-0.015	-0.003
	(0.11)	(0.49)	(0.09)
LN(G_m)	-0.072	-0.070	-0.072
	(1.40)	(1.41)	(1.39)
SSA	**-0.400**	**-0.375**	**-0.399**
	(3.16)***	**(3.09)*****	**(3.15)*****
ASIA	-0.078	-0.004	-0.082
	(0.62)	(0.03)	(0.66)
LAC	0.003	0.020	0.001
	(0.03)	(0.19)	(0.01)
Constant	**-0.742**	-0.287	**-0.719**
	(3.16)***	(0.88)	**(2.93)*****
Observations	81	81	81
R-squared	0.57	0.60	0.57
Wald χ^2_k	66.66	76.33	66.75

	Log(INFANT MORTALITY RATE) regressions		
	Unweighted Index	Beta coefficients weighted index	First principal components weighted index
GDPO	**-0.0002**	**-0.0002**	**-0.0002**
	(5.68)***	**(5.12)*****	**(5.79)*****
LN(PPE)	**-0.198**	**-0.305**	**-0.186**
	(3.18)***	**(3.91)*****	**(3.14)*****
LN(AIDGNP_1)	0.031	0.042	0.029
	(1.06)	(1.43)	(1.00)
LN(G_m)	**0.117**	**0.111**	**0.119**
	(2.48)**	**(2.34)****	**(2.51)****
SSA	**0.840**	**0.801**	**0.840**
	(3.68)***	**(3.81)*****	**(3.68)*****
ASIA	0.207	0.181	0.212
	(0.88)	(0.85)	(0.90)
LAC	**0.412**	**0.396**	**0.417**
	(1.94)*	**(2.04)****	**(1.96)****
Constant	**3.746**	**2.958**	**3.670**
	(13.09)***	**(7.60)*****	**(12.32)*****
Observations	80	80	80
R-squared	0.63	0.68	0.63
Wald χ^2_k	115.60	130.67	115.02

Notes: Random effect estimates reported. Regional Dummies in all regressions. Absolute values of t-ratios in brackets. Wald chi-squared statistics test the joint significance of all coefficients. They reject the null that all the coeffcicients are jointly not different from zero.

All the regressions perform reasonably well as shown in Table 8.4. The selected explanatory variables explain up to 68% of the variation in welfare indicators. Both the unweighted and weighted PPE indices have a highly significant positive effect on welfare in most cases.

As shown in Figure 8.1 (and supported by Table 8B3), public spending can be perceived as mediating the effects of foreign aid on welfare. It is therefore reasonable to believe that PPE indices are capturing the beneficial effects of aid flows, which could explain the insignificance of the latter in the regressions. To take account of this effect, we re-estimate the welfare regressions using *PPEres* ($\widetilde{G}_p$) rather than PPE, that is, we include only that fraction of public expenditures that is not financed by aid[4]. Table 8.5 presents the new set of results.

Table 8.5: Welfare Regressions with PPEres

	Log(HDI) regressions		
	Unweighted Index	Beta coefficients weighted index	First principal components weighted index
GDPO	**0.0001**	**0.0001**	**0.0001**
	(2.41)**	**(1.98)****	**(2.46)****
LN(PPEres)	0.072	**0.148**	0.065
	(1.35)	**(2.30)****	(1.28)
LN(AIDGNP_1)	0.037	**0.127**	0.042
	(1.02)	**(2.17)****	(1.08)
LN(G_m)	-0.072	-0.070	-0.072
	(1.40)	(1.41)	(1.39)
SSA	**-0.400**	**-0.375**	**-0.399**
	(3.16)***	**(3.09)*****	**(3.15)*****
ASIA	-0.078	-0.004	-0.082
	(0.62)	(0.03)	(0.66)
LAC	0.003	0.020	0.001
	(0.03)	(0.19)	(0.01)
Constant	**-0.742**	-0.287	**-0.719**
	(3.16)***	(0.88)	**(2.93)*****
Observations	81	81	81
R-squared	0.57	0.60	0.57
Wald χ^2_k	66.66	76.33	66.75

4 $\widetilde{G}_p$ is generated from the residuals of a regression of each PPE index on lagged aid.

	Log(INFANT MORTALITY RATE) regressions		
	Unweighted Index	Beta coefficients weighted index	First principal components weighted index
GDPO	**-0.0002**	**-0.0002**	**-0.0002**
	(5.68)* **	**(5.12)*** **	**(5.79)*** **
LN(PPEres)	**-0.198**	**-0.305**	**-0.186**
	(3.18)* **	**(3.91)*** **	**(3.14)*** **
LN(AIDGNP_1)	**-0.080**	**-0.239**	**-0.099**
	(2.03) **	**(3.46)*** **	**(2.23)** **
$LN(G_m)$	**0.117**	**0.111**	**0.119**
	(2.48) **	**(2.34)** **	**(2.51)** **
SSA	**0.840**	**0.801**	**0.840**
	(3.68)* **	**(3.81)*** **	**(3.68)*** **
ASIA	0.207	0.181	0.212
	(0.88)	(0.85)	(0.90)
LAC	**0.412**	**0.396**	**0.417**
	**(1.94)* **	**(2.04)** **	**(1.96)** **
Constant	**3.746**	**2.958**	**3.670**
	(13.09)* **	**(7.60)*** **	**(12.32)*** **
Observations	80	80	80
R-squared	0.63	0.68	0.63
Wald χ^2_k	115.60	130.67	115.02

Notes: As for Table 8.4

This new set of estimates provides a significant coefficient on lagged aid in 4 out of the 6 regressions reported. The coefficient estimate on aid which now includes its indirect effects through public pro-poor spending suggests that an additional 10% of foreign aid promotes welfare by about 1%. Initial GDP per capita consistently displays its positive contribution to welfare. Public expenditure on military services as a share of GDP enters with a significant positive sign in all infant mortality regressions, suggesting that this variable captures insecurity and conflict. We also find that welfare of the poor is lower (HDI is lower and infant mortality rates higher) in SSA economies, *ceteris paribus*.

8.5 QUANTILE REGRESSION ANALYSIS

As the descriptive statistics show, the welfare indicators vary widely across countries. In the presence of such heterogeneity, it is insightful to examine the effect of aid and social expenditures at different points of the distribution. Usually, variables are included as uncentred regressors. Quantile regression allows us to center the regressor around different quantiles (for example, regressors are centred around the median at the 0.5 quantile). This adds value to estimation results, especially that distribution of welfare over countries is likely to be skewed. It can be reasonably assumed that the extent to which aid can promote welfare would vary depending on whether this effect is being observed at the lowest or highest level of welfare. On one hand, owing to lack of basic social infrastructure aid may be less effective in cases where poverty is severe. While if the economy is equipped with the appropriate infrastructure, the same aid flows (by financing pro-poor public expenditures) may prove to be more effective in reducing poverty or improving welfare. On the other, aid may have a larger impact on welfare in countries with lowest welfare levels as there will be more scope for aid to bring improvements.

We investigate this hypothesis by using the semi-parametric technique of quantile regression analysis introduced by Koenker and Bassett (1978). Standard OLS or GMM techniques concentrate on estimating the mean of the dependent variable subject to the values of the independent variables. Given a set of explanatory variables, quantile regression estimates the dependent variable conditional on the selected quantile. For example, it allows us to evaluate how far aid flows have been successful when we examine observations centred around the 5^{th} percentile of welfare distribution. The resulting coefficients give an estimate of the impact on countries with relatively low welfare indicators. By estimating the model at different quantiles, one can trace the entire conditional distribution of welfare rates given a set of regressors. A further advantage of employing this estimation method is that the regression coefficient vector is not sensitive to outlying values of the dependent variable, since the quantile regression objective function is a weighted sum of absolute deviations. Provided error terms are homoscedastic, the Koenker and Bassett (1982) and Rogers (1992) methods would be adequate to calculate the variance-covariance matrix. However, Rogers (1992) reports that in the presence of heteroscedastic errors, this method would understate the standard errors. Consequently, we report the bootstrapped estimator of standard errors, as he suggests. Table 8.6A and 8.6B present the HDI and infant mortality regression estimates at five different quantiles, namely, 5^{th}, 25^{th}, 50^{th} (median), 75^{th} and 95^{th} percentile of the welfare distribution.

We can see from both tables that income per capita, social expenditures and aid inflows help improve welfare at all quantiles, albeit not always significant. We however note the distinct features across the quantiles. Pro-poor public expenditure and aid resources have a larger positive impact on HDI at the lower end of its distribution, irrespective of the PPE index used (although effects are stronger for the beta-weighted PPE). On average, each extra percent of public social expenditure and aid improves HDI by about 0.2% in the lower 0.05 quantile. In the 0.95 quantile regression, it appears that these benefits amount to only about 0.03% increase in HDI. It would therefore seem that the lower the human development in the recipient economy, the more effective aid and social expenditure are in promoting welfare as there is more room for improvement to be brought by aid and pro-poor spending. Hence, these estimates do support our hypothesis that effectiveness of aid does vary across economies depending on where they are located in the welfare distribution. Additional support is obtained by the F-test statistics. The null hypothesis of equality of aid coefficients across quantiles is rejected in most cases hence making a case to allow for heterogenous aid effects across the welfare distribution.

Using beta weights in infant mortality regressions, we find each extra percent of PPE reduces mortality rates by at least 0.6% and each extra percent of aid has a positive effect of at least 0.5%, for all quantiles. Using unweighted and first principal component weighted PPE, pro-poor expenditures and aid again appear to be effective at reducing infant mortality (although significantly so only in above median quantiles). Overall, responses to PPE or aid do not seem to vary over the distribution of infant mortality rates in a distinct manner and generally the null hypothesis is not (or weakly) rejected. Income per capita has a consistent positive effect on welfare enhancement across the quantiles.

Table 8.6A: Ln (HDI) regressions

	5%	25%	50%	75%	95%
Using unweighted PPE					
GDPO	**0.0001**	**0.0001**	**0.00003**	**0.00004**	**0.0001**
	(2.99)**	**(2.74)****	**(1.71)***	**(1.79)***	**(2.33)****
LN(PPEres)	**0.178**	**0.151**	**0.106**	0.033	0.027
	(1.82)*	**(2.18)****	**(2.77)***	(0.98)	(1.09)
LN(AIDGNP_1)	**0.088**	**0.061**	0.016	-0.006	0.009
	(1.78)*	**(1.94)***	(0.47)	(0.26)	(0.43)
LN(G_M)	-0.100	-0.045	-0.020	0.029	-0.060
	(0.86)	(0.64)	(0.32)	(0.54)	(0.96)
Observations	81	81	81	81	81
R-squared	0.46	0.45	0.42	0.36	0.29
Testing equality of aid coefficients: F-Stat (Prob>F)					
	5%	25%	50%	75%	95%
5% (1,73)		0.20(0.658)	1.34(0.251)	3.11(0.082)	2.14(0.148)
25%			2.04(0.158)	1.18(0.280)	0.84(0.363)
50%				0.78(0.380)	0.06(0.813)
75%					0.69(0.408)
Using beta coefficient weighted PPE					
GDPO	**0.0001**	**0.0001**	0.00002	**0.00003**	**0.00005**
	(1.74)*	**(2.42)****	(0.96)	**(2.82)*****	**(2.09)****
LN(PPEres)	**0.342**	**0.234**	**0.159**	**0.064**	**0.052**
	(2.88)***	**(2.80)*****	**(3.05)*****	**(2.00)****	**(1.94)***
LN(AIDGNP_1)	**0.288**	**0.194**	**0.111**	0.035	0.040
	(2.92)***	**(2.44)****	**(2.17)****	(1.08)	(1.55)
LN(G_M)	-0.041	-0.035	-0.030	0.032	-0.011
	(0.36)	(0.64)	(0.58)	(0.84)	(0.14)
Observations	81	81	81	81	81
R-squared	0.49	0.49	0.45	0.38	0.30
Testing equality of aid coefficients: F-Stat (Prob>F)					
	5%	25%	50%	75%	95%
5% (1,73)		0.74(0.393)	3.30(0.073)	5.78(0.019)	5.91(0.018)
25%			1.37(0.245)	4.08(0.047)	3.14(0.080)
50%				2.75(0.101)	1.42(0.238)
75%					0.01(0.909)
Using first principal component weighted PPE					
GDPO	**0.0001**	**0.0001**	**0.00003**	**0.00005**	**0.0001**
	(2.77)***	**(2.71)***	**(1.68)***	**(2.39)****	**(2.35)****
LN(PPEres)	0.168	**0.161**	**0.106**	0.032	0.024
	(1.28)	**(2.72)***	**(1.96)***	(0.80)	(0.76)
LN(AIDGNP_1)	0.102	**0.087**	0.030	-0.003	0.011
	(1.01)	**(1.82)***	(0.69)	(0.11)	(0.47)
LN(G_M)	-0.100	-0.052	-0.019	0.030	-0.062
	(0.91)	(0.63)	(0.32)	(0.70)	(0.97)
Observations	81	81	81	81	81
R squared	0.46	0.46	0.42	0.36	0.29
Testing equality of aid coefficients: F-Stat (Prob>F)					
	5%	25%	50%	75%	95%
5% (1,73)		0.03(0.855)	0.58(0.447)	1.30(0.257)	0.89(0.345)
25%			1.33(0.252)	2.45(0.122)	1.66(0.202)
50%				0.83(0.365)	0.22(0.639)
75%					0.32(0.573)

Table 8.6B: Ln (INFANT MORTALITY RATE) regressions

	5%	25%	50%	75%	95%
Using unweighted PPE					
GDPO	-0.0001	-0.0002	-0.0002	-0.0003	-0.0003
	(0.74)	(1.84)*	(1.97)*	(4.01)***	(3.34)***
LN(PPEres)	-0.153	-0.292	-0.462	-0.225	-0.314
	(1.52)	(1.25)	(2.18)**	(1.08)	(2.14)**
LN(AIDGNP_1)	-0.085	-0.108	-0.100	-0.159	-0.263
	(1.08)	(0.72)	(0.61)	(1.88)*	(2.04)**
LN(G_M)	0.016	-0.040	-0.016	0.050	-0.056
	(0.12)	(0.32)	(0.16)	(0.50)	(0.56)
Observations	80	80	80	80	80
R-squared	0.49	0.46	0.46	0.44	0.47
Testing equality of aid coefficients: F-Stat (Prob>F)					
	5%	25%	50%	75%	95%
5% (1,72)		0.03(0.860)	0.01(0.917)	0.31(0.582)	2.05(0.157)
25%			0.00(0.957)	0.13(0.721)	1.06(0.306)
50%				0.37(0.547)	1.16(0.286)
75%					0.86(0.356)
Using beta coefficient weighted PPE					
GDPO	-0.0001	-0.0001	-0.0001	-0.0002	-0.0003
	(0.88)	(2.43)**	(1.74)*	(1.65)	(2.32)**
LN(PPEres)	-0.690	-0.781	-0.678	-0.583	-0.553
	(2.74)***	(4.89)***	(2.90)***	(1.71)*	(1.97)*
LN(AIDGNP_1)	-0.544	-0.603	-0.464	-0.518	-0.574
	(4.24)***	(4.29)***	(2.10)**	(1.94)*	(2.78)***
LN(G_M)	0.021	0.030	0.049	-0.034	-0.007
	(0.18)	(0.19)	(0.51)	(0.34)	(0.07)
Observations	80	80	80	80	80
R-squared	0.59	0.57	0.52	0.46	0.50
Testing equality of aid coefficients: F-Stat (Prob>F)					
	5%	25%	50%	75%	95%
5% (1,72)		0.18(0.669)	0.16(0.688)	0.01(0.915)	0.02(0.894)
25%			0.85(0.359)	0.11(0.736)	0.02(0.897)
50%				0.05(0.823)	0.19(0.664)
75%					0.07(0.796)
Using first principal component weighted PPE					
GDPO	-0.0002	-0.0002	-0.0002	-0.0003	-0.0003
	(0.81)	(1.91)*	(1.72)*	(2.41)**	(4.62)***
LN(PPEres)	-0.128	-0.245	-0.454	-0.226	-0.303
	(0.51)	(0.95)	(1.93)*	(0.96)	(1.74)*
LN(AIDGNP_1)	-0.108	-0.092	-0.143	-0.195	-0.293
	(0.74)	(0.56)	(1.08)	(1.19)	(2.21)**
LN(G_M)	0.015	-0.071	-0.032	0.053	-0.056
	(0.09)	(0.74)	(0.39)	(0.71)	(1.02)
Observations	80	80	80	80	80
R-squared	0.49	0.46	0.46	0.44	0.47
Testing equality of aid coefficients: F-Stat (Prob>F)					
	5%	25%	50%	75%	95%
5% (1,72)		0.02(0.897)	0.05(0.816)	0.24(0.626)	1.07(0.305)
25%			0.15(0.704)	0.34(0.564)	1.16(0.285)
50%				0.24(0.629)	0.81(0.371)
75%					0.37(0.547)

Notes: Constant and regional dummies included in all regressions. Absolute values of bootstrapped t-ratios in brackets

8.6 WELFARE TO GROWTH

So far, we have looked at promoting welfare as the central objective and treat growth, government pro-poor spending and aid flows as important instruments. We now briefly consider whether improved welfare is just an end in itself or can be a means to promote growth possibilities? It is conceivable that as people become say healthier and more educated, they are capable to make more significant contributions to growth.

To investigate this possibility, we specify a growth model that is similar to the one employed in Chapter 5. We here prefer to concentrate on HDI rather than infant mortality rates as the former can arguably be the more relevant welfare indicator when looking at effects it might have on economic growth. As a result, no education variable is included as it is one of the components of HDI. We run the Breusch Pagan (1984) test to find whether OLS would be appropriate. The test produces a chi-statistic of 1.97 with one degree of freedom. Using the 1% critical value from the chi-squared distribution (6.63), the test statistic fails to reject the null therefore suggesting OLS would produce consistent estimates. We introduce one-period lagged HDI as it is not likely to have an immediate impact on growth. This would partly address concerns on endogeneity.

The aim here is to demonstrate that improved welfare might be good for growth. rather than making any assertive claim (which would be a topic in its own right). This exercise is just intended to provide a promising line of research. Table 8.7 presents the results.

As discussed in Chapter 5, introducing both investment and aid in growth regression results in underestimation of aid effectiveness as investment coefficient would capture part of the indirect effects of aid on growth. Using residual-generated regressor, we included only that part of investment that is not due to aid so that the aid coefficient would give an estimate of its total effect on growth. Using the same methodology, we here want to obtain an estimate of aid effectiveness in promoting growth that would include its indirect effects through investment and welfare (HDI).

Table 8.7: Link from Welfare to Growth

	Growth in Real GDP Per Capita (%)		
GDPO	**-0.0004** **(1.71)***	**-0.0004** **(1.71)***	**-0.0004** **(1.71)***
HDI_1	**5.905** **(2.95)*****		
HDI_1res		**5.905** **(2.95)*****	**5.905** **(2.95)*****
INV	**0.196** **(5.24)*****	**0.196** **(5.24)*****	
INVres			**0.196** **(5.24)*****
DEM	-0.008 (0.07)	-0.008 (0.07)	-0.008 (0.07)
INFL	**-0.002** **(3.34)*****	**-0.002** **(3.34)*****	**-0.002** **(3.34)*****
MGDP	**-0.067** **(3.43)*****	**-0.067** **(3.43)*****	**-0.067** **(3.43)*****
AIDGNP_1	13.253 (1.39)	**27.194** **(2.17)****	**53.314** **(3.69)*****
SSA	0.929 (0.80)	0.929 (0.80)	0.929 (0.80)
ASIA	**2.748** **(3.24)*****	**2.748** **(3.24)*****	**2.748** **(3.24)*****
LAC	1.096 (1.48)	1.096 (1.48)	1.096 (1.48)
Constant	**-4.662** **(2.90)*****	**-4.662** **(2.90)*****	**-4.662** **(2.90)*****
Observations	144	144	144
R-squared	0.39	0.39	0.39
F-stat	7.83	7.83	7.83

Notes: Regional dummies included in all regressions. Absolute values of White-heteroscedastic-consistent standard errors in brackets. F-Stat rejects the null that all the coefficients are jointly equal to zero.

Results are in favour of our hypothesis. HDI does effectively make a significant positive contribution to growth. This finding may act as an incentive to allocate aid for welfare enhancement purposes as it indirectly also helps in stimulating growth process. Again, aid appears to be a positive determinant. Also, taking account of its effects through mediators of growth (HDI and investment) enhances the contribution of aid. Each extra percentage point of aid in GNP increases growth (partly through investment) by 0.3% points on average with one year lag. However, once its effect through increased welfare is taken into account, it would appear that on average it improves growth rate by a further 0.2% points.

8.7 CONCLUSION

Our objective is to test the hypothesis that aid flows have an indirect effect on welfare levels. One way is by promoting growth. Alternatively, direct measures aimed at improving the non-income dimensions (for example, consumption of health and access to education) of poverty represent a potential transmission channel. The latter route is believed to be more effective in terms of promoting welfare. Investigating this link therefore motivates our study.

We concentrate on public expenditure on social services, education and health as the relevant direct measures, based on their significance in welfare regressions. To accumulate the effects of aid on welfare into the coefficient on aid, we use residual generated regressors. This allows us to obtain an aid coefficient that includes its indirect effects through public sector resource allocation. For this purpose, we construct four alternative PPE indices such that high values indicate progressively pro-poor budget. We also hypothesise that while evaluating aid effectiveness in improving welfare, it is important to take into consideration that these effects can vary depending on which part of the welfare distribution is examined. We estimate quantile regressions to take account of this observation.

We examine the relationship between aid flows and indicators of welfare (HDI and infant mortality) based on a pooled panel of 57 countries over the period 1980 to 1998 using a random effect model. Results obtained are in support of our hypothesis that public social expenditure is associated with higher welfare and that aid improves welfare of the poor by financing such expenditures. Estimates also support our hypothesis that effectiveness of aid does vary across economies depending on their location in the distribution of welfare – the positive effect of aid on welfare via PPE is stronger at the lower end of welfare distribution (when HDI is the relevant indicator).

Our estimates therefore seem to suggest that one way to address welfare issues is to target governments with pro-poor policy aspirations if selectivity is the criteria. Should conditionality be the preferred criteria then recipient economies should be encouraged to invest significant proportions of aid resources into social policies. Hence, whether the allocation policy is one of conditionality or selectivity.

composition of public spending would appear to hold the key to promote welfare of the poor (and non-poor). In general, our results suggest that aid is effective in improving welfare in the presence of pro-poor public spending including expenditure on social services, education and health. It also appears that targeting aid at enhancing welfare stands more than just on humanitarian grounds. It can also be a means to enhance growth process in developing countries.

APPENDIX 8A: DESCRIPTION OF DATA

Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	Max
Human Development Index	219	0.587	0.215	0.045	0.944
Infant Mortality Rates	284	59.68	37.52	5.7	181
Poverty Headcount:					
% below national welfare line	59	33.234	17.10	1.6	70
% of population earning less than $1 a day	125	20.699	18.527	0	70.24
GDPO	262	2290	1562	299	8092
Pub Exp on Social Services/GDP	85	0.034	0.043	-0.041	0.153
Pub Exp on Education/GNP	246	0.043	0.019	0.008	0.106
Pub Exp on first-level Education/GDP	133	0.016	0.008	0.000	0.040
Pub Exp on Health/GDP	158	0.025	0.015	0.002	0.073
Pub Exp on Primary Health/GDP	44	0.002	0.003	$2.89e^{-06}$	0.011
Pub Exp on Agriculture/GDP	161	0.017	0.014	0.001	0.088
Pub Exp on Military Services/GDP	153	0.032	0.028	0.005	0.156
AID/GNP	255	0.060	0.077	-0.002	0.463
Total Tax Revenue/GDP	201	0.182	0.086	0.038	0.475
PPE	85	0.101	0.063	0.002	0.272
PPE_{bh}	85	0.014	0.009	0.002	0.037
PPE_{bm}	85	0.016	0.009	0.004	0.038
PPE_{pc}	85	0.058	0.036	0.001	0.156
Growth in Real GDP Per Capita (%)	277	0.894	3.812	-15.618	22.250
INV (Investment as % of GDP)	274	23.125	9.116	4.331	79.195
INFL (Inflation Rate)	252	86.236	499.765	-4.379	6351.45
MGDP (Imports as % of GDP)	267	34.707	21.315	5.860	137.843

Note: All data refer to period averages 1980/1983, 1984/1987, 1988/1991, 1992/1995 and 1996/1998 except initial GDPPC. Data from Verschoor (2002) have been extended for this analysis.

List of countries

Algeria
Bangladesh
Bolivia
Botswana
Brazil
Bulgaria
Chile
China
Colombia
Costa Rica
Cote d'Ivoire
Czech Republic
Dominican Rep.
Ecuador
Estonia
Ethiopia
Ghana
Guatemala
Guinea
Honduras
Hungary
India
Indonesia
Jamaica
Jordan
Kenya
Kyrgyz Republic
Lesotho
Madagascar
Malaysia
Mauritania
Mexico
Moldova
Morocco
Nepal
Nicaragua
Niger
Nigeria
Pakistan
Panama
Peru
Philippines
Poland
Romania
Rwanda
Senegal
Slovak Republic
South Africa
Sri Lanka
Tanzania
Thailand
Tunisia
Turkmenistan
Uganda
Venezuela, RB
Zambia
Zimbabwe

APPENDIX 8B: ECONOMETRIC ISSUES

Table 8B1: OLS Welfare Regressions

	Log(HDI) regressions		
PPE Indicator	Unweighted Index	Beta coefficients weighted index	First principal components weighted index
GDPO	**0.0001**	**0.0001**	**0.0001**
	(3.53)* **	**(3.23)*** **	**(3.52)*** **
LN(PPE)	0.052	**0.149**	0.049
	(1.25)	**(3.41)*** **	(1.22)
LN(AIDGNP_1)	-0.028	**-0.045**	-0.028
	(1.09)	**(1.86)***	(1.09)
$LN(G_m)$	-0.024	-0.026	-0.024
	(0.37)	(0.42)	(0.37)
Constant	**-0.749**	**-0.250**	**-0.725**
	(3.60)* **	**(1.09)**	**(3.34)*** **
Observations	81	81	81
R-squared	0.59	0.62	0.59
F-Stat	12.94	13.99	12.94
BreuschPagan χ^2_k	8.46	6.60	8.37
Hausman χ^2_k	5.19	4.54	4.94

	Log(Infant Mortality) regressions		
PPE Indicator	Unweighted Index	Beta coefficients weighted index	First principal components weighted index
GDPO	**-0.0002**	**-0.0002**	**-0.0002**
	(3.98)* **	**(2.98)*** **	**(3.98)*** **
LN(PPE)	**-0.254**	**-0.694**	**-0.240**
	(1.93)*	**(5.20)*** **	**(1.87)***
LN(AIDGNP_1)	0.043	0.081	0.042
	(0.71)	(1.53)	(0.69)
$LN(G_m)$	0.004	0.022	0.003
	(0.06)	(0.32)	(0.04)
Constant	**3.544**	**1.331**	**3.433**
	(7.96)* **	**(2.11)** **	**(6.91)*** **
Observations	80	80	80
R-squared	0.66	0.74	0.66
F-Stat	33.38	36.33	33.37
BreuschPagan χ^2_k	44.90	38.29	44.86
Hausman χ^2_k	1.92	10.41	1.96

Notes: Regional dummies included in all OLS regressions. Absolute values of White-heteroscedastic-consistent standard errors are given in parentheses. F-Stat rejects the null that all the coeffcicients are jointly not different from zero.

The above tables report the OLS estimates of welfare regressions. The Breusch Pagan (1980) Lagrange Multiplier tests the null hypothesis that country-specific disturbance term (v_i) is always zero, that is, the absence of omitted fixed effects. We take the 1% critical value from the chi-squared distribution with one degree of freedom which is equal to 6.63. In all regressions, the test statistic rejects the null therefore suggesting the inappropriateness of OLS coefficient estimates. The only exception is when beta-weighted PPE is used in HDI regressions. However, since the Breusch-Pagan test statistic only just falls in the acceptance region, we treat it as a rejection case.

Note however, that OLS results overall lead to conclusions similar to the ones drawn from Table 8.4. Use of residual generated regressor, PPEres, again produces a measure of total effect of aid on welfare which is along the same lines as those in Table 8.5. In a sense, our results are fairly robust across the estimation techniques.

Hausman (1978) Specification Test

Hausman(1978) tests the validity of random-effects estimator based on the difference between random and fixed effect estimators. Under the null, there is no correlation between the country-specific disturbance (v_i) and the regressors. Both random effect and fixed effect estimates would be consistent although the former would be more efficient (hence preferable). If this hypothesis does not hold, then a random effect model would produce biased estimates whilst a fixed effect model (which eliminates country-specific effects through data transformation) would still give consistent estimates. In other words, the coefficient estimates across these two models will be systematically different. At 1% critical value with 4 degrees of freedom which is equal to 13.28, the Hausman test statistic falls in the acceptance region for all 6 regressions. Hence, we report random effect estimators to analyse effects of aid on welfare of the poor.

Aid and Pro-Poor Expenditures

With the aim to test the hypothesis that government expenditure transmits any effect aid may have on welfare, we have here estimated Equation 8.2. Total tax revenue as a share of GDP (*TRGDP*) is included as a source of government revenue.

In general the regressions perform well as shown in Table 8B3. All explanatory variables enter with the expected sign and have high t-ratios. Irrespective of the PPE index used, tax revenue, income per capita and especially aid flows are significant determinants of the composition of government expenditure. Hence, it appears that

Table 8B3: Pro-Poor Public Expenditure (PPE) regressions

	PPE	PPE_{bh}	PPE_{bm}	PPE[illegible]
AIDGNP_1	**0.158**	**0.023**	**0.022**	**0.092**
	(2.59)**	**(2.90)*****	**(2.69)*****	**(2.66)*****
TRGDP	**0.564**	**0.078**	**0.073**	**0.326**
	(8.94)***	**(8.92)*****	**(8.62)*****	**(8.96)*****
GDPPC x 10^4	**0.055**	**0.009**	**0.009**	**0.032**
	(3.39)***	**(3.55)*****	**(3.81)*****	**(3.39)*****
Constant	**-0.030**	**-0.004**	-0.001	**-0.019**
	(2.18)**	**(1.96)***	(0.57)	**(2.32)****
Observations	83	83	83	83
R-squared	0.83	0.83	0.82	0.83
F-Stat	84.19	82.82	79.82	84.46

Notes: Regional dummies included in all OLS regressions. Absolute values of White-heteroscedastic-consistent standard errors are given in parentheses. F- Stat rejects the null that all the coeffcicients are jointly not different from zero

these findings support our hypothesis that PPE expenditures represent potential channels through which aid impacts on welfare.

Quantile Regression

The quantile regression model, first introduced by Koenker and Bassett (1978), can be viewed as a location model. Suppose, θ is the quantile to be estimated. Then if W and X refer to welfare levels and a vector of control variables, for each observation i, the residual would be given as:

$$r_i = W_i - \sum_j \beta_j x_{ij}$$

and the weight as $w_i = \begin{cases} 2\theta & \text{if } r_i > 0 \\ 2(1-\theta) & \text{otherwise} \end{cases}$

Thus, quantiles other than the median are estimated by weighting the residuals. The regression coefficients for the θ^{th} sample quantile ($0<\theta<1$) of W are estimated by solving the following minimisation problem:

$$\min \frac{1}{n} \left\{ \sum_{i, W_i \geq x_i \beta} \theta \left| W_i - x_i' \beta \right| + \sum_{i, W_i < x_i \beta} 1-\theta \left| W_i - x_i' \beta \right| \right\}$$

Thus, quantile regressions would allow us to evaluate aid effectiveness by focusing on specific parts of the welfare distribution. As one increases θ continously from 0 to 1, one can trace the entire conditional distribution of welfare levels given the set of regressors. Our hypothesis is that economies would respond differently to social expenditures and aid resources depending on where they lie on the welfare distribution. The elasticity of the θ^{th} conditional quantile of welfare due to a change in aid inflows would be given by the partial derivative of the conditional quantile of welfare with respect to aid flows (A), that is, $\partial Quant_{\theta}(W_i \setminus x_i)/\partial A_i$.

Using Monetary Poverty Indicators

With respect to the widespread use of income poverty measures, we here extend our analysis to these indicators. We re-estimate the regressions using these measures which allow us to find elasticity of each type of government social expenditures with respect to monetary poverty indicators. Table 8B4 reports the estimation results.

One can notice the consequent reduction in sample size. Initial income per capita consistently appears to reduce the percentage of population that fall below the poverty line. The share of various public expenditure in GNP does not perform well in most of the regressions. In the cases that they are significant, they appear to suggest that public expenditure on first-level education and primary health are harmful to the poor. Poor data coverage does not allow us to conclusively interpret these findings. Owing to these ambiguous and weak results, it becomes uncertain what would constitute a pro-poor public expenditure index if these monetary poverty indicators were to be used.

Table 8B4: Regressions Using Poverty Headcount Measures

	Log(Poverty head-count) (%below national welfare line)	Log(Poverty head-count) (% below $1/day PPP)
GDPO	-0.0001	**-0.0003**
	(1.19)	**(3.04)*****
Log(Public expenditure on Social Services/GDP)	-0.006	-0.311
	(0.05)	(1.67)
Observations	19	36
R-squared	0.61	0.44
GDPO	**-0.0003**	**-0.0003**
	(2.74)***	**(4.18)*****
Log(Public expenditure on Education/GDP)	0.023	-0.326
	(0.15)	(1.46)
Observations	53	96
R-squared	0.54	0.59
GDPO	**-0.0003**	**-0.0003**
	(2.11)**	**(2.53)****
Log(Public expenditure on first-level Education/GDP)	**0.093**	**-0.180**
	(3.28)***	**(0.70)**
Observations	31	56
R-squared	0.54	0.51
GDPO	**-0.0002**	**-0.0003**
	(2.16)**	**(4.92)*****
Log(Public expenditure on Health/GDP)	-0.021	-0.235
	(0.10)	(1.31)
Observations	45	79
R-squared	0.43	0.55
GDPO	**-0.0006**	**-0.0003**
	(5.78)***	**(1.94)***
Log(Public expenditure on Primary Health/GDP)	**0.277**	-0.105
	(7.83)***	(1.73)
Observations	10	19
R-squared	0.93	0.91
GDPO	**-0.0004**	**-0.0002**
	(3.26)***	**(3.25)*****
Log(Public expenditure on Agriculture/GDP)	0.090	-0.044
	(0.54)	(0.26)
Observations	40	66
R-squared	0.56	0.51
GDPO	**-0.0003**	**-0.0003**
	(2.28)**	**(3.48)*****
Log(Public expenditure on Military/GDP)	0.153	-0.102
	(1.65)	(0.49)
Observations	45	76
R-squared	0.49	0.49

Note: Regional Dummies and constants included in all OLS regressions. Absolute values of White-heteroscedastic-consistent standard errors in brackets.

We prefer to concentrate on HDI and mortality rates rather than the monetary measures of poverty for conceptual reasons as well. Reddy and Pogge (2002) highlight three significant flaws in measures of income poverty. First, they make explicit reference to the fact that global (and domestic) poverty lines are not based on a clear conception of welfare that specifies the goods that must be commanded to avoid being poor. Second, it is difficult to get a meaningful international and intertemporal comparison of these global poverty lines since by construction they rely on an inappropriate measure of purchasing power parity. And finally incorrect extrapolation from limited data is an inherent feature of the methodology used to construct income poverty measures. In fact, Reddy and Pogge (2002) recommend using poverty estimates based on infant mortality, amongst other measures of deprivation/welfare, while an appropriate and much needed global measure of income poverty is developed.

CHAPTER 9

CONCLUSION

In this collection of essays, we address three pertinent issues that we identify while reviewing the literature on aid effectiveness. First, treatment of transmission mechanisms in estimating an aid-growth model. Second, the nature of non-linearity that appears to characterise the relationship between aid and growth. Finally, we try to shed light on how to capture the effect of aid on welfare of the poor and what would make it more effective. We now briefly give an overview of these issues, how they are addressed and the conclusions we reach before summarising the implications drawn. This is followed by a discussion of the limitations of this study together with some suggestions for future research.

9.1 SUMMARY OF MAIN FINDINGS AND IMPLICATIONS

Various developments in the aid literature have resulted in a shift from the limiting Harrod Domar growth model to more recent endogenous models thereby coming closer to modelling the growth process as is now experienced. At the same time, emphasis has been on econometric sophistication and use of panel data. However, it has still been unclear how to treat the indirect routes that channel effects of aid on growth. Investment, imports, public sector have been identified as mediators of aid effects from theoretical work. Recently, policies have been added to this list owing to the emphasis on aid conditionality. Empirics might recognise that aid works indirectly to impact on growth, however this has not been explicitly expressed in specifying a model. Few studies have even acknowledged that investment is one of the most crucial link between aid and growth. On these grounds, they include aid but not investment in their growth regressions. Since investment has been established as the engine for growth, the resulting model misspecification is likely to give biased estimates. In this study, having identified investment as the transmission mechanism operational in SSA countries, we include both aid and investment in our regressions. Although, this approach does circumvent the problem of misspecification, it creates problems of its own. Aid coefficient in such a model is likely to underestimate aid effectiveness as investment coefficient would be capturing part of the effects aid has on growth. Using a residual generated regressor, we are able to introduce only that share of investment that has not been aid-financed. As a result, we overcome model misspecification and are still able to produce an aid coefficient that gives an estimate of the total impact of aid on growth.

Growth in SSA may not be reflecting the predictions based on aid allocations. This does not necessarily imply that aid did not work. In fact, our estimates consistently indicate aid has been effective. Prevalence of factors that are detrimental to growth are quite important in that region and would tend to be a more likely explanation of the observed correlation of high aid and low growth. These characteristics act as a barrier to the full realisation of aid effects. We are more inclined to believe that had donors not been generous to SSA, this region would have been worse off than it is.

Recent work on aid effectiveness has been marked by the introduction of non-linearity either in the form of aid squared or aid interaction terms. While the use of interaction terms has been questioned, in this thesis we do not seek to resolve that debate. Instead, we concentrate on validity of using an aid squared term and test the proposition of an aid Laffer curve. The main limitation with specifying an aid squared term is that the number of threshold (one) and form of non-linearity (inverted U-shape) is exogenously imposed. Using a threshold model, we allow the data to determine both the number of threshold and type of regime as well as the split variable. The possibility to draw inferences on the thresholds identified adds appeal to our finding. Application of this technique is the novelty of that chapter. Our estimates suggest that the relationship between aid and growth is effectively non-linear and it appears that aid is effective at high aid levels. In other words, we find no evidence of diminishing returns in aid. The marginal impact of aid on growth does eventually decline but it occurs only after human capital stock rather than aid surpasses a certain level. Based on our results, it seems that an aid-squared term is not an appropriate way to capture the non-linearity in aid-growth link.

Although poverty reduction is attracting increasing consideration as an objective of aid, there is little empirical analysis of the relation. One of the constraining factor has been lack of data on poverty, and even the limited data - the monetary poverty indicator which has been most widely used – are not without conceptual flaws. Another difficulty encountered in measuring aid effectiveness in reducing poverty is that it is hard to specify a model. Bearing in mind these pitfalls, we have here sought to contribute to this limited literature. For this purpose, we use non-monetary poverty indicators to avoid further complication owing to the doubts raised on validity of poverty line based measures. Hence, our results are interpreted as estimates of effect on welfare of the poor rather than on poverty. Note however that increases in welfare alleviates poverty although this effect may not show on measured *income* poverty. We specifically emphasise the role of public sector in determining how effective aid flows are in promoting welfare. Our estimates are supportive of the hypothesis that aid makes a more significant contribution to improving welfare of the poor (and non-poor) if the recipient government engages in pro-poor spending patterns. This would involve public expenditure that can directly be targeted at reducing non-material hardship, for example through increased sanitation, health and education services. These actions may additionally indirectly enhance the economy's growth potential. Finally, quantile regression estimates is in support of our hypothesis that the positive effect of aid varies depending on the location of the recipient in the welfare distribution – aid is more effective in promoting welfare in economies at the lower end of this distribution (i.e, with low HDI)

In general, based on our findings, the implications are twofold. First, some consequential notes can be drawn for future empirical work. Most importantly, it would be recommended to account for transmission mechanisms in assessing aid effectiveness. Neglecting to do so is likely to give an inaccurate picture of how successful aid flows are. Also, careful thought has to be given to the use and interpretation of an aid squared term. It does not appear to be an appropriate representation of the non-linearity in aid and growth relationship. Also, a significant coefficient on such a term does not necessarily indicate diminishing returns in aid. It may be signalling to the effect of an omitted interaction term as suggested by Hansen and Tarp (2001). Finally, useful insights can be obtained from aid studies that allow for effects of aid to vary across the welfare distribution.

Second, policy-wise the need for continued support of aid to developing countries as well as SSA cannot be overvalued. Our findings show that aid has been effective and suggest that additional flows would be beneficial. However, aid will not solve all of SSA's economic problems. Aid may be a necessary but it is not a sufficient condition for growth and enhanced welfare. Sustainable and enhanced effects depend on other factors as well – for example, independent and transparent legal system, strong government institutions, diversified production sector and development of infrastructure (that would foster growth of the private sector). Finally, an effective way to use aid to promote welfare would be to encourage recipient governments to adopt a pro-poor budget. Whether the aid allocation policy is one of selectivity or conditionality, this proposition can be catered for.

9.2 LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

One important limitation we face in this empirical study is data availability. Most of the recent significant work done in aid literature covers the period from 1970 until 1993. Our sample is extended to more recent years but data on all variables were available until 1998 only at the time the sample was constructed. One possible way to develop this work would be to use more recent data as they become available. That would allow an updated evaluation of aid performance.

We have emphasised the need to recognise the role of transmission mechanisms in mediating effects of aid on growth. We duly take into consideration the importance of investment, imports and government in that regard. Exploring the links through policy would have completed the study. However, it has been difficult to extend the analysis to policy owing to several factors. Most importantly is the lack of clarity regarding how to model the interaction between policies, aid and growth. Enlightening on these matters would be a topic in its own right. Future research in this direction would be vital especially with respect to the recent assertion that aid works only if accompanied with good policies and hence should be allocated to economies with good policy environments only.

To be able to focus on treatment of transmission mechanisms in assessing aid effectiveness, we have adopted a growth specification that is in line with recent work. Although it embraces multiple dimensions of an economy - initial conditions, political institutions and policies - there still are some aspects distinct to SSA that we had to neglect. Close examination of regression results did show that our model is limited in the sense that it cannot fully capture the negative forces on growth in SSA.

An extension to this work would be to account for these additional factors unique to this region. Morrissey and Lensink (2000) highlight the adverse effect of aid instability, Dehn (2000) focuses on commodity price uncertainty and Serven (1998) presents results using a wider range of factors that captures macroeconomic uncertainty. An aid-growth model like the one we employ if augmented by a combination of aid and economic uncertainty factors could be insightful. Finding innovative ways to construct these uncertainty measures would be an important element.

Results regarding transmission mechanisms have been helpful in understanding how aid works and what can be done to enhance its effectiveness. However, these findings are based on panel data growth regressions. Hence, the estimates give an idea on average aid performance. This may be masking individual country experience. Analysis of the regression estimates does suggest a selective set of countries that warrants further investigation. Case studies that would incorporate additional information we gained on the workings of aid would refine our conclusions.

One shortcoming of our work regarding aid and welfare is the limited sample. Although the sample is based on 57 countries over the period 1980 to 1998, it would be worthwhile extending this data set both countrywise and timewise. Another possible refinement would be to gather data on a wider range of public expenditures. For example, as welfare is likely to be poorer in rural areas, it would be advisable to incorporate information on public spending on rural transport and communication. Finally, a formal theoretical model of the relationship between aid and welfare or poverty alleviation will provide a rich environment to pursue research in this area. As it currently stands, the few empirical studies examining this link are fairly *ad hoc*. An approach, that would be based on strong theoretical work, to capture positive effects of improved welfare or poverty reduction on growth performance would also be invaluable.

Throughout this thesis, we have studied aid effectiveness by concentrating on the recipient country. This seems a natural approach as whether aid works or not depends to a large extent on how the recipient government uses it. However, the role of donors is not without relevance. Our preliminary data analysis does provide guidance as to who are the predominant donors by region. Developed countries disburse aid for a range of reasons other than on moral and humanitarian grounds only. The mix of motives driving aid allocation would most likely vary across donors and over time. This leads us to believe that incorporating donor-related factors is as important as giving consideration to individual recipients in studying aid effectiveness. Future empirical work that would be donor-specific or at least allow for aid from various donors may help find out about a possible linkage between source of aid (and donors' interests) and its probability of being successful.

Most of the developing countries have and continue to rely heavily on foreign aid to withstand the forces that prevent them from growing. The overwhelming literature on how aid works has indeed provided invaluable information to both donors and recipients as well as academics. Yet, new issues are bound to appear and would need to be addressed. We hope this thesis provides insights that would be useful for future research.

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