Uneven Human Capital Development in Contemporary China: A Non-monetary Perspective on Regional and Gender Inequality

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ABSTRACT

Regional inequality is one of the most challenging issues facing China in the coming decade. Whilst this matter can be approached from different standpoints; mainstream scholars have tended to examine this issue by way of monetary measurement (e.g. GDP or income per capita). This study draws attention to the non-monetary aspect in order to shed new light on regional inequality.

Accordingly, this research focuses on the gaps and trends of human capital development, a key non-monetary index proxying for regional inequality in transitional China. Taking education and health status as two key indicators, in particular, this research aims to trace the trends in regional inequality over the last two decades, investigate to what extent those two dimensions can help to identify and integrate factors behind regional disparities, and to analyse some profound policies and implications.

Based upon official educational and health status statistics at provincial level, this study develops a model to exam regional disparity between the three economic development zones from 1990 to 2005. Main findings are that different perspectives of regional inequality bring out different consequences; from the viewpoint of human capital development, regional inequality presents positive findings in uneven development. Secondly, causes of development are fairly diverse and different measurements may significantly vary outcomes. Thirdly, uneven development is a spontaneous phenomenon underlying development, which over varying lengths of time may have stimulated economic growth in a positive way. Finally, limitations are discussed associated with policy implications.

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LIST OF ABBREVIATIONS

CASS	Chinese Academy of Social Sciences
CHNS	China Health and Nutrition Survey
CMS	Cooperative medical system
CNHDR	Chinese National Human Development Report
CNKI	China National Knowledge Infrastructure
CPI	Consumer Price Index
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GER	Gross enrolment rate
GNP	Gross National Product
HE	Higher education
HEIs	Higher education institutions
HC	Human capital
ISCE	The International Standard Classification of Education
LEAB	Life expectancy at birth
LIB	Labour-income-based
MOE	Ministry of Education
NBS	National Bureau of Statistics
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary least squares
PRC	The People's Republic of China
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WBDP	The World Bank's Development Reports
YOS	Years of schooling

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Chapter 1 Introduction

1.1 Theme and background of the study

When we have witnessed increased global wealth, it is then important to recognize that global economic development continues to be highly uneven in many perspectives (e.g. Brenner, 1977; Weeks, 2011 and Harvey, 2006). Whilst globalization has brought benefits to some countries, global inequalities have had widely varying rates of economic growth both between developing countries and between developed and less-developed economies. The uneven development is not just felt at the global level between countries but is also experienced within countries and cities on a regional scale.

Regional inequality, reflecting uneven development in many countries, is of interest for a variety of reasons. Firstly, regional inequality is a problem of economic growth. Different regions have grown at varying paces, thus income differences between regions exist in the first place. Secondly, regional inequality is an ethical issue. Both economic growth and fair distribution of income are desirable goals, but in fact they often conflict with each other. The maximisation of growth may exacerbate the problem of inequality, whereas the pursuit of equality may slow down national growth. Thirdly, regional inequality is an issue of political significance, because it may have an impact on the political stability and unity of the nation (Wang, 2006).

With respect to uneven development in the world, China is a good case, not only because China has achieved unprecedented economic growth over the past three decades, but also because it has been accompanies by increasing inequality. Since the beginning of the economic reform in 1978, a vast number of people have seen their living standards rise, but the rapid economic development has opened up a growing divide between the booming coastal provinces in the South and West and a poor, underdeveloped interior. Regional inequality has become a relatively new phenomenon in China along with the economic development over the past three decades. The differences between and within regions, between urban and rural areas and within cities and counties are challenges for China's sustainable development from economic, political and social perspectives. China's government became

increasingly concerned about the need to further develop some backward provinces. Thus, one of the principal objectives of the 10th five-year plan (2001-2005) was to narrow regional inequality (www.peopledaily.com, 28 December 2000).

Most literature on regional inequality focuses on income inequality, and in the 1950s Kuznets postulated the famous inverted U shaped curve to express the relationship between economic development and income inequality (Kuznets, 1955). He observed that income inequality may not adequately measure the many dimensions of inequality because economic growth is driven by different factors at different stages of development, for instance, human capital exhibits various characteristics before the industrial revolution and in the modern economic growth. Economic growth at different stages is determined by various factors, before the economic reform, physical capital[1] plays a predominate role. However, after the economic reform, human capital accumulation has significant influence on development rather than physical capital (Schultz, 1960; Becker, 1962, 1964; Oded and Omer, 2002). While copious amounts of literatures addressing income inequality has been commented on and studied extensively (Khan and Riskin, 1998; Hussain *et al.*, 1994; Démurger *et al.*, 2002), relatively little research is available on inequality in other dimensions of human development, such as inequality in human capital (Zhang and Kanbur, 2005 and Yao, 2006). In some models, human capital plays a crucial role in the relationship between inequality and economic development. For instance, the models of Glomm and Ravikumar (1992), Saint-Paul and Verdier (1993) or Galor and Tsiddon (1997) have found a significant relationship between the source of inequality and the distribution of human capital.

Since 1994, investment in human capital has become the key strategy in Organization for Economic Cooperation and Development (OECD) countries (OECD, 1994) to promote economic development, fuller employment, and social cohesion. There is increasing recognition of the importance of investment in human capital for individuals, organizations and nations, because high levels of knowledge, skills and competence are essential to the future stability and prosperity. For instance, Wang and

[1] Physical capital is used to distinguish from human capital, refers to any non-human asset made by humans and then applied in production, such as machinery, buildings or vehicles capital. It often refers to economic capital in the combination of infrastructural and natural capital.

Yao (2003) found in China, the accumulation of HC was quite rapid, which indicating the same tend of China's GDP growth and welfare improvement.

Human capital is used in modern economies to identify the productive capacity of human beings. It usually refers to both the accumulation of knowledge, skills and competence through education, healthcare and nutrition provision. Therefore, education and health are key dimensions of human capital, and key inputs of the modern processes of economic production (Rosen, 1987; Appleton and Teal, 1998). Those two could create stronger incentives of human capital investment (Liu, *et al.*, 2008) and are closely related to each other. School attendance and learning ability depend on children's health capital; in contrast, greater investment in education reinforces the health capital of individuals and a country. Empirical research on human capital accumulation since the mid-1990s includes the measures of adult literacy rate, school enrolment rate, and average years of schooling (Ludger, 2003; Manuelli and Ananth 2006) for education capital, and also the fertility and infant mortality rates (Koo, 1998) and number of hospital beds and life expectancy (Asian Development Bank, 2006). Some analysis based on data from the China Health and Nutrition Survey (CHNS) reveals the disparity in years of schooling contributed to the increased inequality in the health status (e.g. Chen, Yen and Eastwood, 2010).

The background and development of human capital in education and health dimensions in China is briefly described here. Approximately 70% of the total population were not being formally educated at school before the People's Republic of China's (PRC) was established. Since then, a widespread campaign to eradicate illiteracy has been taking place. Adult illiteracy rate has declined from 52% in 1964 to 32% in 1978. After the reform, it continued dropping to 17% in 1999 due to the promotion of openness and development, and remarkably reached only 9% in 2005 (World Bank, 2001; NBS, 2006). Although years of schooling also increased two or three years in most provinces from 1990 to 2005, the differences could be as large as seven years between provinces and one year between regions. In addition, students from the Eastern region are still advantaged in terms of educational resources, such as the number of schools and teachers, although the implementation of the nine years free compulsory years and higher education expansion policies has benefited for a vast number of students among all regions.

Along with the HE expansion, from 1998 to 2005, the number of students enrolled in the HE increased 5.1 times, while government funding increased 3.3 times, and tuition fees increased 4.4 times. A research carries out by China Education and Research Network in 2006, found that between 1998 and 2003, government subsidies given to HEIs shrunk two-fold to 7,586 yuan per student, while the total expenditure on each student fell from 16,157 yuan to 15.833 yuan. According to the NBS, government financial subsidy to regular HEIs per student dropped from 8,969 yuan in 1998 to 7,244 yuan in 2006, in contrast, the tuition fees per student increased by approximately threefold to 4,932 yuan in 2005. As a result, rising debt has become an important issue for some poor/low-income families who need to support their children's HE. Debts and loans of the HEIs in the HE sector have exceeded the total expenditure of HEIs, by increasing as high as 200 billion yuan (China Education and Research Network, 26 July 2006).

Since 1949 the Chinese government also has had an extensive programme to improve people's health condition. Two indicators of the improvement has proved its efforts, the annual death rate declined from approximately 17 per 1000 in 1952 to 6.51 per 1000 in 2005 (NBS, 2006). Another indicator, life expectancy was 40.8 years in the early 1950s, 49.5 in the early 1960s and 65.3 in the late 1970s, and impressively continued increasing to 71.4 in the early 2000s (United Nations, 2005; and NBS, 2006). During the time many diseases were effectively brought under control and also people's knowledge of health care had increased. Programmes for personal hygiene and health protection were introduced and launched nationwide. Moreover, a large number of health care institutions were established by 1980 and health personnel were trained across regions (Chow, 2007, 2010).

However, those improvements have been uneven by gender, and males are advantaged. In the 20 years between 1979 and 1999, China has achieved a remarkable drop in infant mortality rate with 40.9‰ points (http://www.china-embassy.org/eng/zt/ppflg/t36623.htm). However, there is no scientifically logical reason why female infant mortality rates should be higher than that of male infants; nevertheless in 2005 there was an unbalanced male-female ratio which reached 118:100 (NBS, 2006). In the past if women were sick they delayed seeking medical treatment, mainly due to the lack of finance, time and family tradition of ignoring or

not prioritising the health of women (Paul, and Alderman, 1989; and Wang, Leung and Handayani, 2006). A similar picture could be found in girls' education. Households are more likely to investing in boys who have faster returns of schooling than girls. Recently the issue of poor health and less educated in women has received increased attention.

The gender inequality in employment, income and governance is obviously viewed. China has been facing increasing pressure from the labour force since the 1990s, especially from female workers who usually take the responsibility of looking after their families. Existing circumstances together with traditional concepts determine the limitations of working sectroal structures of the labour force for both genders. Differences in the nationwide sectoral distribution of male and female workers have a direct impact on their income, thus females are more concentrated in low-income sectors and males in high-income sectors (Wang, Leung and Handayani, 2006).

1.2 Conceptual issues

In the process of economic development in China, one of the challenging problems needed to be addressed is the growth in income disparities across regions, including the rapidly growing Eastern region and more slowly growing Western region etc. (Heckman, 2005). In this stage of China's economic development, even development of human capital is thought necessary by China's economists and political leaders for a social and economic balance and also for harmonious and sustainable development. There are several concerns of human capital development listed as follows.

The first concern is the **differences between generations**. Older groups are less-educated, and may face serious economic and social difficulties. In contrast, more education could help young groups build up their confidences in employment and also self-development through training. In addition, the correlation between the education of younger generation individuals and the educational and economic level of their parents can be disturbingly high. Therefore, the gaps of HC of this generation may pass to the next generation.

The second concern is the differences in HC distribution between the **different genders**. A significant difference in male-female educational attainment levels and also in health status, for example, physical height, indicates that historically there has been a significant below-average investment in females (OECD, 1998a).

The third concern is the **differences of HC distribution** across regions. The natural resources may determine the accumulation of social capital in the first stage of development, and then it may cause the accumulation of human capital in the latter economic development. Limits to capital mobility in this sense can create problems both in terms of equity and sustainable development.

Government policies and relevant regulations within communities and organizations also have crucial impact on the development of HC between different generations, genders and regions in terms of the public and private costs and benefits.

In a word, this research focuses on four main dimensions: its influence on different generation, different genders, distribution of the relevant resources by region, and the influence of government policies, thus giving an overall view of the human capital development in China. Some key issues will be analysed and discussed in the following chapters.

1.3 Research hypotheses and strategies

A vast number of researches focused on the issue of regional inequality on China's development over the past three decades, and most of them focused on regional income inequality. Some scholars defined regions into urban and rural areas, and some only compared a number of representative provinces from developed and less developing regions.

Throughout the research, I have attempted two kinds of regional divisions: the three-economic-zone division, which has been formally adopted since the Seventh Five Years (1986-1990) with comparative advantages and regional division of labour. In the chapter dealing with the issue of higher education expansion and social justice, rather than focusing on the three regional divisions of East, Centre and West, this

study divides the regions into an alternative type of regional category for more intuitive comparison: by removing the two Municipal cities (Beijing and Shanghai) from the Eastern region creates a fourth region. Additionally the educational and health resources are concentrated in those cities. Different regional divisions may create different pictures, but all may have limitations.

In the interim period differences in human capital development are also increasingly recognized as obvious evidence reflecting gaps in the economic development and social stabilities across regions. As human capital is one of the most valuable assets the poor may possess its distribution is of significant importance to the population in respect of human welfare and economic growth. This research **firstly** aims to explore a different perspective of the consequences of regional inequality from a non-monetary aspect of human capital development.

The empirical researches focused only on the relationship between education and health, and regional inequality in income underlying regional development. Furthermore, central to any debates about the role of human capital in the growth process across regions is the importance of the accurate measurement of human capital. **Secondly,** this research aims to fill in the gap in the empirical research and to discover an integrated picture of the contribution of income gaps to both education and health capital to among the Eastern, Central and Western regions. A more challengeable goal is to investigate the extent the differences of educational and health statuses could mirror income inequality by region from a reflective inference.

In theory, human capital development could significantly reduce inequalities as well as increasing the productivity and the promotion of its development. For instance, the progress of technology could promote the economic growth rate through a better educated, healthy and more capable workforce (Appleton and Teal, 1998). However, the return of investment in human capital takes longer than that in physical capital, and the results are also more unpredictable (Fontana and Srivastava, 2009). Moreover, a generation of educated and healthy workforce requires constant investment, whilst physical capital normally requires a one-time investment.

Considering the time impacts based on the empirical research in China, some analysis investigated that five-years spans are likely to be correlated between human capital and economic development (e.g. Islam, 1995; Bhargava, *et al.*, 2001), but some analysis are undertaken at ten rather than five years' intervals, because of the "nature of the new education series" (e.g. Cohen and Soto, 2001; Jamison, Lau and Wang, 2010). **Thirdly,** this research aims to investigate to extent and importance time plays in human capital return and its investment. It investigates whether human capital has the long term impact on growth and inequalities not only for this generation and also the next one, as Pasha argued in 1995 (Pasha *et al.*, 1995).

Based on the equal opportunities of accessing to education and health in terms of the investment, this research **fourthly** intends to examine the significant relationship between gender inequality and regional inequality from the reflectional aspect of human capital development within the contemporary China, where women have traditionally been a disadvantaged group. Their accumulation of human capital could not only contribute to healthy nationwide development through their own values in economic, political and cultural perspectives, but also importantly, impact profoundly on the human capital accumulation of next generation.

According to the regional differences in natural resources, government investment, the developments of conditions, and resources redistribution, two main dimensions of human capital development across regions and over time, together with relevant policies and implications are analysed in discussions as the **fifth** objective.

Research question

Regional disparity has been recognized as an important debating issue along with China's transition of economic restructuring since 1990. Conversely, in the meantime the policy of financial decentralization for education from the state was implemented in 1990. As a result, the new policy of co-funding system associates strongly with income levels, and also causes an unprecedented impact on various investment of household and future human capital accumulation. The association between the development of educational capital and health capital and regional economic growth respectively is focused-viewed in China from 1990 to 2005. Two major hypothesises

are examined, to some extent, the trend of regional inequality in China could affect the uneven human capital development in education and health respectively over time; and gender inequality still exists and affects regional inequality. Thus, some research questions are designed for a clear instruction and further development of this research.

1) has regional inequality been alleviated or exacerbated in China from 1990 to 2005?
2) to what extent can those two dimensions help to identify and analyse key factors behind regional disparities? and
3) what is the implication of uneven human capital development for gender inequality during the period?

1.4 Summary of the organization

This research consists of eight chapters, and Chapter one provides a brief background of the research. Chapter two reviews the relevant literature and empirical studies on inequality issues and human capital theory, particularly looks at the regional inequality changes over time and human capital development in education and health in China. It also includes the relationship between the regional inequality and gender inequality. Chapter three interprets the significance of the non-monetary measure on the regional inequality, by employing the average years of schooling, life expectancy and other key indicators in 1990 and 2005 in China.

Chapter four to seven are main chapters to present different focused dimensions and research findings of this research. Chapter four explores to what extent the health status (e.g. life expectancy at birth) reflect the regional inequality in 1990 and 2005; while Chapter five shows to what extent the educational status (e.g. average years of schooling) reflect the regional inequality at the same period of time. Chapter six investigates a layer-depth question following up the previous exploration – the relationship between the higher education expansion and social justice in 1998 and 2006. Chapter seven focuses on regional gender inequality in HC, and discovers its effects on regional inequality in 1990 and 2005. The main findings of this empirical investigation of the regional inequality and gender inequality are summarized in the

final Chapter. It also covers the implications, limitations and future development of this study, and associated with policy recommendations.

Chapter 2 Review of Inequality and Human Capital Theory

2.1 Introduction of regional inequality in China

In the 1950s Kuznets developed his hypothesis as an explanation for trends in inequality according to the level of development (Kuznets, 1955). Since 1980, a new economic growth theory has focused on human capital as the key to growth. Further empirical research has used human capital theory to analyse issues of regional inequality, such as the growth divergence between countries (Barro, 1991) and the basis of growth convergence eliminating disparities (Sala-i-Martin, 1996). A number of empirical researches have shown that the source of inequality lies mainly in the distribution of human capital (Glomm and Ravikumar, 1992; Saint-Paul and Verdier, 1993; Galor and Tsiddon, 1997). Regional inequality is usually measured by income differences; however some underlying factors are not taken into account. Those factors, to varying degrees, determine differences across regions, such as the influence of educational attainment and individual competences on productivity. Although inequality continues to affect human capital accumulation, human capital inequality measures reveal more robust results than income inequality measures. It is because that various factors may have different determined influences on inequality at different stages of development and inequality, such as educational enrolment, schooling attainment, living conditions, life expectancy and other kinds of significant human development indexes.

Research into regional inequality in China indicating the rural-urban and inland-coastal inequalities had a significant impact on economic growth. As Zhang and Kanbur (2005) summarized that over the past 50 years, inequality has peaked three times - during the Great Famine, at the end of the Cultural Revolution, and in the current period of globalization. For instance, the Gini coefficient [2] of regional inequality reached 30.9% in 1976 from about 20% in the early 1950s; during the transition to rural reform in 1984, it decreased to 25.6%. Since then, regional inequality has continued to rising, and the inequality in 2000 (37.2%) was about 16%

[2] The Gini coefficient is the most commonly used measure of inequality. The coefficient varies between 0 and 1, the former of which reflects absolute equality and the latter indicates absolute inequality. The World Bank uses a 0-100 scale instead of 0-1.

higher than that at the time of the Great Famine in 1960 (32.2%) (Zhang and Kanbur, 2005). By the year 2000, China found itself with one of the highest amounts of income inequality in the world (Yang, 2002). However, most empirical research into China's regional inequality focuses on economic factors, with less attention given to other influential factors related to human capital, such as educational and health status. Differences in the level of literacy and health contribute to variation in the level of individual productivity in China, both regionally and nationally (Mingat and Tan, 1992 and Wang 2006).

Since the mid-1990s, researchers have discovered sources of regional inequality in China, with concepts of transitional institutions, externally driven development and place-based development *et al*. (e.g. Wei, 2000; Ma and Cui, 2002) and the dynamics and multi-scalar nature of regional inequality both interregional and interprovincial (e.g. Wei, 1999; Fan, 1995a and 1995b, and Fan *et al*., 2003). Other factors investigated include fiscal decentralization, foreign investment, labour mobility, technology and privatization on regional development (e.g., Ma and Wei, 1997; Fan, 2002; Lu and Wang, 2002; Ying, 2003; Sun and Wang, 2005).

2.2 Regional inequality

2.2.1 Approaches to regional inequality

Along with global and national development, attention has turned more recently to analysis of regional inequality at the disaggregated levels of countries, regions, cities, counties, villages, households and even individuals. There has been an abundant accumulation of theoretical research on regional inequality during the process of economic development. In fact, the absolute regional differential does not only persist but also increases, with a notable increase in less developed countries contrasting with decrease in the more developed ones (Kuznet, 1955; Williamson, 1965; Tamura, 1996 and Lucas, 2000). Williamson raised a presumable concept that economic interdependence among regional units within nations should be stronger than between countries themselves. A bell shaped relationship between regional inequality and national development has been verified in a number of researches (Williamson, 1965; Galor, 1996; Prichett 1997; Temple, 1999b; Durlauf and Quah, 1999; Durlauf, 2001).

Regional inequality was researched in different dimensions within countries, including disparities in income, Gross Domestic Product (GDP) growth, knowledge and technology spillover (Kuznet, 1955; Romer, 1990a; Davies and Hallet, 2002; Petrakos *et al.*, 2003). Tamura (1996) in particular emphasizes that, theoretically, regional disparity in human capital can inhibit the formation of a large market because the differences of human capital across regions can produce market expansion in the process of human capital accumulation.

Output, consumption and income are the most popular indicators of economic development, and per capita nominal GDP is also used as an indicator of the overall level of development, well-being and regional inequality. GDP measures the value of the goods and services produced in a region during a certain period, so that income is created through the production of goods and services. Measuring comparative levels of GDP involves two indices, namely the standard deviation [3] (the overall absolute regional inequality) and the coefficient of variation (the overall relative regional inequality). In both indices, a higher value means larger regional differences. In addition, the Gini coefficient and the Theil index [4]are the most commonly used of inequality. For instance, the Gini coefficient was estimated to be 0.33 in 1980 and increased to 0.47 in recent years (Sisci, 2005; World Bank, 2005; Fan and Sun, 2008). According to the World Bank, China became an unequal developing country with the fastest pace of regional inequality in the world (Editorial, 2005).

Regional inequality is determined by a number of factors, such as location, which represents geographical characteristics, initial natural advantages and agglomeration economies. Location as an obvious determinant of economic possibilities and opportunities is however often missing in conventional economic analyses (Krugman, 1999). Regional economies differ from place to place on account of differences in natural resources, infrastructure, and factors of production or technology. Regions

[3] Standard deviation is a widely used measurement of variability or diversity in statistics. It shows how much variation from the mean value. A low standard deviation indicates a closer value to the mean, whereas a high standard deviation denotes that the data is spread out over a large range of values.

[4] The Theil index, less commonly used than the Gini coefficient, derived by econometrician Henri Theil, is used to measure economic inequality. It has the advantage of being additive across different subgroups or regions in the country, but the disadvantage of not being a straightforward representation and lacking in appealing interpretation.

with varied natural background and at different economic stages determine an uneven development in national resources, labour, capital and trade market level. Thus, regions within nations do not typically possess equal capacity for growth (Williamson, 1965; Petrakos and Brada, 1989; De la Fuente and Vives, 1995; Quah, 1999; Petrako and Saratis, 2000).

Retaining the most restrictive classical assumptions, internal factor mobility should facilitate a reduction in interregional geographic dualism and spatial polarisation. The existence of spatial inequality, depressed areas, and underdeveloped regions may suggest that internal factor flows (e.g. transportation, technology spillover) do not match the speed of faster resource augmentation and technological development in developing regions. This may cause an exacerbation of regional inequality (Williamson, 1965). For instance, the significance of transport connections in Africa can explain regional poverty and its evolution (Christiaense, Demery and Paternostro, 2005). Following Williamson (1965), spillovers may occur through a number of channels such as capital flow and interregional trade among countries (Petrakos and Brada, 1989; De la Fuente and Vives, 1995; Quah, 1999; Petrako and Saratis, 2000).

The second major factor associated with regional inequality is the openness to international trade and Foreign Direct Investment (FDI). Increased inequalities over time in modern economic growth were to be expected with market reforms and a shift from agriculture, where the major determinants of regional differences in inequality arise from the quality of the land. Uneven distribution of physical capital, FDI and trade account is almost 50 per cent of the total regional inequality in China (Wan, Lu and Chen, 2008). Another, an association between trade liberalization and rural-urban inequality was found in Vietnam (Jensen and Tarp, 2005). Trade and FDI variables are the most influential factors leading to fast rises in regional inequality, and unlike location, the contribution of capital has been on the rise in the new economic growth mode (Petrakos and Brada, 1989; De la Fuente and Vives, 1995; Quah, 1999; Davies and Hallet, 2000; Petrako and Saratis, 2000). Capital accumulation requires the development of formal financial markets and guides human capital flow to developed areas. Trade and capital flow, in turn, increase differentials to education and skills (Krugman and Venables, 1995; Stigliz, 1998; Hurrell and Woods, 2000).

In addition, local financial development and relevant policies, such as reasonable taxation management and social welfare systems, may have led to reductions in regional inequality across countries. The development of economic and social infrastructure in disadvantaged regions, and the reduction of barriers to migration between fast growing regions and those lagged behind are two key policy responses to restricted openness to trade (Kanbur and Anthony, 2007). For instance, public infrastructure - roads in Ethiopia and electricity in Uganda - helps to alleviate poverty in remote locations (Christiaense, Demery and Paternostro, 2005).

2.2.2 Debates on regional inequality in China

As the largest developing country in the world, China has continued to make impressive progress since the reforms of the late 1970s. On the eve of economic reform, China was well ahead in terms of life expectancy, infant mortality, and literacy compared with many developing economies of a similar income level (World Bank, 2007), although average nutrition levels were recognised as barely adequate (Lardy, 1983; Piazza, 1986). China has since made huge advances. Educational attainment and literacy rate, life expectancy at birth, nutrition (attained height for age) and income have improved greatly. Economic reform and openness have brought China many opportunities for development, but those improvements have been increasingly uneven, and there exist significant differences in the pace and extent of growth (Birdsall, 1999; Mazur, 2000).

Some Chinese are better off than other: regional disparities are particularly marked. Based on provincial data, such as real per capita GDP and gross value of industrial and agricultural output, most studies have found that regional inequality exists between the coastal and inland provinces and rural-urban areas (e.g. Jian 1996; Kanbur and Zhang, 1999, 2001; Ying, 1999; Song, Chu and Cao, 2000; Lee, 2000; Yang, 2002; Bao *et al.*, 2002; Qian and Smyth, 2005).

The three-economic-zone model was formally adopted in the Seventh Five Years (1986-1990). The Eastern region is specialized in export-oriented industries and foreign trade; the Central region concentrates on agriculture and the energy sector; and the animal husbandry and mineral exploitation was focused in the West (Beijing

Review, 1986a; 1986b). The open-door strategy has brought vast opportunities of foreign investment in the state's favouritism of the Eastern region, which initiates national economic development and then diffuses to the other two regions gradually. For instance, the investment policy, foreign-exchange retention policy, financial policy and price policy, these preferential policies has directly promoted economic growth in some coastal provinces.

In reality, interior provinces sell raw materials (e.g. primary and agricultural goods) to coastal provinces at low prices, while they buy high-priced products manufactured from these materials (e.g. industrial goods) from coastal provinces. "Double losses" for interior provinces, "unequal competition" between the east and west have been criticized by some scholars (Li, 1991; Zhang, 1989). As a result, two regional outcomes have been aware, namely the rise of local protectionism as interior provinces on restricting outflows of raw materials (Li, 1991; Zhang, 1992), and the regional inequality between the coast and the interior and between the three-economic-zones. Indeed the Eighth FYP (1991-1995) has focused on more even regional development.

Empirical studies of regional inequality have reported contradictory results according to different measurements. For instance, Lakshmanan and Hua (1987) and Tsui (1991) reported an increase regional inequality in terms of provincial output and income during the early 1980. Lo found a decline trend in terms of rural income inequality per capita between 1980 and 1983, likewise Huo (1994) noted a reduction in regional income inequality. Whether regional inequality has increased or decreased in the transitional period needs a thorough investigation with mixed evaluation.

Those differences may arise through a number of factors and are expected to have an impact on regional inequality. Location significantly affects regional economic development in China. Some regions, such as the coastal areas, have locations that clearly favour the development of international and national trade. Some of the regions are better endowed with resources such as infrastructure, human capital, market potentials and thus can better develop trade. Furthermore, urbanization varies from region to region and such differences affect regional income and thus inequality. We have seen an increase in returns to education and capital, which in general means

a higher income for those in urban areas or, in the countryside, to those with better education or capital resources, such as local-level party officials and their relatives (Zhou, Han and Harrell, 2008). In addition, policies of local governments and regulations of the labour market differ from region to region (Wan, Lu and Chen, 2008), such as preferential policies of importing highly-skilled employees. During the economic transitional period, increased attention was also paid to regional differences in human capital between and within regions.

2.3 Gender inequality

2.3.1 Theories about gender inequality

Gender is an important macroeconomic variable that is often neglected. Some scholars in particular point out the impact of gender differences on economic development. Increases in per capita income lead to improvements in different measures of gender equality, suggesting that the gender differentials in education and health may be a market failure, hindering low investment in women's human capital (Dollar and Gatti, 1999). Seguino (2000) concluded that the main labour market outcomes of gender differences are:

1. *Job segregation within the paid labour market and the division of labour between paid and unpaid labour*
2. *The distribution of income and resources within the household*
3. *Access to the distributions of the state, such as access to education and social safety net programmes*
4. *Credit in financial markets*

Some social observers, such as Dollar and Gatti (1999), have stated that the status of women tends to go hand-in-hand with overall socio-economic development, as witnessed by the 19th century social critic, Harriet Martineau. Women are one of the most important targeted groups because they are often subject to multiple disadvantages in the developing world (Stromquist, 1996). The relative status of women in the developing countries is poor compared to their status in developed ones. There are sharp differences in gender measures across regions of the world. For

instance, educational attainment in Latin America lags far behind that in the EU or East Asia. Increasing educational access, investment in health and improving quality of life for girls could have profound economic, social and political benefits for women and society (Hill and King, 1995).

Baker observes that, in classical economists' thought, women were "considered to be minors through their lives", subject to the control of their father in youth, husband and in marriage and son on widowhood (Baker, 1979). In recent years, economists have paid more attention to the market and non-market aspects of women's work. They have increased their interest in the effects of income distribution by gender on economic growth, especially the short and long-term macroeconomic outcomes (Cağatay, 1998, Barro and Sala-i-Martin, 1991; Grossman and Helpman, 1991 and Kim and Lau, 1996).

Those outcomes may relate to the structure of industries and affect income by gender in agriculture and the industrial cities. The choice of pursuing employment in non-farm expansion or agriculture determines whether people can increase income. Research on women and rural development has shown that more men than women leave subsistence agriculture for wage employment because of the demands of the labour market for male workers and women's family-care obligations (Matthews and Nee, 2000), especially between the ages of 20 and 35. A central paradox in economic development emerges that the life conditions of women may not be improved despite benefits for households in the aggregate (Boserup, 1970; Standing, 1978; Anker and Hein, 1986).

2.3.2 Gender inequality in China

Confucianism identifies five important relationships (*wulun*) to govern man's life: 1) Rule/minister; 2) Father/son; 3) Elder brother/younger brother; 4) Husband/wife and 5) Friend/friend. Those relationships structured traditional Chinese society and families into hierarchies governed by generation, age and gender. There were no political positions for women within a traditional family.

A woman's position in a traditional family was low. Her main responsibilities were

producing male children to continue her husband's family tree, contributing to the housework and serving the males. "It placed a strong emphasis on the importance of males, while the role and contributions of women were downplayed" (Baker, 1979, P.17). Thus in China, women worked within the household and took farm work in rural areas.

Using 1987, 1996 and 2004 data, Chi and Li (2008) showed that the gender pay gap in the Chinese urban labour market has increased across the wage distribution and that the increase was greater at the lower quintiles. Regarding the case of the rising gender pay gap in China, Gustafsson and Li (2000) found that, from the 1980s to the 1990s, the widening gap could not be attributed to difference between men and women's productivity characteristics, suggesting that discrimination may be the primary cause. So that, by deconstructing gender pay differentials across the wage distribution, they find that the gender differences in the return to labour market characteristics, also known as the "discrimination effect" or "unexplained gender pay gap", contribute most to the increase in the overall gender pay gap (Gustafsson and Li, 2000).

Chi and Li (2008) have contributed two main explanations for the rising gender pay gap in China's transitional country. Firstly, during the transition to a market economy, the return to workers' productivity characteristics, such as education attainment and employment experiences, tend to increase; if men and women have different characteristics, the gender pay gap may rise as the result of the increasing return to these characteristics. Secondly, the rising gender pay gap could also result from escalating discrimination against women in the labour market, as employers gain more autonomy to pay female employees in accordance with their discriminatory taste in a deregulated environment (Chi and Li, 2008).

2.3.3 Measurement of gender inequality

There are various dimensions of gender inequality, based on human capital theory. Dollar and Gatti (1999) have summarized the four main measures of this below:

1. *Access and achievement in education (especially secondary)*
2. *Improvement in health (as measured by gender-disaggregated life expectancy)*
3. *Indexes of legal and economic equality of women in society and marriage*
4. *Measures of women's empowerment (percentage of women in parliament in the year when women earned the right to vote)*

Gender inequality is constant over time across countries. There are a number of methods of measurement, such as gender pay differences, employment rate, educational attainment, and other more concrete measures of well-being, such as life expectancy rates and the ratio of females to males in the population and also in the labour market (Barro and Lee, 1993; Dollar and Gatti, 1999; James and Margaret, 2002; Chi and Li, 2008). A more detailed analysis will be presented in Chapter 3.

2.4 Human capital theory

The neo-classical growth model, also known as the exogenous growth model or Solow–Swan model, is a model of long-run economic growth within the framework of neoclassical economics. It was an extension to the Harrod-Domar model[5] (1946) that included productivity growth as a new term. Later, Solow (1956, 1957) and Swan (1956) developed the model with new capital, which is more valuable than vintage capital. It postulates that growth of per-capita output is the result of capital accumulation and/or technological progress. As soon as the economy reaches its steady state, per-capita output growth is only possible via technological progress, which is exogenous in the model. Nowadays, economists identify three factors in economic growth: technological change, capital and labour (Haines, 2006), with a particular focus on the contribution of human capital (Andreas and Stengos, 2008).

[5] The Harrod-Domar model is used to explain an economy's growth rate in terms of the level of saving and productivity of capital in development economics. It was developed by Sir Roy F. Harrod in 1939 and independently by Evsey Domar in 1946. They are considered to be the pioneers of the exogenous growth model.

A systematic process of economic growth is uneven in space and time. Uneven development is defined as "an inherent feather of the capitalist economy, reflecting the tendency for growth and investment to become concentrate in particular locations" (Unel and Zebregs, 2007). These areas may be advantaged in geographical position, resource base, availability of capital or the skills and competence of the workforce. Uneven development could be considered to be a result of capitalism; it combines the opposed but connected processes of development and underdevelopment. Marx argued that 'capital grows in one place to a huge mass in a single hand because it has in another place been lost by many' (Marx, 1987, p. 586) thus indicating underdevelopment is actively produced and uneven development is 'closely bound up with the logic of capital accumulation' (Frank, 1967). Gallup (*et al.*, 1999) found that location and climate have a significant influence on income growth, thus giving credence to the theory that different areas may be geographical advantaged. Once growth takes place in a particular area, it tends to absorb investment, resources and labour from surrounding regions. Workers are attracted by abundant job opportunities and high income leaving surrounding regions depleted of essential human resources (Unel and Zebregs, 2007).

2.4.1 Human capital definition

Given a man a fish, and you feed him for a day. Teach a man to fish, and you feed him for a lifetime. *Chinese proverb*

HC has been connected with the economic field for at least 50 years (Schultz, 1960, 1961; Becker, 1962, 1964). Human capital theory derived from the research by Adam Smith in the 18th century, and it formally evolved in the twentieth century (Smith, 1776; Little, 2003). In Smith's Wealth of Nations, he considered not only the "fixed capital" such as buildings, machines and land improvements, but also included

[T]he acquired and useful abilities of all the inhabitants or members of the society. The acquisition of such talents, by the maintenance of the acquirer during his education, study or apprenticeship, always costs a real expense, which is a capital fixed and realised, as it were, in his person.

Adam Smith, 1776, *p. 33*

Most economists regarded human beings as conceptual capital for three reasons: raising and educating human being entails a real cost, the product of their labour adds to the national wealth, and those investments could increase product will and national wealth (such as: Smith, 1776; Kiker, 1966). Although Smith did not define the term "capital" specifically, he was concerned about education and its return; he concluded that education provides benefits to society beyond the individual gain (Smith, 1776). He argued that the cost of human capital was "excessive" because:

1. *Apprenticeships were too long and could be completed in a much shorter period*
2. *They were a disincentive to work because apprentices had to wait for a long time to benefit from apprenticeships*
3. *They robbed a man of the property he had in his own labour and bodily skills*

Adam Smith, 1776, p. 35

Earlier economists stated that the contribution of human capital focused on a person's standard of living (income per person) and contribution to aggregate wealth. In later days, scholars turned attention to the contribution of human capital to economic growth; they considered it as the prime engine of modern economic growth instead of physical capital accumulation (Schultz, 1960; Becker, 1962, 1964; Oded and Omer, 2002). The conceptual focus is on education, training, learning by doing and other learning activates that could improve an individual's capabilities and skills and, in turn, raise future income (Psacharopoulos and Woodall, 1985, 1997). Capacities (knowledge and skills) are acquired that are analogous to physical capital and have value in the labour market. A comprehensive definition of HC has portrayed it as: "the knowledge, skills and competences and attributes embodied in individuals that facilitate the creation of personal, social and economic well-being" (OECD, 2001). Human capital is broadly defined to include not only education, but also the capability to make use of wide range of skills. As Smith summarized in 1776, two sources of human capital include education and work experience. Another much broader definition includes the quality of education, the health status of workers and other informal education, such as on-the-job training (Andreas and Stengos, 2008).

HC is an intangible asset with the capacity to enhance or support productivity, innovation and employability nationally and individually. The life-wide settings

relevant to its formation are diverse formal education (including different levels of education: early childhood, school based compulsory education, post-compulsory vocational or general education, tertiary education, adult education, overseas study, etc.), informal education (non-formal enterprise-based training and public labour market training) and learning activities (social networks, families and communities) (OECD, 1998b).

The model provided by Mankiw, Romer and Weil (1992) has demonstrated the central role of human capital in the aggregate production function and has also verified that differences in cross-country income per capita could be interpreted by differences in saving, education and population growth (Mankiw, Romer and Weil, 1992). Furthermore, they extended the Solow-Swan model to assume that the aggregate output function includes physical capital, human capital and labour measured in efficiency units.

Another approach raised by Benhabib and Spiegel (1994), follows on the traditional growth accounting methodology whereby the accumulation of inputs and total factor productivity [6] (TFP) growth determines the growth output. Treating only physical capital and labour as traditional inputs, this approach is to model human capital as contributing to the growth of TFP, rather than as an input to aggregate production. There are two contributions (Andreas and Stengos, 2008, P.7):

(1) Human capital determines the speed by which a country is able to close the gap between its levels of TFP and that of the technological leader or the catch-up effect
(2) Human capital determines the pace by which a country can adapt and implement foreign technologies domestically: the imitation or endogenous-growth effect.

[6] TFP is the measure of the efficiency of all inputs to a production process, and is often seen as the real drive for growth within an economy. Increases in FTP result from technological innovations or improvements in labour and investment. Growth in TFP represents output growth not accounted for by the growth in inputs. --- Hornsten and Krusell (1996).

2.4.2 Human capital dimensions

Based on the definition of HC, this research focuses only on the two key dimensions of human capital, the education capital and health capital, which has the potential to contribute to HC accumulation for individuals and nations, and the detailed description is as follows respectively.

1) Education capital

According to HC theory, education is a form of HC that could raise the productive capacity nationally and individually in economic production (Schultz, 1971; Becker, 1975). Education is treated as a capital good: it is difficult to obtain since it needs to be apportioned, and served as an input into the production of other goods (Olaniyan and Okemakinde, 2008). Education is an important instrument that could increase productive human capability and skills through investment (Sweetland, 1996). Education capital mostly emphasizes formal education, which is inclusive of kindergarten, primary school, secondary education, college or higher education, and post-higher education.

Education capital is an input not only for production activities, but also for innovation, research and development activities, such the creation of new technology and products (Schumpeter, 1973; Van-Den-Berg, 2001; Bronchi, 2003). In mainstream economic analysis, education is seen as a production process. Inputs (such as students, teachers, and textbooks) combine to yield desired outputs (such as student learning) within the education sector and larger societal outcomes outside the sector (such as increased earnings in the workplace or greater social equality) under the prevailing educational technology (encompassing pedagogy, curriculum, and school organization) and input prices. A major application of economic analysis is the consideration of ways of improving efficiency in educational production. Analytically, educational efficiency can be divided into internal and external efficiency.

The internal efficiency of education relates education outputs to inputs, and the external efficiency relates educational outcomes to inputs. Both could be improved if sufficient educational resources are provided (World Bank, 1995). Educational

economic analysis is centrally concerned with the production of education outputs and with education costs (Tsang, 2002). For instance, family background and socio-economic factors (Alexander and Simmons, 1975), as well as school factors e.g. teachers' characteristics and school resources (Heyneman and Loxley, 1983) have a powerful influence on students' attendance and learning outcomes. In addition, education creates an opportunity to earn high income for potential workers in the competitive labour market (Psacharopoulos and Woodall, 1985, 1997). Even Bronchi (2003) asserts that increases in levels of education in a society may, in certain instances, increase the inequalities in income distribution.

On-job training as an informal education form is strongly associated with improved productivity, income and employment chances, and it plays a role parallel to that of education. Investment in training is "essential to increasing productivity (Alan and Philip, 2001) and maintaining competitiveness" (OECD, 1998a). Trained workers have more opportunities to gain better wages and increased productivity than non-trained workers (OECD, 1994) and also get higher quality jobs (Fay, 1996). For instance, a survey of employers in the Netherlands in 1994 showed that workforce training increased productivity by 12 percent and wages by 16 percent (Groot, 1999). Furthermore, on-job training has the greatest impact on performance connected with changes in market demands and work structure, especially with regard to technological innovation in a modern economic environment (Ichniowski *et al.*, 1997; Black and Lynch, 1996).

Based on the definition of HC, human capital is normally understood to refer to the skills and knowledge of the labour force in an economy, which are essentially acquired through formal education and also informal education – on the job training. Knowledge, skills, competences, and other attributes combine in different ways according to the individual and the context. Work experience and training could enhance individual capabilities, individual economic productivity and also competitiveness in the labour market. Labour with better capability could generate more productive capacities of the workforce and highly valued services. In terms of Lancaster's (1966) characteristics, labour is the only factor of production, and only highly-skilled labour can produce higher-quality goods. The presumption from Romer's endogenous growth theory (1990a, b) is that an educated and trained labour

force is better at creating, implementing, and adopting new technologies, thereby generating growth.

Attracted by the empirical literature entitled "Why are some countries richer than others?", Manuelli and Ananth (2006) identified length of schooling period as a measure of the quantity of human capital and they viewed the amount of human capital per year of schooling and post-schooling training as a measure of quality. In particular, on-the-job vocational/technical training provided by employers and adult education programmes financed by individual learners are now popular strategies in adult education (Xiao & Tsang, 1994; Tuijnman, 1996). The large expansion of adult learning opportunities is seen as a "silent explosion" (Belanger & Tuijnman, 1997), which provides learning opportunities beyond formal schooling and begins to mark the workplace as a continuing place of learning.

2) Health capital

Health is another crucial indicator for the further development of developing countries (Bhargava *et al.*, 2001). Conceptually, health is a foundation for people's potential productivity: a healthy person works more effectively and devotes more time to productive activities (Emanuele, *et al*, 2004). Healthier workers are physically and mentally more energetic and robust. For instance, Nicholson found that the value of "living" capital was five times the value of the stock of physical capital in the UK. (Nicholson, 1891).

Various scholars have argued that improvement in health through higher expenditure on healthcare is another way of increasing human capital and national wealth. Grossman (1972) found that health capital is accumulated by purposeful health investment. At a national level, health investment could not only promote capital accumulation but also enhance economic growth. On the other hand, health investment makes high individual production possible through less sick time and more devoted working time. In addition, it results in prolonged longevity which contributes to the total productivity in places of working and in society (Leuong and Wang, 2010). In reality, health care is likely to be a normal good at the aggregate

level. By excluding the consideration of health investment in economic development, conventional models could be severely biased.

2.4.3 Human capital function

In order to understand the importance of human capital, the relevant issues such as what kind of role it is playing and how it accumulates and brings benefits for individuals and countries attract our attentions on its function.

1) The most important engines of economic growth

From the endogenous growth perspective, human capital accumulation has been recognised as one of the most important engines of economic growth. Romer (1990b) developed a growth model, assuming that the creation of new ideas/designs is a direct function of human capital. Persistent accumulation of knowledge by human beings, either by intention (Lucas, 1988) or through learning by doing (Azariadis & Drazen, 1990), promotes productivity of labour and capital, and is the driving force of economic growth (Kim, 1998).

Although it is obvious that people acquire useful skills and knowledge, it is not obvious that these skills are a form of capital, that this capital is in substantial part a product of deliberate investment, that it has grown in Western societies at a much faster rate than conventional capital (non human capital), and that its growth may well be the most distinctive feature of the economic system. It has been widely observed that increases in national output have been large compared with the increases of land, man-hours and physical reproducible capital.

Schultz, 1971, p.24

2) A facilitating factor on catch-up with leading countries

The existing literature on the role of education in economic growth usually employs standard source-of-growth equations based on a dynamic Cobb-Douglas (1928) aggregate production function, which can easily be extended to include human capital as a determinant of the economy's growth rate. Barro and Lee (1993) and Baumol

(1986) have argued that human capital plays the role of an important facilitating factor during the process of international transfer of technology from innovating countries to "imitating" ones, who are supported to "catch-up" with the most advanced countries. Furthermore, Chow (2005) has suggested that the necessary conditions for catching-up include: education and the accumulation of human capital, institutions and market liberalisation and the ability to create or adopt new technologies.

This new, improved theory emphasises the importance of education and human capital, which are the most basic conditions for a late comer catching up through 'learning by doing' and 'learning by watching' (Azariades & Drazen, 1990). Meanwhile, they are the most fundamental conditions for innovation, knowledge creation and skill development (Yao and Wei, 2006). In terms of an overview of countries' global development, in contrast to many other developing countries in Africa and Asia, China, India and the Southeast Asian countries have succeeded in their development of education and human capital accumulation (World Bank, 1993; Yao and Zhang, 2003).

3) An instrument of development through investment in people

Human resources constitute the ultimate basis of wealth of nations. Capital and natural resources are passive factors of production, human beings are the active agencies who accumulate capital, exploit natural resources, build social, economic and political organization, and carry forward national development.

Psacharopoulos and Woodhall, 1997, p.102.

The researchers classified the knowledge, skills and competences, required by people as a form of HC. In 1999, Laroche *et al.* further extended the notion to include 'innate abilities'. Investment in people could bring benefits for individuals, communities and society, and also promote their development (Sweetland, 1996).

Most investment is from public sources that may encompass an awareness of education and health services but, in many countries, a substantial portion is from private sources. Families make a considerable investment in activities that can directly

or indirectly improve their quality of life and also contribute to their future career development. Parents' concepts on fostering children's learning attitudes are important inputs to the accumulation of their children's HC. Outlays for the cost of tuition, educational materials and other costs associated with formal educational can have a direct impact; other spending may influence the quality of children's lives indirectly, such as willingness to invest in education for personal development of themselves and subsequent generations in their journey of life-long learning. Private investment in education also has an effect on growth in the social stock of knowledge and skills, which increases the effectiveness of time spent in school by later cohorts (Stokey, 1991).

As a micro-level, as an individual, human capital is accumulated through schooling and training and self-development. A person's level of human capital upon leaving school and entering the workforce depends on the length of the investment period chosen, and on the effectiveness of the time spent, which is determined by the social stock of knowledge and skills available. The level of human capital upon entering the workforce determines a person's wage rate over the rest of his working life. Therefore, choices about the length of the investment period are made by balancing the opportunity cost of later entry into the workforce against higher wage rate paid to more skilled labour.

2.4.4 Human capital stock and flow

The stock of HC is the accumulation of HC, including the level of skills, knowledge and competences held at any one time by individuals. Within a country, the total stock could influence its prosperity and international competitiveness; for an individual, it could also influence their social participation, employment and income level, and even security and quality of life. Governments have thus implemented policies to encourage people to acquire specific skills and competences through more investment in education and healthcare (OECD, 1998a).

As discussed by Nelson and Phelps (1966), human capital has long been stressed as another prerequisite for attracting other factors, such as physical capital, which contributes measurably to per capita income growth. Lucas (1990) has suggested that

physical capital fails to flow to poor countries because of their relatively poor endowments of complementary human capital, also the technology far behind well developed nations.

Although many studies of the international academic flow adopt the pull-and–push approach[7], the direction of human capital flow is not determined solely by an individual's choice; it can also be affected by resource distribution or policy interference (e.g. Pan, 2008). For instance, the different educational composition of population by region represents the different structure of human capital across regions. The developed Eastern region has the highest proportion of college and above population and the lowest illiteracy rate. On the contrary, the education level of the Central and Western regions lags behind, which is mainly related to the less developed economy and the outflow of skilled labour (Zhang and Wang, 2009). It is common sense to see that the inflow of skilled labour means the attraction of well developed local economic growth and that, on the contrary, the outflow of labour represents backward local economic growth. In reality among the floating population, the Eastern region keeps absorbing high quality graduates and workers from non-Eastern regions in China. The richer region could attract more physical and human capital from other regions to centralize the resources for optimized use. Some studies have investigated the idea that more policy implications may affect human capital flow, such as the hukou system and some preferential recruitment policies of local government (Chen and Martin, 1996; Cai *et al.*, 2002; Pan, 2008). For instance, hukou system is likely to have determined differences among people at the first place, those from the richer region may have more advantages to enjoy their opportunities of better educational and health care provision locally, than the poor regions.

2.4.5 Human capital measurement

An intangible feature of human capital is that stock cannot be observed directly; thus all estimates of the stock must be indirectly constructed. It is not easy to quantify

[7] It is a neoclassical theory that emphasizes the tendencies of people to move from densely to sparsely populated countries/areas or from low- to high -income countries/areas. Push factors include demographic growth, low living standards, lack of economic opportunities and political repression. Pull factors are demand for labour, availability of land, good economic opportunities and political freedoms.

human attributes with economic value and to aggregate all relevant variables into reliable measures (OECD, 1998a). Thus, neither an individual's HC stock nor a nation's HC stock can be precisely estimated. In Temple's new empirical evidence in the economics of growth, he points out that "the literature uses somewhat dubious proxies of human capital aggregation" (Temple, 1999a). Later, Borghans *et al.* (2001) stated that the empirical measurement of skills is comparatively underdeveloped when considering the further theoretical and practical importance of skills.

The empirical research on human capital accumulation in the new economic growth model since the mid-1990s includes three approaches identified by OECD (1997), including the educational, investment and education-income approaches. Three alternative approaches suggested by Trinh, John and Les (2003) are "cost-based approach"; "income-based approach" and "educational stock-based approach". Investing in education could promote better health, lower crime, and economic growth and greater social cohesion for public; and also improve greater personal satisfaction and individual health status (OECD, 1998a). Some other measures take other dimensions of human capital into account, such as the adult literacy rate, school enrolment rate and average years of schooling for measuring educational capital (Ludger, 2003; Chen and Qiao, 2008); life expectancy at birth, mortality, etc. for health capital (Castelló-Climenta and Doménechb, 2002; Cowell, ALM, and FSA, 2008) and investment in training and increased income for trained workers (OECD, 1994).

Individual characteristics such as educational attainment, skills and competence are seen as relevant to the functioning of individuals in the labour market. One way of quantifying the individual HC stock is by aggregating the higher earnings of individuals associated with particular attributes. A labour-income-based (LIB) measure is based on earnings differentials with the advantage of allowing for changes in the relative productivity of workers over time and across regions (on the assumption that earnings are a good guide to marginal productivity). Also, it assumes that workers with different levels of educational attainment have various levels of skills. For instance, if individuals are studying different subjects at the same level of attainment or have working days lost through sickness, their productivity and earnings are reflected variously.

2.5 Human capital, regional and gender inequality

2.5.1 Empirical research on human capital and regional inequality

1) Education capital and inequality

From the 1960s scholars began to factor education into accounts of economic growth. Schultz and Becker showed that education builds up personal productive capacity in economic production (Schultz, 1971; Becker, 1975). Moock and Addou (1994) demonstrated a positive significant relationship between education and productivity. Empirical studies in the field of agriculture also found a positive and significant relationship between productivity and education (Moock and Addou, 1994). At a macro level, education was also associated with economic growth. Spending on education can be considered as an investment activity with both costs and benefits, and thus subject to a cost-benefit analysis. Furthermore, Psacharopoulos (1994) found that, for developing countries, a higher level of education could bring a higher rate of return. Similarly, the more highly an individual is educated, the more able he/she is to grasp knowledge and skills, which can then be applied with greater effectiveness. This in turn raises his/her productivity capacity. Education can also be said to provide the means to earn a higher income in the labour market (OECD, 1998b). As Reich (2002:44) states, concerning the reflection of education on inequality in income, most people with a lower-income are those "lacking an adequate education". He defined education as "the first prerequisite to success in the new economy".

Taking regional differences into account, some scholars have emphasized that education could enhance regional capacity (Birdsall, Ross and Sabot, 1995; Qian and Smyth, 2005; Reuter, 2006). According to research on inequality in education using the Gini and Theil indices of schooling for 140 counties from 1960 to 2000 (Vinod, *et al.*, 2002), Wang and Yao have illustrated that China's progress has been impressive but there are reports of a slowdown in the expansion of average attainment, and widening regional disparities since 1990 (Wang and Yao, 2003). One underlying factor is that the public expenditure on education has been stagnant, at 2.5 percent of GDP, and unevenly distributed. Public investment for primary education is inadequate,

especially in poor regions, where the possibility of private funding is limited (Thomas, Wang, and Fan, 2002).

2) Health capital and income

Evidence that better health improves labour productivity has been found in developing countries (Basta *et al.*, 1979; Spurr, 1983; Strauss and Thomas, 1998; Bhargava *et al.*, 2001; Leung and Wang, 2010). It was further observed in aggregated data at a regional level that improvement in health would drive economic growth forward in developing countries (Fogel, 1994, Fogel and Costa, 1997 and Case *et al.*, 2002). During China's economic development, health improvements have increased productivity at work and have increased the ratio of national working population to the non-working population. School attendance and learning outcomes have also improved, which are achievements that enhanced investment in education and physical capital (Jamison, Lau and Wang, 2010). For instance, research found that health status closely correlates with international trade and foreign direct investment (e.g. Bloom and Sachs, 1998).

The healthier a working population of a country is, with the capability to work longer hours, the more vigorous will be the economic development. As Kotlikoff (1989) found, "life-extension is likely to raise capital and output per worker as well as welfare". Ehrlich and Liu (1991) have argued that increased longevity could contribute more to economic development through motivating human capital investment in the next generation. Based on the findings of Bloom and Canning (2000, 2003), health in the form of life expectancy, has appeared in many cross-country growth regressions, and investigators generally find that it has a significant positive effect on the rate of economic growth. Another result from Bloom, Canning and Sevillar (2003) is that health has a positive and statistically significant effect on economic growth. It has been suggested that a one-year improvement in a population's life expectancy contributes to a 4% increase in output.

Health-care investment and hence longevity are positively correlated with income, which suggests that high income countries are likely to have longer life expectancy than low income countries (Cochrane *et al.*, 1978; Parkin *et al.*, 1987; Gerdtham *et al.*,

1992). Furthermore, in Leung and Wang's very recent model that considers demographic structure, increases in longevity are found to be associated with higher levels of per capita GDP in the same way as income (Leung and Wang, 2010). In other words, as life expectancy rises, higher-income/savings tends to outweigh the negative impact arising from "a higher dependency ratio in the population" (Lee, 2000; Bloom *et al.*, 2002).

Relevant studies on the effects of health on income growth could be divided into three categories: historical case studies, studies of the individual or household level on the impact of specific diseases and cross nation levels on income level and studies of income growth rates or investment rates. Fogel and Costa (1997) introduced the concept of health and nutrition assessment into an economic history of Europe. Later, some studies corroborated the historical findings at the individual and household level among different countries, such as five Latin American countries (Strauss and Thomas 1998; Savedoff and Schultz, 2000) and China (Liu, *et al.*, 2006). Cross-country studies of the impact of health on income levels and growth rates could be traced back to the World Bank's World Development Reports (WBDP) on poverty (World Bank, 1980; World Bank, 1993). For instance, Bhargava *et al.* (2001) found the effects of initial health status on growth were strong in low-income countries over five years.

3) Education capital and health capital

Education and health are two main dimensions of human capital. Each plays a significant role in economic growth and each affects to the other. On the one hand, greater education raises income wealth, leading to an increase in spending on health or further education (Schultz, 1999) with a resulting improvement in life expectancy. On the other hand, greater education could provide access to sufficient information related to improved health, enabling people to look after themselves better. For instance, better educated people with knowledge are more likely to visit more highly skilled doctors, take their prescribed medicines more regularly, pay more attention to nutritious diets, and cultivate themselves to have a more healthy lifestyle, etc. (Becker, 2007).

In Grossman's (1972) demand model for health, he suggested that age, income and education all affect individuals' health demands. However, the focus was only on differences in individuals' input, not on the stock at regional or national level. Some scholars have investigated the positive correlation between income wealth, schooling and health capital (Muurinen, 1982; Muurinen and Grand, 1985; Case *et al.*, 2002). Barro (1997) suggested that both educational attainment and the life expectancy correlated with growth in terms of real GDP per capita. Bloom and Canning (2000, 2003) worked out a utility function to indicate that an increase in schooling raises life expectancy.

Recently, Jin Feng and colleagues explored the relationship between wealth, education and health by using the China Health and Nutrition Survey data for 1991 and 1997 (Feng, Qin and Yu, 2010). They found that higher education positively correlates with better health but negatively correlates with medical expenditure. The escalating cost of health care may have strongly affected less educated people since they may have more need to maintain health and earn a living (Feng, Qin and Yu, 2010).

2.5.2 Empirical research on human capital and gender inequality

It is a common phenomenon that women are far behind of men in terms of their educational attainment, health condition and economic, political and social status. Using cross-country and panel regression, scholars have investigated how gender inequality in human capital affects long-term economic growth from the dimensions of education, health or the labour market. Gender inequality is found to have an effect on economic development across countries, especially in developing countries (Barro and Lee, 1993; Barro and Sala-i-Martin, 1995; Klasen, 2002; James and Margaret, 2002; Michael *et al.*, 2004).

The traditional concept of gender inequality places women at a disadvantage. When facing work-family conflicts, women are more likely than men to sacrifice their careers and independent economic income to look after families, with consequences for market-based opportunities (Jacob and Gerson, 2004). Thus, a husband earns more than the wife as mothers were encouraged to reduce their time at work and fathers to

maximize their earnings by working more. Gender differences in the time spent at work and in parenting present the persistence of unequal opportunities and family responsibilities between women and men. The amount of time spent at work is linked to persistent gender inequality in labour participation rates (Gornick, 1999), which could contribute to longer-term inequalities in income and reinforce patterns of gender segregation in jobs and occupations (Gornick and Jacobs, 1998; Blau, Ferber and Winkler, 1998; Rubery, Smith and Fagan, 1998; Padavic and Reskin, 2002). Therefore, these inequalities in paid working hours could cause an imbalanced power at home and to wives' economic vulnerability (Hobson, 1990; Bianchi, Casper, and Peltola, 1999).

The story of gender inequality portrays differences in the class positions, between men and women, with women in poor, lower paid and exploited jobs relative to the men (Davison, 1983; Benería and Roldan, 1987; Deere, 1990 and Wright, 1996). It may be a result of the fact that women have fewer opportunities for education & training (Seguino, 2000) and less investment in health care than men, and the return on their investment in education and health is also lower (Feng, Qin and Yu, 2010). For instance, in 1990, the ratio of females educated at secondary school level only reached 4.2%. In contrast, the national average rate reached 11% (People's Census, 1993). In addition, 50% fewer trained female workers had college certificates than male workers in 1998 (NBS, 1999).

Scholars have investigated the idea that female educational attainment has a positive effect on economic growth (Benavot, 1989; Hill and King, 1995; Seguino, 2000). Subsequently, Klasen (2002) suggested that gender inequality in education directly influences economic growth by lowering the accumulated human capital. He found that 0.4-0.9 percentage point of difference in annual per capita growth rates between East Asia and Sub-Saharan Africa and the Middle East was impacted by the gender gap in education among these regions (Klasen, 2002). China has achieved striking progress in women's literacy rate in the past three decades across regions, so that reduced gender inequality has contributed to long-term human capital accumulation and regional economic growth. However, the differences in educational attainment between men and women in both poor and well-developed regions consistently reflect

the regional pay gaps by gender, especially between the western inland and coastal area, and between the rural and urban areas (Chi and Li, 2008).

In poor countries, women are inadequately treated in terms of health status, which is a result of income inequality. Many developing countries exhibit considerable gender inequality in health outcomes. Amartya Sen and others (Sen, 1989; Klasen, 1994) refer to China's "missing women" on account of the elevated mortality rates for girls and women. Women averagely have lower age-specific mortality rates than men but higher life expectancy (Jacob and Gerson, 2004). However differences in longevity in poor countries seem smaller: life expectancy was 48.3 years for men and 51.3 for women in 1990; but larger in rich countries with 73.0 years for men and 79.1 years for women (Dollar and Gatti, 1999).

As a supportive measurement, gender inequality with regard to various rights across countries was ranked in Humana's model (1992) on a scale from 1-4. The average rate for women's economic rights of income to the same job is 2 in the poorest countries and 2.9 in the richest. The rating of women's rights of marriage is 2.3 and 3.6 in poor and rich countries respectively. Similarly, the share of parliament seats occupied by women is 7% in poor counties and 17% in rich ones. A programme which aims to safeguard women's rights in terms of economic and political status and also to improve the quality of life and personal development for Chinese women has been implemented since 2001. The focused regulations include the promotion of women's full participation in economic, political, cultural and social development, and the provision of equal opportunities in schools, healthcare services, the labour market and social affairs management etc. (The programme of women's development in China, 2001-2010).

2.6 The gap in the literature review

Regional inequality has been approached from different standpoints, including geographical and socio-economic terms. Mainstream scholars investigating this issue by way of monetary measurement, such as: Gini-coefficient, GDP or income per capita stated that, economically regional inequality may have increased over the last three decades. However, little attention was paid to positive signs based on the human

development index, and scholars rarely observed the overall view of the combination of economic and social development in order to investigate the trend of regional inequality in recent years. Therefore, the concept that growth is uneven and that preferential policies are granted to certain regions may be seen as being illogical.

Human capital has played different roles at various stages of the process of economic growth in China. At present, human capital stock has become a major issue for research into economic growth and regional inequality in China. However, most empirical research has limited human capital stock to either education capital or health capital among employees. It has combined the quantitative measurement of human capital with the qualitative one, which may lead to more or less different research outcomes. The different levels of schooling have not been distinguished, nor the time lag of investment has been taken into account, the picture of the relationship between human capital development and regional inequality is unable to be comprehensively traced out. Another dimension of human capital – that of training / working capital is less taken into account due to the lack of public data. As a result, the current human capital stock is not estimated comprehensively and accurately.

In practical terms, this research only focuses on the two main dimensions (education and health) of human capital, and on-job-training is not considered at this stage. The educational and health capital with other relevant factors among three economic regions can sufficiently present a picture of regional income inequality in China, which is shown in subsequent chapters. As a result, the significance and contributions of this research shows itself here.

Here, income inequality could be represented as regional inequality. This research focuses on the way relationships between education and health capital relates to income inequality when considering the immediate action of investing in education and health care, and the effects of the time taken to reap the investment return. Higher income could drive people to invest more in education and health, in terms of regional inequality it could reflect the extent, to which years of schooling and life expectancy are affected by pay differences across regions. By taking the cyclical relationship of “investment in education - education obtained – income – investment

in education" into account, further factors contributing to regional inequality would complicate the research.

Furthermore, the quantity of education and health is not equal to their quality. One of the limitations for most empirical research is equating the quality to the measure of education and health available to the population. The limitations of measurement and varying indicators chosen in this research could cause different influential results of regressions, thus the aim is to attempt to combine both the quantitative and qualitative measurement to give a different perspective of regional inequality. More detailed analysis will be covered in Chapter 3, and other limitations of this study are to be found in the final chapter.

Chapter 3 Methods and Data

3.1 Methods

3.1.1 The empirical models

Since the 1970s, a new economic growth theory has focused on human capital as the key to growth (Becker, 1975, Romer, 1986; Lucas, 1988). The theory, the first logical way to measure the significance of its accumulation on growth, was to use GDP or Gross National Product (GNP) as a dependent variable and a number of combined measures of income with variables such as educational attainment or life expectancy (Sen, 1994; Crafts, 1997). The equation for production function and the developed ones are listed below.

$$Y = f(K, L, HK) \qquad (1)$$

$$\ln Y = A + \alpha_1 \ln DK + \alpha_2 \ln FK + \beta \ln L + \gamma \ln HK + \varepsilon \qquad (2)$$

Where *Y* indicates the GDP; *K, L,* and HK refer to physical capital, labour and human capital respectively. *K* could be broken down into domestic capital and foreign capital, which are represented by gross domestic investment as a percentage of GDP (DK in Equation 2), and foreign direct investment (FDI) stock as a percentage of GDP (FK in Equation 2). HK indicates the human capital accumulation, which is a proxy with composite indicators, including the quality of education and health. They are represented by total years of schooling at various levels (e.g. Barro and Lee, 2000), or literacy rate and gross enrolment ratio at certain levels (World Development Indicators and United Nations Educational, Scientific and Cultural Organization - UNESCO) and infant mortality, and life expectancy (e.g. Bloom and Canning, 2000). By taking the logarithm of the two sides of equation 1 and differentiating them, Equation 2 is obtained. Where $\alpha_1, \alpha_2, \beta$ and γ represent the elasticity of production relative to domestic capital, foreign capital, labour and human capital variables. e is an error term, which is treated as a random variable.

Focusing on a comprehensive picture of human capital accumulation in China, a current model considers the three factors of human capital stock, namely the number of employees, quality of education and health correlate (Bian, 2004).

$$H_{hc} = LE_{edu}A_{health} \quad (3)$$

Where H_{hc} is regional human capital stock; L is the total number of labours, E_{edu} is the coefficient of quality of employees' education; A the coefficient of quality of employees' health. These three indicators are represented by the total number of employees in the labour market; average years of schooling and average life expectancy at birth.

3.1.2 Model of this research

1) Regional inequality

Since the emergence of a new economic growth theory in 1980, it has been argued that regional inequality may be connected with human capital inequality (Oded and Omer, 2002). In addition, the Human Development Report of 2005 claimed that human capital has been gradually converging for the past 40 years. Developing countries have been catching up with rich countries from a low base in areas such as life expectancy, child mortality and literacy (UNDP, 2005). By using Gini coefficients and the distribution of education by quintiles for 108 countries from 1960 to 2000, Amparo and Rafael drew two main conclusions: a) most countries in the world have made many efforts to reduce inequality in human capital distribution; b) in the estimation of standard growth and investment equations, human capital inequality measures display more robust results than income inequality measures (Amparo and Rafael, 2002).

Based on the three factors of the human capital model raised by Bian (2004), the result of human capital accumulation may change the initial functions of variables when multiplying them. For instance, low quality of education or health multiplied by a large number of employees can generate a big HC stock. Dividing the total

registered population of each province would accurately retain the original influential functions of these three variables, which represent the per capita HC stock by province. By so doing, the effects of labour flow and migrant issues could be avoided. The regional human capital stock could then be standardised by dividing the maximum value of the per capita HC stock among all the provinces. Eventually it is valued from a scale of zero to one for a direct viewing, as calculated from the equation below:

$$HC_{hc.reg.} = LQ_{edu}Q_{health} \quad (4)$$

$$HC_{hc.reg.\,stand.} = \frac{L/Pop. * Q_{edu}Q_{health}}{HC_{hc.reg.\max}} \quad (5)$$

Where $HC_{hc.reg.}$ is the regional human capital stock; $HC_{hc.reg.\,stand.}$ is the standardized per capita regional human capital stock; $L/Pop.$ is the employment rate of total population; Q_{edu} is the coefficient of quality of employees' education; Q_{health} the coefficient of quality of employees' health; $H_{hc.reg.\,stand.}$ indicates the standard of regional human capital accumulation; $HC_{hc.reg.\max}$ is the maximum regional human capital accumulation.

2) Regional inequality in education and health

This research focuses on the contribution of human capital development to regional inequality and investigates the changes of human capital accumulation and also regional inequality in China from 1990 to 2005 from two aspects (education and health) in different models. How the development of education and health status reflects regional inequality is examined. The first approach observes to what extent, the income variable influences the average years of schooling; and the second approach investigates to what extent income affects the average life expectancy at birth.

The equations of regional inequality in education and health status are as follows respectively.

$$H_{edu.} = A + \alpha_1 L_{east} + \alpha_2 L_{west} + \beta I_{inc.} + e \qquad (6)$$

$$H_{heal.} = A + \alpha_1 L_{east} + \alpha_2 L_{west.} + \beta I_{inc.} + e \qquad (7)$$

Where $H_{edu.}$ is the average years of schooling of people aged 6 years and above; $H_{heal.}$ denotes people's life expectancy; A is the constant coefficient. L_{west} is the dummy variable for the Western region; zero indicates non-Western regions, and one indicates the Western region. L_{east} is the dummy variable for the Eastern region; similarly zero indicates non-Eastern regions, and one indicates the Eastern region. The focus of interest for this research is the wider gaps between the Western and Eastern regions, rather than between any other two regions. If the Western region is excluded, all other regions will probably have a negative sign and if the Eastern region is the exclusive one, the sign will be positive. I_{inc} indicates people's per capita real disposable income. e is an error term, which is treated as a random variable. The remaining $\alpha_1, \alpha_2, \beta, \gamma$ are coefficients of the Eastern region variable, the Western region variable, income and education variables respectively.

In addition, this research takes time lag into account (five years and 10 years time lag) in order to explore whether time concern plays a vital role in human capital accumulation, also whether human capital has the long-term impact on regional inequality. Further detailed models will be displayed and analysed in the following chapters.

3) Gender inequality

Also based on the HC stock model raised by Bian in 2004, the model of contribution of gender inequality in education and health to regional inequality of HC is displayed as follows.

$$HC_{hc.reg.} = \hat{A} + \hat{\alpha} HC_{gi.edu.} + \hat{\beta} HC_{gi.health.} + e \qquad (8)$$

Where $H_{hc.reg.}$ is the regional human capital stock from the perspective of human capital, it represents the degree that gender inequality can contribute to regional inequality. $\hat{A}$ is an estimated constant, $HC_{gi.edu.}$ denotes gender inequality in education, and $HC_{gi.health.}$ denotes gender inequality in health. $\hat{\alpha}$, $\hat{\beta}$ are estimated coefficients of gender inequality in education and in health respectively. e is an error term, which is treated as a random variable, covering some factors, such as the implementation of some relevant policies, which are not the focus of this research.

3.1.3 Research questions

A number of research questions on regional inequality in education and health and also gender inequality are as follows:

Regional inequality

1) To what extent can average years of schooling and life expectancy reflect regional inequality?
2) What is the correlation between income, average years of schooling and life expectancy?
3) Is there any improvement in regional inequality from 1990 to 2005 when considering these educational and health indicators respectively? If so, what affects this improvement?

Gender inequality

1) How is human capital by gender accumulated differently when considering its educational and health dimensions?
2) To what extent does gender inequality in the education and health dimensions influence regional inequality in HC?

3) Is there any improvement in gender inequality between 1990 and 2005 when considering these educational and health indicators? If so, what affects this improvement?

3.2 Data

3.2.1 Definitions of regions in China

Since 1978, the implementation of Deng Xiaoping's policy allowed some people to get rich first and other people to follow and allowed some regions to develop quickly first and other regions to follow (Deng, 1994). Based on this policy, the special economic zones from coastal cities were established to encourage foreign direct investments (FDI) in private ownership in the cities (McMillan and Naughton, 1992). Nothing could stop China's rapid development over the past 25 years, even if a high price would be paid for this: there is an uncontrollable trend of rising regional inequality. Finally, several inequalities of regions have been generated between coastal areas and inland regions, intra-provincial, inter-provincial, and urban-rural regions. For instance, urban-rural inequality has been frequently observed. The World Bank (1997) reports that from the late 1980s to mid-1990s, more than one-third of China's total inequality and over half of inequality growth could be interpreted by urban-rural inequality. After the reforms, the urban/rural divide has been maintained by the strict population registration system (Yao, 2005).

Analysis of regional inequalities is influenced by the preferred method to aggregate provinces, the common geographic unit for regional analysis. Since the 1980s, Chinese planners have used a three-zone model comprising East, Central and West China (Yao and Liu, 1998; Linge and Forbes, 1990; Fan and Sun, 2008). The Eastern region includes Beijing, Shanghai, Liaoning, Tianjin, Shandong, Hebei, Jiangsu, Zhejiang, Fujian and Guangdong; the Central region includes Heilongjiang, Jilin, Shanxi, Henan, Anhui, Hubei, Hunan and Jiangxi; and the Western region includes Xinjiang, Inner Mongolia, Ningxia, Shaanxi, Qinghai, Gansu, Tibet, Sichuan, Chongqing, Yunnan, Guizhou and Guangxi. This classification places Guangxi in the West, though from the mid-1980s until the early-2000s the official three-region schema included Guangxi in the East, despite its low level of development and lack of

ocean ports. This approach captures well the effects of China's opening up, whereby FDI and trade development has fanned out from coastal China to the inland provinces. This is evident in the anomaly of including Guangxi[8] in the Eastern region and Inner Mongolia in the Central region, when both had a GDP per capita equivalent to the average level of the Western region provinces. The East-Coastal zone the most open and technologically advanced zone, attracts the lion's share of FDI, and contains China's leading cities.

However, the three-zone model masks large North-South differences and does not reflect the economic geography that underpins agriculture and the spatial organization of China. Chinese planners have recently adopted a modified four-region model, which hives off the three northeast provinces as a separate region (Fan and Sun, 2008). Other scholars prefer to use a different system that closely maps regional divisions onto the agricultural and climatic zones of China, reflecting the available natural resources. The alternative system that accounts for China geographic variation is a seven-zone model, which is derived from the Skinner physiographic macro-region division of China (Skinner, 1964). The seven regions can be compressed into three broad zones of North, Central-East and South.

Another important issue in any regional classification is how to handle the municipal-level cities of Beijing, Tianjin, Shanghai and Chongqing that were carved out of the now adjoining provinces. Beijing, Tianjin and Shanghai have a long privileged position under the plan and are now predominantly urban as their rural hinterland countries have become dormitory suburbs over the past three decades, with fields turned into new towns or industrial districts. We retain the municipalities as part of the East zone in the East-Central-West model, which is common practice.

3.2.2 Human capital indicators

Based on the empirical literature in the previous chapter, the relevant human capital indicators are summarized in the three following approaches with brief descriptions,

[8] In 2001, the Ninth People's Congress programme for the development of the Western region reclassified Inner Mongolia and Guangxi into the Western region in order to offer them the preferential policies on economic growth (Xinhuanet, 2005).

along with their usefulness and limitations. They comprise the educational, investment and education-income approaches (OECD, 1997b).

There are two main indicators often being employed for the educational approach. One is the average years of schooling of the population aged 25-64, which estimates the average number of years spent on completed episodes of primary, secondary and tertiary education. It gives a single figure for stock of human capital based on attainment, takes a year of education as a constant unit regardless of level, but does not measure any specific set of knowledge and skills. Another indicator is literacy by educational attainment, which shows the average literacy score of people with respective attainment levels in each country. However, this measurement does not take differences in educational quality into account, although it allows comparisons across countries of literacy among people with similar educational attainment (OECD, 1997a).

The investment approach covers two main indicators. The share of national income devoted to education and training shows public and private expenditure on formal programmes as a percentage of GDP. However, this measurement excludes information learning and compares national effort relative to need imperfectly, because countries with higher youth populations need to spend more. Another indicator is average spending per student by educational level, relative to income per head. It shows annual expenditure on a student in a primary, secondary and tertiary education as a percentage of GDP per capita. Although it shows how much effort is devoted to each student, it does not take account of variations in investment due to participation rates outside compulsory schooling (OECD, 1997b).

The third approach is educational-income based, involving another two main indicators. The employment-population ratio by level of educational attainment presents the proportion of employed in the total population aged 30-44 with particular levels of education. However it focuses only on initial educational attainment. Another indicator is that of relative earnings by educational attainment, which shows average annual earnings of 30-44 year olds with particular levels of educational attainment, relative to people with upper secondary education. However, it only represents only the wage premium associated with extra education for people in mid-

career and does not prove that this benefit is caused by the extra education or that it accurately reflects higher productivity (OECD, 1997a).

Improved fundamental background of education and health status in China may be helpful to better understand human capital accumulation in China at this time. Human capital accumulation could reflect the intensity of human capital investment, which also could be treated as the foundation of human capital stock. Due to data availability and different economic, social, political and cultural conditions, it focuses on the following aspects of human capital investment.

(1) the proportion of employees in total population, reflecting the region and the formation of human capital in labour productivity levels;
(2) the proportion of students enrolled in universities in total number of enrolled students, reflecting the government and the residents of the region's investment in human capital;
(3) the proportion of students enrolled in regular secondary schools in total number of enrolled students, reflecting the government and the residents of the region's investment in human capital breadth;
(4) per capita expenditure on culture, education science and public health, reflecting the financial expenditure in human capital;
(5) average wage of workers, the microeconomic foundation of human capital investment;
(6) average number of beds per 10,000 people, reflecting the health status and investment;
(7) number of doctors per 10, 000 people, reflecting health investment in the region.

Table 3.1 Human capital investment by region and year (1990, 1995, 2000 and 2005)

	1990			1995			2000			2005		
	E	C	W	E	C	W	E	M	W	E	M	W
LS	53	48	50	55	50	52	51	51	51	52	50	52
ESPU	48	30	22	48	31	21	48	31	21	45	33	21
ESPS	37	36	27	41	35	24	40	35	25	37	35	28
AW	2.3	1.9	2.1	6.1	4.5	4.8	10.6	7.4	8.1	20.6	14.7	15.7
PCEXP	56	38	53	145	83	96	256	139	168	560	316	378
BEDS	26	25	24	28	25	25	30	24	22	29	25	24
DOR	16	12	16	17	12	16	18	13	15	16	14	14

Source: Data for 1990, 1995 and 2000 are from *China Compendium of Statistics 1949-2004* NBS (2005), and data for 2005 are from *China Statistical Yearbook* 2006 (NBS, 2006), and are calculated by the author.

Notes:
1. E = East, C = Central, W = West
2. LS = Labour share - the proportion of employees in total population (%),
3. ESPU = Enrolled Students Proportion in universities (%),
4. ESPS = Enrolled Students Proportion in regular secondary schools (%),
5. AW = average wages (1,000 yuan),
6. PCEXP = per capita expenditure on Culture, Education Science and Public Health (yuan),
7. BEDS = number of beds per 10000 persons (persons),
8. DOR = number of doctors per 10000 persons (persons)

Comparing these seven indicators of human capital investment among the three regions over time, it indicates that the situation of employment, education enrolment, income and investment in education and health, and also the health resources have been positively improved from 1990 to 2005. However, the regional disparities are very obvious and persistent. The regional differences in employment and education were reduced in 1990 and 2005, although they fluctuated between these two years. The other indicators reflecting the differences of enrolment rates are partly because of unbalanced regional investments. With increasing income inequality, regional differences in average wages, expenditure on culture, education, science and public health, the health status, and investment in health care exacerbated during the same period. It is evident that large regional gaps existed. More detailed analysis will be provided in the following chapters.

The policies of the nine years of free compulsory education and higher education (HE) expansion have promoted education coverage and opportunities at higher levels. For instance, tertiary school enrolment rate has been rapidly increasing since the government set a target of 15% for 2005 (Dahlman and Aubert, 2001). However, there is a considerable gender gap between education provision and the average education conditions. At secondary level, gross enrolment rates gradually increased, however the dropout rate was around 4-6% in remote regions, and those where female students were often higher than male students (Wang and Yao, 2003). Additionally, in terms of achievement within the higher education system females remain disadvantaged even though, according to the relevant data analysed in Chapter 7 (for example NBS, 2006), educational status of females has improved more markedly than males, the gap between male and female students still exists in terms of illiteracy rate or years of schooling. However, female education is still a key concern in low-income areas.

3.2.3 Some key educational and health indicators

From the early growth accounting to the cross-country growth regressions of the mid-1990s, the measurements include education-augmented labour input, adult literacy rates, school enrolment ratios, and average years of schooling of the working-age population, which is currently the proxy most commonly employed. When looking for a measure of the stock of human capital that is currently used in production, it seems logical to quantify the accumulated educational investment embodied in the current labour force. Thus, several studies have tried to construct data on the highest level of educational attainment of workers to quantify the average years of schooling in the labour market (OECD, 1998b; Barro and Lee, 1993).

Educational attainment is clearly a stock variable: it takes into account the total amount of formal education received by the labour force. The average years of schooling has now become the most popular and most commonly used specification of the stock of human capital (e.g. Ludger, 2003). Previously, most scholars preferred to use the average years of schooling measurement in China, which showed misspecification by the proxy, including an incorrect specification of the functional form of the education-human capital relationship, for instance, the investment of

education with rates of return to it, differences in the quality of education and the competitive labour market, etc.

1) Educational attainment

Educational attainment, as the most commonly used proxy of HC stock, could be described as the percentage of the population who have successfully completed various levels of formal education. That is broadly and economically associated with some forms of relevant knowledge and competence. The International Standard Classification of Education (ISCE) defines the levels in relation to the years of schooling and the age associated with a cycle of education (OECD, 1998b). Therefore, this measure produces an estimate of a country's HC stock in a number as the average years of schooling of the adult population.

2) Average years of schooling

Today, the average years of schooling (AYOS) have become the most popular and most commonly used specification of the stock of human capital (e.g. Ludger, 2003). In this research, the average years of schooling involve four levels of education: primary; junior, senior middle schooling and higher education. Different levels of schooling generate various outcomes of educational status. For instance, students in higher education have more years of schooling, so that it may be interpreted that students who completed higher education schooling have more opportunities in the labour market than students who only completed senior middle school education.

3) Life expectancy at birth

Life expectancy at birth (LEAB) is one of the most intuitive and simple measures of human well-being. Differences in life expectancy over time and across regions are powerful indicators of the differences in the quality of life, and in turn the inequality in the distribution of factors contributing to LEAB. It is defined as the number of years a new born infant would live if prevailing patterns of mortality at the time of birth were to remain the same throughout life (World Bank). Some emerging empirical research has analysed the influence of life expectancy and mortality on

economic growth (e.g. Bloom, Canning and Sevilla, 2003). In some developing countries with a high mortality rate the average life expectancy was 65 years. In contrast, the LEAB had a life expectancy of 79 years in high-income countries and 65 years in low-income countries (World Bank, 2007). Sala-i-Martin *et al.* (2004) found that life expectancy could be one of the most robust factors in economic growth.

4) Physical height

To nurture a baby to achieve its potential human capital, it is necessary not only to educate him/her, but also to provide him/her with nutrition. Height is a sensitive indicator of nutrition (Steckel, 1995; Steckel and Floud, 1997; Hiza, *et al.*, 2000; Morgan, 2004). The change in the average height of a person reflects his level of nutrition, and also the available resources, such as food and access to health care service. There are two periods of rapid height growth for humans during infancy and the adolescent growth spurt (9 to 15 years of age). After these periods, the growth rate reduces rapidly until approximately 18 years of age (Morgan, 2000). In this research, the genetic issue of height is not taken into account, only the height of males and females aged 15 years are looked at as a representative indicator.

Height is a well-established measure of human welfare or the biological standard of living. At an individual level, the height of an adult (or a child at the time of measurement) is a product of the complex interaction between their genetic make-up and the living environment (Eveleth and Tanner, 1990). Height measures the net nutrition available for human growth. Whilst genes are important for differences between individuals, the average height of a population is determined primarily by disease, economics, and social environment (Steckel, 1995, 2009). Over the past decade economists have increasingly turned to height data to measure a variety of economic growth and inequality issues (Thomas and Strauss, 1992; Deaton, 2007; Case and Paxson, 2008; and Steckel, 2009). Height data has been used fruitfully to analyse contemporary and past Chinese economic growth (Morgan, 2000, 2004, 2009). The average height of a population is closely correlated with income. Further, differences in height between social groups, gender or across regions are an indicator of unequal distribution of resources available for human growth and well-being.

3.2.4 Data

All relevant data is taken from the People's Republic of China Census of 1990 and of 2000 (NBS 1993, 2001a), and the 1% sampling of the population survey of 2005 and from the China Statistical Yearbook online resources of 1996-2005 published by China's Statistics Bureau (NBS, 1997-2006). Data has also been taken from the China Compendium of Statistics 1949-2004 compiled by the National Bureau of Statistics (NBS, 2005a), the China Educational Statistical Yearbook of 1990 to 1998 (NEC, 1991-1999) and the Human Development Report 2008 (UNDP, 2008). Some specific data is from the 2001 Chinese Rural Household Survey Yearbook (NBS, 2001b), and the Report on the physical fitness and health surveillance of China's school students for 1985 and 2005 (CCAHS, 1988, 2007).

The published key indicator of education status – the average years of schooling (Barro and Lee, 2000) for people aged six and above is only available in the 1990 and the 2000 census and the 1% sampling population survey in 2005, which are used in the fundamental regression models in the main chapters. The weighted values of AYOS are estimated for the population aged 6 years and above who have completed various educational levels covering the primary school, junior and senior secondary and higher education, using the formula:

$$Y_{AYOS} = \frac{\sum (6 * \mathrm{POP}_{\mathrm{Stu.\,pri.}} + 9 * \mathrm{POP}_{\mathrm{Stu.\,jun.}} + 12 * \mathrm{POP}_{\mathrm{Stu.\,sen.}} + 16 * \mathrm{POP}_{\mathrm{Stu.\,he.}})}{POP_{stu.tot.6+}}$$

The weighted AYOS is the sum of the years of those who have completed primary (six years: $\mathrm{POP}_{\mathrm{stu.pri.}}$), junior secondary school (nine years: $\mathrm{POP}_{\mathrm{stu.jun}}$), senior secondary school (12 years: $\mathrm{POP}_{\mathrm{stu.sen}}$) and higher education (16 years: $\mathrm{POP}_{\mathrm{stu.he}}$) divided by the population of the sum of the four groups ($\mathrm{POP}_{\mathrm{stu.tot}}$).

Life expectancy at birth is a proxy for the health status of people, although it measures mortality rates rather than morbidity. Higher life expectancy implies better health status and low morbidity (Murray and Chen, 1992; Murray and Lopez, 1997). Based on the available data of provincial LEAB in 1990, 2000 and 2005, the author calculated the weighted mean of life expectancy from 1990 to 2005 yearly.

Furthermore, the per capita real disposable income in 2005 was calculated by per capital disposable income divided by the Consumer Price Index (CPI), using 1990 as the year base.

3.2.5 Limitation of data

There may be two general types of measurement errors among all variables: data recording errors may constitute an initial reason for mismeasurement and errors may also be due to the use of an imperfect proxy for the true stock of human capital (Ludger, 2003). The choice of the human capital proxy is hardly reflected upon and practically depends on data availability. Human capital theory offers a specification of the human capital function, which represents the stock of human capital. Therefore, the task of deriving a viable measure of the stock of human capital embodied in the labour force is to correctly specify the form of the relationship between education and human capital (Ludger, 2003).

Most of studies identify human capital with the quantity of education measured by the rates of school enrolment and average years of school (Azariadis and Drazen, 1990; Durlauf and Johnson, 1995; Kalaitzidakis *et al.,* 2001). Recently scholars have started paying attention to the qualitative measures of education. Hanushek and Kimko (2000) found that quality of education significantly impacts the growth of per capita GDP, with data from international exam results of mathematics and science in 31 countries. However, in fact, it is difficult to measure the quality of education with accurate and available data.

Although, in theory, years of schooling data turns out to be an important element of a well-specified measure of human capital, some shortcomings still exists, including lack of bench-marking and limited availability of the data necessary to facilitate implementation. In addition, some data represents average years of schooling in the adult population, but not in the labour force market. As a result, data includes adults who are not labour force participants, which may exclude some members of the labour force (Gemmell, 1996), as well as members of the retirement population.

Some fundamental problems with the specification of the stock of human capital by average years of schooling were discovered (Mulligan and Sala-I-Martin, 2000). Their two major criticisms contended that the years of schooling did not raise the human capital stock. The criticism argued that one year of schooling does not raise the human capital stock by an equal amount, regardless of whether it is a person's first or 16th year of schooling and regardless of the quality of the education system in which it takes place. Therefore, the year of schooling should be weighted differently, depending on how many years of formal schooling the person has already accumulated (Mulligan and Sala-I-Martin, 2000; Ludger, 2003). Most scholars preferred to use the average years of schooling measurement to others in China, which showed misspecification by proxy, because this includes an incorrect specification of the functional form of the education-human capital relationship, for instance, the investment of education with its rates of return as well as the differences in the quality of education and the competitive labour market.

This research uses average years of schooling as one of the main indicators of human capital in China, which could be a useful instrument for focusing on the educational features of the HC stock. In reality, it does not take educational quality into account, but the differences among students from primary school to university level. The average years of schooling may be correlated with relevant skills, knowledge and competence, whereas school completion does not guarantee these attributes. It only certifies education undertaken as part of completed cycle of formal education at school. However, it ignores other informal education forms as well as enterprise-based trainings.

Here, income inequality could be represented as regional inequality. This research pays attention not to the one way relationship from education and health capital to income inequality but to the reverse relationship. Higher incomes could drive people to invest more in education and health. Under the circumstances of regional inequality it could reflect, the extent to which years of schooling and life expectancy are affected by income differences across regions. When taking the cycle relationship between "investment in education - education obtained – income – investment in education" into account, more factors contributing or reflecting regional inequality are needed. It

could provide another research topic, but may make this research less focused and more complicated.

During the research, I have attempted two kinds of region divisions: the three economic zones division which has been employed for a long time and the four regions, separating Municipal cities from the Eastern region. It is resulted in some relevant policies are different, additionally; educational and health resources are unevenly distributed spatially in the Municipal cities. Different regional divisions may produce different pictures, but all may have limitations.

In addition, it is acknowledged that this research has been limited by the lack of accurate data for specific periods of time (1990-2005). Nevertheless it may still be taken as representative of the meanings of the equations. If survey data at a county level were available, the results of regressions may be more meaningful and closer to the real story of regional and gender inequality in China.

Chapter 4 Health Status and Regional Inequality, 1990-2005

4.1 Introduction

Scholars have increasingly analysed the relationship between income, wealth and health (Anand and Ravallion, 1993; Pritchett and Summers, 1996; Sen, 1998; Bloom and Canning, 2000; Wagstaff and Eddy, 2000; Case *et al*, 2002; Moser, Leon and Gwatkin, 2005; Deaton, 2006, 2008). Countries with high-income are better able to provide healthcare service, good sanitation, health education and standard living conditions. Similarly, individuals with high-income are able to afford adequate food, secure housing, any necessary healthcare and relevant education (Wolff and Zacharias, 2009). Health status can be seen as an important contributor to variations in relative inequality.

Two key dimensions of human capital, education and health, have attracted the attention of many scholars and led them to research these issues in relation to economic growth and regional inequality. Whilst vast numbers of articles have been written on the dimensions of education (e.g. Ram, 1990; Vinod, Wang and Fan, 2002), there have been fewer articles written on health and economic development in China (Zhang and Kanbur, 2005). This may partly be because the contribution of health to society is not always apparent and also health as an important aspect of human capital is viewed differently from that of education (Strauss and Thomas, 1998; Becker, 2007). In fact, a healthy person could also work longer hours and contribute to productivity (Emanuele, *et al*, 2004).

However, the prevailing view more focuses on a well-educated people who grasps knowledge and skills could work effectively and raise productivity. This view has diminished the contribution of health as a crucial aspect of human capital, which may lead to an incorrect measurement of human capital accumulation (Barro and Sala-i-Martin, 1995). Healthier workers are generally physically and mentally more energetic and robust, and are less likely to absent themselves from work because of their own sickness or sickness of family members, thus allowing them the potential to maximise their earnings (Bloom, Canning and Sevilla, 2003). Research has predominantly shown that the influence of health has a positive and statistically

significant influence on economic growth. A one-year improvement in life expectancy may contribute as much as a four per cent increase in economic growth (Bloom, Canning and Sevilla, 2003). Increased investment in health is beneficial not only for the welfare of people but also for labour productivity and economic growth as a consequence.

Amparo and Rafael (2008) examined the direct impact on human capital accumulation and the regional inequality that results from the disparity of health investment and resources distribution. Their research involving 92 countries suggested there was a strong positive correlation between human capital equality and the accumulation of human capital in respect of life expectancy (Amparo and Rafael, 2008). In contrast, other recent studies have focused on the effect of optimal education on life expectancy, analysing the relationship between the 'demographic transition' and the long term development in increasing life expectancy (Kalemli-Ozcan, 2002; Cervellati and Sunde, 2005; Soares 2005; Tamura, 2006), and the relationship between health expenditure and life expectancy (Chakraborty, 2004). Strauss and Thomas (1998) argued that health affects the variation of incomes to the same extent as education (Culter and Lleras-Muney, 2006; Thrane, 2006). As a result, there is a significant correlation between education, health and regional inequality.

Focusing on the health dimension of human capital, this chapter investigates how life expectancy at birth captures an important aspect of regional inequality in China in 1990 and 2005. The aim of this chapter is to examine to what extent, if any, regional inequality has improved as a result of improvement in distribution and investment of health resources and other factors, such as living conditions and education. In addition, it considers how the various levels of schooling impact on the health status as well as focusing on the comparison between regions.

4.2 Background

The relationship between income, income inequality and health has attracted the attention of scholars from a variety of social science disciplines, such as economics, sociology and public health. Health as a dimension of human capital is able to positively affect the long term level of economic growth, national productivity, and

also human sustainable development (Solow, 1956; Swan, 1956; Barro and Barro, 1996; Arora, 2001; Bhargava *et al.*, 2001; Howitt, 2005). These findings are also supported by evidence found in developing countries (Basta *et al.*, 1979; Spurr, 1983; Fogel, 1994; Strauss and Thomas, 1998; Bhargava *et al.*, 2001). Health is essential in order for the individual to achieve their potential productivity; it can give increased strength, focus, stamina which, within the work place, has the potential to increase output for the companies they work with (Baldacci and others, 2004 and Howitt, 2005).

4.2.1 General health indicators

Generally available indicators of health status of an individual from birth onwards are birth rates, death rates and population natural growth rates. In developing countries, the average rate of mortality for children under the age of five is 84 deaths per 1,000 (Howitt, 2005). Over the past 30 years, health conditions have dramatically increased in developing countries, but many people in poor countries or areas of poverty still live in appalling conditions, where some of them are constantly in danger of contracting diseases such malaria and tuberculosis (Howitt, 2005). Over a billion people in low and middle-income countries [9] are short of safe drinking water (Stern, 2003).

In China, both the birth rate and the natural growth rate fell between 1990 and 2005, which may be a consequence of the change in people's concepts regarding marriage, birth and family. The traditional concept of "early marriage and early births", "more children, greater happiness", and "looking up on men but down on women" are being

[9] **Low-income country.** A country having an annual gross national product (GNP) per capita equivalent to $760 or less in 1998. The standard of living is lower in these countries; there are few goods and services; and many people cannot meet their basic needs. In 2003, the cut-off for low-income countries was adjusted to $745 or less. At that time, there were approximately 61 low-income countries with a combined population of approximately 2.5 billion people (World Bank). **Middle-income country.** A country having an annual gross national product (GNP) per capita equivalent to more than $760 but less than $9,360 in 1998. The standard of living is higher than in low-income countries, and people have access to more goods and services, but many people still cannot meet their basic needs. In 2003, the cut-off for middle-income countries was adjusted to more than $745, but less than $9,206. At that time, there were about 65 middle-income countries with populations of one million or more. Their combined population was approximately 2.7 billion (World Bank).

exchanged by the new generation at the child-bearing ages for later marriage and fewer children. In reality, the reduction in the size of families has reduced the extent of burdens placed on family members (Qian, 2006). In addition, since the reform and openness era, the development of China's economy, science, technology, education, public health and social welfare has brought about a change in prevailing attitudes about the family. Economic growth and population control by the state government influence each other. Although since 1990 the less-developed Western region has the highest birth and death rate indicators, the urban and rural areas across regions have formed a modern population reproduction pattern, which is characterised by a low birth rate and natural growth rate (Information Office of the State Council Of the People's Republic of China, 1995).

4.2.2 Life expectancy at birth

Over the past century, the LEAB has undergone continuous growth around the world. LEAB is defined as the number of years a new born infant would live if prevailing patterns of mortality at the time of birth were to remain the same throughout its life (World Bank, 2007). According to Human Mortality Database, the LEAB in the OECD countries was around 40 years at the end of the 19th century. There was a vast improvement during the 20th century and by the beginning of the 21st century life expectancy was close to 80 years. According to the World Bank, between 1980 and 1998, the average life expectancy in the world rose from 61 to 67 years (World Bank, 1998). In 1975, on the eve of economic reform China has attained a LEAB of 65 years, which was two years higher than middle-income countries (UNDP, 1990 and NBS, 1997). By 2000, China's LEAB has increased another seven years over two decades of reform (UN, 2007).

Based on the division of China into three economic regions[10] (the Eastern, the Central and the Western regions), we can see some of the vast variations across China in socioeconomic indicators. There are huge discrepancies in income, life expectancy, mortality, and urbanization. Table 4.1 summarizes some of these inequalities at the provincial level. China shows great variety across its regions, similar to that which

[10] See chapter 3 for regional division.

can be found across the world. For example, the differences in life expectancy range from a level similar to those in low-income economies, around 65 years, such as found in Guizhou and Yunnan provinces, to a level on par with high-income economies, of around 78 years or more, such as in Beijing and Shanghai (World Bank, 2007).

Table 4.1 Selected provincial socioeconomic indicators (2005)

2005	Urbanization	Per capita income[1]	Longevity
	%	yuan	years
Eastern [2]	**53.3**	**9,023**	**74.7**
Beijing	83.6	15,962	76.9
Tianjin	75.1	10,882	76.0
Shanghai	89.1	17,511	79.1
Hebei	37.7	5,602	72.6
Liaoning	58.7	6,870	74.4
Jiangsu	50.1	8,805	75.6
Zhejiang	56.0	12,058	75.1
Fujian	47.3	8,174	74.3
Shandong	45.0	6,997	74.0
Guangdong	60.7	10,806	75.0
Hainan	45.2	5,318	75.8
Central	**39.1**	**5,234**	**72.7**
Anhui	35.5	4,710	73.0
Shanxi	42.1	5,427	72.2
Jilin	52.5	6,114	73.3
Heilongjiang	53.1	5,903	74.3
Jiangxi	37.0	5,160	70.2
Henan	30.7	4,647	73.0
Hubei	43.2	5,555	72.7
Hunan	37.0	5,488	72.6
Western	**34.6**	**4,594**	**70.4**
Inn Mongolia	47.2	5,891	70.7
Guangxi	33.6	4,778	73.6
Chongqing	45.2	6,169	72.0
Sichuan	33.0	4,645	71.9
Guizhou	26.9	3,563	66.6
Yunnan	29.5	4,173	66.4
Tibet	26.7	4,049	65.8
Shaanxi	37.2	4,368	71.1
Gansu	30.0	3,813	68.8
Qinghai	39.3	4,469	68.8
Ningxia	42.3	4,874	72.0
Xinjiang	37.2	4,528	72.3

Source: NBS, 2006 and UNDP, 2008

Notes:
1. Per capita income is the rural-urban populated-weight mean of the per capita urban income and the per capita net rural income for 2005 from NBS (2006) Tables 10.15 and 10.22.
2. Inner Mongolia and Guangxi were reclassified into the Western region in 2001. The summary data shown for each region is the populated-weighted mean of the variable. http://www.stats.gov.cn/tjsj/ndsj/2006/indexch.htm

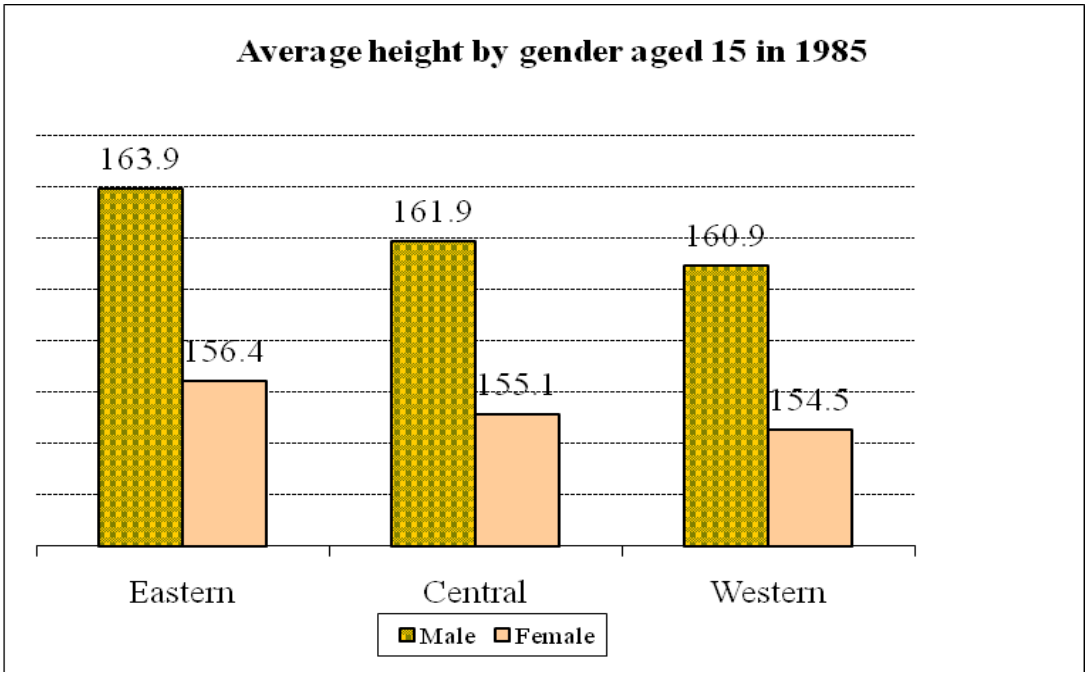
The three provincial-level Municipal cities of Beijing, Tianjin and Shanghai in the Eastern region are exceptional in all measures. The Municipal cities have obtained a life expectancy on par with developed economies and are 10-14 years ahead of that of poorer provinces. Their life expectancy is similar to the level of low/middle-income developing economies, such as most countries in Latin America and in the Caribbean. Some developed countries like the US, the UK., and Japan had already achieved approximately 78 years of life expectancy in 2003 (World Development Indicators, 2005).

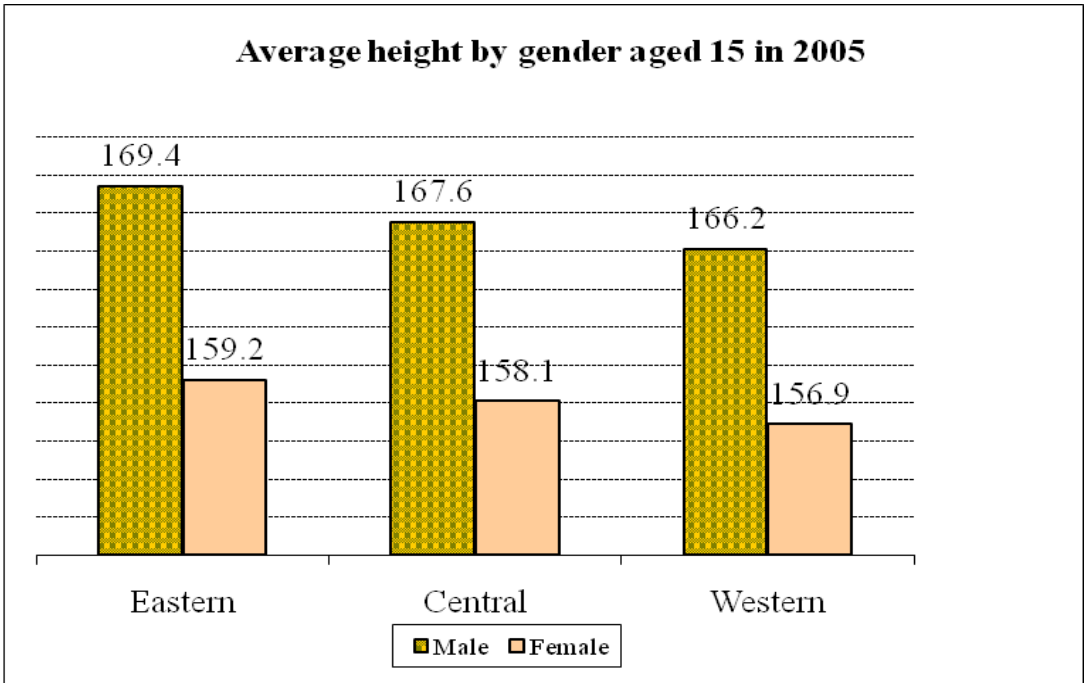
Morgan and Su (2010) summarized that, although these Municipal cities are the smallest in population, they are the most urbanized, have the highest urbanization rate, have the greatest longevity, and are the richest in per capita income. The contrast with Tibet, Guizhou and Yunnan in the Western region is considerable. The urbanization level is approximately one-third of that of the Eastern city provinces, income approximately one-third to one-quarter, and life expectancy is in excess of 10 years lower. Regional level averages for life expectancy show that in the Eastern region the population attained 74.7 years, compared with 72.7 years in the Central region. The Western region attained a life expectancy of 70.4 years, which was between 40 and 60 per cent less than in the East.

A similar picture is drawn with the increase in average stature, which is an indicator of nutritional status, for both male and female (Morgan, 2004, Yao and Morgan, 2008). Figure 4.1 compares the height of 15-year-old male and female in 1985 and 2005. It clearly indicates significant regional differences in the increase in mean height by gender. The mean height of boys increased between 5.3cm and 5.7cm from 1985 to 2005, while girls increased 2.4-3.8cm. In the two examined years both males and females in the Western region were the shortest and experienced the least increase in height over time among all of the regions. Those in the Eastern region were the

tallest, and the height of those in the Central region was midway between the West and East.

Figure 4.1 Average height of people aged 15 and above by region and gender (1985 and 2005)





Sources: Data for 1985 and 2005 from *Report on the Physical Fitness and Health Surveillance of Chinese School Students* 1985 and 2005 (CCAHS, 1988, 2007).

4.3 Literature review

Some scholars argued that income has a positive effect on health (Grossman, 1972; Preston, 1975; Behrman, and Wolfe, 1987a; Behrman and Deolalikar, 1987b; Adler *et al.*, 1994; Deaton, 2003, 2008), others argued that income inequality determines differences in health status (Lynch *et al.*, 1998; Wagstaff and Eddy, 2000; Mellor and Milyo, 2001). Thus, people from disadvantaged economic backgrounds are more likely to be less healthy than their peers in a reference group (Marmot *et al.* 1991 and Wilkinson, 1997). Illnesses such as stress and depression may be caused by earning relatively low income (Cohen and Wills, 1985) or weaken the access to the local health-related resources (Deaton, 2003). Pritchett and Summers (1996) estimated the effect of income on health with data from across countries and time series by the infant mortality rate and life expectancy to obtain a country's health performance. They concluded three plausible interpretations for health-income relationship, namely: [1] increased income leads to better health; [2] healthier individuals are generally more productive and earn a higher income; [3] and some other factors, such as reward and management system within corporations, that could cause both an increased level of income and improved health (Pritchett and Summers, 1996).

4.3.1 Life expectancy and income

Some researchers found that life expectancy has a significantly positive effect on economic growth (Kalemli-Ozcan, 2002; Bloom and Canning, 2003; De la Croix and Doepke, 2003; Sala-i-Martin *et al.*, 2004; Moav, 2005; Cervellati and Sunde, 2005; Soares, 2005, Tamura, 2006). Ehrlich and Lui (1991) explained the links between longevity and economic growth. They found on the one hand, the increase in longevity could improve economic growth, and low levels of life expectancy usually accompany low levels of economic development. On the other hand, rapid economic growth could also promote life expectancy at birth, in particular improve longevity by increasing the survival rate of the middle-aged and older age groups (Wilmoth, 2000).

Longevity is an important aspect of investment in health that seems to bear directly on long term economic growth because it is linked to income and poverty. There is a strong positive relationship between increasing income and life expectancy (Wolff

and Zacharias, 2009), and global trends have seen a generalised increase in income and life expectancy (www.gapminder.org). Furthermore, Amparo and Rafael (2006) found increased life expectancy has a significantly positive influence on human capital accumulation. The disparity in life expectancy affects the human capital stock, and in turn the degree of inequality (Amparo and Rafael, 2006). Therefore the differences in income levels in both developed and developing countries to some extent could reflect differences in their health status. In some low-income developing countries the average life expectancy was 65 years; in contrast, life expectancy was 79 years in high-income countries (World Bank, 2007). However, income alone is not a sufficient interpretation for differences in LEAB between regions with large differences in income as these may be because of other factors, such as: education rather than health status. For instance, there is a significant gap in per capita income between China and America, which is associated with relatively modest gains in life expectancy (Wolff and Zacharias, 2009).

Some scholars found a significant relationship between the three factors of income, health status and education (Marmot *et al.*, 1991; Deaton and Paxon, 1999; Lleras-Muney, 2002). The significant improvement in longevity is a result of various factors, including not only income, but also better living and working conditions, maternal and preventative care, and education and learning (Helliwell, 2003; Blanchflower and Oswald, 2004; Sassi and Hurst, 2008). As an individual, being born into a better-off family (with sufficient income savings) may have an impact on the life expectancy of an individual because of personal preferences and possible inherited innate abilities (Amparo and Rafael, 2002). Individuals from better off families have a higher life expectancy than those from poorer families, which may be the result of differences in the type of nourishment given in the early stages of life, health practices and standards of hygiene, and available information on health care (Amparo and Rafael, 2002).

In addition, being born into a family whose parents have a high level of education can have a significant influence on the longevity of the individual, because the tendency is for these parents to invest more money and time on education (Thomas, Strauss and Henriques, 1990 and 1991; Jacobson, 2000; Wolfe and Haveman, 2001; Grossman, 2006). In contrast poor families have a low life expectancy and devote little time to education. Similar studies found that parents' education has a positive impact on the

long term health status of people, even after the issue of income is disregarded (Thomas, Strauss and Henriques, 1990 and 1991).

4.3.2 The contribution of education to health

Two dimensions of human capital, education and health, correlate with each other (Schultz, 1999; Culter and Lleras-Muney, 2006; Thrane, 2006). This section focuses specifically on the contribution of education to health. An increase in education can raise health status in two ways. Education can directly raise the survival rate by enabling a person to be more pro-active at investing in their health and that of their children. This can be achieved by gaining better information about doctors, medical knowledge, diet habits, and other health improving information. Conversely, better education raises the expected net expenditure on education, which then produces a wealth effect that could lead to increased spending on health, and as a result is likely to raise the life expectancy level (Schultz, 1999). On average, people who are more highly educated enjoy better health than those less educated. Some scholars found that the optimal schooling investment decisions depended positively on life expectancy (De la Croix and Licandro, 1999; Kalmeli-Ozecan, Ryder and Weil, 2000). Using the data of schooling years provided by Barro and Lee, the relationship between inequality and increase in life expectancy, empirical evidence shows a clear relationship between average schooling years and life expectancy (Barro and Lee, 2000).

Although there is little literature available on how health affects economic growth compared with that available on the effects of education (Baldacci and others, 2004), the variation in life expectancy and average years of schooling interprets a substantial proportion of the income gaps across countries. In contrast, differences in average work experience are small. However, their model only observes the direct effect of education and health on output and not the development process of them. This misses the effect of increased education on health (Pritchett and Summers, 1996; Summers, 1992; and Younger, 2002) and of improvement of health through education (Balasz *et al.*, 1986; Bhargava *et al.*, 2001; Kremer and Miguel, 2001; Pollitt, 1997, 2001).

A recent study by Amparo and Rafarl (2006), found that a reduction of one standard deviation in education inequality could increase life expectancy by three years. The result suggested that the more unequal the distribution of schooling, the lower the life expectancy. The improved health status of people is not only a result of having higher levels of per capita income or education, but also because of the better distribution of educational and health resources and investment allocation together (Amparo and Rafarl, 2006). For instance, people in the urban areas with centralized educational and health resources may be provided more opportunities of schooling and healthcare than those in the rural remote areas (Li and Zhu, 2006).

Table 4.2 shows that the number of health institutions has increased in all of the three regions. While the number of sickbeds and doctors per 10,000 people remained the same in the Central region, there was a slight decline in both the Eastern and Western regions. The significance of these shifts in welfare provision is difficult to interpret in the absence of information about the organization of the delivery of medical services, which have changed markedly over the period.

Table 4.2 The distribution of health resources by region (1990 and 2005)

Per 10,000 persons	**1990**	**2005**
Health institutions		
East	1.96	2.66
Central	1.57	2.07
West	2.10	3.08
Sickbeds		
East	2.7	2.9
Central	2.5	2.5
West	3.3	2.4
Doctors.		
East	1.7	1.6
Central	1.4	1.4
West	1.7	1.4

Sources: NBS, 1991 and NBS, 2006

One of the possible reasons for that may be that many professional doctors prefer to work in the Eastern and Central regions with centralized health institutions because of the better working conditions and pay than those in the Western region. Furthermore, the reason that people from developing provinces enjoy better health status than those

from less developing provinces could be that developing provinces have more health care resources and better living conditions (Hu, *et al.*, 2008). Sick people in developing areas may have more treatment opportunities because they are more able to afford medical care, or they have received adequate education with which to better comprehend and adopt good health care practices (Zhang and Kanbur, 2005).

4.3.3 Social spending on health

Mixed results have been generated by examining the impact of social spending on social indicators. Gupta *et al.* (2002), Baldacci and others (2004) found that social spending was a key to determining the outcomes of education and health (Anand and Ravallion, 1993; Psacharopoulos, 1994; Hojman, 1996; Bidani and Ravallion, 1997). Furthermore, Gupta *et al.* (2002) found that spending on education had a more significant influence on social indicators than health spending. These results showed that public education spending has a significant link with education indicators (Noss, 1991; Mingat and Tan, 1992, 1998; Flug, Spilimbergo and Wachtenheim, 1998; Gupta *et al.*, 2002). In contrast, Gupta and others found a positive correlation between public spending on health and the health status of the poor (Gupta and others, 2004). Therefore, uneven educational and health status across regions in China may correlate with uneven investment in education and health; furthermore the differences of its status and investment may reflect differing status of local economic development.

Table 4.3 Investment resources allocation by region (1990 and 2005)

	East	Central	West	Central	East
EXPEH (%)				Level as % of the East	
1990	41.5	35.8	22.6	86.4	54.5
2005	50.1	27.9	22.0	55.6	44.0
RCEXPEE (%)					
1990	45.4	30.9	23.7	68.2	52.3
2005	50.2	28.5	21.3	56.7	42.4
RCEXPME (%)					
1990	43.3	33.3	23.3	76.9	53.8
2005	47.1	28.5	24.4	60.5	51.7

Sources: Data for 1990 are from *Chinese Rural Household Survey Yearbook* 2001, and data for 2005 are from *China Statistical Yearbook* 2006 (NBS, 2006).

Notes:
1. EXPEH = proportion of the total education and health expenditure (100 mil)
2. RCEXPEE = proportion of the total rural Cash Expenditure on education and entertainment (yuan/person)
3. RCEXPME = proportion of the total rural Cash Expenditure on medical care (yuan/person)

Table 4.3 shows the investment in education and cultural facilities by rural households and the investment in medical care by local governments. It shows that in both 1990 and 2005, the Eastern region invested much more in education and medical care than the other regions. The expenditure of the Western region was only 54.5% of the Eastern region in 1990 and declined to 44% in 2005. Although rural household expenditure on education and health care in all the regions has substantially increased between these two years, economic growth was particularly significant in the Eastern region. Furthermore, people from the Eastern region were willing to invest more in their educational facilities and also the medical care than other two regions between those two years. Even though an impressive picture with improvement of investment in schooling and health care in the Central and Western regions is shown over time, people from the Central and Western regions are still disadvantaged, since the people spent on average half as much on schooling and health care as people from the East.

4.4 Methods and data

4.4.1 Methodological issues

After reviewing some key factors of health status, the following equations are formulated between regions, focusing on the relationship between income and health status (Equation 1a and 1b); the relationship between various schooling levels and health status (Equation 2a and 2b) respectively.

$$H_{heal.t} = A + \alpha_1 R_{east} + \alpha_2 R_{west.} + \beta I_{inc.t-5} + \mathrm{E} \quad (1a)$$

$$H_{heal.t} = A + \alpha_1 R_{east} + \alpha_2 R_{west.} + \beta I_{inc.t-10} + \mathrm{E} \quad (1b)$$

$$H_{heal.t} = A + \alpha_1 R_{east} + \alpha_2 R_{west.} + \gamma H_{edu.t-5} + \mathrm{E} \quad (1c)$$

$$H_{heal.t} = A + \alpha_1 R_{east} + \alpha_2 R_{west.} + \gamma H_{edu.t-10} + \mathrm{E} \quad (1d)$$

Where $H_{heal.}$ indicates life expectancy at birth; $H_{heal.t}$ indicates life expectancy at birth in year t; A is the constant coefficient; R_{east} is the dummy variable for the Eastern region; R_{west} is the dummy variable for the Western regions. $I_{inc.t-5}$ and $I_{inc.t-10}$ indicate people's per capita real disposable income in year t-5 and t-10 respectively; similarly with considering the time lag of five and 10 years for education, $H_{edu.t-5}$ and $H_{edu.t-10}$ indicate the average years of schooling of enrolled students. E is an error term, which is treated as a random variable. The remaining $\alpha_1, \alpha_2, \beta, \gamma$ are coefficients of the Eastern and Western regions, income and education variables respectively.

It is important to observe the various contributions of income and education to the health status between regions here, and also the importance of living conditions and health resources distribution are necessarily to be taken into account. Therefore, another group of equations are divided into three regions as following, covering the living conditions of the floor space of residential completed buildings, the total energy consumption and the total number of sick beds per 10,000 persons presented as health care conditions (Maslow, 1943), which may strongly effect on health status.

$$H_{heal.east.} = A + \alpha\, I._{inc.} + \beta(LC._{1.space.} + LC._{2.gov.invt.} + LC._{3.sickbeds}) + \gamma H_{edu.} + \mathrm{E} \qquad (2a)$$

$$H_{heal.cen.} = A + \alpha\, I._{inc.} + \beta(LC._{1.space.} + LC._{2.gov.invt.} + LC._{3.sickbeds}) + \gamma H_{edu.} + \mathrm{E} \qquad (2b)$$

$$H_{heal.west} = A + \alpha\, I._{inc.} + \beta(LC._{1.space.} + LC._{2.gov.invt.} + LC._{3.sickbeds}) + \gamma H_{edu.} + \mathrm{E} \qquad (2c)$$

In Equation 2a, 2b and 2c, where $H_{heal.}$ is the average life expectancy at birth; $H_{heal.east}$, $H_{heal.cen.}$ and $H_{heal.west}$ indicate the average life expectancy in the Eastern, Central and Western regions respectively, A is the constant coefficient. $I._{inc.}$ indicates the real per capita disposable income (yuan); $LC._{1.space.}$ indicates the living condition of the floor space of residential completed buildings (10,000 sq.m); $LC._{2.gov.invt.}$ indicates the living condition of the total amount of investment in education and health by the local governments; $LC._{3.sickbeds}$ indicates the distribution of health resources by total number of sick beds per 10,000 persons (unit); $H_{edu.}$ indicates the average years of schooling of enrolled students. E is an error term, which is treated as a random variable. The remaining α is the coefficient of the variables of the real per capita disposable income, β is the coefficient of the living conditions, γ is the coefficient of the average years of schooling of enrolled students.

4.4.2 Data

The data for the regressions are from the People's Census of 1990 and of 2000 (NBS, 1993 and 2001a), the China Statistical Yearbook of 1989, 2000 and 2005 (NBS, 1990, 2001 and 2006), the China Compendium of Statistics 1949-2004 (NBS, 2005b), and the Human Development Report 2008 (UNDP, 2008). Some additional data are from the 2001 Chinese Rural Household Survey Yearbook (NBS, 2001b), and the Report on the physical fitness and health surveillance of China's school students for 1985 and 2005[11] (CCAHS, 1988, 2007).

This chapter uses life expectancy as the representative proxy for the health status, because LEAB is one of the most intuitive and simple measures of human well-being.

[11] After each source indicate the institutional author and year (e.g. NBS, 1991) as they will be listed in the bibliography.

Additionally, differences in life expectancy over time and across regions are powerful indicators of the differences in the quality of life, and in turn the inequality in the distribution of factors contributing to LEAB. Based on the available data of provincial LEAB in 1990, 2000 and 2005, the author calculated the yearly life expectancy from 1990 to 2005. The weighted mean of life expectancy are computed by three factors by the data of death rate, per capita investment in culture, education, science and public health by region and grain output for each year.

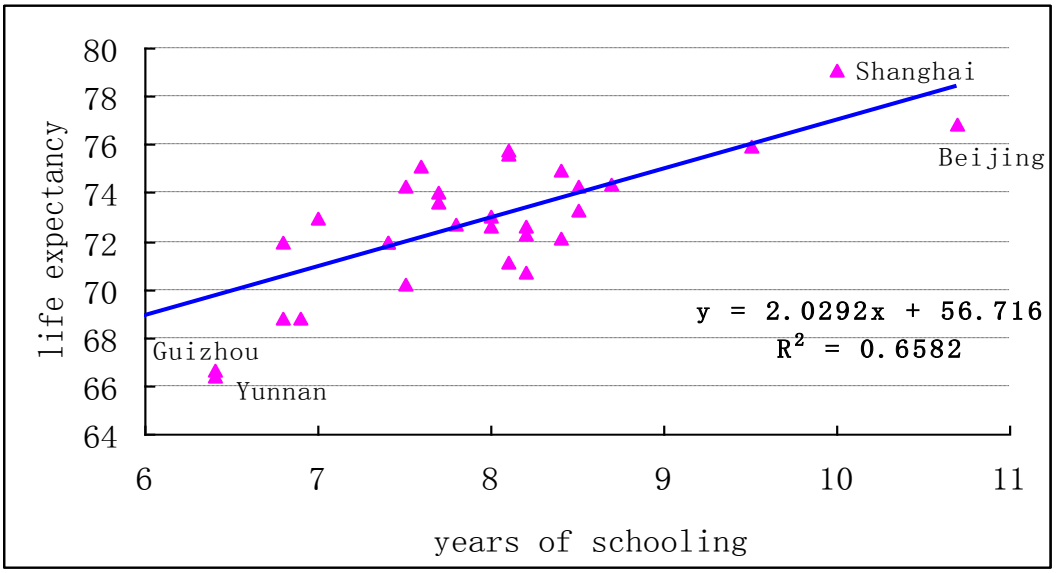
Table 4.4 Years of schooling and Life expectancy by region (1990 and 2005)

	YOS (years)			LE (years)		
	1990	2005	changes	1990	2005	changes
East	6.32	8.23	1.91	71.1	74.7	3.6
Central	6.11	7.88	1.77	68.3	72.7	4.4
West	5.57	7.17	1.60	66.0	70.4	4.4
West-East	-0.75	-1.06	-	-5.1	-4.3	-

Sources: Data for 1990 are from 1990 China Population Census, data of years of schooling of 2005 are from China Statistical Yearbook 2006 (NBS, 2006), data of Life expectancy for 2005 are from 2008 China Human Development Report (UNDP, 2008)

Table 4.4 represents those two indicators by region in 1990 and 2005, and the years of schooling and life expectancy have been remarkably improved from 1990 to 2005 within the three regions with an increase of at least 1.6 years of schooling and 3.6 years in longevity. However, the differences in years of schooling between the developed East and the poorer West are larger: from 0.75 percentage points to 1.06, in contrast, and; the differences in life expectancy have reduced from 5.1 to 4.3 years.

Figure 4.2 Correlation between the average years of schooling and life expectancy (2005)



Sources: Data for 2005 are from the *China Statistical Yearbook* 2006 (NBS, 2006), and for 2008 from the Human Development Report (UNDP, 2008) and have been calculated by the author.

Figure 4.2 illustrates the relationship between average years of schooling and life expectancy in 2005. It shows that when a person's average years of schooling increases by two years; his or her life expectancy will extend by one year. Students from Beijing and Shanghai benefit from a 10 year period of schooling; they also have more people living beyond the age of 76 years. In contrast, people from Guizhou and Yunnan have 6.4 years of schooling reflecting their life expectancy of only 66 years. The R^2 of 0.66 indicates that education accounts for 66 per cent of the improvement in life expectancy.

4.5 Regression results

Two sets of ordinary least squares (OLS) regressions were carried out. Table 4.5a lists the regressions' results of Equation 1a and 1b, displaying the relation between income investment and health between regions with considering the time lag of five and ten years. Table 4.5b (5 years' lag) and 4.5c (10 years' lag) list the results of Equation 1c and 1d respectively, which focus on how significant the differing levels of education effect health. Table 4.6 display the three regional results of Equation: 2a (East), 2b

(Central) and 2c (West), focusing on the influential contribution of living conditions and health resources distribution to health.

The three levels of schooling are divided into nine years of compulsory free education (inclusive of six years of primary school education and an additional three years of junior secondary school education), 12 years' education up to senior secondary school, and 16 years' education up to higher education. In Table 4.5b and 4.5c, the education variables from Model 1 to 4 focus on 16 years' education (levels from primary school to higher education); from Model 5 to 8 focus on 12 years' education (level from primary school to senior secondary school), and the remaining four models from Model 9 to 12 take only the nine years of compulsory free education schooling level into account.

Table 4.5 Regression results of health status by region (1990 and 2005)

4.5a Income – 5 and 10 years' lag

	M 1	**M 2**	**M 3**	**M 4**	**M 5**	**M 6**	**M 7**	**M 8**
	1990	**1995**	**2000**	**2005**	**1990**	**1995**	**2000**	**2005**
Constant	67.020 ***	57.852 ***	69.724 ***	70.621 ***	67.484 ***	57.160 ***	69.328 ***	70.916 ***
West	-2.956 ***	-5.602	-3.023 ***	-2.514 ***	-3.167 ***	-5.596	-2.775 ***	-2.701 ***
East	3.085 **	4.298	1.394	0.875	2.953 **	5.082	1.698	1.205
INC.	0.002	0.007	0.001 **	0.001 ***	0.003	0.014	0.002 **	0.001 **
F	16.733	2.349	20.537	20.705	16.527	2.333	19.179	17.893
R^2	0.650	0.207	0.695	0.697	0.647	0.206	0.681	0.665

Sources: Data for 1990 are from *China Census Statistics* in 1990 (NBS, 1993), and data for 2005 are from *China Statistical Yearbook* 2006 (NBS, 2006), and are calculated by the author.
Significance * <10%, ** <5%, ***<1%

Notes:
1. M = Model
2. INC. = Per capita Disposable income (yuan)
3. Model 1-4: considering the time lag of five years
4. Model 5-8: considering the time lag of ten years

4.5b Education – 5 years' lag

	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M 10	M 11	M 12
	1990	**1995**	**2000**	**2005**	**1990**	**1995**	**2000**	**2005**	**1990**	**1995**	**2000**	**2005**
Constant	60.402 ***	49.998	66.821 ***	41.257 ***	55.973 ***	58.899	69.713 ***	27.218 **	57.386 ***	85.451	69.807 ***	14.579
West	-3.075 ***	-6.421	-2.693 **	-2.066 **	-3.137 ***	-6.274	-2.878 ***	-1.886 **	-2.978 ***	-5.975	-2.871 ***	-1.337
East	3.371 ***	6.88	3.016 ***	1.336	3.381 ***	7.371	2.917 ***	1.648 **	3.487 ***	7.698	2.907 ***	2.059 **
16 years	1.02	1.814	0.536	4.031 ***			0.203	5.949 ***				
12 years					1.639	0.651			1.508	-3.069	0.2	7.901 ***
F	16.437	2.08	16.033	26.02	16.818	2.05	15.414	24.796	16.201	2.064	15.398	21.534
R^2	0.655	0.188	0.64	0.743	0.66	0.186	0.631	0.734	0.65	0.187	0.631	0.705

Sources: NBS, 1993 and NBS, 2006

Notes:
1. M = Model
2. 16 years indicate schooling levels from primary school to higher education
3. 12 years indicate schooling levels from primary school to senior secondary education
4. 9 years indicate the nine years of compulsory free education schooling level
5. Significance * <10%, ** <5%, ***<1%

4.5c Education – 10 years' lag

	M 1	M 2	M 3	M 4	M 5	M 6	M 7	M 8	M 9	M 10	M 11	M 12
	1990	**1995**	**2000**	**2005**	**1990**	**1995**	**2000**	**2005**	**1990**	**1995**	**2000**	**2005**
Constant	52.792 ***	22.849	59.872 ***	70.011 ***	51.009 ***	21.204	62.344 ***	72.428 **	64.454 ***	28.158	50.162 ***	73.161 ***
West	-2.797 ***	-6.363	-3.181 ***	-2.49 **	-2.678 ***	-6.518	-3.156 ***	-2.641 **	-3.028 ***	-5.968	-3.178 ***	-2.688 **
East	2.583 ***	7.279	2.328 **	2.788 ***	2.577 **	7.685	2.656 **	2.683 **	3.478 ***	8.074	2.57 **	2.638 **
16 years	1.953 **	5.507	1.522	0.309			1.218	0.027				
12 years					2.182 **	5.802			0.51	5.065	3.002	-0.064
F	21.811	2.414	17.568	13.062	22.956	2.332	16.018	12.858	15.975	2.231	16.879	12.863
R^2	0.716	0.218	0.624	0.592	0.726	0.212	0.64	0.588	0.648	0.205	0.652	0.588

Sources: NBS, 1993 and NBS, 2006

Notes:
1. M = Model
2. 16 years indicate schooling levels from primary school to higher education
3. 12 years indicate schooling levels from primary school to senior secondary education
4. 9 years indicate the nine years of compulsory free education schooling level
5. Significance * <10%, ** <5%, ***<1%

Based on the regression results, it can be concluded that both income and years of schooling have differently significant influence on regional inequality in health in 1990, 1995, 2000 and 2005 respectively. Several conclusions may be summarized as follows when comparing the different contributions of those factors to life expectancy.

The Central region is able to be treated as a benchmark as both the East and West are treated as dummy variables in the equations; those two regions also have particularly highly profile areas during the economic development. In Table 4.5a, taking the five years' and 10 years' time lag into consideration, only in 1990 has the Eastern region a positive significant influence on life expectancy. In contrast in 1990, 2000 and 2005 the Western region has negative significant influence. Only in 2000 and 2005 income variables become significantly influential.

In Table 4.5b, the Western and Eastern regions display a varying extent of significant influence on life expectancy in 1990, 2000 and 2005 across all three levels of schooling under examination. However, education only plays an influential role at these various levels in 2005. In Table 4.5c, the 10 years' time lag exhibit a similar picture to the five years' one, but only the 16 years (receiving a total of 16 years education is the equivalent of higher education) and 12 years of schooling levels (receiving 12 years of compulsory and secondary education is the equivalent of senior secondary schooling level) have a significant relationship with life expectancy in 1990.

From a macro picture of these results, it is found that in different years, along with various stages of economic development, regional locations and income investment have varying influence on longevity. Additionally, the differences of regional locations and per capita income have less influence on longevity over time. However, with considering the five year's time lag, a totally reverse picture is found in education. The three durations of schooling have increasingly influential effects on longevity, changing from insignificant to significant (in 2005) relationship over time. A more interesting finding is the influential degree of schooling on life expectancy decreases along with the increasing levels of schooling accordingly in the same year of 2005. However, only the 16 years and 12 years of schooling in 1990 have a significant relationship with longevity with the concern of the 10 years' time lag.

People may have similar longevity between regions, which could be treated as a relative regional equality in health, in terms of the insignificant coefficients of the regression results in the remaining years.

Considering the relationship between regions and income, income shows a remarkable change from insignificant to significant influence on life expectancy, which means the regional inequality in health in 1990 and 1995 is replaced by regional inequality in income in 2000 and 2005. Income has no impact on life expectancy in 1990 and 1995. People had the same health status at that time, as same as education status. In 2000 and 2005, people are in various statuses of health, which is the result of the various levels of income and the effects of different years of schooling. In fact, the influence of education on health status differs from those various levels of schooling according to different years and regional locations. For instance, the effects of higher education on health become noticeable. This was the case across all regions in 2000, and particularly so in the Western region in 2005. Meanwhile, in contrast, the nine years of compulsory free education retained the most powerful effect on life expectancy particularly in the Eastern region. In addition, higher education and senior secondary education in 1980 significantly contributed to life expectancy in 1990. In other words, education may attribute to the foundational knowledge of health care that was cultivated since that time.

While it is not only necessary to consider the contribution of income and education to life expectancy in 1990 and 2005, but also the basic living conditions and health resources distribution from 1990 to 2005 should also receive attention. The results are displayed in Table 4.6 according to equations 2a, 2b and 2c respectively.

Table 4.6 Regression results of health by region and schooling (1990-2005)

	E 1	**E 2**	**E 3**	**C 1**	**C 2**	**C 3**	**W 1**	**W 2**	**W 3**
INC.	0.50 ***	0.67 ***	0.71 ***	0.29 **	0.32 ***	0.32 ***	0.29 ***	0.36 ***	0.36 ***
FLSR	0.10 *	0.09	0.08	0.01	-0.02	-0.02	0.15	0.15	0.13
BEDS	-0.01	0.16 ***	0.18 **	-0.05	-0.07	-0.07	-0.32 ***	-0.30 ***	-0.27 ***
ECON	-0.11 **	-0.10 *	-0.09	0.21 **	0.22 **	0.22 **	0.02	0.04	0.05
16 years	0.41 ***			0.07			0.31 ***		
12 years		0.17 ***			0.00			0.25 ***	
9 years			0.13 **			-0.01			0.22 ***
F	55.78	51.05	49.60	4.74	4.63	4.63	24.08	22.08	21.24
R^2	0.67	0.65	0.64	0.19	0.19	0.19	0.46	0.44	0.43

Sources: NBS, 1993 and NBS, 2006

Notes:
1. E = East, C = Central, W = West
2. INC. = Real Per Capita disposable income (yuan)
3. FLSR = Floor space of completed residential buildings (10000 sq.m)
4. BEDS = number of beds per 10000 persons
5. ECON = Total energy consumption (10000 tons of SCE)
6. 16 years indicates schooling levels from primary school to higher education
7. 12 years indicates schooling levels from primary school to senior secondary education
8. 9 years indicates the nine years of compulsory free education schooling level
9. Significance * <10%, ** <5%, ***<1%

From 1990 to 2005, based on the regression results of the three regions, the real per capita disposable income within all the three regions has substantial effects on life expectancy. In particular, the income in the Eastern region has the greatest influence, while the Western region is midway. Both the total number of sick beds per 10,000 persons and three levels of schooling show very significant contributions to life expectancy in the Eastern and the Western regions. Compared with their standardized coefficients, the number of sick beds per 10,000 persons in the West has greater effects on longevity than in the East. The higher education level in the East shows a greater significant relationship with life expectancy than in the West, but the nine years of compulsory free education and the senior secondary schooling levels in the

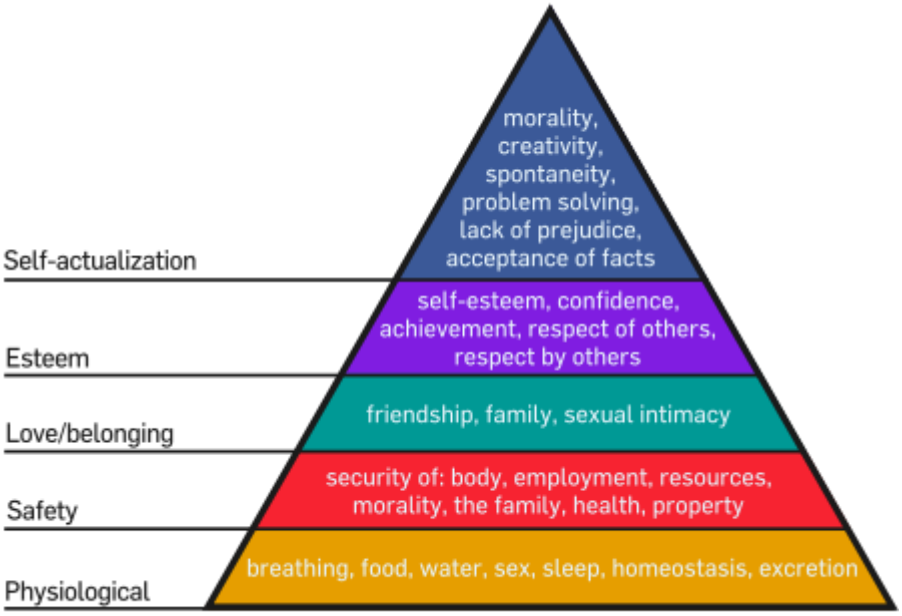
West contribute to life expectancy greater than in the East. At the higher education level, only in the Eastern region, the floor space of residential completed buildings has a slight significant contribution to longevity. Interestingly, the total energy consumption at both the higher education and the senior secondary school exhibits negative significant influential on longevity in the Eastern and Central regions from 1990 to 2005.

4.6 Discussion

According to the first two levels of Maslow's hierarchy of needs (1943), as shown in Figure 4.3 [12], physiological needs such as food, water, shelter, are the basic requirements for human survival. When their basic physical needs are satisfied people strive for their individual needs, which generally include: personal and financial security, health and well-being.

[12] Maslow's hierarchy of needs is predetermined in order of importance. It is often depicted as a pyramid consisting of five levels: the lowest level is associated with physiological needs, while the uppermost level is associated with self-actualization needs, particularly those related to identity and purpose. The higher needs in this hierarchy only come into focus when the lower needs in the pyramid are met. Once an individual has moved upwards to the next level, the needs in the lower level will no longer be prioritized. If a lower set of needs is no longer being met, the individual will temporarily re-prioritize those needs by focusing attention on the unfulfilled needs, but will not permanently regress to the lower level. For instance, a businessman at the esteem level who is diagnosed with cancer will spend a great deal of time concentrating on his health (physiological needs), but will continue to value his work performance (esteem needs) and will likely return to work during periods of remission.

Figure 4.3 Maslow's hierarchy of needs



Source: Maslow (1943), A Theory of Human Motivation

In 1990, people from the Western region relied heavily on agricultural work, and their work on the land provided them with an adequate income and a stable lifestyle which could affect their longevity in a positive way. Due to the enlarging of regional inequality over time, people from the remote Western region gradually feel forced to immigrate to developing regions in order to improve their standard of living. It is not surprising therefore, that when a work opportunity presents itself outside their less developed home town, farmers, especially the younger generation, leave home to seek incomes as cheap manual labourer in the bigger cities. If people's living standards are measured by the substantial increases in personal disposable income and consumption, they will be profoundly affected by economic growth (Yao, Zhang and Feng, 2005). To a certain extent, disposable income disparity has determined the differences in people's living conditions and health status.

In fact, although people in the Western region not only face income inequality, worse natural and ecological environment, a lack of educational resources and uneven health resources distribution but circumstances also force them to fight for a better standard of living that effects their longevity. For example, sick people from the Eastern region are likely to receive more convenient and successful treatment than their counterparts

in the Western region who have limited health care resources. This may be because improved information, and also higher standards of health care resources are available in the more highly developed cities. Furthermore, medical care specialists are often centralized in the Eastern region, therefore, people who are seriously ill not only have to travel to the Eastern region but also have to have sufficient money to seek out and pay for better medical treatment (Gao, 2006). However, nowadays living in developed areas also presents people with new challenges such as facing stressful living and working conditions, suffering loneliness and having physical or mental problems.

Theoretically, the average years of schooling has a significant impact on longevity as a result of formal and informal health-care education. Education could make healthy living styles for people possible (Barro and Lee, 2000). Generally, people who are well educated are better able to look after themselves, both physically and mentally. In 1995, the World Health Organization launched the "Global School Health Initiative", which encouraged school-based efforts to improve health, such as policies for cleanliness of sanitary facilities, food safety and hygiene, and also medical insurance services (World Health Organization, 1996). According to the results of the regressions, education, especially higher education of people in the Eastern and Western regions contributes significantly more to their life expectancy than education contributes to life expectancy in the Central region. In reality, people would be taught at a younger age how to develop beneficial practices in order to increase their rate of survival (Becker, 2007). As a result, health programmes for children from their early schooling have a significantly positive effect on their long term longevity and living style, which additionally they may pass onto the next generation.

Education and health expenditure is tied to the economic development of regions and provinces and it was found that different regions and provinces allocated different shares of their GDP to their local education and health care, thereby showing regional differences are affected by its performance of growth and openness. The openness has rapidly expanded since the reform, whereas the regional disparity has worsened (Cai, Wang and Du, 2005). China's openness provides an opportunity for the Eastern region to benefit from FDI and capital flow, not only because of its economic and geographic advantages, but also because of the preferential policies and opportunities for it to take the lead in developing its economy and widening the income gap

between the region and other regions. In contrast, the Central and Western regions are still able to utilize their comparative advantages relative to the Eastern region, through regional trade and capital flow, which results in indirect benefits from a following-up openness (Cai, Wang and Du, 2005). For instance, I found that the relationship between the provincial urbanization level and years of schooling, and urbanization level and life expectancy was 63 per cent and 64 per cent correlated respectively. This indicates that, to a certain extent, educational and health status was affected by its provincial urbanization, which could be regarded as its openness and driven by immigration from rural to urban areas.

According to Noss's research result (1991) the Chinese government focused more on education than on health care, resulting in a higher expenditure on education than on health-care. However, the 2005 Chinese National Human Development Report (UNDP, 2008) funded by the Chinese Development Research Foundation called for a focus on development with equality. It encouraged strengthening public health and improving basic medical care in under-developed areas and stated that all public health sectors need to pay close attention to the vulnerable population, in order to overcome the imbalances in public health development (CNHDR, 2005).

Local governments are responsible for investing in local schools and hospitals, therefore, well-developed provinces tend to produce better education and health results than less-developed provinces. Different resource constraints across the provinces and regions impact on the individual's educational attainment and health status, especially in remote areas. To some extent, a person's place of birth may determine their future human capital condition. This creates severe regional disparity, and is a major source of inefficiency in current policy and a powerful source of inequality within Chinese society (Gustafsson and Li, 2002). The hukou policy has a significant impact on regional inequality, for instance, the additional fees for access to schooling for the children of interregional immigrants are approximately 10 per cent of total household income (Xie, 1999).

It needs noting that in this chapter different measurements may cause different outcomes, in particular because of other complicated factors, such as genetic and environmental issues**,** which have not been taken into account the measurement of life

expectancy at birth will make a difference to health status. There are other limitations of measurement which still exist, such as the regional inequality which can be exacerbated by the interregional flow of human capital. This situation may arise if, for instance, people from rural areas or less developed regions move and settle in the urban areas or developing regions. This is an aspect not considered in this chapter.

4.7 Conclusions

In conclusion, health status in China among regions has been improved over time to certain extent. Over the past 15 years, people have become better educated, live longer and on average are much taller, thus reflecting improvements to education and health. However, those living in the more highly developed Eastern region have experienced a more rapid improvement in their standard of living and well-being than those living in the Central and Western regions.

This chapter adopts approaches of regional inequality in health from the aspects of income and various levels of educational attainment in 1990, 1995, 2000 and 2005 with considering the time lag of five and 10 years respectively. In addition, it investigates the influence of basic living conditions and distribution of health resources on health status from 1990 to 2005. The differing income levels, uneven natural resources / living conditions / distribution of healthcare resources, lack in awareness of the relationship between education and health, implementation of influential policies and also different measurement have various degrees of influence on the regional inequality in health as discussed in the previous section.

Some detailed findings are summarized as follows. Firstly, the regional locations, natural environment, living conditions, income and various schooling levels have various effects on the health statuses from 1990 to 2005. Secondly, disposable income displays a very significant influence on people’s life expectancy irrespective of which region they are from. Moreover, health inequality in the Central and Eastern regions is represented by the income inequality along with the different stages of economic development. However, in the Western region, health inequality is not only represented by income inequality but also by differences of natural and ecological resources. Thirdly, education plays a crucial role in promoting life expectancy, and it

impinges greatly upon health status. The influence of education levels on life expectancy decreases along with the increasing years of schooling. In addition, there are some remarkable improvements in the reduction of regional inequality, in terms of positive policies by central government, such as the national nine years of compulsory free education and improvements in higher education recruitments from the Western region, as well as the practical medical insurance service expectation. Finally, state and local governments need to be vigilant on the issue of even distribution of health resources and investment contributions in order to sustain regional equality.

Chapter 5 Educational Status and Regional Inequality, 1990-2005

5.1 Introduction

Since 1980 new economic growth theory has focused on human capital as the key to growth. Oded and Omer defined human capital as the prime engine of modern economic growth instead of physical capital accumulation (2002). They argued that regional inequality may be connected with human capital inequality. For instance, on the one hand, the modelling of Glomm and Ravikumar (1992), Saint-Paul and Verdier (1993) and Galor and Tsiddon (1997), all showed that the source of inequality lies mainly in the distribution of human capital. On the other hand, inequality itself affects human capital accumulation (Oded and Omer, 2002). Combining an analysis of Gini coefficients and the distribution of education by quintiles for 108 countries from 1960 to 2000, Amparo and Rafael concluded that human capital inequality measures display more robust results than income inequality measures (Amparo and Rafael, 2002). In another study (Amparo and Rafael, 2008), they found that the countries with higher inequality in the distribution of education had lower human capital accumulation rates (Amparo and Rafael, 2008).

Focusing on the educational dimension of human capital, this chapter investigates how the average years of schooling of the enrolled students reveals an important aspect of regional inequality in China from 1990 to 2005. It aims to examine whether improvements exist in income and educational conditions in the two time periods (1990-1998 and 1999-2005) contributing to educational equality between and within the three regions.

The chapter is organized as follows: section two discusses the background of regional inequality in educational status in China; section three reviews theories and empirical research on educational and income inequality; section four describes methods and data used in this chapter; by employing some simple regressions section five analyses how much the factors of income and regions reflect educational inequality in the average years of schooling. In section six and the conclusion, the key results of this empirical investigation are summarized.

5.2 Background

5.2.1 Educational status in China

A Chinese traditional saying asserts that all other activities are inferior and only learning from books is superior (*wanban jie xiapin, weiyou dushu gao* 万般皆下品，唯有读书高), thus officials were selected by the Civil Service Examinations in China for over one thousand years (Chao, 2009). The abolition of the nationwide examinations in 1905 marked the end of traditional education and then transferred to modern education. During the 20th century, much modern natural and social scientific knowledge was brought into China from western civilizations, replacing the Confucian classics, and therefore new education system was established in China. It was divided into three levels: elementary, secondary and higher education. The instrumentalist view that studying/learning is not only for the sake of knowledge but also to transform the individual's or nation's destiny (*zhishi gaibian mingyun* 知识改变命运) is still a well-known Chinese traditional saying (Chan, 2006). Entering the 21st century, expansion of education was promoted, from primary schools to higher education, across all provinces. The most noticeable evidence is found in the increase in the literacy rate[13] for people aged 15 years old and above, and in increasing numbers of students and schools at all levels of schooling since 1990.

China's education begins with three years' kindergarten (ages 3-6)[14] and continues with five-six years' primary education (ages 6-12), three years' secondary education (ages 12-18), and higher education (tertiary). Secondary education includes junior and

[13] A literate person in China is defined that one who can recognise more than 1,500 Chinese characters for a farmer and 2000 characters for an office employee or urban resident. The decision of the State Council on the reform and development of basic education promulgated on 10th July 2001, in order to strengthen the leadership and guidance provided by governments at all levels to literacy and post-literacy education. It is provided by local governments at all levels and it should persist in making the "two basics" their "top priorities" in educational development. In order to further expand 9-year compulsory schooling, and to keep the literacy rates among young and middle-aged adults above 95%, a basic education programmes with literacy classes as its integral part should be incorporated into the plan for economic and social development. National Literacy Policies (http://www.accu.or.jp/litdbase/policy/chn/index.htm)

[14] It refers to full-day programme educating children from age 3 to age 6, about 20% of the 3-6 years old attend kindergarten (Zhong, 1989), most of them are from urban families. It covers three groupings: junior (3 years old), middle (4 years old) and seniors (5 years old) (Cleverley, 1985). Class size increased with age, ranging from 20 to 40 children, typically with two teachers and a nurse per each group. It has various sources that the government, government-licensed private individuals and neighbourhood committees and work units all could provide kindergarten programmes.

senior secondary schools, and some specialized secondary and vocational secondary schools. Higher education includes universities and colleges, normally a college certificate requires three years but a university bachelor's degree takes four years. In addition, higher education covers programmes for postgraduates, inclusive of 2-3 years for a master's degree and a further 3-4 years for a doctorate.

Over the past two years, China has gone through successful educational reform with two positive steps (Hawkins, 1992). First, China has taken the introduction of legislative measures and linking "educational law" with the overall planning process in education and teacher education. In the "teachers law and educational law" publicized recently, teachers' rights and responsibilities and educational financing have been stipulated. Second, teachers' treatment has been significantly improved. For instance, by January 1995, almost all elementary and secondary teachers have been fully paid in their salaries.

The shortage of teachers, especially in remote areas, may have been the consequence of the implementation of the compulsory education law extending to nine years mass education ruling, as the extra years of compulsory education resulted in the previously underdeveloped lower level of secondary schooling experiencing even more pressure. Meanwhile there emerged a new demand for specialists to teach in the increasing number of secondary technical and vocational schools which led China to establish new criteria for teachers (State Education Commission, 1995, p. 58):

1) Primary school teachers should have normal school certification
2) Junior secondary school teachers should be graduates of normal colleges
3) Senior secondary school teachers should have educational background including normal universities

However, there has never been any certification, in its true sense, as the quality of graduation grades from education institution various greatly because there were no clear national standard of implementation, thus a high quality of teaching could not be guaranteed. Shortage of qualified teachers is more detrimental in less-developed areas than in the more developed areas thus together with the differences in regional economic development education inequality is exacerbated.

Some key indicators of education inequality are listed in Table 5.1. Data are displayed within the three geographic regions (the Eastern, Central and Western regions) to show regional differences in population size, illiteracy rates for people aged 15 and above, and average years of schooling between 1990 and 2005. It is clear that most provinces in the Eastern region have a high density of population, for instance, the population of Guangdong province increased by over 30 percent from 1990 to 2005 to 91.94 million. The provinces in the Central region are medium-size in terms of population, and the Western region has a smaller population than the Central and Eastern regions. Provinces with larger populations are likely to have higher illiteracy rates than those with smaller populations. However, the people in the Eastern region have fairly good illiteracy with an average rate of 8.1%. For instance, Shandong province, with over 92 million people, had a 12% illiteracy rate in 2005, having improved 11 percentage points from 1990. The nationwide literacy rate has achieved a fast increase over time, especially the Western region. For instance, the illiteracy rate declined 24.5 percentage points to 44.8% in 2005 from 1990.

The years of schooling of people aged six and above told another story: those education achievements are uneven among regions and provinces. For instance, in 2005, the average years of schooling was 8.6 in the Eastern region, and eight and seven years for the Central and Western regions respectively; and the gap in the average years of schooling could be as large as seven years between provinces. The greatest number of years of schooling was attained in the Eastern region with nearly two years of additional schooling in 2005, compared with 1990. This was especially so for students in the metropolitan cities of Beijing, Shanghai and Tianjin, which all had illiteracy rate lower than 6% and had at least a 2.2 year increase in average years of schooling compared with 1990. However, the Central and Western regions were catching up, with some provinces in the Western region making especially quick progress. In Gansu and Qinghai the illiteracy rate was still over about 20% in 2005, and the average years of schooling was less than 7 years, although it had improved 2 years between 1990 and 2005. There were no striking differences in average years of schooling between provinces in the Central region over time.

Table 5.1 Key indicators of education inequality (2005)

Indicators	POP.	2005 ILR	CIILR	2005 YOS	CIYOS
East	**506.1**	**8.1**	**9.8**	**8.6**	**2.0**
Beijing	15.4	3.9	7.0	10.7	2.6
Tianjin	10.4	4.8	6.8	9.5	2.2
Shanghai	17.8	5.2	8.3	10.0	2.3
Hebei	68.5	7.2	14.4	8.2	2.0
Liaoning	42.2	4.8	6.7	8.7	1.6
Jiangsu	74.8	10.0	12.7	8.1	1.9
Zhejiang	49.0	12.0	11.0	7.6	1.7
Fujian	35.4	12.9	10.2	7.5	1.8
Shandong	92.5	12.4	10.6	7.7	1.7
Guangdong	91.9	6.0	9.1	8.4	1.9
Hainan	8.3	9.8	11.4	8.1	1.9
Central	**417.4**	**9.7**	**11.0**	**8.0**	**1.7**
Anhui	61.2	19.2	15.1	7.0	1.9
Shanxi	33.6	5.6	10.2	8.4	1.8
Jilin	27.2	5.9	8.5	8.5	1.6
Heilongjiang	38.2	6.2	8.8	8.5	1.6
Jiangxi	43.1	10.5	13.6	7.5	1.8
Henan	93.8	9.8	13.3	8.0	1.8
Hubei	57.1	12.1	10.2	7.8	1.7
Hunan	63.3	8.6	8.4	8.0	1.7
West	**359.8**	**18.1**	**13.7**	**7.0**	**1.8**
Inner Mongolia	23.9	11.3	10.4	8.2	2.0
Guangxi	46.6	8.6	7.6	7.7	1.6
Chongqing	28.0	11.7	9.6	7.4	1.6
Sichuan	82.1	16.6	4.6	6.8	1.0
Guizhou	37.3	21.4	15.3	6.4	1.8
Yunnan	44.5	20.1	17.4	6.4	2.0
Tibet	2.8	44.8	24.5	3.7	1.8
Shaanxi	37.2	10.3	14.8	8.1	2.0
Gansu	25.9	20.8	18.3	6.9	1.9
Qinghai	5.4	24.1	16.0	6.8	2.0
Ningxia	6.0	18.7	14.8	7.4	2.1
Xinjiang	20.1	8.3	11.2	8.2	2.0

Sources: Data for 2005 are from the *China Statistical Yearbook* 2006 (NBS, 2006), and data for 1990 are from the China Educational Statistical Yearbook (NEC, 1991). Changes were calculated by the author.

Notes:
1. POP. = population (million persons)
2. 2005 ILR = 2005 Illiteracy rate of aged 15 and above (%)
3. CIILR = 1990-2005 change in illiteracy rate (percentage point)
4. 2005 YOS = 2005 average years of schooling of people who are six years and above (years)
5. CIYOS = 1990-2005 change in average years of schooling (years)

5.2.2 School resource distribution

In order to understand resource distribution between the three regions, it is valuable to analyse the following factors in detail: the number of schools, students and teachers at different levels of education, the ratio of students to teachers and the amount of investment in education.

In 1990, there were 766,072 primary schools, 87,631 regular secondary schools (inclusive of 71,953 junior secondary schools, and 15,678 senior secondary schools), and 1,075 higher education institutions nationally. By 2005, the number of primary schools had decreased while the number of senior secondary schools and higher education institutions had increased. There were 366,213 primary schools, 77,977 regular secondary schools (inclusive of 61,885 junior secondary schools, and 16,092 senior secondary schools), and 1,792 higher education institutions.

The change reflects demographic trends and policy initiation. Generally speaking, 5-24 year old is the age for education. The percentage of the total population aged 5-14 (from primary school to junior secondary school) declined from 17.4% in 1990 to 14.2% in 2005; meanwhile the percentage of 15-24 year olds (from senior secondary school to higher education) dropped from 21.8% to 16.5%. This specific demographic trend is described as an overviewed increasing population over time, but with a small number of youth populations and a large number of ageing population. That is partially a result of the one child policy, which was implemented in China after 1979 and had a huge impact within one generation. In addition, while expanding nationwide literacy since 1979, in order to centralize education resources and focus on quality improvement in secondary schools, some county-level secondary schools and village-level schools have been merged. Therefore, there has been a shift of resources from primary to secondary and post-secondary schools, and also from less-developed

to developing regions. Higher education was likewise reformed, and a number of private institutions appeared in a previously state-only system.

Table 5.2, the distribution of school establishments by education level in 2005, shows that the Eastern region, compared with the Central region, had fewer primary, junior and senior secondary schools, but table 5.2 shows that average primary and junior secondary school sizes were larger in the East. The Western region was positioned between East and Central in terms of the total number of educational establishments at all levels. There was the same number of universities in both the Eastern and Central regions in 2005. From 1990 to 2005, the number of primary schools and junior secondary schools in the Eastern region declined by 2.9% and 1.6% respectively, whilst the number of senior secondary schools increased by 4.9%; there was a slight increase, of 0.6% in higher education institutes. In the Western region, the number of primary schools and higher education institutes dropped by 4.4% and 3.8% respectively. More striking is the 9.2% decline in the number of senior secondary schools. However, a more positive picture is revealed in the Central region, with numbers of schools at all levels increasing to different degrees, e.g. a 7.2% increase in primary schools and a 3.1% increase in universities.

Table 5.3 reports the number of students per school in 2005 and the changes over time between 1990 and 2005. There was an increase of about 70% across the three regions in terms of the number of students per senior secondary school and university. In 2005, the students per primary school and per junior secondary school were 395 and 1,122 in the Eastern region, which had the highest numbers. For senior secondary school and university the highest enrolments per institution were in the Central region with 1, 620 and 9,076 respectively. From 1990 to 2005, numbers of enrolled students per school in the Eastern region increased by 54% for primary schools, by 53.8% for junior secondary schools, by 70.7% for senior secondary schools and by 77.5% for higher education. Some improvement could also be found in the Central and Western regions. There was a great increase of about 70% in the Western region enrolments, for both senior secondary schools and universities. For primary schools the increase was a more modest 49.9% and only 37.2% in junior secondary schools, which lagged far behind the increase at other levels of schooling and in other regions.

Teacher resource is also a key input in educational production. In fact, it is a common phenomenon that remote and rural areas with harsh working conditions lack well-trained teachers (Ankhaza-Dove, 1982). Furthermore, low educational quality in those areas is related to the existence of an uneven distribution of teachers across schools (Tsang, 1997). However, the importance of supplying sufficient and qualified teachers has been recognized by many policy makers in education, so that salaries and working conditions for teachers are paid more attention nowadays (Murnane and others, 1995).

Table 5.4 illustrates that the highest ratio of students to teachers in 2005 was in primary schools (20) in the Western region, but the ratio falls to 18 in the secondary and 16 in higher education. However, the lowest student/teacher ratio in the primary schools and secondary schools was in the Eastern region where, on average one teacher looked after 17 students. From 1990 to 2005, the student/teacher ratio only decreased in primary schools, but had increased by approximately 11 students in higher education across all three regions. It remained the same in the Eastern and Western regions for secondary schools.

The three tables may have reflected that the uneven distribution of educational resources at various levels of education across regions. If only the numbers of students increase but not the numbers of schools and teachers, the intensity of resources usage may cause competitiveness and unfairness in the market of education. From 1990 to 2005, along with the increase in senior secondary school and university numbers, the number of students who entered post-senior secondary schools kept climbing. More students entering universities may bring teachers more workload and pressure; as a result, a teacher has to take more responsibility for an increasing number of students.

Table 5.2 Number of schools at different levels in 2005 and ratio changes from 1990 by region

2005	PRI.	%	JUN.	%	SEN.	%	HE	%
East	8,767	-2.9	1,816	-1.6	562	4.9	72	0.6
Central	17,420	7.2	2,890	0.4	641	4.2	72	3.1
West	10,868	-4.4	1,566	1.2	399	-9.2	36	-3.8

Sources: Data for 2005 are from *China Statistical Yearbook* 2006 (NBS, 2006), and data for 1990 are from the China Educational Statistical Yearbook (NEC, 1991). Changes were calculated by the author.

Notes:
1. PRI. = Primary schools
2. % = changed ratios to the national numbers in 2005 from 1990
3. JUN. = Junior secondary schools
4. SEN. = Senior secondary schools
5. HE = Higher education

Table 5.3 Students numbers at different level of schools in 2005 and changes between 1990 and 2005

2005	In PRI.	%	In JUN.	%	In SEN.	%	In HE	%
East	395	54.0	1,122	53.8	1,554	70.7	8,974	77.5
Central	254	33.8	949	50.7	1,620	66.5	9,076	79.2
West	269	49.9	924	37.2	1,292	69.4	7,753	75.2

Sources: NBS, 2006 and NEC, 1991

Notes:
1. In PRI. = in primary schools
2. % = percentage increase over numbers in 1990
3. In JUN. = In junior secondary schools
4. In SEN. = In senior secondary schools
5. In HE = In higher education

Table 5.4 Student and teacher ratio at various levels of schooling in 2005 and changes of the ratio between 1990 and 2005

STR.	In PRI.	change	In SEN.	change	In HE	change
East	17.2	-6.1	16.6	0.0	17.0	11.5
Central	18.0	-3.2	18.7	1.2	16.5	11.0
West	20.6	-1.4	18.3	0.0	15.7	10.7

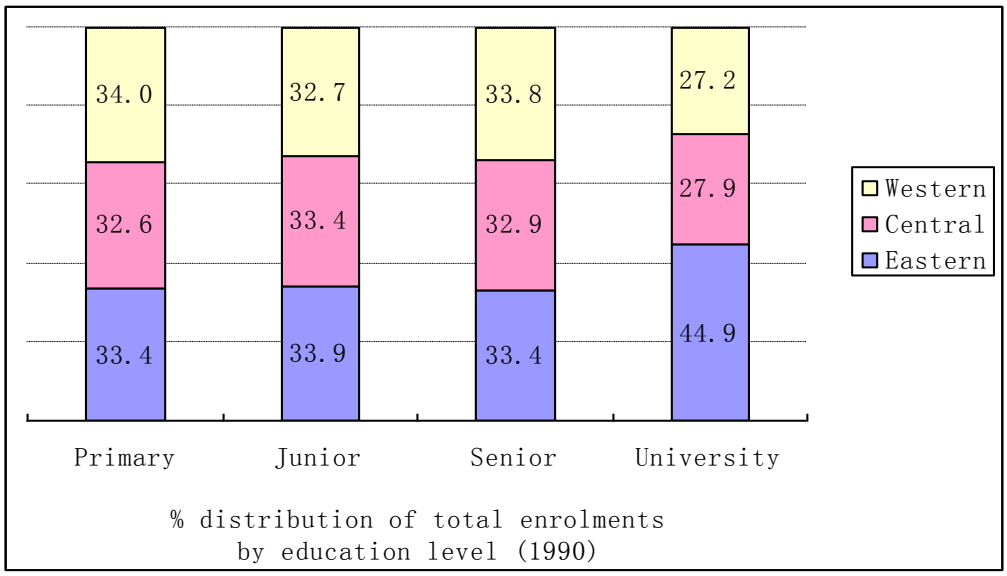
Sources: NBS, 2006 and NEC, 1991

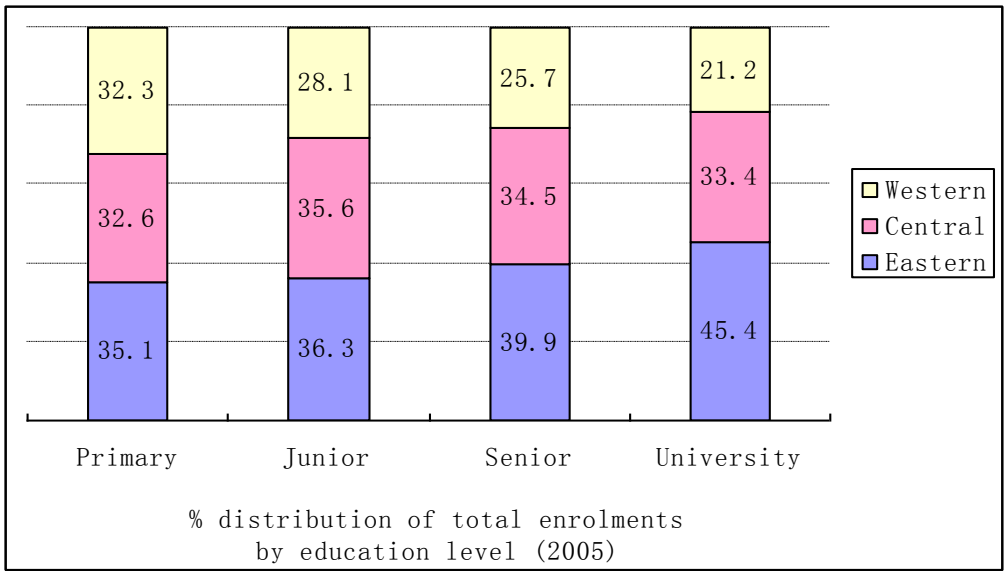
Notes:
1. STR. = Students and teachers ratio
2. In PRI. = In primary schools

3. In SEC. = In secondary schools
4. In HE = In higher education

Increasing figures of educational resources may promote fortune-changing opportunities for school students. Figure 5.1 represents the percentage distribution of total enrolments at different levels of schooling, by region, in 1990 and 2005. In primary schools, the enrolled students were relatively evenly allocated among the three regions with, only a slight change between 1990 and 2005. The biggest percentage distribution in primary school was in the Western region at 34%, in 1990, but shifted to the Eastern region, at 35.1%, in 2005. The number of enrolled students in junior and senior secondary schools increased by three percentage points in the East and six percentage points in the Central region from 1990 to 2005, but decreased by approximately four and eight percentage points in the West in the same period. The highest percentage of total enrolments remained in both the junior and senior secondary schools in the Eastern region. There was an increase at six percentage points in the university level in the Central region, whilst the lowest percentage remained in the West, which decreased by six percentage points.

Figure 5.1 The distribution of total enrolments at different levels of schooling by region (1990 and 2005)



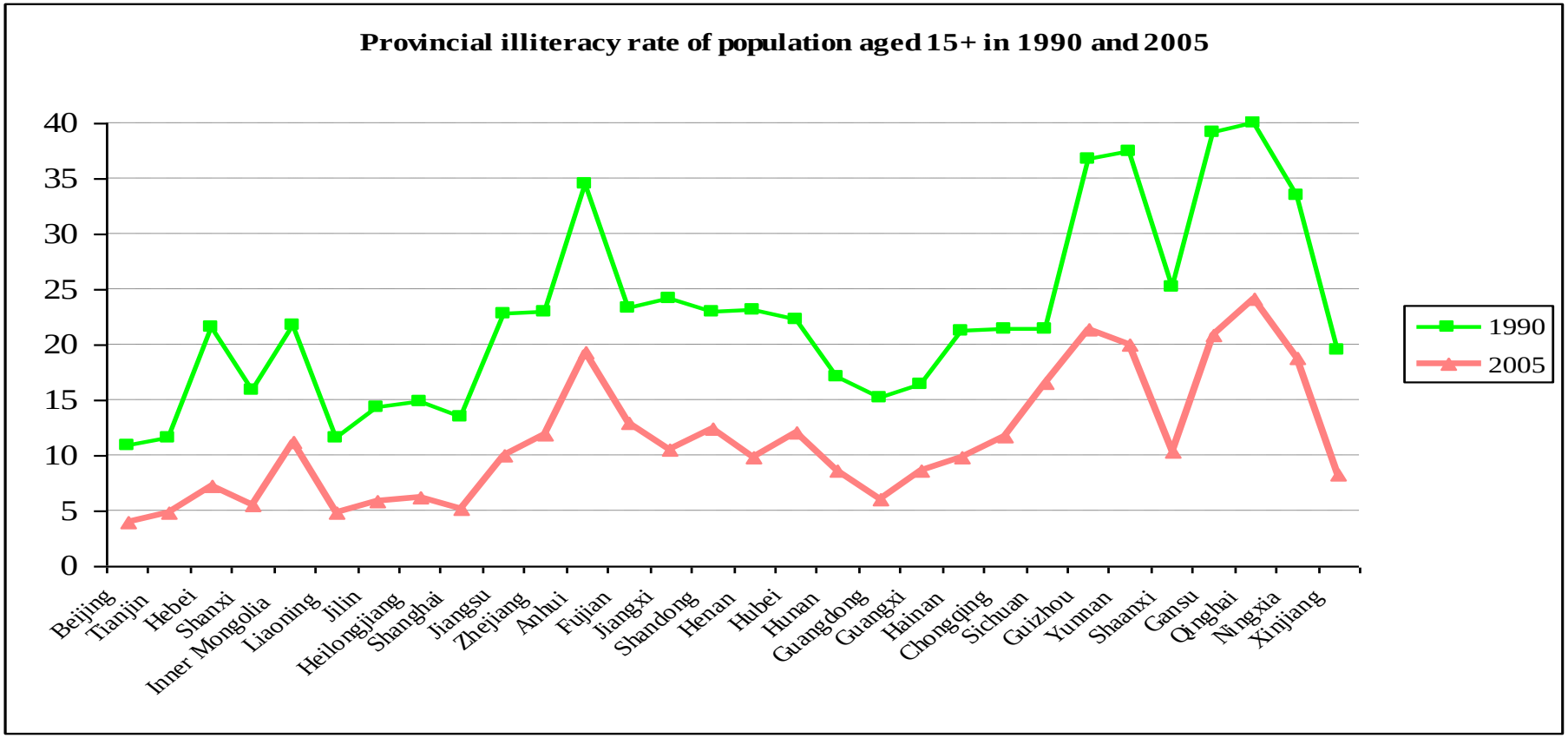


Sources: Data for 1990 are from China *Educational Statistical Yearbook* 1990 (NEC, 1991), and data for 2005 are from *China Statistical Yearbook* 2006 (NBS, 2006).

In 1949 China had a population of 0.54 billion, with widespread illiteracy, with only about 20% said to be literate. In 1990, with a population of over 1.2 billion, the literacy rate in China reached 78%, which was twice the average for low-income countries. By the end of 2005, the literacy rate had reached 95%, and the illiteracy rate of youth and middle-aged people was below 4%. Figure 5.2 compares, by province, the illiteracy rates of people aged 15 and above in 1990 and 2005. Variation

between provinces remains large despite huge improvements. In terms of reduced illiteracy rates there was a remarkable improvement between these years. The lowest rates remained in Beijing, Tianjin and Shanghai, with less than 13.5% in 1990 and less than 5.5% in 2005. In contrast, Qinghai had the highest illiteracy rates with 40% in 1990 and 24% in 2005. People from the poorer, remote Western region were seemingly disadvantaged regarding the provision of education, with the illiteracy rate four to five times higher than in the developed Eastern region in 2005.

Figure 5.2 Illiteracy rate of people aged 15 and above (1990 and 2005)



Sources: Data for 1990 are from *China Population Census* (NBS, 1993), and data for 2005 are from *China Statistical Yearbook* 2006 (NBS, 2006) http://www.stats.gov.cn/tjsj/ndsj/2006/indexch.htm

5.2.3 Investment distribution

Since the policy of decentralization of state financial support for education was implemented in 1990, the government proportion of the education budget has gradually dropped from 85.6% in 1990 to about 60% in 2005; its average growth per year is below the investment from non-governmental sources at the same period of time. In 1990, the USA government invested 6.5% of GDP in education in order to accumulate powerful human capital and it increased education investment to 7.15% of GDP in 2005 (http://www.chinavalue.net, 27th January, 2010). In 2005, the Chinese government's expenditure on education accounted for only 2.82 % of GDP, which lagged behind the 4% target required under China's 1993 Education Law (Development Research Centre of the China's State Council, 1993).

Meanwhile, households need to follow the co-funding system and to share the rising tuition fee with national and local government. For instance, in 1990 tuition fees and incidental expenses were approximately 100, 200 and 300 RMB per annum for primary, junior and senior secondary schools respectively; and in 2005, there increased about four fold to approximately 405, 708 and 1,215 real RMB. In addition, tuition fees in higher education increased at least 50% during the same period. However, in fact, the increase of income was imbalanced across different industries, regions and ownerships; for instance, the income of farmers in the Eastern region was 14% higher than those in the Western region (http://www.jnmpacc.com/ 13th June, 2007). Therefore, the real differences in affordability of tuition fees by household determine the real investment in education and educational attainment.

5.3 Literature

5.3.1 Growth, education and income inequality

From the 1960s scholars began to take the education factor into accounts of economic growth. They named education and health as the two economic growth engines and found that education builds up personal productive capacity in economic production (e.g. Schultz, 1971; Becker, 1975), and also enhances regional capacity. Moock and Addou (1994) demonstrated a positive and significant relationship between education

and productivity. The more highly a person is educated the more able he/she is to grasp knowledge and skills, which can then be applied with greater effectiveness, this in turn raises his/her productive capacity. Education can also be said to give the means of earning a higher income in the labour market. Just as education contributes to individual persons, better education can also promote the economic development of countries. Psacharopoulos (1994) found investment in education could bring a high rate of return for developing countries. For instance, the attention to how China has invested in education for sustainable development was increasing (Tsang, 2002).

Furthermore, a 1995 World Bank report focused on the contribution of educational development to economic growth and competition, improvement in social equality and poverty alleviation (World Bank, 1995). Sen defined poverty as the "deprivation of some minimum fulfilment of elementary capacities"; inequality in education is thus inequality in well-being (Sen, 1992). Since 1982 with the increases in wages, western policy makers have stated that schooling was the best tool to reduce increasing wage inequality (Katz and Murphy, 1992; Juhn *et al.*, 1993). Evidence from high-income countries suggested that differences in income between countries were heavily affected by rewards for various educational attainments (Sullivan and Smeeding, 1997). Similar research found that increased levels of education could increase skills and income for individuals, and therefore that educational policies have a powerful influence on income inequality (Ashenfelter and Rouse, 2000).

Also, a primary result from some research models found that anticipated economic growth could stimulate increased demand for schooling (Becker, 1964; Mincer 1974; Rosen, 1976; Mark and Peter, 2000). Schooling involves a sacrifice of current income for higher future income, and it helps contribute to income and then promote economic growth. Barro *et al.* found that growth drives schooling rather than that schooling drives growth (Barro and Sala-i-Martin, 1995). In reality, once people's income rises, they can invest more in education immediately. However, it takes time to be educated, and then to be ready to enter the labour market and then possibly to earn a high future income. Therefore observing the contribution of income to education rather than the contribution of education to income could ignore the time lag error in the research.

5.3.2 Investment and returns

Returns from education have been much analysed in labour economics research, because the pay-off from schooling affects public and private decisions about how much to invest in education (Card, 1999; Martins and Pereira, 2004). Gupta *et al.* (2002) and Baldacci and others (2004) found that social spending was a key to determining the outcomes of education (Anand and Ravallion, 1993; Psacharopoulos, 1994; Hojman, 1996; Bidani and Ravallion, 1997). Furthermore, Gupta *et al.* found that spending on education had a very significant influence on development of literacy and quality of population. These results showed that public education spending has a significant linkage with literacy rate and educational attainment, etc. (Noss, 1991; Mingat and Tan, 1992, 1998; Flug, Spilimbergo and Wachtenheim, 1998; Gupta *et al.*, 2002).

According to a report from the E-Journal of China Development Observation published by the Development Research Centre of China's State Council, two major problems relate to investment in China's education. Firstly, the actual investment from local governments lags behind the budgets, although central government is able to provide financial support. Public education resources are unevenly distributed, for example, the number of schools at various levels, and enrolled students and full-time teachers. Even if investment in education in the Western and Central regions keeps increasing, local governments' ability to afford it varies widely across and within regions. For instance, in 2004, the per capita local budget for education displayed huge differences among the 31 provinces. Comparing the province with the highest amount of educational investment with the lowest, the highest investment in primary schools was 10.2 times at the lowest, 8.9 times at junior secondary school level, and 7.8 and 8.1 times-higher at senior secondary school and higher education levels respectively.

Secondly, the structural imbalance in educational investment persists. The ratio of the share of the state investment in higher education to the total amount of investment in education in China is the highest in the world, especially in national key universities (Sun, 2005), such as Peking University and Tsing Hua University. In contrast, basic education - the nine years of compulsory education - received less financial support

from the central government and local governments than higher education. One of the Chinese representatives of the World Bank, Fuman Hao, suggested that China restructure the investment share evenly across various levels of education, and that more investment was needed in basic education, especially in the poor and remote provinces (http://www.chinado.cn 20th April, 2006).

5.3.3 Measurement of inequality in education

Education inequality can be measured in various ways. Two common methods are the use of the standard deviation or dispersion of education as a measurement of absolute inequality, and the other is to construct a Gini style coefficient of education inequality as a measurement of relative inequality. There is growing literature on measuring inequality in education by using standard deviations of schooling (Lam and Levinson, 1991; Londoño 1990; Ram, 1990; Birdsall and Londoño, 1997; Vinod, Wang and Fan, 2002). For instance, Birdsall and Londoño examined a significant negative relationship between education dispersion and income growth (Birdsall and Londoño, 1997). Another instance, in the Inter-American Development Bank (1999) study on inequality in Latin America, the standard deviation of schooling as a measurement of educational inequality, has a positive relationship with income inequality. Rati Ram also concluded that the trend of the development of educational attainment shows that educational inequality first increases and then decreases. Educational equality reaches a peak after about seven years' education (Ram, 1990). However, standard deviation of schooling is only a measurement of dispersion, but not a good indicator of education inequality in distribution (Vinod, Wang and Fan, 2002).

Some studies have measured the inequality in education by using Gini coefficients based on enrolment rate for sixteen East African countries, although they were unable to take the quality of education into account, which may correlate with income growth significantly (Maas and Criel, 1982; Rosthal, 1978 and Sheret, 1988). Vinod *et al.* (2002) used a measure similar to Income Gini coefficient: an education Gini, which measures the inequality in average years of schooling. They found that education inequality has been dropping, although it has made slow progress in most countries (Vinod, Wang and Fan, 2002). From 1960 to 2000, the education Gini declined rapidly in some countries, such as South Korea and China. Countries with higher

average years of schooling achieve more equitable education than those with lower average years of schooling. Education inequality in high-income countries is less than that of low-income ones (Vinod, Wang and Fan, 2002). In regression results with panel data, Vinod *et al.* verified a significant negative relationship between educational attainment and education Gini. A slowdown in the expansion of average educational attainment in China has exacerbated regional inequality since 1990 (Wang and Yao, 2003). That has been attributed to the stagnant public investment in education and the uneven distribution of education resources, in particular in poor regions (Wang, 2006).

5.4 Methods and data

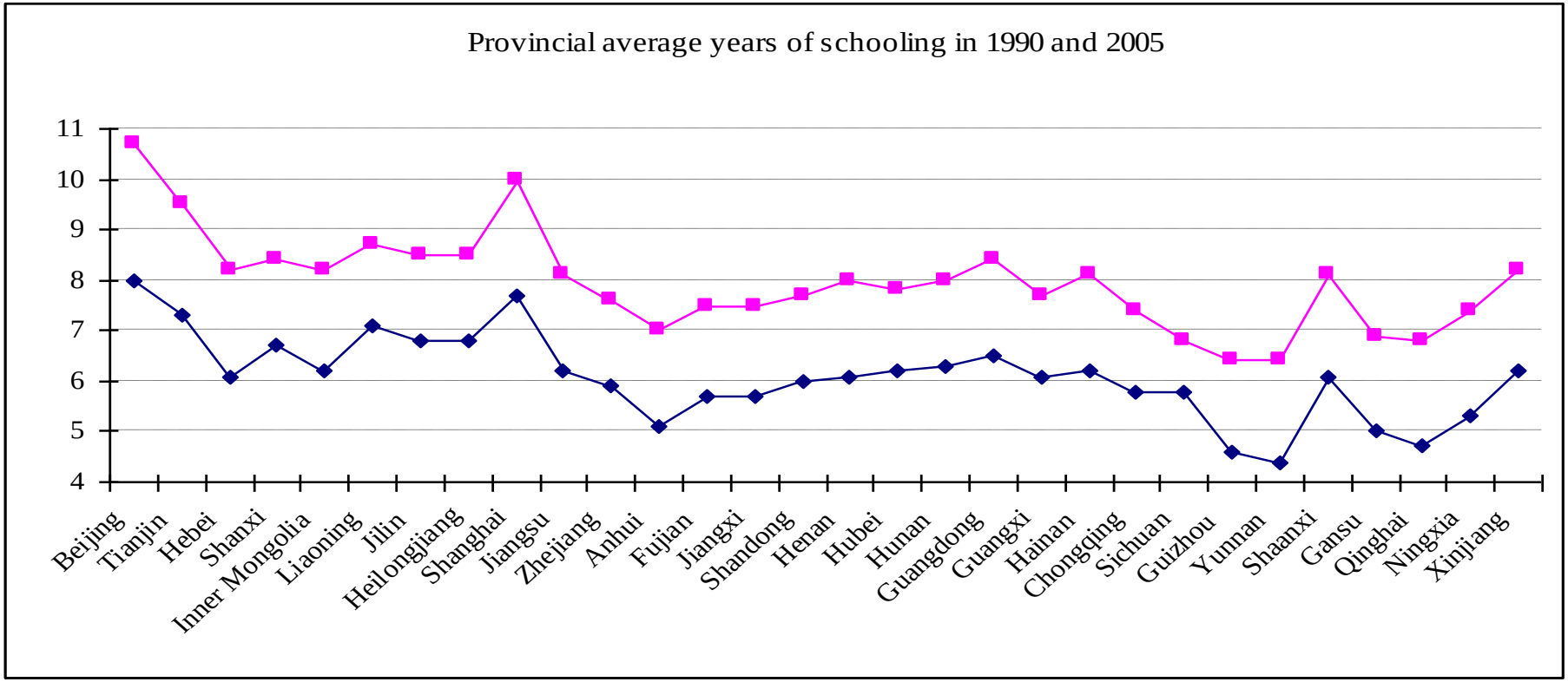
Regional inequality in education is broadly a measure of the opportunity of a population to access different levels of schooling. This chapter selects average years of schooling as the most representative variable of educational status. It is a measure of the per capita stock of education attained.

5.4.1 Educational indicator

At the aggregated level, the outcome of education of each province could be measured in different ways, using indicators such as adult literacy rates, enrolment rates or average years of schooling. Average years of schooling is the most commonly used measure of education and proxy for human capital stock. It is calculated as the average years of education of the population who have successfully completed various levels of formal education in the total population in education aged from 6 years old and above. Average schooling is broadly and economically associated with attainment of relevant knowledge and competence. This is one of the key advantages of the measure, in comparison with the adult literacy rate and enrolment rate measure in this research. In addition, both the literacy rate and enrolment rate indicate how many people are educated, but not which level of schooling they are in. In other words, they are the proxies of breadth of education rather than of depth of education. However, the various levels of schooling associated as a cycle of education relate to different age groups (OECD, 1998b).

In practice, the populations in education age groups are not available for each year, and, consequently the average years of schooling of the enrolled student population is employed as the primary measure in this chapter. This number of enrolled students is expected to complete schooling successfully, and the small number of dropouts is ignored. The average years of schooling involve four levels of education: primary, junior, senior secondary schooling and higher education.

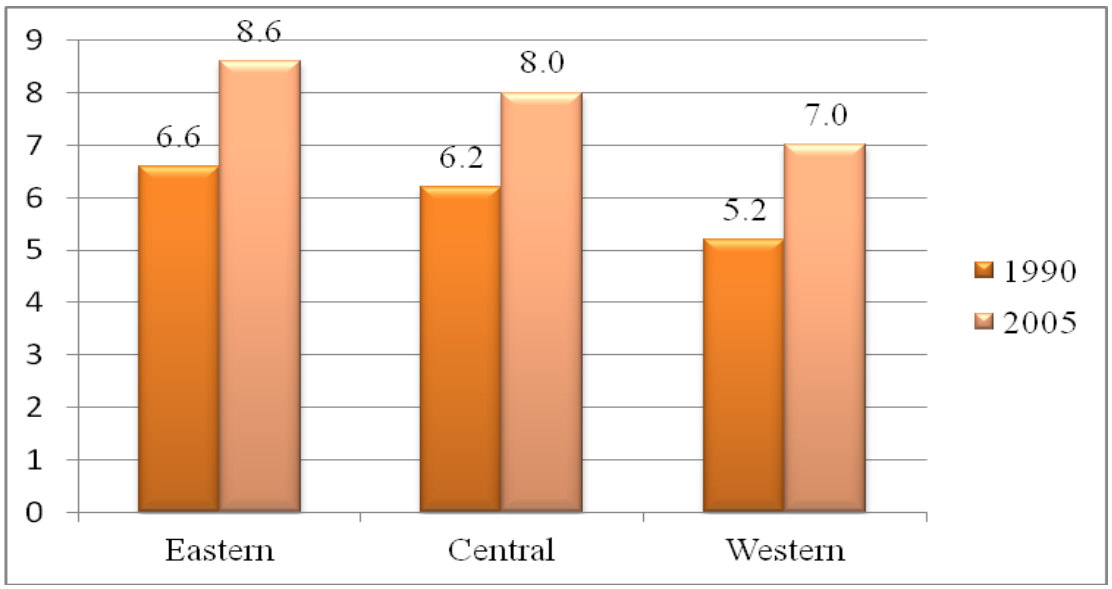
Figure 5.3 Provincial average years of schooling (1990 and 2005)



Sources: Data for 1990 are from *China Census Statistics* in 1990 (NBS, 1993) and data for 2005 are from *China Statistical Yearbook* 2006 (NBS, 2006), and are calculated by the author. http://www.stats.gov.cn/tjsj/ndsj/2006/indexch.htm

Figure 5.4 represents the average years of schooling of people aged 6 years and above at provincial level in 1990 and 2005. At first glance, the improvement of each province between the two periods is of a similar magnitude, though the absolute difference is large. Years of formal schooling in most provinces increased approximately two or three years on average. Beijing and Shanghai achieved the longest length of schooling, with 10 years on average. But most provinces were in the range 6.5-8.5 years of average schooling.

Figure 5.4 Years of schooling of people aged 6 and above by region (1990 and 2005)



Sources: Data for 1990 are from *China Census Statistics* in 1990 NBS (1993), and data for 2005 are from *China Statistical Yearbook* 2006 (NBS, 2006), and are calculated by the author.

A noticeable difference in average years of schooling by region is shown in Figure 5.4. Students from the Eastern region had a two years' increase in schooling from 1990 to 2005, in contrast, students from both the Central and Western regions only had a 1.8 years increase. It may be concluded that even though the Western region lags behind the Central and Eastern regions in terms of years of schooling; however in relative terms the increase in years of schooling between 1990 and 2005 was greater in the West than in the East and Central regions. Nevertheless, people from the Eastern region are ahead of other regions in general because of advantages in terms of education resources, such as the number of schools and full-time teachers.

5.4.2 Methodological issues

Using the three economic region divisions, the rest of chapter attempts to firstly investigate to what extent average income determines educational status, which is the relationship between average years of schooling of enrolled students and income. Secondly, it explores the contribution of government investment to average years of schooling. Thirdly, it measures whether there have been changes by region from 1990 to 2005. As a result of the implementation of higher education expansion in 1999, nine years of compulsory free education is widely spread in most of provinces in late 1999 and 2000. These two policies have had huge impacts on the average years of schooling of enrolled students since 1999. Therefore, 1999 could be treated as a turning point, and the time period observed in this research is divided into two periods, 1990-1998, before the expansion, and 1999-2005 post-expansion.

In order to investigate whether 1999 is a turning point from educational equality to inequality in the time period from 1990 to 2005, an F and p-value test is used. The ANOVA Post Hoc Test shown in Table 5.5, $p>0.05$, means the logged income has an insignificant relationship with the average years of schooling of the enrolled students in the period of 1990-1998. In contrast, $p<0.05$, represents a significant relation between the logged income and average years of schooling in the period 1999-2005. Therefore, this F and p test supports the hypothesised division of time period in this research.

Table 5.5 Results of the ANOVA Test (1990 and 2005)

1990-1998	Sum of Squares	df	Mean Square	F	p.value
Between Groups	20.87	217	0.096	1.137	0.296
Within Groups	4.397	52	0.085		
Total	25.267	269			
1999-2005	Sum of Squares	df	Mean Square	F	p.value
Between Groups	99.644	164	0.608	3.988	0
Within Groups	6.856	45	0.152		
Total	106.5	209			

Sources: Data for 1990-1998 are from the China Educational Statistical Yearbook (NEC, 1991-1999 for various years), and data for 1999-2005 are from China Statistical Yearbook online resources (NBS, 2000-2006 for various years).

Income plays a direct influential role in the average years of schooling. Three representative factors of educational conditions to the average years of schooling are also taken into account: total population, total government investment and student/teacher ratio in primary schools; the first two factors are relative to the coverage population being beneficiaries of education expansion and the latter relates to the distribution of teaching resources at a basic level and the quality of teaching in basic education.

Therefore, two groups of regression equations were designed, observing the relationship between income and average years of schooling of the enrolled students between regions (Equation 1a), and then the relationship between income and the three educational conditions mentioned above and the average years of schooling between regions (Equation 1b). The first group of equations treat the average years of schooling of enrolled students as the dependent variable, and the logged per capita disposable income and regional dummies as the independent variables. Another group of equations focus on the relationship between the logged income, educational conditions and the average years of schooling of the enrolled students within the Eastern (2a), Central (2b) and Western (2c) regions.

The two groups of equations for education status are listed as follows respectively.

$$H_{edu.} = a + \alpha_1 R_{east} + \alpha_2 R_{west} + \beta I_{inc.} + \mathrm{E} \quad (1a)$$

$$H_{edu.} = a + \alpha_1 R_{east} + \alpha_2 R_{west} + \beta I_{inc.} + \gamma EC + \mathrm{E} \quad (1b)$$

$$H_{edu.east} = a + \alpha I_{inc.} + \beta(EC._{1.pop.} + EC._{2.gov.invt.} + EC._{3.stu./tea.}) + \mathrm{E} \quad (2a)$$

$$H_{edu.central} = a + \alpha I_{inc.} + \beta(EC._{1.pop.} + EC._{2.gov.invt.} + EC._{3.stu./tea.}) + \mathrm{E} \quad (2b)$$

$$H_{edu.west} = a + \alpha I_{inc.} + \beta(EC._{1.pop.} + EC._{2.gov.invt.} + EC._{3.stu./tea.}) + \mathrm{E} \quad (2c)$$

In Equation 1a and 1b, the dependent variable $H_{edu.}$ is the average years of schooling of the enrolled students; a is the constant coefficient; R_{west} is the dummy variable for Western regions, where coded 0 for non-Western regions and 1 indicates the Western regions. R_{east} is the dummy variable for the Eastern

region, similarly coded 0 for non-Eastern region, and 1 indicates the Eastern region. Accordingly, the Central region becomes the reference region[15] for more intuitive comparison, which is omitted. $I_{inc.}$ indicates people's real per capita disposable income, EC as a weighted value indicates the educational conditions, which affects the years of schooling of the total population, the amount invested in education by the local governments and the student/teacher ratio in primary school. E is an error term, which is treated as a random variable. $\alpha_1, \alpha_2, \beta, \gamma$ are coefficients of the East region variable, the Western region variable, real per capita disposable income and educational conditions variables respectively. The purpose of regressions 1a and 1b is to measure variations between regions in the average years of schooling.

The second group of regressions, 2a, 2b and 2c, aims to measure the average years of schooling within regions. $H_{edu.east}$, $H_{edu.central}$ and $H_{edu.west}$ indicates the average years of schooling of enrolled students in the Eastern, Central and Western regions respectively. The purpose of the equations is to measure within region sources of inequality in the average years of schooling. a is the constant coefficient; $I_{inc.}$ is real per capita disposable income, educational conditions $EC._{1.pop.}$ is the total population; $EC._{2.gov.invt.}$ is the total amount of investment in education and health by local governments; $EC._{3.stu./tea.}$ is the student/teacher ratio in primary schools. α, β are coefficients of the variables of real per capita disposable income and educational conditions respectively. E is also an error term, which is treated as a random variable.

5.4.3 Data

Data for provincial education, income and government spending are taken from the Chinese national census of 1990 and 2000 (NBS, 1993, 2001a), the China Educational Statistical Yearbook from 1990 to 1998 (NEC, 1991-1999), combined with online resources of China Statistical Yearbook from 1996 to 2005

[15] Taking any one of the three regions as a reference region and keeping other two as dummy variables, the results of regression will keep consistent. However by focusing on the Central region a more intuitive comparison may be made.

(NBS, 1997-2006). Data, such as that for the provincial population, has also been taken from the China Compendium of Statistics 1949-2004 compiled by the National Bureau of Statistics (NBS, 2005a).

The missing data from 1990 to 1996 for Chongqing is here replaced by the data for Sichuan province. Tibet, which is part of the Western region, is excluded from our analysis since its low level of development; ethnic minority status and different education system make it an outlier compared with other provinces. The average years of schooling of the enrolled students and the three representative variables of educational conditions are weighted values calculated by the author.

The data for the average years of schooling of people aged 6 and above are only available in 1990 census and 1% sampling population survey in 2005. Based on the available data of the enrolled student numbers from 1990 to 2005, the average years of schooling of the enrolled students in the various four levels of schooling are estimated as weighted values using the formula:

$$Y_{AYOS} = \frac{\sum (6 * \text{Enr.}_{\text{Stu. pri.}} + 9 * \text{Enr.}_{\text{Stu. jun.}} + 12 * \text{Enr.}_{\text{Stu. sen.}} + 16 * \text{Enr.}_{\text{Stu. he.}})}{Enr._{stu.tot.}}$$

The estimated AYOS is the sum of the years of those who are enrolled at primary school (six years: Enr. $_{stu.pri.}$), junior secondary school (nine years: Enr. $_{stu.jun}$), senior secondary school (12 years: Enr. $_{stu.sen}$) and higher education (16 years: Enr. $_{stu.he}$) divided by the population of the sum of the four groups (Enr. $_{stu.tot}$).

As mentioned earlier, the available published AYOS is for people aged 6 and above in 1990 and 2005, so that the estimated AYOS from 1990 to 2005 is data for the enrolled students, which is available for each year. Comparing the estimated AYOS with the published AYOS, it found that the estimated data are on an average one year more than the published data in 1990 and 0.5 of a year more in 2005. However, in order to discover any effects within the fifteen year periods through regressions with the cross section panel data, the estimated average years of schooling of the enrolled students from 1990 to 2005 are used meaningfully, rather than the data for these two years.

5.5 Regression results

Using the data above, two simple regressions were carried out. The results of equation 1a and 1b are shown in Table 5.6. 1998 is an identifiable turning point of educational status due to implementation of the most influential educational policy in this year. Two time periods constitute the focus for comparison in these models: one from 1990 to 1998 and the other from 1999 to 2005. The former two models focus on the contribution of real per capita disposable income to the average years of schooling in the two time periods; the latter focus on both the contribution of real per capita disposable income and the educational conditions to the average years of schooling in the same time periods (1990-1998 and 1999-2005) respectively. The regression results of equation 2a, 2b and 2c with six models are shown in Table 5.7. Model 1 and 2 picture educational status within the Eastern region (Equation 2a); Model 3 and 4 are for the Central region (Equation 2b) and the remaining two models are for the Western region (Equation 2c).

Table 5.6 Regression results of education status between regions (1990-2005)

	Model 1	**Model 2**	**Model 3**	**Model 4**
	1990-1998	**1999-2005**	**1990-1998**	**1999-2005**
Constant	6.965 ***	6.914 ***	6.64 ***	6.649 ***
Western region	-0.113 ***	-0.184 **	-0.163 ***	-0.294 ***
Eastern region	0.068	-0.351 ***	0	-0.366 ***
PC Income	0.22 ***	0.822 ***	0.192 ***	0.672 ***
Educational conditions			0.893 ***	1.22 ***
F	26.423	87.359	90.355	97.137
R^2	0.23	0.56	0.577	0.655

Sources: Data for 1990-1998 are from the China Educational Statistical Yearbook (NEC, 1991-1999 for various years), and data for 1999-2005 are from China Statistical Yearbook online resources (NBS, 2000-2006 for various years).

Notes:
1. The missing data from 1990 to 1996 for Chongqing is replaced by the data of Sichuan province here.
2. Tibet is excluded from the regression.
3. The average years of schooling of the enrolled students is a weighted value calculated by the author.
4. PC Income = Per capita disposable income (1,000 yuan)
5. The educational conditions including three representative variables, are weighted values calculated by the author.
6. Significance * <10%, ** <5%, ***<1%

Looking at the Model 1- Model 4 of Table 5.6, it could be summarized that the average years of schooling of the enrolled students, real per capita disposable income, regional locations and educational conditions have a significant relationship. Several further conclusions could be draw as follows.

In Model 1 (1990-1998), the Western region, real per capita disposable income has a significant relationship with the average years of schooling of the enrolled students, and the income variable had a great influence on the years of schooling than the Eastern region variable. In Model 2 (1999-2005), in the Western region and the Eastern region, real income makes a significant contribution to the years of schooling; with income having the most influential relationship among the independent variables. In Models 3 and 4, similar pictures are displayed, but the additional variable - educational conditions - is the most influential contributor to the years of schooling in both time periods; real income has much less of an effect than the educational conditions.

Comparing the relationship between the regional locations of real per capita disposable income and the average years of schooling in the two time periods, some changes can be noted. Firstly, in the Western region there was a negative significant influence on the average years of schooling of the enrolled students in both time periods, 1990-1998 and 1999-2005, and this influence increases over time (from -0.113 to -0.184). Secondly, in the Eastern region there was an insignificant relationship with the years of schooling in the earlier time period, but this became a negative significant effect in the latter time period. This shows that the Central and Western regions had similar average years of schooling of enrolled students in the time period of 1990-1998; but the Eastern region changed quickly over time. It may

be a result of educational expansion in the non-Eastern regions that pushed a vast number of students to the Eastern region to share a limited number of schools with students in the East. Thirdly, in both periods and both regions, the real per capita disposable income makes a significant contribution to the average years of schooling; its influence increases over time from 0.220 to 0.822 in terms of the coefficient of the income.

When considering educational conditions as well as the real per capita disposable income in Models 3 and 4, the effects of the Western (-0.163 to -0.294) and Eastern regions and the real per capita disposable income (0.192 to 0.672) show a similar picture to that in Models 1 and 2. In particular, the enrolled students in the Western region lag well behind those in the non-Western regions over time, in terms of contribution to the average years of schooling. Meanwhile, it is worth noting that the importance of the effect of educational conditions on schooling has increased: the coefficient of it increases from 0.893 in the earlier time period to 1.220 in the later time period.

Table 5.7 Regression results of education status within the three regions (1990-2005)

	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**	**Model 6**
	E 90-98	**E 99-05**	**C 90-98**	**C 99-05**	**W 90-98**	**W 99-05**
Constant	-2.603 ***	-1.080 ***	6.743 ***	5.483 ***	6.726 ***	6.000 ***
RPC Income	0.005	-0.007	0.269 ***	1.831 ***	0.046	1.225 ***
EDU condition	0.420 ***	0.191 ***	0.462 ***	0.547 **	0.610 ***	0.729 ***
F	49.669	40.397	66.612	59.296	31.884	27.447
R^2	0.509	0.522	0.659	0.691	0.399	0.426

Sources: Data for 1990-1998 are from the China Educational Statistical Yearbook (NEC, 1991-1999 for various years), and data for 1999-2005 are from China Statistical Yearbook online resources (NBS, 2000-2006 for various years).

Notes:
1. E = East, C = Central, W = West
2. RPC Income = Real per capita Disposable income (yuan)
3. EDU condition = Educational conditions
4. Significance * <10%, ** <5%, ***<1%

The relationship within regions is shown in Table 5.7. When comparing the coefficients of the real per capita disposable income variable within the Eastern region (Models 1 and 2) in the two time periods, the relationship with the years of schooling remains insignificant. It could be interpreted that the years of schooling of students from the Eastern region are unaffected by household income. The influence of educational conditions in the East decreases from 0.420 to 0.191; this may be because of less investment in education and educational resources in the East over time. In contrast, in the Central region (Models 3 and 4), real income (0.269 to 1.831) and educational conditions (0.462 to 0.547) play significant roles in affecting the average years of schooling with a stronger influence in the period of 1999-2005 than the time period of 1990-1998. In the Western region (Models 5 and 6), the influence of income changed from insignificant to significant to the years of schooling from the earlier to latter time periods. It may show a picture in which people from the Western region were unfairly disadvantaged in terms of schooling in the earlier period. The variable of educational conditions shows an increasing influence on schooling (0.610 to 0.729), which has greater effect than those in the non-Western regions

Among these regions, educational conditions have a greater influence on schooling than real income, especially in the West. Interestingly, the effect decreases in the East but increases in the Central and West. The remarkable change of income effect is generated in the Western region where income plays an important role in educational development. Income in the Central has a greater influence on the schooling than in the West in both time periods. It may be concluded that households in the Central region carry continual pressure of schooling investment in both earlier and latter time periods.

5.6 Discussion

Regional inequality in education still exists in China, particularly between the Eastern and non-Eastern regions and also within the Central and Western regions. The reasons for the existing educational inequality could be analysed as follows, according to the observed variables in the equations, including the effects of educational conditions (distribution of schools and full time teachers), income and certain relevant policies.

Initially, inequality in educational conditions was represented by the uneven distribution of schools in the early period of time 1990-1998. In fact, it has high numbers of primary schools, but fewer resources for senior secondary schools and higher education institutions. The resulting differences in number of schools between the Central and non-Central regions could be twofold. It may increase difficulties for students to access to limited school resources, which may enhance the intense competition. In addition, a considerate amount of school resources, at various levels, is centred on the Eastern region, which provides sufficient education opportunities for students within the region.

Although the average years of schooling of the enrolled students in the Western region, in the early time period of 1990-1998 had a similar picture to that in the Central region, in the latter time period of 1999-2005, the educational status in the Western region became severe because of the shortage of educational resources. Especially, the lack of post-primary school resources in the Western region may stop students aspiring to continue their schooling after their graduation from the primary schools.

Teacher resources together with school resources are an important foundation of educational development. In 1983, Deng Xiaoping stated "teachers hold the key to a school's success in training qualified individuals of socialist upbringing and in training workers to develop morally, intellectually, and physically with both socialist consciousness and culture" (Deng, 1993, p. 105). Central government not only made efforts to build respect for teachers but also to improve their salaries and living conditions in order to attract a larger number of better qualified and more committed teachers, especially to deprived areas. Theses government actions are essential if future development is to succeed. As a result of their rapid economic development teachers are attracted to the more affluent regions able to pay higher salaries thus resulting in the remote Western regions being significantly more affected than the more developed Eastern regions. A further Chinese phenomenon is that a number of substitute teachers are reluctant to teach in those less developed areas where they received low wages which are not paid on time.

The decreasing relative numbers of enrolled students found in senior secondary school and higher education may be the result of rising tuition fees, which are beyond the reach of lower-income households, especially in the latter time period, of 1999-2005, after expansion. Before the introduction of tuition fees, in the early 1990s, higher education was free. Although there is still a government contribution to appropriation in higher education, the proportion of the total amount has declined gradually. In 1997, a new policy of tuition payment, with two tracks merging into one, was implemented (Li, 2004). A framework of multiple financial sources was promoted, to mitigate the financial pressure of higher education on the state, pushing HEIs to be independent and rely on tuition fees to survive (Wan, 2006). This has resulted in some people experiencing difficulties when trying to access higher education, because the present co-funding model in HEIs' is out of their financial reach. Inevitably this could lead to households with higher incomes being able to give their children more opportunities in higher education than those with lower incomes. As the income disparity worsens, households, especially from the less-developed Western regions, find it increasingly difficult to finance their children's education, particularly their university education (Huang, 2007). According to a recent survey of poor students in China in 2006, 60% of families of poor students are unable to afford the tuition fees for their higher education (CYDF, 2006). Having considered the high cost of higher education, some parents may have decided to stop sending their children for secondary education.

Table 5.8 Investment in education by investors and year (1990, 1996 and 2005)

	East	Central	West	National
GAFE				
1996	1,054,272	778,487	520,277	898,354
2005	2,177,396	1,311,716	957,992	1,731,479
Growth	2.1	1.7	1.8	1.9
TMF				
1996	122,261	104,119	40,558	85,952
2005	649,927	483,102	204,292	434,372
Growth	5.3	4.6	5	5.1
RPCDINC				
1990	1,375	861	798	1,019
2005	9,812	5,324	4,530	6,609
Growth	7.1	6.2	5.7	6.5

Source: All data for government appropriation for education in 1996 and 2005 are from *Chinese Statistical Online Resources*. Data of income for 1990 and 2005 are from *Chinese Statistical Online Resources* and are calculated by the author.

Notes:
1. GAFE = Government appropriation for education
2. TMF = Tuition and Miscellaneous Fees
3. RPCDINC = Real per capita disposable income

Table 5.8 displays the total amount and the growth of government appropriation for education and tuition and miscellaneous fees from 1996 to 2005, and also the real per capita disposable income in 1990 and 2005. At first glance, the growth in tuition fees is at least 2.6 times that of government appropriation for education across the three regions. In particular, the Eastern region gained the highest amount of government appropriation for education, and charged the highest tuition and miscellaneous fees. In contrast, the Central and Western regions lagged behind the national standard in terms of financial support from the government and tuition fee funds. In particular, students from low-income families in the Western region experienced a five-fold increase in tuition fees between 1996 and 2000. However, in reality, the real per capita disposable income only increased approximately six-folds in the past 15 years. In a word, the tuition fee rose faster than income. An interesting point is that the Western region does not have the highest growth in financial support or tuition fee but has the lowest growth in income.

The investment in different levels of schooling in China could be described as a "U" shape, the two top points representing that the nine years of compulsory free education funded by central or local government and higher education founded by individual households. The bottom point represents junior and senior secondary schools with less investment by both government and individuals. However, the uneven distribution of educational resources may raise a further crucial issue, which China's central government has now realized. This is the important role which senior secondary schools play, especially in the Western region. In fact, central and local government invested less in senior secondary schools than in any other level of education. To some extent, a balanced investment across various levels of schooling may be more important than a vast amount of investment in an individual level.

China's central and local governments have made efforts to reduce regional inequality, particularly with policies aimed at giving support to the Western region for its educational development. Nevertheless, it seems that financial efforts are not sufficient to help the Western region eliminate poverty, unless more human capital aid is also provided for education. For instance, Shaanxi government ran an exchange project between officers in urban and rural areas, which aimed to encourage different levels of officers to work with, and learn from local people, meanwhile providing effective support to benefit the local people (Shi and Jiang, 2006). Furthermore, they sent educational specialists to train local people to grasp advanced and accurate knowledge, use new facilities, and eventually to improve their productivity.

How to solve the education funding crisis is one of the fundamental acts of the government's obligations. As Deng Xiaoping once said, we have to try every possibility, and even sacrifice time in order to solve the problems of education (Deng, 1993). It appears that all education policies implemented by the government are aimed at promoting and safeguarding equal education, nationwide, for all. Some scholars, however, argue that certain preferential policies have artificially created and expanded the gap between key schools and regular schools in China, and call for emphasis to be on "high quality education" based on equal educational expansion. In addition, some scholars propose that the efficiency of different levels of education in China needs to fundamentally break down the monopoly in education resources, in

order to attract more social funds to support balanced national educational development (Yang, 2004).

The law on nine years of compulsory free education that was implemented in 1986 could be treated as a long-term strategy for reducing inequality to ensure people's education rights. By providing the free nine years of education policy, not only has the Chinese government already stimulated an increase in the national literacy rate, but it has also benefitted the people of China, through the resulting increased income and improved living conditions. Additionally, the number of educated people has increased and the potential for labour productivity has increased. To some extent, the nine years of compulsory free education may help to reduce regional inequality through increasing income.

Chinese central government not only pays attention to providing financial support to the nine years of compulsory free education, but also to equality in higher education recruitment. In June 1999, the Chinese government launched a new policy to expand higher education enrolment as a national strategy to improve the overall human resource capacity of the country. More recently, central government has called for more new entrants from the Western region, and therefore an increasing proportion of students from the Western region have benefited by this policy. At the 2008 national HE conference, the Vice Minister of Education, Guiren Yuan, announced that the Ministry of Education is to promote a fair trial on HE recruitment, entitled the Partnership Scheme, which aims to narrow regional gaps. An extra 35,000 university places are being created in five appointed provinces from the Central and Western regions in the year 2008. The students taking these places will have the opportunity to enter quality universities located in eleven provinces (Yuan, 2008).

5.7 Conclusions

This chapter evaluates regional inequality using educational status, from 1990 to 2005, considering this as two time periods, 1990-1998 and 1999-2005. It finds firstly, that regional location and household incomes have a significant influence on educational status, and also their effects on schooling increase over time. Secondly, in the earlier period students from the Western region were disadvantaged in terms of the lack of

educational resources, such as sufficient schools at various levels and well-qualified teachers. In the latter period, the exacerbation of income inequality replaced regional inequality in education all over as China. Thirdly, the educational conditions (total population, total government investment and student/teacher ratio in primary schools) had a significant impact on average years of schooling. In addition, some remarkable improvements in the reduction of regional inequality can be seen to stem from central government promotion of nationwide nine years of compulsory free education, and from the increased higher education enrolment in the Western region. Fourthly, the expansion may stimulate more students from non-Eastern regions to flow to the Eastern region, which may have a negative effect on teaching resources as they are shared among increasing numbers of enrolled students. This may also have a negative effect on teaching quality at schools in the East.

Furthermore, this study also discusses several factors relevant to regional inequality. Reducing income disparity could be one of the long-term strategies to reduce regional inequality. The intervention of government policy has achieved a remarkably positive influence on the development of educational status, especially in the Western region. The wide spread of literacy, the nine years of compulsory free education and also higher education expansion have brought profound benefits to a large number of students, especially those from poor areas. There are also other important issues which have yet to be addressed, such as how to put an end to uneven distribution of educational resources, and how to diversify educational investment among regions.

Finally, it should be noted that the use of different measurements in this research may influence the regression outcomes. For instance, the calculated average years of schooling of the enrolled students not for the population in their education ages may slightly longer than the real values, which could influence on the resulting coefficients in regression. Another instance, technically, having more students in primary schools and fewer students in HEIs may achieve the same average years of schooling in terms of the weighted mean: Shaaxi province, for instance, achieved approximately 10 years of schooling because of its higher numbers of HEIs. Furthermore, there are other limitations of measurement which still exist, such as regional inequality, which can be exacerbated by the interregional flow of human capital. This situation may arise if, for instance, students move from the Western region and continue their higher education

in the Eastern region, and afterwards remain to live and work there. That is an aspect not considered in this chapter.

Chapter 6 Higher Education Expansion and Social Justice, 1998-2006

6.1 Introduction

The last decade has seen the implementation of the HE expansion policy which has resulted in massive increase enrolments into higher education gradually. The policy's plan was to give greater nationwide access into higher education institutions (HEIs) for all students, including those traditionally recognised as disadvantaged.

The gross enrolment rate (GER) of HEIs rose from 7% to 22% from 1997 to 2006, and the number of new entrants reached 7.3 million from 2 million over the same period. It is predicted that this trend will continue and the GER will reach 25% in the next few years. Accordingly, in 1997, 1,020 HEIs were established, increasing to 2,311 in 2006, inclusive of regular HEIs and adult universities. In spite of the remarkable higher education expansion attempts, and also the increased numbers of HEIs, the needs of approximately 5% of applicants of all student applications will not be met, this indicating an equality issue. (NBS, 1998 and 2007).

Although the substantial increase in GER has created more HE opportunities for students, it has created a number of difficult challenges, conflicts and problems (Zhang, 2000). Increased access to HE raises social justice for three reasons. First, HE expansion coincided with increasing economic and social inequality. The Gini coefficient, which measures income inequality, increased to 0.45 in 2006 from 0.39 in 1998 (Xing, 2006). The expansion of HE and rising inequality have caused important concern as to whether the redistribution of HE resources and opportunities has adversely affected regional and inter-group equality and social justice.

Second, HE expansion was associated with a sudden change in public funding, from a model supported by three different government authorities (The Ministry of Education, other central ministries and local governments) to a co-funding model supported by students' parents. The Ministry of Education (MoE) represents the central government to fund the 107 national key universities, and local governments are responsible for supporting all non-key ones (Huang, 2007). As key universities in China are concentrated in big cities and some rich provinces, and central ministries are no

longer financing any HEIs, the change in public funding must have disadvantaged poorer prospective students from less affluent regions.

Soaring tuition fees in HE has prevented students from low-income families studying further. Before the 1990s, HE was free to all students, now students are charged tuition fees of over 5,000 yuan per student per year. Many students from low-income family are unable to afford the high tuition fees, thus they are forced to forego HE. High university fees have become a real deterrent to poor families, whereas relatively more opportunities are available to wealthy families, especially those from big cities where entry requirements are significantly lower for local residents than for those outside the cities, giving the former social group unfair access to HE.

Third, the extent of HE expansion raises a serious question about the quality and employability of graduates. Due to urban unemployment and social discrimination, graduates from universities in recent years face more pressure in the labour market than ever before (Yang, 2006). A student from poor families is likely to make enormous efforts to study in some prestigious universities anticipating this will give a secure future, however, when they graduate they are often faced with unemployment or discrimination. For instance, from 2001 to 2005, the employment rate of graduates was only 70%, although it did not encumber the HE expansion. In 2001 there were 1.1 million graduates, this tripled to 3.9 million in 2005. According to data from the Ministry of Education, the number of graduates unable to find employment was 0.34 million in 2001, 0.52 million in 2003 and 0.79 million in 2005. In 2006 the number of graduates entering the labour market reached 4.3 million, leaving over 2 million still unemployed (BBC news, 28/08/2006). Furthermore only 20% of graduates found employment in the Western region compared to 50% in the Eastern region (Xinhua news, 21/02/2006).

The purpose of this chapter is to examine the impact of HE expansion on different regions, social groups and resources distribution by analysing the profiles of two cohorts of university graduates enrolled in 1998 and 2006. This chapter is structured as follows. Section two traces back the process of HE reforms and exhibits some consequences of regional and national expansion, it then reviews a number of theories and empirical research on HE expansion and social justice. Section three represents

methodological issues. Section four analyses the impact of HE expansion on social justice, and also discusses some key factors of the outcomes of inequality. Finally, conclusions and some suggestions are given.

6.2 Background

6.2.1 HE reforms

Before the end of the 1970s, China's HE was based on the former Soviet Union model, which implies that all HE resources were controlled by the state, therefore only 5% of middle school graduates were able to continue their HE study. To balance HE resources inter-regional, many universities were moved from the Eastern to the Western region (Kang, 2004). Students were entirely financed by the state, and were allocated to work in government agencies or state-owned enterprises after graduation (Wu and Zheng, 2008).

The Soviet pattern had reinforced the tendencies toward the centralization of knowledge and uniformity of thoughts (Hayhoe, 1989). In a nutshell, the HEIs were state controlled, therefore the provisions, resources' allocation, financing and governance of education was monopolised by the state. However, over-centralization of HE governance overburdened the MoE, resulting in inefficient administration and ineffective delivery (Ngok and Lee, 2009).

Despite the gradual introduction of education reform, elitism dominated HE until the late 1990s. Since then, rapid changes have taken place. In the course of one decade of fast expansion supported by dramatic changes in the administration system and funding mechanism. Chinese HE was transformed from elite to mass higher education. The first radical reform in the late 1990s was the commercialization of HE which led to the emergence of a co-funding model to replace the former regime previously supported by the government (Wu and Zheng, 2008). Under the co-funding model, all students are required to pay tuition fees from 1999 onward, although certain student loans were offered to students from poor background (Ngok and Lee, 2009).

The second reform was the decentralization of HE so that all central ministers, apart from the Ministry of Education, relinquished their control and ownership of all HEIs under their authority to provincial governments where these HEIs were located. The policy of decentralization was initiated in the mid 1980's, and since 1993 the processes of decentralization and marketisation of HE have been in use. After decentralization, HEIs have been divided into two major groups based on their funding models and ownership. The first group includes the national key universities which are centrally funded by the Ministry of Education. This is a small group which consists of 107 universities, or the '211' universities designated as research-oriented key universities so that they become internationally competitive. The HEIs in the second group are all entirely funded and owned by provincial governments.

The third reform set up new university campuses of existing universities in different locations in order to increase enrolment. A further reform introduced non-state owned or private HEIs which provide more opportunities for students from different backgrounds (Wu and Zheng, 2008). Adult HE programmes, short-cycle and normal (teaching-training) courses are also offered at the bachelors, masters and doctoral levels which were previously limited to regular HEIs.

Before decentralization, universities were divided into three main groups according to their ownership, namely central government through the MoE, other non-educational central ministries, and provincial governments (Wu and Zheng, 2008). The first group had 36 universities owned and controlled by the Ministry of Education. The second group had about 100 universities and HE colleges which were controlled and owned by other central ministries. The third group had over 800 universities and HE colleges controlled and owned by local governments at provincial and city levels (Li, 1996).

Since then, a new pattern of HE governance has restructured the relationship between the central and local governments, and the decentralized administrative system of HE. This has resulted in many universities being regrouped and consolidated. Furthermore, it led to the segmentation of universities and effectiveness of educational resources. A number of universities and colleges with similar functions were merged in order to centralize resources; for instance, from 1992 to 2000, 387 regular universities were merged to make 212 (Zhou, 2005). From 1994 to 2002, 250 of the 367 HEIs run by

the non-educational central departments were empowered to provincial governments. A number of key universities and disciplines receive much needed investment, for instance, in 1999, Shanghai government combined financial resources to develop Fudan University and Shanghai Jiaotong University, both two key universities under the MoE, to turn them into "world-class" universities (Ngok and Lee, 2009).

6.2.2 HE expansion

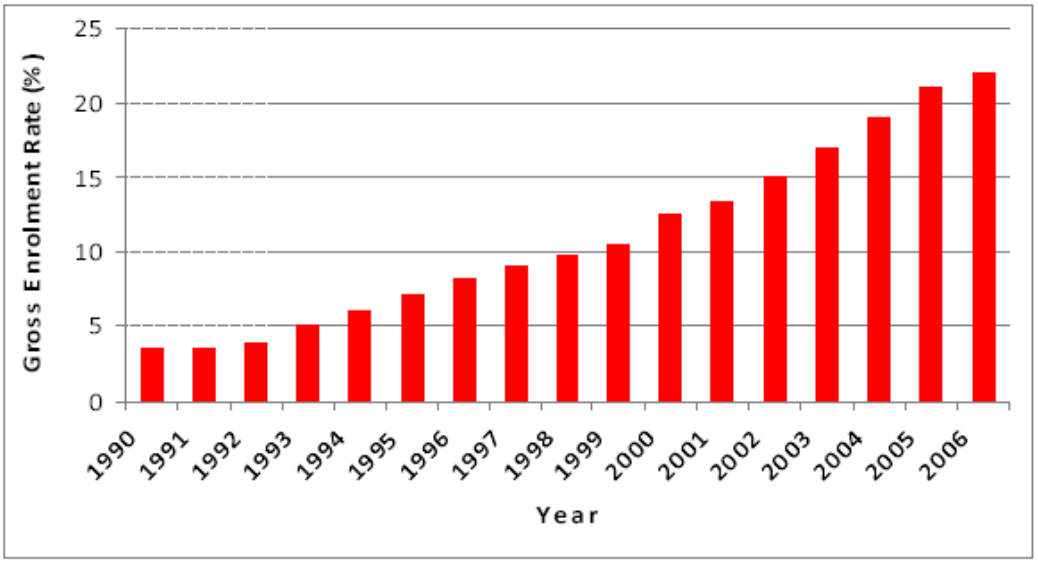
From the late 1990s, rapid economic development in China has resulted in a rising demand for HE because the labour market required more university graduates. In addition, after the Asian financial crisis in 1997, some scholars made suggestions for the central government that charging for education would stimulate public consumption. Ming Tang, an economist of the Asian Development Bank Mission in China, suggested that expanding HE enrolment would not only encourage families to spend their savings on HE but also stimulate investment in HE related services industries (Zheng, 2006). It was further suggested that by encouraging students of employment age to enter higher education the pressure on the employment market in the year of the access to university could be alleviated (Wei and Li, 2008).

From a national perspective, Lanqing Li, the vice premier in charge of education, emphasised two reasons for HE expansion and commercialisation. One is the need for more talented personnel to sustain China's development; and another one is the state's obligation to meet the increasing public demand for HE (Li and Wei, 2000). In June 1999, the Chinese government launched a new policy to expand HE enrolment as a national strategy to improve the overall human resource capacity of the country.

In 1972 world renowned educationist Martin Trow divided HE development into three stages: Elitism, Mass and Universal, a theory has been widely accepted around the world. The key indicator of these three HE developments is Gross Enrolment Rate (GER), which refers to the share of the 18-22 years olds enrolled in full-time HE as a proportion of the total population in that age group. The cut-off points between each stage are below 15%, between 15%-50%, and over 50%, respectively. Most developed countries such as the US and Germany have achieved a Universal HE level (Tsang, 2000). China reached 21% in 2006, which is a considerable increase from the

1st to 2nd stage of development, the Mass level. As shown in Figure 6.1, GER of China's HE gradually increased five-fold from approximately 4% in 1990 to 22% in 2006 (Li and Min, 2001). As a result, China's HE development has changed from elitism to mass education since 2002.

Figure 6.1 Growth of gross enrolment rate of HE in China (1990-2006)



Source: Wu and Zheng, (2008).

According to research conducted by the Higher Education Research Institute at the Beijing University of Science and Technology, the increased number of enrolled students from urban areas is more than that of their rural counterparts. The report of the Chinese National Commission for UNESCO in 2004 stated that there was a big discrepancy in education expansion between different regions, due to historical, natural, regional and other factors. The Western region is particularly disadvantaged compared to the Eastern region due to the significant differences between their economic, education and other infrastructure conditions (Ngok and Cheng, 2006).

The size of HEIs including national (public) and private (minban) institutions, have expanded rapidly since 1993, particularly those under the administration of local government (Mok, 2001, Mok and Chan, 2001). For instance, as Table 6.1 indicates that from 1997 to 2006, the total number of HEIs increased from 1,020 to 1,867, therefore more HEIs run by central government were transferred to provincial

government, and the figure of local universities increased approximately 3-fold, from 675 to 1,756. During the same period, the number of private (minban) HEIs has increased significantly from only 20 to 276, and the number of public HEIs more than doubled.

Table 6.1 Affiliation of regular HEIs (1997-2006)

Year	HEIs No.	the central government			provincial government		
		MoE	non-MoE	Subtotal	Public	Private	Subtotal
1997	1,020	35	310	345	655	20	675
1999	1,071	46	202	248	786	37	823
2000	1,041	72	44	116	888	37	925
2003	1,552	73	38	111	1,268	173	1,441
2006	1,867	73	38	111	1,480	276	1,756

Sources: Zhou J., (2006), Higher Education in China, Singapore, Thomson Learning. P.56, and data for 2006 are from the China Statistical Yearbook 2007 (NBS, 2007).

Notes:
1) the central government = HEIs affiliated directly to the central government
2) provincial government = HEIs affiliated to provincial government

When the education industrialization was implemented followed by the expansion of HE in 1999, many universities were restructured into comprehensive universities rather than specialised universities in order to expand its range of recruitment. Table 6.2 represents the structural changes in regular HEIs between 1998 and 2006. In terms of the demands of the labour market, sciences and technology remain the top position of specialization. This remarkable change can be seen in the development of comprehensive universities, which to a certain extent have flexibilities to adjust courses according to the demands of the labour markets in order to meet the local economic and social development. Between 1998 and 2006 a further 345 new comprehensive universities were established, in contrast, in the same period, the number of Arts universities were reduced by 51, and other universities reduced by 86.

Table 6.2 Structural adjustment of regular HEIs (1998 and 2006)

Type	1998	2006	Changes
Comprehensive	72	417	345
Sciences & Technology	271	666	395
Agriculture & Forestry	59	93	34
Medicine & Pharmacy	118	128	10
Teacher Training	229	178	-51
Language & Literature	15	36	21
Finance & Economics	75	172	97
Political Science & Law	25	67	42
Physical Education	14	27	13
Arts	30	68	38
Others	101	15	-86
Total	1009	1867	858

Sources: Data are from the China Statistical Yearbook online resources (NBS, 1999 and 2007)

Along with the increasing number of HEIs, the number of new entrants has also significantly increased. Table 6.3 shows a total number of 5.46 million students were enrolled 1,867 regular HEIs in 2006, which represents a five-fold increase since 1998. The number of graduates increased from 0.83 to 3.77 million. The total number of enrolled students in HE increased from 3.4 million to17.39 million in 2006. The demand for full-time teachers changed accordingly from 0.41 to 1.08 million in the same period, however teachers' recruitment did not keep up with the increasing number of students.

Table 6.3 Number of annual new entrants, graduates and FT teachers (1998-2006)

Year	New Entrants (million persons)	Graduates (million persons)	Full-time teachers (million persons)
1998	1.08	0.83	0.41
1999	1.60	0.85	0.43
2000	2.21	0.95	0.46
2001	2.68	1.04	0.53
2002	3.21	1.34	0.62
2003	3.82	1.88	0.73
2004	4.47	2.39	0.86
2005	5.04	3.07	0.97
2006	5.46	3.77	1.08

Sources: Data are from the China Statistical Yearbook online resources (NBS, 1999-2007)

6.2.3 HE expansion and social justice

From a macro perspective, HE expansion is a necessity of economic growth and society development as HE can improve labour skills and productivity (Wan, 2006). Hannum and Buchman summarized three impacts of HE expansion on economic and social development, namely HE contributes to national economic growth since better-educated workers create more production, narrows social inequality by promoting social mobility and promotes the development of a more democratic society (Hannum and Buchman, 2003).

Since the 1990s, several relevant studies on educational inequality have been carried out, such as Ram (1990), Lam and Levinson (1991), and Liu, Yu and Li (2006). Ram used the average years of schooling to measure educational inequality and revealed that educational inequality follows the trend of first increasing and then reducing, indicating Kutznet's curve exists in education. Thomas *et al.* (2002) measured the educational inequality by Gini coefficient, and Green, Preston and Malmberg (2004) investigated whether the Gini coefficient of education correlates to Gini coefficient of income.

Most of the empirical research only focused on general educational inequality, less of them considered equal opportunity of HE. Based on the theory of Maximal Maintained Inequality, Raftery and Hout (1993) argued that HE expansion widened the gaps between advantaged and disadvantaged classes/groups, because the students who benefited from the expansion were from advantaged groups with the financial ability to afford tuition fees. Wan also argued that not only the present generation but also the next generation may be affected by the increasing disparity according to the enrolment expansion (Wan, 2006). Although the representative data of equal opportunity of HE is currently unavailable to verify the relationship between it and income inequality, this chapter provides a number of suggestions.

A 2003 research carried out by Ding Xiaohao (2003), using 1991 and 2000 urban household survey data, compared the opportunity for students to access HE to their family's income levels. He came to three main conclusions. HE opportunity became more equal within various income groups from 1991 to 2000. According to the GER

of households, the opportunity of HE entry for low-income groups had improved. Furthermore, access opportunity to HE for students from families with a lower educational background increased in 2000 compared to 1991.

Li's (2004) research calculated the inequality of HE opportunity by using comparable HE GER from 20% households with a maximum and minimum income respectively. Table 6.4 is based on results of income inequality for urban household with combined data (Wang and Zeng, 2004). Both the inequality of HE opportunity and income continued increasing from 1996 to 2000, but an anomalistic increase appeared in 1997 because the tuition fees charged in HE was standardised by the central government. The inequality of income fell slightly from 1998 to 1999, however, the entry opportunity rate to HE continued rising from 1.91 to 2.04 during the same period. If the trend of income inequality in China continues, inequality in education may result (Liu, Yu and Li, 2006).

Table 6.4 The inequality of HE opportunity and of urban household income (1996-2000)

Year	1996	1997	1998	1999	2000
Inequality in HE opportunities	1.52	3.77	1.91	2.04	2.48
Income inequality	0.257	0.277	0.297	0.287	0.340

Sources: Li, (2004) and Wang and Zeng, (2004)

Increased dependence of HE expansion on tuition fees has important social and economic implications, especially on social justice and equality. Based on a study of 10 Chinese universities, Jacob (2006) has concluded the following results in the HE system.

- The scores of university entrance examination cannot adequately reflect students' talents, gifts and ethics. As a result, the examination system is not entirely equitable.
- Access opportunities are inequitable because of the diverse quality and development of fundamental educational levels in different geographic regions.
- Making HE more equitable requires special financial assistance for applicants from rural regions and poor urban households.

- Another common discrimination against students in rural regions is the quality of their schools, teaching, and limited resources such as facilities and technology.

Although GER as the most widely used measurement of HE expansion provoked controversy among academic scholars, some argued that the expansion of HE has created more opportunities and accelerated the transition from elitism to mass education in China. Others argued that expansion has aggravated regional disparity and unfair competition for HE places. Only a few realised the importance of analysing the impact of HE expansion on social justice to students and their families in a comprehensive and long-term perspective of development. In addition, a suitable regional division in the HE sector is important for our initial analysis of resource redistribution. Therefore, relevant data were systematically collected at regional, provincial and national levels.

6.3 Methods and data

In order to observe the impact of HE expansion on social justice, it is helpful to define their relationship. Social justice is defined as all students having equal opportunities to access higher education and to have an equal share in school resources. Details are as follows:

- Firstly, students from different regions, family background, social classes/groups and classes are recruited to access to HE with an identical standard.
- Secondly, entrants from different regions are provided with equal learning resources, such as HEIs and full time teacher.
- Thirdly, selected students are able to afford the increased tuition fees with the support of state or local governments, universities or families.
- Fourthly, after having received the benefits of HEIs and the same sound base for employment and personal development, graduates then have equal opportunities for entry into the labour market. As a result, both quantity and quality terms of HE are considered when evaluating social justice here.

Taking these into consideration, the rest of this chapter assesses the impact of HE expansion through a systematic collection and analysis of official statistics and

secondary information. The relevant raw data are from the China Statistical Yearbook published by China's statistics Bureau in 1999 and 2007, the national data of registers and new entrants for university entry exams from 1996 to 2005, and the China Census accordingly. All the relevant indicators in both 1998 and 2006 according to the four points defined on social justice above are separately compared to examine the consequences and impact of HE expansion. The main factors in HE expansion derive from local economic and social development and also relevant policies, centring on the implications of HE expansion, a number of key aspects are studied as follows, geographical location, resources distributions, and social groups.

One of the main aspects of HE expansion is the increasing numbers of entrants across all provinces and cities. By considering various local economic developments, the economic development zones may indicate the impact of HE expansion on social justice more obviously than provinces, which is valuable for formulating policies from the perspective of regions. The number of HE entrants per 10,000 people is one of the key indicators to measure access to HE.

Whether students from different social groups receive equal opportunities of recruitment is a greater measurement of access. Parental income level is the main determining whether their children are able to gain entry into HE, thus indicating students from rural families with lower incomes may lose equal opportunity of accessing university because of the financial burden it places on their families. In contrast, urban families with higher incomes are more able to afford the increased tuition fees. Additionally, parental educational background has a strong effect on their children's educational attainment. In general, parents who have received a higher standard of education provide a higher standard of education for their own children, and generally also pass on their concepts of education attainment to the next generation (Geeta, 1998). As a result, social justice perpetuates a negative influence on the view of educational attainment.

Across the regions, along with HE expansion, the numbers of HEIs, entrants, and full time teachers are increasing at a different rate of development. HE expansion, to some extent, has promoted a redistribution of all HE resources, inclusive of funding and the separation of students into regular and adult HEIs (Wu and Zheng, 2008). As there is

a high volume of students entering regular HEIs, this chapter focuses only on the regular HEIs. However, management responsibility in regular HEIs is governed differently from that of the central and local governments, and this variation can also be seen between national key universities and local ones. According to the different standards of applicants' scores in the university entrance examinations, only a few students are able to gain access to national key HEIs, which are entitled "985" or "211" programmes. Taking these two points into consideration, students from different regions and family background indicate equality has never existed.

Using the evidence of the causality of HE expansion and social justice, some following research questions will be investigated.

- How much progress has HE made since HE expansion was implemented?
- Does HE expansion lower the barriers to access into colleges/universities but make accessing the labour market more difficult?
- What advantages and disadvantages are there as a result of HE expansion?
- What changes of social inequality can be seen as a result of HE expansion?
- What issues need to be considered regarding inequality in HE?

6.4. Analysis and discussions

6.4.1 Overview of HE resource redistribution

Relevant data of resource distribution are systematically employed at national, provincial and regional levels in this section. A general picture of some indicators of HE resources in regular HEIs is shown in Table 6.5, including the size of the population within the province, HEIs, 211 list, student enrolments and enrolment rate by province. Several conclusions are summarized as follows.

Firstly, HE resources are distributed unevenly at a provincial level. Large provinces with vast population do not necessarily have more HEIs. More HEIs are located in coastal provinces, such as Jiangsu, Shandong and Guangdong; and less in inland provinces, especially in the Western region, such as: Yunnan and Sichuan.

Secondly, geographical distribution of HEIs influences directly on access to HE. For instance, comparing Shandong with Henan, both with a similar population of 93 million in 2006, however both with different student enrolments, 1.34 and 0.97 million respectively. In terms of enrolment rates, Shandong had 144 students and Henan 104 per 10,000 people. In addition, comparing the number of HEIs and key universities, Shandong had 24 more HEIs and two more key universities than Henan.

Thirdly, HEIs new entrants across geographical boundaries; Tianjin is perceived as an excellent example of student enrolment rate with higher rate than Shanghai. Hubei with seven key national universities attracted more students across provinces to apply for HE.

Finally, Municipal cities have centralized HE resources, especially universities with the "211" programme, Beijing has 23 and Shanghai has 10 out of the total 107 universities. These key universities have received a great deal of funding from the central government in order to establish top universities at an international level which is shown in the high enrolment rates of over 330 students per 10,000 people in Beijing, Tianjin and Shanghai. As a result, the uneven distribution of "211" programme universities could be a convictive indicator of HE resources across regions.

Table 6.5 Distribution of China's HE resources and students (2006)

	Population	HEIs	211 List	Enrolments	Enrolment rate
Provinces	million	unit	unit	in 1,000	per 10,000
East	**47**	**75**	**6**	**718**	**186**
Beijing	**16**	**80**	**23**	**566**	**358**
Tianjin	11	45	3	357	332
Shanghai	**18**	**60**	**10**	**466**	**257**
Hebei	69	88	1	863	125
Liaoning	43	78	4	721	169
Jiangsu	76	116	11	1306	173
Zhejiang	50	68	1	720	145
Fujian	36	63	2	461	130
Shandong	93	108	3	1338	144
Guangdong	93	105	5	1009	108
Hainan	8	15	0	90	108
Central	**54**	**74**	**3**	**766**	**151**
Anhui	61	83	3	664	109
Shanxi	43	66	1	771	178
Jilin	27	45	3	435	160
Heilongjiang	38	65	4	592	155
Jiangxi	43	66	1	771	178
Henan	94	84	1	974	104
Hubei	57	86	7	1092	192
Hunan	63	96	4	830	131
West	**30**	**38**	**2**	**307**	**99**
Inner Mongolia	24	37	1	253	106
Guangxi	47	55	1	387	82
Chongqing	28	38	2	376	134
Sichuan	82	74	5	861	105
Guizhou	38	36	1	222	59
Yunnan	45	50	1	284	63
Tibet	3	6	0	23	83
Shaanxi	37	76	7	726	194
Gansu	26	33	1	264	101
Qinghai	6	11	0	36	66
Ningxia	6	13	0	56	93
Xinjiang	21	31	1	199	97

Source: National Bureau of Statistics (2007), *China Statistics Yearbook*. (NBS, 2007)

According to these indicators of HE resource distribution, it could be summarized that uneven distribution of public HE resources relates to uneven economic and social development. In terms of the outstanding centralized HE resources in Beijing and

Shanghai, these two will be grouped into a fourth category for a high-visible comparison. As a result, there are four regional divisions being used in the following section, namely the Eastern, Central, Western regions and Municipal cities (Beijing and Shanghai only).

A further comparison of relevant teaching resources, Table 6.6 shows baseline information and distribution of HE resources within the three regions and two Municipal cities (Beijing and Shanghai). It found uneven distribution of HEIs, full-time teachers, students and government education funds against student enrolment, for example, the Western region lagged far behind the advantaged Eastern region. The two outstanding Municipal cities of Beijing and Shanghai with high urbanization were exceptional; they shared only 2.6% of total population and 7.9% of the national GDP, but retained 5.9% of total HE students, and 7.5% of HEIs, 7.9% of HE full-time teachers and 11.8% of funding from the state.

Table 6.6 Composition of HE resources by region (2006)

Region	Provinces unit	POP. %	GDP %	UR. %	HEIs %	T %	S %	State funds %
East	9	37	51.8	53.9	36.7	38	39.5	41.7
Central	8	32.4	23.2	42.5	31.1	31.9	33.4	23.6
West	12	28	17.1	36.7	24.6	22.2	21.2	22.9
Municipals	2	2.6	7.9	86.5	7.5	7.9	5.9	11.8
Total	31	100	100	46.4	100	100	100	100

Source: All data are derived from China's official statistical data online at http://www.moe.gov.cn/.

Notes:
1. POP. = Total population (million)
2. UR = Urbanization rate
3. T = Teachers, S = Students
4. State fund is not limited to HE but all sectors including primary and secondary education.
5. Municipal cities indicate Beijing and Shanghai

Over the last decade, there was more balanced growth in the number of HEIs across regions as Table 6.7 shown. The number of HEIs in the Municipal cities increased 1.36 times between 1998 and 2006 compared with the growth rate of more than 1.8 times in other regions. As for the number of full-time teachers, the East had the

highest, but the Municipal cities the lowest growth among all regions. Regional differences in the growth of HEIs and HE teachers imply a shift of HE resources from Beijing and Shanghai to the rest of the country, and a shift from inland provinces (West and Centre) to coastal provinces (East). The first shift had a positive effect on regional balance but the second shift had the opposite effect.

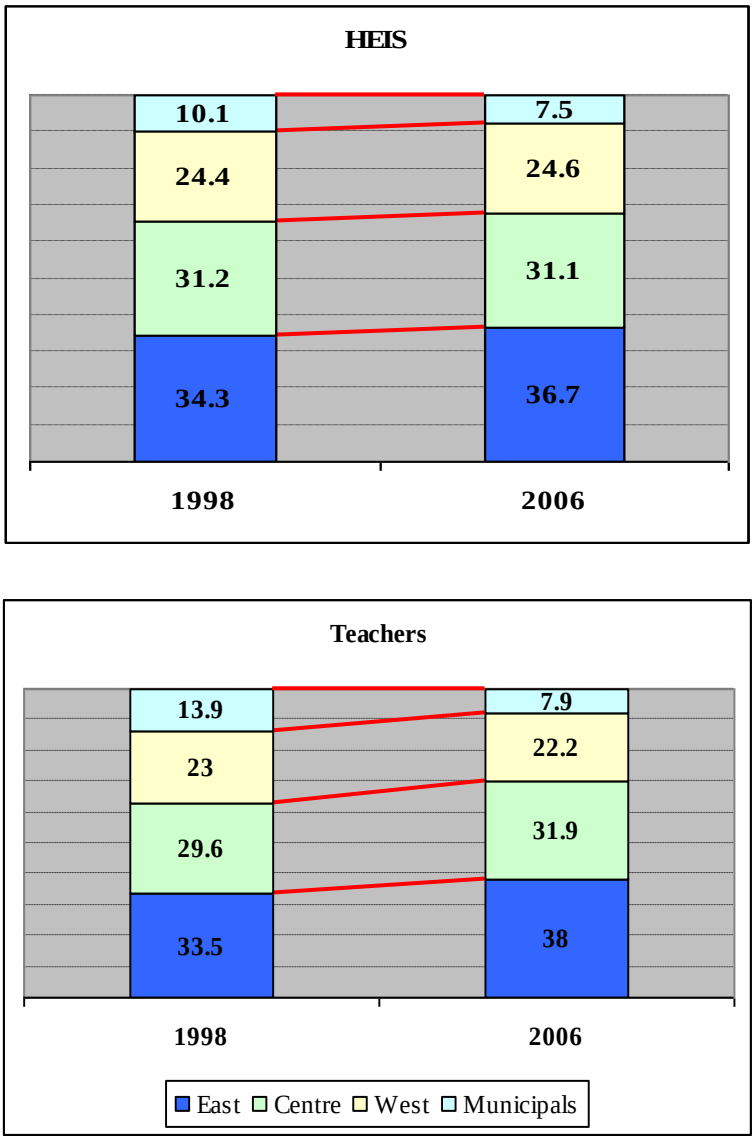
Table 6.7 Growth and distribution of HE resources by region (1998 and 2006)

	1998 (number)		2006 (number)		2006/1998 (ratio)	
	HEIs	Teachers	HEIs	Teachers	HEIs	Teachers
East	351	136,372	686	408,433	1.95	2.99
Centre	319	120,570	581	343,082	1.82	2.85
West	249	93,681	460	239,043	1.85	2.55
Municipals	103	56,630	140	85,431	1.36	1.51
Total	1,022	407,253	1,867	1,075,989	1.83	2.64

Sources: All data are derived from China's official statistical data online at http://www.moe.gov.cn/.

Figure 6.2 illustrates the change in the regional composition of HEIs and teachers between 1998 and 2006. The share of HEIs accounted for by the East in the national total increased from 34.3% to 36.7% compared to a slight decline in the share accounted for by the Municipal cities, whilst an unchanged share is attributed to the Central and Western regions. As for the number of teachers, both the East and Central regions increased their shares in the national total. This resulted in a big fall in the share of teachers accounted for by the municipals from 13.9% to 7.9%. The West also experienced a decline in its share of teachers.

Figure 6.2 Change of regional composition of HE resources (1998 and 2006)



Sources: All data are from China's official statistical data online at http://www.moe.gov.cn/.

The student/teacher ratio is usually one of the indicators of HE quality. The Chinese government have pledged to increase the quality in order to raise the efficiency of resource utilisation and improve welfare and income for staff (Wu and Zheng, 2008). The total number of HE students achieved an unprecedented growth, from 3.4 million in 1998 to 17.4 million in 2006, in contrast, the increase of full-time teachers lagged behind with only 2.6 fold increase. The student/teacher ratio rose from 8.4:1 to 16.2:1 at a national level. At a provincial level, in 1998 student/teacher ratio was the same from province to province, however, the differences across provinces fluctuated from a two to six fold increase. In particular, provinces from the Eastern region were

outstanding in terms of sufficient resources of numbers of both teachers and students in HEIs, however, the strict resources distribution in these developing cities may cause ineffective teaching quality.

6.4.2 Change of access to HE

Table 6.8 shows a five-fold increase of new entrants at the national level between 1998 and 2006. There were no significant differences in the growth of new entrants between regions except in the Municipal cities where the growth was half of that in other regions. With respect to the regional composition of new entrants, it shows the shares accounted for by the East and Central regions increased significantly, while the share accounted for by the Municipal cities declined by almost a half from 10.3% to 5.3%. The share accounted for by the West remained more or less unchanged.

Table 6.8 Growth and composition of new HE entrants by region (1998 and 2006)

Region	1998 ('000)	2006 ('000)	2006/1998 (ratio)
East	411 (37%)	2,195 (40%)	5.3
Centre	331 (30%)	1,813 (33%)	5.5
West	231 (21%)	1,160 (21%)	5.0
Municipals	111 (10%)	292 (5%)	2.6
Total	1,084	5,461	5.0

Sources: All data are derived from China's official statistical data online at http://www.moe.gov.cn/.

In conclusion, Table 6.9 shows that all regions experienced a large improvement in enrolment rates between 1998 and 2006. At the national level, the enrolment rate rose from 34 to 142 per 10,000 people in eight years. Additionally, the gap of enrolment rates between the Municipal cities and the regions was reduced as the ratio of enrolment rates between the Municipal cities and the national average declined from 4.17 in 1998 to 2.17 in 2006. Compared with the East and Central regions, however, the West is only 70% of the national average in 2006, albeit representing an improvement from 61% of the national average in 1998.

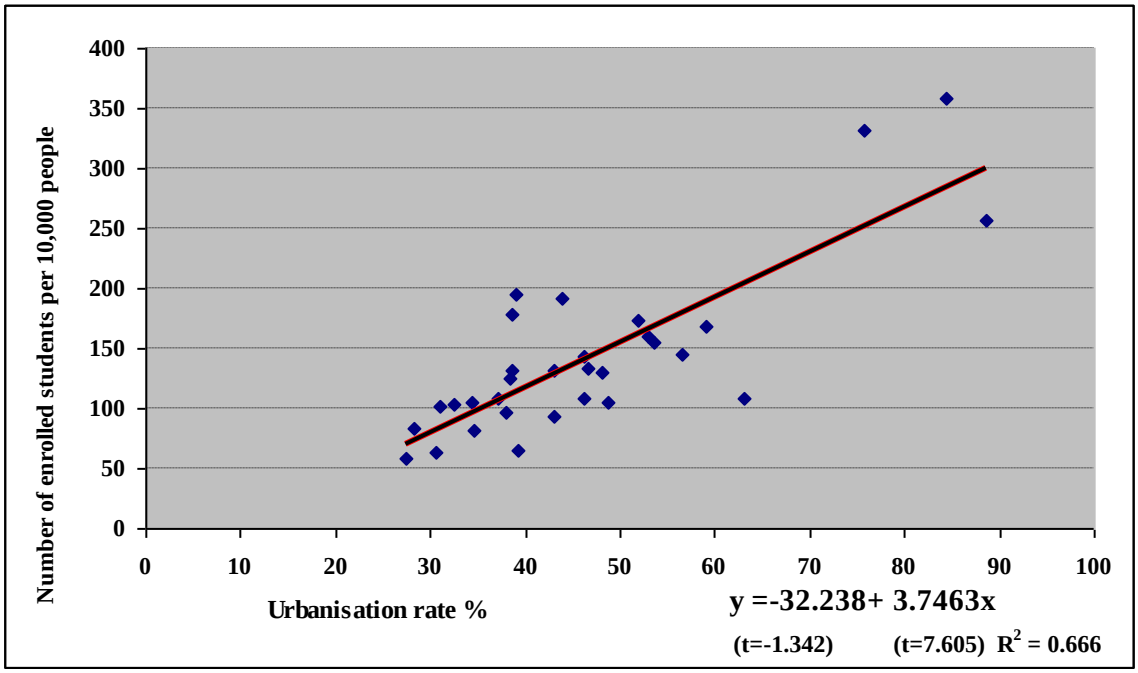
Table 6.9 Changes of new entrants by region and year (1998 and 2006)

Region	1998		2006	
	Entry rate Per 10,000	Region/Nation %	Entry rate Per 10,000	Region/Nation %
East	33.9	99.7	159.3	112.4
Centre	27.1	79.7	144.9	102.3
West	20.7	60.8	98.6	69.6
Municipals	141.9	417.6	307.4	217.0
National	34.0	100.0	141.7	100.0

Source: All data derives from China's official statistical data online at http://www.moe.gov.cn/ and are calculated by author.

One major factor responsible for less HE opportunities in the West may be its relatively low level of urbanization. Using a simple cross-section regression of provincial level data in 2006, Figure 6.3 shows a strong correlation between urbanization and HE enrolment rates. One average, enrolment increases by 3.7 students per 10,000 people if urbanization rises by one percentage point.

Figure 6.3 Correlation between urbanization and HE enrolment rate (2006)



Source: Yao, Wu, Su, and Wang, (2010)

6.4.3 Distribution of national key universities

So far we have discussed the impact of HE expansion on social justice in terms of quantity but not in terms of quality. The quality of Chinese HEIs varies significantly. Hence, the assessment of HE expansion on social justice needs to concern the quality differences of HEIs as well. In this regard, the distribution of national key universities is a good indicator of the uneven distribution of HE resources and its impact on different regions.

Apart from the MoE, all central ministries have relinquished to provincial governments their control and ownership of the universities previously under their authority. This decentralization of HEIs has led to an even more unbalanced redistribution of HE resources between regions. As shown in Table 6.10, the number of HEIs owned by central ministries declined from 214 in 1998 to 71 by 2006, but the share of HEIs accounted for by the Municipal cities as a proportion of national total rose from 22% to 38%, implying that national key HEIs became more concentrated in the Municipal cities. The West is shown to have been most disadvantaged as a result of decentralization.

Table 6.10 Rearrangement of ministry-owned universities by region (1998 and 2006)

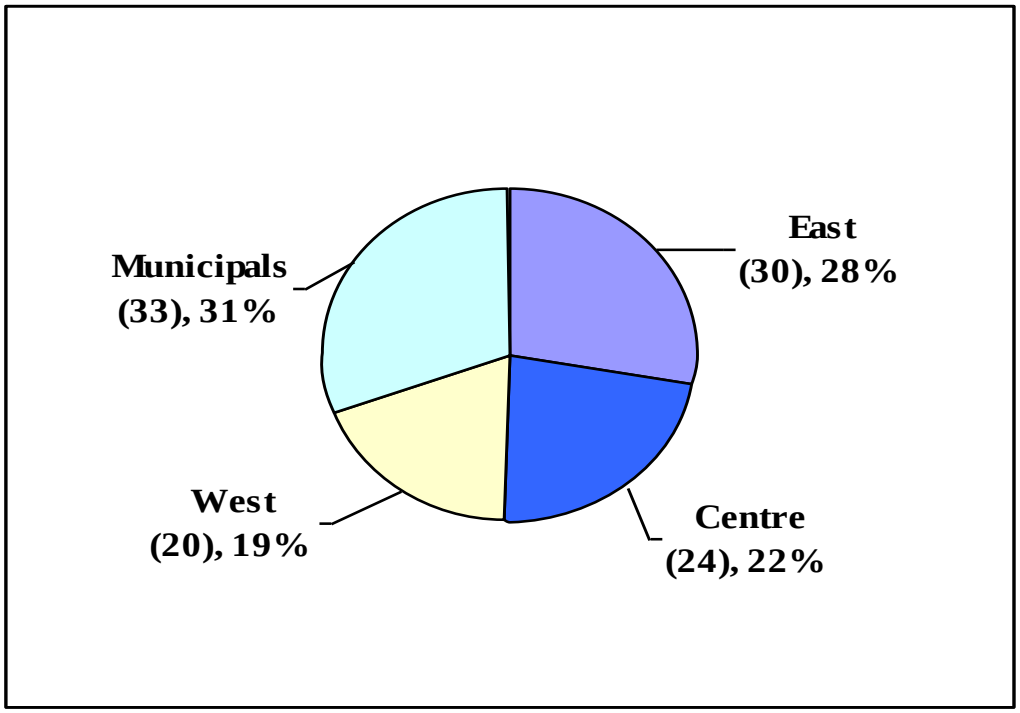
	1998		2006		2006/1998
Region	No.	%	No.	%	%
East	66	30.8	20	28.2	30.3
Centre	57	26.6	13	18.3	22.8
West	43	20.1	11	15.5	25.6
Municipals	48	22.4	27	38	56.3
Total	214	100	71	100	33.2

Source: combined with http://zx.china-b.com/cadx/zixun_11075.html and Wuhan University online resources

"211" Programme universities could be one of the key indicators of the impacts of HE expansion on social justice used in this chapter. A regional view of the key universities in 2005 can be seen at Figure 6.4. A total of 107 national key ("211" programme) universities, Beijing and Shanghai have 33, or 31% of the total, followed by the East region 30 (28%), the Central region 24 (22%) and the West region 20

(19%). This shows a clear distinct of uneven distributions of key universities across regions.

Figure 6.4 Distribution of national key universities by region (2005)



Source: http://www.sina.com.cn, 03/04/2006

In reality, it is much easier for students from Beijing, Shanghai and other big cities to gain access to key universities due to their advantaged locations, and more difficult for students from outside of those big cities. Table 6.11 indicates the ratio of local students, in big cities with centralized educational resources, to the total number of new entrants in seven key universities in 2005. 16% of the new entrants who attended Tsing Hua University came from Beijing and 17% attended Peking University. As Beijing accounted for 1.2% of China's total population, it implied that, on average, students from Beijing were 14 times more likely to study in Peking University than those from outside of Beijing. The high localisation of new entrants could be seen in some key universities located in provincial capital cities, such as: Nanjing, Shanghai and Wuhan. Zhejiang University is a prime example; in 2005 61% of its new entrants were local students from Zhejiang.

Table 6.11 Ratio of local students in selected universities (2005)

Universities	Location	Local students in total new entrants (%)
Tsing Hua	Beijing	16
Peking	Beijing	17
Nanjing	Nanjing	55
Fudan	Shanghai	44
Shanghai Jiaotong	Shanghai	47
Zhejiang	Hangzhou	61
Wuhan	Wuhan	50

Source: China education and research network, www.edu.cn.

A further relevant issue is the funding distribution; all key universities are financially supported by the MoE, therefore all across the region receive uneven financial support from central government. As a result, students from key universities are more likely to be provided with better equipped teaching resources supported by government. In contrast, few key universities are located in the Western region, implying both universities and students there are disadvantaged.

Table 6.12 shows that inequality in HE entry opportunities also reflect the different minimum entrance examination scores set by universities for students from different regions. The minimum entrance examination scores in Beijing and Shanghai were significantly 10% lower than the rest of the regions, thus seemingly being unfair to students from the other regions with fewer centralized quality educational resources in their pre-university education.

The minimum entrance examination scores are not determined by the central government but by provincial or city authorities individually, according to their own different examination paper, and therefore the minimum entrance examination scores may not be comparable nationwide. However, this system appears to give freedom for some regions, especially Beijing and Shanghai, to lower their recruitment standards for local students and disguise its unfairness towards those from disadvantaged social groups and regions.

Table 6.12 Minimum examination scores of new entrants for key universities (1998 and 2006)

Region	1998	2006
East	550	566
Centre	541	559
West	481	529
Municipals	**462**	**497**
Total	516	546

Notes: The minimum entrance scores are for Bachelor of Science.

Yang's research (2006) indicates graduates from key universities are more likely to find higher paid employment than those from non-key universities. Students who are capable of scoring highly in entry examinations and therefore gain entry into key universities are more likely to obtain high positions in the labour market. However, in reality, students from both key and non-key universities have difficulty in securing employment as an oversupply of graduates come into the intensely competitive labour market. Moreover, the higher paid jobs are centralized in the established developing cities, especially along the Eastern coast. As a result, human capital flows to those developing cities leaving less-developed cities with a serious shortage of highly skilled human capital, such as qualified technical and professional workers. Most of the graduates prefer to stay in the big cities or move to coastal provinces in order to find employment resulting in an oversupply of graduates to meet market demands. This unequal distribution of graduate resources relating to the current HE system and unequal distribution of HE resources is detrimental to a healthy and stable economy.

6.4.4 Family background

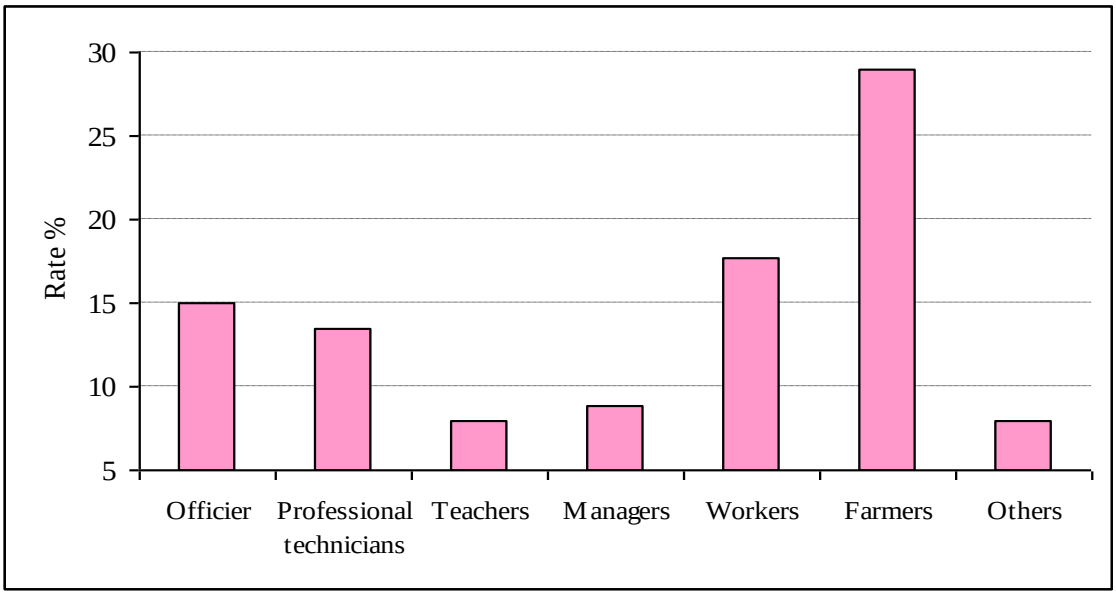
A similar research carried out by UNESCO found that family's social background determines students' choices of HEIs. Students from urban areas prefer to enter national key universities rather than regular or private universities, whilst students from rural areas usually attend regular or local HEIs. Urban families tend to have better financial and educational conditions and resources thus enabling their children to receive a better quality of education up to HE standard, this in turns makes it easier for them to access key universities. In contrast, students from rural areas and some disadvantaged urban areas tend to be sent to provincial and local HEIs, which are

relatively affordable, but lack the quality and quantity of facilities and resources available to key universities (Wan, 2006).

In 1998 the Education Department of Hong Kong Chinese University carries out a survey involving 13,511 students among 14 universities in Beijing, Nanjing and Xi'an. It found that opportunities of accessing HE for students whose parents' attained a college level of education or higher were 17.2 times greater than for students whose parents were illiterates, 11.5 times greater for those whose parents only held primary school education,10 times and 3.6 times greater for those whose parents received junior and senior secondary school education, respectively.

Figure 6.5 represents the rate of students in HE according to their fathers' occupations in 1999 in mainland China. According to seven different divisions of occupations, the ratio of total number of officers to total number of employees in various sectors within China was only 2.02%, but the rate of their children who were in HE to the total number of students reached 15%. If taking into account the number of students whose fathers worked as managers, the rate reached 23%. Students from professional technicians' families were advantaged. 5.43% of people employed as technicians contrasted to the ratio of their children to the total number of students in HE was 13%. In contrast, 69.3% of people worked as farmers, but the rate of their children in total HE to the total number of students was only 29.4%. This indicates that family background, income level and level of occupation are determining factors in the uneven distribution of HE students resources, and therefore on the level and prestige of HEIs available to them. Students from lower-income families have more restrictions to access HE than those from higher-income families. Furthermore, students from families with well paid occupations, such as officers and businessmen are centralized in key universities; however those from family with lower income occupation such as workers and farmers are allocated in regular colleges and universities (Yang, 2006).

Figure 6.5 Rate of students in HE according to their fathers' occupations (1999)



Sources: Lu Genshu, (1999), HE return, a research of affordable ability and wills for mainland university students

In contrast, according to the demands of the labour market, students in HEIs have been strongly influenced by their parents' educational and occupational background when choosing their subjects. Table 6.13 represents the distribution of entrants in regular HEIs by subject in 1998 and 2006. In both 1998 and 2006, "Engineering" remained the top choice of HE, whilst in 1998 the new subject "Administration" became the second most popular choice with 19.7 of entrants taking it as their course of study instead of "Economics". There was little chance in the number of students choosing "Literature", "Medicine" and "Education", however science fell to the sixth place of choice as fewer students selected this as their main subject.

Table 6.13 Distribution of entrants in regular HEIs by subject (1998 and 2006)

Subjects	1998(%)	Rank	2006 (%)	Rank
Philosophy	0.2		0	
Economics	15.3	2	4.9	
Law	4.2		3.6	
Education	4.7	6	6.1	5
Literature	14.3	3	15	3
History	1.6		0.3	
Science	11	4	5.2	6
Engineering	38.1	1	36.5	1
Agriculture	3.6		1.8	
Medicine	7	5	7	4
Administrators	--		19.7	2
Total	100		100	

Sources: Data are from the China Statistical Yearbook online resources (NBS, 1999 and 2007)

The most popular subjects, ranked from one to four, were selected by students whose parents are officials or businessmen or professional technicians. In contrast, students whose parents are manual workers and farmers only choose general subjects, ranked above five as shown in the table above. In general, the more highly educated parents provide their children with a better quality of education and invest more in HE. As a result this group of students, with all the advantages of coming from a better educational family background, are the dominant group.

6.4.5 Impacts of HE commercialization

The effect of HE expansion on disadvantaged social groups and regions is twofold, more HE opportunities are provided, however, at the same time these groups and regions are extremely financially burdened. Since the co-funding mechanism was implemented, the central government has transferred the funding burden to regional government and families, who have to share all the costs of HE with the central government.

Tuition fees in HE was only 200 yuan in 1989, which is 1/7 of the average urban 1,376 yuan income (NBS, 1990). Since then it has continued to gradually increase until reaching 610 yuan in 1993, in 1996 it dramatically doubled to 1,319 yuan and

tripled to 3,895 yuan in 2001. The soaring tuition fees became an issue of public dispute, although in 2001 and 2002 the intensity of the dispute lessened. The present tuition fees in HE have, however, increased to a minimum of 5,000 yuan and up to 10,000 yuan, an increase of 25 to 50 times that in 1989. The annual income of urban residence has increased by only fourfold, therefore the increase in HE tuition fees increased by 10 times the average income from 1989 to 2007 (Chinacom.cn, 3rd July, 2007). As a result, the disadvantaged group of students forced to abandon hopes of entering HE were those from poor families.

A research carried out by Professor Zuoyu Xie on differences in HE development from 1978 to 2000 at a provincial level found two main issues, namely, the size of HE enrolment and HE investment. Nationwide HE was centralized in the Eastern region in terms of the universities high student numbers per 10,000 populations. Differences increased from 3.0 in 1978 to 38.5 in 2000, the number of enrolled students in Municipal cities (Beijing, Shanghai and Tianjin) dramatically increased, contrasting those from the Western region which fell to lower than national average level. In 2001, there were only nine provinces, which expenditure was 20,000 yuan per capita for students in regular HEIs run by the central government, and 13 provinces from the Central and Western regions spent below 20,000 yuan. A similar situation was found in the regular HEIs run by the local government, here the national average expenditure was 23,743 yuan per student, 24 provinces from the Eastern and Central regions exceeded 20,000 yuan per student, and seven from the depressed Western region was below 10,000 yuan per student (Xie, 2001).

Table 6.14 represents the changes of public funding and tuition fees from 1998 and 2006. The increase of tuition fees was spectacular compared to public funding. From 1998, tuition fees increased 4.2 times to 155.3 billion RMB in 2006, while public funding increased by only 2.5 to 516.1 billion RMB. Among the four regions the increase in tuition fees was the highest in the Western region by 5.3 times, followed by the Municipal cities by 5.1 times, the Eastern and Central regions by 4 and 3.8 times respectively.

Table 6.14 Change of HE funding (1998 and 2006)

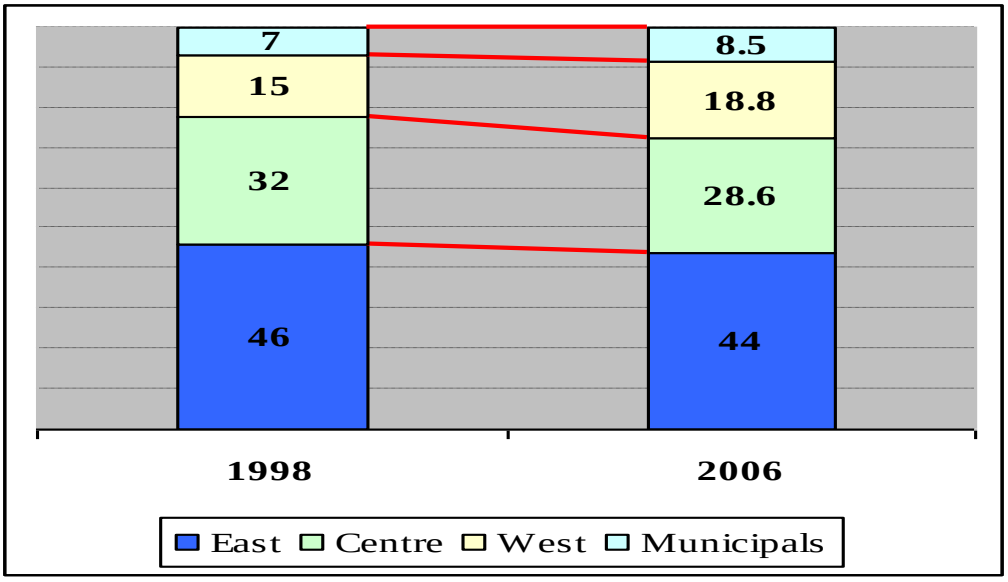
	1998(billion RMB)		2006(billion RMB)		2006/1998	
Region	Fund	Fees	Fund	Fees	Fund	Fees
East	83.5	17.0	215.2	68.4	2.6	4.0
Centre	51.8	11.8	121.9	44.4	2.4	3.8
West	46.5	5.5	118.0	29.2	2.5	5.3
Municipals	21.5	2.6	61.1	13.3	2.8	5.1
Total	203.2	37.0	516.1	155.3	2.5	4.2

Sources: Data are from the China Statistical Yearbook online resources (NBS, 1999 and 2007) and are calculated by the author.

Notes: Government funds are not limited to HE but to all education.

The different increasing rate of tuition fees and public funding resulted in an adjustment in the regional shares of HE funding required from students as shown in Figure 6.6. The Western region accounted for 15% of total national tuition fees in 1998, and increased to 18.8% in 2006, implying the poorest region was more financially burdened as a result of the HE funding reform.

Figure 6.6 Adjustment of regional composition of tuition fees (1998 and 2006)



Source: Data are from online resources of 1998 and 2006 tuition fees from different universities, representing different provinces.

Accordingly, the HE funding reform has a serious impact on social justice. Table 6.15 shows the comparison between tuition fees per student and income per person in rural and urban areas. The average tuition fees per student were 0.75 times of per capita

income of the urban households, but 2.2 times of the per capita income of the rural households. In particular, the Western region's average tuition fees per student was three times that of the rural income per capita, which although was the lowest in both rural and urban areas. In contrast, other regions were lower in terms of the fee/income ratio.

Table 6.15 Tuition fees, rural and urban income and the ratios (2006)

	Fees	Income (RMB/person)		Fee/income ratio	
Region	(RMB/student)	Rural	Urban	Rural	Urban
East	9,382	4,979	13,185	1.88	0.71
Centre	7,532	3,359	9,803	2.24	0.77
West	**7,638**	**2,576**	**9,545**	**2.97**	**0.80**
Municipals	13,093	8,707	20,323	1.50	0.64
Total	8,469	3,871	11,364	2.19	0.75

Sources: National Bureau of Statistics, Statistical Yearbook of China (NBS, 2007)

In general, people from rural areas with lower-income have less education, which may directly affect their decision regarding the provision of HE for their children in order to improve their current situation. Parents' educational and occupational background has a substantial influential on the educational attainment of children, which invariably means that the well educated parents who have top positions in the labour market are more able to provide their children with a high quality of education in key universities. More importantly, the concept of providing better education may pass on to next generation, the equality of HE opportunities for disadvantaged social groups needs to be carefully considered and supported by policy makers and educators.

6.5 Conclusions

Over the last 30 years, China has made tremendous achievements in HE development along with its fast economic growth. The numbers of HEIs, students and teachers have increased rapidly. In particular, the GER has risen from less than 7% to 22% over the last decade thanks to two major reforms: decentralisation of HEIs and the commercialisation of HE. Decentralisation focused on transferring control and ownership rights from central ministries, except for the Ministry of Education, to regional and city authorities. Co-funding system focused on charging tuition fees to establish a co-funding model between parents and government.

This chapter does not focus on how HE has contributed to economic growth, or vice versa, or the overall development of HE in China, as these issues have been well studied in existing literature. Instead, it focuses on implication of the above-mentioned HE reforms over the last decade from social justice perspective, an issue which has not been sufficiently addressed by other studies but has important policy implications on the future direction of HE reform in China.

Social justice is defined as 'equal access to HE for all and an even share of school resources' in both 'quantity' and 'quality' terms. The former refers to the absolute number of HEIs and educational places offered to different social groups, and to different geographic locations as a result of HE expansion from elitism to mass education. The latter refers to the opportunities of access to both regular and national key universities. Furthermore, social justice indicates the relative ability of different social groups to afford HE and how the co-funding reform may have affected the relative welfare of different groups.

The key questions are:

- Have different social, economic and geographical groups had better and fairer access to HE opportunities in both quantity and quality terms?
- Have the HE reforms enhanced the opportunities of the disadvantaged groups compared to the advantaged groups or not?

To answer these questions, we used statistical data from two separate cohorts of newly enrolled students in 1998 and 2006. Empirical analysis of the enrolment data and additional information on HEIs in the same years provide the following answers to the questions.

Firstly, at the same time as more HEIs were established within the four regions used in this chapter in 1998 and 2006, the number of HE students and teachers were proportionately increased. In particular, relatively more HEIs and HE places were created in the provinces compared to the Municipals. However, the provinces fared relatively better than the Municipal cities; whilst the poorest provinces in the Western

region did not benefit much from the redistribution of HE resources. In contrast, the Eastern region benefited most.

Secondly, the distribution of national key HEIs became more uneven across the regions over the data period. In particular, a large share of the total number of national key universities, such as Beijing and Shanghai had a high localised HE recruitment, which set an unfair standard of entry for students from outside of the big cities and resulted in students from non-local cities needing to hold higher examination scores to gain entry into key universities.

Thirdly, uneven resources distribution determined uneven funding distribution, because national key universities were centrally financed. Tuition fees, for individual students from low income families became a critical deterrent for access into HE. Immediate action needs to be taken in order to balance the uneven educational resources. The vast number of regular universities, vocational and local colleges, particularly in remote and depressed regions, should have immediate increased investment from central and local governments. The disadvantaged students, those from rural and poor urban areas need to be given better access to national key HEIs. The average quality of HE and educational conditions, together with provision of pre-university education, need to be revised and improved in order to minimize potential inequalities in HE.

Tuition fees accounted for a much smaller proportion of urban incomes than rural incomes. As a result, HE reforms increased more financial pressure for the disadvantaged groups and regions compared to the advantaged ones. For some low income families, high tuition fees would only add to their poverty, especially as the threat of unemployment was high when their children graduated, thus, social justice deteriorated in terms of quality as result of HE funding reform.

Although the government has attempted to help poor students through the provision of student loans, the take-up rate has been low and the help provided to the most needy has been limited. Other problems such as unreasonable category applications and over-centralized governance still affect the functions and efficacy of students' loans. Against the background of a highly divided and unequal society in today's China, HE

reforms over the last decade may have contributed to more economic inequality and social injustice.

Social injustice has become one of the challenges for the government aiming to build a harmonious society. Two aspects of improvement may help, firstly the government need to enhance reforms for national key universities to improve their sensitive reaction to market process in order to create a healthy competitive environment, which will enable them to improve the implementation of equal opportunity for students to access HE. Secondly, government need to reform the existing subsidy system to include such issues as student loans, grants, scholarships and a variety of donations in order to adopt appropriate incentive funding policies to stimulate the participation of the private HE sectors. This will improve the current systems and also will reduce dependence of HE on the income of individuals or households.

Chapter 7 Gender Inequality, Regional Inequality and Human Capital

7.1 Introduction

In recent decades, a significant increase in gender pay inequality has become evident in China. According to the National Bureau of Statistics of China (NBS), the ratio of total number of female to male employees' average income from 1987 to 2004 declined by eight percentage points (Chi and Li, 2008). However, the average educational attainment of the total number of female employees had risen faster than that of male employees at national level. The percentage of female employees who completed HE (college or higher level education) increased five-fold, whereas that of male employees approximately tripled in the same period of time. However, paradoxically, females' average pay worsened.

The income gap is a used mostly as a monetary measurement of regional inequality in China. Income is determined by a vast number of factors, such as educational levels and work experience; and it also broadly reflects the socioeconomic and environmental circumstances of the human being. As Simon Kuznets (1955) noted, conventional income measures fail to capture many important elements of human welfare and the standard of living. Therefore, HC accumulation as a non-monetary measurement of regional inequality could compensate for that limitation and draw a comprehensive picture of regional inequality. In fact, China has made huge advances since economic reform, in terms of both education attainment and longevity; however, those improvements have been uneven by both region and gender. Some Chinese are better off than others, and males are advantaged.

Few comparative studies have explicitly considered the impact of gender inequality in economic growth. Bloom and Canning (2000, 2003) found that education has a significant positive effect on the rate of economic growth. Barro and Lee (1993) and Barro, Mankiw and Sala-i-Martin (1995) found that females' primary and secondary schooling has negative effect on economic growth. Dollar and Gatti (1999) found a positive relationship between females' secondary education achievement and economic growth, but a negative relationship for males. Hill and King (1995) found

that a female-male enrolment ratio has a positive relationship to the level of GDP per capita.

LEAB is a frequently cited as an indicator of human welfare and of the level of economic development. More developed countries or regions have, on average, a higher life expectancy at birth. In general, women live longer than men, and the significant improvement in longevity can be attributed to factors such as better living and working environments, better maternal and preventative care, education and higher income (Michael, *et al.* 2004). For the past decade, life expectancy for men increased slightly more slowly than for women. Although living and educational conditions seem to be better for both male and female over time, gaps in life expectancy between them have developed: the increase in men's longevity in particular is much slower than that of women. For instance, the gender gap in life expectancy reached at least 3.5 years at regional level in 2005.

The traditional concepts of investment in girls and boys have a continual impact on their status in education and health among households from various backgrounds. This chapter argues that human capital development is a key factor explaining the regional and also the gender inequality in China from education and health - two key dimensions. Two main research questions have been designed as follows: 1) to what extent does gender inequality in the dimensions of education and health influence regional inequality in 1990 and 2005 respectively? 2) are there any changes in its influence over time?

This chapter focuses on a non monetary measure of regional and gender inequality in China over the past 15 years. Section two discusses the background of some related topics in gender concerning a wide range of issues. Section three reviews some theories and the empirical research into the importance of gender issues in human capital. Section four presents methodology and data. Section five analyses to what extent gender inequality contributed to regional inequality in 1990 and 2005. In section six and final section, a number of discussions and conclusions are summarized.

7.2 Background

7.2.1 Gender inequality

In the process of development in China, modern inequality has widened across regions, along with gender equity. The national population of China more than doubled between 1953 and 2005. Both of the actual sex ratios at birth (male/female ratios) and sex ratios at younger age groups are underestimated to 5-9 percentage points lower than those reported in the census. The female birth rate is also underestimated by about 50% in the 1990s (Zhai and Chen, 2007). Using the male/female ratios of the 0-4 year age group instead of the overall average sex ratio from the census, at a national level, the imbalance in the sex ratio varied hugely, the ratio of males per 100 of females climbed from 105.6 in the 1953 census to 111.7 in the 1990 census, and continually jumped to 122.7 in the 1% sample census of 2005. In some areas the ratio increased to 130, with a wider gap between urban and rural areas (Guardian, 2007).

In 1990, 90% illiteracy was concentrated in the rural areas, 70% of which affected women, but few provinces reached 90% (NBS, 1993). At that time, the illiteracy rate was one of the urgent challenges for the central government, girls benefitted from the implementation of the policy of extending education. In 2005, an encouraging picture emerged as the illiteracy rate of female declined to 16.15% in a big step forward. Moreover, the gaps in years of schooling between girls and boys decreased positively from 1.9 years in 1990 to 1.2 in 2005, which shows that the improvement in education resources reduced distinctly over time.

Just as their educational status has improved, girls' health status has made obvious progress in terms of increased physical height and longevity. However, in China, 80% of the health resources are centralized in cities, so that an insufficient investment in girls' healthcare and the shortage of health resources in poor and remote areas has hugely impacted on women's health status. For instance, there had been 3,944 national maternal and child health agencies in 1955, but this number declined to 3,179 in 1995 and, in recent years the decline continued so that in 2004 there were 2,998 agencies (www.china.com.cn, 2006). The streamlining of healthcare agencies has had

a great impact on the special services for motherhood and children, increasing, the disparities of health resource and investment across regions.

Chinese women have traditionally been subordinate to men, and perceived as lowly, weak and destined to serve others. While such views persist in remote and depressed areas, political strategies have promoted the ideology of gender equality (Croll, 1995). As the United Nations Development Programme (UNDP) report of 2005 states: "China's labour market is highly segregated by gender" (UNDP, China, 2005:2). This has resulted not only in an increased workforce participation in the cities that obviated the need for migrant workers to join industry, but also entitled women to secure good jobs (Loscocco and Bose, 1998). Before the economic reform, the participation rate of female employees was in excess of 90%; in the total labour market it was 48%. After the reform, it gradually increased from 44.8% in 1990 to 45.4% in 2005, and the participation rate of male employees rose to 54.6% from 55.2% in the same period (The Information Office of Chinese State Council, 2004 and www.gzswomen.org.cn).

At the beginning of the economic reform, the ratio of the average female income to that of male employees remained at a constantly high level and in all sectors of the workplace, regardless of work effort, equality in pay was almost achieved. This changing set of beliefs about equal welfare for both genders was tested in a rapidly changing work environment after the late 1970s, when labour markets and market forces came to the fore (James and Margaret, 2002). After the economic reform in the 1980s, a decentralization of the wage payment system was implemented at local levels, and employers were allowed to diverge from national wage scales. Female employees are considered as a disadvantaged group in the intense competition in both product and labour markets (Becker, 1971). In rural areas, the per capita income per month for male employees is 32.6% higher than for females in 2005 (www.sdxm.gov.cn).

7.2.2 Key indicators

Key indicators by gender, as employed in the chapter, are listed by province between 1990 and 2005. Table 7.1 shows the average years of schooling of people aged six

and above, which is an indicator of the level of education achieved, while life expectancy is an indicator of the level of health achieved.

Table 7.1 Key indicators of gender (1990 and 2005)

	1990		2005		1990		2005	
	YOS M	YOS F	YOS M	YOS F	LE M	LE F	LE M	LE F
Units	years	years	years	years	years	years	years	years
East	**8.1**	**7.7**	**9.2**	**8.8**	**69.0**	**73.4**	**72.5**	**77.1**
Beijing	9.6	9.4	11.2	11.1	71.1	74.9	**75.1**	78.8
Tianjin	8.9	8.6	10.1	9.9	71.0	73.7	74.3	77.7
Shanghai	**9.5**	**9.1**	**10.8**	**10.4**	**72.8**	**77.0**	77.1	**81.0**
Hebei	7.9	7.6	8.9	8.7	68.5	72.5	**70.8**	74.7
Liaoning	8.4	8.1	9.3	9.1	68.7	71.9	72.5	76.4
Jiangsu	8.2	7.7	9.3	8.8	69.3	73.6	73.3	78.0
Zhejiang	7.8	7.5	8.7	8.5	69.7	74.2	72.9	77.6
Fujian	7.7	7.0	8.8	8.3	66.5	70.9	72.0	76.8
Shandong	8.0	7.5	9.0	8.5	68.6	72.7	71.8	76.4
Guangdong	8.0	7.4	9.1	8.7	69.7	75.4	72.4	77.7
Hainan	8.2	7.6	9.1	8.6	66.9	73.3	73.4	78.2
Central	**8.0**	**7.5**	**8.9**	**8.5**	**66.5**	**70.1**	**71.0**	**74.5**
Anhui	7.8	7.2	8.6	8.2	**67.8**	**71.4**	**71.3**	**74.7**
Shanxi	8.1	7.8	9.0	8.7	67.3	70.9	**70.5**	74.1
Jilin	8.3	8.0	9.1	8.9	66.7	69.5	71.5	75.2
Heilongjiang	**8.3**	**8.1**	**9.2**	**8.9**	65.5	68.7	72.3	76.6
Jiangxi	7.8	7.2	8.6	8.0	64.9	67.5	69.6	70.6
Henan	8.0	7.5	8.9	8.6	68.0	72.6	71.1	74.9
Hubei	8.1	7.6	9.0	8.5	65.5	69.2	70.9	74.7
Hunan	7.8	7.4	8.8	8.5	65.4	68.7	71.0	74.5
West	**7.6**	**7.3**	**8.4**	**8.2**	**64.8**	**67.4**	**68.8**	**72.3**
In. Mongolia	**8.2**	**7.9**	**9.3**	**9.1**	64.5	67.2	69.1	72.7
Guangxi	7.6	7.1	8.5	8.1	**67.2**	**70.3**	**71.3**	**76.1**
Chongqing	7.5	7.2	8.4	8.2	65.1	67.7	70.1	74.1
Sichuan	7.5	7.2	8.1	7.9	65.1	67.7	70.0	74.2
Guizhou	7.3	7.0	8.0	7.7	63.0	65.6	65.2	68.3
Yunnan	7.3	7.2	7.9	7.7	62.1	65.0	65.1	67.8
Tibet	7.0	7.0	6.8	6.9	57.6	61.6	62.5	66.2
Shaanxi	8.3	7.9	9.1	8.7	66.2	68.8	69.9	72.4
Gansu	8.0	7.9	8.6	8.2	66.4	68.3	68.1	69.6
Qinghai	8.0	8.0	8.8	8.7	59.3	62.0	67.2	70.5
Ningxia	8.1	7.9	8.9	8.6	66.0	68.1	70.5	73.7
Xinjiang	8.0	7.8	9.0	8.9	62.0	63.3	70.7	74.1

Sources: Data for 1990 are from the *China Census Statistics* in 1990 (NBS, 1993), the 2005 data are from the *China Statistical Yearbook* 2006 (NBS, 2006), and are estimated from data reported for 2005 in the *China Human Development Report* (UNDP, 2008).

Notes:
1. YOS M = The average years of schooling of males
2. YOS F = The average years of schooling of females
3. LE M = Life expectancy at birth of males
4. LE F = Life expectancy at birth of females
5. In. Mongolia = Inner Mongolia

It can be seen from the figures in Table 7.1 that in both years, males and females from Shanghai were the most advantaged people in terms of their education and health status, exceeding the average regional level with over 1.4 years in 1990 and 1.6 in 2005. A further comparison of years of schooling by gender within the three regions in both years found that females in the Eastern region had 0.4 years less education than males, in the Central region decreased from 0.5 to 0.4 and in the Western region dropped from 0.3 to 0.2. Similarly some improvement in life expectancy in both genders was found, females in the Eastern region lived 4.4 years longer than males in 1990 and 4.5 years longer in 2005. In both the Central and Western regions females lived 3.6 and 3.4 years longer during the same period. In 1990 and 2005 at national, regional and even provincial level, figures showed a distinct difference between the average years of schooling and life expectancy by gender.

7.3 Literature review of gender inequality

7.3.1 Concepts of gender pay inequality

The gender pay inequality has been a common social problem in many developing countries (Katz and Autor, 1999; Brainerd, 2000). Economists have argued that gender pay differentials have resulted from different human capital endowments (Oaxaca and Ransom, 1994; Neumark, 1988). In other words, if male and female employees gain productivity differently, and their capital characteristics are appropriately rewarded, their pay may differ (Hare, 1999; Liu *et al*, 2000). Gender pay difference is determined by how the capabilities of men and women are rewarded in the competitive labour market (Blau and Kahn, 1992, 1997). However, gender pay discrimination cannot be interpreted by observable differences in human capital (Milliment and Wang, 2006). Others research suggests that gender pay discrimination is not driven by productivity differences but is gender based (Arrow, 1972; Becker, 1957). Gender pay differentials and pay discrimination are reflected in industry or occupational segregation (Rozelle, *et al.* 2002). For instance, men have a larger share

of employment in heavy industry and certain occupations; in contrast, women work more in the third industry and in the service sectors.

7.3.2 Factors of gender and regional gaps

A national view of gender inequality may affect economic growth, social stabilisation and prosperity (Klasen, 1999; Lagerlöf, 1999; Ravi, 2002). Few models have considered gender inequality in education and its impacts on economic growth. Lagerlöf (1999) found that gender inequality in education led to low economic growth. Research by Ravi found that gender inequality impedes overall efficiency and growth because of its direct effect or contribution to inequality in general (Ravi, 2002).

The educational influence on gender pay differentials is found in both developed and developing countries. A survey found that female employees with a higher level of education received a higher level of pay than those who were less educated (Blau *et al.*, 1998). James and Margaret, in 2002, showed that the absolute gender wage gap reduced along with increased schooling levels from 45 yuan per month for women with a primary school education to 19 yuan for those with a college education. In addition, it is noticeable that the female/male wage ratio narrowed from 0.91 for those with primary schooling to 0.79 for those with higher education (James and Margaret, 2002).

Some research by other scholars found that the geographical location affected the wages gap: the well developed cities of the Eastern Seaboard provinces have more prevalent market forces than other developing and less-developing cities (Gustafsson and Li, 2000). Moreover, female employees were paid less than males in the private sector than in the state-owned or collective sectors (Khan and Riskin, 1998; Maurer-Fazio and Hughes, 2002; Dong and Bowles, 2002; Liu, Meng, and Zheng, 2000; Zhang and Dong, 2006). Some evidence suggests that the gender pay gap increased between 1980 and 1990 in China (Maurer-Fazio, Rawski and Zhang, 1999; Gustafsson and Li, 2000). They also revealed that gender segmentation and discrimination in rural and urban labour markets displayed various gender pay gaps (Dong, MacPhail, Bowles and Ho, 2003; Rozelle, Dong, Zhang, and Mason, 2002; Meng, 1998a, 1998b). Discrimination against women in the labour market arises from

the belief that they sacrifice time caring for the family (Chi and Li, 2008). Chi and Li (2008) explained the China's rising gender pay gap as following two possible reasons. Firstly, in the planned economy, women are discouraged from participating in employment and investing in education, so that the valuable human capital of women is underdeveloped and underutilised in society. Secondly, during the transition to a market economy, the return to employees' characteristics of productivity such as educational attainment and skill enhancement tends to increase (Chi and Li, 2008).

7.3.3 Human capital dimensions – education and health

Education and health are two dimensions of human capital and each plays a significant role in economic growth and affects the issue of equality. Table 7.2 shows a correlation between the average years of schooling and life expectancy in males, a correlation that improved over time. In contrast, the relative correlation for females changed from an insignificant to a significant level in 1990 and 2005, which may be attributed to a greater input in education than for males. It was also found that the correlation was greater for males than for females in these years.

Table 7.2 The correlation between national years of schooling and life expectancy by gender (1990 and 2005)

	1990	2005
Male	years of schooling	
years of schooling	---	---
life expectancy	0.521**	0.649**
Female	years of schooling	
years of schooling	---	---
life expectancy	0.300	0.531**

Sources: Data for 1990 are from the *China Census Statistics* in 1990 (NBS, 1993), and data for 2005 are from the *China Statistical Yearbook* 2006 (NBS, 2006), and are calculated by the author.

** Correlation is significant at the 0.01 level (2-tailed).

7.4 Methods and data

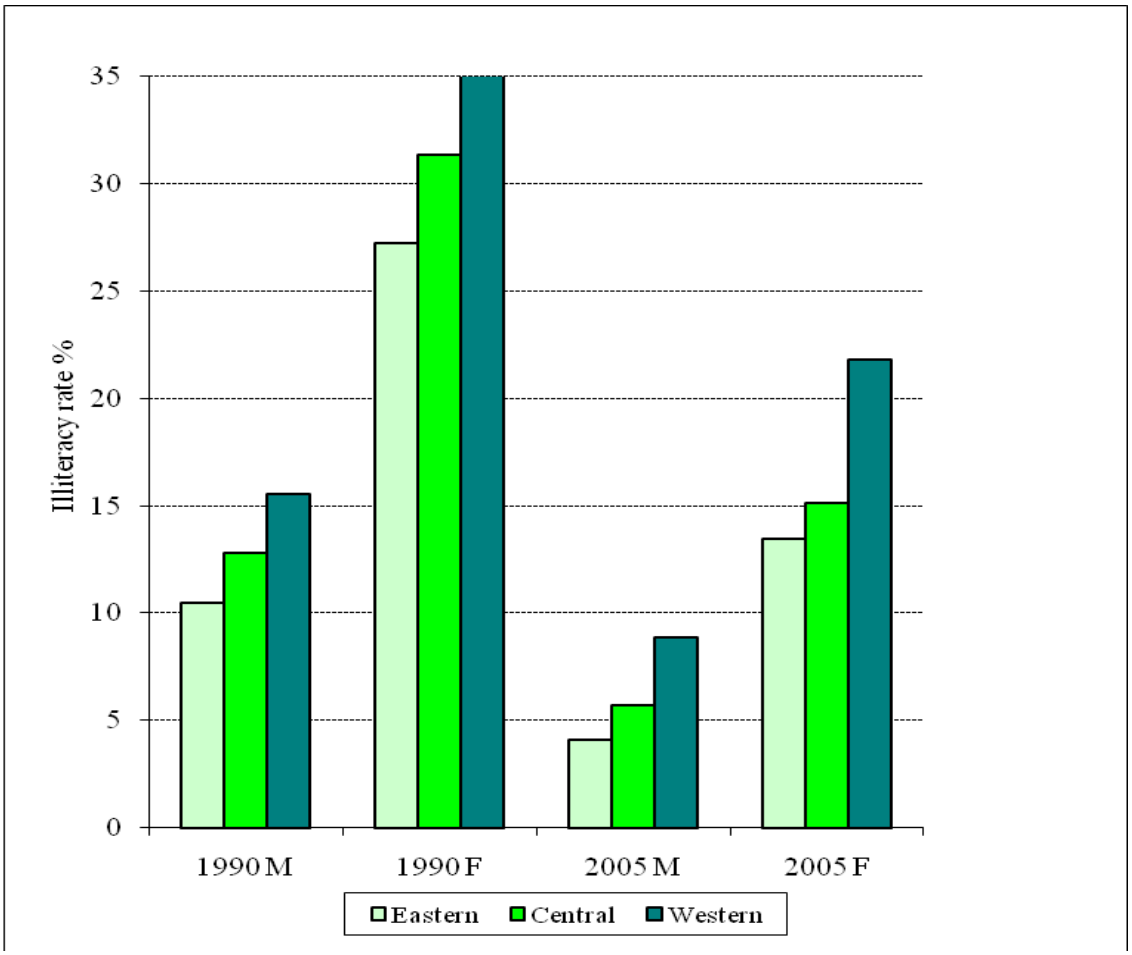
Gender inequality can be measured simply in terms of the differences in the mean of various indicators for men and women. The implications of gender equality employed

in this chapter for better understanding are described as follows. The gender equality in education implies that boys and girls have equal rights to education, and should be provided with equal opportunity to access different levels of schooling. Similarly, gender equality in health implies that both males and females receive similar investment in nutrition and have a similar life expectancy. This chapter selects four indicators for a comprehensive comparison by gender. The illiteracy rate of people aged 15 and above and average years of schooling of people aged six and above are treated as educational indicators, and the average height of people aged 15 and life expectancy at birth are treated as indicators of health status.

7.4.1 Educational indicator for gender inequality

Education levels in each province could be measured in terms of adult literacy rates or illiteracy rates, enrolment rates or average years of schooling. The illiteracy rate is an indicator of the coverage rate of education. Figure 7.1 represents differences in illiteracy rate of people aged 15 and above, by gender, within the three regions in 1990 and 2005. Comparing illiteracy rates of both males and females, the differences between the Western and Eastern regions appeared to be greater in 2005 than in 1990. Although illiteracy rates of females have improved faster than males, as a result of increased local and state government attention and investment in education, males still have more than a two-fold and a three-fold lead over the rate of educated females in 1990 and 2005 respectively.

Figure 7.1 Illiteracy rate by region and gender (1990 and 2005)



Sources: Data for 1990 are from the *China Census Statistics* in 1990 (NBS, 1993), data for 2005 are from the *China Statistical Yearbook* 2006 (NBS, 2006), and are calculated by the author.

The average years of schooling of people aged six and above, as referred to in this chapter, is an indicator of the length of education received in the four levels of schooling, which are primary, junior and senior secondary schooling and higher education. Students from different levels of schooling represent different educational outcomes. For instance, those students in higher education not only have longer years of schooling but also, generally, are more capable of grasping knowledge and thus may have more opportunities in the labour market than students without higher education.

7.4.2 Health status indicator for gender inequality

Nutritional intake is an important factor affecting health and height. There are generally two periods of rapid height growth for people, during infancy and the adolescent growth spurt between the ages of 9-15 years of age (Morgan, 2000). Ignoring innate genetic factors and unstable periods, Table 7.3 represents the comparable height of males and females aged 15 years in 1991 and 2005.

Table 7.3 Average height of people aged 15 and over by region and gender (1990 and 2005)

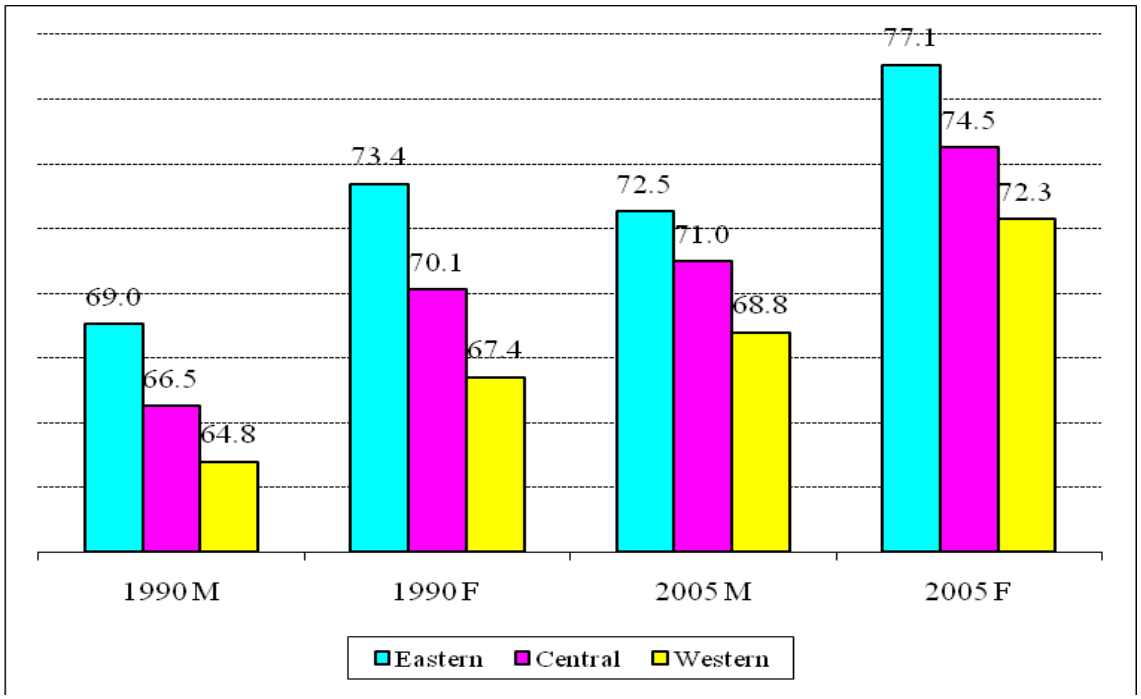
Year	1985(cm)			2005(cm)		
Regions	**Male**	**Female**	**M-F**	**Male**	**Female**	**M-F**
East	163.9	156.4	7.4	169.4	159.2	10.2
Central	161.9	155.1	6.7	167.6	158.1	9.5
West	160.9	154.5	6.4	166.2	156.9	9.2

Sources: Data for 1991 and 2005 from the *Report on the Physical Fitness and Health Surveillance of Chinese School Students* 1991 and 2005.

The results show some improvements in both genders aged 15 years among all regions over time. However, both genders in the Western region had the shortest stature; in contrast those in the Eastern region were the tallest. Those in the Central region were between the two. Within the three regions, there was a slight variation in height increase, with the Western region having the least increase. In both years, the biggest difference in average height was found to be in the Eastern region, although the difference approximately 7cm in 1990 and 10cm in 2005 became more evident over time.

Life expectancy at birth is the average number of years a newborn infant would be expected to live if health and living conditions at the time of birth remain constant throughout life. It reflects the health status and the quality of health care they receive. Life expectancy is higher in high-income countries than in all but a few low- and middle-income countries, and also females have a longer life expectancy than males (World Bank). Figure 7.2 represents a comprehensive picture of life expectancy by gender in 1990 and 2005. It indicates that females live approximately 3.5 years longer than males in these three regions in both years. Life expectancy data produced a picture the reverse of that produced by the data regarding physical height.

Figure 7.2 Life expectancy by region and gender (1990 and 2005)



Sources: NBS, 1993 and UNDP, 2008

Note: The 1990 LEAB data are from the fourth national census. The 2005 data are estimates derived from data reported for 2005 in the *China Human Development Report* (UNDP, 2008).

7.4.3 Methodological issues

In order to investigate to what extend educational and health inequality by gender contributes to the regional inequality in human capital, the equation is designed as below. Detailed explanation is referred to Section 3.1.2, and two further developed equations for gender inequality in education and health are as follows.

$$HC_{hc.reg.} = \hat{A} + \hat{\alpha} HC_{gi.edu.} + \hat{\beta} HC_{gi.health.} + e \qquad (1)$$

Where $HC_{hc.reg.}$ represents the regional inequality in human capital stock; $\hat{A}$ is an estimated constant, $HC_{gi.edu.}$ denotes gender inequality in education, and $HC_{gi.health.}$ denotes gender inequality in health. $\hat{\alpha}$, $\hat{\beta}$ are estimated coefficients of gender inequality in education and health respectively. e is an error term, which is treated as a random variable, covering a number of factors that are not the focus of this chapter.

7.4.4 Data and indexes

All the relevant raw data are from the China Statistical Yearbook published by China's statistics Bureau, online resources, the China Census in 1990 (NBS, 1993), 1% population sample data in 2005 (NBS, 2006), and also the China Compendium of Statistics 1949-2004 compiled by National Bureau of Statistics (NBS, 2005a). Some specific data, such as height by gender comes from the 1985 and 2005 Report on the Physical Fitness and Health Surveillance of Chinese School Students (CCAHS, 1988, 2007). Due to a lack of data for certain years, the available data in the nearest years was used in regression, with the available height data for 1985 replacing the missing data for 1990.

$$HC_{gi.edu.} = \frac{Edu._{ineq.yos} + Edu._{ineq.ill}}{2} \quad (2)$$

$$HC_{gi.health} = \frac{Hea._{ineq.ht} + Hea._{ineq.le}}{2} \quad (3)$$

The standardised gender inequality in education $HC_{gi.edu}$ comprises two variables: $Edu._{ineq.yos}$ and $Edu._{ineq.ill}$ respectively, indicating gender inequality in the average years of schooling of people aged six and above and the illiteracy rate of people aged 15 and above. Similarly, the standardised gender inequality in health $HC_{gi.health}$ includes another two variables: $Hea._{ineq.ht}$ and $Hea._{ineq.le}$ respectively, indicating gender inequality with regard to the average physical height of people aged 15 and life expectancy at birth. The four key indexes of gender inequality in education and health are calculated by the following equations:

$$Edu._{ineq.yos} = \frac{Y_M - Y_F}{(Y_M - Y_F)_{Max}} \quad (4)$$

$$Edu._{ineq.ill} = \frac{I_F - I_M}{(I_F - I_M)_{Max}} \quad (5)$$

$$Hea._{ineq.ht} = \frac{H_M - H_F}{(H_M - H_F)_{Max}} \quad (6)$$

$$Hea._{ineq.le} = \frac{(L_F - L_M)_{Min}}{L_F - L_M} \qquad (7)$$

The standardised gender inequality in average years of schooling is represented as $Edu._{ineq.yos}$, which in illiteracy rate is represented as $Edu._{ineq.ill}$; the standardised gender inequality in average height and in life expectancy are represented as $Hea._{ineq.ht}$ and $Hea._{ineq.le}$ respectively.

Based on the data collected, males receive more education than females, and also males are taller than females, however, the illiteracy rate in females is higher and females generally live longer than males. In respect that differences, it is better to figure out standardised values of gender inequality in these four indicators to positive constant by some techniques. $Y_M - Y_F$ represents the gender gap in the average years of schooling; $I_F - I_M$ represents the gender gap in illiteracy rate; $H_M - H_F$ represents the gender gap in average height and $L_F - L_M$ represents the gender gap in life expectancy. "Max" of each indicator represents the maximum gender gaps between males and females and "Min" denotes the minimum accordingly. For instance, $(Y_M - Y_F)_{Max}$ represents the maximum gender gap between males and females in average years of schooling; $(L_F - L_M)_{Min}$ represents the minimum gender gap in life expectancy.

It is necessary to point out that females living longer than males is a normal phenomenon; thus the gender gap existing between males and females in life expectancy is interpreted equality, and vice versa. Here, the minimum gender gap in life expectancy being used to divide the gender gap could maintain the same standard score of equality. By doing so, all the values are standardised from a score of zero to one with zero indicating complete gender equality, and one indicating gender inequality. The technique used could transfer both the negative and positive functional indicators into a consistent standard. A score of one represents an exacerbation of gender inequality and a score of zero represents an improvement of it.

7.5 Regression results

Table 7.4 shows the correlation within the four indicators of gender inequality in education and health dimensions in 1990 and 2005. The standardized values proved that in 1990 years of schooling and life expectancy correlates, and in 2005 illiteracy rate and average height of people aged 15 correlates.

Table 7.4 The correlation among four indicators of gender inequality (1990 and 2005)

o

u	Gender inequality	1990			2005		
r	in	YOS	HT	LE	YOS	HT	LE
c	YOS	---	0.194	-0.499**	---	-0.042	0.343
e	ILLR	0.134	-0.263	-0.098	0.225	-0.531**	0.177
	HT	0.194	---	-0.354	-0.042	---	-0.156
s	LE	-.499**	-0.354	---	0.343	-0.156	---

:

Sources: Data for 1990 are from the *China Census Statistics* in 1990 (NBS, 1993), and data for 2005 are from the *China Statistical Yearbook* 2006 (NBS, 2006), and are calculated by the author.

** Correlation is significant at the 0.01 level (2-tailed).

Notes:
1. YOS = Years of schooling of people aged six and above
2. ILLR = Illiteracy rate
3. HT = Average height of people aged 15
4. LE = Life expectancy

Table 7.5 shows the regression results of the relationship between gender inequality in HC and regional inequality in HC based on the model mentioned in the previous section. The four indicators of gender inequality are divided into two groups by matching one of educational indicators with another one of health. Considering the results of correlation above, a total of three groups are formed with both dependent variables in each year.

Table 7.5 Regression results of the relationship between gender inequality and regional inequality in 1990 and 2005

	M 1	M 2	M 3	M 4	M 5	M 6
Constant	-0.15	0.831 ***	-0.098	0.707 ***	0.316	0.683 ***
ILLR	0.046	-0.092	-	-0.021	-	-
	-	-	-	-	-	-
YOS	-	-	-0.059	-	-0.001	0.044
HT	0.946 ***	-	0.951 ***	-	0.4	- -
LE	-	-0.347 **	-	-0.187	-	-0.214
F	5.443	2.048	5.6	1.164	1.117	1.259
R2	0.295	0.136	0.301	0.082	0.079	0.088

Sources: Data for 1990 are from the *China Census Statistics* in 1990 (NBS, 1993), and data for 2005 are from the *China Statistical Yearbook* 2006 (NBS, 2006), and are calculated by the author.

Notes:
1. M = Model
2. ILLR = Illiteracy rate
3. YOS = Years of schooling of people aged six and above
4. HT = Average height of people aged 15
5. LE = Life expectancy
6. Significance * <10%, ** <5%, ***<1%

The regression results of Model 1 to Model 3 show that, in 1990, the regional inequality of human capital was significantly influenced by gender inequality in terms of average height and life expectancy. However, in 2005, none of those four indicators of gender inequality affects regional inequality because of the insignificant results from Model 4 to Model 6.

7.6 Discussion

When comparing the attributes of the four variables, the illiteracy rate and physical height could be considered to be the basic indicators of education and health status. In contrast, both the years of schooling and life expectancy variables could be treated as further indicators of quality of education and health status. At a basic level, females are averagely shorter in physical height but higher in illiteracy rate than males. At a further quality level, females have a longer life expectancy but less years of schooling

than males. As a result, the two variables at a basic level and another two at a further quality level correlate negatively.

The results of correlation could be described as a pyramid structure of gender equality. The top represents the gender equality status in 1990, and the bottom represents the status in 2005. It could be interpreted that in 1990, a time of relative gender inequality in education and health, most people of both genders seemed to have similar status at a basic level, but few have differences at a further quality level. However, 2005 was a time of absolute inequality in income across regions, which had a direct impact on people's affordability of education and health care by gender. In other words, most people's attention was more focused on the basic standard of gender equality in education and health, rather than at a further quality level.

Based on the results of regressions, only gender inequality in health significantly influences regional inequality in 1990. In other words, people of both genders may have similar poor education status but different health status across regions at that time. However, in 2005, the gender inequality in education and health does not have any impact on regional inequality. It could be interpreted that gender inequality in 2005 has been replaced by income inequality.

In 1987, the Three Step Development Strategy [16] set out China's overall economic construction objectives. Step one was to double the 1980 Gross National Product (GNP) and ensure that people had enough food and clothing, which was attained by 1990. It is easy to understand that, in a huge agricultural country, the first step of the development strategy focused on the health status, which was a fundamental requirement of nationwide agricultural foundation. Differences in health status directly influence regional agricultural productivity; more healthy farmers may contribute to the development of land production and subsequent local economic growth.

[16] Step Two: to quadruple the 1980 GNP by the end of the 20th century was achieved in 1995 ahead of schedule, Step Three: to increase per-capita GNP to the level of the medium-developed countries by the mid-21st century--at which point, the Chinese people will be fairly well-off and modernization will be basically realized (http://www.china.org.cn/english/features/38199.htm).

Furthermore, the central government started work on the elimination of illiteracy in 1990. Technology diffusion had not played a major role in economic development across regions at that stage, which meant that people did not have a strong awareness of how significantly education may contribute to regional productivity (Tamura, 1996). However, in 2005, regional inequality in income emerged as a severe impediment to China's development. Along with improvement in education and health statuses for both genders across regions, gender inequality to some extent was alleviated. Meanwhile, income inequality, rather than gender inequality became an outstanding issue across regions. Possible factors for this shift from gender inequality, especially in health in 1990, to income inequality in 2005 are analyzed from following three perspectives: the household and culture, the labour market and employment and also society and policies.

Parental affordability and educational background are key determinant factors to educational attainment of children, especially strongly for girls (Geeta, 1998; Monazza and Geeta, 2004). Within a household, traditionally, parents expect more benefits from investing in sons, who will take responsibility for looking after the whole family, particularly in their old age. Daughters, however, will join husbands' families as entirely independent households. Therefore, whilst parents treat sons' education as a beneficial necessity, that of girls is a luxury that needs to be carefully considered (Geeta, 1998; Monazza and Geeta, 2004). Moreover, the returns from girls' schooling may be lower than that of boys or it may take longer to materialise, on account of restrictions in working sectors, occupations, and even working hours for females.

As with the allocation of educational expenditure, Ahmad and Morduch found evidence of significant gender differences in mortality and health outcomes, which could be the result of different patterns of household expenditure governed by traditional concepts (Ahmad and Morduch, 2002). Although some increasing opportunities of education and healthcare have been offered for girls gradually over time, the differences in educational attainment, and other areas, such as investment in healthcare persist between girls and boys. For instance, Hu Angang and other scholars calculated that the healthy female population accounted for 86.72% of total female

population, the sick women accounted for 7.69%, and the disabled population accounted for 5.56%, while the corresponding proportion of men was 89.27%, 5.55% and 5.16% (http://www.china.com.cn/zhuanti2005).

Before economic reform and openness, the state-owned and collective economy had an absolute advantage in the structure of industries. The authority to employ a labour force was manipulated by specialised departments so that, both males and females, regardless of the human capital level, were equal in employment opportunities and reward management. After the reform, the state-owned and collective enterprises were reformed accordingly with more emphasis on autonomy. Some new resources were reconfigured and emerging industries became established. Market mechanism played a leading role in the labour market during the process of resources allocation, while government intervention gradually reduced. At the same time, awareness of the causality between human capital stock and productivity, as well as income and productivity rose.

Although the total employment rate has increased, the female share of employment is still small compared to that of males. For instance, in 2005, the adult female participation rate in the labour force was 49.9%, but 69.3% for males (UN data, 2005). The traditional aspect of Confucianism that discriminated against women diminished during the planned economy, when China was committed to gender equality in the labour market. The socialist equality ideology suppressed human capital characteristics and induced equal pay between males and females (Meng and Miller, 1995; Liu, Meng and Zhang, 2000; Shen and Deng, 2008). Economic reform has created another story: firms' have the autonomy to create their own reward systems, whilst decentralization and marketisation of the pay system allow managers to manage staff reward flexibly, according to firms' profitability and individual performance. In other words, this freedom provides room for gender discrimination (Hughes and Maurer-Fazio 2002; Knight and Song 2003; Ng 2004; Shen and Deng, 2008). Therefore, female employees treated with less human capital are more likely to be underpaid. Additionally, gender discrimination is much more serious in the urban rather than the rural areas, due to a deep-seated discriminatory culture existing in rural areas (Shen and Deng, 2008).

The increasing number of female employees over time indicates that opportunities for the participation of women in social labouring have been enhanced by the impact of a market economy. Female employees have been observed to make a substantial shift from the primary and secondary industries to the tertiary industry. For instance, the proportion of female employees working in tertiary industry reached 43.8% of the total employees in 2002, exceeding 40% which was a target in 2010 on <<the Outlines of Women's Development from 2001 to 2010>> (http://www.gov.cn/zwgk/2005-08/24/content_25813.htm). Other striking data is that, in 2005, the proportion of female employees employed in the health, social security and welfare sectors gained 59.1% maximally.

A similar picture could be found in vocational distribution based on the fifth census, in 2000, by gender. Both at the national and regional average levels, the proportion of "white-collar" female employees is less than that of male employees, but the number of "blue-collar" female employees is more than that of males. For instance, more women are working as secretaries, waitresses and administrators but less work as managers, technicians, engineers, etc. Although the average years of schooling of "white-collar" female employees is higher than that of male employees, the reverse applies to "blue-collar" employees. This reflects, to a certain extent, the fact that the educational requirements for "white-collar" female employees are higher than those of males. In other words, as long as female employees hold higher level educational degrees than males, they are more likely to gain "white-collar" jobs with better pay (Wang, 2006). Therefore, living cases can prove that it is not women who are advantaged in the entry threshold and high level of monopoly industries, but men.

As well as the different vocational distribution, gender income differs in the ownership of sectors. The state-owned sectors pay lower wages to female employees than the non-state owned sectors. However, the non-state owned sectors have higher level of marketization (Wang, 2006). It could be interpreted that marketization promotes human capital return but discourages income inequality (Stewart, 2000). According to the China Census Statistics, the human capital level of Chinese females is lower than that of males in terms of the income gap. A recent "Education Blue Report", published in 2009 by the Social Science Press, indicates that education is playing a prominent role in reducing the income gap between male and female

employees. This chapter further shows that the average pay gap gradually shrinks along with the development of education levels. According to data for 2005, the rates of female pay as a proportion of male pay is 68% for those up to junior secondary school level, 76% in senior secondary school level and 83% in higher education and above level.

The improved educational status for both genders, especially for girls, in China is very encouraging. The government policy of nine years of compulsory free education has ensured the educational rights, with the reduction of inequality by gender and by region as a long-term strategy. Some national projects, such as the "Hope Project"[17] and the "Spring Buds Project"[18] have been focusing on girls' improvement in education and health. The policy of higher education expansion implemented in 1999, has benefited most female students by facilitating access to higher education, which has also influenced expansion in lower schooling levels. For instance, there was further 5% increase of female students entering junior and senior secondary schools. There have also been effects on the labour market: today, in most developing regions, gender discrimination for employers is edited into organizational recruiting regulations.

Differences in income could also reflect another problem left behind by history of society and policy - gender difference in employment age. In the 1950, when both

[17] It is a non-governmental Project, sponsored by the Communist Youth League (CYL) Central Committee and the China Youth Development Foundation, to support young dropouts in poverty-stricken areas. The 1990s Development Program for Chinese Children promulgated by the State Council in March 1992 formally listed Project Hope as one of the main measures for ensuring the survival, protection and development of children. The short-term goal is to establish grant-in-aid programs in 328 poverty-stricken counties, with the long-term target centered on ensuring that all Chinese children enjoy the basic right to an education as advanced by the United Nations. (http://www.china.org.cn/english/features/poverty/95783.htm)

[18] In 1989, China Children and Teenagers' Fund under the leadership of All China Women's Federation launched the Spring Bud Project to raise money to assist the dropout girls in poor areas to go back to school. Also, this program is conducive to China's realization and solidification of the nine-year compulsory education and elimination of adult illiterates. Up to now, this program has been widespread all over the country, with 600 million RMB have been raised, 1.5 million dropout girl children have been assisted to go back to school, and over 300 Spring Bud Schools have been set up (http://www.womenofchina.cn/html/report/97981-1.htm).

genders had short life expectancy than today, the retirement age was set by the state at the ages of 55 for women and 60 for men. Although males are more advantaged than females in respect of physical characteristics such as height and weights, females have a higher life expectancy than males; better health can improve the quality of labour force and speed up economic development through higher productivity. Working life for males could reach 35 years, but 22 years for females, which may restrict women's contribution to society and underutilise females' human capital. Along with access to higher education and the improved life expectancy enjoyed by women nowadays, the Director of the Research Centre for Labour and Social Security, Chinese Academy of Social Science (CASS) Mr. Wang Yanzhong, has indicated that the retirement age should be increased gradually (Caixinnet, 2010).

Finally, in China, non registered female births in China are still a factor that has a direct impact on the gender gap. The traditional concept of gender makes all the "missing girls" be a matter of speculation (Sun, 2005). A 1995 household survey carried out in three provinces found a normal gender ratio in the under-14 age group, with the actual number of girls exceeding the number registered by 22%. Experts have acknowledged some disastrous social consequences of this gender imbalance, which is especially associated with the one child policy. For instance, with the shortage of women, unmarried men as "surplus males" may generate high levels of crime and social disorder in China (Husdon and den Boer, 2005). Nowadays, people can have more than one child so long as they can afford the huge amount of excess birth-fine. This phenomenon may to some extent, reflect the relationship between gender imbalance and regional economic development.

7.7 Conclusions

The lasting influence of traditional concepts of gender discrimination and of shifts in some relevant aspects of employment impacted by marketization still exists. As a result, gender inequality exists, which affects regional inequality to some extent. In 1990, a time of relative gender inequality, most people of both genders had a similar status in education and health; few people pursued a further level of equality in education and health. Along with economic growth and openness, in 2005, absolute regional inequality in income replaces the gender inequality of 1990.

Gender inequality is experienced mainly by women, so it has become a societal problem with negative effects on society, communities and, families as well as individuals. UNDP has emphasized this issue, and has focused on some areas to contribute to women's' empowerment[19]. For instance, the Beijing Platform for Action (PFA)[20], founded in 1995, aims to provide "an agenda for women's empowerment" as "a necessary and fundamental pre-requisite for equality, development and peace."

Some factors like government expenditure, improvement of welfare and the introduction of relevant policies have had a significant influence on the educational and health status. In particular, the implementation of equal access to education and health care, in addition to transparent recruitment procedures for both genders, will accumulate healthy human capital. This will encourage sustainable development and help to build a harmonious society.

[19] Women's empowerment has five components: women's sense of self-worth; their right to have and to determine choices; their right to have access to opportunities and resources; their right to have the power to control their own lives, both within and outside the home, and their ability to influence the direction of social change to create a more just social and economic order, nationally and internationally". Guidelines on Women's Empowerment". Document prepared by the Secretariat of the United Nations. Inter-agency task force on the implementation of the ICPD Programme of Action. http://www.un.org/popin/unfpa/taskforce/guide/iatfwemp.gdl.html

[20] The Beijing PFA provides a blue-print for women's empowerment that is exceptionally clear, straightforward and actionable. The document includes gender analysis of problems and opportunities in twelve critical areas of concern, and clear and specific standards for action to be implemented by governments, the United Nations (UN) system and civil society, including where appropriate by the private sector (http://www.undp.org/women/docs/Gender-Equality-Strategy-2008-2011.doc).

Chapter 8 Conclusion

8.1 Introduction

In this chapter I summarize what I have done, what I have learnt and where the research might lead. It firstly reviews the research questions in order to summarize the main findings are presented in the four main chapters of this research. Then the implications of the findings are presented. Moreover, the strengths and limitations in terms of the theoretical framework, data selection and practicalities, are discussed. Recommendations for future research are addressed at the end.

The key research questions are reviewed below. Based on the four kinds of influential relationship interpreted in the four main chapters of this research, a summary of the main findings are presented accordingly.

1) has regional inequality been alleviated or exacerbated in China from 1990 to 2005?
2) to what extent can those two dimensions help to identify and analyse key factors behind regional disparities?
3) what is the implication of uneven human capital development for gender inequality during the period?

8.2 Main findings

1) the relationship between health status and regional inequality

Over the past 15 years, the people of China have become better educated and live longer, reflecting improvements to schooling, nutrition and health. The regional locations, natural environment and living conditions, as well as people's income levels and various levels of schooling have influenced the health status from 1990 to 2005.

Those living in the Eastern region have seen a more rapid improvement in their standard of living and well-being than those in the less developed Central and Western regions. Disposable income is a significant influence on people's life expectancy irrespective of the region they are from. Health inequality in the Central

and Eastern regions is reflected by the income inequality along with the different stages of economic development. The Western region is represented not only by income inequality but also differences in the natural and ecological resources, which have an influential effect on the health status there.

Education plays a crucial role in the promotion of improved life expectancy. There have been some remarkable improvements in the reduction of regional inequality through the implementation of positive policies by central government. Furthermore, the influence of education levels on life expectancy decreases with increased years of schooling.

2) the relationship between educational status and regional inequality

Regional location and household incomes have a significant influence on educational status and their effects on schooling increase over time. In addition, educational conditions have a significant impact on educational status reflected by the average years of schooling. In the early period (1990-1998) students from the Western region are disadvantaged by a lack of educational resources, such as schools offering education at different levels and well-qualified teachers. In the later period (1999-2005), the exacerbation of income inequality replaces the regional inequality in education across China.

Some remarkable improvements in the reduction of regional inequality can be seen to stem from the central government's promotion of nine years of compulsory free education nationwide, and the increased higher education enrolment in the Western region.

3) the relationship between HE expansion and social justice

At the same time as more HEIs were established within the four regions in 1998 and 2006, the number of HE students and teachers were proportionately increased. However, the provinces fared relatively better than the Municipal cities; whilst the poorest provinces in the Western region did not benefit much from the redistribution of HE resources. The distribution of national key HEIs became more uneven across

the regions over the data period. In particular, a large share of the total number of national key universities, such as Beijing and Shanghai had a high localised HE recruitment. Furthermore, uneven resources distribution determined uneven funding distribution. Tuition fees, for individual students from low income families became a critical deterrent for access into HE.

HE expansion has great significance for those disadvantaged social classes/groups and regions. All families have been provided with more HE opportunities, but at the same time have to bear a large financial burden. The high tuition fees would add to parents' poverty especially as the threat of unemployment was high when their children graduate. Therefore, social justice deteriorated in terms of quality as result of HE funding reform. HE reforms over the last decade may have contributed to more economic inequality and social injustice, which has become big challenges for the government aiming to build a harmonious society.

4) the relationship between gender inequality and regional inequality

The lasting influence of lasting traditional concepts of gender discrimination, in combination with shifts in employment patterns through the establishment of a market economy has a direct effect on regional inequality.

In 1990 the regional inequality of human capital was significantly influenced by the gender inequality which can be measured by differences in average height and life expectancy. In 1990, a time of relative gender inequality, most people of both genders had a similar status in education and health; few people pursued further equality in education and health. However, in 2005, along with economic growth and greater openness, gender inequality in education and health is no longer an outstanding matter, although income inequality is.

8.3 Policy implications

Based upon the findings of this research, some policy implications are drawn as follows.

In 1990, a time of relative regional and gender inequality in education and health, most people had a similar educational and health status at a basic level of indicators (e.g. illiteracy rate and physical height), but different status at a further quality level of indicators (e.g. the average years of schooling and life expectancy). However the inequality in income across regions of 2005 directly affected the affordability of education and health care. If people's living standards are measured by substantial increases in personal disposable income and consumption, they will be profoundly affected by economic growth (Yao, Zhang and Feng, 2005). In fact, disposable income disparity has determined the differences in people's living conditions, educational and health status.

As China was a big agricultural country, the first step of its development strategy focused on the health status, which was a fundamental requirement of the agricultural foundations of the nation. Differences in health status directly influence regional agricultural productivity; more healthy farmers may contribute to the development of land production and local economic growth. Households from the Western region rely heavily on agricultural work, which provides them with an adequate income and a stable lifestyle that could promote investment in education and health care.

The welfare of poor people, especially in the rural area and indigent areas, declined in comparison with the welfare of rich people, especially those in big cities and the Eastern provinces. As the income disparity worsens, households, especially from the less-developed regions, find it is increasingly difficult to finance their children's education, particularly their university education (Huang, 2007). Tuition fees became a critical deterrent for students from low-income families seeking access to education, especially HE. As a result, HE reforms increased financial pressure for the disadvantaged groups and regions compared to the advantaged ones. For some low income families, paying tuition fees could reduce them to poverty, especially in cases where graduates could not find suitable employment after graduation.

Education and health expenditure is tied to the income standard of regions and provinces, thereby showing that regional differences are affected by the development and openness. Openness has rapidly expanded since the reform, whereas regional disparity has worsened (Cai, Wang and Du, 2005). China's openness provides an

opportunity for the Eastern region to benefit from FDI and capital flow (Cai, Wang and Du, 2005), because of its economic and geographic advantages, and also the preferential policies. To a certain extent, educational and health status have been affected by its provincial urbanization, which could be regarded as its openness and driven by migration from rural to urban areas. Compared with the Eastern region, people in the Western region are more disadvantaged: they not only need to face big gaps in income, but also a worse natural and ecological environment, lacking in educational and health care resources.

As local governments are responsible for investing in local schools and hospitals, rich provinces tend to produce better education and health results than poor provinces. Different resources constraints in provinces and regions impact on an individual's educational attainment and health especially in remote areas.

Initially, the inequalities in education were represented by the uneven distribution of schools in the early period of time 1990-1998. This may increase the difficulties for students to access the limited school resources, which may lead to intense competition. Over time, educational status in the Western region has become problematic as a result of the shortage of educational resources. In particular, the lack of post-primary school resources in the Western region may prevent students from continuing their schooling after graduation from the primary schools. In contrast, the East gained the greatest advantage in the number of institutions. For instance, the distribution of national key HEIs became more uneven across the regions. In particular, Beijing and Shanghai had a large share of the total number of national key universities, although they accounted for a small fraction of the country's population. Moreover, as national key universities had a strong bias in their recruitment policy, students from the eastern provinces had a much better chance of being accepted by those universities.

At the same time, although people in the Western region are also disadvantaged because of uneven distribution of health resources, such as hospitals and doctors, so that poor circumstances force them to fight for a better standard of living. In contrast, sick people from the Eastern region are likely to receive more convenient treatment with centralized health care resources and also advanced information of health care there. Furthermore, medical care specialists are often centralized in the Eastern region

or big cities of other regions, therefore, people who are seriously ill not only have to travel to the those places but also have to have sufficient money to seek out and pay for better medical treatment (Gao, 2006).

People with better education and health may be employed more easily than those with less education and poorer health. This is particularly true for manual workers. However, gender inequality has become a problem in labour market with negative effects on society, communities, families as well as individuals. Along with improvement in education and health status for both men and women across regions over time, gender inequality has been alleviated although it is experienced mainly by women. In 2005, income inequality across regions has become an outstanding issue instead of gender inequality. Furthermore, parental wealth and educational background are key determinant factors to the educational attainment of children, especially for girls. A tradition of Confucianism that discrimination against women makes parents regard girls' education as less of a beneficial necessity than that of sons (Geeta, 1998; Monazza and Geeta, 2004). Furthermore, the lower achievement from girls' schooling is reflected in the restrictions in working sectors, occupations, and even working hours for women.

Although increased opportunities in education and healthcare have been offered to girls gradually over time, differences in educational attainment, and investment in healthcare differ between girls and boys. In addition the increased number of female employees over time indicates that opportunities for the participation of females in the workplace have been enhanced by the introduction of a market economy. For instance, an increased number of female employees now work in the service industries. Although the overall employment rate has been increasing, the female share of employments is still small compared to males.

Policies such as the nine years of compulsory free education in 1986, and the expansion of higher education in 1999, created more equal opportunities for both genders and across regions access to education. In fact, more students from the Western region have been able to enter various levels of education and have benefited from those policies. On the other hand, the co-funding policy has tended to reduce

opportunities for access to education because of the inequalities between urban and rural households (Heckman, 2005).

In addition, increased financial support from local government is important. As Noss found in 1991, the Chinese government has focused more on education than on health care, resulting in a higher expenditure on education than on healthcare (Noss, 1991). In 2005, the Chinese National Human Development Report appealed for close attention to be paid to public health and basic medical care for the vulnerable population in under-developed areas in order to overcome the uneven investment in public health development (CNHDR, 2005). As a result, medical system reform and relevant policies of medical insurance have been paid great attention by central and local government recently.

8.4 Contributions and limitations

This research explores the human capital development in China from 1990 to 2005 with a comprehensive overview from a non-monetary perspective. Focusing on the three economic development regions, it analyses the relationship between the two main dimensions of human capital - health and education - with regional inequality. Then the correlation between higher levels of education and social justice is explored as part of the big picture of China's development from a vertical perspective. Moreover, the study investigates the impact of gender inequality on regional inequality as a horizontal development of the research. As a result, some direct effects and also hidden factors are discovered. The regional differences in natural resources, government investment, household situation, and distribution of resources, along with relevant policies and implications are analysed step by step.

Those findings allow an alternative method of assessing the consequences of uneven development in China from a perspective of a combination of economic and social development. Firstly, findings indicated different perspectives of regional inequality bring out different consequences. Taken from an economic viewpoint regional inequality may have been exacerbated, however, taken from a viewpoint of human capital development regional inequality may have been alleviated. Thus it indicates a positive sign in uneven development by region over the past fifteen years. Secondly,

causes of development are fairly diverse and different measurements may significantly vary outcomes. Openness, FDI contribute to the early stage of development, thus when the mechanism of marketization becomes mature human capital emerges. When humans are viewed as an important asset then their skills, knowledge and production capacity become more attractive to economy and wealth of the region, and of the country. Thirdly, uneven development is a spontaneous phenomenon underlying the development in China, which over varying lengths of time may have stimulated the economic growth in a positive way. Therefore, the concept that growth is uneven and that in certain regions preferential policies have been granted could be interpreted rationally.

Like any empirical research, this study also has limitations some of which could be addressed in future research.

Firstly, in terms of regional divisions only three economic development zones are studied, not other divisions. An alternative approach, taking into account China's geographic variation would be a seven-zone model, derived from the Skinner physiographic macro-region division of China (Skinner, 1964), and which can be compressed into three broad zones of North, Central-East and South China. This division may be better reflect the climatic-geographical constraints that have had long influence on agriculture, have provided the foundation of past economic growth, the spatial distribution of cities and also the complicated elements of health development.

The second limitation is the availability of data collection and indicators' selection, so that the regression results may exhibit different degrees of significant or insignificance. I have acknowledged that certain data used in the study has limitations due to the lack of accurate data for the successive years from 1990 to 2005. Although I have calculated some missing data myself, it may have slight differences. For instance, I looked at only three key factors for estimating life expectancy in the missing years, namely the living conditions in the floor space of completed residential completed buildings, the total energy consumption and the total number of sick beds per 10,000 persons. Other health care factors such as genetic factors, health risks, accident risks, have been neglected.

Another limitation concerns the definition of human capital: this research focuses on only two main dimensions, with the dimension of on-job-training in the labour market remaining a field that has not been considered. In addition to the shortage of accurate data, human capital accumulation is often treated as a stable rather than variational estimation, resulting in the human capital flow being neglected. Other limitations of measurement still exist, such as that of regional inequality, which can be exacerbated by the interregional flow of human capital. This situation may arise if, for instance, people from rural areas and less developed regions move and settle in the urban and developing regions. This aspect is not considered in the study.

The third limitation relates to the question design and analysis from a comprehensive angle. Research questions were asked from a macro level, according to different indicators selected and the equations used. Further questions could be raised and considered, which could include the quality of education and healthcare as well as the quantity.

The fourth limitation concerns the methodology used: if secondary data analysis could be accompanied by the questionnaire and interview support, more hidden stories may be discovered. Sometimes, data only provides some answers, especially the socioeconomic issues associated with economic, political, social even cultural factors.

8.5 Future research

According to the limitations discussed above, further studies could adopt the following perspectives.

As Yin (1994, P.45) has stated, the comparative study is “often considered more compelling, and the overall study more robust”. Another regional division (physiographic macro-region division) could be used to compare and investigate whether those divisions are reasonably employed for analysing human capital development, although the genetic element is hardly taken into account. Furthermore, the indicators’ estimation and data adjustment need to be reattempted before proceeding to field work, which should be easily and accurately measured. The

exploration of the field work should be well prepared and associated with realistic possibilities in order to discover new facts and fulfil the research aims more fully.

Based on the findings of this study, further investigation also could be conducted at a deeper level. It is difficult to calculate the stage at which HC development reacts to regional income inequality, and also what level of investment best meets the needs of economic growth. Therefore, it is strategically important to consider whether the skill level of the population is sufficient, and what kind of education, training or learning activities are needed. On-job-training could be added as another main dimension of human capital development. Consequently the importance of human capital flow in transitional China could experience a deeply profound consequence in the current situation, resulting in human capital accumulation being centralized in the more developed areas. This could also bring about a realistic result in the process of China's industrialization.

The private gains in education or training, and also in health status may be researched from their cost-sharing with public authorities. Whether student loans and medical insurance could benefit disadvantaged people would be a possible approach to the study of the issue of resource redistribution. More interestingly, follow-up research could look at the ways in which graduates enter the labour market and how employees contribute to the investment-return measurement. Some scholars have pointed out the problem of unemployment of the educated or over-education during educational expansion in a depressed economy (Dore, 1976). It would also provide a meaningful research topic to gain a better understanding national sustainable development and personal human capital accumulation.

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