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Research in Progress 21

INVESTMENT IN EDUCATION
AND INCOME INEQUALITY

Juha Honkkila

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UNU World Institute for
Development Economics Research
(UNU/WIDER)

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This study has been prepared within the UNU/WIDER research project on Rising Income Inequality and Poverty Reduction: Are They Compatible?, which is directed by Professor Giovanni Andrea Cornia.

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ABSTRACT

Income inequality has risen in many parts of the world during the past decades. Rising inequality is no longer a problem of only Latin American and Sub-Saharan African countries. Some OECD countries, and recently also East Asian countries, have experienced widening income differentials. In the 1990s the problem has also become visible in the countries of the former socialist bloc during their transition period towards market economy. Rising income inequality has led to a significant rise in the number of poor people, which makes the issue even more critical.

The unfavourable developments of the income distribution can, to a large extent, be blamed on the unequal acquirement of human capital investment. This paper analyses a data set of fifty countries and recognises the influence of educational attainment on inequality. Given the differences in the distribution of physical capital, it can be observed that countries that do not provide sufficient education at the primary level, have more problems in creating an egalitarian society. Especially in developing countries this means that poverty is strongly correlated with unequal supply of education. In developed countries the recent rise in earnings differentials has been a consequence of rising returns to education. This paper examines the impact of post-primary education in general, which is probably not a sufficient indicator of the supply shortages of education. The rise in wage inequality seems to be a problem in certain technical branches and its impact could be better analysed with more specific data on secondary and tertiary education in several areas.

I INTRODUCTION

The rise in income inequality and poverty is one of the most serious problems the world economy is currently facing. After a period of declining inequality the income distribution has deteriorated in a number of countries during the past 10-15 years. The issue that was kept off the agenda for some time has aroused new attention lately. Inequality is rising not only in developing countries with a history of high inequality, but also in some OECD-countries. The problem has been recognised lately even in some of the East Asian countries formerly famous for achieving fast growth with equity.

Poverty rates have been falling in the developed world and in most Asian countries for several decades, but the aggregate situation is not that favourable. The share of poor people is rising again in Latin America, sub-Saharan Africa and in most of the former socialist countries. Although relative poverty is declining in some Asian countries, absolute poverty is increasing because of the fast population growth. Overall, between 1987 and 1993 the number of poor people in developing countries increased by 100 million in spite of a slight decline in the poverty rate (UNDP, 1997: 33).

Several economic theories starting from Kuznets (1955) consider rising inequality as an inevitable feature of growth at a certain stage of economic development. Industrialization widens the income gap between the rural and urban population and increases overall inequality because the share of the less egalitarian urban population rises. This famous 'Kuznets curve' was used to explain the increase in inequality in Western Europe shortly after World War II, and in some developing economies at the start of their industrialization and growth period.

It has however become evident that the current rise in inequality cannot be explained by the Kuznets theorem. Already a brief look at the income statistics reveals that the countries that have experienced a rise in income inequality in the 1990s are at various levels of development (see section two). On the other hand, there is evidence of growth and development with no increase in inequality from other countries. In addition, the industrialized countries have reached a level of development and technology that could not be analysed by Kuznets or any other economists 40 years ago. It is hard to find any evidence from recent periods to prove a relationship between growth and inequality as indicated by the Kuznets' inverted U-curve.

One of the factors that has been suggested to explain the differences in income inequality in the current stage of world development has been the lagged effect of education and the long-term consequences that unequal access to human capital accumulation will have for the income distribution over the medium-term. This explanation can be applied both to the developing countries where basic education is still not guaranteed for the whole population, and to the industrialized countries where rapidly changing labour markets increase the demand for skilled workers and the returns to human capital in some knowledge-based sectors.

The supply of all levels of education has risen all over the world since World War II (see section three), and the argument is not that an increase in the attainment of human capital itself explains the increase in inequality. On the contrary, the provision of education for a

larger share of the population should lead to a more egalitarian distribution of human capital and hence to a more egalitarian income distribution. The point is that not only the supply of but also the demand for education has risen in the past ten to twenty years and different countries have been able to prepare and to respond to these changes in a different way. In those countries that have provided education for a larger share of the population there is no big contrast between the demand and supply for skilled workers and the wage difference between skilled and unskilled labour is smaller than in countries that have a surplus demand for skilled workers.

The two-way interaction between inequality and lack of educational attainment worsens the problem. Not only does unequal access to schooling increase inequality, as argued before, but an increase in inequality and the number of poor influences negatively the accumulation of human capital (Cornia and Addison, 1997: 5). When inequality is high, the share of people who are able to invest in schooling decreases. At the same time, governments have fewer possibilities to finance public education if they have to spend an increasing share of their expenditure to social security. The main issue in this study, though, is to analyse the effects of unequal access to education on income inequality and not vice versa. Still, it is important to recognise that inequality has influence on education, which can develop into a vicious circle with serious effects on poverty and growth in an economy.

Why is income inequality considered a serious problem in the world economy? How harmful is inequality for growth and for poverty reduction? A rise in inequality per se is not necessarily harmful. If a change in income distribution leads to increased earnings and therewith to better incentives for the higher income deciles in the sectors that are responsible for the economic growth, but leaves the poorest income deciles unaffected or even better off because of an increase in aggregate earnings, the rise in inequality can be beneficial—at least over the short-term.

If, however, rising inequality means a shift of income from the poorest income deciles to the richest, the causes can be destructive from the point of view of poverty alleviation and growth. Empirically income inequality has been shown to be a significant cause for poverty increase. A decomposition of changes in poverty into its determinants (changes in aggregate income and changes in income inequality) indicates this relationship. This has been demonstrated both for less developed countries (Cornia and Addison, 1997) and for transitional economies (UNICEF, 1995).

Even if an increase in inequality occurs simultaneously with fast economic growth and does not leave any individual worse off, there are strong reasons to believe that rising inequality can be harmful for the economy. Recent literature on endogenous growth claims that income inequality is a growth-detering factor. This hypothesis, based on the political economy mechanism linking income distribution with growth, has been demonstrated by Alesina and Perotti (1994, 1996) and Persson and Tabellini (1994). Even more critical is the view of Nafziger and Auvinen (1997: 28, 41), who claim that income inequality is a significant cause for humanitarian emergencies.

Skewed income distribution reduces the incentives to invest and increases growth-depressing political behaviour of the poorest part of the population. Furthermore, it reduces the possibilities to accumulate human capital and in extreme cases even cuts down labour productivity. Therefore income inequality must be addressed as a problem and various governments should be encouraged to keep income distribution within certain levels.

This paper discusses the changes in the distribution of income and earnings and the long-term effects of education at the macro-level. The short and medium-term changes in the labour markets and international competition from the past 10-15 years give reason to now raise this issue once more. The other reason to study the relationship between education and inequality, that has not really been questioned by social scientists, is a more up-to-date dataset on the distribution of gross income and on educational attainment, which should provide more accurate results.

Before analysing the relationship, we will give evidence, in chapter two, for the argument that income inequality has been rising in most parts of the world. The third section provides an empirical international comparison of changes in human capital accumulation. The theoretical analysis is introduced in section four, which examines the significance of human capital accumulation in the earnings distribution function by reviewing the literature on that issue. In section five we describe the data and data sources used for the empirical testing. After that, we construct a regression model testing the significance of all levels of education on earnings inequality, taking the development and the structure of the economy and the distribution of physical assets as control variables, in section seven. We carry out and interpret the empirical analysis both mathematically and graphically. Finally, the most important theories, results and conclusions are reviewed in section seven.

II RECENT DEVELOPMENTS IN INCOME INEQUALITY

The changes in income distribution since the 1970s have been quite diverse in different regions and even in different countries within the same regions. The increase in income inequality has occurred in both developing and industrialized countries. It has not been a characteristic of only a certain phase of economic development or a certain geographic region.

The regions most severely suffering from that problem are sub-Saharan Africa, Latin America, and most distinctly the former socialist economies in Central and Eastern Europe and in East Asia. There are several reasons to assume that a significant rise in inequality will take place in countries going through an economic transition from plan to market (Cornia 1996, Milanovic 1996). One of the most significant explanations is the increase in the returns to education and skilled labour that has occurred after the deregulation of wage policies. Although the direction of the inequality development in transitional economies has been as expected, the increase in poverty and inequality in several of these countries has been much larger than expected.

Latin America and sub-Saharan Africa are regions with a tradition of high income and asset concentration. In these regions a rise in inequality from already high levels has had serious effects to poverty rates. Also in these regions, most substantially in sub-Saharan Africa, the significance of providing equal opportunities for educational attainment should be emphasized. The reduction of poverty rates over the long-term is not possible if the bulk of the population does not have access to vocational or even to basic education.

The East Asian miracle of high growth rates and equality was widely honoured in the past. However, as recognised by the recent World Bank report (Zirnite 1997), the situation is

beginning to turn around. Some of the countries formerly categorised as 'East Asian miracles'

FIGURE 2.1
TRENDS IN INCOME INEQUALITY—AUSTRALIA, LATIN AND NORTH AMERICA,
AFRICA AND MIDDLE EAST†

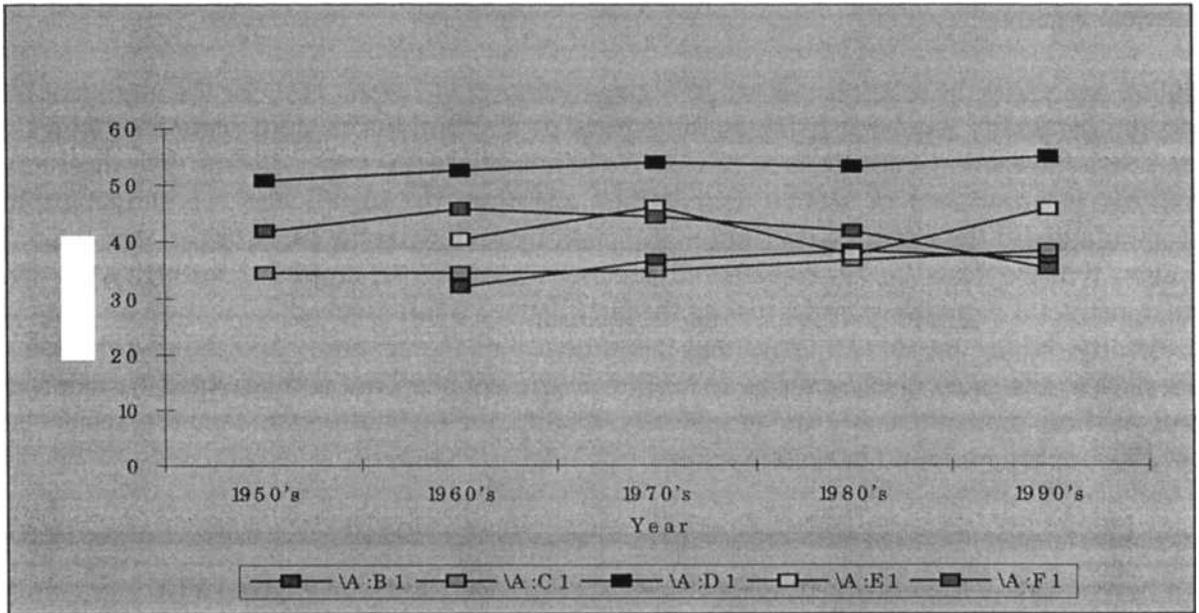
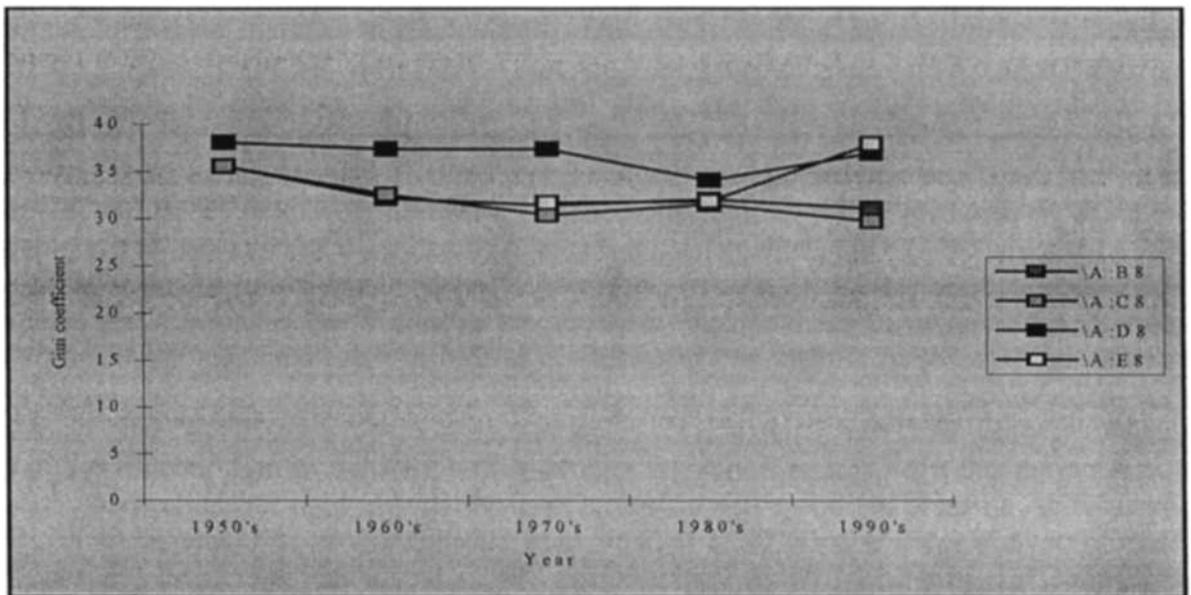


FIGURE 2.2
TRENDS IN INCOME INEQUALITY—SOUTH AND EAST ASIA†



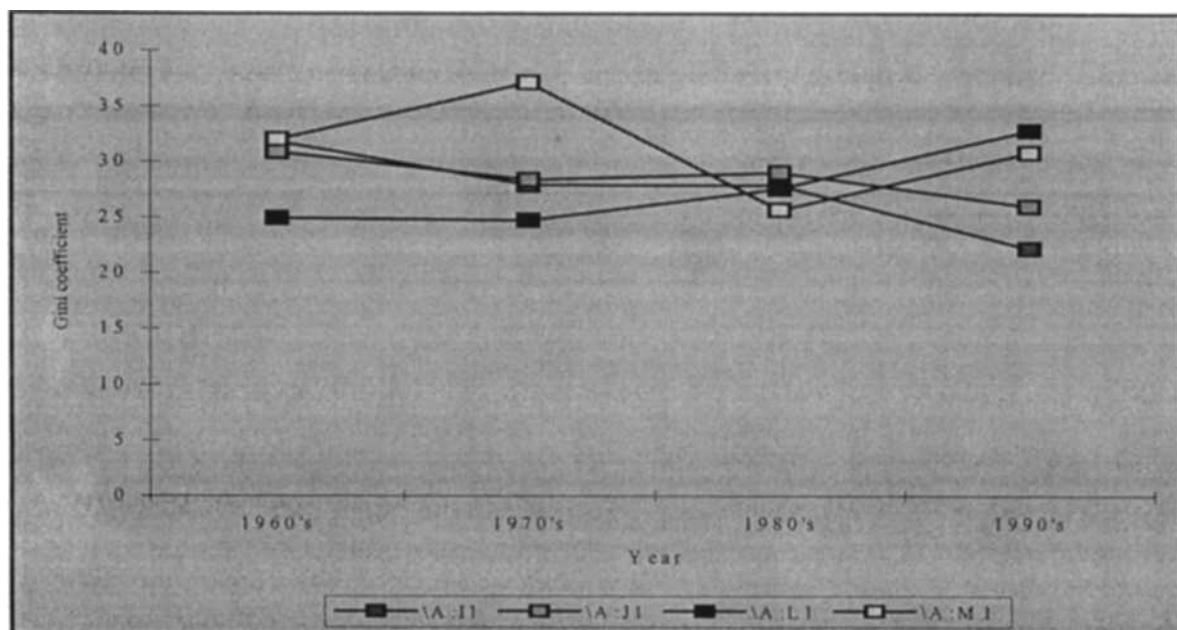
Sources for figures 2.1—2.4: Atkinson 1995, Bulmer-Thomas 1996, Deininger and Squire 1996, Dowling and Soo 1983, Ikemoto 1991, Zhang Ping 1997.

Note: † Weighted averages

(particularly Thailand, Philippines and Hong Kong) have experienced a rise in inequality. In other countries in the same area (South Korea, Taiwan, Japan) inequality has though stayed at a modest level. The extensive economic crisis in 1998 has most probably widened the income gaps even in the most successful East Asian economies. In South Asia and North Africa inequality seems to have stayed at the same, reasonably modest, level for quite a long period.

The evidence from OECD countries is mixed. In countries like UK, USA and Spain inequality has risen to an alarmingly high level, while Scandinavian countries, have been able to maintain a welfare state with modest net income inequality. The variances in income inequality between the industrialized countries are at least to some extent due to different government transfer policies. The distribution of earnings seems to be on the rise even in the most egalitarian OECD countries (OECD 1995). The fact that the rise in income inequality is due to rising earnings differentials supports the argument that educational attainment and rising returns to education are probable causes for increasing inequality and that this relationship should be examined in detail.

FIGURE 2.3
TRENDS IN INCOME INEQUALITY—WESTERN EUROPE



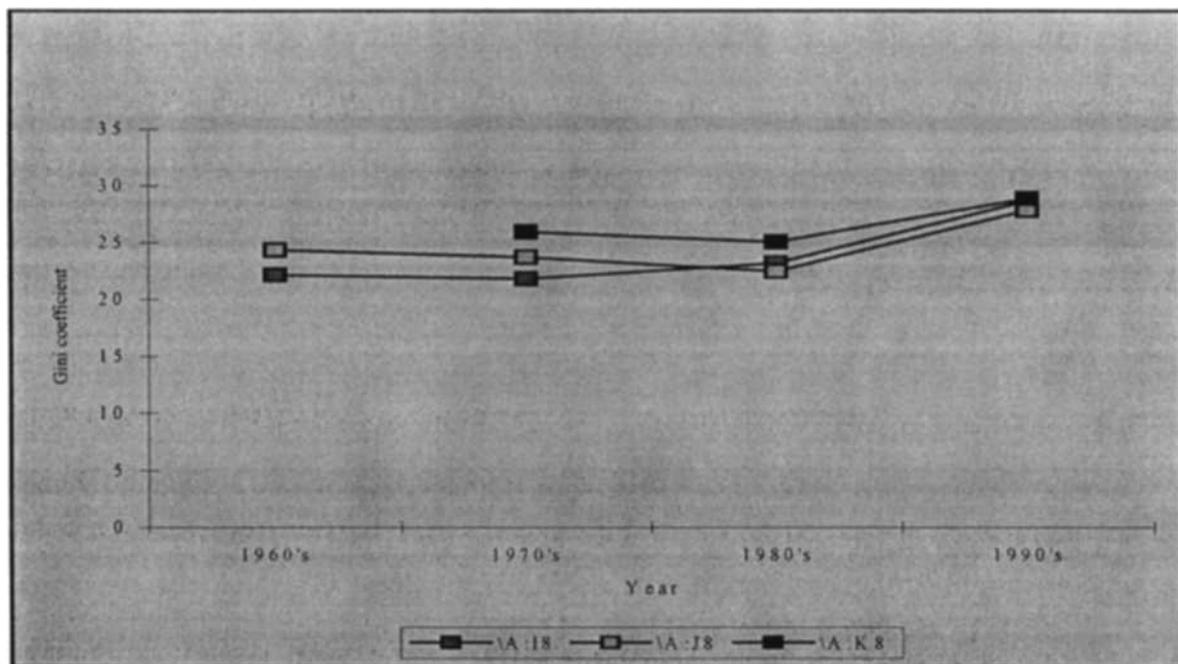
Figures 2.1 -2.4 demonstrate the development of inequality in different regions and different countries. The indicator we will use to measure income inequality in this section is the Gini ratio of net income¹. Figure 2.1 shows the averages (weighted by the population in 1995) for different decades for five regions in Australia, America, Africa and Middle East. In sub-Saharan Africa, and Latin America the trend is almost identical. After an improvement in the 1980s—a slight one only in Latin America, but a quite significant one in sub-Saharan Africa—inequality has risen again during the past decade. In North America rising inequality has been a problem already since the 1980s. In Australia, North Africa and Middle East an

¹ We use net (post-tax) income as a measure of income to demonstrate that inequality is rising. To analyze the effects of educational attainment, we will measure income with gross earnings in the later sections.

opposite trend can be discovered. The income distribution is showing slight improvements in the 1990s.

Figure 2.2 shows the situation in South and East Asia. The two lines showing averages for the regions (South and East Asia separately) are averages weighted by the population size. The two most populated countries, China and India, are separated because of the disturbingly strong effect those two countries would have on the weighted averages of the region. East Asia, on average, is experiencing a trend similar to Latin America. Inequality is rising sharply, especially in China. However, a more detailed look at different countries shows that the aggregate numbers do not tell the whole story. While in sub-Saharan Africa and Latin America rising inequality is more or less a general issue, the differences between various countries are bigger in East Asia. In all South Asian countries (Bangladesh, India, Nepal, Pakistan, Sri Lanka) inequality has, somewhat surprisingly, remained at a relatively tolerable level for around 30 years.

FIGURE 2.4
TRENDS IN INCOME INEQUALITY: CENTRAL AND EASTERN EUROPE



Sources for figures 2.1—2.4: Atkinson 1995, Bulmer-Thomas 1996, Deininger and Squire 1996, Dowling and Soo 1983, Ikemoto 1991, Zhang Ping 1997.

In Western Europe various trends are observable. Figure 2.3. demonstrates this with the examples from four different countries. In Finland and Germany inequality is falling, but in Spain and UK inequality is rising from the rather modest levels of the 1980s.

Finally, in the Central and Eastern European transitional economies the trend is very clear. Inequality is rising sharply in the 1990s from the low levels of the socialist era. Figure 2.4 shows the trend in three countries that have remained the same independent states since World War II. Although harder to measure reliably, the rise inequality and poverty has been estimated to be even faster in some new independent states of the former Soviet Union.

According to Milanovic (1996: 57-8), the Gini coefficient of Russia rose from 24 to 48 during the first five transition years.

III THE INCREASE IN EDUCATIONAL ATTAINMENT: AN INTERNATIONAL COMPARISON

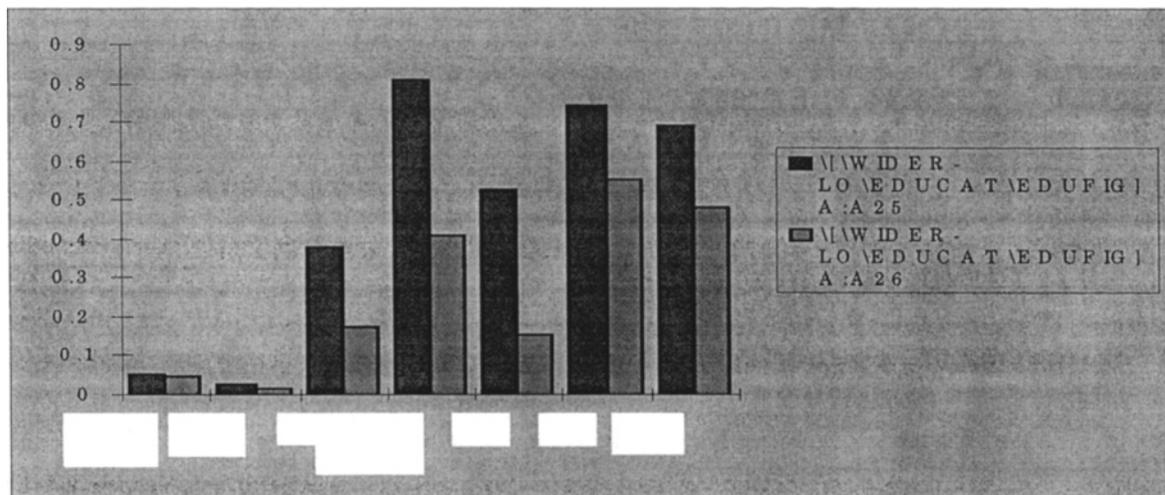
The changes in the supply of education—and therewith in the supply of skilled workers—can be measured with the enrolment rates from the previous periods, or with the rates of educational attainment or average years of schooling obtained by the adult population. All of these variables have indicated a strong increase in the accumulation of human capital in the past three decades (see Barro and Lee 1996; UNDP 1997). The increase has occurred globally and it has concerned all levels of education.

More and more people have got the possibility to obtain basic education. The share of adult population (15 years or older) with no educational attainment has decreased in every region in the world. In 1960 out of a sample of 126, more than half of the adult population was without any attainment of schooling in 46 countries, but only in 24 countries thirty years later (see figure 3.1). Also the level of secondary and higher education has been rising significantly everywhere (figure 3.2). These increases have not only occurred in the aggregate rates of different regions but also individually in almost every country. There are only a few exceptions from that rule in sub-Saharan Africa, Latin America and in the transitional economies. Average years of schooling have more than doubled in the developing economies (figure 3.3, Barro and Lee 1996).

Although the rise in educational attainment has been universal it has not been equal. While some developing countries and regions have achieved incredible success in increasing the quantity of schooling, others are still struggling in that respect. The OECD countries and the former centrally planned economies had high rates of educational attainment and were providing basic education for practically every citizen already in the 1960s, so the recent increases in the supply of education have naturally not been as large as in some developing countries. The difference between the developed and the developing world is, though, still apparent. The regional averages presented in figures 3.1-3.3 do not tell the whole story for each individual country, but some trends are clearly observable.

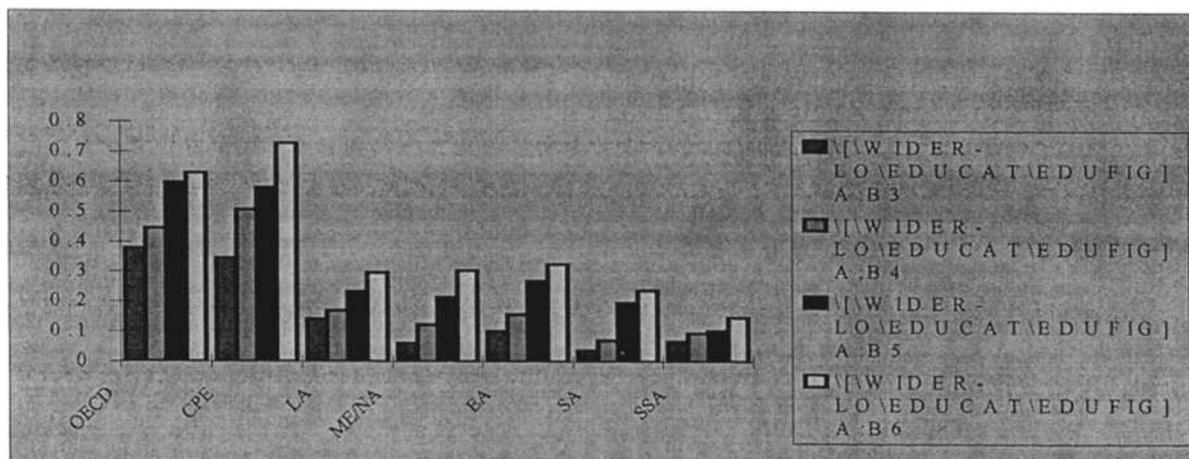
Even basic education can still not be provided sufficiently in many parts of the world. In 1990 every second adult was without any educational attainment both in South Asia and sub-Saharan Africa. Most of the individual countries that lie over the 50 per cent line in the share of non-educated adults are located in sub-Saharan Africa. Also in the big South Asian countries, India, Pakistan and Bangladesh the share of adults with no schooling is very high, 56 per cent, 52 per cent and 60 per cent respectively. On the other hand, the share of population with no schooling in the Middle East (including North Africa), Latin America and East Asia has fallen exceptionally since 1960 (from 81 to 41 %, from 38 to 20 per cent and from 53 to 15 per cent respectively).

FIGURE 3.1
THE SHARE OF POPULATION WITH NO EDUCATIONAL ATTAINMENT BY
REGIONS, 1960 AND 1990



Source: Barro and Lee (1996). Abbreviations: OECD: OECD member countries, CPE: (former) centrally planned economies, LA: Latin America, ME/NA: Middle East and North Africa, EA: East Asia, SA: South Asia, SSA: sub-Saharan Africa.

FIGURE 3.2
THE SHARE OF POPULATION WITH SECONDARY OR HIGHER EDUCATION BY
REGION, 1960 TO 1990



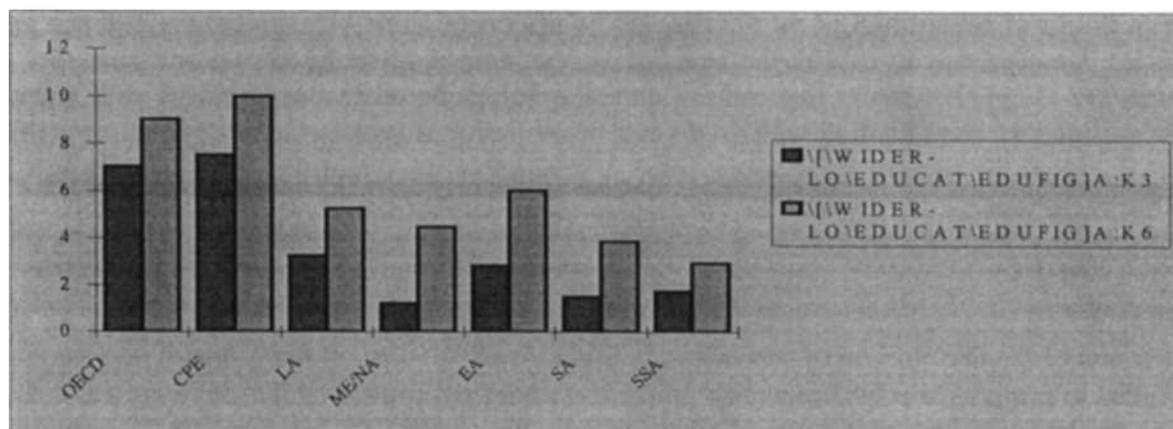
Source and abbreviations: see figure 3.1.

Also the supply in the level of secondary and higher education has risen remarkably in both East Asia and Middle East. Almost one third of the adult population in these regions had attained at least some secondary or tertiary education in 1990. The increase in the supply of

secondary education has been even larger in the South Asian countries. Most remarkably so in the late 1970s when for example the secondary education attainment rate more than doubled in both India and Pakistan. The South Asian trend is an interesting one; the share of non-educated is not falling very fast, but the average level of education for those who can obtain schooling is rising rapidly.

The situation in Latin America has been quite different from South Asia. The combined secondary and tertiary schooling attainment rates have scarcely doubled in the past three decades, which is a meagre achievement compared to the sixfold increase in South Asia. Still, in Latin America the share of non-educated is much lower than in South Asia and falling more rapidly. In sub-Saharan Africa the education attainment rates are increasing slowly at all levels.

FIGURE 3.3
MEAN SCHOOLING YEARS FOR POPULATION OVER 15 YEARS BY REGION, 1960 AND 1990



Source and abbreviations: see figure 3.1.

From the distributional point of view the conclusions from the educational attainment figures need to be specified from two aspects. First of all, the latest observations are from 1990. In most cases those values can be implied to describe the current situation without a large bias. There is of course one exception, the transitional economies, where major political and economic changes have been taking place since the turn of the decade and most sociopolitical and economic variables have changed remarkably. The education sector is only one of the many that was affected by the collapse of central planning. In Eastern Central Europe the consequences of transition towards the enrolment rates have not been very dramatic, but in Bulgaria and in most new independent states of the former Soviet Union a huge decline, especially secondary enrolment rates, has occurred (UNICEF/ICDC 1995: 147; EBRD 1997: 42). Therefore the educational attainment figures from the Barro-Lee dataset should be interpreted with care in the case of transitional economies.

The second bias that arises by looking solely at the rates of educational attainment is the gender problem in many countries of Middle East and South Asia. Education is still not provided equally for both sexes. The gender ratios for combined secondary and tertiary educational attainment are around 1 in the OECD and in most Latin American and East Asian

countries, but around 0.6 in the Middle East and North Africa and less than 0.5 in every South Asian country except for Sri Lanka (Barro and Lee 1996).

IV INVESTMENT IN HUMAN CAPITAL AND EARNINGS INEQUALITY

The accumulation of human capital is one of the most important determinants of individual earnings. The value of a person's human capital is partly dependent on some personal characteristics, like health and what has been described as abilities, but the most significant way, in which it can be increased is education. The relationship between years of schooling in period t and earnings in period $t + n$ at the micro-level has been analysed in numerous studies (see Becker 1964; Mincer 1974).

A common way to measure the relationship between years of education and income is a personal earnings function. Marin and Psacharopoulos (1976) determine earnings as a function of education, where earnings of a person are dependent on the years of education, the rate of return of schooling and on the sum of the effects of some other variables like age and abilities. Another way to exhibit the benefits of education is given by the schooling model of Mincer (1974: 11) He shows that ratio of annual earnings between an individual with s years of schooling and an individual with $s-d$ years of schooling is greater than unity, which means that the bigger the number of years invested in education, the better the expected earnings in the future periods.

Mincer draws the conclusion that the skewness of income distribution is dependent on the dispersion of the distribution of schooling. In other words, a more unequal access to education will lead to greater earnings inequality. In addition Mincer argues that the earnings inequality is positively dependent on the rate of return to schooling (*ibid.*, 24-25). The latter assumption is also important for this paper since it has been argued that the rate of return to education in many sectors is increasing.

These kind of long-term relationships which show that educational expansion decreases inequality have been empirically tested by several economists. For example Chiswick and Mincer (1972) show that in the United States a rise in the average number and a fall in the variance of schooling years contributed to the fall in income inequality in the years following the Second World War. Ahluwalia (1976: 130-1) exhibits in his cross-country macro analysis that the decrease in the illiteracy rate has had a positive effect on the income of the lowest two quintiles in developing countries while increases in enrolment rates improved the relative position of the middle income classes. Therefore even in the early stages of development education is an important determinant not only of growth but also of equity.

If the causality from rising enrolment rates to lower inequality would be as simple as described by the human capital theory, the rise in educational attainment described in the previous section would have led to similar effects in the past few decades as it did in the United States after World War II according to Chiswick's and Mincer's study. More equal and comprehensive access to education should have reduced inequality. However, in many parts of the world increased access to education has recently been followed by completely opposite changes in inequality than expected. Still, the statement that education does matter to

inequality should not be completely rejected without analysing the causality in detail. Other variables than educational attainment may be the cause of the observed increase in inequality.

Birsdall, Ross and Sabot (1995: 491) explain the relationship between education and inequality as the result of the compression effect and the composition effect. Educational expansion increases the number of workers with high earnings (composition effect), which is rather an inequality-increasing than -decreasing factor. However, since the relative abundance of skilled workers increases (compression effect) scarcity rents for educated workers diminish, their relative wages decrease and hence inequality falls. The interaction of the composition and compression effects was demonstrated in a comparison between South Korea and Brazil. In South Korea the effects of an increase in educational attainment have been as presumed: a rapid increase in enrolment rates and the provision of education to all segments of the population can lead to a situation where the compression effect offsets the composition effect and inequality decreases. In Brazil the increase in enrolment rates was slow and returns to skilled labour have risen for the still relatively small share of population possessing these skills. The result has been an increase in the relative earnings of the high income classes which has had a negative effect on inequality.

Another even more decisive argument, that explains why rising educational attainment has not led to falling inequality is, that one should not consider the supply side of the labour markets only. In spite of the increase in the abundance of skilled workers, there has been an upward pressure for the relative wages of skilled workers. The reason may be simple: a rise in the demand for skilled labour which has been stronger than the rise in the supply of educated workers, has led to an increase in the returns to skills and education. These changes have counteracted to the compression effect. The scarcity rents of people with higher levels of educational attainment have not been eroded.

According to Topel (1997) the recent change in the wage structure, that has benefitted the higher income classes, has been demand-driven. The demand for skilled workers has increased faster than its supply. For example in the United States the trend from the 1970s when the growth in the supply of educated labour exceeded the growth in its demand was reversed in the 1980s. Since the demand growth will presumably continue, the only way to overcome the following rise in earnings inequality is to increase the supply of educated workers. Calculations by Johnson (1997) support these conclusions. The relative wages of skilled workers (college graduates) to less skilled workers (high school graduates) declined in the seventies, but have risen in the past two decades.

Gottschalk and Joyce (1993: 21-22) show that the returns to education generally are rising and the gap between returns to education in different sectors is increasing in most developed countries. Technological progress has increased the relative productivity and wages of skilled workers in western countries. Simultaneously, international competition and increasing imports from developing economies with low labour costs decrease the demand and wages for low-skilled workers. In addition, if education in the area of modern technology is not provided sufficiently or only provided at very high costs, unemployment will increase. Those with no vocational education, or with education that qualifies them to work in branches where human capital is being replaced by technology or branches that are struggling because of the pressure from international competition, will not only suffer from wage decreases but also have a bigger risk to become unemployed. That will cause a further rise in earnings inequality and also in income inequality, if necessary compensations are not supplied. Some other

factors like the increase in the participation rate of women or, less significantly, immigration, increase the supply of low-skilled labour (Topel 1997).

The rise in inequality due to increasing demand for skilled labour is not only a problem of the high-income countries. Some middle-income countries, particularly in East Asia, are experiencing a rapid export-oriented technological progress, while a large part of the population is simultaneously working in the labour-intensive sector and has no access to higher education. It is, however, not that simple to imply the theory of rising returns to post-primary education to every developing country. Most countries still have a production structure based on agriculture and other sectors that require less skilled labour. O'Neill (1995) points out that in spite of a bigger increase in secondary enrolment rates in developing countries the income gap between the rich and the poor countries has not been reduced, because the rise in the returns to secondary education has been faster in the developed countries.

So can it be argued that the sharp rise in the returns to education due to technological change is chiefly a feature of the developed countries? Maybe that argument is exaggerating, but there is certainly some truth in it. All developing countries have not been able to shift their production structure in a way that would cause a huge increase in the share of the high technology branches currently experiencing large upward demand shifts and rising returns to skills. The significance of rising returns to post-primary education as an explanatory factor in the increasing income inequality is presumably much lower in the least developed countries.

The accumulation of human capital in general has been shown to have a strong effect on the income distribution in the less developed middle- and low-income countries. Research by Psacharopoulos *et al.* (1995) on Latin America emphasizes the significance of differences in educational attainment in the increase in income inequality in the 1980s, which was a period of recession and difficult macroeconomic adjustment—factors that *ceteris paribus* increase inequality. Consequently, in spite of increasing enrolment rates, Gini coefficients rose in most Latin American countries in the 1980s. Of the variables explaining individual earnings education was proved to be clearly the most significant one, more significant than for example age or the economic sector one is working in.

In some of the world's poorest countries governments are still struggling to provide basic educational needs for the bulk of the population. The situation is extremely bad in a number of countries in sub-Saharan Africa. Illiteracy rates are high and not falling with sufficient speed. Possibilities for schooling are everything but equal for all individuals. Child labour is commonly used and necessary for the survival of many families, thus reducing the schooling prospects of many children. Similar problems of poverty and lack of schooling can be seen in some South Asian countries. The main issue causing an increase in inequality in these countries is the increase in the number of poor, uneducated people. Therefore the policy implications are also slightly different. The first priority in these countries should be set on the expansion of primary education.

The transitional economies of Central and Eastern Europe and East Asia are a very special case. In the socialist economy education had a high priority. Enrolment rates were high, illiteracy was practically non-existent, and because of full employment, vocational training was provided for practically every citizen. Income distribution was very egalitarian, because returns to education were low. The wages were controlled by the state and the distribution of earnings in the socialist economies cannot be analysed within the conventional labour supply-

demand framework. Accumulation of human capital was practically insignificant in the determination of individual earnings.

After the transition towards a more market-oriented economic system the relationship between education and earnings on the one hand, and labour productivity on the other has become very complicated. A big part of the skills supplied during socialism can no more be regarded as productive human capital. Emphasis on education in the socialist countries was less oriented into problem-solving (see Cornia *et al.* 1996) and the application of the strong skills in mathematics, physics, etc. in the new economic environment will not be simple. The industrial structure was biased especially in the Soviet Union and the changes in the demand for labour in different economic sectors have been huge. The returns to a large share of the education provided under the socialist system are nowadays even smaller than during the socialist era, sometimes practically non-existent.

However, a massive liberalization of wage policies, technological progress and a radical change in the industrial and economic structures have caused an enormous rise in the demand of workers with certain kind of skills (economy, marketing, computer technology, generally branches that were neglected by the communist rule). Returns to education that has been provided for less than a decade in these countries increase. The results are already visible, returns to education have risen in the 1990s (Rutkowski 1996) and will presumably continue to rise faster than in the OECD countries. Although education did not have a strong effect on the income distribution in centrally planned economies, and although the effects of schooling provided under socialism are difficult to evaluate, schooling certainly does matter in transitional economies currently and in the near future, probably even more than in the OECD countries. The problem is, that educational attainment rates from the socialist period cannot be judged reliably, and probably other indicators measuring the quality or the sector of education from the past 6-7 years would give more relevant results from the changes in human capital accumulation in transitional economies.

Finally, in the application of the traditional human capital theories one must consider some restrictions of that model. Most of the theories on the investment in human capital assume that a person can borrow almost limitlessly to pay for his or her education. However, it is obvious that there is not one single country where these financial markets for providing investment are perfect or where the state supplies even close to equal education possibilities for persons with different family backgrounds. Therefore education provided by the public sector plays a major role.

Human capital theories also assume competitive and perfectly functioning labour markets. It is, however, apparent that in the real world those assumptions are not true for any country. The applicability of this theory is though an interesting issue. Because of the rapid changes in the labour markets technology and increasing international competition in the past 10-20 years, the relationship between education and inequality is a particularly crucial issue in the current phase of development. In many countries the tendency has been to liberalize the labour markets, to deregulate wage policies and to cut the power of the labour unions. A liberalization of the labour markets will be favourable to the higher income classes, since it enables a rise in the relative wages of highly-skilled workers and increasing returns to education. Perfectly functioning labour markets enable the acceleration of inequality increase.

V THE DATA

For analysing the theories from the previous section we have collected variables indicating the distribution of gross income/earnings and educational attainment for 20 OECD countries, 7 transitional economies and 23 developing economies². The first dataset covers the year 1980, the second one the year 1990³. A summary of the variables is given in table 5.1. The entire data used for this analysis is provided in the data appendix tables A1 and A2.

In section two the developments of inequality were compared with the Gini ratios of disposable (net) income. Using this variable in a distribution model trying to exhibit the effects of schooling would cause a bias especially in the developed welfare states. Certain factors affecting the disposable income, like taxation and other kinds of government transfers, are not correlated with the level of educational attainment. In the determination of the distribution of net income, the fiscal policies of different countries have to be taken into account in addition to analysing the distribution of physical and human capital. Taking earnings rather than income distribution as the dependent variable makes it possible to avoid the effects of taxation and government transfers from the analysis. The main sources for the income data are OECD 1995, Milanovic 1996, Rutkowski 1996, Chen *et al.* 1995 and Deininger and Squire 1996b.

The drawback of earnings distribution is that it will cause problems in data collection. On the other hand, using the Gini coefficient of gross (pre-tax) income as an indicator of earnings inequality for the developing economies should not cause a very large bias, since the government transfer regimes in these countries are reasonably less advanced than in the post-industrialized welfare economies of Europe, North America and Australia.

Government expenditure on social security and welfare is much smaller in developing countries than in industrial countries (IMF 1993). Most of the observations for 1980 are from 1975 to 1985 and the observations for 1990 from between 1986 and 1993⁴. Although there was no one consistent source for all countries and both periods, the bias caused by using various data sources should be modest. A comprehensive research on different inequality studies has preceded the data collection.

We have used the rates for educational attainment of the adult population to indicate the quantity of human capital accumulation. This is a more convenient measure than enrolment rates, which must be considered with a time lag. Ahluwalia used the secondary enrolment and literacy rate in his earnings function. However, his intention was to analyse the quality of

² List of countries: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Mexico, Netherlands, Norway, Portugal, Spain, Sweden, Turkey, UK, USA; China, Czech Republic, Hungary, Poland, Romania, Russia; Bangladesh, Brazil, Chile, Colombia, Costa Rica, Egypt, Ghana, Honduras, India, Indonesia, Jordan, Kenya, Malaysia, Pakistan, Peru, Philippines, Singapore, South Africa, Tanzania, Thailand, Tunisia, Venezuela, Zambia.

³ Naturally it was not possible to gather data for exactly the years 1980 and 1990, but we will use these two years to represent the periods. Basically the period 1980 covers data from late 1970s to early 1980s and the period 1990 data from late 1980s onwards.

⁴ Because of problems related to data collection one 1980 figure is from earlier than 1975 (Turkey) and one (Ghana) from 1988. The 1990 observations from Germany and France are from 1984. However, the difference between the 1980 and the 1990 figure is at least five years for all other countries except Ghana and Germany (four years).

human resources rather than to explain the lagged effects of education. Since we want to measure how equal or unequal the distribution of schooling for the current working population is, educational attainment figures of the adult population are more valid indicators and the problem of lags is avoided.

The variables indicating the accumulation of human capital are derived from the excellent dataset provided by Barro and Lee (1996b). The dataset divides the population of 126 countries into seven categories: individuals with no, with some and completed primary, secondary and higher educational attainment. There are actually two datasets, one measuring the share of educational attainment for persons older than 15, the other for persons older than 25. We use the former dataset, because in many developing countries a large share of the labour force is younger than 25. The datasets cover both years used to test the model, 1980 and 1990.

TABLE 5.1
SUMMARY OF THE DATA BY REGIONS

Region ¹	Number of countries	Gini coeff. of gross income	Adult pop. with no schooling %	Adult pop. with post-primary schooling %	GNP per capita, PPP \$
1980					
European OECD	14	32.0	5.5	43.7	9711
Non-Euro OECD	6	39.4	12.0	59.0	8195
C&E Europe	6	25.4	4.9	47.2	3728
South Asia	3	35.4	69.5	17.3	250
East Asia	6	41.2	25.2	29.0	1578
Latin America	7	50.7	20.3	27.9	1940
N. Africa & Middle East	3	40.6	57.4	21.5	1230
SSA	5	47.6	45.4	16.1	894
TOTAL	50	38.1	21.6	36.3	4789
1990					
European OECD	14	33.4	4.8	49.0	17011
Non-Euro.OECD	6	39.7	8.9	64.6	16142
C&E Europe	6	27.8	2.0	62.1	5590
South Asia	3	33.4	55.7	23.8	1580
East Asia	6	40.8	17.3	36.4	8524
Latin America	7	49.3	15.3	32.2	5574
North Africa & Middle East	3	37.6	42.0	34.0	4280
SSA	5	46.0	44.0	15.7	1790
TOTAL	50	38.5	17.6	42.0	9455

Sources: Deininger and Squire (1996b), OECD (1995), Kende and Strimaska (1987), Rutkowski (1996), Ikemoto (1991), Chen *et al.* (1995), Barro and Lee (1996b), World Bank (1996), CIA (1996).

Note: ¹=Unweighted averages

For our analysis we take into consideration two of these categories. The first one is the share of the population with no educational attainment indicating to what extent the governments allow a large share of the population to remain as 'drop-outs' when it comes to obtaining education. The other variable is chosen to see if the share of skilled workers has any consequences for inequality. We have calculated the share of the population who have obtained post-primary education, that is the share of population with at least some secondary or higher schooling attainment (calculated as the sum of the variables SEC15 and HIGH15 in the dataset).

Although this paper is not trying to test the Kuznets hypothesis, we think it is feasible to include the level of GDP per capita as a control variable. Therefore we have also included information on the level of GNP per capita in US\$ from the 1996 World Development Report by the World Bank. The GNP figures are purchasing power parity estimates of Gross National Product per capita in current international \$ (World Bank 1996). We also added the share of agricultural sector to the analysis. Berry (1980) claims that the relationship between education and income is more direct in urban than in rural areas.

VI EDUCATIONAL ATTAINMENT AND INEQUALITY: A MATHEMATIC AND GRAPHIC ANALYSIS

The previous sections can be summarized with two main arguments that should be tested with empirical data. The first question is: has the share of uneducated people been an important factor causing earnings inequality in the early 1980s and in the current decade? The second one is: has the lack of response for the increased demand for skilled labour (measured with the share of educational attainment at the secondary and tertiary level) been an important factor causing earnings inequality?

In this paper we will reform the individual earnings function into a macro-level inequality function, like in various other studies on income distribution (see, for example, Ahluwalia 1976). The linear regression model will be of the following type:

$$(1) \text{ Income inequality }_t = F(\text{enrolment rate }_{t-w}, \text{GDP/capita }_t, \text{share of agriculture }_t, \text{dummy variables for different country groups}).$$

To measure the effects of schooling we have used the two variables described in the previous section: the share of population with no schooling (NOSCH) or the share of population with post-primary schooling (PPRED). A linear regression model for a world-wide dataset, that uses the Gini coefficient as the dependent variable, either of the indicators measuring educational attainment as explanatory variables, and GNP per capita (GNP) and the share of the agricultural sector in the labour force (AGR) as control variables, does not produce the kind of results that would be expected and fails to show the expected significance of especially primary education⁵.

⁵ See Chapter 6.3 for linear regression results with no dummy variables in the case of post-primary education.

It would, however, be hasty to make the conclusion only on the basis of the model described above. It is obvious that many other indicators apart from schooling and the stage of economic development matter to inequality. After all, considering the divergence of the countries in this sample, it would be rather surprising if the relationship between income distribution and schooling would be identical everywhere. Cultural, political and historical factors affect the distribution of income and wealth differently in different regions. To solve this problem, we will include three dummy variables, which will be described below. Dummy variables are a useful method to include the effects of those inequality-increasing or -decreasing factors which cannot be measured with other variables of the model. Dummies are an inevitable characteristic for the validity of any cross-country study which analyzes indicators that presumably have different effects for countries at different levels of development, and that has not the possibility to measure all factors numerically.

6.1 The distribution of physical assets

The most important distributive factor, often ignored by inequality studies founded on human capital theory, is the distribution of physical capital. The biggest problem of the variable is, that there is no single indicator which could be used as a reliable measure of it. One could use the Gini coefficients of the ownership of land or productive assets, but besides the problems related to data collection the number of variables would increase too much and affect the degrees of freedom in the model.

However, there are clear regional patterns for the distribution of especially land, but also of productive assets. Latin America, more clearly than any other region, has inherited a very concentrated distribution of land (see Sundrum 1987: 184) and other physical assets from the colonial times. Therefore, the distribution of income is expected to be relatively more unequal in spite of a relatively egalitarian distribution of human capital. For a given share of population with no schooling, the income distribution is presumably higher than in developing countries on average.

The concentration of physical capital into the hands of a small share of population is not only a problem of the Latin American countries. Some East Asian and sub-Saharan African countries have similar patterns of asset distribution as in the Latin American economies. Of the African countries in the sample, Kenya, South Africa and Zambia, for very similar historical reasons, have a very skewed asset distribution. The growth-oriented government policies in the colonial times created a dualistic pattern to the society in these countries (IFAD 1993). This pattern has not changed radically and the distribution of physical assets is still very concentrated.

In East Asia the distribution of most physical assets does not vary a lot across countries, but the unequal distribution of land has been a major source of (rural) poverty, and hence inequality. From the five East Asian non-transitional economies in our sample, differences between Malaysia, Philippines and Thailand on the one hand and Indonesia and Singapore on the other are apparent in this respect. The political history of Philippines—both in the colonial period and in the more recent decades under the dictatorial leadership of Marcos—has resulted in a very unequal ownership structure of land (Canlas, Miranda and Putzel 1988: 27-32). Neither have the policy interventions during the recent decades been able to change the unequal distribution of agricultural asset ownership in Malaysia or Thailand. In Malaysia land ownership became more concentrated in the late 1970s and the rapid growth policies have not even attempted to change that situation (see Mehmet 1986: 36-41). In Thailand the trend has

been towards an increased average size of farms, due to the dying out of small farms, which leads naturally to a more concentrated ownership structure (Turton 1987: 20).

On the other hand, in Indonesia small scale farming dominates the agricultural section (World Bank 1980: 39) and the distribution of land is more equal than in the three East Asian countries described above. The share of agricultural production in Singapore is very small and other means of production are distributed relatively equally compared to other East Asian economies. In countries still classified as developing countries these differences in land ownership patterns cannot be ignored in any inequality study. In agricultural societies the principal means of production and the primary source of wealth is land. Therefore we will categorize Malaysia, Philippines and Thailand to the same category with Latin America to separate them from the rest of East Asia, although the distribution of physical assets on aggregate might not be as concentrated as in Latin American countries.

The distribution of land is not as concentrated in the agricultural societies of India, Pakistan and Bangladesh as it is in Latin America or in most other parts of the world for that matter. Also in South Asia there are numerous sharecroppers who do not own any land, but the Gini coefficients for land distribution are relatively low (Sundrum 1987). That is one of the reasons why South Asian countries have had stable and quite low income inequality already for many decades. For a given share of population with no schooling, the income distribution is presumably somewhat lower in South Asia compared to developing countries on average, because a large share of the agricultural production is based on small-scale farming.

The other developing countries in the sample, including Singapore and Indonesia, can be categorized as 'average' developing countries from the point of view of asset distribution. For these, mainly Middle Asian and North African countries, the factors that affect inequality and that are exogenous in this model, are less inequality-increasing than in Latin America and the inegalitarian African and East Asian countries, and these countries are generally more developed and more inegalitarian than the South Asian countries. When these countries are grouped together, there should be a rising trend between inequality and educational attainment.

The last country group to be distinguished by its distribution of physical assets are the former socialist countries. Around 1980 there was little, if any, private ownership of physical capital in Central and Eastern Europe, which was a part of the state dominated egalitarian regime in these societies. In the latter period there have been big changes in the distribution of assets in the former socialist countries. After the first transition years the distribution of assets has been claimed to be approaching the level of the most inegalitarian developing countries, like the countries of Latin America, in some transitional economies (Honkkila 1997). Of the countries in the sample, in five out of six the distribution of wealth has, though, stayed at a relatively egalitarian level. The sixth one, Russia, has experienced a rapid concentration of asset distribution.

The explanation for the failure of the linear regression model with no dummy variables was simple: there is not one single observable linear trend for the world that shows the relationship between these two pairs of variables. The following model, which uses three dummy variables to separate countries with different patterns of physical capital distribution, shows also the effects of human capital distribution more clearly. The dummies are TRANSIT (transitional economies, most physical capital owned by the state (1980) or a history of egalitarian asset distribution (1990)), LOW (South Asia—poor agricultural societies with

relatively egalitarian distribution of land) and HIGH (Latin America⁶, three sub-Saharan African and three East Asian countries (and Russia in 1990)—economies with concentrated distribution of land and/or other productive physical capital).

6.2 Effects of primary education

Evidence to support the positive effect of providing basic education to the bulk of population, *given the differences in the distribution of land and productive assets*, is clear from the sample for both periods. In the linear regression model the coefficient for the variable NOSCH, indicating the share of population with no education, is positive and significant at the 1 per cent level in 1980 and at the 5 per cent level in 1990. As predicted, a higher share of uneducated people leads to a higher Gini coefficient, or greater inequality.

The control variables GNP and AGR fail to show any significance for either period. However, the dummy variables HIGH and LOW reflecting the distribution of physical assets are significant in both cases. The variable HIGH is significant at the 1 per cent level and the variable LOW at the 5 per cent level in both periods. The dummy for transitional economies (TRANSIT) is significant only in the former period when the countries had socialist regimes, as could be expected.

TABLE 6.1
DESCRIPTION OF THE LINEAR REGRESSION MODELS USED IN THIS STUDY

<i>Model A: the effects of the share of adult population with no educational attainment on gross income inequality:</i>	
GIN _{XX} =	constant + α *GNP _{XX} + β *AGR _{XX} + χ *NOSCH _{XX} + δ *LOW + ε *HIGH + φ *TRANSIT.
<i>Model B: the effects of the share of adult population with post-primary educational attainment on gross income inequality:</i>	
GIN _{XX} =	constant + α *GNP _{XX} + β *AGR _{XX} + χ *PPRED _{XX} + δ *LOW + ε *HIGH + φ *TRANSIT.
<i>Variables:</i>	GIN _{XX} = Gini coefficient of earnings/gross income inequality GNP _{XX} = GNP per capita, purchasing power parity US \$ AGR _{XX} = Share of labour force in the agricultural sector NOSCH _{XX} = % of population with no educational attainment PPRED _{XX} = % of population with post-primary education TRANSIT = Dummy for socialist/transitional economies LOW = Dummy for countries with low asset inequality HIGH = Dummy for countries with high asset inequality

Note: XX indicates the period in question, 80 = 1980, 90 = 1990.

In all, the models with the dummy variables for different levels of physical capital distribution are much stronger than the models described earlier. The explanatory power of these models,

⁶ In this regression we have classified also Mexico, although being a member of OECD, with the Latin American countries because of its asset distribution pattern.

indicated by the \bar{r}^2 figures, is twice as high. The coefficient for NOSCH is not very big in either of the periods. The coefficients for the significant dummy variables, especially for the high asset inequality -group, are quite substantial and increase between 1980 and 1990.

The results from the linear regression model can be illustrated graphically. The relationship between educational attainment and inequality is visible in figures 6.1 and 6.2 that scatter the share of population with no educational attainment on the x-axis and the Gini coefficients on the y-axis for 1980 and 1990.

Both in 1980 and in 1990 the bulk of the OECD-countries are scattered in the bottom left hand bottom corner of the scale. In European and North American OECD countries (including Japan) inequality (the Gini coefficient) varies from 26 to 37 in 1980 and from 26 to 40 in 1990. With only a few exceptions the share of population with no schooling is less than 6 per cent already in 1980, in 1990 the number of OECD countries with less than 5 per cent non-educated is even smaller, since both Greece and Spain have joined that group. Because of the low variance of the no schooling variable it is impossible to find any relationship between that variable and inequality in the developed economies.

TABLE 6.2
REGRESSION RESULTS: MODELS A AND B, THREE DUMMY VARIABLES FOR COUNTRIES WITH DIVERGENT DISTRIBUTION OF PHYSICAL CAPITAL

Variable	1980		1990	
	Model A coeff. (t-stat.)	Model B coeff. (t-stat.)	Model A coeff. (t-stat.)	Model B coeff. (t-stat.)
constant	31.79 (9.15) **	39.54 (11.80) **	33.09 (7.77) **	39.81 (9.96) **
GNP80/90	-0.01 (-0.03)	-0.35 (-1.24)	-0.08 (0.04)	-0.22 (-1.16)
AGR80/90	0.01 (0.20)	0.02 (0.37)	-0.01 (-0.27)	-0.003 (-0.06)
NOSCH80/90	0.16 (2.72) **	..	0.17 (2.21) *	..
PPRED80/90	..	-0.06 (-1.19)	..	-0.03 (-0.56)
LOW	-8.05 (-2.52) *	-4.19 (-1.37)	-8.39 (-2.55) *	-5.23 (-1.67)
HIGH	14.23 (7.78) **	12.11 (6.88) **	15.21 (7.56) **	13.08 (7.04) **
TRANSIT	-7.32 (-2.90) **	-10.30 (-4.39) **	-2.79 (-0.87)	-6.39 (-2.21) *
\bar{R}^2	80.5	77.9	76.0	73.5

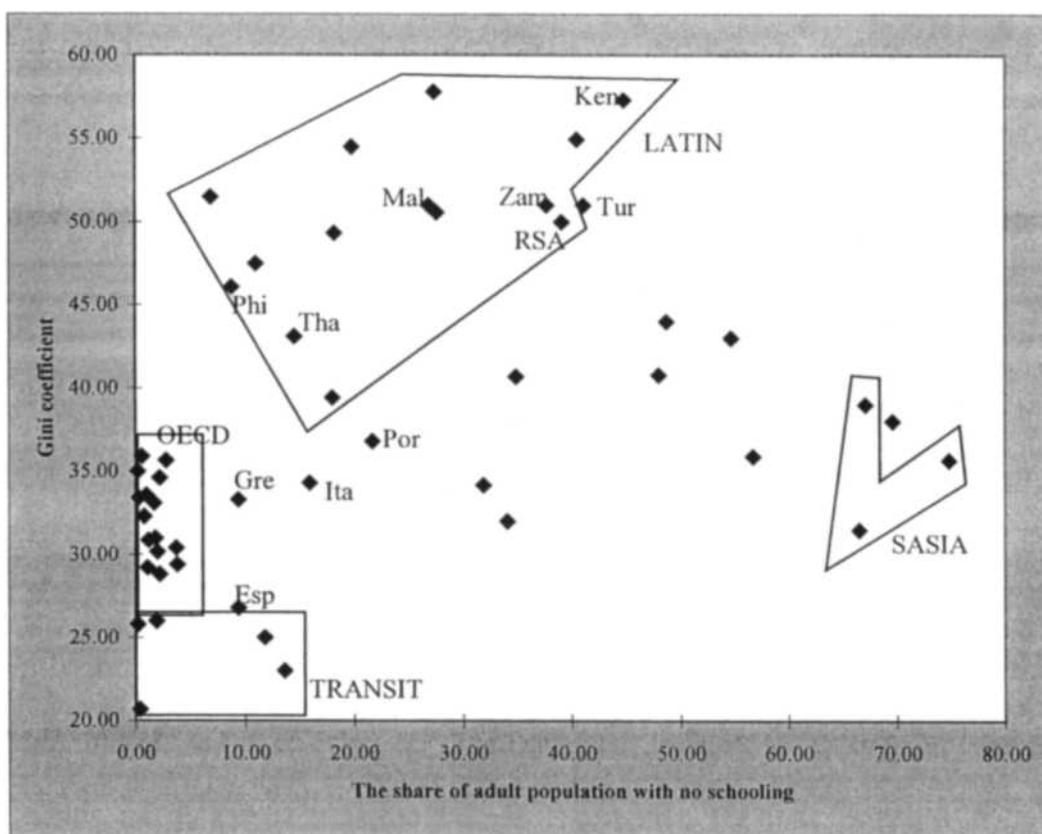
Note: * significant at 5 % level, ** significant at 1 % level

In 1980 the socialist countries had lower inequality and partly lower level of education (Romania, Bulgaria) than the OECD countries, but as argued before, in the socialist countries the relationship between schooling and earnings was practically non-existent. Since the start

of economic transition the Central and Eastern European countries have moved to the same area in the graph with the European and North American OECD countries. The only exception is Russia, where high income and asset inequality is becoming a serious issue. In the other transitional economies any relationship between the no schooling variable and inequality is hard to spot⁷.

The results from the OECD and transitional countries are hardly surprising. The level of primary education is generally at such a high level that differences in educational attainment rates are not necessarily due to anything else than calculatory factors and do not affect earnings inequality. For the developing world secondary and tertiary education were the variables that were presumed to make a difference to the distribution of earnings.

FIGURE 6.1
THE SHARE OF ADULT POPULATION WITH NO EDUCATIONAL ATTAINMENT
AND THE GINI COEFFICIENT OF GROSS INCOME IN 1980

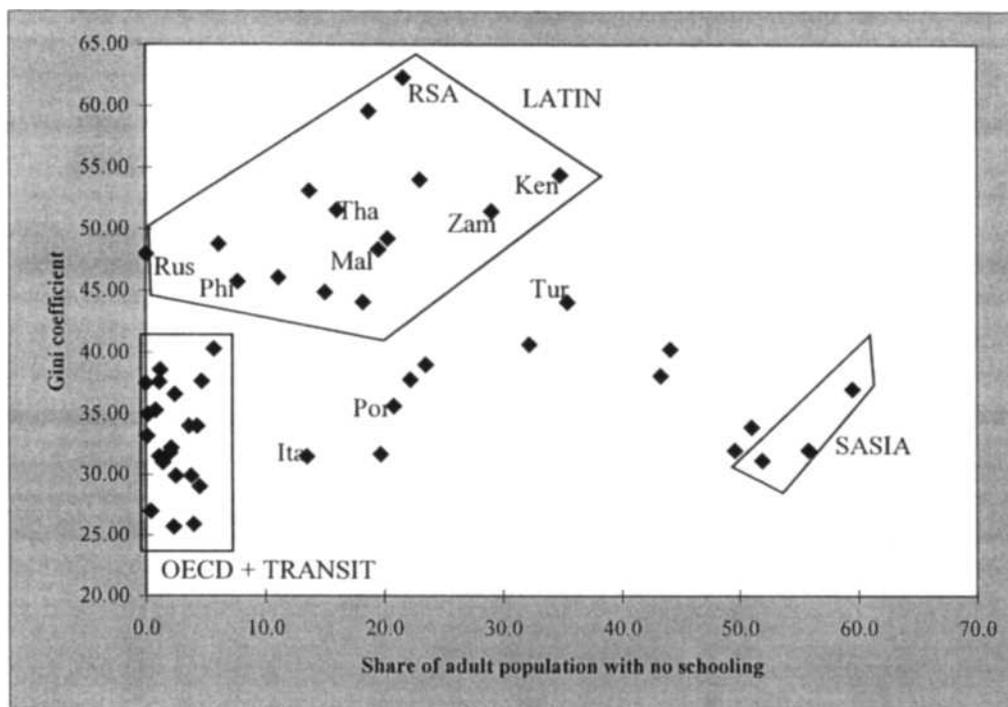


As could be predicted, the scatter does not show one clear pattern for the developing economies. For most observations the trend is as expected, inequality is higher in countries with higher share of non-educated population. However, in the South Asian (Bangladesh, India and Pakistan) and also in some African (Egypt, Ghana) countries the relationship between the two variables seems completely different as expected and that causes a bias in the global linear regression model. If one globally valid trend between the share of non-educated

⁷ Note that although the period is described as '1990', when inequality caused by transition was not yet a serious issue, the inequality figures are from more recent years when inequality had already increased heavily in some Eastern European countries.

and the Gini coefficient was to be detected, the regression line should actually be drawn from top left (high inequality, low share of non-educated) to bottom right (low inequality, high share of non-educated) and not vice versa, as would be logical. The reason is this 'tail' in the distribution on the bottom right corner of the graph caused mainly by the outlying South Asian countries.

FIGURE 6.2
THE SHARE OF ADULT POPULATION WITH NO EDUCATIONAL ATTAINMENT
AND THE GINI COEFFICIENT OF GROSS INCOME IN 1990



If the countries are separated according to the inequality in the distribution of physical capital, the graph reveals the relationship that was given by the regression model. Apart from the group of OECD countries and the centrally planned economies, for which there was no clear relationship between the no schooling -variable and inequality, there are three groups of countries that can be separated from the graphs. The first one is the group of countries with high inequality of asset distribution, separated with the polygon in the top left corner of the graphs. The second one are the three South Asian countries with relatively egalitarian land distribution, separated with the polygons in the bottom right corner of the graphs, and the third one the rest of the economies in the sample. In the scatters the OECD and socialist/transitional countries are marked out with rectangles in the bottom right corner.

In both periods there is a clear rising trend between the two observed variables for the group of countries consisting of Latin America, three sub-Saharan African and three East Asian countries. The linear trend is somewhat steeper in 1990 than in 1980. Because the number of South Asian countries in the sample is only three, it is hard to show the relationship for these economies. If the egalitarian South Asian and inegalitarian Latin American groups are excluded, the rest of the countries in the scatter exhibit a positive relationship, as expected. More inegalitarian countries are countries with a bigger share of adult population that has no educational attainment. For this 'average' group the difference between the two periods is

identical with the Latin American case: the relationship stays positive but the trend becomes steeper in 1990.

The growing supply of primary education to all segments of the population in most parts of the world during the past decades has not radically changed these patterns described above, but it has made them less distinct. Differences in schooling attainment rates are smaller, but inequality has increased both within and between countries. The decline of the no schooling variable has been remarkable in many countries with low inequality (Egypt, South Asia, the East Asian low-inequality countries), but also in some countries where inequality is a major problem (South Africa, Mexico, Honduras). The patterns for the same groups of countries are very similar in 1980 and in 1990, with the exception of the transitional economies. For both periods the three trends (and the OECD group with no trend) are observable, but the inter-country differences are more visible in 1980.

The slight decrease in the significance of the no schooling-variable in the latter period is not necessarily surprising. First of all, in spite of low returns to education the inequality decreasing effect of basic education in Central and Eastern Europe was clearer under the communist regime in 1980 than it has been under a more market-oriented regime in 1990. Even when Russia—with huge shifts in asset distribution in the early 1990s—is moved away from the group of transitional economies, the dummy variable TRANSIT, which was significant at the 1 per cent level in 1980, is no longer significant even at the 10 per cent level in 1990. The relationship between schooling and inequality has become ambiguous in Central and Eastern Europe and that causes a bias for the entire model.

Secondly, the inter-country differences in the share of non-educated have diminished, because of the large fall in the share of non-educated adults that has occurred globally. The average of the NOSCH variable was 21.6 in 1980 and only 16.5 in 1990, and the standard deviation 22.0 in 1980, but only 17.2 in 1990. The differences have become negligible especially between most industrial countries, which creates problems for the model since 27 of the 50 countries are classified as industrial or transitional economies. Such a fall in the variance of one explanatory variable naturally decreases the explanatory power of that variable.

A slight change in the approach improves the verification of the theory on primary education and inequality. One could claim that basic education is no more important in industrial and post-industrial developed economies and test the relationship for developing countries only. If the OECD countries and the transitional economies are withdrawn from the sample, leaving 23 developing countries for the cross-country regression, the significance of the NOSCH-variable rises in spite of a loss of degrees of freedom. The values of t-statistics increase in 1980 from 2.72 to 4.75 and in 1990 from 2.21 to 3.35 (making the variable significant at the 1 per cent level)⁸.

6.3 The effects of post-primary education

Evidence from the dataset of this research to support the inequality decreasing effects of widespread primary education was well-founded, taking into account the diversity of countries and regions. Particularly if we take notice of the differences in the distribution of

⁸ In the modified model B with 23 developing countries the coefficients and standard deviations for the variable NOSCH are 1980: 0.21 (0.06) **, 1990: 0.25 (0.05)**.

physical capital. The case of the supply of post-primary education is, though, much harder to prove.

In the linear regression model B the variable PPRED indicating the share of adult population with at least some secondary or tertiary education, is insignificant, regardless of the year. The relationship is not any stronger if we assume that secondary and tertiary education is meaningful only for the industrialized countries and exclude the 23 developing economies from the analysis.⁹

The variable GNP fails to show any significance as it did in some of the models testing for basic education. Like in the previous model, the variable AGR is not significant. In the model B the dummy variable for South Asian countries is also insignificant in both periods, whereas the dummy HIGH is again significant at the 1 per cent level in both cases. Also the dummy for transitional economies is significant in both periods. In 1980 at the 1 per cent level and, perhaps surprisingly, in 1990 at the 5 per cent level. The explanatory power of the model is relatively high (\bar{r}^2 77.9 and 73.5 for 1980 and 1990 respectively) considering the low significance of the PPRED variable.

If the dummy variables are removed and only AGR and GNP are left as control variables, the variable PPRED is significant at the 10 per cent level. All the models without any dummies have rather weak explanatory power with \bar{r}^2 figures around 20 (see table 6.4). However, the inequality decreasing impact of secondary and tertiary schooling becomes more clear in that model.

TABLE 6.3
MODEL B' WITHOUT DUMMY VARIABLES

Variable	1980	1990
	Model B' coeff. (t-stat.)	Model B' coeff. (t-stat.)
<i>constant</i>	44.91 (8.05) **	51.43 (8.79) **
<i>GNP80/90</i>	-0.35 (-0.82)	-0.46 (-1.83) #
<i>AGR80/90</i>	0.03 (0.37)	-0.07 (-0.85)
<i>PPRED80/90</i>	-0.17 (-1.83) #	-0.13 (-1.69) #
<i>R bar 2</i>	25.6	17.1

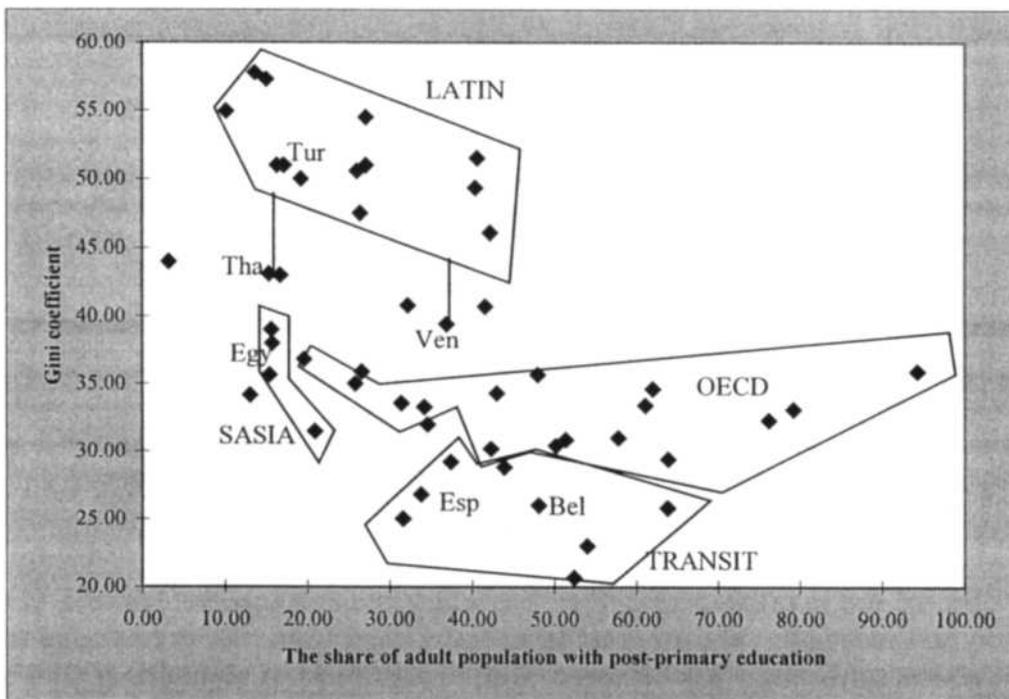
Note: # significant at the 10 % level, * at the 5 % level, ** at the 1 % level.

⁹ In the modified model B with 27 industrial countries the coefficients and standard deviations for the variable PPRED are 1980: 0.06 (0.07); 1990: 0.05 (0.07).

The graphic analysis gives more evidence of an expected negative impact of the PPRED-variable to the Gini coefficient. On the post-primary educational attainment versus Gini coefficient scatter the fifty countries in the sample show a downward tendency between the two variables (see figures 6.3 and 6.4). As in the previous scatters, South Asian, Latin American (with the other countries with unequal asset distribution) and OECD and socialist/transitional countries are marked out with polygons. The outlying countries of the groups are marked separately.

FIGURE 6.3

THE SHARE OF ADULT POPULATION WITH SECONDARY OR TERTIARY LEVEL EDUCATIONAL ATTAINMENT AND THE GINI COEFFICIENT OF GROSS INCOME IN 1980



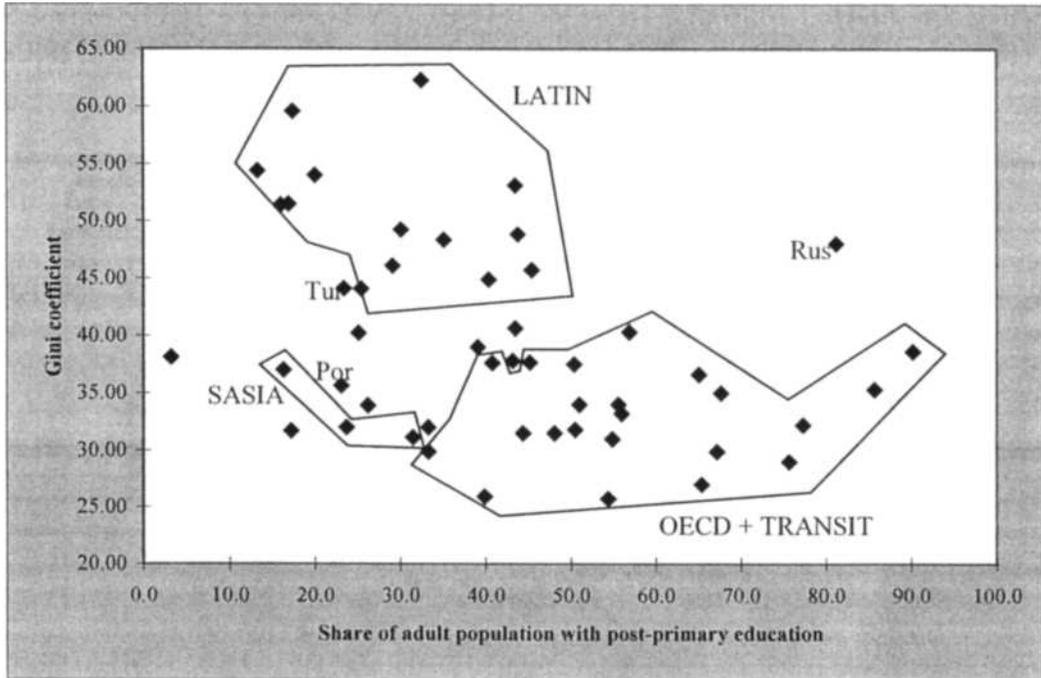
Countries of the HIGH group are in the top left corner and countries of the LOW group in the bottom left corner. Educational attainment rates at the post-primary level are generally quite low in developing countries, but vary quite substantially across different OECD and transitional countries which means that the polygons for these country groups cover a large area in the bottom half of the scatter.

It seems that it is the high inequality in the distribution of physical capital rather than of human capital that has the most substantial effect of gross income inequality. If the world is divided into the same groups as in the case of the NOSCH variable, countries with high inequality in physical capital distribution stand out as countries with high inequality. For the developing countries the relationship within various groups is also detectable. This implies that at lower stages of economic development not only basic education but also comprehensive secondary and even tertiary education has an inequality decreasing effect. As in the case of basic education, the effect does not seem to be as strong as the effect caused by

some other factors, like the distribution of physical capital, but the importance of human capital accumulation should neither be ignored.

FIGURE 6.4

THE SHARE OF ADULT POPULATION WITH SECONDARY OR TERTIARY LEVEL EDUCATIONAL ATTAINMENT AND THE GINI COEFFICIENT OF GROSS INCOME IN 1990



In the case of the developed countries, for which the relationship between post-primary education and inequality was assumed to be more significant, the graphic and mathematic analysis shows surprisingly little evidence for the arguments in section four. Various OECD countries are scattered quite randomly in the graph and any relationship is extremely hard to spot. Particularly problematic for the model are the North American countries and Australia. These are the three countries with biggest post-primary educational attainment rates, but where inequality is at a level above the OECD average.

Although both formal and graphic evidence are not too convincing, one should not deny the rising importance of skilled labour in the determination of income distribution in the developed countries. There are a few factors that this statistical analysis does not take into account. First of all, the variable PPREM measures only the share of population with a certain level of schooling in quantitative terms. The variable ignores the quality of education, and more importantly, for which sectors the education prepares the individuals. Also, the educational system is different in different countries. Secondly, studying at North American and Australian colleges and universities usually requires high tuition fees, which is not the case in most central and north European countries. This is one possible explanation for the combination of relatively high inequality and high educational attainment in North America and Australia.

Another important point that this paper has not had the possibility to analyse in detail are the the inter-country differences in the demand for skilled labour. The vital importance of the demand-side of the labour markets was recognised in section five, but the model B2 only has the supply of skilled labour as a variable and assumes that the demand for skilled labour is equal in all countries. This has naturally not been the case. The demand for skilled labour determines the speed in which the scarcity rents will decline, and in which way the increase in human capital accumulation at higher levels of education affects inequality. The outcome of the model presented above suggests, as in the case of primary education, that there is not one globally valid pattern between variables measuring educational attainment at the secondary or tertiary level and gross income inequality. Other factors affecting the distribution of income must be taken into account.

VIII SUMMARY AND CONCLUSIONS

Income inequality has risen in many parts of the world in the past 15-20 years. Recent research on the issue has regarded this development as detrimental for both economic growth and poverty alleviation (Alesina and Perotti 1993, Birsdall, Ross and Sabot 1995, Cornia and Addison 1997). Various factors determine the changes in income inequality. One of the most important determinant is certainly the structure and magnitude of the supply of education.

There are good theoretical reasons to believe that these unfavourable developments that have increased income inequality in many countries could have been much smoother, or even reversed, if a larger amount of resources had been invested in the accumulation of human capital. The rise in the demand for skilled workers increases returns to education, if the supply of educated people does not rise equally. The result will be a shift of income from the unskilled workers with low initial earnings to the skilled workers with higher initial earnings, which will naturally increase inequality.

The empirical evidence given by this study to support the human capital theory does justify the need for a world-wide increase in the provision of education, but also acknowledges other factors that have contributed to the rise in inequality. Because of substantial differences in the patterns of physical capital distribution in different regions and even different countries, it would be surprising if one could discover a simple linear relationship valid for all regions in the world between inequality and educational attainment. Such a single linear relationship does not exist between basic education and inequality, but if the patterns in physical capital distribution are taken into account, the relationship between these two variables becomes perceptible. The share of adult population for which at least primary education has been provided is a significant determinant of a more egalitarian earnings distribution, especially in developing countries. The share of adult population with educational attainment at the secondary or tertiary level is also correlated with inequality, but countries where the level of post-primary education is low, are to a big extent also countries that have very unequal patterns of physical capital distribution.

Altogether, for the analysis on the rise in the share of skilled workers this study has two influential shortcomings. First of all, not only the quantity of education supply, but also its price and quality determine its effect in the distribution of income. Second, the rise in the returns of skilled labour is not necessarily identical in every country, but depends on the demand for skilled workers and the developments in labour market regulations. Probably

because of these shortcomings, the argument that rising supply of secondary and tertiary education decreases earnings inequality in developed industrial countries, where technical development is supposed to affect returns to skills more strongly than in the developing world, cannot be supported by the data in this paper. For example, in countries like the United States or United Kingdom inequality has stayed high in spite of high enrolment rates.

In transitional economies in Central and Eastern Europe the relationship between education or skills and wages is less straight-forward than in other industrial countries. Some idiosyncratic factors like location or access to private sector employment are still claimed to be more important determinants of wages than individual skills (EBRD 1997: 44). In addition, part of the education provided before the transitional period has lost its value because of the change in the political and economic regime and because of large shifts in the structure of production. Although the increase in wage inequality in transitional economies has been a more serious and more predictable issue than in the market economies, its determinants are more complicated and the role of education even harder to evaluate. From the point of view of both growth and inequality the need for a quick educational expansion especially in those branches that were formerly neglected is, though, apparent.

In the developing countries inequality is clearly related to the progress in the supply of education. This result has been discovered numerous times earlier and does not come as a surprise. However, only a part of the increase in inequality can be explained by equal possibilities for human capital accumulation. From the other determinants the most important is the distribution of physical capital.

In conclusion, educational expansion is a recommendable policy with a high priority in developing countries in which income inequality is high and increasing. Countries, that have good initial conditions for building an egalitarian and fast growing society, have been able to keep income inequality at modest levels by providing good and relatively equal schooling opportunities for the majority of the population. However, supplying education does not create miracles, if the initial conditions are unfavourable, particularly if the distribution of physical assets is very concentrated.

For the developed countries, where returns to education are high, this paper does not give sufficient answers to the problem of inequality. A surplus demand for skilled labour and rising returns to education in certain sectors has been blamed for the recent rise in wage inequality. The supply of education measured with the educational attainment figures at secondary and tertiary levels do not give grounds for approving or denying that hypothesis. It seems that the issues behind the rise in the demand for skilled labour, like the liberalization of labour markets or fast technological development and fast changes in the production structure are more consequential for the negative inequality developments.

TABLE A1
INEQUALITY, EDUCATIONAL ATTAINMENT AND GNP/CAPITA DATA IN
DEVELOPED COUNTRIES

Country	Year	Gini	No school.	2 or 3 sch.	GNP/cap
Australia	1980	32.30	0.8	76.2	11.080
	1990	32.20	2.1	77.3	18.120
Belgium	1980	26.00	1.9	48.1	11.920
	1990	25.70	2.3	54.4	20.270
Bulgaria	1980	25.01	11.8	31.6	3.814
	1990	34.00	4.3	51.0	4.380
Canada	1980	33.10	1.7	79.2	11.400
	1990	35.30	0.8	85.7	19.960
Czechoslovakia	1980	20.67	0.4	52.4	.355
	1990	27.00	0.4	65.4	8.900
Denmark	1980	30.99	1.8	57.8	13.120
	1990	33.20	0.1	56.0	19.880
Finland	1980	30.86	1.2	51.4	10.680
	1990	37.50	0.0	50.4	16.150
France	1980	33.55	1.0	31.4	12.190
	1990	37.60	1.1	40.8	19.670
Germany	1980	35.00	0.2	25.8	13.450
	1990	29.90	2.5	33.3	19.480
Greece	1980	33.29	9.4	34.2	4.420
	1990	37.67	4.7	45.2	10.930
Hungary	1980	29.20	1.1	37.4	2.100
	1990	31.50	1.1	44.4	6.080
Ireland	1980	35.65	2.8	48.0	.230
	1990	40.30	5.7	56.9	13.550
Italy	1980	34.29	15.9	43.0	6.960
	1990	31.50	13.5	48.1	18.460
Japan	1980	33.40	0.3	61.1	10.080
	1990	35.00	0.2	67.7	21.140
Mexico	1980	50.58	27.6	26.0	2.250
	1990	53.10	13.7	43.5	7.040
Netherlands	1980	29.40	3.8	63.9	11.790
	1990	29.90	3.8	67.2	18.750
Norway	1980	30.18	2.0	42.3	14.060
	1990	31.81	2.0	50.5	20.210
Poland	1980	28.80	2.2	43.9	4.359
	1990	31.00	1.4	54.9	5.480
Portugal	1980	36.80	21.7	19.6	2.520
	1990	35.63	20.8	3.1	11.970
Romania	1980	23.00	13.6	54.0	2.540
	1990	29.00	4.5	75.7	4.090
Russia	1980	25.80	0.2	63.8	4.198
	1990	48.00	0.0	81.2	4.610
Spain	1980	26.79	9.4	33.8	5.640
	1990	25.91	4.0	39.9	13.740
Sweden	1980	34.60	2.2	62.0	14.870
	1990	36.60	2.4	65.1	17.130
Turkey	1980	51.00	41.1	17.1	1.540
	1990	44.09	35.4	23.4	4.710
UK	1980	30.40	3.7	50.2	9.110
	1990	34.00	3.6	55.6	17.970
USA	1980	35.90	0.6	94.3	12.820
	1990	38.60	1.2	90.2	25.880

Note: Gini = Gini coefficient of gross income / earnings
No Schol. = Adults (>15 years) with no schooling, percentage of population
2 or 3 sch. = Adults (>15 years) with secondary or higher education, percentage of population.
GNP/cap = GNP per capita, purchasing power parity \$

TABLE A2
INEQUALITY, EDUCATIONAL ATTAINMENT AND GNP/CAPITA DATA,
DEVELOPING COUNTRIES

Country	Year	Gini	No school.	2 or 3 sch.	GNP/cap
Bangladesh	1980	39.00	67.1	15.6	140
	1990	37.00	59.5	16.3	1.330
Brazil	1980	57.78	27.4	13.6	2.220
	1990	59.60	18.7	17.4	5.400
Chile	1980	51.50	6.9	40.6	2.560
	1990	48.80	6.1	43.8	8.890
China	1980	32.00	34.1	34.6	300
	1990	37.80	22.2	43.2	2.510
Colombia	1980	54.50	19.8	27.1	1.380
	1990	49.24	20.3	30.1	5.330
Costa Rica	1980	47.49	11.0	26.4	1.430
	1990	46.07	11.1	29.1	5.919
Egypt	1980	38.00	69.6	15.7	650
	1990	32.00	49.6	33.3	3.720
Ghana	1980	35.90	56.7	26.6	400
	1990	33.91	51.0	26.2	2.050
Honduras	1980	54.94	40.5	10.1	600
	1990	54.00	23.0	20.0	1.940
India	1980	31.49	66.5	20.9	260
	1990	32.02	55.8	23.7	1.280
Indonesia	1980	34.15	31.9	13.0	530
	1990	31.69	19.7	17.2	3.600
Jordan	1980	40.80	48.0	32.2	1.620
	1990	40.66	32.2	43.5	4.100
Kenya	1980	57.30	44.8	15.0	420
	1990	54.39	34.8	13.3	1.310
Malaysia	1980	51.00	26.9	27.1	1.840
	1990	48.35	19.5	35.1	8.440
Pakistan	1980	35.67	74.8	15.4	350
	1990	31.15	51.9	31.5	2.130
Peru	1980	49.33	18.2	40.4	1.170
	1990	44.87	15.0	40.4	3.610
Philippines	1980	46.08	8.8	42.2	790
	1990	45.73	7.7	45.4	2.740
Singapore	1980	40.69	34.9	41.6	5.240
	1990	39.00	23.5	39.1	21.900
South Africa	1980	50.00	39.1	19.2	2.770
	1990	62.30	21.6	32.5	5.130
Tanzania	1980	44.00	48.7	3.2	280
	1990	38.10	43.3	3.2	620
Thailand	1980	43.10	14.5	15.3	770
	1990	51.50	16.0	16.9	6.970
Tunisia	1980	43.00	54.7	16.7	1.420
	1990	40.24	44.1	25.1	5.020
Venezuela	1980	39.42	18.0	36.9	4.220
	1990	44.08	18.2	25.4	7.770
Zambia	1980	51.00	37.7	16.3	600
	1990	51.40	29.0	16.0	860

Note: Gini = Gini coefficient of gross income / earnings. No School. = Adults (>15 years) with no schooling, percentage of population. 2 or 3 sch. = Adults (>15 years) with secondary or higher education, percentage of population. GNP/cap = GNP per capita, purchasing power parity \$

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