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Heterogeneous Returns to Education in the Labor Market

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Abstract

Since the development of human capital theory, countless estimates of the economic benefits of investing in education for the individual have been published. While it is a universal fact that in all countries of the world the more education one has the higher his or her earnings, it is nevertheless important to know the empirical returns to schooling. However, simply knowing average returns is not useful in a world of heterogeneity. This paper finds increasing returns going from the lower to the higher end of the earnings distribution, but with some important differences across regions. The returns increase by quantile for Latin America. The returns decrease by quantile for most East Asian countries, producing an overall equalizing effect. India and Pakistan demonstrate opposite results. In Ghana, the returns across the distribution are flat, while for Kenya and Tanzania education is dis-equalizing.

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Sector Board: Education

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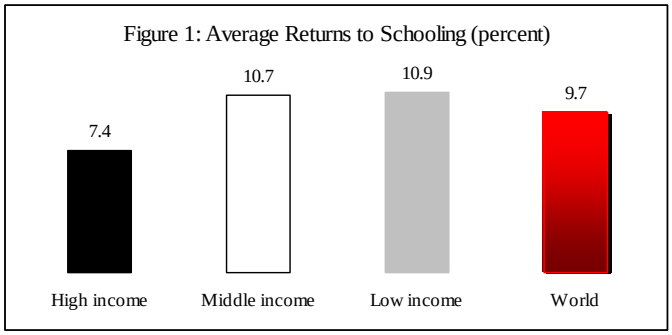
Introduction

The benefits of schooling are many, including poverty reduction, equity enhancement, promotion of rights, gender equity, child education, child and own health, fertility decisions, job search efficiency, technological change, social cohesion, crime reduction – among many others. Since the development of human capital theory (Becker 1964), countless estimates of the economic benefits of investing in education for the individual have been published. Earnings differentials by level of education represent the monetary incentives for someone to invest in education, and the intersection of supply and demand curves for educated labor. Differences in relative earnings reflect a number of factors, such as the demand for skills in the labor market, minimum wage legislation, the strength of unions, collective agreements, the supply of workers with various levels of educational attainment, the work experience of workers with high and low levels of schooling, the distribution of employment among occupations and the relative incidence of part-time and seasonal work.

It is a universal fact that the more education one has the higher her earnings. The empirical literature on returns to schooling has proven to be a useful standard. The global average rate of return to schooling, estimated at 10 percent, is used as a global benchmark (Figure 1). Estimates of the returns on investment in education have been made since the late 1950s. There are indeed thousands of estimates from a wide variety of countries. Some are based on studies done over time and some are based on new econometric, rigorous techniques. Nevertheless, all reaffirm the importance of investing in education for development. Most studies estimate the mean return to education which may be interpreted as the return to additional schooling for an individual with mean ability; in other words, the average individual. A number of observations on the pattern of returns across countries have been highlighted in the literature (see, for example, Psacharopoulos

and Patrinos 2004; Denny et al. 2003; Card 2001; Flabbi et al. 2008; Harmon et al. 2003). In particular, past average return to education estimates suggest that returns are higher in developing compared to developed countries, with developing countries exhibiting high returns to primary education, while returns to tertiary education are higher in developed countries.



Knowing the empirical returns to schooling is useful for policymaking. The returns to schooling, or education-wage differentials, give important information to policymakers about what skills the market values and ideas for what types of programs to expand or close down. This information is used to set public investment priorities, orient poverty reduction programs, and make spending decisions more efficient (see, among others, Jimenez and Patrinos 2008). These decisions, however, are made on the basis of averages; that is, average levels of schooling, average rates of return, therefore, average spending decisions. Similarly, while economists have generally estimated the average of the marginal returns to education (assuming homogeneity of returns across individuals), in fact returns to education can be heterogeneous across people. This is fine as long as all people are average, but once an element of heterogeneity is introduced, the averages are much less useful. This has implications for the inequality-reducing role of education. This paper documents increasing returns as one goes from the lower to the higher end of the earnings distribution, but with some important differences across region. The returns increase by quantile for Latin America. The returns decrease by quantile for most East Asian

countries, producing an overall equalizing effect. India and Pakistan, demonstrate opposite results. In Ghana, the returns across the distribution are flat, while for Kenya and Tanzania education is disequalizing.

1. Heterogeneity of returns to education

Averages are not so useful in a world of heterogeneity. Heterogeneous is used here to describe something that has large variation. In this case there is variety in terms of the estimated rates of return. In the rate of return literature, heterogeneity can be seen as another source of bias, along with the often studied forms such as unmeasured ability and measurement errors. Less effort has gone into determining whether there are variations from the "mean" – or average – return to education across the population. Evidence of heterogeneity in the returns to education exists (Girma and Kedir 2005; Harmon et al. 2003; Martins and Pereira 2004; and see below). From such research it is clear that average returns to the average individual will not suffice for policy purposes. We need to know more about which interventions are more likely to affect which parts of the distribution, and to establish at the same causality.

1.1 Policy relevance

Education is considered an excellent tool to decrease earnings inequality as research has shown that it has high returns. Thus, effective educational policies would have the potential to decrease existing – and growing – inequities. This is more likely if newly educated cohorts benefit from the existing patterns of returns. However, this approach disregards whether the existing patterns of returns are concentrated or dispersed. If dispersed, then one needs to take account of the potential problems concerning levels of inequality and educational policies designed to erode wage dispersion. Moreover, the available evidence suggests that differences in the extent of

earnings inequality among high income countries are heavily influenced by the rewards for educational attainment (Lemieux 2008, 2006b, 2006c).

Thus, for policy purposes, understanding how heterogeneous the returns estimates are in a particular country is important. For example, if the returns to education are higher for those at the top of the income distribution, then further investments in education – doing nothing else different – will lead to an increase in inequality. That is, if marginal schooling returns in a particular country are higher for the less able (assuming that "ability" is captured by the residuals of the earnings function), educational opportunities should be expanded for this section of society, as education and ability are substitutes. Furthermore, in such a case the interaction of education and ability has an equalizing effect on earnings. But if education leads to more inequality, then compensatory interventions may be necessary in order to equalize the chances of the less able. If, on the other hand, education tends to equalize earnings, then further investment is warranted, without changes in the way it is provided.

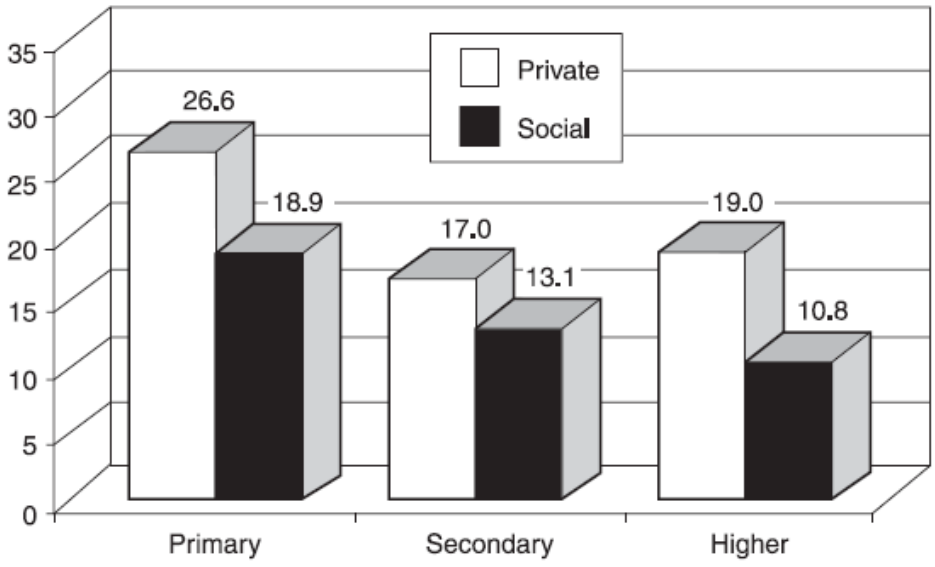
2. Returns to different education levels – The changing trends

Conventional wisdom, based on the theoretical expectation of diminishing returns, suggests that the economic reward of an extra year of education will fall as years of schooling rise. Diminishing returns lead to a concave earnings function whereby earnings increase with education but at a decreasing rate. The slope of the education-earnings relationship (which is the measure of the rate of return to education) is steep at low levels of education but becomes progressively flatter (the marginal return to education falls) at higher levels. The theoretical prediction of concavity is confirmed by empirical evidence from the 1960s to the 1990s. For instance, meta-studies (see, for example, Psacharopoulos and Patrinos 2004) find that the general pattern of returns to education across a large number of studies is that the return to education is

highest at the primary education level and progressively lower at secondary and tertiary education levels.

It is tacitly held (including in the Millennium Development Goals) that basic education reduces poverty, and this idea is supported by the notion of diminishing returns to education and evidence that labor market returns to education are highest at the primary level of education. However, recent data from some countries strongly suggest this may have changed and this has important implications for our understanding of the poverty-reducing role of different levels of education (World Bank 2008).

Figure 2: Returns to Education by Level



The growing importance of post-primary education is evident in several countries. A number of studies using 1990s and early 2000s data find that the return to primary education is lower than that to post-primary education (Table 1). The fall in return to primary education over time could be due to both supply-side reasons (the supply of primary completers has greatly increased over

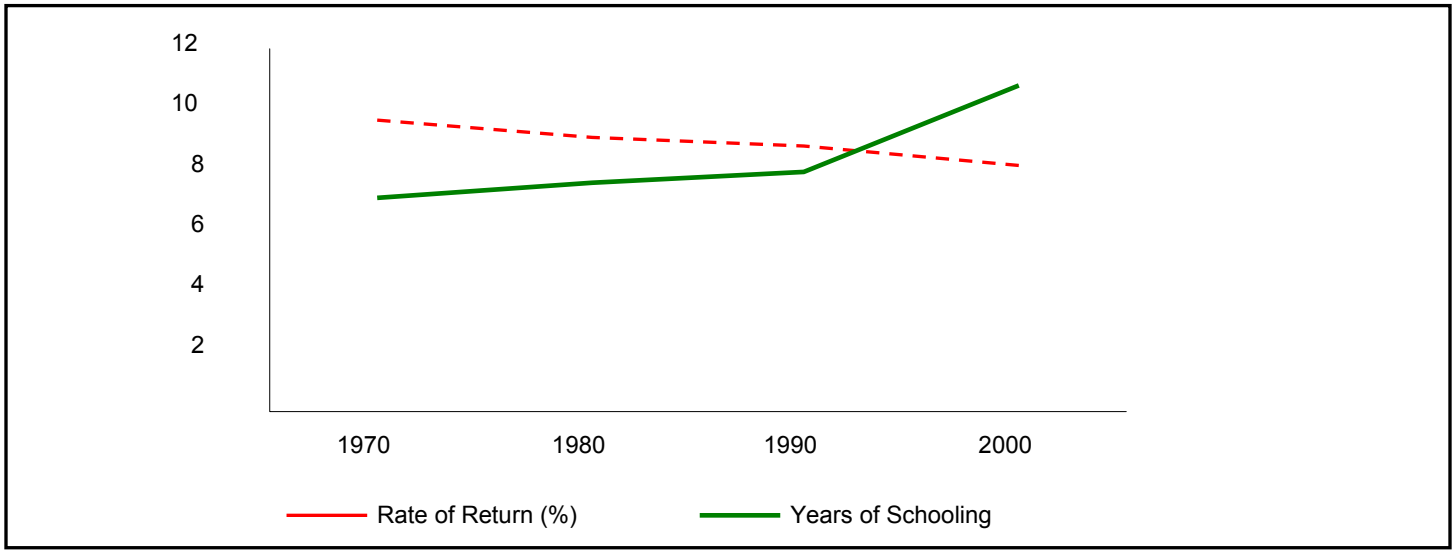
the decades in most developing countries) and demand-side reasons. One example might be that falling demand for people with low skills, due to changes in the skill composition of goods that are demanded and produced in the economy, leads to reductions in returns to schooling at lower levels.

Table 1: New Evidence on Returns to Primary vs. Higher Levels of Education

Country	*Study*	*Evidence*
Cote d'Ivoire, Ethiopia, Uganda	Appleton, Hoddinott and Krishnan (1999)	Higher returns at higher levels of schools
Cote d'Ivoire, Burkina Faso, Ghana, Kenya, Nigeria, South Africa	Schultz (2004)	Returns higher for postsecondary education
Rwanda	Lassibille and Tan (2005)	Primary education returns lower than secondary
Tanzania, Kenya	Söderbom, Teal, Wambugu and Kahyarara (2006)	Average return for those with post-secondary education exceed 27%
South Africa	Moll (1996)	Effect of secondary schooling substantially stronger for 1960-90
India	Kingdon (1998); Kingdon and Unni (2001); Duraisamy (2002); Vasudeva-Dutta (2004)	Low returns to primary relative to secondary & higher
Argentina, Brazil, Chile, Guatemala, Indonesia, Mexico, Mongolia, Philippines, Singapore, Thailand, Venezuela, Vietnam	Patrinos, Ridao-Cano and Sakellariou (2009)	Except for Cambodia, China, Colombia (males) & Bolivia, highest returns for university
Nigeria	Aromolaran (2006)	Returns to secondary education are double of primary

If the pattern of returns to different levels of education is indeed changed in this way, then primary school completion is not sufficient any more to provide access to lucrative jobs and reduce poverty.[†] The poor would need to attain well beyond primary education in order to enjoy high labor market rewards that enable them to climb out of poverty. The definition of basic education is also changing, now it is not just primary school completion or six years of schooling. In addition, while more years of schooling are required, higher academic standards and learning outcomes are needed. The world is becoming more educated – or, at least, more schooled – and the average return to a year of schooling is going down, as would be predicted by human capital theory (see Figure 3).

Figure 3: Average Private Returns to an Additional Year of Schooling over the Decades



[†] Nevertheless, education would continue to be important in a rights-based perspective and due to its social benefits such as reductions in fertility and mortality, empowerment, better democratic participation, enlightenment and so on.

3. Detecting and measuring distribution/heterogeneity in the returns to education

Do all individuals face the same return to education, or are some individuals more likely to benefit from education than others are, and why? What are the policy implications of that? Certain examples can help better understand the notion: (1) if we want to design a policy that induces individuals to go to college (for example, a tuition subsidy), we would ideally target it to individuals who are likely to be induced to go to college by this policy; and (2) if high-income individuals have higher returns than low-income individuals, then investments in education will generate more inequality.

The reasons to be concerned about heterogeneity are not simply that there is variance. If there were no variance in earnings, then one could not even compute returns to schooling. Some variation is very useful. But it is the extreme variation that may be a problem, in the sense that it limits the effectiveness of education policy. Detecting it is one thing. But knowing how to interpret it and what policies to put in place is the real challenge. For instance, increasing returns as one goes from the lower to the higher end of the earnings distribution has been interpreted as an indication that ability and education (or skills) complement each other, with more able workers benefiting from additional investment in education. On the other hand, a negative relationship between ability and returns to education (decreasing returns with quantile) may be interpreted as evidence of substitutability between education and ability. Finally, if there is no distinct pattern, then average returns (in the absence of biases in their estimation) capture the overall profitability of education. The question is empirical: which pattern best fits the evidence and are there variations across groups of countries?

3.1 Measuring heterogeneity

The standard human capital pricing function assumes that earnings are determined by schooling and experience, sometimes unobserved ability. This restrictive version of the human capital model imposes that the return to education experience is the same for all workers. Models are needed that incorporate heterogeneity in the returns (Lemieux 2008). The issue of heterogeneity and the limitations of the rate of return literature are also picked up on (Heckman, Lochner and Todd 2006). Moreover, the standard model is estimated typically using Ordinary Least Squares (OLS) regressions. However, relying on OLS estimates for the average individual will not suffice for policy purposes. Recently, an increasing number of studies investigate the pattern of returns to an additional year of education along the earnings distribution using quantile regression (QR) analysis.[‡] The quantile regressions method allows an investigator to differentiate the contribution of regressors along the distribution of the dependent variable – in our case the contribution of education along the conditional distribution of wages. An examination of the results of recent studies (several for developed countries and a handful for developing countries) may suggest that certain stylized facts are emerging. In particular, in developed countries of North America and Europe we tend to observe increasing returns with quantiles, while in much of East Asia we tend to observe decreasing returns by quantile. In middle- and low-income countries the evidence is mixed. All this is not to say that the Mincerian earnings function, what has become the dominant specification in analyses of earnings, where (the log of) earnings is a

[‡] There are a number of other methodologies that have been used in literature to identify heterogeneous returns. These include Instrumental Variable (IV) technique, estimation of Marginal Treatment Effects (MTE) and Quantile Regression among others (see for instance, Card 2001; Duflo 2001; Heckman and Vytlacil 2000 and 2005; and Buchinsky 1994 and 1998). Whereas, the first methodology may give a very accurate estimate of returns for those induced to more education by a certain policy, this is only so if the instrument really corresponds to the policy under consideration. The Marginal Treatment Effect is a simple extension of the IV technique and can be used to characterize heterogeneity and construct estimates of policy relevant and other returns. However, this methodology is strongly subject to data limitations.

function of schooling, experience and experience-squared, is not useful; in fact, it is one of the longest lasting specifications in economics, and estimates of returns from this equation have been calculated for more than 100 countries. As a first approximation, it is entirely appropriate (Chiswick 2003). It remains a parsimonious and accurate way of modeling the relationship between education and earnings (Lemieux 2006a).

In this paper we also estimate quantile regression estimates of the returns to education. This allows us to assess the differences in the schooling related pay increment across the wage distribution. Thus, we compare the returns to education for the "skilled" and the "unskilled" workers (conditional on their schooling and experience) in order to shed light on the contribution of schooling upon within-levels wage inequality (the methodology is described in detail in Technical Annex 1). If we assume that education is exogenous then the QR approach tells us the return to education for people with different levels of ability.[§]

The few studies that have examined the wage impact of education across the earnings distribution have focused on high-income countries and show education to be more profitable at the top of the distribution. The implication is that education may increase inequality. Higher returns at upper ends of the distribution are documented for all but one European country examined—the exception is Greece.[**]

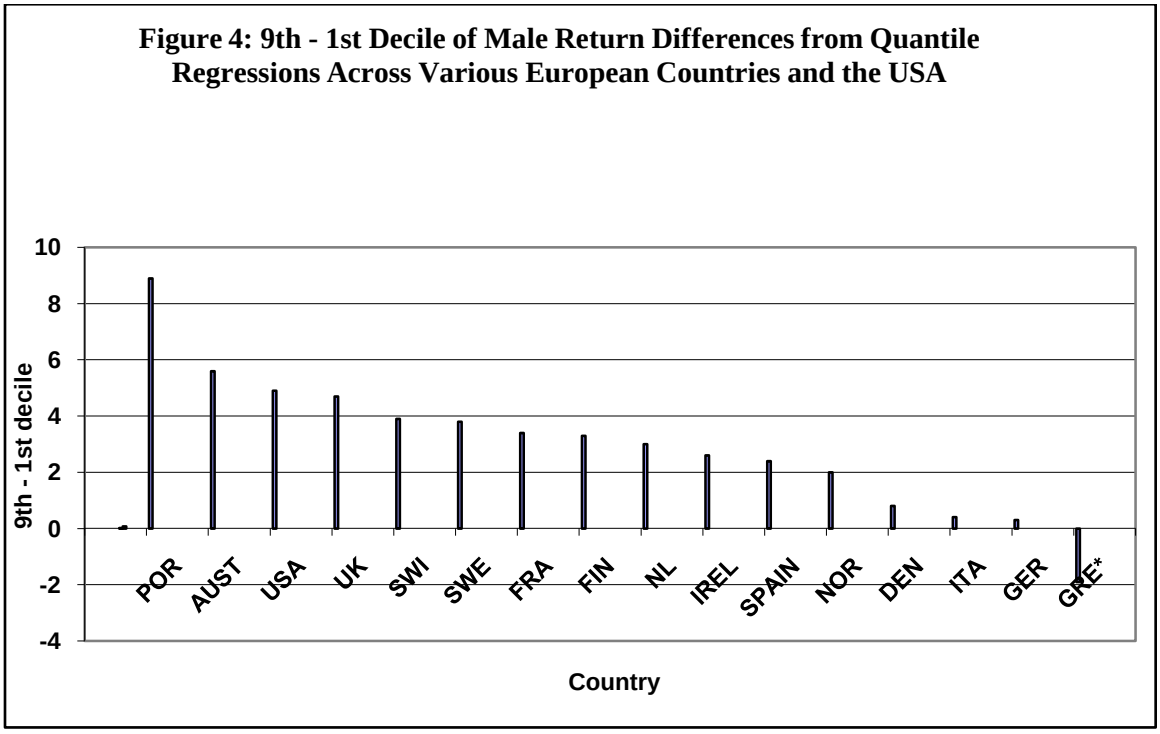
Denmark, Germany and Italy could be considered borderline cases (Martins and Pereira 2004; see Figure 4). The same is true for the United States (Buchinsky 1998), where this phenomenon

[§] However, *a priori* we cannot assume that education is exogenous. Thus, we cannot say that the return to education for, say, the 90th percentile gives the true return to education for high ability people, purged of ability bias. The same caution is given in Arias, Hallock and Sosa-Escudero (2001), who cite QR studies of returns to education (Buchinsky 1994; Machado and Mata 2001; Schultz and Mwabu 1998) and say that the results of these studies should be interpreted with caution since they do not handle the problems of endogeneity bias.

[**] However, the data for Greece do not allow for a straightforward comparison with the other countries, as they are based on net wages. Progressive taxation is likely to have a stronger impact in eroding the returns to education at the top of the distribution than at its bottom. This may explain the Greek results.

helps explain the rapidly increasing earnings inequality associated with rising rewards for educational qualifications at a time of tremendous schooling expansion. Therefore, for almost all developed countries, returns are higher at the top of the earnings distribution. It could be a high income phenomenon, since the returns are also higher at the top in Singapore (Patrinos et al. 2009) and for whites in South Africa (Mwabu and Schultz 1996); but then this is not the case for Korea (Lee and Lee 2002) or for other groups in South Africa (Mwabu and Schultz 1996).

Figure 4: 9th - 1st Decile of Male Return Differences from Quantile Regressions Across Various European Countries and the USA

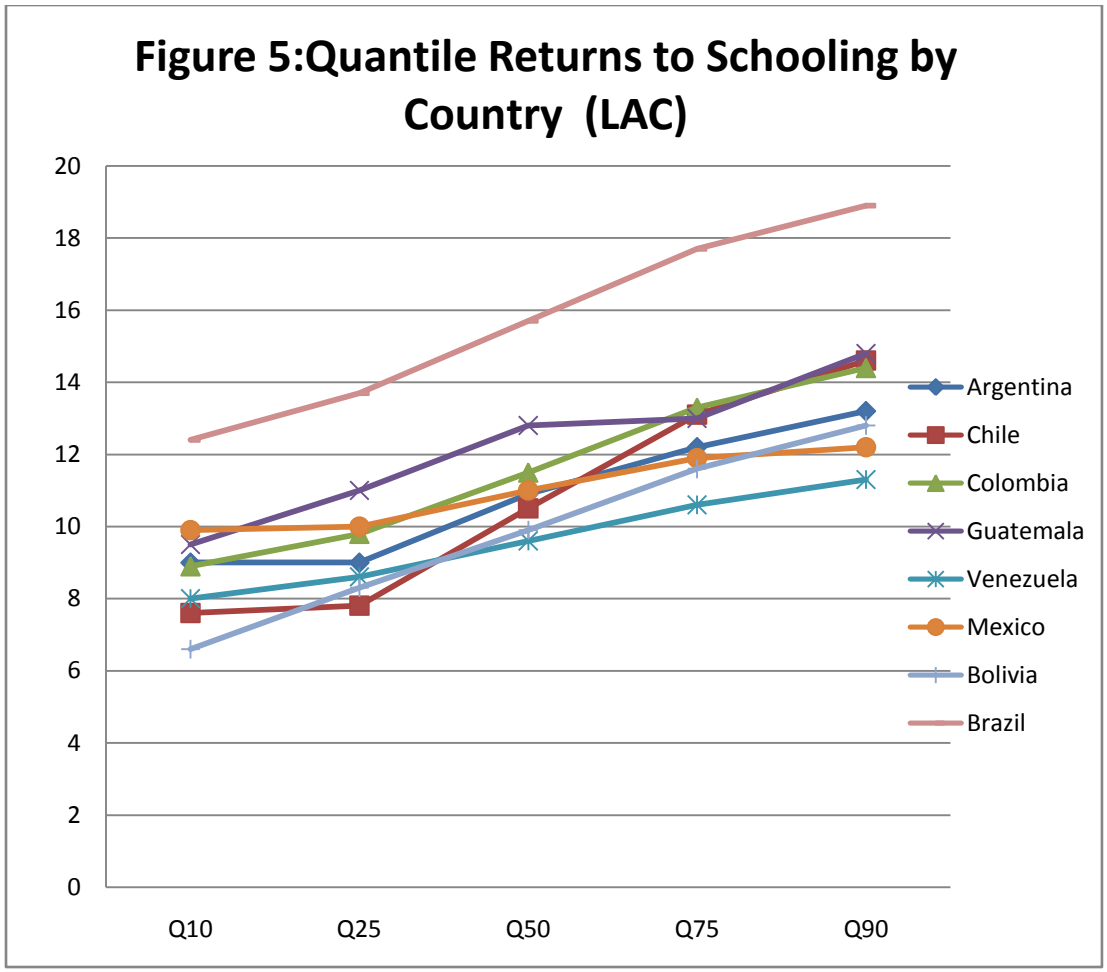


Source: Martins and Pereira (2004)

In the United States, the returns for university graduates are higher at the higher quantiles. However, for high school graduates returns are lower at higher quantiles in 1972 and 1979; but this pattern is reversed in the post-1985 period, during which an increase in wage differentials by education has been documented (Buchinsky 1998). Lemieux (2006b) presents evidence from

quantile regressions, as well as estimates from a human capital model with heterogeneous returns, to show that most of the increase in wage inequality in the United States between 1973 and 2005 is due to a dramatic increase in the return to post-secondary education. His evidence also helps explain why both the relative wages and the within-group dispersion among highly educated workers have increased over time. These findings add to the growing evidence that changes in wage inequality are increasingly concentrated in the very top end of the wage distribution. In another paper, Lemieux (2006c) looks at the timing of the growth in residual wage inequality in the United States and challenges previous suggestions that there was a pervasive increase in the demand for skills due to skills-biased technological change. He shows that a large fraction of the 1973–2003 growth in residual wage inequality is due to composition effects linked to the secular increase in experience and education; two factors associated with higher within-group wage dispersion.

Returns increase by quantile for Latin American countries, while returns decrease by quantile for most East Asian countries. Patrinos et al. (2009) examined quantile returns for eight Latin American and eight East Asian countries (see Figure 5). They find that returns increase by quantile for all Latin American countries, while returns decrease by quantile for seven of eight East Asian countries examined; the exception is Singapore, a high-income country. Interestingly, there is no pattern for Korea, as shown in Lee and Lee (2002). The high income and/or Latin American pattern is consistent with human capital theory, in that wages rise with education, and unobserved ability.



Source: Patrinos, Ridao-Cano and Sakellariou 2009

Educational attainment in the East Asian countries examined, and employed in the formal sector, ranges from 7 to 11 years of schooling for males with an average of 9.8 years, and between 5 and 13 years with an average of 9.9 years for females. In Latin America, the averages are 9.0 and 10.2 years of schooling for men and women. The typical rate of return – or average from OLS – for another year of schooling for the average person for males in East Asia is comparable to the average for Latin American countries, at 10.2 to 11.6 percent. Generally speaking, wage effects are considerable for all countries, especially Thailand and Brazil. In only three cases are the

estimates less than 10 percent – which is the global average (Psacharopoulos and Patrinos 2004). Therefore, it is not the general effect or average effect of education on earnings; that is, it does not matter if returns are high or low, that determines the equity pattern. The Latin American countries display uniform results. While the expectation may have been that for countries such as Argentina and Chile the pattern will be similar to that of high income countries, and this is confirmed, a mixed pattern may have been expected for the rest. However, the results exhibit a pattern more akin to high income countries in every other country examined.

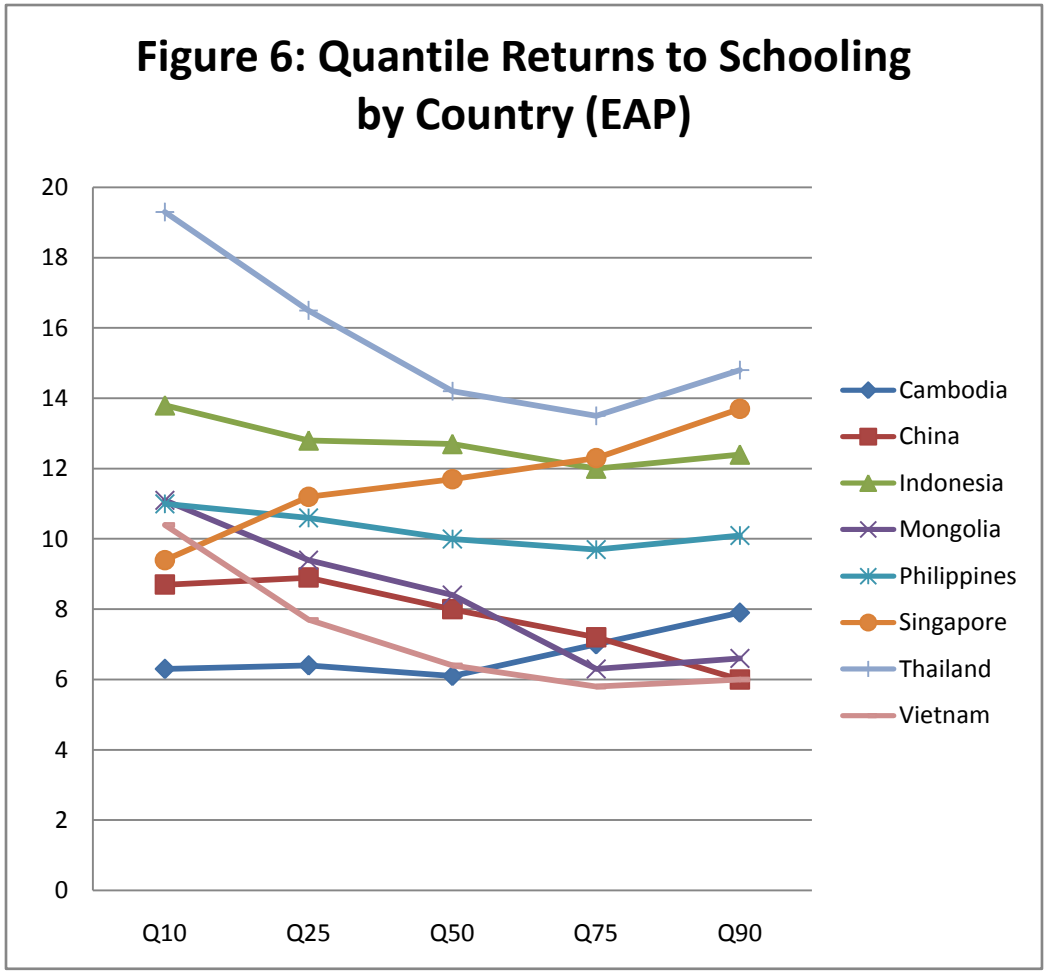
In general the East Asian pattern is equalizing. The lower quantiles have higher returns or the pattern is flat (see Figure 6). Even in countries where the pattern is not equalizing, the level of variation is much less than in, say, Latin America. In Indonesia there is a slightly decreasing pattern along the conditional distribution of earnings (90^{th} to 10th decile difference of -1.4 percentage points). In the private sector, the pattern along the conditional distribution of earnings is flat, at about 10-11 percent, while in the public sector the pattern is U-shaped, with the highest wage effect at the two ends of the distribution (14 percent).

Quantile returns estimates for men in the Philippines indicate that the rate of return to an additional year of schooling is approximately constant across the wage distribution, at about 10 percent, and this is the case for males in the private sector. However, as in the other countries examined, the return is clearly decreasing in the public sector (90^{th} to 10^{th} inter-quantile difference of -5.9 points), suggesting that public sector employment has an equalizing effect.

In Thailand, while on average, no public sector wage premium was detected, quantile estimates of the wage gain from one additional year of schooling reveal not only considerable within group heterogeneity but also different patterns between sectors. Overall, one additional year of

schooling results in over 19 per cent increase in earnings at the bottom (10th) percentile of the wage distribution, compared to just below 15 per cent at the 90th percentile. The inter-quantile difference in wage effects, however, is much larger in the public sector, where the wage gain at the 10th percentile is as much as 22 per cent compared to less than 14 per cent at the 90th quantile. On the other hand, in the private sector, differences are small.

In China, quantile regression estimates for men show that the same pattern in the coefficients of years of schooling as in almost all other countries examined is exhibited. Within education qualifications, a clearly decreasing pattern is observed in the case of university and vocational education qualifications, while no clear pattern is observed for general secondary qualifications.

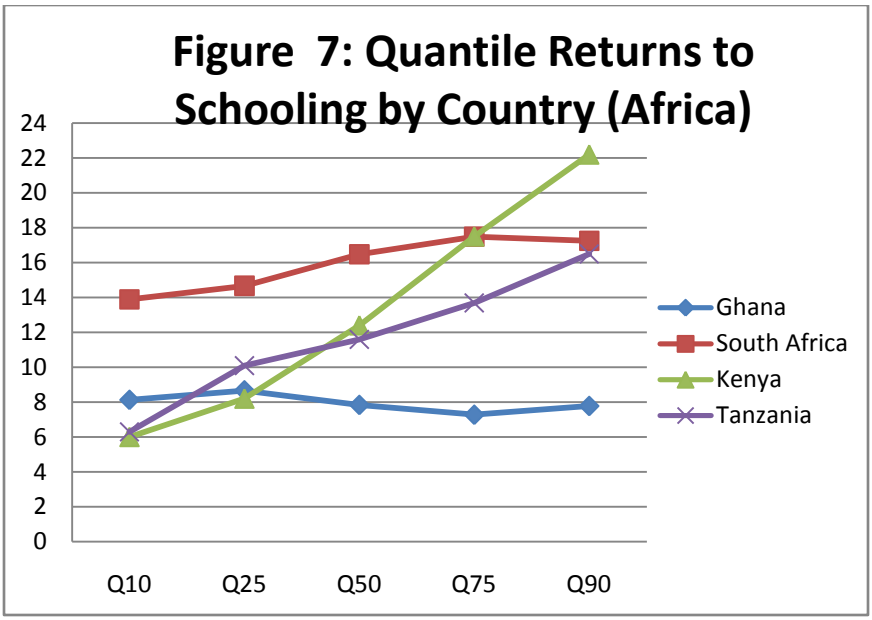


Evidence for other middle and low-income developing countries is scarce, especially for the latter. For low-income developing countries, Girma and Kedir (2005) present evidence for Ethiopia. After controlling for endogeneity using parents' education, they find that education is more beneficial to the less able. In particular, returns in the lowest (10^{th}) quantile of the earnings distribution (at about 20 percent) are twice that in the highest (90^{th}) quantile.

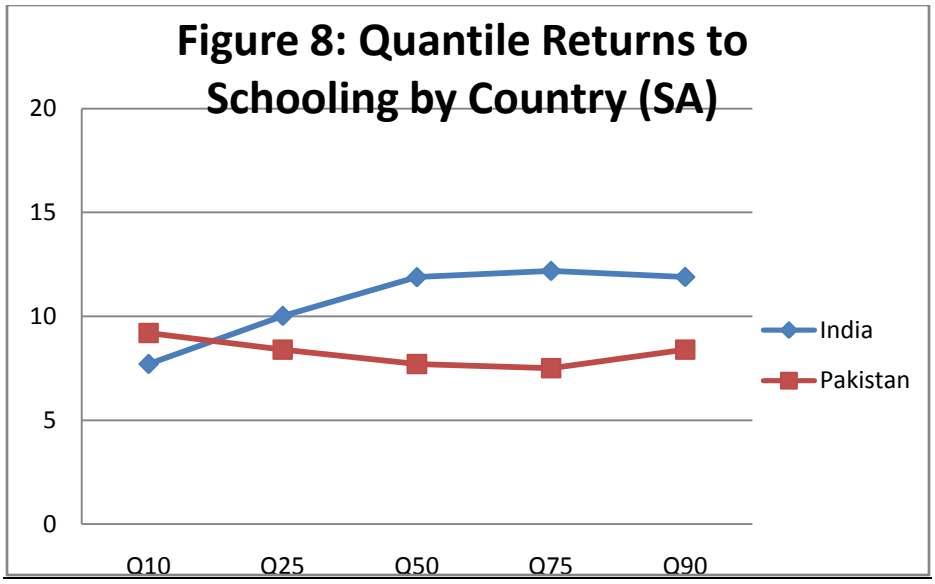
For South Africa, an upper middle income economy, Mwabu and Schultz (1996) derive quantile-returns estimates for white and non-whites in 1993. They find that, among Africans, returns do not increase by their decile in the distribution of residuals, while among whites, returns to higher education increase significantly, from 9 to 18 percent. This is interpreted as evidence that ability and higher education are complements for whites (one-third of whom obtained this form of education) and substitutes for African males, at least at the primary level. The returns to schooling in South Africa are high for an upper middle income country. In 2003, male returns were on average 16.4 percent and for females 18.7 percent (see Figure 7).

In Ghana, a low income country in Africa, the returns across the distribution are very flat – and low overall with an average return of only 8.2 percent – ranging from 7.3 to 8.7 percent for males. For Ghanaian females, however, schooling is much more equalizing, with returns of 14 percent at the bottom of the wage distribution and only 8 percent at the top; therefore highly equalizing.

For Kenya and Tanzania, our evidence is from employer surveys; therefore, the results may not be representative of the entire labor market. In both Tanzania and Kenya, education is highly disequalizing.



In South Asia, India and Pakistan, both low income countries, demonstrate opposite results. That is, the returns are higher at the top of the distribution in India, as they are in predominantly higher income countries. In Pakistan, returns are higher at the bottom of the distribution (see Figure 8). Thus education is highly disequalizing in India, while in Pakistan the schooling is slightly equalizing, given that the lowest quantile of men has a higher return. The difference in Pakistan is not great though, and across the distribution the returns vary only from 7.5 to 9.2 for males. For females in Pakistan education is much more equalizing with low ability females experiencing a very high 26.3 percent return, compared to 15.2 for the top end of the distribution.

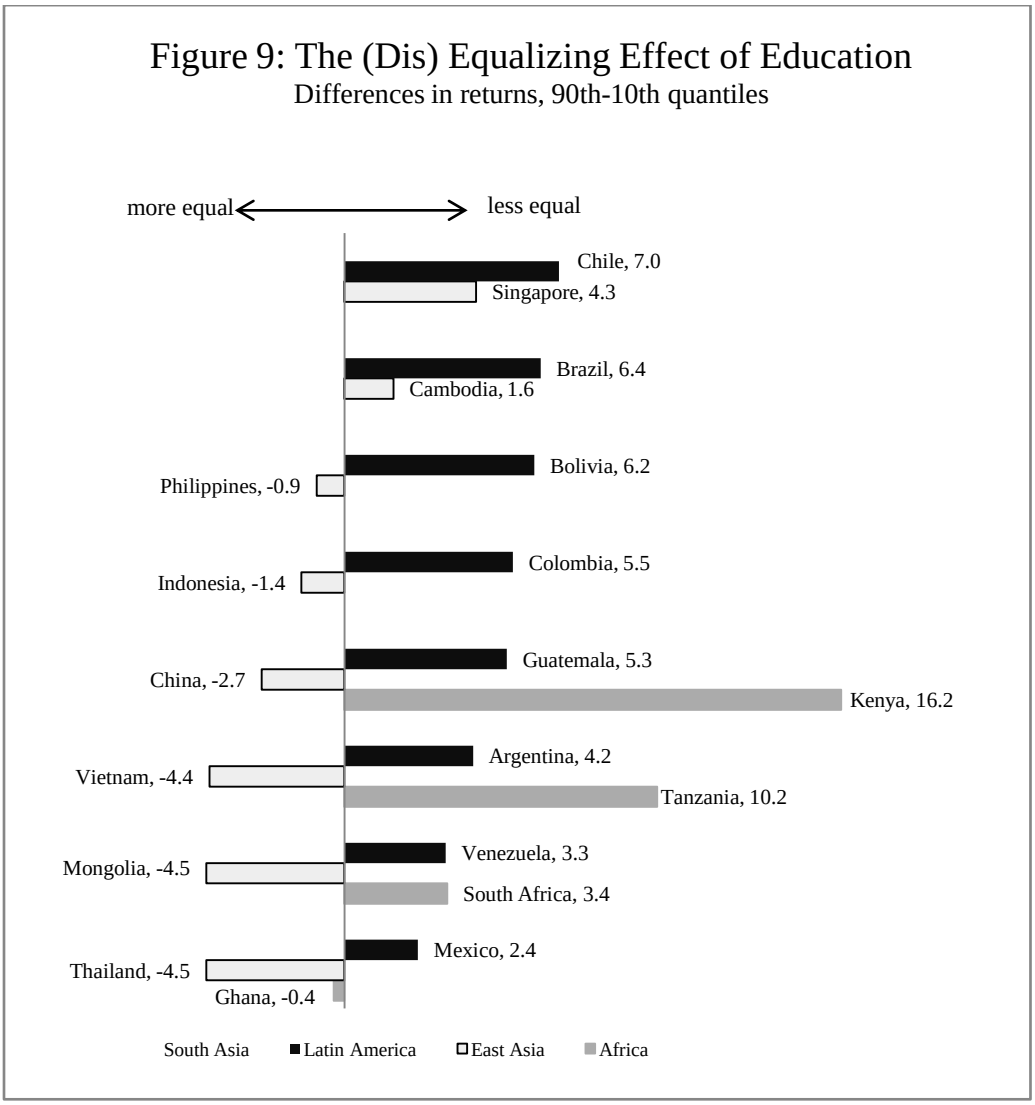


4. Interpreting policy relevance of heterogeneous returns

4.1 Sector differences – The public versus the private sector

The equalizing effect of education in East Asia is presented in Figure 9. The effect is more pronounced in the public sector. In Vietnam, Thailand, the Philippines and China, it is found that the profitability of an additional year of schooling for males 25-65 years of age exhibits a declining pattern, while an increasing pattern was observed for Cambodia. However, returns in the small private sector in Vietnam clearly increase with higher unobserved skills, returns in the Thai private sector exhibit a slightly increasing pattern, while in the private sector of the Philippines they decrease only slightly. In the case of Cambodia, the overall increasing pattern can be attributed to the strongly increasing wage effect in the private sector, while in the much larger public sector we observe a flat (or slightly decreasing) wage structure. The average 9^{th}-1^{st} quantile difference in public sector returns in the East Asian countries is -5.4 percentage points, compared to about 2.6 percentage points in the private sector (see Figure 10). On the other hand, returns in all countries for which an overall increasing pattern is observed exhibit an increasing

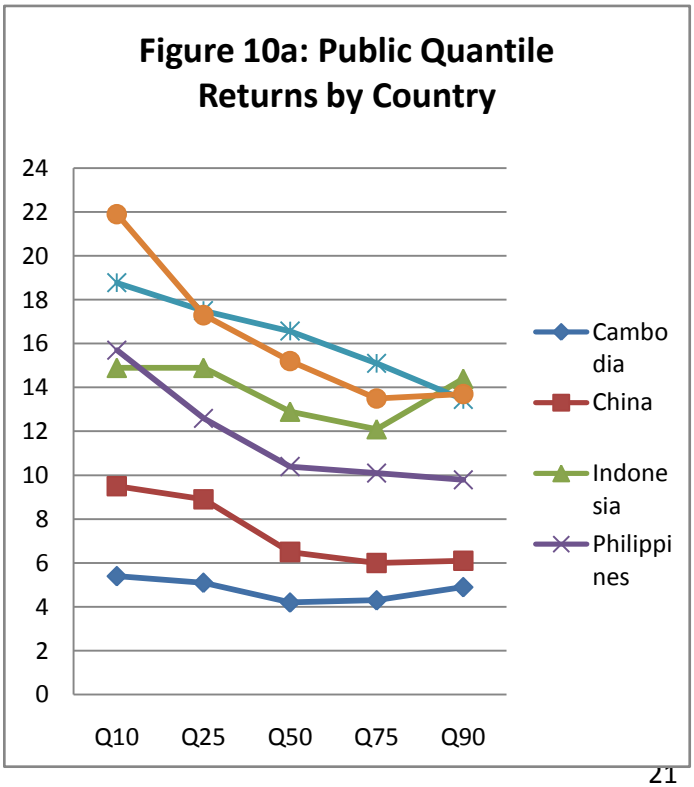
pattern in both the private and public sectors (with the exception of Mexico where returns in the public sector are flat); this pattern is more pronounced in the private sector (7 country average of 6.7 versus 3.2 percentage points in the private and public sectors).

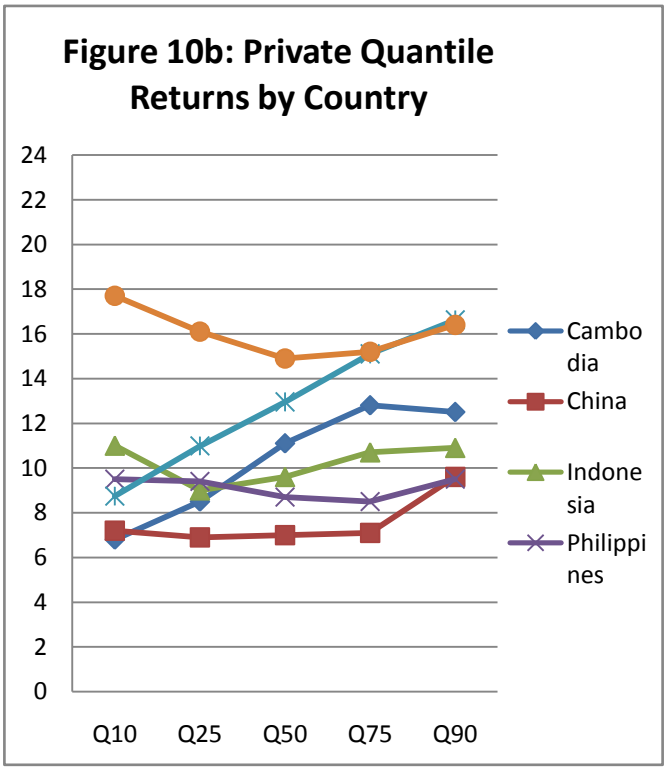


The government is the largest employer in several East Asian countries, and in most countries (even developed ones) the two sectors use different criteria in recruiting and promoting workers, setting wage scales in relation to productivity and the role of collective bargaining and trade unions tends to be different. These differences are expected to result in sorting of workers into

the two sectors, and a different distribution of earnings across sectors affecting overall within-groups wage inequality. Schooling is a risky investment and a measure of risk is differences in wage effects across quantiles. Public sector employment involves less risk as the impact of schooling on within-groups wage dispersion is substantially smaller in the public sector (and in the case of the East Asian economies examined, more schooling has an equalizing effect); furthermore, the public sector provides more job security. Recent evidence shows that in Pakistan (Hyder 2007) and Cambodia (Lall and Sakellariou 2010), a year of education yields a greater increase in wages in the private sector than the public sector (despite more educated workers being attracted to the public sector of both countries) and that there is a different reward system in the private sector (where the earnings gap is small) compared to the private sector.

While it would be difficult to provide a complete explanation for the lower within-group dispersion, the distribution of unobservable skills and other characteristics between the two sectors will likely figure in any explanation. Assume for example that workers located at higher





quantiles of the distribution have more favorable characteristics (including unobserved skills such as motivation) and that these characteristics interact positively with schooling. In the public sector, due to less pressure for wages to be flexibly associated with productivity, stronger unions, political appointments, and in general certain entrenched practices associated with the public sector, this sector will tend to have a more homogeneously skilled work force, a flatter wage structure and lower earnings at the top of the wage distribution compared to the private sector. Under such a wage structure, while the public sector would be able to attract workers with above average formal schooling, it would be difficult to attract workers with favorable unobserved skills even with higher average wage offers. Borjas (2002) reports that offering higher wages in the United States public sector is not enough to attract high quality workforce due to low earnings at the top of the earnings distribution (see also Budria 2006).

The strongly decreasing pattern of wage effects in the public sectors of East Asian countries is responsible for the overall observed decreasing pattern. Wage effects in the private sectors of these countries are non-decreasing. Such differences between countries and sectors could be due to differential exposure to market forces. Therefore, the Latin America-East Asia differences may relate to different labor markets (as well as different sectors within the same labor market) having a differential exposure to market forces and the link between pay and productivity. In particular, in exploring within sector differences, one can divide the data into the competitive (private) and the uncompetitive (public) sector. Psacharopoulos (1979) looked at such a distinction between private and public sectors and argued that wages may exceed productivity in the public sector but not in the private sector. Other research suggests that the public sector pay premium is declining as one moves up the conditional wage distribution, suggesting that the profitability of public sector employment is higher in the lower end of the wage distribution

(Poterba and Rueben 1994; Mueller 1998). Some evidence for developing countries exists in Skyt-Neilsen and Rosholm (2001) for Zambia and Hyder and Reilly (2005) for Pakistan, who find a sizable public-private sector differential; however, this differential declines monotonically with movement up the conditional wage distribution. Budria (2006), instead of looking at the impact of public sector status on the conditional wage distribution, examined wage differences within education groups in the private and the public sector in eight European countries and compares the effects of schooling on the conditional distribution of each sector. He found that, while the average impact of schooling on wages is similar across sectors, the impact of schooling on within-groups dispersion is substantially larger in the private sector than in the public sector. He concludes that the effects of educational expansion on overall within-groups dispersion may be lower than previously thought, as previous studies did not consider the public sector.

In general, the evidence suggests that increasing wage effects are generally observed in the private sector. This is true for both developed and developing countries. Thus, more schooling unambiguously increases within group inequality in the private sector. In the public sector of developed countries (Europe and North America) and Latin America, increasing wage effects are still observed, but the dispersion is considerably lower compared to the private sector. Finally, in the public sector of a number of low income developing countries where the distorting pay and employment policies in the public sector are particularly severe, wage effects in the public sector (and overall, when there is a large presence of the public sector in the economy) are decreasing with quantiles and the presence of the public sector in the economy reduces the impact of educational expansion on the overall within-groups wage dispersion.

4.2 Levels of education

Using years of schooling in the wage equation implies that the impact of one additional year of schooling on within-group earnings dispersion is the same, irrespective of education level. Using education levels in the wage equation instead of years of schooling allows for further insight on differences across educational qualifications. Budria and Pereira (2005) used quantile regression analysis to estimate the returns to different education qualifications in nine European countries. They find that returns to education generally increase with quantiles and that education (especially tertiary) has a positive impact on within group dispersion.

Looking at the pattern of wage effects by quantile, in East Asian countries (where a decreasing pattern by quantile is found), the pattern of wage effects at the primary and secondary level is mixed, while at the tertiary level we generally see a decreasing pattern (with the exceptions of Singapore and Cambodia). A consistent finding, however, is that the effects of university education decline through the 75th quantile and subsequently rebound at the highest quantile. In Latin America, generally speaking, an increasing pattern is observed within every education level. Exceptions are found in the case of primary education in Guatemala, Brazil and Colombia and tertiary education in Mexico (see Tables 2 to 8).

Table 2: Differences in Returns between 90th and 10th quantile among Males by Country (LAC)

	Primary vs. < Primary	*Low secondary vs. Primary*	*Upper secondary Voc. vs. Low Sec.*	*High Technical vs. Secondary*	*University vs. Upper sec. General*
Argentina	5.9	2.3	0.3	2.8	4.4
Chile	8.5	8.5	13.4	-	8.3
Colombia	-1.3	2.5	-	4.5	11.7
Guatemala	-12.6	6.8	-	-	5.0
Venezuela	1.4	3.9	-	0.6	8.4
Mexico	3.7	-0.9	10.0	-	-4.4
Bolivia	11.4	1.2	-	4.5	19.2
Brazil	-6.4	5.6	5.6	-	5.9

Table 3: Differences in Returns between 90th and 10th quantile among Males by Country (EAP)

	Primary vs. < Primary	*Low secondary vs. Primary*	*Upper secondary General vs. Low Sec.*	*Upper secondary Voc. vs. Low Sec.*	*University vs. Upper sec. General*
Cambodia	0.2	1.3	4.1	-	7.2
China	7.2	-9.8	2.5	-3.9	-7.9
Indonesia	-8.2	-4.3	-7.5	-7.2	1.1
Mongolia	28.1	-4.5	-4.7	-4.5	-7.2
Philippines	-5.4	-3.3	3.3	-	2.9
Singapore	11.3	-	4.1	2.8	1.5
Thailand	-4.4	0.4	-6.7	-5.5	-3.6
Vietnam	-20.9	0.4	0.9	-3.9	-7.0

Table 4: Differences in Returns between 90th and 10th quantile among Males (South Asia)

	Primary vs. < Primary	*Low secondary vs. Primary*	*Upper secondary General vs. Low Sec*	*University vs. Upper sec. General*
India	-21.8	7.5	3.8	-2.7
Pakistan	0.4	-8.7	-2.4	7.6

Table 5: Differences in Returns between 90th and 10th quantile among Males (Africa)

	Primary vs. < Primary	*Low secondary vs. Primary*	*Upper secondary General vs. Low Sec.*	*University vs. Upper sec. General*
Ghana	14.6	40.9	-44.6	-3.0
Kenya	18.9	22.4	-	-10.4
South Africa	-5.2	14.2	9.2	-12.1
Tanzania	5.2	15.9	-	-8.0

Table 6: Differences in Returns between 90th and 10th quantile among Females (South Asia)

	Primary (vs. < Primary)	*Low secondary (vs. Primary)*	*Upper secondary General (vs. Low Sec.)*	*University(vs. Upper sec. General)*
India	-5.5	34.8	2.0	-9.3
Pakistan	6.8	21.3	-68.1	-5.8

Table 7: Differences in Returns between 90th and 10th quantile among Females (East Asia and Pacific)

	Primary (vs. < Primary)	*Low secondary (vs. Primary)*	*Upper secondary General (vs. Low Sec.)*	*Upper secondary Voc. (vs. Low Sec.)*	*University(vs. Upper sec. General)*
Cambodia	2.4	4.7	14.9		7.9
China	-13.3	12.6	-1.2	-12.5	-8.6
Indonesia	-17.4	16.2	-23.6	-18.9	-3.1
Philippines	2.4	-	-3.1	1.4	-11.3
Thailand	-9.5	-20.1	-2.7	-5.6	-6.5

Table 8: Difference in Returns between 90th and 10th quantile among Females (Africa)

	Primary vs. < Primary	*Low secondary vs. Primary*	*Upper secondary General vs. Low Sec*	*University vs. Upper sec. General*
Ghana	-25.0	6.2	1.3	-21.2
Kenya	28.6	21.7	-	.-
South Africa	4.0	4.5	25.8	-28.2
Tanzania	7.6	16.7	-	-28.6

There are larger premiums for higher education qualifications. One consistent finding is that wage premiums are higher for those with university, but also for higher vocational qualifications. This was the case for Indonesia and Cambodia (monotonically increasing premiums as one goes form lower to higher qualifications), as well as the Philippines (premiums for university

qualifications more than twice those for lower qualifications), Thailand (largest premiums for university qualifications), and China (highest premiums observed for university and upper secondary vocational qualifications). These findings are of interest given similar recent findings, even from African countries. Existing literature based on empirical evidence from a large number of studies in both developed and developing countries implies an empirical tendency for private internal rates of return to education to decrease at higher levels of education. This was first observed by Becker (1964) for the United States (for other countries, see Psacharopoulos and Woodhall 1985; Psacharopoulos and Patrinos 2004). However, along with the frequently discussed evidence of an increase in the returns to college educated workers in the United States (see, for example, Katz and Autor 1999; Acemoglu 2002; Lemieux 2006c) and evidence of the same for a host of countries, such as Brazil; Chile; Colombia; Mexico; Korea; Taiwan, China; Indonesia; Thailand; and China (Topel 1999; Schultz 2004). Schultz (2004) finds that evidence from recent representative surveys in Africa confirms the same regularity. It was found that in six African countries (Ghana, Cote d'Ivoire, Kenya, South Africa, Nigeria and Burkina Faso) the wage gains associated with each year of higher education are relatively attractive by world standards at between 10 and 15 percent. Schultz (2004) finds it ironic that world leaders of higher education are reluctant to consider wage structures for policy purposes because they think that wage returns to higher education are low and that large returns to education are probably evidence of distorted labor markets.

4.3 Interpreting the quality of schooling link – PISA and dispersion

One possible contributing factor to the observed pattern of returns is the interaction between ability and schooling, which results in an amplification of the impact of ability upon earnings. Another possible explanation has to do with school quality differences. In particular, it may be

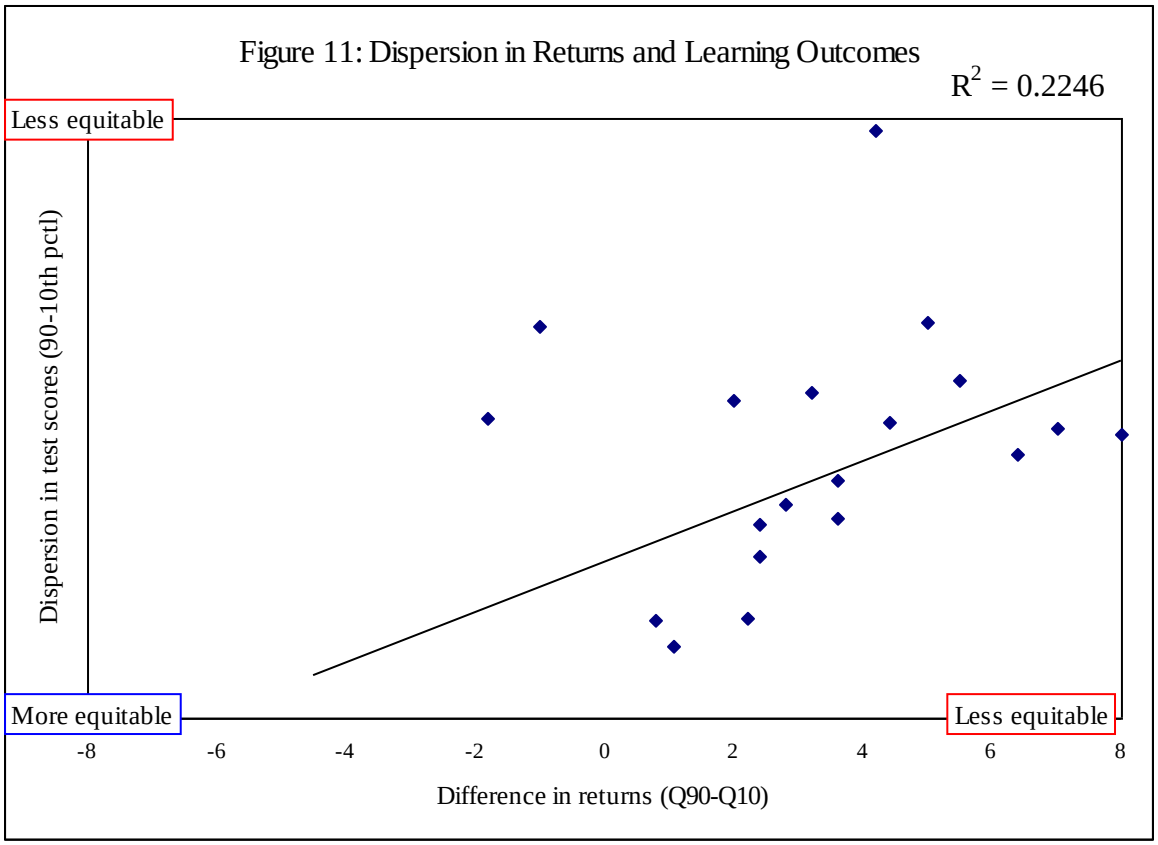
that individuals who do worse in the labor market (for a given school attainment), are those individuals who received lower quality schooling (World Bank 2008). This is a difficult proposition to test without adequate information. However, there are several international student assessments that would allow us to look at the question of achievement and inequality. The assessments can be used to rank countries; but they can also be used to estimate equality in learning as well, such as the dispersion in learning outcomes. Is there a relationship between dispersion in learning outcomes and dispersion in returns?

There appears to be an association between dispersion in learning outcomes and dispersion in returns. Figure 11 shows dispersion in returns measured as the difference between the 90^{th} and 10^{th} quantile and dispersion in learning measured as the difference in 90^{th} and 10^{th} percentiles. There is an apparent association. The lower the dispersion in test scores, the lower the dispersion in returns. Despite the limited sample of countries, since we are limited to countries that participated in PISA and for which we have quantile return estimates, there is a clear link. In fact, all East Asian countries in our sample exhibit low dispersion in test scores and low dispersion in returns.

Korea is known as a country that excels in ensuring that all students learn. Efforts are made to equip students with the teachers and resources they need to succeed. At the middle school level, a national lottery is held to assign students to private schools. That is part of the Government's high school equalization policy, in effect since 1973. Initially a response to growing demand for better schools and rampant private tutoring, under this policy the competitive entrance exams were substituted with random assignment of students for all secondary schools (both private and public). In addition, the government subsidizes private schools. Under the equalization policy, all schools, public or private, had to give up their rights to select new students and are required to

take all students assigned by the Ministry of Education through the district-wide lottery. While the policy has contributed to the remarkable expansion of secondary school enrollments, competition for better colleges and private tutoring has not decreased. The policy has raised both equity and average achievement level of Korean 15-year-olds. Meanwhile, the lack of competition and diversity among secondary schools created little incentives for schools to respond to the need of students and parents.

Other countries with low test score and returns dispersion are Denmark, Ireland, Mexico and Spain. Mexico is interesting given that Latin America is known for high levels of inequality. Most countries in Latin America have high levels of income inequality, and typically unequal access to schooling, especially among the poor, rural and indigenous populations. Low academic achievement in Latin America is also accompanied by high levels of learning inequality. The dispersion in test scores is typically very high in Latin America. While it is surprising that the returns dispersion is relatively low in Mexico, it is even more surprising that the dispersion in learning outcomes is one of the lowest of all PISA performing countries. While Mexico does not have an equalization policy, there is evidence of specific policy interventions that tend to increase equity at the primary education level. The Government's compensatory education interventions target schools in disadvantaged rural areas and increase resource allocations for those schools to give students more equal opportunities. Compensatory education programs tend to decrease dispersion in scores. Perhaps the cumulative impact of compensatory education from basic education is carried over to lower secondary schools, and explains in part the high equity observed in PISA results.



4.4 Summing up the evidence

We hypothesize that there might be a relationship between a country's development stage (as this is reflected in their labor market characteristics) and the impact of schooling on earnings by quantile. In the OECD it is clear that education is a complement to unobserved skills (or abilities), and that education investment will increase inequality, other things being equal. We observe cases where the OECD pattern does not apply. The idea behind our approach is that if wage effects are higher at the top end of the earnings distribution than at the bottom end (as is the case for OECD countries and, based on our findings, other high and middle income countries), then education tends to increase earnings inequality, since education is a better investment for the better off. On the other hand, if skills and education are substitutes, then the least skilled will benefit more from education and education tends to reduce earnings inequality.

The question that remains is what explains the observed patterns (increasing or decreasing). Explanations that have been cited in previous studies relate to:

(1) The presence of more job mobility in developed countries. That is, higher levels of schooling and higher levels of unobserved skills (therefore higher levels of human capital), allow workers to change jobs, to improve their position, and therefore earnings.

(2) The scarcity of skills. Based on the relationship between a country's development stage and the pattern of wage effects from additional schooling, the argument might be that the lower the human capital in a country, the more equal the impact of schooling on earnings by quantile. This could apply to countries such as Ethiopia, some East Asian countries and the case of Blacks in South Africa. Latin American countries on the other hand historically have higher levels of income inequality and this may relate to the nature of the results for Latin America.

(3) Differences in the quality of schooling. In particular, the deviation from the OECD pattern could be due to differential access to quality education or distribution of quality outcomes (based on measures such as test scores).

However, without discounting the possible relevance of such explanations when considering differences between developed and less developed countries, they do not seem to be convincing in our case (that is, different patterns between East Asian and Latin American countries). For example, there are no significant differences in educational endowments between these two groups of countries. Likewise, it is unlikely that, on average, there are significant differences in quality of education between the two groups of countries. We, therefore, hypothesize that there is another possible explanation for the differences in observed patterns, namely within sector (public vs. private) differences within each country.

5. Conclusions

It is a universal fact that, in all countries of the world, the more education one has the higher her earnings. Knowing the empirical returns to schooling is useful for policymaking. However, averages are not so useful in a world of heterogeneity. For policy purposes, understanding how heterogeneous the returns estimates are is important.

Oftentimes, policymakers portray schooling as the best tool to decrease earnings inequality. However, the distribution of the returns is an important piece of information.

Increasing returns as one goes from the lower to the higher end of the earnings distribution has been interpreted as an indication that ability and education (or skills) complement each other, with more able workers benefiting from additional investment in education. The few studies that have examined the wage impact of education across the earning distribution have focused on high-income countries and show education to be more profitable at the top of the distribution. In the United States, the returns for university graduates are higher at the higher quantiles. Returns increase by quantile for Latin American countries, while returns decrease by quantile for most East Asian countries. The East Asian pattern is equalizing. In South Asia, India and Pakistan, both low income countries, demonstrate opposite results.

The equalizing effect in East Asia is more pronounced in the public sector. The strongly decreasing pattern of wage effects in the public sectors of East Asian countries is responsible for the overall observed decreasing pattern. In general, the evidence suggests that increasing wage effects are generally observed in the private sector. The profitability of public sector employment is higher in the lower end of the wage distribution.

The growing importance of post-primary education is evident in several countries. There are larger premiums for higher education qualifications. If the pattern of returns to different levels of education is indeed changed in this way, then primary school completion is not sufficient any more to provide access to lucrative jobs and reduce poverty.

One possible contributing factor to the observed pattern of returns is the interaction between ability and schooling, which results in an amplification of the effect of ability upon earnings. There appears to be an association between dispersion in learning outcomes and dispersion in returns.

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Annex: Quantile Regression Methodology

The ordinary least squares (OLS) regression relies on the mean of the conditional distribution of the dependent variable. When it is suspected that various explanatory variables (such as schooling and experience) influence parameters of the conditional distribution of the dependent variable other than the mean, quantile regressions are particularly useful, because they allow the full characterization of the conditional distribution of the dependent variable, rather than the conditional mean only. In short, the quantile regressions method allows an investigator to differentiate the contribution of regressors along the distribution of the dependent variable. In particular, the estimation of returns to education entails much more than the fact that, on average, one more year of education results in a certain percent increase in earnings.

The quantile regression model (Koenker and Bassett 1978; Buchinsky 1994) can be outlined as follows:

$$\ln w_i = X_i\beta_\theta + u_{\theta i},$$

$$X_i\beta_\theta = (\text{Quantile})_\theta(\ln w_i|X_i)$$

where X_i is a vector of exogenous variables; β_θ is the vector of parameters; $(\text{Quantile})_\theta(\ln w_i|X_i)$ is the θth conditional quantile of ln$w$ given X, with $0<\theta<1$. The θth quantile is derived by solving the problem (using linear programming):

$$\text{Min } \Sigma\rho_\theta(\ln w_i - X_i\beta_\theta),$$

$$\beta \in R^k \; i$$

where $\rho_\theta(\varepsilon)$ is the check function defined as $\rho_\theta(\varepsilon) = \theta\varepsilon$ if $\varepsilon \geq 0$, and $\rho_\theta(\varepsilon) = (\theta-1)\varepsilon$ if $\varepsilon < 0$. Standard errors are bootstrap standard errors. The median regression is obtained by setting $\theta = 0.5$ and similarly for other quantiles. As θ is varied from 0 to 1, the entire distribution of the dependent variable, conditional on *X*, is traced.

The quantile approach has a number of useful features, in addition to allowing the full characterization of the conditional distribution of the dependent variable. These include: (a) the linear programming representation of the quantile regression model makes estimation easy; (b) the quantile regression objective function is a weighted sum of absolute deviations, resulting in a robust measure of location, so that the estimated coefficient vector is not sensitive to outlier observation on the dependent variable; (c) when the error term is non-normal, quantile regression estimates may be more efficient than OLS estimators (Buchinsky 1998).

Estimated returns to education at different quantiles can provide further insight into within-education level/skill group changes and differences in returns at the upper and lower level of the income distribution, as well as differences by sex.

Quantile regressions are also used to estimate standard earnings functions (Mincer 1974), which involves the fitting of a function specified as:

$$\ln Yi = \alpha + \beta Si + \gamma_1 EXi + \gamma_2 EX^2 i + \varepsilon i,$$

where lnY is the natural logarithm of monthly wage, S is the number of years of schooling of individual i, and EX and EX^2 are the years of experience and its square.

The corresponding level of education equation is:

$$\ln Yi = \alpha + \beta_1 PRIMi + \beta_2 SECi + \beta_3 HIGHER + \beta_4 UNIVi + \gamma_1 EXi + \gamma_2 EX^2 i + \varepsilon i,$$

where PRIM, SEC, HIGHER and UNIV refer to dummy variables for primary, secondary, higher and university education, from the formulas:

$$r_{(PRIM)} = \beta_1 / S_{PRIM}$$

$$r_{(SEC)} = (\beta_2 - \beta_1) / (S_{SEC} - S_{PRIM})$$

$$r_{(HIGHER)} = (\beta_3 - \beta_2) / (S_{HIGHER} - S_{SEC})$$

$$r_{(UNIV)} = (\beta_4 - \beta_2) / (S_{UNIV} - S_{SEC})$$

where $S_{PRIM,}$ S_{SEC}, S_{HIGHER} and S_{UNIV} are the total number of years of schooling for each successive level of education.