Returns to investment in education: a decennial review of the global literature

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ABSTRACT

In the 60-plus year history of returns to investment in education estimates, there have been several compilations in the literature. This paper updates Psacharopoulos and Patrinos and reviews the latest trends and patterns based on 1120 estimates in 139 countries from 1950 to 2014. The private average global return to a year of schooling is 9% a year. Private returns to higher education increased, raising issues of financing and equity. Social returns to schooling remain high. Women continue to experience higher average returns to schooling, showing that girls' education remains a priority.

Introduction

With roots in the writings of classical economists (see, for example, Adam Smith 1776; Marshall 1890) the link between education and earnings only recently emerged. Formal modeling did not take place until much more recently (Schultz 1960, 1961; Becker 1964; Mincer 1974; Chiswick 2003). The study of earnings by schooling has led to several empirical works testing hypotheses on a great variety of social issues. These include, for example, racial and ethnic discrimination, gender discrimination, income distribution, and the determinants of the demand for education. But the dominant application that has used earnings by level of education is the estimation of the rate of return to investment in schooling.

The concept of the rate of return on investment in education is very similar to that for any other investment. It is a summary of the costs and benefits of the investment incurred at different points in time, and it is expressed in an annual (percentage) yield, like that quoted for savings accounts or government bonds. Returns on investment in education based on human capital theory have been estimated since the late 1950s. Human capital theory puts forward the concept that investments in education increase future productivity.

Estimation of the returns to education has been a popular subject in the literature (Ashenfelter and Krueger 1994; Becker 1964; Becker and Chiswick 1966; Card and Krueger 1992; Card 2001; Duflo 2001; Heckman, Lochner, and Todd 2006; Oreopoulos 2006; Rosenzweig 1995; Schultz 1961). Since our last review of the literature, contributions on the subject have grown exponentially, to the point of being difficult to track (for previous compilations see Harmon, Oosterbeek, and Walker 2003; Psacharopoulos 1972, 1973, 1981, 1985, 1993, 1994; Psacharopoulos and Patrinos 2002, 2004a). There have been several compilations that we have undertaken, including a few encyclopedia articles (Patrinos and Psacharopoulos 2010, 2002; Psacharopoulos and Patrinos 2008, 2004b). There are also a few attempts to create databases of comparable estimates of the return to schooling (Hendricks 2004; Montenegro and Patrinos 2014; Peet, Fink, and Fawzi 2015).

The popularity of estimating returns to education stems from the resulting efficiency, equity and financing implications. The rank order of returns to a level or type of education, and a comparison with the returns of alternative investments can assist education policy makers to make informed investment decisions.

Previous compilations have shown that private returns to primary education decline over time, but slightly (Psacharopoulos 1981). Previous work also shows that returns are highest for primary education, the general curricula, the education of women, and countries with the lowest per capita income (Psacharopoulos 1985). Also, primary education continues to exhibit the highest social profitability in all world regions. Social and private returns at all levels generally decline by the level of a country's per capita income. Overall, the returns to female education are higher than those to male education. The returns to the academic secondary school track are higher than the vocational track – since the unit cost of vocational education is much higher; and the returns for those who work in the private (competitive) sector of the economy are higher than in the public (noncompetitive) sector (Psacharopoulos 1994).

The classic pattern of falling returns to education by level of economic development and level of education is maintained. The private returns to higher education are increasing, highest returns are recorded for low-income and middle-income countries, average returns to schooling are highest in Latin America and the Caribbean (Psacharopoulos and Patrinos 2004a). Returns to investment in education provide the opportunity for people to raise incomes and for society to reduce inequality. But if investments in education do not keep pace with rising demand, then inequality may increase. This could be interpreted as a 'race between education and technology' as discussed by Tinbergen (1975). In fact, high or increasing returns suggest that the price of education is increasing even though supply is going up.

In this update we follow the tradition (see, for example, Psacharopoulos and Patrinos 2004a) and present the latest estimates and patterns. We review estimates from 139 countries over several years resulting in a panel of 1120 country-year cases.

Methods

Returns to education in the literature have been estimated using two main methods – the full-discounting method and the Mincerian earnings function. For an explanation of these methods see Psacharopoulos (1995) and Psacharopoulos and Mattson (1998). Over the years, researchers have given preference to the Mincerian method because of its convenience (Mincer 1974).

The concept of rate of return to education

The rate of return to schooling equates the value of lifetime earnings of the individual to the net present value of costs of education. For an investment to be economically justified, the rate of return should be positive, and should be higher than the alternative rate of return. For the individual, weighing costs and benefits means investing if the rate of return exceeds the private discount rate (the cost of borrowing and an allowance for risk).

The costs incurred by the individual are the foregone earnings while studying, plus any schooling fees or incidental expenses incurred. The private benefits amount to how much extra an educated individual earns (after taxes) compared with an individual with less education. *More* and *less* in this case refer to adjacent levels of education – e.g. university graduates compared to secondary school leavers.

The social rate of return includes the society's spending on education – for example, money spent on renting buildings and professorial salaries. The social attribute of the estimated rate of return refers to the inclusion of the full resource cost of the investment – the direct costs by government and the foregone earnings of students as they invest in their education. Ideally, the social return should be measured by including non-monetary and external benefits of education, such as the

number of lives saved because of improved sanitation conditions followed by a woman because she has received more education. Given the scant empirical evidence on the social benefits of education, the social rate of return estimates are usually based on directly observable monetary costs and benefits of education. In this sense, they could be characterized as 'narrow-social' returns. Since the costs are higher in a social rate of return calculation relative to the one from the private point of view, social returns are typically lower than a private rate of return. The difference between the private and the social rates of return reflects the degree of public subsidization of education – since practically the only difference is the addition of social costs.

Estimation issues

The Mincerian earnings function has been the subject of controversy in the literature (Psacharopoulos and Layard 1979; Heckman, Lochner, and Todd 2006). One issue with the Mincerian method of estimating returns to education is missing variables, e.g. ability bias. Griliches (1977) analyzed the issue many years ago. He found that the bias is small or negative. Adding more variables to the equation will not solve the problem and might add other biases (Patrinos 2016).

The earnings premium associated with the level of education suggests that productivity increases as people acquire additional qualifications. An alternative view is that earnings increase with education due to credential effects. This refers to the idea that higher levels of schooling are associated with higher earnings, not because they directly raise productivity, but because they certify that the worker is likely to be productive. In this sense, education merely sorts workers according to their unobserved attributes; it does not necessarily augment their intrinsic productivity. For public policy reasons it is important to distinguish between the human capital (productivity) and screening hypotheses about returns to education. In very basic terms, these two hypotheses mean, respectively: schooling imparts skills that enhance productivity; hence, increases in earnings are due to the increased productivity brought about by investments in schooling (human capital); while the screening hypothesis maintains that employers select workers with higher qualifications to reduce their risk of hiring someone with a lower capacity to learn; in this case, higher earnings may not be due to productivity alone (screening). With these concepts in mind, if the only purpose of schooling is to sort prospective employees, then questions arise as to the appropriateness of public investment in the expansion or improvement of schooling.

Layard and Psacharopoulos (1974) found no support for the screening hypothesis. Psacharopoulos (1979) made a distinction between the weak and the strong versions of the screening hypothesis. It is true that, at the hiring point, employers do not have enough information on the prospective productivity of a job applicant, so they might offer a premium to those who have a higher level of schooling relative to the rest. This is the weak version of screening. But after years on the job, such premium should diminish if the worker did not live up to the expectations. Such finding contradicts empirical data showing the earnings gap between more and less educated workers increases over time.

Card (2001) provides a rigorous test of the screening hypothesis by taking advantage of natural experiments such as changes in the school leaving age or college openings. By and large, while some evidence of weak screening is revealed, education is generally associated with higher earnings due to productivity rather than to screening. A recent analysis that uses rigorous evaluation techniques to compare the earnings of workers who barely passed versus those who barely failed high school exit exams finds little evidence of diploma screening effects (Clark and Martorell 2014).

More recent analyses, which exploit data that permit the disaggregation of earnings by years of completed schooling, have questioned the linear nature of the earnings function approach. Furthermore, due to ongoing and rapid technological progress, cross-sectional data based on observations from many years in the past may produce biased estimates of the returns to schooling. Some have even questioned whether it is still possible to interpret the coefficient on schooling as a rate of return (Heckman, Lochner, and Todd 2006). For instance, some researchers argue that the literature following Mincer's estimated returns to schooling using cross-sectional data assumes that younger workers

base their earnings expectations on the current experiences of older workers. However, if prices (the cost of schooling, for example, tuition associated with university) change over time and workers can at least partially anticipate these changes, then estimates of the returns to different schooling levels based on cross-sectional data may not represent the ex-ante rates of return governing human capital investment decisions. Relying on past cohorts to assess current investment decisions requires several strong assumptions, such as stability of the economic environment and perfect certainty of future earnings streams. This is difficult in the current context, given that emerging evidence suggests that wage patterns have changed substantially over time, making it difficult to use cross sections to approximate lifecycle earnings. One solution could be to follow actual cohorts over their entire educational and employment lifecycles to measure their earnings patterns to estimate the returns to education. Brinch and Galloway (2012) exploit a reform that increased compulsory schooling from 7 to 9 years in Norway in the 1960s to estimate the effect of education on IQ. The schooling reform, which primarily affected education in the middle teenage years, had a substantial effect on IQ scores measured at the age of 19. This suggests that schooling increases general ability, casting doubt on the pure signaling model.

The debate is ongoing about the external validity and causality of rate of return estimates. More conclusive evidence will emerge once data on the lifetime earnings profiles of beneficiaries of voucher programs can be obtained, as many of these programs use lotteries to assign places, thus giving researchers access to randomized data. In 1981, Chile introduced nationwide school choice by providing vouchers to any student wishing to attend a 'voucher school' (essentially, a private school participating in the program, whereby the funding from the voucher would be used to pay the fees and tuition). Beneficiaries of the vouchers obtained more schooling and subsequently earned more than non-voucher students. Also, it is estimated that formal sector earnings are higher for lottery winners in Colombia's large-scale government program which used a lottery to distribute scholarships for private secondary school to socially disadvantaged students. Institutional factors have also been used to more precisely estimate the returns to schooling, including the effect of birth date. Those who are forced to remain in school because of their birth date and the school attendance law receive the same rate of return to education as those who voluntarily continue schooling.

The Mincerian method gives private returns, whereas the full discounting method can give private and social returns. In interpreting the evidence presented below, the reader should bear in mind that Mincerian and full-discount returns are not directly comparable because they differ in scale. This is because, by construction, the Mincerian method tacitly assumes foregone earnings even for children aged 6–12 years, thus underestimating the true size of the returns (Psacharopoulos and Mattson 1998; Psacharopoulos 1995).

In our exposition below we start with private returns based on the Mincerian method, then move on to the full-discounting method that includes social returns.

The database

The database includes rate of return estimates of investment in education in the published literature after the Psacharopoulos and Patrinos (2004) update, to which the new estimates were added. Consistent with our previous compilations, studies were selected based on our ability to extract a rate of return in a study. This was not an easy task, as many studies in fact report wage effects of education, rather than rates of return. When coefficients of an expanded Mincerian earnings function were reported by the author, but no rates of return, we estimated the returns using the formulas in Psacharopoulos (1994).

When using Mincerian estimates from regression coefficients, we opted for the most basic form of the earnings function that included only years of schooling, years of labor market experience and its square. When this was not possible, we reported the coefficient of years of schooling controlling for other variables.
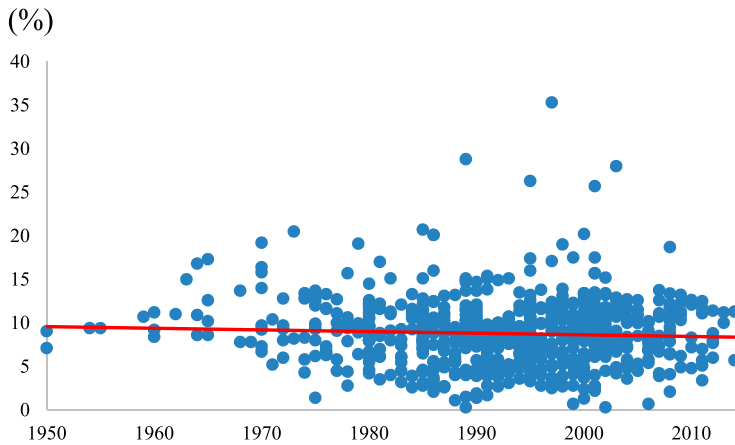
Figure 1. Rate of return to schooling over time.

Note: Regressing the overall Mincerian rate of return on the year of the estimate, gives: Return = 49.611–0.020Yea; R^2= 0.003 (t = 1.4)

Although the studies differ in terms of methodology, we did not censor them, accepting the publication legitimacy.

Results

Mincerian private returns

The coefficient on years of schooling of the basic Mincerian function gives an overall picture of the returns to education. Based on 705 estimates, over the years 1950 to 2014, the private rate of return to an additional year of schooling is 8.8% (see Annex 1; given the size of the database, only summary statistics are reported here, while the rest can be found online in Annex 2[1]). This is lower by about one percentage point relative to our (Psacharopoulos and Patrinos 2004a) compilation. It should be noted that the decline over time of the returns to education is very gradual and statistically insignificant (see Figure 1). This could be interpreted as a 'race between education and technology' as the price of education fails to decline proportionately in the face of rapid supply increases (Tinbergen 1975). Thus, demonstrating that the demand for skill is outpacing the growth in supply of skills.

Regressing the Mincerian overall return on the country's years of schooling (*S*) in the survey year, yields a very small but statistically significant decline of the returns of about 0.2 percentage points for every additional year of schooling (see Figure 2).

Nevertheless, there has been an increase in the returns to schooling since 2000. Parsing the sample of estimates into pre- and post-2000 estimates, the returns have increased, albeit at a slower rate relative to the increase in the years of schooling (see Table 1). The schooling revolution of the twentieth century continues, with an average increase in schooling years of more than 10% in the first decade and a half of the twenty-first century, as compared with the latter half of the twentieth century. The returns to schooling increased in the twenty-first century by 4% relative to the latter half of the twentieth century.

Restricting the sample to the most recent estimate for each country, we get an average rate of return of 9.5%, just slightly lower than the 9.7% we obtained in our Psacharopoulos and Patrinos (2004a) update. Again, this could refer to Tinbergen's (1975) race between education and technology. The higher returns since 2000 suggest that the price of education is increasing even though supply is going up. This points to the interpretation that education is no longer winning the race.

Focusing on a single country is illustrative. For Colombia, we have a record of 35 return estimates over time (Psacharopoulos 1985, 1994; Patrinos 1995; Kaboski 2003; Sanchez Torres and Nunez Mendez 2003; Psacharopoulos, Arriagada, and Velez 1992; Psacharopoulos and Velez 1992; Tenjo
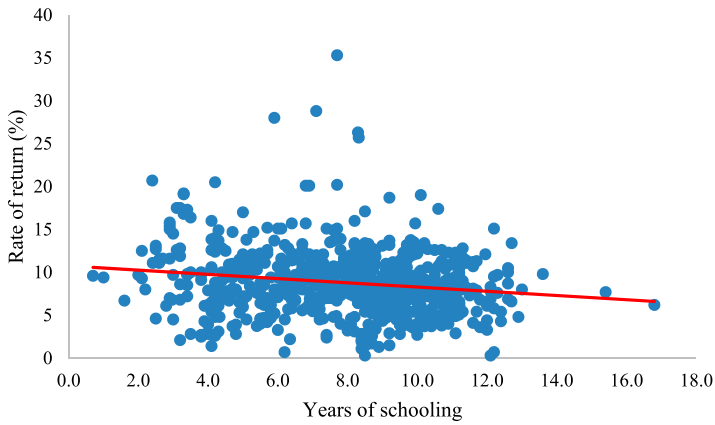
Figure 2. Return to schooling by years of schooling.

Note: Regressing the overall Mincerian rate of return on the year of the estimate, gives: Return = 10.749–0.246 S, R^2 = 0.027 ($t = 4.4$)
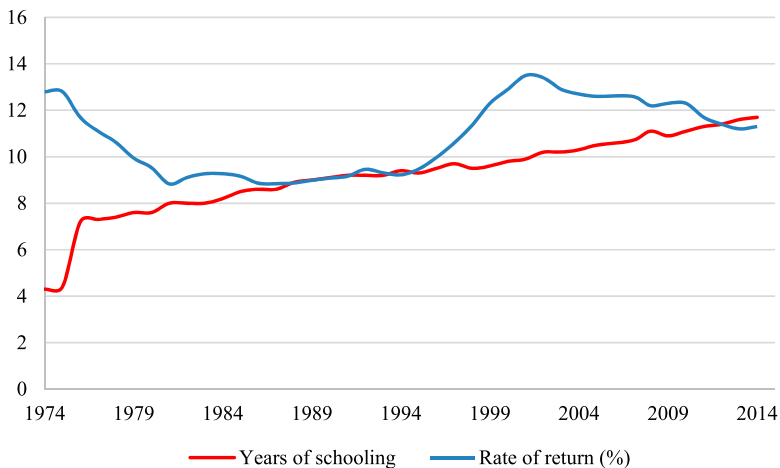
Table 1. Years of schooling and returns over time.

| Period	Mean years of schooling	Overall Mincerian rate of return (%)	Number of studies
Pre 2000	7.8	8.7	511
Post 2000	8.6	9.1	194

et al. 2015) since 1965. Taken together, we note a convergence to a 10% overall rate of return to a year of schooling. At the same time, average schooling had gone up considerably, from less than 5 years in the 1960s to more than 10 years by 2013 (see Figure 3).

Focusing on Argentina, for which we have Mincerian returns (Kaboski 2003; Psacharopoulos 1994; Kugler and Psacharopoulos 1989; López Bóo 2010; Fiszbein, Giovagnoli, and Patrinos 2007) over a 25-year period, we notice a remarkable stability of such returns even during the country's economic crisis (Figure 4). Note that the wide variation of the returns over time is due to different samples and methodologies.

This finding can be interpreted using Tinbergen's (1975) race between education and technology, in the sense that over time the education supply curve has been shifting more to the right relative to the demand curve. This is most evident in the returns to higher education (see Figure 5). While enrollment in

**Figure 3.** Returns and years of schooling over time: Colombia.
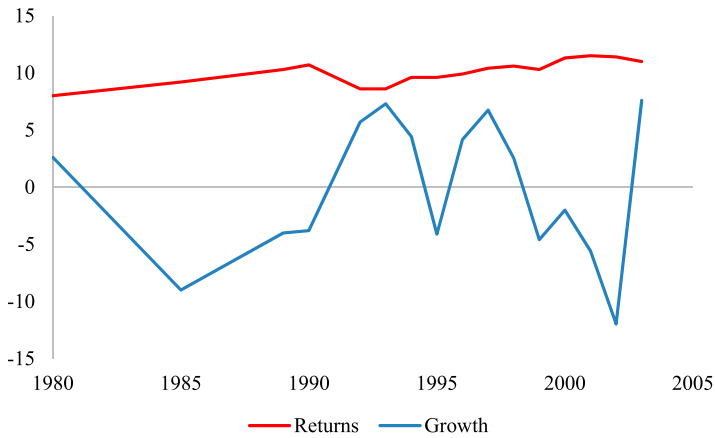
Figure 4. Returns to schooling and economic growth: Argentina.

Note: Source of change in GDP per capita is World Bank World Development Indicators.

higher education has gone up three-fold since 1970, the returns have not changed overall. The increased share of the labor force with higher education should have reduced the rate of return on the investment. Yet, the rates of return over time do not fluctuate much because as the supply of educated labor increases, so does the demand for higher skills, hence not depressing the returns to education. As discussed by Goldin and Katz (2010), the race reflects, on the one hand, the skill-biasedness of technological progress with its consequences for income inequality and the pivotal role of education in mediating this relation. While higher education increased substantially, the premium on high skills continued to increase. This suggests that educational advancements were insufficient to countervail demand due to technological progress. The rising inequality implies that technology is winning this race.

Income level and regional differences

Private returns to schooling are higher in low-income countries by about one percentage point relative to high-income countries (see Table 2). This is the case even though the mean years of schooling differs by a factor of almost two between country groups. In fact, years of schooling will peak, to about 10 years by 2050.
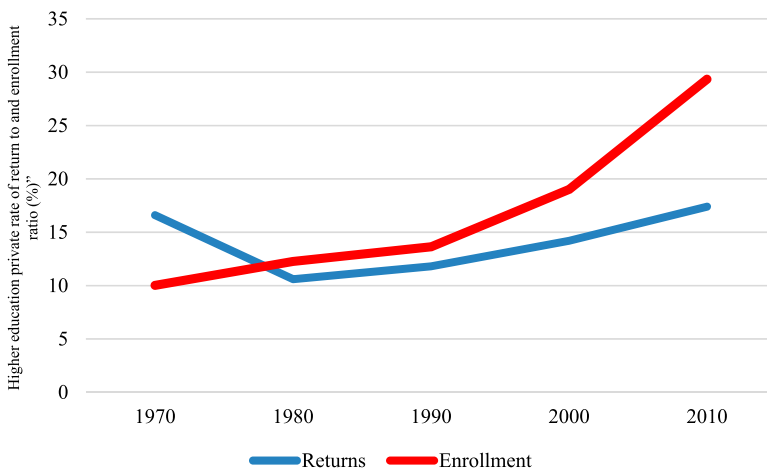
Figure 5. The race between higher education and technology.

Note: Returns are averages by decade from our compilation; enrolment rates come from the World Bank's EdStats database

Table 2. Private returns to schooling by income group.

Country income level	Overall rate of return (%)	Mean years of schooling
Low	9.3	5.0
Middle	9.2	7.0
High	8.2	9.2
World average	8.8	8.0

Note: Country per capita income levels based on World Bank (2016) classifications in 2015 US$: low = $1045 or less; middle = $1046–12,735; high = $12,736 or more.

Disaggregating further by world region, private returns to schooling are highest in Latin America and Sub-Saharan Africa and lowest in the Middle East and North Africa (see Table 3). The Middle East and North Africa is an outlier, given the relatively low average level of schooling. Kingsbury (2018) provides several hypotheses for the low returns citing such factors as corruption, natural resources and poor academic performance. While South Asia exhibits relatively low returns, within the region India has seen increasing returns since the economic liberalization program of the 1990s.

Gender

As in previous reviews, the private returns to female education exceed that of males by about two percentage points (see Figure 6). The gap has increased. The female advantage was just over one percentage point in previous updates (Psacharopoulos and Patrinos 2004a; Psacharopoulos 1994). This does not imply that earnings are higher for females, but only that education is a good investment for women and girls, and a development priority.

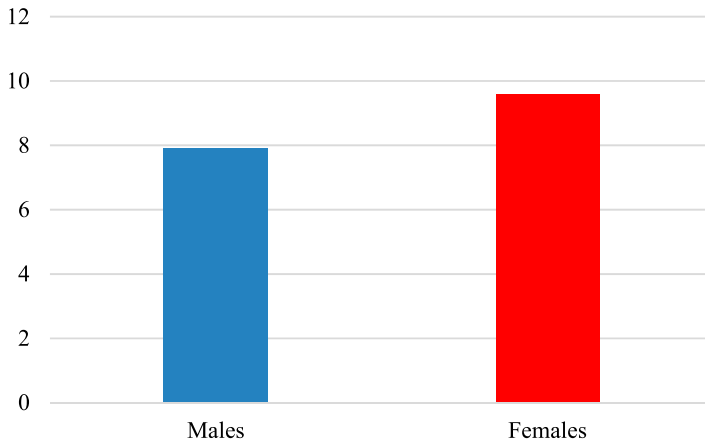## Private sector of employment

The returns for those working in the private sector of the economy are higher than for those working in the public sector. The finding lends credibility that, where productivity matters, education is recognized (Psacharopoulos 1983; Harmon, Oosterbeek, and Walker 2003). There is a clear earnings advantage for workers in the private sector (see Figure 7).

## Full discounting method and social returns

Based on 166 estimates using the full discounting method, the returns to schooling fall by level of economic development (see Table 4). The private returns to primary education are still high, but there are fewer countries where this calculation can be made given the drive for universal primary education. The private returns to higher education are substantial and have remained high since the last update. They have increased since the last update in both low- and high-income countries, falling only in middle-income countries. The returns to secondary education have declined, but not in high-income countries.

Table 3. Private returns to schooling by region.

Region	Overall rate of return (%)	Mean years of schooling
Latin America and Caribbean	11.0	7.3
Sub-Saharan Africa	10.5	5.2
East Asia and Pacific	8.7	6.9
South Asia	8.1	4.9
Advanced Economies	8.0	9.5
Europe and Central Asia	7.3	9.1
Middle East and North Africa	5.7	7.5
World average	8.8	8.0

Figure 6. Private Mincerian returns to education by gender.
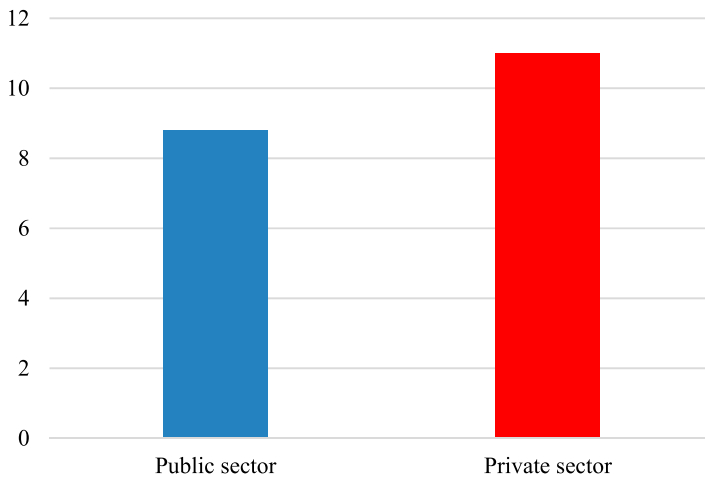
**Figure 7.** Returns to schooling by sector of employment.

The social returns follow the well-known pattern of falling by level of development and level of education. Social returns to education are universally lower than private returns because of the public subsidization of education. Social returns are lower than private because researchers can account for full social costs, but they do not include social benefits. The costs of higher levels of schooling are much higher, hence the lower returns (see Figure 8).

As a rule, returns are higher in lower-income countries relative to higher-income countries (see Figures 9 and 10). This can be attributed to the relative scarcity of human capital in the two types

Table 4. Returns by income and educational level (%).

Per capita income level	Private			Social		
	Primary	Secondary	Higher	Primary	Secondary	Higher
Low	25.4	18.7	26.8	22.1	18.1	13.2
Middle	24.5	17.7	20.2	17.1	12.8	11.4
High	28.4	13.2	12.8	15.8	10.3	9.7
Average	25.4	15.1	15.8	17.5	11.8	10.5

Note: The 'high' private return to primary education in high-income countries is due to an outlier 1959 estimate of 65% for Puerto Rico, a country classified as high-income under our current-per-capita income classification system.
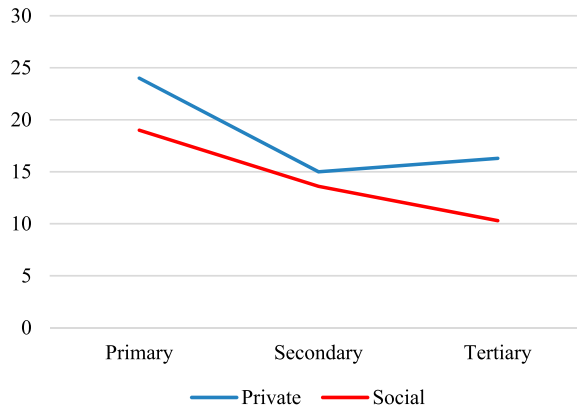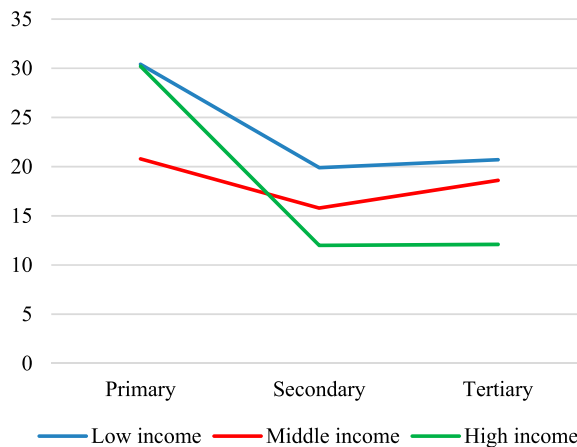
Figure 8. The pattern of private and social returns.

of countries. For example, the mean years of schooling of the labor force in Sub-Saharan Africa is 5.1, compared with 10.2 in advanced economies.
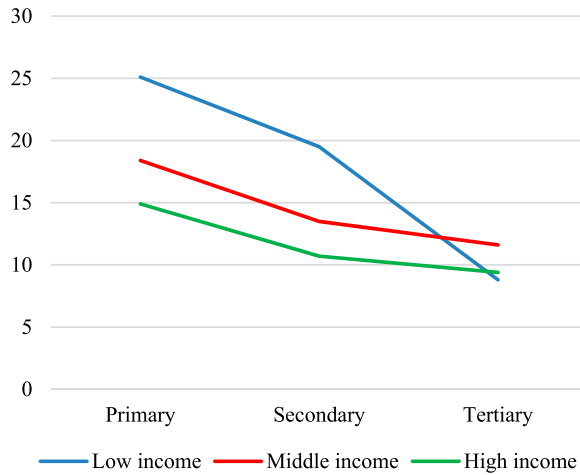
Private and social returns by region

In our previous analysis (Psacharopoulos and Patrinos 2004a) we presented estimates from 83 countries and showed that the returns to education were highest in Sub-Saharan Africa, the region with the lowest levels of schooling. With near universal primary education in most regions, it is becoming difficult to estimate returns to primary schooling using recent surveys and the full discounting method. Our update – using estimates since 2000 – is dominated by such returns from high-income countries, which exclude returns to primary education (since the comparison group, that is, workers with no education, is absent). Overall, private returns to secondary and higher education in high-income countries are high, at 13 and 12% (see Table 5).

In terms of social returns, these are higher than any plausible social discount rate though lower than private, across all income groups. The social returns to higher education are particularly high, but these are driven by returns in Africa, where the social returns to higher education are 35% in Malawi (Chirwa and Matita 2009) and 22% in South Africa (Salisbury 2016) – this of course implies that private returns to higher education are even higher.

Figure 9. The structure of private returns.

Figure 10. The structure of social returns.

Table 5. Private and social returns to schooling by region, post-2000 (%).

	Private		Social	
	Secondary	Higher	Secondary	Higher
Average	13.2	12.4	10.2	10.6
Developing countries	–	–	10.2	16.4
Number of studies	50	54	59	61

Note: For private returns, sample consists of high income countries plus Turkey; for social returns, two are from Africa, two are from Latin America, one is from Europe, one is from East Asia, and the rest are from high income countries.

Discussion

The rate of return patterns found in previous updates are upheld and reinforced. Regarding efficiency in the use of resources, spending on human capital is a good investment. For example, in the United States the long-term 1966–2015 average return on stocks and bonds is 2.4% (Damodaran 2016) versus a 10.5% overall private return to investment in education in our database for education.

Recent research indicates that the social rates of return reported above are under-estimates of the true returns because of the omission of externalities (Munich and Psacharopoulos 2018). Taking just one externality into account, the social rate of return to investment in education could be 50% higher than the one traditionally estimated. Monetizing the value of just one externality of education – reduced mortality – Pradhan et al. (2018) found that the social rate of return to investment in one extra year of schooling in low-income countries is 16%, relative to 11% based solely on earnings differentials.

In allocating an education budget among different levels of schooling, priority should be given to the lower levels of education in countries that have not yet achieved universal primary. In countries with disparities between male and female enrollment, priority should be given to the education of girls. The size of the private returns to education and difference between private and social rates calls for selective cost recovery in higher education. The overall 10%private return to one year of schooling has marginally declined since first estimated over half a century ago (see, for example, Becker 1964).

When making education decisions, it is very tempting to use estimates as those presented above for countries that lack such information. We emphasize that there is no substitute for a country-specific study. In such case, we recommend using the full discounting method as it is more appropriate relative to the Mincerian method.

Future updates will attempt to include estimates of the returns to school quality. Although there are plenty of macro studies in this respect, micro studies on the returns to investing in specific school quality inputs are emerging. One such study (Hanushek et al. 2015) uses a new survey of adult skills over the full lifecycle in 23 countries to show a one-standard-deviation increase in numeracy skills is associated with an 18% wage increase among prime-age workers.

Note

1. http://datatopics.worldbank.org/education/files/GlobalAchievement/ReturnsEdAnnex2.xlsx.

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(References to the database used in this compilation are found on-line in Annex 3.) Note: http://datatopics.worldbank.org/education/files/GlobalAchievement/ReturnsEdAnnex3.docx

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