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ABSTRACT

The Effect of Raising School Quality on Earnings

The evidence underscores the need to shift attention from school attainment to actual learning. While the average global return to an additional year of schooling is about 10 percent, a one standard deviation increase in test scores raises earnings by 15 percent. Studies show that including direct measures of skills reduces the estimated return to schooling, revealing the stronger role of quality. These findings suggest that education policy should prioritize learning outcomes, not just years in school, to more accurately reflect the economic value of education.

JEL Classification: I21, I26, J24
Keywords: returns to education, cognitive skills, earnings

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1. Introduction

Estimates of the returns to education are criticized for measuring only the quantity of schooling, with little regard for quality. While not a flaw in the rate of return methodology per se, this limitation stems from the difficulty of capturing learning outcomes. Despite these constraints, multiple studies highlight the significance of school quality in determining future earnings (Card and Krueger, 1992, 1996; Psacharopoulos and Velez, 1993; Bedi, 1997).

This paper offers a short review of the research, highlighting studies that estimate the effect of an increase in school quality, usually measured as an increase in test scores, on earnings. It builds on the literature that reviews such studies (Hoekstra, 2020; Ozawa et al., 2022) and contributes to our understanding of how learning affects earnings. Most research to date has focused on the extensive margin—the number of years of schooling. In contrast, studies of the intensive margin—school quality or learning outcomes—are relatively rare (Behrman and Birdsall, 1983).

This scarcity reflects limited longitudinal data and conceptual challenges in defining quality. While some adopt input-based proxies (expenditure per student, repetition rates), others focus on outputs, such as student achievement. However, the causal link between schooling and cognitive skills is often obscured by family background and prior knowledge (Carlsson et al., 2012).

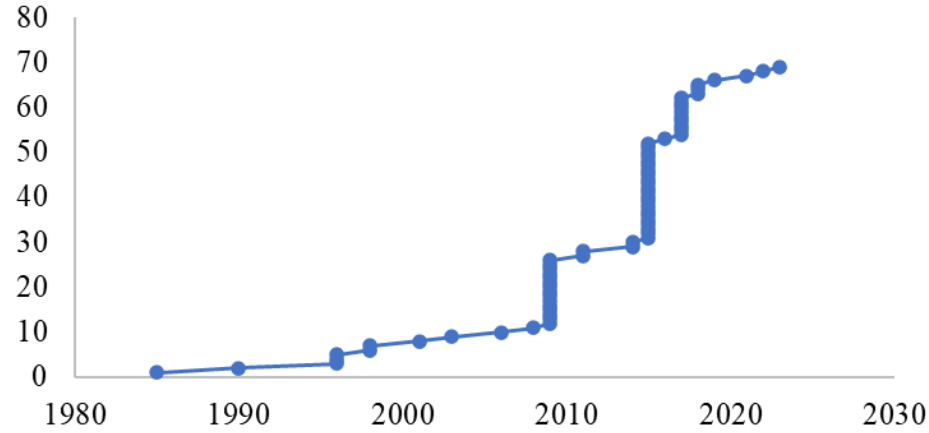
The paper is structured as follows. Section 2 presents the database and overall trends and differences by country income. Section 3 compares the obtained results to the brief macro literature on education and income, while the last part brings concluding remarks.

2. Empirical Evidence on Skills and Earnings

The database of studies estimate earnings associated with a 1 standard deviation (SD) increase in

learning outcomes numbers 72. That includes the studies in Patrinos and Psacharopoulos (2020) as well as in Hoekstra (2020) and Ozawa (2022), as well as those obtained through a database search. The studies cover 40 countries, 25 of which are high income and 15 middle-income according to the World Bank's classification – 6 lower-middle-income countries and 9 upper-middle-income. The data is published between 1985 and 2023, but most of the publications come after 2009. The modal year is 2015 (Figure 1).

Figure 1: Number of estimates by publication year, cumulative count



Several papers use access to more selective schools as the indicator of quality (eg, Hoekstra et al., 2018) using Regression Discontinuity and identifying the effect through test scores. Others use surveys that include cognitive tests and labor market outcomes and run modified Mincer equations (eg, Alderman et al., 1996). A few use natural experiment like settings such as the quasi-random timing of enlistment in Sweden (Lindqvist and Vestman, 2011) or use twins data (de Hoyos et al., 2021). Currie and Thomas (2001) use longitudinal data (Lin et al., 2018) and control for socioeconomic status. In Chile, Patrinos and Sakellariou (2011) used quantile regression to assess the importance of adult functional literacy. When literacy scores were included, the return to schooling dropped by 27 percent, equivalent to about two years of

education. At the same time, a one SD increase in literacy was associated with a 20 percent earnings increase. These findings suggest that skills—especially for low-skilled individuals—are more critical than additional schooling.

2.1 Results

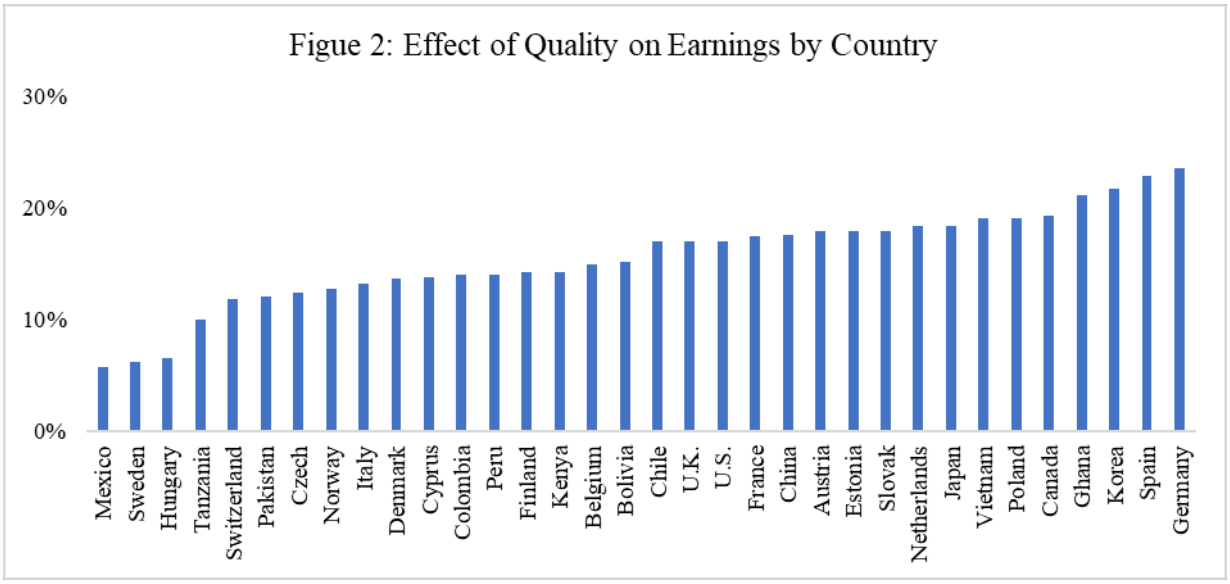
A one SD increase in literacy skills is associated with a 15 percent increase in earnings globally, based on 72 estimates (Table 1). The effect is slightly higher in high-income and middle-income countries, both at 16 percent, with lower-middle-income and upper-middle-income countries showing similar effects at just above 16 percent.

Table 1: Effect of School Quality on Earnings (percent)

	Estimated effect	N
World	15.3	72
High Income Countries	16.3	25
Middle Income Countries	16.3	15
(of which:) Lower-middle-income	16.4	6
Upper-middle-income	16.3	9

Note: See full study details in Appendix Table 1

The effect of school quality on earnings varies significantly across countries (Figure 2). However, the averages for countries are similar across income levels. That is the effect is about the same in high income countries as it is in middle and lower-middle income countries.



The significant effect of school quality on earnings has important implications for education policy, particularly in the context of school expansion. These effects are especially pronounced when the expansion involves higher-quality schooling and targets marginal students (Clark, 2023). Using global data, Lee and Lee (2024) estimate that a one standard deviation improvement in educational quality—measured by average test scores—raises earnings by 9.5 percent. Similarly, Angrist et al. (2021) show that a 1 percent increase in national learning outcomes is linked to a 7.2 percent rise in income growth, underscoring the critical importance of learning outcomes over mere school attendance. Together, these findings highlight that improving the quality of education—rather than just expanding access—can generate substantial long-term gains in both individual earnings and national economic growth.

3. Toward a Rate of Return to School Quality

There is evidence that higher cognitive skills—measured by test scores—are associated with higher earnings (Neal and Johnson, 1996). Traditional estimates of the private rate of return to education typically consider only the opportunity cost of schooling in the form of foregone earnings (Glewwe, 1996). However, if school quality also boosts earnings, then a fuller

accounting must include the costs of improving quality. While it might be assumed that raising quality would require students to remain in school longer—thus increasing opportunity costs—this is unlikely. The real costs stem from interventions that improve quality, such as textbooks, infrastructure, instructional materials, or training teachers. Other costs may include relocating to areas with better schools or adjusting instruction to meet student needs.

Importantly, the marginal cost of improving test scores tends to rise with performance and varies by individual due to differences in preferences, innate ability, family background, and access to credit (Currie and Thomas, 2001). These heterogeneities must be accounted for in any estimate of the returns to quality improvements.

Currie and Thomas (2001) present a model in which test scores influence future earnings, and individuals choose how much effort to exert in school by maximizing utility—balancing the benefits of higher earnings against the cost of effort (Becker, 1967; Card, 1995). The return to higher test scores diminishes as scores increase, while the effort and cost of raising them grow. This yields a concave relationship between log earnings and test performance.

Despite the theoretical importance, few empirical studies of school quality have incorporated cost considerations beyond foregone earnings (Rizzuto and Wachtel, 1980). One exception is Glewwe (1996), who estimates a private rate of return of 5.4 to 6.3 percent from school quality improvements in Ghana. Another is Behrman et al. (2008), who estimate the social rate of return to school quality in Pakistan by combining earnings functions with data on opportunity costs, private expenditures, and public spending. Their analysis, under several assumptions, finds substantial returns. For example, while the return to helping a student from a low-quality primary school complete middle school is modest (3 percent), the return to improving primary school quality is much higher (13 percent), and providing access to even low-

quality primary education yields an even higher return (18 percent). Notably, the private rate of return to moving from low- to higher-quality primary education is effectively infinite—because students benefit from higher future earnings without incurring additional private costs. The government bears the investment cost, while enrolled students capture the gains.

A global review of 150 education interventions illustrates the economic value of school quality. Nearly half of interventions reviewed yielded no measurable improvement in learning outcomes. However, several consistently stood out as "best buys"—interventions that are both effective and cost-efficient. Among the most impactful are structured pedagogy programs, which align inputs such as high-quality textbooks, scripted lesson plans, teacher training, and ongoing coaching to improve instructional practice. Another high-return approach is teaching at the right level, which tailors instruction to students' current learning level rather than age or grade, with or without the use of technology. Additionally, informing parents about the long-term returns to education has been shown to increase student participation and effort (Angrist et al., 2023).

These interventions are particularly valuable in resource-constrained settings. Since a one standard deviation (SD) increase in learning is associated with a 20 percent increase in future earnings (Angrist et al., 2021), their economic impact can be substantial. On average, best buys deliver benefit-cost ratios of approximately 65:1 in low- and lower-middle-income countries, reflecting exceptional cost-effectiveness.

Similar results can be seen in high-income settings. Consider Mississippi's early literacy initiative, which produced substantial gains—raising reading and math scores by 0.18 SDs for students with any exposure and up to 0.29 SDs for those exposed from kindergarten through third grade (Spencer, 2024). Assuming an average learning gain of 0.25 SDs, which Das et al. (2022) equate to 0.25 years of schooling, and applying the standard estimate of a 10 percent

return per year of schooling (Psacharopoulos and Patrinos, 2018), this implies an annual earnings gain of approximately $1,017 per student (based on a median high school graduate salary of $45,200 (NCES). The program reaches 465,679 students at a total cost of $15 million annually—just $32 per student, or 0.2 percent of the state budget (Spencer, 2024). These inputs yield an internal rate of return of 22 percent and a benefit-cost ratio of 32, demonstrating that investments in quality education can be not only educationally transformative but also economically prudent.

4. Conclusion

This paper offers a concise review of research estimating the impact of school quality—typically measured by test scores—on earnings. The evidence underscores the need to reorient education policy and research from a narrow focus on school attainment toward a greater emphasis on actual learning. While the global average return to an additional year of schooling is 10 percent (Psacharopoulos and Patrinos, 2018), a one standard deviation increase in test scores is linked to earnings gains of approximately 15 percent—indicating that the quality of education may yield even greater economic benefits than its duration.

These findings make a strong case for prioritizing improvements in learning outcomes alongside efforts to expand access. Going forward, future research should focus on collecting robust longitudinal data—particularly in low- and middle-income countries—improving the precision of learning assessments and identifying policy interventions that effectively raise educational quality. Additionally, it remains uncertain whether the earnings gains associated with better school quality are primarily driven by enhanced human capital, signaling effects, or improved access to professional networks (Hoekstra, 2020). Disentangling these channels will be essential for designing education systems that translate learning into long-term economic and social gains.

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Annex Table 1: The Database

Country	Study	Estimated effect	
Armenia	Chua 2017	0.02	
Austria	Hanushek et al. 2015	0.18	*
Belgium	Hanushek et al. 2015	0.15	*
Bolivia	Chua 2017	0.15	*
Brazil	Francis-Tan and Tannuri-Pianto 2018	0.27	*
Canada	Hanushek et al. 2015	0.19	*
Chile	Hanushek, Zhang 2009	0.15	*
Chile	Patrinos, Sakellariou 2011	0.17	*
China	Glewwe et al 2017	0.07	*
China	Hanushek et al 2023	0.18	*
China	Sun 2019	0.09	*
Colombia	Chua 2017	0.14	
Colombia	Saavedra 2009	0.20	*
Cyprus	Hanushek et al. 2015	0.14	*
Czech	Hanushek et al. 2015	0.12	*
Czech Republic	Hanushek, Zhang 2009	0.05	*
Denmark	Hanushek et al. 2015	0.14	*
Denmark	Hanushek, Zhang 2009	0.06	*
Estonia	Hanushek et al. 2015	0.18	*
Finland	Hanushek et al. 2015	0.14	*
Finland	Hanushek, Zhang 2009	0.10	*
France	Hanushek et al. 2015	0.17	*
France	Canaan, Mouganie 2014	0.13	*
Georgia	Chua 2017	0.24	*
Germany	Hanushek et al. 2015	0.24	*
Germany	Hanushek, Zhang 2009	0.08	*
Ghana	Chua 2017	0.21	*
Ghana	Glewwe 1996	0.26	*
Ghana	Glewwe 1996	0.31	*
Ghana	Jolliffe 1998	0.06	*
Hungary	Hanushek, Zhang 2009	0.07	*
Ireland	Hanushek et al. 2015	0.24	*
Italy	Hanushek et al. 2015	0.13	*
Italy	Hanushek, Zhang 2009	0.05	*
Japan	Hanushek et al. 2015	0.18	*
Kenya	Boissiere et al 1985	0.21	*
Kenya	Chua 2017	0.14	*

Korea	Hanushek et al. 2015	0.22	*
Mexico	Campos-Vazquez 2018	0.14	*
Mexico	de Hoyos, Estrada, Vargas 2021	0.06	*
Netherlands	Hanushek et al. 2015	0.18	*
Netherlands	Hanushek, Zhang 2009	0.15	*
Norway	Hanushek et al. 2015	0.13	*
Norway	Hanushek, Zhang 2009	0.07	*
Pakistan	Alderman et al 1996	0.20	*
Pakistan	Behrman et al 2008	0.25	*
Poland	Hanushek et al. 2015	0.19	*
Poland	Hanushek, Zhang 2009	0.01	*
Slovak	Hanushek et al. 2015	0.18	*
South Africa	Moll 1998	0.41	*
Spain	Hanushek et al. 2015	0.23	*
Sweden	Hanushek et al. 2015	0.12	*
Sweden	Hanushek, Zhang 2009	0.06	*
Sweden	Lindqvist, Westman 2011	0.10	*
Switzerland	Hanushek, Zhang 2009	0.12	*
Tanzania	Knight, Sabot 1990	0.10	*
U.K.	Hanushek et al. 2015	0.23	*
U.K.	Clark and Del Bono 2016	0.17	*
U.S.	Hanushek et al. 2015	0.28	*
U.S.	Lazear 2003	0.12	*
U.S.	Hanushek, Zhang 2009	0.24	*
U.S.	Currie, Thomas 2001	0.14	*
U.S.	Rose 2006	0.07	*
U.S.	Hoekstra 2009	0.20	*
U.S.	Zimmerman 2014	0.22	*
U.S.	Lin et al 2018	0.17	*
Ukraine	Chua 2017	0.05	
Vietnam	Chua 2017	0.19	*
Average		0.*16*	

*Significant at the 1% level or better