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## Teacher Labor Markets in Developing Countries

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# Teacher Labor Markets in Developing Countries

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## *Abstract*

The types of workers recruited into teaching and their allocation across classrooms can greatly influence a country's stock of human capital. This paper considers how markets and non-market institutions determine the quantity, wages, skills, and spatial distribution of teachers in developing countries. Schools are a major source of employment in developing countries, particularly for women and professionals. Teacher compensation is also a large share of public budgets. Teacher labor markets in developing countries are likely to grow further as teacher quality becomes a greater focus of education policy, including under the United Nations Sustainable Development Goals. Theoretical approaches to teacher labor markets have emphasized the role of non-market institutions, such as government and unions, and other frictions in teacher employment and wages. The evidence supports the existence and importance of such frictions in how teacher labor markets function. In many countries, large gaps in pay and quality exist between teachers and other professionals; teachers in public and private schools; teachers on permanent and temporary contracts; and teachers in urban and rural areas. Teacher supply increases with wages, though teacher quality does not necessarily increase. However, most evidence comes from studies of short-term effects among existing teachers. Evidence on effects in the long-term, on the supply of new teachers, or on changes in non-pecuniary compensation is scarcer.

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## 1 Introduction

This chapter considers how markets and non-market institutions determine the quantity, wages, skills, and spatial distribution of teachers in developing countries.<sup>1</sup> A growing body of evidence suggests that teachers are the most important input that schools provide to students. According to one estimate from the United States, replacing a teacher in the bottom 5 percent of value-added with an average teacher would raise the present value of student lifetime earnings by \$250,000 per classroom (Chetty, Friedman, and Rockoff 2014). Estimates of teacher value-added for developing countries also find large effects of teacher quality on student achievement and wide variation in teacher quality, echoing findings from developed countries (Araujo et al. 2016 for Ecuador; Talancé 2017, Bau and Das 2020 for Pakistan; Buhl-Wiggers et al. 2017 for Uganda). The types of workers recruited into teaching and their allocation across classrooms can therefore greatly influence a country’s stock of human capital.

Besides the effects of teachers on students, there are at least three reasons to study teacher labor markets in developing countries.<sup>2</sup> First, young populations and growing demand for education make teacher compensation a large share of public budgets and national economies. Second, schools are a major source of employment in developing countries, particularly for women and professionals. Third, teacher labor markets in developing countries are likely to grow further as teacher quality becomes a greater focus of education policy, including under the United Nations (UN) Sustainable Development Goals (SDGs). We consider each of these factors in turn. We conclude this section with a roadmap for the remainder of the chapter.

### 1.1 Teachers and public spending

Demand for education in developing countries increased dramatically in recent decades. In low-income countries, gross enrollment rates in primary schools rose from 63 percent in 1990 to 100 percent in 2017 (Figure 1, top left panel; World Bank 2018).<sup>3</sup> Secondary school enrollment rose shortly thereafter as primary school graduates continued their studies. In middle-income countries, primary school enrollment was already at or above 100 percent during this period, but secondary school enrollment rose sharply, from 47 to 78 percent (Figure 1, bottom left panel).

[Figure 1 here]

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<sup>1</sup> “Developing countries” refers to low and middle-income countries throughout this chapter, using categories established by the World Bank. However, we will also include evidence from some previously developing countries that recently achieved high-income status, such as Chile, where appropriate.

<sup>2</sup> A separate chapter in this *Handbook* considers teacher effectiveness.

<sup>3</sup> The gross enrollment rate is the number of enrolled students, regardless of age, divided by the number of students in the relevant age group. Gross enrollment can, therefore, exceed 100 percent. Net enrollment counts only those enrolled from the relevant age group. Demand for teachers is determined by all enrolled students, regardless of age, making gross enrollment the more appropriate measure for our purposes.

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This influx of students increased demand for teachers. In low-income countries, employment of primary school teachers tripled from 1 million to 3 million between 1990 and 2017, while in middle-income countries the amount grew from 16 million to 23 million (Figure 1, middle panels). Employment growth for secondary school teachers was also robust, nearly quadrupling in low-income countries (0.5 million to 1.9 million) and growing from 14 million to 25 million in middle-income countries. Overall, the primary and secondary school teaching corps in developing countries rose from 32 million in 1990 to 53 million in 2017, an increase of 64 percent.

Did demand for teachers during this period keep pace with increases in student enrollment? At first, pupil-teacher ratios in low-income country primary schools rose with enrollment, from 36 in 1990 to 45 in 2005 (Figure 1, top right panel). Since then, the ratio has declined back to 39, reflecting the large increase in the teaching corps. Stagnant or declining pupil-teacher ratios in low-income country secondary schools, and in both primary and secondary schools in middle-income countries (Figure 1, bottom right panel), also reflect major inflows into teaching.

The large number of teachers employed in developing countries has major implications for public budgets. Table 1 shows teacher payroll across various country groupings, based on available data for individual countries within each group (weighted by GDP, with the number of countries reporting data in column 1). Across all developing countries, teachers account for 63 percent of education spending. Teacher payroll accounts for more than half of education budgets in all developing country income categories and regions, and in high-income countries outside the Organization for Economic Cooperation and Development (OECD). Of the groups considered, teacher payroll falls below 50 percent of education spending only within the OECD, reflecting higher management and capital expenditure in those countries. Developing country education systems are therefore relatively labor-intensive, with teachers supplying the bulk of the labor.

[Table 1 here]

Teacher payroll also influences overall government spending. Across developing countries for which there is data, teacher payroll accounts for 11 percent of public expenditure (Table 1, column 3). This translates into 2.8 percent of GDP (column 4). These quantities are remarkable. Put another way, more than one of every ten dollars spent by governments in developing countries goes to teachers. In these same countries, teacher income represents almost \$3 of every \$100 of economic output. If we assume that the teacher payroll share of GDP in countries with available data holds elsewhere, then developing countries spend \$749 billion annually on teachers (in 2010 dollars). Even under a more conservative estimate of 2 percent of GDP, teacher payroll would account for \$541 billion in annual public spending in the developing world or more than three times the amount of all official development assistance.<sup>4</sup>

Spending on teachers follows an inverse U-shape across income levels (Table 1). Low-income countries spend the least on teachers as a proportion of GDP, but the proportion grows among lower and upper-middle-income countries, before falling in high-income countries. There is also

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<sup>4</sup> This substantial public spending understates total expenditure on teachers. The private sector educates 1 in 6 primary students and 1 in 4 secondary students in developing countries (UNESCO Institute for Statistics 2018). Data on teacher payroll spending is available from the UNESCO database for 48 of 133 developing countries.

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considerable regional variation in teacher payroll, with Latin America and the Caribbean and the Middle East and North Africa spending proportionately most on teachers, while South Asia spends least.

### 1.2 Teachers and the labor force

In addition to their importance for public budgets and the economy, teachers represent an important source of employment in developing countries. Table 2 presents data on the percentage of teachers within various employment categories. The data are drawn from the Integrated Public Use Microdata Series (IPUMS-International), using population census microdata from all developing countries with harmonized occupation codes, to consistently identify teachers across samples (Minnesota Population Center 2018). We limit the sample to censuses conducted since 2005, using the most recent round available for each country. This leaves data from 14 developing countries, distributed across income categories and developing regions (column 1). We further limit the sample to adults aged 25-55 in the labor force, resulting in 6.4 million individual records. We classify as “teacher” a teaching professional at any level (pre-primary, primary, secondary, tertiary, and special education). We weight all calculations by population.<sup>5</sup>

[Table 2 here]

Across all countries in the sample, slightly less than half of the teachers are female (column 2).<sup>6</sup> Females are 61 percent of teachers in upper-middle-income countries, reflecting greater professional opportunities for women in richer parts of the developing world. In some regions, teaching is an overwhelmingly female profession (62 percent or more in Latin America, East Asia, and Eastern Europe/Central Asia), whereas in other regions (e.g. South Asia) teaching is predominantly male.<sup>7</sup>

Teachers account for 2 percent of the labor force among countries in the sample (column 3). This proportion grows with income, reflecting higher demand for education in wealthier countries. There is considerable regional variation, with teachers accounting for 1 percent of the labor force in South Asia and 6 percent in Middle East and North Africa. Teachers represent greater fractions of the female labor force than overall, accounting for 3.5 percent of the female labor force across all countries in the sample (column 4). In some cases, the teacher share of the female labor force is strikingly large, such as for upper middle income countries (13 percent) and the Middle East and North Africa (19 percent).

Teaching is a significant source of formal, professional employment in developing countries. Teachers are highly represented among wage and salaried workers (i.e., excluding the self-

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<sup>5</sup> Data for most countries are 10 percent random samples of the census microdata, with sampling weights provided to estimate the corresponding population.

<sup>6</sup> This figure masks considerable heterogeneity by school level. Females are 60 percent of primary and pre-primary teachers, 44 percent of secondary, and 38 percent of tertiary teachers, using the same IPUMS-International data as Table 2. School leaders are much less likely to be female – for example just 22 percent in South Africa and 29 percent in Vietnam (Wills and others 2015; OECD 2019).

<sup>7</sup> Female teacher percentage for these country groups using more comprehensive data are broadly similar to those in our sample (World Bank 2018).

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employed, many of whom work in the informal sector), professionals, public sector workers, and secondary and university graduates (Table 2, columns 5-9). The teacher shares of professional and public sector workers are particularly large, at 38 and 24 percent, respectively. In low-income countries, three of every five professionals and about one of every five secondary and university graduates work as teachers. Overall, Table 2 shows that teaching provides a considerable share of employment opportunities for women and educated workers in developing countries.

### **1.3 Teachers and the Sustainable Development Goals**

Teachers play a prominent role in the United Nations Sustainable Development Goals, an internationally agreed set of aspirations to achieve by 2030. Goal 4 (of 17) is “Quality Education.” Meeting this goal, i.e., achieving universal primary and secondary education for all children, would require 69 million additional teachers by 2030 (UNESCO Institute for Statistics 2016).<sup>8</sup> This figure implies a 234 percent increase over the 51.5 million primary and secondary teachers employed in developing countries in 2015, immediately before SDG adoption.

Included in Goal 4, Quality Education, is Target 4.C: “substantially increase the supply of qualified [certified] teachers” (United Nations 2016). To meet the target, suppose developing countries trained or replaced all currently untrained teachers with qualified teachers. How many newly qualified teachers would be required? Table 3 presents estimates, separately for primary and secondary schools and different country groupings. Across all developing countries, 25.4 million teachers are employed in primary schools, of whom 83 percent have received formal training (columns 1-2). The implied “SDG gap,” or number of untrained teachers, is 4.3 million. Looking down column (2), we see that the proportion of trained primary teachers is particularly low in low income countries, South Asia, and Sub-Saharan Africa.

[Table 3 here]

Table 3, columns (4)-(6) and (7)-(9) repeat the exercise for secondary teachers and the total, respectively. Most cells in these columns are empty due to the lack of data on secondary teachers. Where data do exist, however, we see that the proportion of trained secondary teachers falls below the proportion of trained primary teachers within each country group. This pattern suggests that the SDG gap of untrained teachers is proportionately larger among secondary school teachers. Under the more conservative assumption that the 26 million secondary teachers in developing countries are trained at the same rate as primary school teachers, the SDG gap for secondary teachers is 4.4 million, or 8.7 million across both primary and secondary. In other words, even if we take the UN estimate of 69 million new teachers as infeasible, upgrading the qualifications of the existing corps would require training or replacing 8.7 million teachers, a massive investment.

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<sup>8</sup> These estimates by UNESCO assume that class sizes are 40 or fewer students in primary schools and 25 or fewer students in secondary schools.

## 1.4 Organization of this chapter

The following section, Section 2, presents a theoretical framework for how teacher labor markets operate in developing countries. The framework offers several questions for further exploration. We review the evidence on these questions in Section 3. Section 4 concludes with thoughts on the remaining questions and the future research agenda.

## 2 Theoretical Framework

### 2.1 Teacher Labor Market

What determines the number of teachers employed and their wage? Consider a model of the market for teachers, following Dolton (2006). Unlike labor markets in the private sector, demand for teachers in this model is set by a single employer, government. Suppose the government desires a certain pupil-teacher ratio, implying an optimal quantity of teachers  $q_0$  (Figure 2). The labor supply schedule  $S$  represents the quantity of qualified teachers, i.e., those meeting education and certification standards, at each wage. Teacher labor supply  $S$  slopes upward because the government must offer a higher wage to induce workers to teach rather than enter alternative occupations. The wage  $w_0$  would clear the market at the optimal quantity of teachers  $q_0$ .

[Figure 2 here]

However, the government may not have a budget sufficient to hire  $q_0$  teachers. Instead, its expenditure on teacher payroll is fixed. The expenditure schedule  $E$  represents the corresponding tradeoff between the wage per teacher and the number of teachers hired. The actual number of teachers hired and their wage, therefore, occurs at the intersection of the teacher supply and government expenditure curves, point  $(q_1, w_1)$ . The teacher shortfall,  $q_0 - q_1$ , is consistent with policymaker concerns about excessive class size or shortages of qualified teachers.

The government could lower the wage below  $w_1$  to hire more teachers. At wage  $w_2$ , it could hire the target number of teachers  $q_0$ . Doing so would move it off the supply curve, however, leading to fewer qualified teachers hired ( $q_2$ ), with  $q_0 - q_2$  unqualified teachers required to close the gap (Chen 2009).

Suppose we make the (admittedly strong) assumption that a competitive teacher labor market would reach equilibrium at  $(q_0, w_0)$ . Then the wage gap required to close the shortfall,  $w_0 - w_1$ , reflects rents extracted by the government as wage-setters in the teacher labor market.<sup>9</sup> In other words, teachers are underpaid relative to the value of their skills in a competitive market.

What if the government instead has a budget sufficient to hire the optimal quantity of teachers? Figure 3 shows this scenario, with the higher expenditure schedule labeled  $E_0$  and the original expenditure level  $E_1$  shown for comparison. The intersection of this higher expenditure level and the teacher supply curve leads to an equilibrium at  $(q_0, w_0)$ , consistent with the competitive market

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<sup>9</sup> For monopsony models of the teacher labor market, see Landon and Baird (1971) and Ransom and Sims (2010).

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assumption. An alternative possibility is that a shortfall of teachers still exists, with  $q_T$  teachers hired at the higher wage  $w_T$ . This scenario might occur if, for instance, a teacher's union bargains with the government to move up the expenditure curve. Then teachers have successfully extracted rents and are overpaid relative to the value of their skills in a competitive market.

[Figure 3 here]

Key questions arising from the model are therefore:

- Are wages sufficient to attract the desired number of qualified teachers? If not, to what extent is the shortfall met by unqualified teachers?
- How responsive are teachers to wage changes, i.e., what is the elasticity of teacher labor supply?
- Are teachers underpaid or overpaid relative to what they would earn in a competitive market? What is the source of the distortion?

### 2.2 Teacher Occupation Choice

In the model of Section 2.1, the teacher labor supply schedule  $S$  represents the wage required to induce the marginal worker to choose teaching over the best alternative occupation. Specifying this occupational choice model in greater detail provides further insights into teacher characteristics. Consider a simple Roy (1951) model, in which a worker chooses between teaching ( $T$ ) or not teaching ( $N$ ). The worker's wage in each occupation is  $w_O = \mu_O + \varepsilon_O$ , where  $O \in \{T, N\}$  indexes occupation;  $w$  is the wage;  $\mu$  is the mean offered wage in each occupation; and  $\varepsilon$  represents the market value of the worker's occupation-specific skill relative to the population mean. The random variable  $\varepsilon_O$  has mean zero and variance  $\sigma_O^2$ .

The worker chooses to teach if  $w_T \geq w_N$ . Suppose that wages for teachers follow a relatively rigid schedule, whereas non-teaching wages are more flexible. Then non-teaching wages reflect a closer match between idiosyncratic worker skill and its market value. By contrast, teaching wages should deviate less from the mean, i.e.,  $\sigma_N^2 > \sigma_T^2$ . This will be the case if teacher wages are set by paycales for civil servants or collective bargaining, while non-teaching wages are set by more competitive labor markets.

What does the model imply for the distribution of wages and skills in each occupation? For simplicity, assume that mean offered wages are identical across occupations,  $\mu_T = \mu_N$ , and no correlation between  $\varepsilon_T$  and  $\varepsilon_N$ . Figure 4 presents a stylized depiction of occupational choices under the model. The vertical axis represents non-teacher wages, the horizontal axis is the teacher wage, and the 45-degree line represents equal wages. Each point of the scatterplot represents the wages that a hypothetical individual would receive in each occupation.<sup>10</sup> Points below the 45-degree line

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<sup>10</sup> To generate Figure 4, we simulated wage offers in each occupation for 100 workers. Teacher and non-teacher wage offers are both distributed normally with mean 2. Teacher wage offers have standard deviation 0.2, while non-teacher wage offers have standard deviation 0.8. Although we



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(black circles) represent workers who would choose to teach, while those above the line (gray triangles) would choose a different profession.

[Figure 4 here]

In equilibrium, Figure 4 shows two key predictions of the model. First, mean wages are lower among teachers than non-teachers. Second, wage dispersion is lower for teachers than non-teachers.<sup>11</sup> Teachers are negatively selected relative to their counterparts in other professions because the return to their skills is lower.

The model can also apply to selection into different segments within the market for teachers. For instance, private schools might pay wages more closely aligned to a teacher's marginal product than public schools. The model would, therefore, predict that higher-productivity teachers select into private schools, where the return to their skills is greater.

Key questions arising from the occupation choice model are:

- Who becomes a teacher in developing countries?
- How do teachers compare to other professionals? To teachers in different education sectors?

### 2.3 Spatial distribution of teachers

In the model of Section 2.2, potential teachers considered only wages when choosing among occupations. In reality, workers consider both wages and other conditions associated with different jobs. Schools can differ greatly in working conditions, making some teaching posts more desirable than others. How do teachers sort across schools?

Suppose teaching positions differ by two characteristics: wages ( $w$ ) and distance ( $d$ ) from a city. Here, distance serves as a numerical proxy for all working conditions associated with a school; the greater the distance from the city, the less desirable the teaching position. Teachers, therefore, must receive higher wages to be willing to work in a more distant school. Consider the preferences of a hypothetical teacher with reservation utility  $U_0$ , i.e., the utility necessary to choose teaching over an alternative occupation. In Figure 5, indifference curve  $U_0$  depicts all the wage and distance combinations a teacher would accept without leaving the profession. In a labor market with flexible wages and a continuum of working conditions (distances), wages would adjust to induce teachers to meet staffing needs in all schools.

[Figure 5 here]

In most teacher labor markets, however, wages are set inflexibly. Moreover, the finite number of schools limits the set of available working conditions (McEwan 1999; Goldhaber, Destler, and

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assume no correlation between the stochastic components of wage offers, results hold when allowing for correlation.

<sup>11</sup> The accepted wage distribution for teachers has a mean and standard deviation (4.0,0.2), while for non-teachers it is (4.5,0.4).

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Player 2010). Suppose wages for qualified teachers are set at  $w^*$  in all schools. Further suppose there are three schools, one in the city (distance=0), and the others at distances  $d_1$  and  $d_2$ . The wage is set efficiently for the school at distance  $d_1$ , because it matches teacher and school at minimum payroll cost. In the school at distance zero, the teacher earns a rent of  $w^* - w_0$ . This urban school will face a queue of teachers wishing to work there and must ration the available positions.

By contrast, in the school at  $d_2$ , the teacher must earn at least  $w_2$  to accept the position. Because this school is not free to raise wages above  $w^*$ , it must find a teacher with different preferences, offer non-wage benefits (such as housing) to mitigate its locational disadvantage, hire an unqualified teacher, or leave the position unfilled. This situation underpins the concerns over low teaching quality and teacher shortages in rural schools in developing countries.

Key questions arising from this model of the spatial distribution of teachers are therefore:

- How large are rents earned by teachers in schools with more desirable working conditions? What determines how these positions are rationed?
- How effective are wage or benefit increases at attracting teachers to rural schools?

### 2.4 Segmented labor markets

The models considered to this point might apply equally to teacher labor markets in developed and developing countries, albeit with some modifications.<sup>12</sup> But other issues arise that are mainly unique to developing countries. For instance, teacher labor markets are more likely to be segmented in developing countries. In many developed countries, nearly all teachers are certified, unionized, and employed in the public sector. By contrast, in developing countries teacher labor markets are often segmented in various ways, e.g., between qualified/unqualified teachers, public/private sector, or unionized/contract teachers. This segmentation suggests the presence of market frictions that fall outside the models considered thus far.

Consider a labor market for teachers segmented between a primary sector  $p$  and a secondary sector  $s$ . For instance, the primary sector could be the market for certified teachers, private school teachers, or teachers covered by a union collective bargaining agreement. The secondary sector is the market for teachers lacking these characteristics (e.g., unqualified/public/contract teachers). Figure 6 shows how these markets interact with each other to determine the equilibrium wage and proportion of teachers employed in each sector. The vertical axis is wages, with primary sector wages on the left axis ( $w_p$ ) and secondary sector wages on the right axis ( $w_s$ ). The horizontal axis is the proportion of teachers in each sector. The proportion of teachers in the primary sector ( $q_p$ ) ranges from 0-1 moving left to right, while the proportion in the secondary sector ( $q_s$ ) ranges from 0-1 moving from right to left. The sector-specific demand curves ( $D_p$  and  $D_s$ ) slope downward.

[Figure 6 here]

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<sup>12</sup> For instance, in developed countries distance from the city might be associated with *better* working conditions in the spatial allocation model of Section 2.3, if suburban school districts are more affluent.

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In a frictionless market, teachers would move freely between sectors, with the wage in each sector adjusting accordingly. Equilibrium would occur at  $(w^*, q^*)$ , with equal wages between sectors. However, in many cases, there is some friction preventing this equilibrium. For instance, certification might be prohibitively costly for many teachers, private schools might set wages above the public sector pay scale to attract the most desirable candidates, or a collective bargaining agreement might limit union jobs. Such frictions would move the equilibrium proportion of primary sector jobs to the left of  $q^*$ , such as to  $q_p^*$ . Teachers unable to find work in the primary sector would enter the secondary sector, leading to  $q_s^* > q^*$  employed there. The primary sector would enjoy a wage premium,  $w_p^* - w_s^*$ .

The model can thus explain observed wage premia between sectors within teacher labor markets. It also can predict how wage premia should change, and how teachers should reallocate across sectors, in response to sector-specific shocks. The segmented markets model can also shed light on other features relatively particular to teacher labor markets in developing countries. For instance, moonlighting—holding another paid job, often as a private tutor—could be seen as a response by secondary-sector teachers to lower wages and lack of access to primary sector positions.

The segmented markets model and the occupation choice model of Section 2.2 can conflict with each other. While both seek to explain wage gaps arising in equilibrium between sectors of the teacher labor market, the Roy model of Section 2.2 locates the source of the gap in labor supply, while the segmented markets model focuses on demand. Our purpose is not to favor one or the other explanation, but instead to sketch each model and, later, consider the evidence for each.

Key questions arising from the segmented labor markets model include:

- Are teacher labor markets in developing countries segmented? If so, in what ways?

## 3 Evidence

### 3.1 Teacher labor market

#### 3.1.1 Teacher demand and pay determination

In most countries, public sector pay is set centrally, on a scale depending on factors such as qualifications, experience, and location. In Bolivia, these three factors alone explain 90 percent of the variation in teacher pay (Urquiola and Vegas 2005). In most countries market salaries in private schools are much lower, much more closely linked to performance, and have much wider dispersion.

Looking across countries, Dolton and Marcenaro-Gutierrez (2011) find that wages respond to supply and demand shocks. As the supply of teachers increases, wages fall. On the demand side, however, there is a short-run reduction in teacher wages as the stock of school-age children grows, due to frictions in the adjustment of wage levels.

Teacher unions play an important role in wage setting in many countries. In India, membership in a union increases teacher pay (G. Kingdon and Teal 2010), due in part to unions' political power (G. Kingdon and Muzammil 2009; 2013). Teacher unions also play an important political role in Mexico (Santibañez and Rabling 2007; Estrada 2018), where recruitment has long been managed by unions. A 2013 reform introduced a standardized test for new teachers, which led to substantially

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better performance than through union-managed recruitment (Estrada 2018).<sup>13</sup> Ecuador introduced a similar change in 2007. Teachers recruited through the new system did not have higher overall value-added but did have positive effects on reading abilities of the poorest students (Cruz-Aguayo, Ibarra, and Schady 2017; M. D. Araujo 2019).

The evidence, therefore, suggests that institutions—the public sector and unions, where applicable—largely determine teacher pay, though market factors also play a role.

#### **3.1.2 Are teachers underpaid or overpaid?**

Are teachers underpaid or overpaid relative to what they would earn in a competitive market? Defining the appropriate counterfactual has been difficult. Civil service teachers in many developing countries earn multiples of GDP per capita (up to 8 times in India; Kingdon, 2017), but are also often not particularly well paid for their level of skill. Further, due to the dual or segmented labor market described in section 2.4, the pay of private sector teachers may be artificially low if teachers only accept that salary because they are in effect queuing for a public sector teacher job. Putting aside these concerns, the best causal evidence comes from regression-discontinuity approaches in two countries. In Kenya, teachers who narrowly obtain a public sector job earn a wage premium of over 100 percent relative to those who remain in the private sector (Barton, Bold, and Sandefur 2017). A similar approach in Colombia finds a public sector pay premium of 65 percent (Saavedra et al. 2016). More papers have relied on Mincer OLS regressions, with mixed findings. Some find a teacher pay premium conditional on observed characteristics (Piras and Savedoff, 1998 in Bolivia, van der Berg et al., 2010 in South Africa), others a pay penalty (Asadullah 2006 in Bangladesh and Mizala and Ñopo 2016 for 13 Latin American countries), and some both (Psacharopoulos et al. 1996 for 14 Latin American countries). A common finding in these studies is compressed pay scales, lead to overpayment of low-skill teachers and underpayment of high-skill teachers relative to similarly skilled workers in other sectors. This pay structure might lead to adverse selection and perverse incentives. Other studies compare the pay of civil service teachers with private sector teachers. In India, estimates of private school teacher pay range from half of public teacher pay in 1988 to just 3 percent in 2014 (G. G. Kingdon 2017).

Whether public sector teachers are under- or over-paid varies by country. What seems more consistent is that public sector pay scales are compressed, leading to over-payment for low skill teachers and under-payment for high skill teachers.

#### **3.1.3 Supply elasticity**

How much do applications for teaching roles vary with pay? An experimental doubling of salary level offers for new contract teachers in Kenya led to a 12 percent increase in the probability of filling a vacancy (Bold et al. 2018). Two papers use a spatial discontinuity to study the effect of bonus payments of around 35 percent of salary for teachers in rural schools in Peru. Castro and Esposito (2017) look at attrition and vacancy fulfilment one year after the implementation of the

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<sup>13</sup> This reform was though successfully challenged by the union and reversed in 2019 (de Hoyos 2019).

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policy, finding effects ranging from 1.1 to 1.6 percentage points. Alva et al. (2017) find sustained improvements in these two outcomes two years after the policy reform. A similar policy in The Gambia increased the share of qualified teachers by 10 percentage points (Pugatch and Schroeder 2014).

Tincani (2012) estimates a structural model of teacher recruitment to conduct a counterfactual policy simulation of a proposed reform in Chile. The reform allows for an average increase in pay, for pay in the public sector to be linked to performance, and for a new entrance exam. She estimates that such a reform would substantially improve the quality of teachers, by drawing in applicants to the public sector from outside teaching and from private voucher schools.

Observational estimates from Indonesia found the supply elasticity of college-educated teachers to be 0.15 (i.e., a 100% increase in teacher salary would lead to a 15% increase in supply; Chen, 2009). In Venezuela, relative wages of teachers are unrelated to the quality of applicants to teaching, contrary to the other studies cited above (Ortega 2010).

Across countries, where teachers' relative pay is higher, they have higher skills relative to the population (Figure 7).<sup>14</sup> The teacher skill premium is estimated as the coefficient on a teacher indicator variable in a bivariate regression on literacy score, by country. The wage premium is estimated as the coefficient on a teacher indicator in a Mincer-type OLS regression, with log wages regressed on gender, age, and literacy level.

[Figure 7 here]

Beyond pay levels, other factors that affect the supply of teachers include the skill level of young adults, particularly women. In Punjab, Pakistan, villages in which a government secondary school was built in the 1980s were three times more likely to have a private school open in 2000 (Andrabi, Das, and Khwaja 2013). Villages with a government secondary school had twice as many educated women, and wages for private school teachers were 27 percent lower, consistent with the relative abundance of potential teachers.

The evidence, therefore, points to two conclusions. First, the (qualified) teacher supply curve indeed slopes upward as a function of wages. Second, supply matters for wages. Although elementary, these conclusions demonstrate that governments cannot simply choose the teacher wage-employment combination they prefer.

## **3.2 Teacher occupation choice**

### **3.2.1 Who becomes a teacher?**

Qualification requirements for teachers are typically lower in developing countries. In most high-income countries, teaching requires a teaching qualification in addition to an undergraduate

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<sup>14</sup> This figure extends the analysis in Hanushek, Piopiunik, and Wiederhold (2018) that focuses on high-income countries to include comparable data from developing countries. Data for Belgium, Cyprus, Czech Republic, Denmark, Italy, Japan, Korea, Netherlands, Poland, Russian Federation, Slovak Republic, Spain, and United Kingdom come from the OECD PIAAC survey. Data for Armenia, Bolivia, Colombia, Georgia, Ghana, and Vietnam come from the World Bank STEP surveys.

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tertiary degree. Most developing countries require just a post-secondary school teaching qualification.<sup>15</sup> Many employed teachers are not even qualified according to these lower standards. As discussed in the Introduction, across low-income countries, one in four primary school teachers is considered unqualified according to national standards. In secondary schools this figure is nearly half (45 percent; Table 3).<sup>16</sup>

Despite formal qualification requirements, the average skill level of teachers in developing countries is low. For instance, most Indonesian teachers are unable to do high school-level mathematics (De Ree 2016). Teachers in many Anglophone African countries have mathematics ability comparable to 14 year olds in high-income countries (Sandefur 2018). In a survey of primary school teachers from seven Sub-Saharan African countries, only 7 percent of language teachers and 68 percent of mathematics teachers demonstrated minimum knowledge for teaching, defined as marking at least 80 percent of items on a subject test correctly (Bold et al. 2017). In four countries (Mozambique, Nigeria, Tanzania, Togo), no surveyed teachers met this standard.

Figure 8 presents data from the World Bank STEP skill survey (Pierre et al. 2014) of adults in largely lower-middle-income countries. In developing countries, teachers are drawn from higher in the distribution of tertiary educated adults than in high-income countries. Despite this positive selection, teachers still have very low absolute levels of literacy, able to complete tasks that “may require low-level inferences” (Level 2), but below “navigating complex texts” (Level 3).

[Figure 8 here]

Teachers also have a distinct psychological profile to high school graduates, having above-average levels of extraversion, conscientiousness, grit, agreeableness, openness, and life satisfaction. Teachers are much more likely than other workers to report that their job requires frequent thinking and learning (Table 4).

[Table 4 here]

In many countries, teaching is seen as a low-status career of ‘last resort’ (Bennell 2004; Dolton et al. 2018). Teaching lacks the status of professions such as law or medicine, largely due to low pay, slow pay progression, and few opportunities for promotion (Mulkeen 2009b). In one study, teachers in Tanzania reported discouraging their own children from pursuing their profession (Sinyolo 2007). In Ghana, 73 percent of rural teachers said they did not feel respected in the community (Bennell and Akyeampong 2007). In Cambodia, entry requirements for teaching are considered easy, contributing to low prestige (Tandon and Fukao 2015). In Latin America, university programs in education fail to attract students from higher socioeconomic status

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<sup>15</sup> For example, the following countries require an ISCED 4a qualification or lower (post-secondary non-tertiary education); Benin, Cambodia, Guinea-Bissau, Mali, Mozambique, Romania, Singapore, Uganda. The following countries require a ISCED 5b qualification (short-cycle tertiary); Brazil, Cote d Ivoire, Georgia, Kazakhstan, Kenya, Kyrgyz Republic, Mexico, Moldova, Morocco, Nigeria, Papua New Guinea, Paraguay, Russian Federation, Samoa, Solomon Islands (data for 2010-2018; World Bank, n.d.).

<sup>16</sup> Estimate for 2017 for primary school teachers and 2015 for secondary school teachers (UNESCO Institute for Statistics 2018).

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households, reflecting teachers' low status (Bruns and Luque 2014). Efforts to raise the status of teachers include the "Teach for All" network and its national affiliates that aim to recruit high performing university graduates into teaching. A study from Chile found that graduates from this scheme had higher expectations of students, used a wider range of teaching approaches, and achieved better student outcomes (Alfonso, Santiago, and Bassi 2010).

How can we reconcile the low perceived status of teachers with the generally positive selection of teachers among those with tertiary education? One explanation is that teachers enjoy benefits that compensate for relatively low wages and status. Teaching positions in developing countries are plentiful and growing, as shown in the Introduction. For many teachers, particularly those in government schools and unions, job security is high. Outside urban areas, teaching is among the few occupations requiring university-level training. We discuss these factors in greater detail in the section on segmented labor markets.

#### **3.2.2 Selection within teacher labor markets**

Studies have also analyzed selection into different segments within the market for teachers. In most countries, there is a higher dispersion of pay in private schools, and pay is more closely linked to performance. In Chile, the existence of (higher wage) private schools attracts higher productivity individuals into the teaching profession (Behrman et al. 2016). This system leads worse teachers to select into public schools (Correa, Parro, and Reyes 2015).

An experiment in Rwanda advertised different contracts to teachers in different markets – some regular contracts and some with a performance-related bonus (Leaver et al. 2019). Teachers recruited under the performance pay contract were less intrinsically motivated and more money orientated. Despite these characteristics, their performance (in terms of their presence, conduct, or student results) was no different. Performance-related pay was generally popular amongst teachers in the study, consistent with similar findings from India (Muralidharan and Sundararaman 2011) and Tanzania (Mbiti and Schipper 2019).

Evidence on selection within the teacher labor market is therefore broadly consistent with the Roy (1951) model of Section 2.2. Within school systems, the opportunity for higher pay—for example, through performance bonuses or in private schools—attracts teachers with higher observable skills, though their performance is not always better.

### **3.3 Teacher allocation across schools and positions**

#### **3.3.1 Spatial placement**

Teacher labor markets are mainly local. For example, teachers in Peru are very unlikely to work outside of their region of birth (Jaramillo 2012). Even fewer teachers work outside their country of birth, in large part due to restrictions on visas. Appleton et al. (2006) focus on two countries with relatively high levels of out-migration of teachers, estimating that around seven percent of Jamaican teachers work abroad, and up to four percent of South African teachers. In the United States, 10-13 percent of healthcare workers are born in Africa, Asia, South and Central America, and the Caribbean, compared to just 6 percent of education and training workers (OECD

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2016). One reason for the relatively low mobility of teachers could be concern about whether non-national teachers will appropriately transmit the correct national culture and values. For example, the communist government in Cuba explicitly banned non-nationals from teaching for this reason (Pritchett and Viarengo 2015).

Many countries with centralized recruitment of teachers struggle to place recruits in isolated rural schools. McEwan (1999) applied the compensating wage differentials model to this problem. He also pointed out the widespread use of rural recruitment incentives in developing countries. In recent years, evidence has accumulated on the amount by which teachers trade-off different job attributes with different pay levels. For example, Fagernäs and Pelkonen (2012) use a discrete choice experiment with new teaching recruits in Uttarakhand, India. They estimate urban men would need an additional \$100 a month to be indifferent between a remote village and a district capital. This is large compared to starting salaries of \$340 in 2010. Rural men had no preference. For urban women the figure is larger - \$166 for urban women or \$88 for rural women.

A school's location correlates highly with its pupil-teacher ratio (PTR), another important working condition for teachers. PTR varies widely across schools, with a strong negative correlation between class sizes and local per capita GDP, both between and within countries (Figueiredo Walter 2019). Many developing countries have a long tail of schools with very few teachers. For example, India has a national pupil-teacher ratio of 25, but over one in three public primary pupils attend a school with a ratio above 40 (Figueiredo Walter 2019). In schools with many pupils but few teachers, double shifts for teachers are common (Mulkeen 2009a). Teachers assigned to such schools must tolerate more difficult working conditions, despite similar or equal pay as teachers in schools with lower PTRs. In Malawi, variation in pupil-teacher ratios across schools is driven in part by teacher preferences for access to roads, electricity, water, and a local trading center (Asim et al. 2017).<sup>17</sup> Teachers leverage informal networks and political patronage to resist placement in remote schools.

Many countries have responded to this situation by offering bonuses for teachers in rural schools, including Peru (Alva et al. 2017; Castro and Esposito 2017), Bolivia (Urquiola and Vegas 2005), the Gambia (Pugatch and Schroeder 2018), and Zambia (Chelwa, Pellicer, and Mabooshe 2019). Credible causal estimates using geographical discontinuities from these studies suggest in general that bonuses of 20-30 percent of baseline salary for rural teachers are effective at recruiting more and better-qualified teachers, but effects on student outcomes are small. A major effort in India named "Operation Blackboard" between 1987 and 1994 included the recruitment of over 140,000 teachers to be deployed in schools that only had one teacher. Though the policy was somewhat effective, less than half of these teachers ended up in one-teacher schools (Chin 2005).

The bulk of evidence on the spatial distribution of teachers in developing countries is therefore consistent with the model of compensating wage differentials, as McEwan (1999) proposed. Moreover, recruitment incentives can mitigate shortfalls in teacher supply and skills in remote schools.

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<sup>17</sup> By contrast, Walter (2019) finds that measures of remoteness are not strongly correlated with pupil-teacher ratios.



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#### **3.3.2 Recruitment**

In addition to the spatial placement of teachers, governments must decide how to allocate teachers across schools more generally. For instance, should teachers be hired locally or centrally? In many systems recruitment is managed centrally, though local recruitment of teachers is associated with better test scores (in India; Agarwal and Reis 2018) and lower absence (in six countries; Bangladesh, Ecuador, India, Indonesia, Peru, and Uganda; Chaudhury et al. 2006). Decentralization of responsibility through “School-Based Management” reforms has rarely involved transferring responsibility for recruitment (in just three of eleven programs reviewed in Patrinos, Barrera-Osorio, and Fasih 2009). In Kenya, offering local control over recruitment led to similar improvements in filling vacancies as providing twice as much money (Bold et al. 2018). Evidence on the effects of centralization runs in the opposite direction. Centralizing teacher recruitment from town to county government in Gansu province, China led to fewer teachers being allocated to schools with shortages, exacerbating existing inequalities (Han 2013).

Better school-level recruitment and teacher management practices are also associated with better performance in Uganda (Crawford 2017). There is some evidence that in the private sector in India, better-managed schools can attract and retain better teachers (Lemos, Muralidharan, and Scur 2018).

One consequence of central recruitment of teachers is national political influence in the process. In Indonesia, the recruitment of contract teachers and promotions of civil service teachers increase during election years (Pierskalla and Sacks 2019). A similar electoral teacher recruitment cycle occurs in India (Fagernäs and Pelkonen 2018).

#### **3.3.3 Promotion**

Governments must also decide how to allocate teachers to job titles and duties within schools. In many low and middle-income countries, promotion opportunities for teachers are scarce (Evans and Yuan 2018). Some systems have different pay scales, with pay increasing linearly with experience within a level, but promotion offering a step up into a higher scale. In China, teachers increase their effort in the years approaching eligibility for promotion and reduce effort if they are repeatedly passed over for promotion, in line with theory (Karachiwalla and Park 2016). A review of teacher professional development programs around the world found that training can be most effective when explicitly linked to promotion decisions (Popova et al. 2019).

### **3.4 Segmented labor markets**

As a starting point of inquiry on segmented markets for teachers, we identify departures from the costless adjustment of wages, employment, or hours which would prevail in a competitive labor market. Some of these—such as public sector and union wage-setting—have been discussed in previous sections. Here we present evidence on additional frictions. We then discuss how these frictions relate to market segmentation.

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*Firing government teachers can be nearly impossible.* In several countries, it is not possible to dismiss a teacher for incompetence or poor performance (World Bank n.d.).<sup>18</sup> In practice, even where it is possible to dismiss teachers for absence or misconduct, cases of such dismissal are incredibly rare (Pritchett and Murgai 2007). High rates of teacher absence persist in part because teachers are rarely dismissed for this reason (Chaudhury et al. 2006). Indeed, a systematic review of teacher absenteeism listed no studies measuring the effects of dismissal as an explicit consequence of teacher absence (Guerrero et al. 2013).

*Official working hours are lower in developing countries.* Median (official) working time is 27 hours per week in low-income countries, 30 hours in lower-middle-income, 36 in upper-middle-income, and 40 in high-income countries (UNESCO Institute for Statistics 2018).

*The stock of potential teachers is large.* Across 25 African countries, the stock of graduates from teacher training courses is 4.7 times the stock of teachers (UNESCO Institute for Statistics 2018).<sup>19</sup> This excess supply is consistent with government rationing access to high pay permanent civil service jobs, and graduates queuing for teaching posts. Simultaneous high rates of unqualified teachers may be attributable to an older cohort of unqualified but tenured teachers, and the presence of contract teachers.

*Moonlighting—holding another paid job, often as a private tutor—is a common practice among teachers in developing countries* (Mizala and Ñopo 2016b; Béteille and Evans 2019). Moonlighting can be seen as a response by teachers to low wages or exclusion from the formal sector. This may also have negative consequences for students. For example, in Nepal, teachers who tutor privately out of school teach less during the day (Jayachandran 2014). The effect is driven by teachers in government schools, which attract higher-quality students and teachers on average.

Each of these stylised facts is consistent with a dual labor market. There is a formal public sector employer, characterised by higher wages and permanent contracts, and an informal private sector with much lower wages and non-permanent contracts.<sup>20</sup> Public school systems have made some attempts to take advantage of lower potential salaries in two ways. First, they recruit “contract teachers” into the public system (Chudgar, Chandra, and Razzaque 2014). Second, they contract out school operation entirely to the private sector, either through the privatisation of existing government schools or through subsidisation of existing private schools (Aslam, Rawal, and Saeed 2017; Romero, Sandefur, and Sandholtz 2020).

An important constraint on governments to make teaching contracts more flexible has been successful lobbying by teacher unions for the regularisation of teachers on different contractual terms (Bold et al. 2018). Yet teachers remain willing to accept contract or private positions on less favorable terms. In many cases such teachers are unqualified, and therefore effectively shut out of the more advantaged sector. Others may be optimally queuing for a chance to obtain a formal

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<sup>18</sup> These countries are Benin, Cambodia, Cote d'Ivoire, Croatia, Guinea-Bissau, Lebanon, Morocco, Paraguay, Russian Federation, Serbia, Uganda, and Yemen.

<sup>19</sup> The countries are Botswana, Burkina Faso, Burundi, Cabo Verde, Cote D'Ivoire, Eritrea, Eswatini, Guinea, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritius, Morocco, Mozambique, Niger, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Togo, Tanzania, Zambia. Latest data available for each country between 2012 and 2015.

<sup>20</sup> In some cases, the relative position of these sectors is the reverse. In Chile, for instance, the private sector offers higher pay and attracts better teachers than the public sector (Behrman et al. 2016; Correa, Parro, and Reyes 2015).

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public sector position eventually, and so are willing to work (temporarily) for a lower wage than they would otherwise accept.

## 4 Conclusions and remaining gaps

Rapid growth in student enrollment in developing countries has led to a commensurate growth in the size of teacher labor markets. This growth is only expected to continue under the education targets of the Sustainable Development Goals. Research on how these markets function has also expanded in depth and breadth. Of particular note are the advances in understanding how teachers respond to salary increases and how teachers in the public sector compare to their counterparts in private schools or other professions. The literature also highlights the many frictions present in teacher labor markets in developing countries, such as non-market wage-setting and effective prohibitions against firing.

Despite these advances in understanding, gaps remain. For instance, credible evidence on the direction and magnitude of teacher rents comes from a small number of countries. And although the responsiveness of teachers to changes in pay has been widely studied, most evidence focuses only on short-term effects on the existing corps of teachers. Evidence on long-term effects, on recruitment of new teachers, or from variation in non-pecuniary compensation is scarcer. Geographically, the highest quality studies focus on Latin America, Sub-Saharan Africa, and Asia, with less evidence from Eastern Europe, North Africa, and the Middle East. Future research would benefit from an expansion of topics and developing regions, using evidence from randomized control trials and quasi-experiments where possible.

Important policy questions remain for developing country governments and donor partners around how the further expansion in enrolment, particularly at the secondary level, and improvement in the quality of teaching throughout, can be financed.

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## 6 Tables and figures

Table 1: Teacher payroll

	<u>number of</u>	<u>total teacher compensation as percentage of:</u>		
	<u>countries</u>	<u>education spending</u>	<u>public expenditure</u>	<u>GDP</u>
	(1)	(2)	(3)	(4)
<u>Income group</u>				
all developing countries	49	62.6	11.1	2.8
low	15	54.6	7.8	1.6
lower middle	17	62.0	12.0	2.3
upper middle	17	63.7	11.2	3.1
high (non-OECD)	14	61.6	7.0	2.5
high (OECD)	19	48.9	6.1	2.5
<u>Region (excludes OECD)</u>				
East Asia & Pacific	10	58.4	11.5	2.2
Europe & Central Asia	11	62.6	6.8	2.4
Latin America & Caribbean	15	64.9	11.6	3.3
Middle East & North Africa	5	70.1	13.1	2.8
South Asia	5	56.8	6.7	1.1
Sub-Saharan Africa	17	57.5	10.7	3.2

Source: UNESCO Institute for Statistics (2018) for teacher compensation, World Bank (2018) for all other data. Regional groupings exclude countries that are OECD members. Teacher payroll data are from most recent year available from 2013-2017. All other data from same year as teacher payroll data, or 2013-2017 average when that year is unavailable. To calculate column (3), teacher compensation as percent of education expenditure multiplied by education spending as percentage of public expenditure. To calculate column (4), teacher compensation as percent of education expenditure multiplied by education spending as percentage of GDP. All calculations weight by GDP within country groups.

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Table 2: Teachers and the labor force

	Number of	female	teachers as percentage of:						
	Countries	teacher	labor	female	wage/salary	professionals	public	secondary	university
	in sample	percentage	force	labor force	workers		sector	graduates	graduates
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<u>Income group</u>									
all developing countries	14	47.5	2.0	3.5	3.1	38.2	23.8	5.7	13.1
low	3	45.9	1.8	1.7	11.9	60.3	19.8	18.1	22.1
lower middle	8	45.5	1.9	3.1	2.8	36.7	25.6	5.3	12.3
upper middle	3	60.9	4.5	12.5	7.6	47.0	18.8	7.9	18.1
<u>Region (excludes high income)</u>									
East Asia & Pacific	2	74.5	2.9	6.7	4.9	49.4	26.4	5.1	14.3
Europe & Central Asia	2	85.3	4.0	6.8	4.8	35.6	N/A	4.2	15.1
Latin America & Caribbean	2	61.9	1.9	2.9	3.0	31.2	11.2	6.1	14.2
Middle East & North Africa	2	48.4	6.1	18.6	8.8	50.2	20.7	11.6	22.4
South Asia	1	36.0	1.1	1.7	1.9	27.1	N/A	3.7	9.8
Sub-Saharan Africa	5	50.2	3.4	3.7	8.6	57.1	28.2	9.6	18.7

Source: Minnesota Population Center (2018). Sample includes population census from following countries: Armenia 2011, Belarus 2009, Botswana 2011, Cambodia 2008, Egypt 2006, El Salvador 2007, India 2009 (employment survey), Iran 2011, Mozambique 2007, Nicaragua 2005, Nigeria 2010 (household survey), Philippines 2010, Zambia 2010, Zimbabwe 2012. Sample limited to adults aged 25-55 in labor force (limited to employed workers in Philippines because labor force participation unavailable). Teachers includes teaching professionals at all levels. Professionals excludes managers and technicians. Wage worker data unavailable for Mozambique, Nigeria, and Zimbabwe. Public sector data available only for Cambodia, Egypt, El Salvador, Iran, Mozambique, Nigeria, and Philippines. All calculations weighted by population.

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Table 3: Teachers and the Sustainable Development Goals

	primary			secondary			total		
	number (millions) (1)	percent trained (2)	SDG gap (millions) (3)	number (millions) (4)	percent trained (5)	SDG gap (millions) (6)	number (millions) (7)	percent trained (8)	SDG gap (millions) (9)
<u>Income group</u>									
all developing countries	25.4	83%	4.3	26.0	N/A	N/A	51.5	N/A	N/A
low	2.8	71%	0.8	1.8	55%	0.8	4.7	65%	1.6
middle	22.6	85%	3.5	24.2	N/A	N/A	46.8	N/A	N/A
high	5.7	N/A	N/A	7.5	N/A	N/A	13.2	N/A	N/A
<u>Region (excludes high income)</u>									
East Asia & Pacific	9.7	N/A	N/A	9.1	N/A	N/A	18.8	N/A	N/A
Europe & Central Asia	1.2	89%	0.1	3.4	N/A	N/A	4.6	N/A	N/A
Latin America & Caribbean	2.5	88%	0.3	3.4	81%	0.7	5.9	84%	1.0
Middle East & North Africa	1.9	84%	0.3	1.9	80%	0.4	3.9	82%	0.7
South Asia	5.8	71%	1.7	5.4	N/A	N/A	11.2	N/A	N/A
Sub-Saharan Africa	4.3	63%	1.6	2.8	51%	1.4	7.1	58%	3.0

Source: World Bank (2018). Data from 2015. “All developing countries” aggregates low and middle income. “SDG gap” is number of untrained teachers, in millions. N/A: data unavailable.

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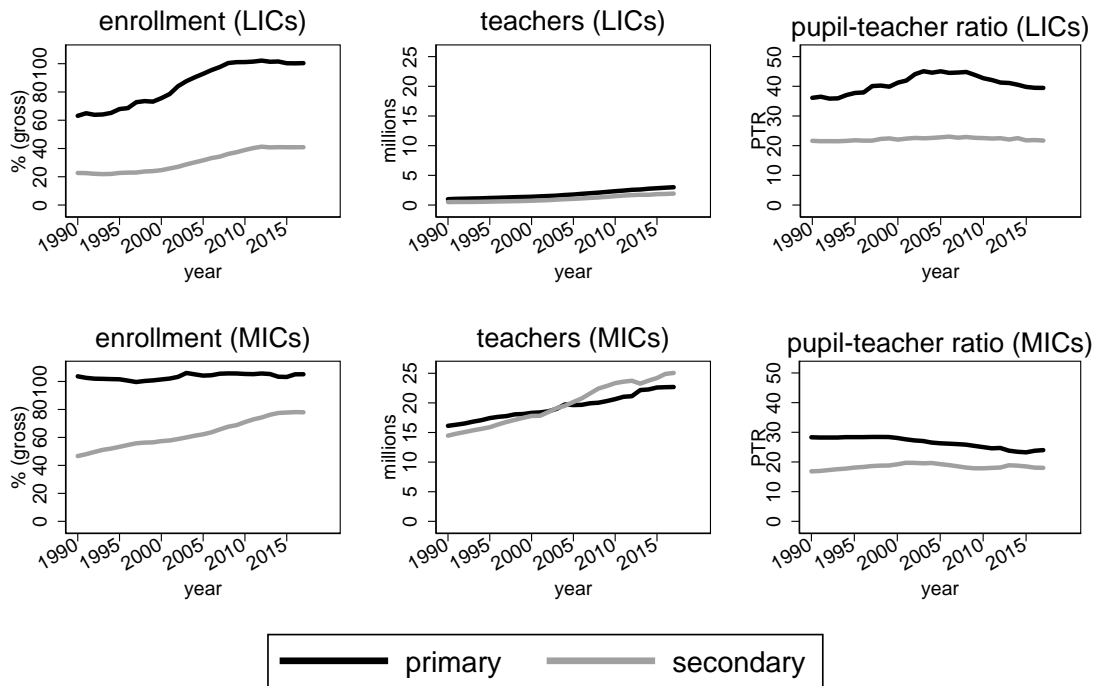
Table 4: Teacher Characteristics

	Teachers	University Graduates	High School Graduates	p-value (Teachers vs University Grads)	p-value (Teachers vs HS Grads)
<b>Teacher</b>					
Age	38.91	39.07	38.31	0.68	0.21
Female	0.71	0.58	0.58	0.00	0.00
Education	15.40	16.95	14.43	0.00	0.00
Parent went to	0.85	0.95	0.84	0.00	0.48
Went to Private	0.05	0.08	0.15	0.00	0.00
Was Best in Class	0.73	0.73	0.60	0.94	0.00
Literacy	254.36	261.10	243.73	0.00	0.00
Extraversion	0.14	0.05	-0.03	0.01	0.00
Conscientiousness	0.23	0.20	0.09	0.26	0.00
Grit	0.20	0.17	-0.01	0.41	0.00
Agreeableness	0.21	0.16	0.04	0.07	0.00
Openness	0.35	0.33	0.14	0.43	0.00
Risk Aversion	0.01	0.12	0.01	0.00	0.90
Discount Bias	-0.03	-0.06	-0.02	0.26	0.90
Hostility Aversion	-0.02	-0.08	-0.01	0.05	0.79
Life Satisfaction	6.71	6.58	6.41	0.07	0.00
<b>Job</b>					
Earnings Index	113.04	177.47	100.00	0.02	0.15
Asset Index	0.31	0.50	0.25	0.00	0.10
Provides Social	0.76	0.72	0.50	0.01	0.00
Written Contract	0.89	0.90	0.75	0.28	0.00
Informal Sector	0.25	0.31	0.55	0.00	0.00
Public Sector	0.79	0.53	0.38	0.00	0.00
Permanent Job	0.77	0.78	0.70	0.86	0.00
Hours Last Week	30.91	42.37	43.58	0.00	0.00
Autonomy Index	-0.16	-0.16	0.01	0.82	0.00
Repetitiveness	0.02	0.19	0.04	0.00	0.47
Requires Learning	0.69	0.40	0.12	0.00	0.00
Requires	0.64	0.47	0.10	0.00	0.00

This table presents summary statistics for adults aged 15-64 in urban Armenia, Bolivia, Colombia, Georgia, Ghana, Kenya, Laos, Macedonia, Sri Lanka, Ukraine, Vietnam, and Yunnan (China), taken from the World Bank STEP Skills surveys conducted between 2012 and 2014.

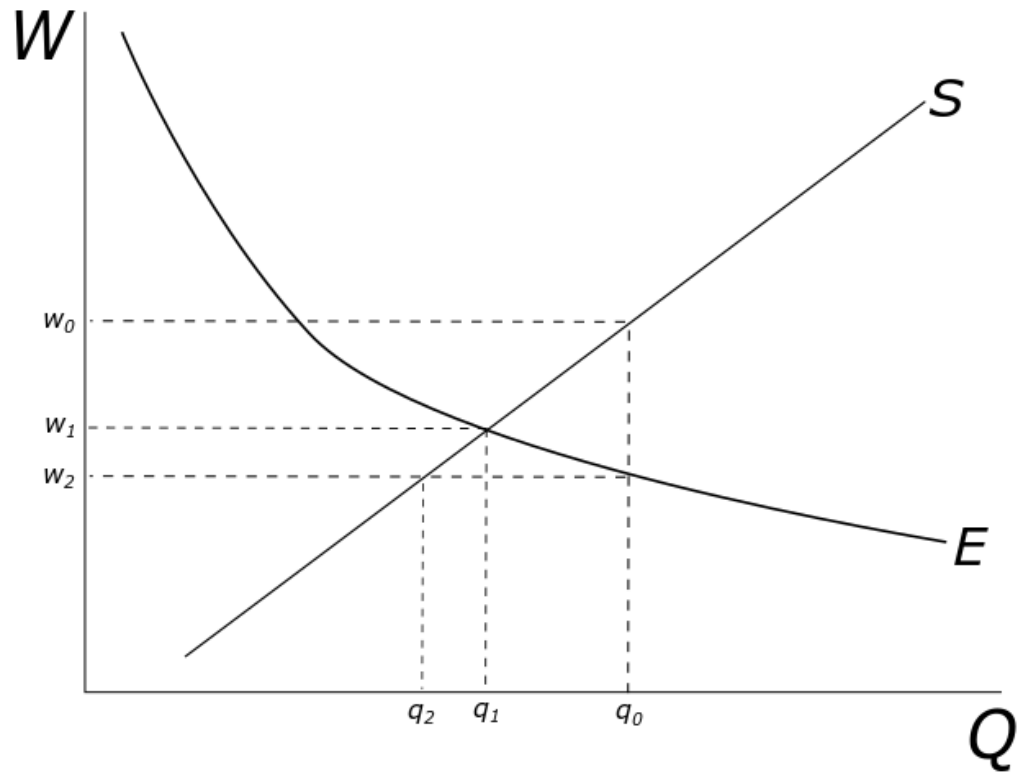
Figure 1: Enrollment and pupil-teacher ratios

Enrollment, teachers, and pupil-teacher ratio  
 low and middle income countries (LICs/MICs)



Source: World Bank (2018)

Figure 2: Teacher labor market



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Figure 3: Teacher labor market, with increased public expenditure

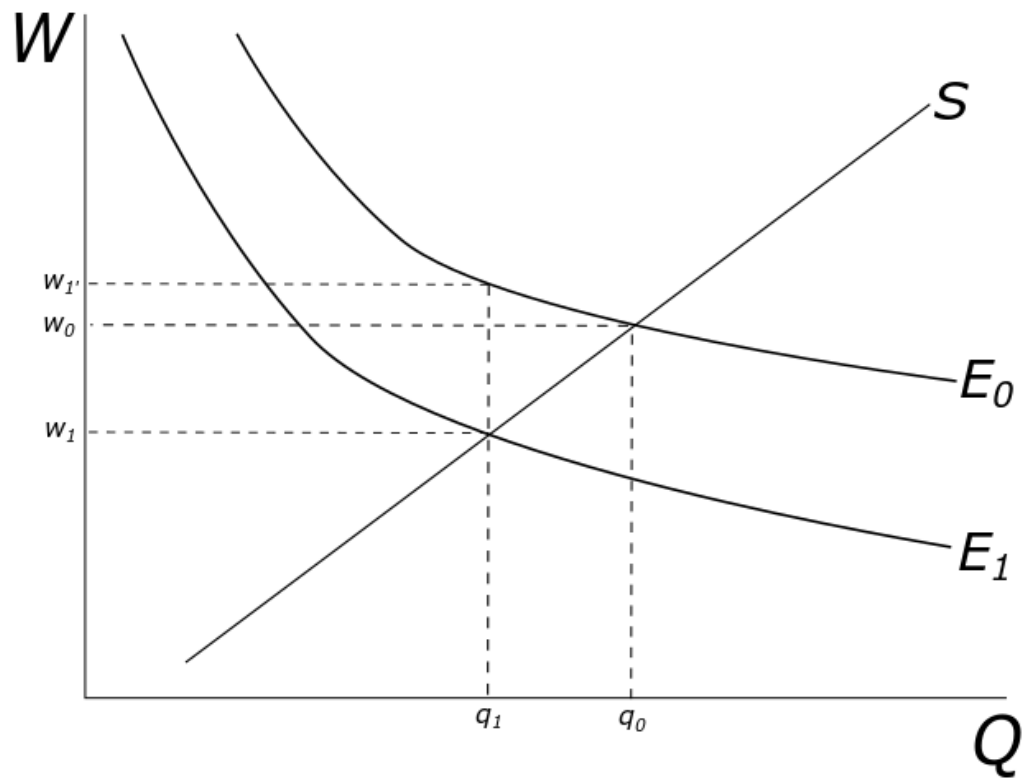
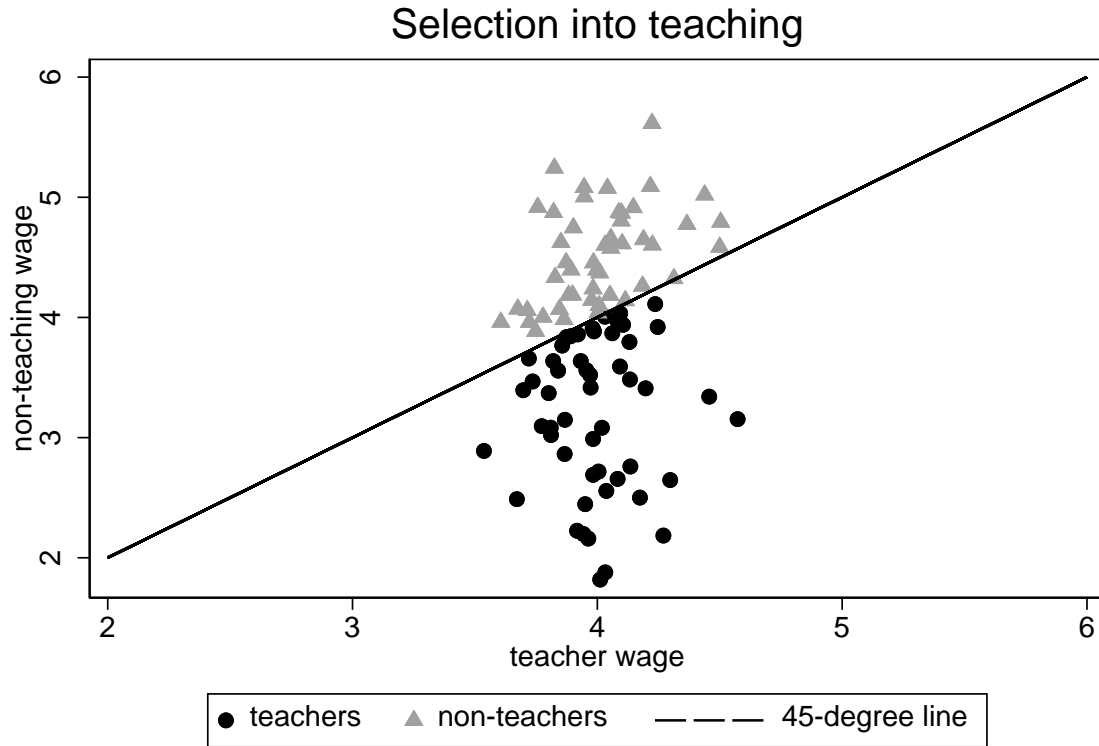


Figure 4: Selection into teaching



Assumes mean teacher & non-teacher wage offers = 2, teacher s.d. = 0.2, non-teacher s.d. = 0.8.

Figure shows results from simulating wage offers in teaching and non-teaching for 100 workers. Teacher and non-teacher wage offers are both distributed normally with mean 2. Teacher wage offers have standard deviation 0.2, while non-teacher wage offers have standard deviation 0.8. We assume no correlation between the stochastic components of wage offers.



Figure 5: Spatial distribution of teachers

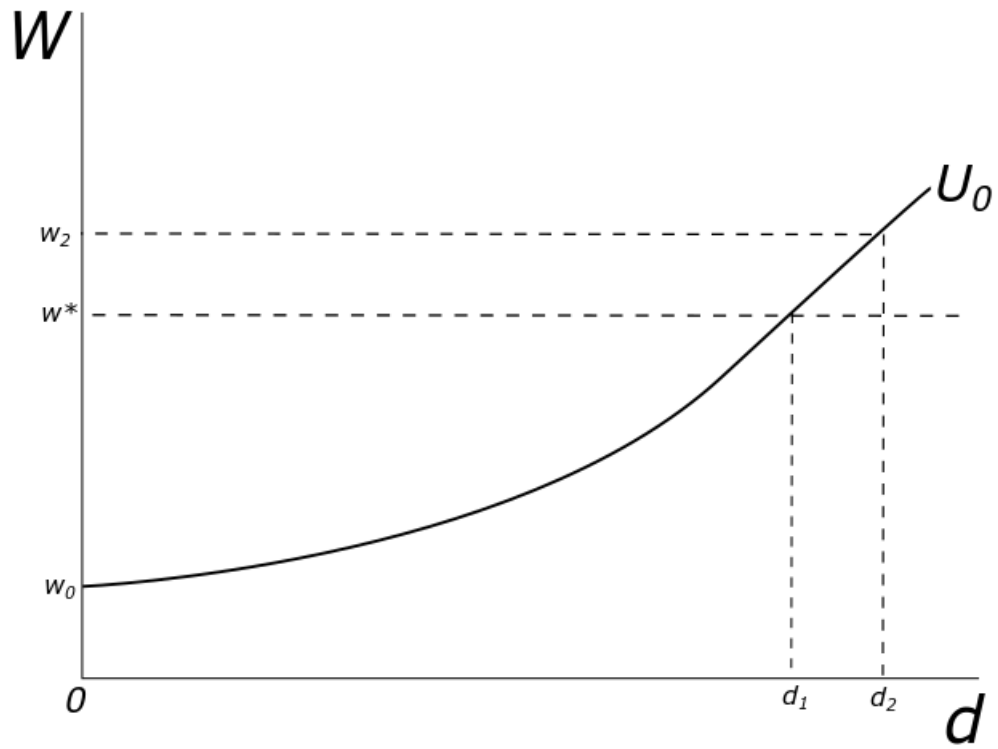


Figure 6: Segmented labor markets

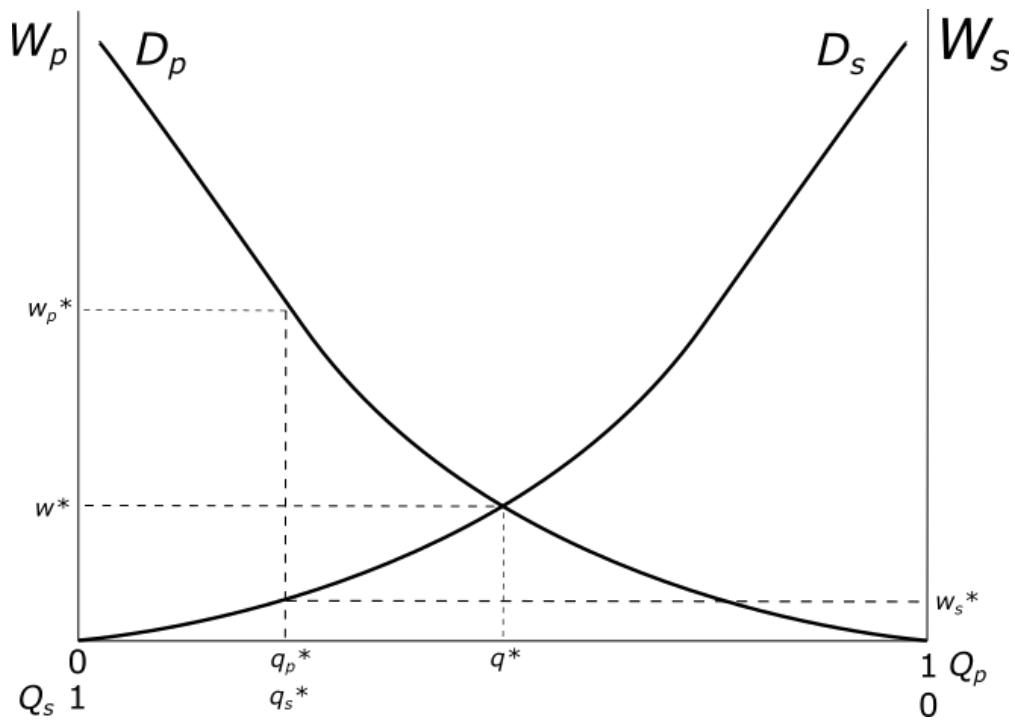
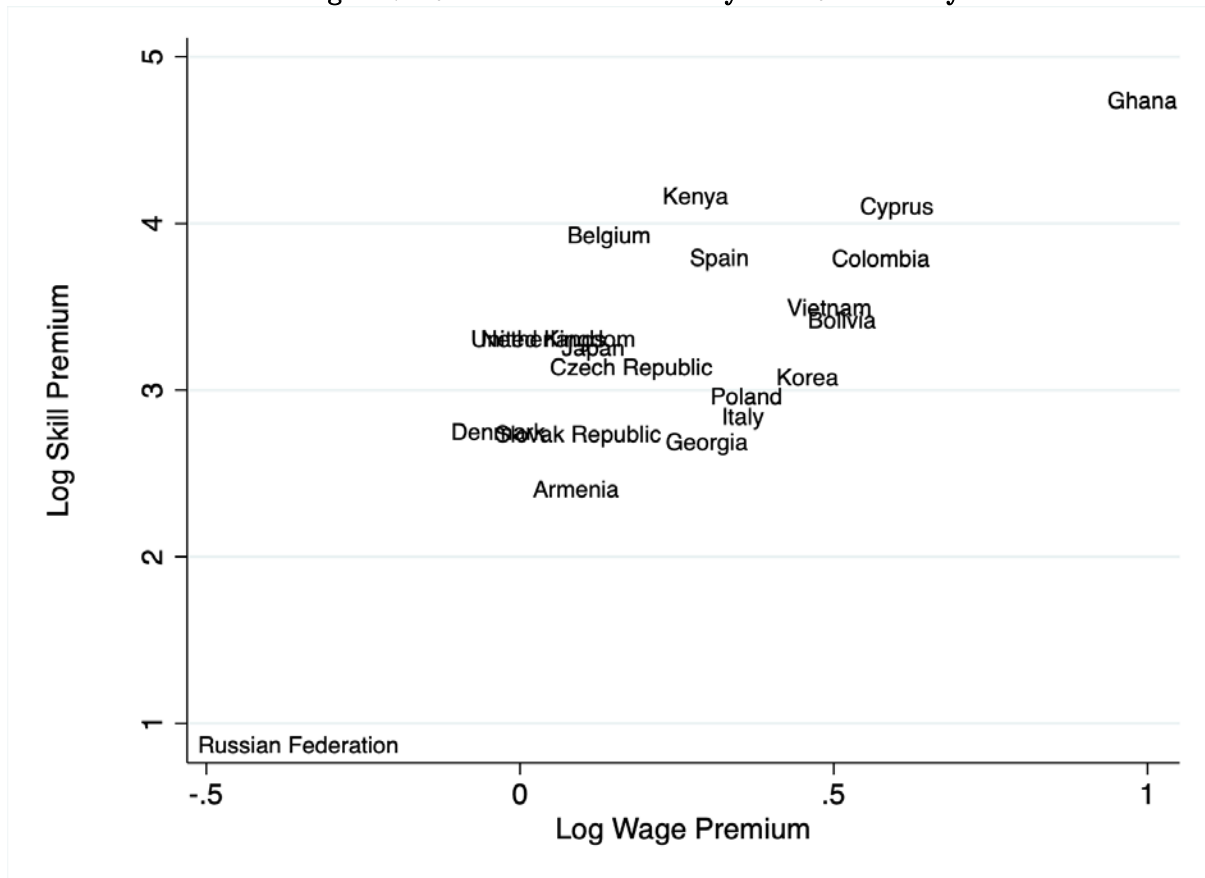
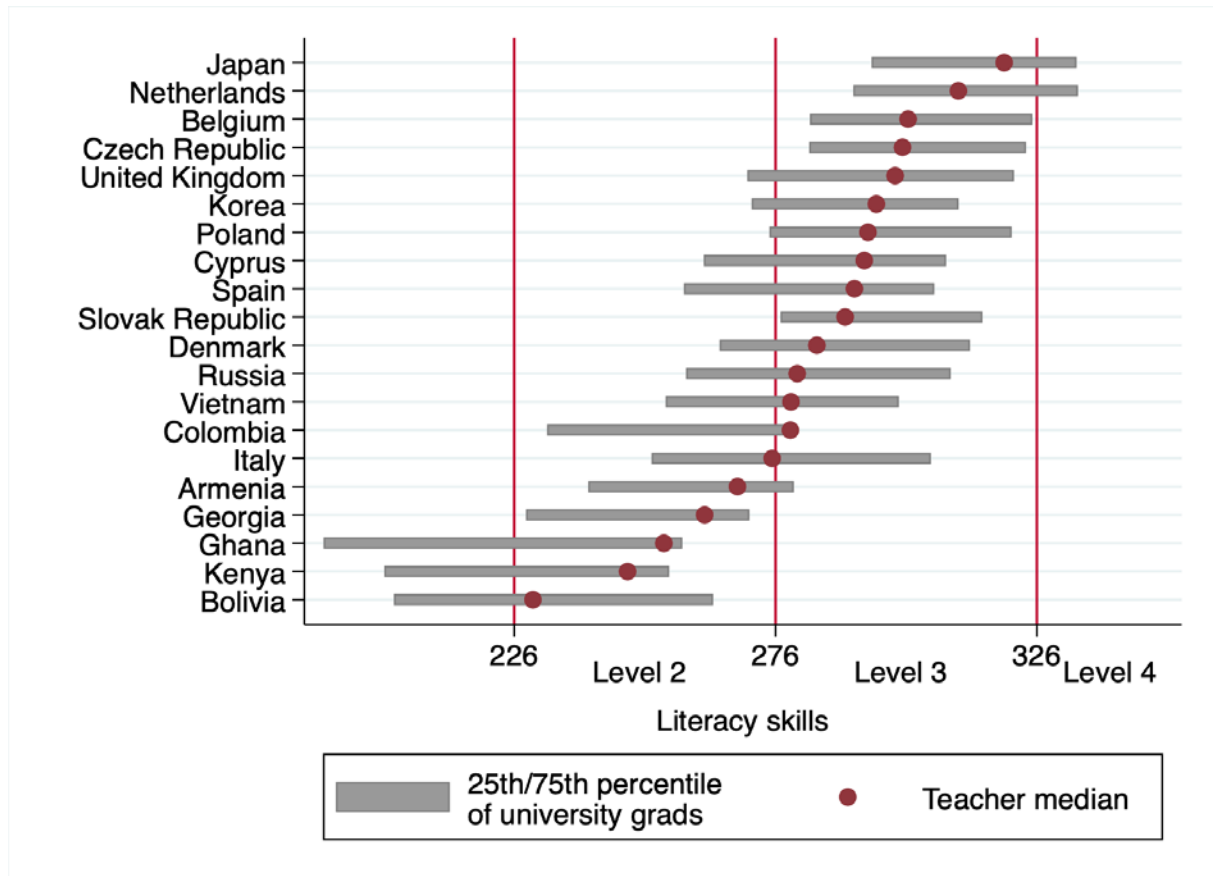


Figure 7: Relative Teacher Literacy and Relative Pay



Note: This figure shows the cross-country correlation between the skill premium and the wage premium for teachers. The skill premium is estimated as the coefficient on a teacher indicator variable in a bivariate regression on literacy score, by country. The wage premium is estimated as the coefficient on a teacher indicator in a Mincer-type OLS regressions, with log wages regressed on gender, age, and literacy level. Data for Belgium, Cyprus, Czech Republic, Denmark, Italy, Japan, Korea, Netherlands, Poland, Russian Federation, Slovak Republic, Spain, and United Kingdom come from the OECD PIAAC survey. Data for Armenia, Bolivia, Colombia, Georgia, Ghana, and Vietnam come from the World Bank STEP surveys.

Figure 8: Literacy of Teachers and University-Educated Adults



Note: This figure presents descriptive literacy levels for the median teacher, alongside the distribution of literacy levels of university graduates. This figure extends a similar figure in Hanushek, Piopiunik, and Wiederhold (2018), using data from the OECD PIAAC survey and the World Bank STEP Skills survey.