How to Recruit Teachers for Hard-to-Staff Schools: A Systematic Review of Evidence from Low- and Middle-Income Countries

David K. Evans, Amina Mendez Acosta

Abstract

Recruiting and retaining teachers for schools in rural areas or in areas with high concentrations of poverty is a challenge around the world, and many governments have implemented policies to make working in hard-to-staff schools more attractive, either to teachers overall or to the most effective teachers. This systematic review provides new empirical evidence on the relative quality of education in hard-to-staff schools, with lower teacher skill and higher teacher absenteeism in rural areas in many countries. The review then synthesizes the results of 15 experimental and quasi-experimental studies of policies to increase the quantity or improve the quality of staffing in hard-to-staff schools. The most evaluated policies—by far—are financial incentives. Financial incentives are often effective at increasing the supply and reducing the turnover of teachers in hard-to-staff schools, and incentives designed to increase the quality of teachers in hard-to-staff schools can be successful. Impacts on student learning and attendance are likewise mostly positive. Although there are fewer evaluations, behavioral and informational interventions are highly cost-effective in reducing vacancies. There is limited evidence either in favor or against the effectiveness of other policies, even though countries use a wide range of programs to draw teachers to hard-to-staff schools.

Keywords: Education, teachers, hard-to-staff schools, low- and middle-income countries

JEL codes: I22, I24, I28, J38, J45, O15

Center for Global Development
www.cgdev.org

Working Paper 595
October 2021

How to Recruit Teachers for Hard-to-Staff Schools: A Systematic Review of Evidence from Low- and Middle-Income Countries

David K. Evans and Amina Mendez Acosta
Center for Global Development

We thank the Bill & Melinda Gates Foundation for financially supporting this research. We thank Tara Béteille, Juan Castro, Lee Crawfurd, Gregory Elacqua, Miguel Urquiola, and Noah Yarrow for helpful comments. Author names are listed alphabetically. Corresponding author: Evans (devans@cgdev.org).

David K. Evans and Amina Mendez Acosta. 2021. "How to Recruit Teachers for Hard-to-Staff Schools: A Systematic Review of Evidence from Low- and Middle-Income Countries." CGD Working Paper 595. Washington, DC: Center for Global Development. https://www.cgdev.org/publication/how-recruit-teachers-hard-staff-schools-systematic-review-evidence-low-and-middle-income

Center for Global Development
2055 L Street NW
Washington, DC 20036

202.416.4000
(f) 202.416.4050

www.cgdev.org

Contents

List of figures

List of tables

1. Introduction

Schools in rural areas and schools in areas with high concentrations of poverty or poor performance are difficult to staff. In low- and middle-income countries in particular, rural schools and the communities that house them may lack an array of amenities, such as quality housing and electricity. In urban areas, schools in high-poverty neighborhoods likewise may have less discretionary funding or lack other amenities. These factors and others make recruiting and then retaining teachers—especially high-quality teachers—a consistent challenge. Dozens of low- and middle-income countries have implemented policies to increase the supply of teachers in hard-to-staff schools, including financial incentives, additional training, a faster track towards promotion, mandatory rotations, and subsidized housing (Elacqua et al., 2018; McEwan, 1999; Pugatch and Schroeder, 2014). More recently, governments are experimenting with behavioral nudges to encourage teachers to select hard-to-staff schools (Ajzenman et al., 2021a, 2021b). How effective are these strategies?

This review examines the available empirical evidence measuring the effectiveness of government-implemented policies to recruit and retain teachers to rural or otherwise hard-to-staff schools in low- and middle-income countries. Our systematic search identified 7,400 potential studies, of which 15 were experimental or quasi-experimental evaluations of policies to boost teacher recruitment or retention in schools. All of those studies were of interventions in Africa, Latin America, or South Asia. Twelve were of financial incentives to teachers and three were of other policies. We draw on these studies to summarize the cross-country challenge of recruiting quality teachers and present evidence from newly available data on teacher quality in hard-to-staff areas. We then examine impacts on teachers as well as on student performance, with a separate analysis of results on the proportion of female teachers. We discuss costs, common implementation challenges, and results from non-state interventions. Finally, we include a discussion of findings from weaker, non-experimental studies, including surveys of teachers, which provide insight into stated preferences and experiences in a broader range of countries.

We find that most financial incentive programs have positive impacts on teacher outcomes, ranging from increasing placement in hard-to-staff schools to reducing turnover. Not all programs were successful: for example, one particularly small bonus in Brazil had no impact. Effects were sometimes concentrated in particular sub-groups: an incentive program in Peru improved recruitment, but only for short-term positions. One intervention—in Chile—focused explicitly on increasing the quality of teachers in hard-to-staff schools: that program dramatically increased retention for teachers already working in the disadvantaged schools at baseline, but not recruitment to those schools. Two other programs not explicitly designed to increase quality (in Peru and the Gambia) also boosted measures of teacher quality. There is evidence of implementation challenges in many of programs, and evidence from Peru suggests that even when financial incentives are effective at boosting recruitment or retention, they are unlikely to close the existing gaps in teacher supply and quality at the spending levels currently in place.

Most evaluations of non-financial programs show positive impacts on teacher outcomes. Both informational and behavioral interventions were effective: one, in Chile, provided

information either about an existing financial incentive program or emphasizing the good that teachers do, and another, in Ecuador, simply put hard-to-staff schools at the top of the list of schools teachers could choose from. Both increased placements in hard-to-staff schools at low (or almost zero) cost. These are cost-effective complements to other efforts to staff rural or high-poverty schools. The final study, a recruitment drive for additional teachers in short-staffed schools in India—in which the federal government financed the teacher contracts for the first few years—did not increase teacher recruitment, but it did redistribute teachers from larger schools to smaller schools.

We find positive impacts on student learning in most studies that report on that outcome. (Only 9 of the 15 studies report student outcomes.) Again, some of the impacts are driven by sub-groups: an incentive program in Brazil improved student outcomes only for initially low performers, a program in Zambia significantly improved test scores for boys but not for girls, and an incentive program in Gambia improved student outcomes consistently only for better-off students.

There is very little evidence on the effectiveness of other mechanisms to recruit or retain teachers in hard-to-staff schools, despite the fact that countries implement a wide array of policies (e.g., professional development, subsidized housing, and faster promotion), and teachers signal support for such alternative policies. Finally, we provide new evidence that teachers in rural areas (using newly available data from eight African countries) tend to have lower skills and higher absenteeism than teachers in urban or peri-urban areas.

This review complements a broader literature on recruiting and retaining service professionals in hard-to-staff areas. For example, a recent review of evidence on teachers that is almost entirely focused on high-income countries (See et al., 2020a, 2020b) finds that financial incentives (including signing bonuses, loan forgiveness, and allowances) can be effective in recruiting teachers in disadvantaged schools, but only while the incentives last or when there is an explicit time commitment to remaining in hard-to-staff schools. There is little robust evidence for alternative interventions such as teacher professional development and mentoring support. This paper also complements existing synthesis work on hard-to-staff schools in low- and middle-income countries: Elacqua et al. (2018) document a wide array of policies to attract teachers to vulnerable schools across Latin America, and Bertoni et al. (2018) discuss policies in Chile, Colombia, and Peru in greater detail. Related research seeks to facilitate more even distribution of teachers across schools, without a focus on hard-to-staff schools per se (Bashir et al., 2018; Datta and Kingdon, 2021; Majgaard and Mingat, 2012).

Part of this broader literature includes the recruitment and retention of doctors and nurses in the health sector, where many countries have implemented similar policies (Araújo and Maeda, 2013). A recent review identifies over 100 studies of monetary and non-monetary interventions for rural health workers that includes work-related materials such as bicycles, boots and smart phones, job aids such as access to digital health technology, and other reforms such as family and community engagement and health service redesign. They find that incentives, while effective at recruitment and short-term retention, are sometimes not in place long enough to have a lasting impact on retention and may in fact have adverse

unintended consequences, such as when financial incentives lead to increased administrative burden, in turn reducing clinical hours (World Health Organization, 2020). They also find that financial incentives implemented in isolation are rarely effective, concluding that bundled interventions that provide comprehensive packages of financial and non-financial rewards including community support are more likely to improve post attractiveness, worker recruitment and retention, and patient health.

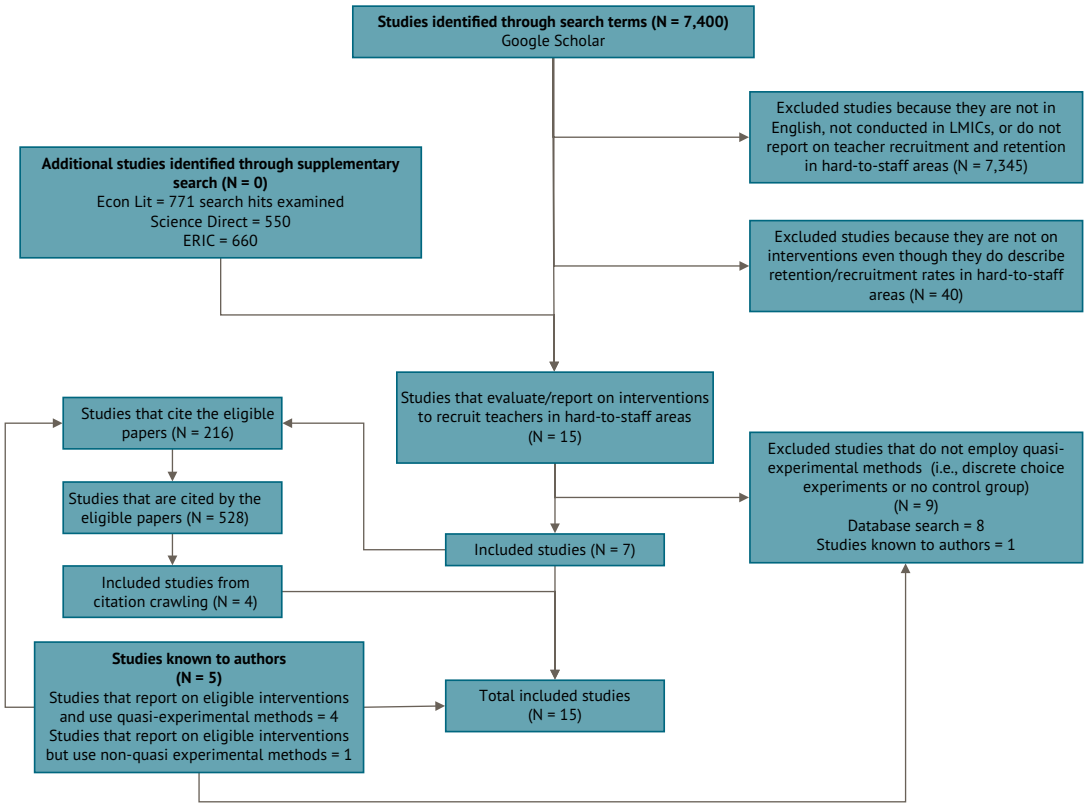
Finally, this contributes to the literature on teacher labor markets in low- and middle-income countries more broadly (Crawfurd and Pugatch, 2020), especially teacher compensation (Evans et al., 2020; Mizala and Ñopo, 2016). Indeed, several studies have used discontinuities for hardship pay to identify the impact of unconditional salaries increases for teachers (Chelwa et al., 2019; Pugatch and Schroeder, 2018), complementing other work on teacher salary increases (de Ree et al., 2018). A richer understanding of how to staff schools with challenging working conditions contributes to a full understanding of how to build an effective teacher corps and successful students.

2. Methods

2.1. Systematic review of interventions to boost teacher quality or quantity in hard-to-staff schools

Our search strategy focused on experimental or quasi-experimental evaluations of interventions to recruit and retain teachers in hard-to-staff schools such as those in rural and remote areas, lower income neighborhoods, or otherwise disadvantaged communities in low- and middle-income countries. We did not impose a limit on publication dates for the search. We searched for papers written in English and published in peer-reviewed journals, working papers series, and academic conferences. The search was conducted between June and August 2021. Figure 1 provides an overview of our search process.

Figure 1. Consort diagram of the search and review process



Source: Authors' illustration based on this study's search and review strategy.

We used Google Scholar as the primary search database and used the following search terms: ("teacher" OR "teaching" OR "school") AND ("hard-to-staff" OR "disadvantaged" OR "remote" OR "rural" OR "high poverty" OR "underprivileged' OR "hardship") AND ("incentive" OR "allowance" OR "bonus" OR "higher salary" OR "higher pay") and "country X," where "country X" is substituted by each low- and middle-income country name as classified by the World Bank in 2020 (World Bank, 2021). In order to ensure that we captured non-financial incentives, we also ran searches that use the terms ("incentive" OR "housing" OR "transportation" OR "promotion" OR "retirement" OR "training"). We include papers regardless of publication status (e.g., working papers and conference papers as well as journal publications) to limit publication bias. We evaluated the title, abstract, and the full text of the papers as needed to review eligibility. Since each unique search often returned hits in the thousands, we narrowed the screening by reviewing the first 50 hits from each search, sorted by relevance. In total, we reviewed 7,400 hits from Google Scholar. The majority of the studies were excluded (7,345 studies) because they were either not conducted in low- and middle-income countries, not designed to recruit teachers in hard-to-staff areas, did not report relevant outcomes such as teacher recruitment and retention or related student performance, were not government implemented, or were not in English. Another 40 studies were excluded because they did not evaluate interventions, even though they did describe retention/recruitment rates in hard-to-staff areas. Another 8 studies that did report on the topic of recruiting teachers in hard-to-staff areas in low- and middle-income countries were

excluded from the primary sample because they did not employ experimental or quasi-experimental methods—i.e., they used discrete choice experiments or had no control group.[1] This stage of the screening yielded 7 eligible studies.

Recognizing the limitations of Google Scholar as a search system (Gusenbauer and Haddaway, 2020), we supplemented our primary search with additional, limited searches in EconLit (771 search hits), ScienceDirect (550 search hits) and the Education Resources Information Center (ERIC) (660 search hits) to ensure we had not missed relevant studies. We used the same search terms but with (a) no geographical identifier, (b) a regional identifier such as "...AND Africa" instead of the country identifier, or (c) the country name for the most populous country in each region (e.g., "... AND Nigeria"), and evaluating the first 50 hits of each unique search or all the hits, whichever number was smaller. We found several studies that were already in the database but no additional papers.

For the next stage of the search, we reviewed the papers that cited the studies that passed our eligibility criteria and studies that were cited by the eligible studies, repeating the citation crawl for any new eligible study. In total, we reviewed 216 studies that cited our eligible studies and 528 studies that were cited by our eligible studies. This stage added four eligible studies to the list. Finally, we reviewed five studies that were known to the authors but did not come up in the search. Four of those five studies passed all of the eligibility criteria. The remaining study was a discrete choice experiment: this was added to the list of studies that report on the topic of recruiting teachers in hard-to-staff areas but whose methodology did not pass the eligibility criteria. (This brings the total of such evaluations to nine studies. We list these studies in Appendix Table A1 and discuss them briefly in Section 3.4.)

In total, we identified 15 studies that pass our eligibility criteria (Table 1). All of those studies are from either Latin America (Bolivia, Brazil, Chile,[2] Ecuador, Peru, and Uruguay), Sub-Saharan Africa (the Gambia, Tanzania, and Zambia) or South Asia (India). Twelve of them are quasi-experimental evaluations of various forms of financial incentives for teachers in hard-to-staff schools, either rural areas or high-poverty schools, one is a quasi-experimental evaluation of a recruitment drive for short-staffed schools, and the other two are experimental evaluations of interventions to encourage more teachers to list hard-to-staff schools among their choices for potential assignment. (The predominance of financial incentives among evaluated programs is consistent with the pattern in a recent systematic review focused on high-income countries, where all the well-identified studies were of financial incentives (See et al. 2020a).) Of the thirteen total quasi-experimental evaluations, ten use regression discontinuity designs, one uses a difference-in-differences strategy, and

---

[1] Discrete choice experiments are a research method that asks survey respondents to choose between alternative hypothetical scenarios in order to better understand preferences (Mangham et al., 2009). In the context of staffing hard-to-staff schools, a discrete choice experiment might ask a teacher training student to choose between a certain wage in an urban setting and a higher wage in a remote setting. By testing different wages, one can understand candidates' stated preferences. These may not map perfectly to their preferences when faced with real life scenarios.

[2] Chile is a high-income country today, but it was classified as a middle-income country through 2012, and most of the studies in our sample include years previous to that (World Bank, 2021).

two use matching strategies.[3] We include a discussion of strengths and weaknesses of the different strategy in our narrative of the results.

Table 1. List of 15 included studies of interventions

Study	Type of Program	Country	Year of Intervention Evaluated
Ajzenman et al. (2021a)	Informational interventions emphasizing either financial incentives or altruistic motivations for teachers in underprivileged schools	Peru	The informational interventions were implemented in 2019.
Ajzenman et al. (2021b)	Behavioral nudge (listing hard-to-staff schools first in job application platform)	Ecuador	Platform change was implemented in 2019.
Bobba et al. (2021)	Financial incentive (government-sponsored wage bonus for teachers in select rural areas)	Peru	Policy was first implemented in 2014 with increase in bonuses in 2015.
Cabrera and Webbink (2020)	Financial incentive (increase in base salary for teachers working in poor neighborhoods)	Uruguay	Program was launched in 1995 and updated in 2005 to use a poverty index cut-off as eligibility criteria.
Camelo and Ponczek (2021)	Financial incentive (wage premium for teachers at disadvantaged schools)	Brazil	Program was launched in 2008.
Castro and Esposito (2021)	Financial incentive (rural bonuses)	Peru	The program was started in 1990 and revamped in 2014 to increase bonuses and include more schools.
Chin (2005)	Other intervention (government recruitment drive for additional teachers in one-teacher primary schools)	India	Launched in 1987, the program served all originally targeted schools by 1994.
Chelwa et al. (2019)	Financial incentive (rural hardship allowance)	Zambia	Allowance was implemented in the 1990s, revamped in 2008 (to become 20% salary increase), and implementation rules were changed in 2010.
Elacqua et al. (2019)	Financial incentive (salary bonus)	Chile	Program under evaluation was implemented between 2012 and 2015.

[3] Not all researchers would characterize matching studies as "quasi-experimental" because the assumptions required to establish causality are stronger. However, we do include them here because matching studies seek to emulate experimental designs, albeit with highly varying degrees of credibility.

Study	Type of Program	Country	Year of Intervention Evaluated
Hinze-Pifer and Méndez (2016)	Financial incentive (additional bonus for teachers in disadvantaged schools)	Chile	Program was originally established in 1996.
Pugatch and Schroeder (2014, 2018)	Financial incentive (hardship allowance for school teachers in remote locations)	Gambia	Allowance policy was adopted in 2005.
Rosa (2019)	Financial incentive (wage premium for teachers farther from downtown)	Brazil	Classification of neighborhoods and corresponding wage premium was set up in 1991.
Swai (2013)	Financial incentive (cash bonus to attract teachers in the region)	Tanzania	Policy was initially implemented in 2004.
Urquiola and Vegas (2005)	Financial incentive (salary bonus to rural teachers)	Bolivia	Bonus based on geography is based on different incentive programs. The bonus reported in the study reflect 2002 salary levels.

Note: See Appendix Tables A5 and A7 for additional details on the interventions, research designs, evaluation timeframes, samples, and outcomes.

In this review, we principally report the results in narrative form rather than meta-analysis because the studies vary widely in their outcomes, making meta-analysis more difficult to interpret. To supplement our narrative analysis, we also report vote counts (i.e., the distribution of positive and negative results across studies), which should be viewed as suggestive only, given the significant limitations of that method (Higgins and Green, 2011).[4] Still, understanding the pattern of results can be useful.

2.2. Methods to characterize the problem

Beyond summarizing the impacts of interventions, we also characterize the problem of staffing hard-to-staff schools. We do this in two ways. First, we draw on the studies identified in our systematic search and summarize how they characterize the problem across a range of countries.

Second, while this study focuses on staffing hard-to-staff schools across all low- and middle-income countries, our original analysis of data to help quantify the problem focuses on African countries because of newly available data in those settings. The Service Delivery

[4] A key limitation of vote counting is that it ignores crucial data such as sample size, statistical precision (beyond significance cut-offs), and effect size. As a result, small but significant effects may come to be viewed as more positive than large but just barely insignificant effects (Evans and Popova, 2016). One partial solution is to focus on the distribution of positive versus negative results rather than on statistical significance (Higgins and Green, 2011).

Indicators (SDI) program collects and reports nationally representative cross-sectional surveys on service delivery performance in education and health facilities across select countries in Africa (Bold et al., 2011, 2010). Currently, there are nine publicly available education datasets for eight countries (World Bank Microdata Library, 2021): Kenya (2012), Madagascar (2016), Morocco (2016), Mozambique (2014), Nigeria (2013), Tanzania (2014 and 2016), Togo (2013) and Uganda (2013).

The datasets use a multistage cluster sampling design across rural and urban areas and public and non-public schools, and they report a wide range of information on teachers' workload and performance along with school-level variables. For this study, we looked at differences in teacher absenteeism, teacher skills, and pupil-teacher ratios between rural and urban areas. Absenteeism rates are calculated from the attendance records of an unannounced visit of an enumerator to schools (Service Delivery Indicators, 2017). The SDI surveys also evaluate the teachers' minimum knowledge required to be effective in reading, writing, arithmetic, and pedagogy by administering task-based tests to all mathematics and language teachers who taught fourth grade in the year the survey was conducted or third grade in the previous year (Service Delivery Indicators, 2017). The test covers the literacy and numeracy curriculum expected to be taught at the lower primary level. We used the observed classroom size data available to calculate student-teacher ratios. Finally, we used the data on students with at least one exercise book and classrooms with functioning boards (i.e., blackboards have enough contrast for students at the front and back of the classroom to read what is written on it) to analyze available classroom resources. Averages were computed at the school-level and aggregated at the country level using the provided school-level weights. We compare these indicators for schools in rural areas versus schools in the same country located in urban or semi-urban areas.

3. Results

3.1. Quantifying the problem

Hard-to-staff schools face two primary staffing problems. First, they face shortages of teachers, which may arise from either a failure of candidates to apply for these vacancies, a higher rate of turnover among teachers at those schools, or both. Second, they may face a shortage of quality teaching candidates. Even if schools manage to staff rural schools or high-poverty schools, they may principally have to staff them with novice teachers, less motivated teachers, less skilled teachers, or contract teachers that do not yet meet the minimum official standards to be permanent teachers.

3.1.1. Quantity of teachers

Despite widespread reports of teacher shortages in rural and other hard-to-staff schools, quantifying these shortages systematically can be a challenge. One may be tempted to compare pupil-teacher ratios, but that would only make sense when comparing areas with comparable population densities. Many hard-to-staff schools are in rural areas, where

population densities are much lower, such that pupil-teacher ratios are actually lower. This is true both in high-income countries (Avvisati, 2018; OECD, 2018) and in our sample of African countries (Appendix Figure A1). The challenge, in those cases, is not that pupil-teacher ratios are too high, but rather that schools may not be able to find teachers to teach at all or to retain them, leading to either an inability to offer certain grades or to multi-grade classrooms. Another manifestation—observed in rural schools in several Latin American countries—is when teachers are assigned to subjects for which they have not been formally trained (Bertoni et al., 2020). This challenge will grow as education continues expanding in low- and middle-income country environments, where most out-of-school children are in rural areas (Carvalho et al., 2021; Global Education Monitoring Report Team, 2020).

The studies in our sample provide insight into the magnitude of the problem (Table 2). In Peru, as part of the teacher-school matching process, teacher candidates who score above a required threshold on a knowledge test may list all the schools they would be interested in teaching at. Schools in the most rural areas, with high levels of poverty, further from the provincial capital, or with lower student test scores were all more likely to have zero candidates select them (Ajzenman et al., 2021a). In a 2018 teacher survey, also in Peru, only 6.5 percent of urban teachers indicated a willingness to relocate to rural areas without additional compensation, and almost a quarter of teachers would not relocate under any circumstances (Castro and Esposito, 2021). In Brazil, schools with a lower socio-economic index and poorer students have higher teacher turn-over rates, fewer teachers on permanent contracts, and generally worse teacher shortages (Camelo and Ponczek, 2021; Rosa, 2019). In India (in a characterization that is now quite dated), almost 30 percent of India's half million primary schools were one-teacher schools in 1987 (Chin, 2005).

Table 2. Characterization of the problem

Quantity of Teachers		
Ajzenman et al. (2021a)	Peru	"Out of the 12,300 public schools that had vacancies in the 24 regions of Peru in 2019, 6,424 (52%) were not selected by any candidate at the national stage. The difference in terms of observable characteristics between these two groups of schools is striking and illustrates teacher preferences for more advantaged institutions: those not selected are notably more rural, farther from the province capital, with less access to basic services, and with a greater proportion of low-performing students."
Ajzenman et al. (2021b)	Ecuador	"Ecuador's teacher selection process still generates some inefficiencies and inequities. While some schools receive more applications than available vacancies, others struggle to attract applicants. As a result, a large proportion of teaching positions remain unfilled at the end of the process, and a number of candidates are unable to secure a job offer."
Cabrera and Webbink (2020)	Uruguay	"In 2005, at the start of the program… schools in areas with a lower poverty score have a more experienced teaching staff."
Camelo and Poczek (2021)	Brazil	Schools with low socio-economic index "had higher turnover rates before the program (almost 53%)…had more students with worse profiles: lower average scores on proficiency exams, a higher proportion of poor performers, and less-educated parents… [and] had less-experienced teachers and fewer permanent contract ones."

Castro and Esposito (2021)	Peru	"The 2018 National Teacher Survey showed that only 6.5% of teachers working in public schools in urban areas would be willing to accept a position in a rural school without any additional compensation, and 24.1% would not be willing to accept it under any circumstance. 4 As a result, rural schools face difficulties attracting and retaining teachers. In fact, teachers in urban areas accumulate, on average, 50% more years of experience working in the same school than teachers located in the rural areas."
Chelwa et al. (2019)	Zambia	"According to the Ministry of Education, in any given year 7% of the teaching staff in rural areas leave versus 3% in urban areas. Similarly, the tenure of teachers in rural schools is on average 2 years shorter than it is in urban schools." Pre-treatment data from the sample confirms this trend: rural areas have rate of teachers transferring out (7.8% vs. 5.4% in urban areas) and lower average teacher tenure (10.0 years vs 11.2 years in urban areas).
Chin (2005)	India	At the time of program implementation, almost 30% of India's primary half million primary schools were one-teacher schools.
Rosa (2019)	Brazil	In the 2010 teacher recruitment cycle in São Paulo, Brazil, schools requested to fill 6,336 positions but only 4,205 candidates passed the exam and only 3,643 are matched to schools. "Teacher shortage is larger in areas where the socioeconomic status of students is lower."
Swai (2013)	Tanzania	"Since 1961, the Rukwa and Kigoma regions consistently face teacher shortages and high teacher demands, a situation created by limited mechanisms for motivating teachers to accept teaching positions and stay working in the region."
Pugatch and Schroeder (2018, 2014)	Gambia	"Female teachers are dramatically under-represented in hardship schools…with a 10 percentage points lower share of the overall teaching corps and a qualified female teacher-pupil ratio that is 50% lower."
Quality of Teachers		
Bobba et al. (2021)	Peru	"Teachers at rural schools are 20% less likely to pass the requirements set by the government for permanent teachers (competent teachers) and are twice as likely to lack teaching credentials (non-certified teachers)."
Elacqua et al. (2019)	Chile	More talented teachers as measured by test scores and teacher portfolio "are less likely to work in rural schools, municipal schools, and disadvantaged schools… [and] are less likely to leave the system in two years and less likely to transfer to another school."
Hinze-Pifer and Méndez (2016)	Chile	The authors cite existing research that shows that private schools attract better skilled teachers (Behrman et al., 2016) and that teachers who studies from less selective universities tend to teach in disadvantaged schools (Ortúzar et al., 2009).
Urquiola and Vegas (2005)	Bolivia	"16 percent of urban teachers lack formal training, whereas in the provincial and rural areas, 24 and 29 percent, respectively, are in a similar situation."

We also see evidence of this from additional countries in the descriptive studies that our systematic search revealed (Appendix Table A1). An early study in Ghana reported that "trained teachers are unwilling to accept posting to the rural areas, and those who accept do not normally stay for more than two years" (Cobbold, 2006).

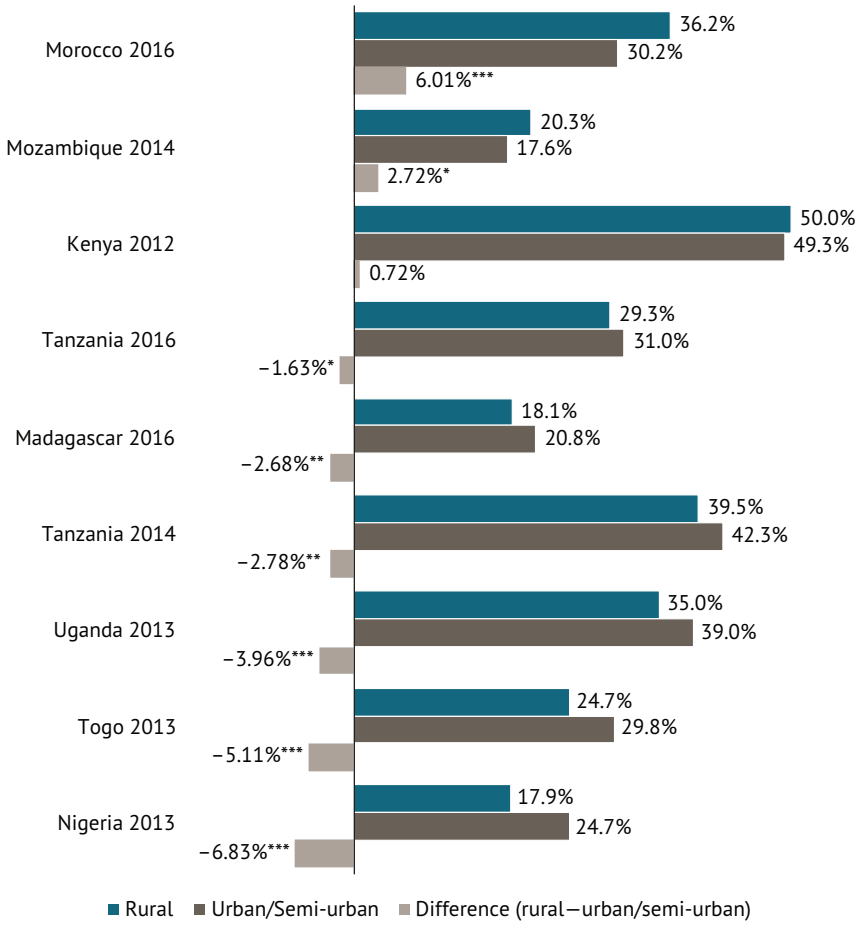
3.1.2. Quality of teachers and teacher performance

Hard-to-staff schools face an additional challenge beyond simply unfilled vacancies. When they do fill their vacancies, they often have more poorly qualified teachers. For example, in Chile, teachers who won the pedagogical excellence award (based on teacher test scores and teacher portfolio) were less likely to work in rural or disadvantaged schools (Elacqua et al., 2019). Also in Chile, teachers who were trained at less selective universities were more likely to teach in disadvantaged schools (Ortúzar et al., 2009). In Peru, rural teachers were 20 percent less likely to fulfill eligibility requirements for permanent positions and were twice as likely to lack required formal teaching credentials (Bobba et al., 2021). In Bolivia, 16 percent of urban teachers did not have formal training, compared to 24 percent in provincial areas and 29 percent in rural areas (Urquiola and Vegas, 2005). In a descriptive study from Ghana, Gad (2015) reports that in the country's Northern region, "about 404 schools do not have a single trained teacher, leaving the running of the educational establishments in the care of volunteers and untrained teaching personnel."

Our own analysis of differences between urban and rural schools—with rural schools being one common category of hard-to-staff schools—in eight African countries bears out a similar pattern, albeit not universally. For the countries in this sample, teacher competence is a challenge regardless of school location (Bold et al., 2017), but in five out of eight countries (Madagascar, Nigeria, Tanzania, Togo, and Uganda), teachers in rural areas score lower on tests of math, language, and pedagogy (Figure 2).[5] Differences in most countries are modest: only two are larger than five percentage points (one favoring rural teachers in Morocco and one favoring urban teachers in Nigeria), and none are larger than ten percentage points.

[5] Appendix Tables A2, A3, and A4 show a similar pattern for each test (language, numeracy, and pedagogy), with rural teachers most consistently scoring lower in language.

Figure 2. Teacher competency score in urban and semi-urban vs. rural areas in selected low- and middle-income countries

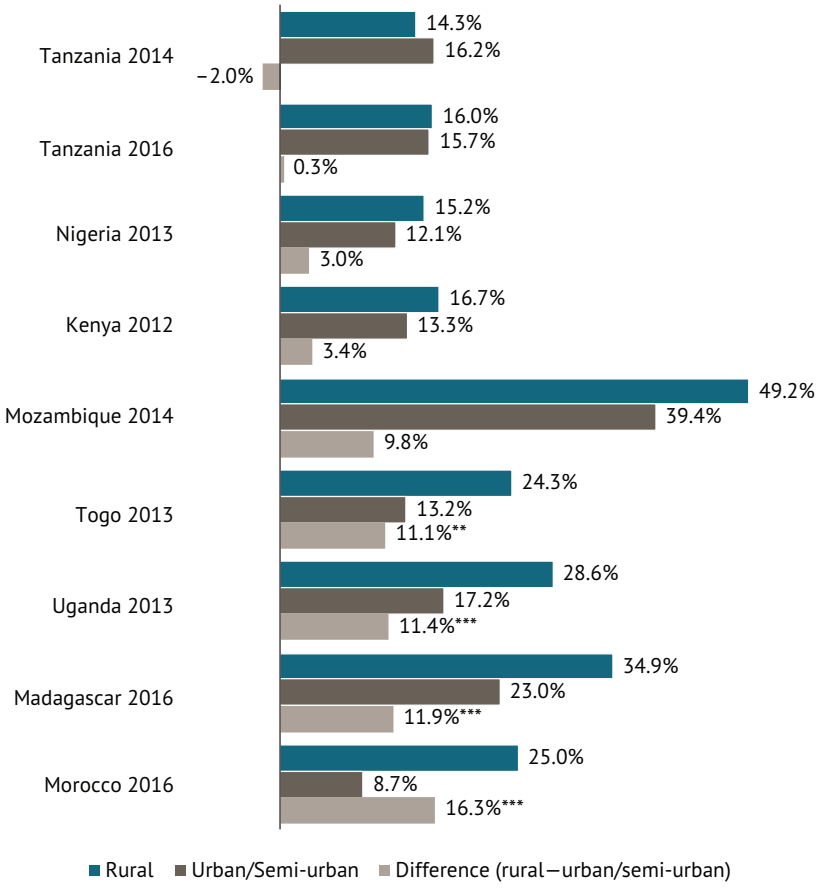


Source: Authors' analysis using data from the World Bank's Service Delivery Indicators Education Survey.
Note: The teacher competency score is the percent answered correctly in task-based assessments of teachers' literacy, numeracy and pedagogy skills based on lower-primary level curriculum (scores are out of 100 percent). Averages are first computed at the school-level and aggregated at the country level using school-level weights. Differences in rural and urban/semi-urban rates are tested using bivariate regressions with school-level weights and robust standard errors and are presented here with statistical significance: * significant at 10%; ** significant at 5%; *** significant at 1%.

Teacher absenteeism, on the other hand, is higher in rural areas in every country in our sample except Tanzania (Figure 3), and the differences are sizeable: around ten percentage points or higher in five out of eight countries. In Morocco, absenteeism among rural teachers is about three times that of urban teachers. Absenteeism is not a measure of quality in the same way that teacher competencies are: it is likely a result of teacher management practices and of the fact that teachers in rural posts may travel more frequently to spend time with families that have not moved to rural areas (e.g., on Fridays and Mondays). However, from the perspective of a student, this is an indicator of quality, since any absenteeism means that students are not benefiting from teachers. Finally, schools in rural areas often have worse infrastructure. For example, in no country in our sample are students in rural schools more likely to have an exercise book, and in several countries students in rural areas are

less likely to have them (Appendix Figure A2). Similarly, there are more countries in which rural students are less likely to have a functioning blackboard than urban students than the reverse (Appendix Figure A3). While these amenities are not measures of teacher quality, teaching in the absence of teaching aids is more difficult, so these statistics demonstrate that in many countries, rural teachers face more difficult working conditions. Likewise, students in rural areas tend to perform worse on exams (Cattaneo et al., 2021). While this may be in part a function of all the factors listed above, it may contribute to a vicious cycle in which teachers—and especially highly skilled teachers—may be reluctant to transfer to schools with high concentrations of struggling students.

Figure 3. Teacher absenteeism rates in urban and semi-urban vs. rural areas in selected low- and middle-income countries



Source: Authors' analysis using data from the World Bank's Service Delivery Indicators Education Survey.
Note: We calculated teacher absenteeism rates from the attendance records of the second unannounced visit in the survey. Averages are first computed at the school-level and aggregated at the country level using school-level weights. Differences in rural and urban/semi-urban rates are tested using bivariate regressions with school-level weights and robust standard errors and are presented here with statistical significance: * significant at 10%; ** significant at 5%; *** significant at 1%.

3.2. Impacts on teacher outcomes

Twelve of the fifteen studies in our sample use quasi-experimental designs to identify the impact of financial incentives on teacher outcomes (and in most cases, on student outcomes as well). One study evaluates a government-sponsored recruitment drive for additional teachers in short-staffed areas and two other studies explored alternative strategies to boost teacher placement in hard-to-staff schools. We summarize all teacher outcomes in each of the fifteen studies in detail in Appendix Table A5. On the whole, across all teacher outcomes—placement, turnover, competence, working hours, holding a second job, and expressed preferences—the vast majority (71 percent) are positive (Appendix Table A6). None of the outcomes have fewer than 69 percent of results positive, except for the outcomes related to working hours reported by just two studies. Teacher turnover stands out with 89 percent positive. If these interventions were ineffective at changing teacher outcomes, we would expect an equal distribution of positive and negative impacts.

3.2.1. Financial incentives

Almost all of the twelve studies that measure the impact of financial incentives use regression discontinuity designs, comparing schools that are eligible for teacher financial incentives to those that are not. Most focus on efforts to increase the quantity of teachers in hard-to-staff schools. In Peru, the government implemented a wage increase for teachers in rural schools at three different levels: the highest increase, for teachers in "extremely rural" schools was equal to between 20 and 30 percent of the earnings of permanent teachers (Bobba et al., 2021). In Peru's centralized teacher allocation system, contract teachers with the highest test scores get first choices for open positions. (Assignment for permanent teachers includes test scores but also other factors.) While the wage increase had no impact on vacancies filled, it did lead to the placement of contract teachers with scores that were 0.45 standard deviations higher in hard-to-staff schools. Subsequent impacts on student learning were concentrated among schools that had openings for teachers, suggesting that the wage increases had no impact on the effort of incumbent teachers, consistent with existing data on unconditional wage increases (de Ree et al., 2018). The authors go on to simulate a model suggesting that a more precise, data-driven policy that incorporates teacher preferences could—at no additional cost—both reduce vacancies and increase teacher quality substantively (Bobba et al., 2021).

Similar rural bonuses have been implemented in Zambia and the Gambia. Chelwa et al. (2019) report on a rural hardship allowance in Zambia which increased salaries by 20 percent for teachers in schools outside a pre-specified distance to district city centers (computed using global positioning system data – GPS). Schools could appeal their eligibility if natural barriers such as mountains made the actual travel distance longer than the GPS distance. Implementation changes and errors—subsequent reclassification of schools and a teacher-payroll mismatch where teachers were still listed in schools where they no longer taught—meant that passing the GPS-eligibility criteria increased the share of teachers receiving the allowance by only 40 percent. (Full compliance and accurate payroll would make this 100 percent.) Limiting the analysis to provinces with higher compliance as verified by telephone survey, the authors find positive but weak evidence that the program increased

the quantity of teachers (by 10 percent) and teacher tenure (by between 0.5 to 0.8 years). Impacts may have been muted further due to payment delays (as reported by teachers), a documented challenge in many countries (Evans and Yuan, 2018).

In the Gambia, Pugatch and Schroeder (2014) evaluate the rural hardship allowance and find stronger but similarly positive results. The Gambian rural allowance awarded a salary premium between 30 and 40 percent to teachers in primary schools located 3 kilometers or more from a main road. (Hardship schools in regions that were farther from the capital of Gambia received higher bonuses.) The program increased the share of qualified teachers by 10 percentage points and reduced the ratio of students to qualified teachers by 61 percent of the mean (27 students). Teachers not only chose hardship areas over non-hardship areas, but they were also responsive to the higher incentive provided in the most remote regions: increasing the hardship allowance by 10 percentage points increased share of qualified teachers by 2.8 percentage points.

Rosa (2019) report on an initiative in the city of São Paulo, Brazil to provide a wage premium for teachers in schools that are farther from downtown. The premium, evaluated using data from 2010, was based on salary values in 1991 (30 to 50 percent of teacher wages at that time) and was not corrected for inflation in succeeding years, leading to the actual premium being just 5 to 7 percent of 2010 wages when data for evaluation was collected. In addition, assignment of which neighborhoods qualified for the wage premium had also not changed since the 1990s, creating adjacent neighborhoods with similar socioeconomic indicators but in different wage-premium zones. The incentive had no significant effect on teachers' preferences towards hard-to-staff schools, potentially because the incentive was too small to change preferences or because the incentive did not appear in official hiring documents, such that teachers may not have even realized the policy was in place when making employment decisions.

Many of these hardship allowance policies use eligibility criteria based on location (distance from provincial capital or road). But some hard-to-staff schools face other vulnerabilities that are not exclusively tied with geography. Cabrera and Webbink (2020) evaluate an Uruguay program (*Contexto Socio Cultural Crítico*) program that provides up to a 26 percent increase in base salary for teachers who choose to transfer or who are already working in schools with a high poverty index (a composite score based on various student characteristics). The program did attract more experienced teachers to schools in target neighborhoods, leading to an increase in average teacher experience of around three to seven years in beneficiary schools. The program also increased how long teachers stayed in their current school by one to two years (compared to a pre-treatment average stay of five years). In Brazil, Camelo and Ponczek (2021) evaluate the national program Bonus for Place of Work (*Adicional por Local de Exercício*) salary incentive for teachers working in disadvantaged schools, in this case defined by the municipal-level socio-economic index of household income, characteristics of the household head and the family composition. Staff (teachers, principals, and support staff) received an additional compensation of between 24 and 34 percent of their base salary, depending on their job position and seniority. The program reduced teacher turnover by 5 percentage points (about 10 percent over pre-treatment average) over the four years succeeding the introduction of the policy in 2008.

Hinze-Pifer and Méndez (2016) evaluate an incentive program in Chile called the Difficult Conditions Bonus (*Asignación de Desempeño en Condiciones Difíciles*). This program awarded incentives of between 4 percent and 30 percent of salary based solely on choosing hardship schools. Eligibility was measured by an index of disadvantages including share of low-income students, distance from a large city, and public transit access. The more disadvantaged schools received a higher bonus, with all teachers in an eligible school receiving the same bonus regardless of performance. In addition, schools must apply to be eligible for the program every two years. The program did not significantly affect teacher retention and—in the face of opaque bonus calculation and unpredictable delivery—it actually led to fewer contract hours worked and teaching hours per student. These teachers are paid an hourly wage, so the higher pay may have enabled them to work fewer hours in difficult-to-teach circumstances.

To round out studies explicitly focused on increasing the quantity of teachers in hard-to-staff schools, Urquiola and Vegas (2005) and Swai (2013) use matching designs in Bolivia and Tanzania. Matching designs tend to be less credible than discontinuity designs because observers usually have less confidence that the treatment and comparison groups are comparable (besides the effect of treatment), particularly since treatment may be assigned based on both observed and unobserved characteristics. So we put less weight on these studies, but we include them for the readers' awareness and in the interest of expanding geographic coverage. Bolivia has had several programs that provide additional salary to teachers based on geography—including a financial incentive for teachers in poor and rural regions, a bonus for "inaccessible areas," and a bonus for teaching in schools within 50kms of international borders—which together provided up to 12.5 percent of the teachers total wage bill (Urquiola and Vegas, 2005). The different potential geographically determined bonuses, combined with the Ministry of Education's hesitation to remove the bonus of teachers who teach in schools that have been reclassified from rural to urban in previous years (for fear of union opposition) means that teachers may have similar training and experience and work in geographically similar schools but have different salary levels. Urquiola and Vegas (2005) match schools classified as urban and rural but all located within three large cities. So-called rural schools in this case used to be rural but as cities have grown, they have fallen within city borders, albeit further from the center. While they do not report recruitment or retention outcomes, they find that teachers in schools classified as "rural" work 7 hours less than teachers in schools classified as "urban" (a difference of about one third of a standard deviation) and are 16 percentage points less likely to hold a second job. Because of the matching design, it is difficult to interpret how much of the results may be due to selection. However, the reduction in work hours is consistent with the finding of Hinze-Pifer and Méndez (2016) in Chile.

Swai (2013) uses a matching design in Tanzania. They report on the Rukwa Civil Servant Facilitation Fund in Tanzania, which provided a signing bonus to secondary school teachers recruited in the rural region equivalent to at least one month of take-home pay in addition to accommodations and other inputs. The evaluation did not find statistically different retention rates between schools in the Rukwa region and the neighboring Kigoma region (which served as one comparison group). Within the Rukwa region, there was no significant difference in the retention rate between teachers recruited through the incentive system and teachers recruited via traditional means (the other comparison group).

As demonstrated above, teacher quality is a further challenge in hard-to-staff areas. Elacqua et al. (2019) report on the Pedagogical Excellence Assignment program in Chile, which awarded a monetary incentive to high-performing teachers (in any school), with an additional bonus of 40 percent of the base value of the award for teachers working in schools where at least 60 percent of students were considered low-income. This is the only program in our sample explicitly designed to improve quality. The bonus applied to both newly hired teachers and teachers that transferred to disadvantaged schools; consequently, teachers lost the bonus when they moved out of disadvantaged schools. Winning the award increased the probability that teachers already working in disadvantaged schools continued to do so two years after the award (by 25 to 29 percentage points). On the other hand, winning increased the probability that teachers working in non-disadvantaged schools at the time of the award would be working in high-performing—i.e., not disadvantaged—schools two years after (by 41 percentage points), suggesting that many teachers used the award as a quality signal to move to more desirable posts.

One limitation of these regression discontinuity designs is the potential spillovers: if there is a clear boundary between advantaged and disadvantaged schools, then a bonus for teachers in disadvantaged schools may draw teachers from just across the boundary (the control group in discontinuity designs), leading the impact of the bonus to be overstated. This overstatement is due to what might be thought of as "double counting." Schools on the advantaged side of the boundary grow slightly worse off because teachers leave, and schools on the disadvantaged side grow slightly better off because the same teachers arrive. But both the improvement and the deterioration (despite being part of the same teacher movement) are counted. One estimate of the magnitude of that spillover effect comes from an evaluation of the Peruvian rural allowance which provides a bonus of about 26 percent of a teacher's starting salary. Castro and Esposito (2021) compare schools in the most remote category (with the highest bonus), reserved for schools in communities that are more than 120 minutes from a provincial capital and have less than 500 inhabitants, to similar rural communities on the other side of the threshold that receive slightly lower bonus. Three years after the incentive was launched, the differential recruitment bonus reduced attrition by between 1.5 and 4.9 percentage points and increased proportion of vacancies filled by between 1.6 and 3.4 percentage points, with the larger effects in the most distant schools. However, in control schools that are less than 30 minutes away from the treatment schools, the proportion of teacher vacancies filled dropped by between 2.5 and 3.1 percentage points. This substitution between schools that are near each other has two implications. First, it means that bonuses may lead to improvement in some schools at the expense of schools that are almost as hard-to-staff themselves; indeed, teachers already in semi-rural areas may mind transferring to more rural schools less. If teachers are less effective in their first year or two in a new school, then the net effect may even be negative. Second, it means that the estimated impact of bonuses for programs that do not account for spillovers may be overstated.[6]

---

[6] For comparison, the other study on Peruvian rural incentives by Bobba et al. (2021) do not account for spillovers and report more positive outcomes on teacher recruitment. In addition, they use data from a longer timeframe, extending to more recent data (from 2015 to 2018) than the Castro and Esposito (2021) study (data from 2016).

While most studies do not engage the potential impact of spillovers, at least two do. Cabrera and Webbink (2020) highlight this potential negative externality (from hiring experienced teachers away from other schools) but do not have available data to verify this. Pugatch and Schroeder (2014) report back-of-the-envelope calculations to estimate relative supply and demand of teachers, which suggests that the gains in qualified teachers from the Gambian rural allowance are not just from teachers switching from non-hardship to hardship schools. The degree to which incentives draw teachers from schools that are only slightly less disadvantaged is crucial to understanding the impact of these programs going forward.

3.2.2. Other interventions

Other interventions do not explicitly involve financial incentives to teachers. A study in India used a difference-in-differences strategy to evaluate a national recruitment drive implemented between 1987 and 1994 for teachers to be deployed exclusively to one-teacher primary schools (Chin, 2005). The strategy compared states with many primary schools with only one teacher (which received a higher intensity of the program) to states with few primary schools with only one teacher (lower intensity of the program). In this intervention, the central government took responsibility for paying the salary of these new teachers in the initial few years, after which the state government took over and paid the teachers' salaries for the subsequent years. The program aimed to recruit and have paid for 140,000 new teachers (around 8 percent of pre-program teacher supply in the country). However, only between a quarter to a half of these teachers were placed in target schools. The average number of teachers per primary school and the pupil to teacher ratio also did not increase, suggesting that the nationally funded program merely created incentives for state governments to redistribute existing teachers from larger schools to smaller schools, slow down their own hiring efforts, or likely both.

Another class of interventions provides information to teachers in order to increase their likelihood of applying to work in hard-to-staff schools. These behavioral interventions are promising largely because they are much cheaper to implement than an increase in pay. Ajzenman et al. (2021a) tested two interventions to increase applications of newly accredited teachers to hard-to-staff schools in Peru. The first emphasized the altruistic nature of teaching: candidates were invited to reflect on their reasons for becoming a teacher, received text messages reminding them of this role of teachers (e.g., "thank you for being an agent of social change"), and saw pop-ups with similar messages on the online application platform. The second intervention used the same three tools, but rather than focusing on altruistic motives, it focused on the financial benefits (including an already existing financial incentive) and career path advantages associated with working in disadvantaged schools. A third set of schools received placebo messages with general application information. The two interventions had similarly sized impacts: teachers in the two treatment groups increased the proportion of disadvantaged schools in their set of application schools by about 2 percentage points (relative to 46 percent at baseline). The effect is driven by male candidates. Perhaps unsurprisingly, the intervention that focused on financial benefits was more effective among candidates who performed worse on the test (and were also likely lower income), whereas the altruism-focused intervention appealed to higher scoring teachers.

Since higher scoring teachers were more likely to get their preferred schools, only the altruism-focused intervention ultimately resulted in more teachers assigned to disadvantaged schools: male teachers in that group were 3.4 percentage points more likely to be assigned to a hard-to-staff school, and male teachers who scored above median on the qualifying exam were 5.2 percentage points more likely.

In Ecuador, teachers similarly pass a series of exams and then use an online platform to apply for school vacancies. In this context, researchers tried an even lighter touch intervention (Ajzenman et al., 2021b). In the treatment group, hard-to-staff schools were listed first in the online platform, whereas in the control group, schools were listed alphabetically. For both groups, hard-to-staff schools were identified with an icon on the list. Candidates in the treatment group were about 5 percentage points more likely to rank a hard-to-staff school first, and they were about 3 percentage points more likely to accept a position at a hard-to-staff school (relative to a 27 percent likelihood in the control group). This impressive result from simply re-ordering school names was likely driven by simple choice overload: with lots of options, it was easier to pick the first ones. How impacts are sustained over time is of interest with all intervention designs, and this one is no exception, as new teachers may be more explicitly aware of the nudge and then incorporate that knowledge into their selection behavior over time.

These studies provide promising evidence for this kind of behavioral intervention, as either a complement (in Peru) or a substitute (in Ecuador) to financial incentives. While outcomes across studies are mostly not strictly comparable, the ultimate effect of these behavioral interventions is likely to be smaller than most of the financial interventions (i.e., the biggest effects of the behavioral interventions are on teachers putting hard-to-staff schools on their choice lists), although they may be more cost-effective since they are extremely cheap. Thus, they are unlikely to fully close gaps between hard-to-staff schools and other schools, but they are a valuable, innovative tool in the policymaker's toolkit.

3.3. Impacts on student outcomes

One of the primary objectives (if not the primary objective) of an education system is to increase student learning (World Bank 2018). Thus, increasing the quantity or even the quality of teachers in hard-to-staff schools is primarily a means to an end, with the desired outcome being improved student outcomes, whether those be access or achievement. Of the 15 studies, while all but one report teacher-related outcomes, only 9 report student-related outcomes.[7] All student-related outcomes are summarized in Appendix Table A7. Just as with teacher outcomes, the vast majority of student-related outcomes are positive (77 percent), with a higher percentage for student attendance (92 percent) than for student achievement

[7] The one study that does not report teacher-related outcomes (Pugatch and Schroeder, 2018) is complemented by another study by the same authors, using the same experiment, which does report teacher-related outcomes (Pugatch and Schroeder, 2018). So to be more precise, all interventions report teacher outcomes, even though not all studies do.

(72 percent) (Appendix Table A8). There is a similar pattern of statistical significance for student versus teacher outcomes for studies that report both sets of outcomes (comparing Appendix Table A6 and Appendix Table A8), and studies that include student outcomes have a similar distribution of positive (and significant positive) impacts on teachers as studies that do not include student outcomes.[8] In other words, with our limited sample, we do not have reason to believe that the distribution of reported student outcomes is biased.

Despite this broad pattern of positive, significant impacts, there is heterogeneity across studies: one of the interventions improved student test scores across the board, some have heterogenous impacts, and some did not affect student outcomes at all. In Peru, students in target rural schools improved their test scores in Spanish and math with effect sizes of 0.30 to 0.35 standard deviations (Bobba et al., 2021). Consistent with the finding that the program improved the quality of recruited contract teachers, the effect on student test scores was bigger in schools with short-term teacher vacancies (0.32 standard deviations in Spanish and 0.47 standard deviations in math). (Short-term vacancies are open for one academic year, with contracts renewable for up to one more year subject to administrative approval.)

In Brazil, the incentive program had no effect on average student test scores, but did reduce the proportion of low-performers in math (by 6.8 percentage points, or an 11.3 percent absolute reduction) and reading (by 5.4 percentage points, or a 17.4 percent absolute reduction) (Camelo and Ponczek, 2021). In the Gambia, the rural allowance had no effect on average test scores, but it did improve student outcomes for the subset of students with higher socio-economic status (by about 0.40 standard deviation in math and English test scores) (Pugatch and Schroeder, 2018).[9] Girls were no more and no less likely to benefit from the program. The rural bonus program in Zambia also had no effect on average student performance but did show some positive effect for boys—they were 2 percentage points more likely to have a score that qualifies for the highest category in the national exams—but not for girls (Chelwa et al., 2019). The recruitment drive for additional teachers in India improved primary completion rates, especially for girls (by between 0.91 to 1.61 percentage points for each teacher recruited per 1,000 children) and for girls in households at the bottom expenditure quartile (by between 2.23 to 2.95 percentage points). The impact on primary completion rates for boys was also significantly positive (between 1.00 to 1.64 percentage points) but only for some model specifications.

The incentive program in Uruguay did not improve student test scores or grade-retention, or drop-out, although it reduced insufficient student attendance by 15.3 percentage points in one specification (but not in others) (Cabrera and Webbink, 2020). Similarly, the incentive program in Chile did not improve test scores for 4th Grade students, either for math or

---

[8] Across all studies that report student outcomes, 74 percent of teacher outcomes are positive, and 37 percent are positive and statistically significant. Across studies that do not report student outcomes, 68 percent are positive, and 45 percent are positive and statistically significant.

[9] The index is measured by indicators such as speaking English at home, have attended nursery school, and parents completing primary school, suggesting that better-off students are more able to take advantage of gains in teacher quality from the rural bonus.

reading, in year 1 or year 2 of the policy (Hinze-Pifer and Méndez, 2016). Finally, the rural pay differential in Bolivia is not systematically related with student test scores or grade repetition, but is slightly correlated with both higher pass rates and higher drop-out rates (between 0.6 to 1.4 percent change, significant only in some specifications) (Urquiola and Vegas, 2005).

Given potential spill-over effects on teacher recruitment and retention, we might expect to see spill-over effects on student outcomes as well. Surprisingly, the rural bonus in Peru—where the authors explicitly measured spillovers—did not affect student scores in schools with the bonus, but students in control schools less than 30 minutes away from beneficiary schools experienced up to 0.30 standard deviation gains in both reading and math scores, despite having more teacher vacancies go unfilled (Castro and Esposito, 2021). This may imply that the rural bonus recruited lower skilled teachers away from neighboring control schools to bonus schools, leading to higher average teacher quality (if lower quantity) in control schools.[10] Neither of the behavioral interventions (Ajzenman et al., 2021a, 2021b) nor the three other financial incentive interventions (Elacqua et al., 2019; Rosa, 2019; Swai, 2013) report student outcomes.

3.4. Findings from other studies

Our search also unearthed seven studies that were excluded from our final sample for methodological reasons—e.g., because they lacked a control group or simply reported on a survey of preferences—but which do provide insight on programs aimed at staffing hard-to-staff schools in a wider range of countries (Appendix Table A1). In Ghana, Cobbold (2006) describes a scheme in which rural districts sponsor candidates from their districts for teacher training and then contract them for three years, the idea being that candidates from rural districts might be more likely to remain in postings close to their homes. However, interviews with 12 teachers found that while they all appreciated the program, none of them planned to remain in the districts after their initial contract. In rural South Africa (North West province), most teachers report that the financial allowance is a motivating factor for them, both to work in their current schools and to show up to class (Poti et al., 2014). In China, Zhai et al. (2019) characterize a program that provides both "carrots" (free education and stipends) and "sticks" (a ten-year contract). Among teacher trainees, they find survey evidence that the policy boosts willingness to work in hard-to-staff schools. In 2014, China launched a policy that sent eligible urban teachers to short-staffed rural schools for a fixed period of time and compensated the participating teachers with a transportation subsidy, professional awards, and early promotion (Liao et al., 2019). However, school principals in rural areas reported that the relocated teachers were often tardy and refused to attend school meetings or teach on Fridays, and that the principals did not have the administrative authority to hold them accountable.

---

[10] This counterintuitive finding is consistent with the strong evidence on the importance of teacher quality (Araujo et al., 2016; Buhl-Wiggers et al., 2019) and the weaker, more mixed evidence on the impact of pupil-teacher ratios (Banerjee et al., 2007; Duflo et al., 2015).

Some studies asked teachers or teacher trainees to rank possible incentives. Surveys with teacher trainees in Lao PDR and Cambodia reveal a high valuation of amenities, such that—for example—teachers would require between a 10 and 11 percent salary increase to compensate for each additional hour travel time from the nearest town. Among other amenities, a lack of electricity required the highest hypothetical compensation: 73 percent higher salary in Cambodia and 158 percent in Lao PDR (Sisouphanthong et al., 2020). In India, teachers originally from urban areas are more averse to moving to rural locations than those from rural areas (Fagernäs and Pelkonen, 2012). In Ghana, teacher trainees stated that they preferred alternative benefits such as housing, expedited promotion, or study leave with pay over a hardship allowance (Gad, 2015). A qualitative study of female teachers in Kenya found support for both hardship allowance and free housing (Kamere et al., 2019). One of the studies included in our main sample, Swai (2013), also reports on a small survey in which teachers rate various program components—cash incentives, housing, and other in-kind incentives (like bicycles or beds)—as equally important in drawing them to their rural postings.

Lastly, a survey in Malawi reveals one of the greatest weaknesses of these surveys. Rural teachers were split on whether they believed the hardship allowance they received led them to remain at their current school. Urban teachers were much more supportive of housing provision as an incentive than rural teachers, perhaps—as the authors posit—because rural teachers were acquainted with the actual poor quality of available housing (Mwenda and Mgomezulu, 2018). This signals the limitation of teachers or teacher trainees rating hypotheticals about which they lack concrete knowledge.

3.5. Female teachers and hard-to-staff schools

There is evidence that female teachers can have positive impacts both on student learning and on girls' aspirations, particularly in secondary school (Eble and Hu, 2020; Lim and Meer, 2020). Yet parity in teacher gender ratios can be harder to achieve in more remote schools. In Peru, female teachers were more likely to choose schools in urban areas and closer to where they attended their initial teacher training program (Bertoni et al., 2021). In the Gambia, the share of female teachers in schools that qualified for hardship allowances (classified according to distance from the main road) was 10 percentage points lower than the country average (Pugatch and Schroeder, 2014). While none of the impact evaluation studies in our sample explicitly focused on increasing the proportion of female teachers in hard-to-staff schools, several studies provide insight both on the challenge and on the impact of incentives as a solution.

Studies on teacher preferences highlight the potential and the limitations of financial incentives and other similar packages to attract female teachers to remote areas. A discrete choice experiment in India found that female teachers would require a salary differential of between 24 and 73 percent to move to a remote village, depending on whether they were originally from a rural or urban location (Fagernäs and Pelkonen, 2012). This is higher than the size of most actual financial incentives offered by real-life programs in our sample (Table 3). On the other hand, another discrete choice experiment, this time in Ghana,

reported that female teachers preferred other incentives such as study leave with pay, expedited promotion and provision of housing over rural incentive allowance (Gad, 2015). Finally, a qualitative study with female teachers in Kenya reported support for both provision of housing and hardship allowance as viable strategies to attract teachers to remote areas (Kamere et al., 2019).

Table 3. Available cost data on programs to staff hard-to-staff schools

Study	Country	Cost Analysis
Bobba et al. (2021)	Peru	Teachers in extremely rural schools receive up to S/500 a month which is equivalent to 30 percent of contract teachers' salary and between 20 to 30 percent of permanent teachers' salary. In addition, they present cost-efficiency frontier graphs for filling every vacancy (no quality restriction) and filling every vacancy with teachers of equivalent competence as the average urban teacher.
Cabrera and Webbink (2020)	Uruguay	Bonus for teachers in schools in poor communities is up to 26% of base salaries.
Camelo and Ponczek (2021)*	Brazil	"a sizeable wage premium (24% to 36%)" for teachers in disadvantaged schools
Castro and Esposito (2021)	Peru	Teachers in extremely rural areas received about USD 70 every month in 2014, raised to USD 176 every month in 2015. Teachers in less rural but still eligible areas received between USD 25 and USD 35 every month for both years. The difference of USD 141 between the extremely rural area and the least rural area represents a 26% increase of a teacher's starting salary.
Chelwa et al. (2019)	Zambia	"rural hardship allowance corresponding to 20% of the base salary"
Elacqua et al. (2019)*	Chile	Teachers in disadvantaged schools received an additional 40% of the competency-based award value (in itself, 11% to 33% of teachers' base salary)
Hinze-Pifer and Méndez (2016)*	Chile	Teachers in disadvantaged schools receive between 4 percent to 30 percent over their base salary depending on the "difficulty score" of the school.
Pugatch and Schroeder (2014, 2018)	Gambia	Teachers who choose to teach in remote schools receive between 30 to 40 percent salary bonus. "At a cost of approximately US$350,000 annually, these additional teachers cost US$2,500 each to recruit."
Rosa (2019)*	Brazil	São Paulo city pays "wage-premiums [5%–7%] for teachers working in schools in selected neighborhoods" farther from downtown.
Swai (2013)	Tanzania	cash incentive including signing bonus of between USD 179 to USD 357 (equivalent to at least one month take home pay), accommodations, and other inputs
Urquiola and Vegas (2005)	Bolivia	salary bonus of about 12. 5 percent of total compensation available (for comparison, the base salary of the paid teacher—interim teacher in an urban area—is USD 65 in 2002 or about 40 percent of total wage bill). Additional bonus is available for teachers depending on seniority and trainings received.

Study	Country	Cost Analysis
Other Interventions		
Ajzenman et al. (2021a)	Peru	"The cost of filling a teaching vacancy in a disadvantaged school using either [of the two information interventions] is approximately USD 13 per vacancy." The existing national reward system highlighted by the information intervention can go up to twice the lowest salary level (which is about USD 650).
Ajzenman et al. (2021b)	Ecuador	$0 (zero-cost intervention)
Chin (2005)	India	The teacher component of the Operation Blackboard cost "cost $300 million from 1987–94 in 1994 U.S. dollars)" to recruit 140,000 teachers. "The central government pays the salary of the second teachers only for the initial few years. The state governments must pay the salary for subsequent years."

Note: *Although Elacqua et al. (2019) and Hinze-Pifer and Méndez (2016) both evaluate bonus for schools with disadvantaged status in Chile, they contextualize the incentive programs differently. Elacqua et al. (2019) frame the disadvantage school bonus as an add-on to the competency-based award available for all teachers regardless of location while Hinze-Pifer and Méndez (2016) cite up to thirteen bonuses (which includes both the disadvantage bonus and the competency bonus) on top of the basic renumeration for teachers. For the two incentive programs in Brazil, Rosa (2019) evaluates an incentive bonus established in the 1990s for São Paulo, Brazil while Camelo and Ponczek (2021) evaluate a more widely available incentive bonus launched in 2018 but limits the analysis of impact to schools in São Paulo due to challenges in data availability.

Three of the fifteen studies in our sample provide gender-disaggregated impacts. Despite the potential preferences reported above, none of these programs were effective in recruiting female teachers. The rural hardship allowance in the Gambia did not increase the share of female teachers in target schools, but it reported positive teacher recruitment outcomes in general, suggesting that it increased recruitment for female and male teachers roughly equally (Pugatch and Schroeder, 2014). The behavioral intervention in Peru reported improved teacher recruitment on average, but the positive effects were driven by male teachers (Ajzenman et al., 2021a). Finally, the teacher recruitment drive in India encouraged the appointment of female teachers—so that each school would have one male and one female teacher—but the share of female teachers in target schools did not increase (Chin, 2005). These findings suggest that while incentives can be effective in some settings and for some female teachers, more work is needed to identify effective ways to improve teacher gender ratios in disadvantaged schools.

4. Discussion

4.1. Costs and cost-effectiveness

Most of the 15 included studies report on financial incentives in the form of bonuses or salaries. Teacher compensation already tends to make up a high percentage of education budgets in low- and middle-income countries, so understanding the cost implications is particularly important. We summarize the available cost data in Table 3.

Teacher incentives tend to be reported either as a percentage of increase over base salary—such as the rural hardship allowance in Zambia that corresponds to 20 percent of the teachers' base salary (Chelwa et al., 2019)—or in absolute amounts such as the USD 70 monthly bonus received by teachers in extremely rural schools in Peru in 2014 (Castro and Esposito, 2021). One study in Tanzania reports a one-time signing bonus equivalent to at least one month of take-home pay (about USD 179 to USD 357) (Swai, 2013).

The amounts reported vary dramatically. In Brazil, the disadvantage premium implemented in São Paulo ranges from 5 to 7 percent of teachers' initial wages (Rosa, 2019) which is significantly smaller than other incentive programs, primarily because the wage premium was established in 1991 (about 30 to 50 percent of teachers wages at that time) and has not been amended or corrected for inflation at the time of the evaluation 20 years later. At the upper end of the range, the most competent teachers in Chile received an award of 33 percent of their base salary, plus an additional 40 percent of that award if the teachers chose to go to a disadvantaged school (Elacqua et al., 2019). Finally, the rural hardship allowance in the Gambia provided a salary bonus of 30 to 40 percent, yielding a cost of USD2,500 for recruiting one additional teacher, based on the total annual cost of the program and the number of qualified teachers recruited in hardship schools (Pugatch and Schroeder, 2018, 2014).

Bobba et al. (2021) evaluate a program that provides a rural bonus of up to 30 percent of teachers' salary in Peru. They also model the cost-efficiency of filling every vacancy with either regular teachers (no restriction on qualification) or teachers of equivalent competence as the average urban teacher (i.e., a quality upgrade for rural schools). Unsurprisingly, they find that attracting competent teachers to rural schools would cost significantly more than just filling up all vacancies. It would take about twice the total national current budget for teachers' wages to fill almost every vacancy (with only about half of the vacancies filled with a competent teacher), while it would take up to six times the total wage budget to close the teacher quality gap between rural and non-rural schools. In addition, they model an alternative policy that increases the supply of local teachers in the most disadvantaged locations (an increase of about 3 percent relative to the whole teacher applicant pool), taking into account revealed teacher preferences, including the willingness of teachers from rural areas and ethnic minorities to work in communities with similar profiles, and find that it could potentially save between 30 to 35 percent of the projected wage bill (i.e., a reduced but still massive sum) to completely close the teacher gap.

The recruitment drive in India for additional teachers cost the government USD 300 million (in 1994 dollars) between 1987 to 1994 to recruit 140,000 teachers which translates to USD 2,140 per teacher (Chin, 2005), not too different from the USD 2,500 price tag for recruiting a rural teacher in the Gambia (Pugatch and Schroeder, 2018, 2014).

Unsurprisingly, the behavioral interventions are much cheaper. The intervention in Ecuador was labeled as zero-cost since the treatment only requires re-ordering of schools in the job application portal which would require a one-time programming effort with no significant increased cost for rolling-out nationwide (Ajzenman et al., 2021b). The two alternative information interventions in Peru both cost approximately USD 13 to fill one teacher

vacancy (Ajzenman et al., 2021a). If we look at outcomes that are comparable between these extremely cheap behavioral interventions and teacher financial incentives, we find that while behavioral interventions are not likely to close the quantity or quality gap between hard-to-staff schools and other schools, they are likely a cost-effective step in the process.

4.2. Common challenges across these programs

In this section, we report implementation challenges cited by the 15 eligible studies. The behavioral interventions included in our review are more straightforward and would likely not require significant sustained investment over time. In contrast, financial incentives have multiple moving parts and often rely on—and are therefore limited by—existing civil service infrastructure.

4.2.1. Timing and reliability of receiving payments

Any financial incentive program is subject to the limitations of the administrative system that houses it. Incentives to work in hard-to-staff schools are no exception. Teachers in Tanzania report delays in receiving the promised bonuses and a lack of facility to address concerns and follow-up on issues related to bonuses (Swai, 2013). In one province of South Africa, teachers also report long delays in rural bonus payments and an unwanted yearly disbursement schedule instead of a preferred monthly payment (Poti et al., 2014). In Ghana, teachers report delays in payment, discrepancy between what was promised and what was paid out, and piecemeal payments instead of lumpsum payment (Cobbold, 2006). In Zambia, delays in salary payment are also associated with teachers departing for better schools (Chelwa et al., 2019). Addressing bonus payment delays can be challenging if they stem from more systemic flaws such as generally late salary payments for civil service workers or lack of a central office to receive and process payment issues, but some of these concerns—such as the expected frequency of payments—could be a communication gap that could be corrected at lower costs.

An analogous challenge may be exacerbated with non-financial benefits, although those are not explicitly evaluated in our included studies. In Uruguay, non-salary benefits such as "additional time for coordination between teachers" and training sessions were supposedly a part of the program along with the financial incentive, but the non-salary components were not strictly enforced (Cabrera and Webbink, 2020).[11]

4.2.2. Information

In some cases, teachers may simply lack information about the incentives in place to encourage them to work in rural schools. Focus groups with teachers in Peru revealed that

[11] These other, non-salary incentives may be at least as difficult to implement effectively as financial incentives, as evidenced by the experience of many countries with teacher professional development (Popova et al., 2018).

teachers were aware of the financial incentives, but they did not know which schools would qualify (Ajzenman et al., 2021a). In São Paulo, Brazil, information about wage premia at hard-to-staff schools was not included in official hiring documents, such that teachers may again have been unaware of which schools benefited from the program (Rosa, 2019). In one Chile study, the authors posit that teachers may not be aware of the wage premium in disadvantaged schools until they begin teaching there, which may explain the positive impact of the wage premium on retaining teachers but not on attracting teachers (Elacqua et al., 2019).

In one intervention in Peru, the web-based application in which teachers identified which schools they would be willing to work in included simple icons like a money bag to indicate the presence of monetary incentives or a ladder to indicate the promise of faster career progression (Ajzenman et al., 2021a). Simple informational interventions like that may solve some information challenges.

4.2.3. Other logistical implementation challenges for financial incentives

Aside from the timing of and information about payments, other logistical challenges in designing and implementing other components of the financial incentive programs may blunt potential positive effects on recruitment and retention. The incentive program in São Paulo, Brazil—evaluated in 2010—was hampered by outdated eligibility designations (assigned in 1991), and an outdated bonus value (1990s wage rate), which potentially led to indifferent teacher recruitment and retention response (Rosa, 2019).

Many of the interventions use eligibility criteria that are straightforward to measure, communicate, and validate, such as municipal-level socio-economic scores, GPS-computed distance from roads, or population counts, but these may still miss capturing relevant aspects of hardship. Countries may include incentives for some types of hardship (rural schools) but not for other types (high-poverty urban schools). In Zambia, the GPS-computed distance from city centers failed to reflect natural barriers such as mountain ranges which increased actual travel distance to the school (Chelwa et al., 2019). The program did allow for an appeal process and subsequent re-classification of schools. The same evaluation also reported inaccuracies in payroll data—teachers were still listed in schools where they no longer taught—which complicated the validation of compliance and subsequent evaluation of impact. Similar to cash transfers and other benefit programs, designing eligibility thresholds for teacher incentives in hard-to-staff schools in contexts with limited or unreliable administrative data will mean contending with the trade-off between errors of exclusion (schools with significant hardship that do not pass the eligibility cut-off) and errors of inclusion (non-hardship schools that qualify and receive incentives) and limited resources for monitoring compliance.

The duration for which schools are guaranteed hardship status can also influence how teachers rate the incentives' attractiveness. In one program in Chile, for example, schools had to apply and be approved for hardship status every two years (Hinze-Pifer and Méndez, 2016). On the one hand, this ensures that the distribution of hardship status is accurate and current, as opposed to outdated eligibility assignments reported in other programs.

However, this can introduce a new information challenge, since in the absence of explicit action, teachers may only become aware of the change of status when they stop receiving the bonus, as happened in another program in Chile (Elacqua et al., 2019). In addition, short-lived incentives with high administrative burdens might affect the attractiveness of the bonus both for recruiting new hires but especially for retention, as is the case for teacher incentives in high-income countries (See et al., 2020a, 2020b) and for health workers in rural areas in low- and middle-income countries (World Health Organization, 2020) that are only effective in retaining workers as long as the incentives last.

Finally, systems have to decide which teachers qualify for the benefits associated with working at hard-to-staff schools. In Peru, many candidates who take advantage of the incentives to work in rural schools are temporary teachers who have not yet passed the national teacher qualification test (Bertoni et al., 2021). This may propagate inequalities across schools by drawing less qualified teachers to disadvantaged schools. Across the incentive programs evaluated in our sample, almost half report that both permanent and temporary contract teachers are eligible.[12]

4.2.4. Teacher recruitment versus teacher retention

Some incentive programs may successfully increase teacher recruitment or retention, but in ways that do not significantly improve student outcomes. In Uruguay, for example, the incentive program improved average teacher experience but did so both by replacing inexperienced teachers (less than five years) with more experienced teachers (more than five years)—which is likely to boost student learning outcomes—and by replacing experienced teachers with even more experienced teachers (more than ten years)—which is unlikely to boost student learning (Cabrera and Webbink, 2020). Similarly, the retaining of teachers currently working in disadvantaged schools was more closely associated with higher student outcomes rather than hiring experience from other schools.

This comparison between relative efficiencies of hiring new teachers from outside the school or retaining teachers already at the school, as well as deciding which teachers and where in their experience and productivity function the incentives should target, may vary from country to country and even across different schooling contexts within the same country.

4.3. Non-government interventions

This paper focuses on interventions implemented by the government in recruiting teachers to disadvantaged schools, but several evaluated interventions to address the teacher gap have been implemented by non-state actors, often in public schools.

---

[12] Specifically, six report that incentives are available for teachers on permanent and temporary contracts (Bobba et al., 2021; Camelo and Ponczek, 2021; Castro and Esposito, 2021; Elacqua et al., 2019; Hinze-Pifer and Méndez, 2016; Urquiola and Vegas, 2005). Three report that incentives are only available for teachers on permanent contracts (Ajzenman et al., 2021a, 2021b; Swai, 2013). The others do not report this information.

One such class of interventions involves recruiting teachers who are not part of the civil service directly from communities and for a fixed period of time. These teachers are often referred to as "contract teachers." While these have been implemented widely by governments (UNESCO, 2020), they have largely been evaluated in the context of non-government interventions. These teachers may either be individuals with formal teacher training but no civil service position—as in a study in Kenya (Duflo et al., 2015)—or community members who receive basic training before assisting with classes—as in a study in India (Banerjee et al., 2007). Both the Kenya and India interventions had positive impacts on student learning, particularly for students taught by the contract teachers. This may be in part because teachers on temporary contracts may be at greater risk of losing future contracts due to nonperformance. In Kenya, however, the government subsequently implemented a contract teacher intervention, and the impacts on student learning were indistinguishable from zero (Bold et al., 2018). A large-scale contract teacher intervention implemented by a non-government organization in the same study delivered positive impacts, suggesting that the difference is more likely to be administration than scale. In the government program, the national teachers' union sued for civil service positions for the contract teachers, such that the incentive to perform in order to achieve contract renewal may have been dampened.

Another set of interventions include programs that aim to provide potentially high performing candidates with an expedited path into teaching. One prominent example, the Teach for All initiative, recruits high-performing university graduates from non-teaching backgrounds, provides them with pre-service training and on-going mentorship, and deploys them to disadvantaged schools for a pre-determined period, usually two years (Cumsille and Fiszbein, 2015; Teach for All, 2021). A preliminary evaluation of Chile's version of the program reported positive effects on student test scores as well as students' self-esteem, self-efficacy, and other non-cognitive skills (Alfonso et al., 2010). An evaluation in Peru reported mostly positive test score impacts (Lavado and Guzmán, 2020), and an evaluation in Mexico showed that the program reduced student tardiness and absenteeism and improved students' socio-emotional skills (Chacón and Peña, 2017).

4.4. Limitations to this work

This work faces several limitations. First, the included studies are from Latin America, Africa (two countries), and South Asia (just one country). Staffing rural or high-poverty schools is a challenge around the world, as evidenced by descriptive work highlighted in Section 3.4, but we lack evidence of the effectiveness of schemes from the Middle East, other parts of Asia and elsewhere. Second, this review is limited by the interventions that have been studied. Countries have implemented a wide range of activities to attract or retain teachers in rural schools (Elacqua et al., 2018; McEwan, 1999; Pugatch and Schroeder, 2014), and teachers signal that various of these programs could potentially be effective (Gad, 2015; Kamere et al., 2019; Swai, 2013), but most of these policies remain unevaluated. Almost all the evidence is focused on financial incentives, with one evaluation of an earlier teacher recruitment drive and a couple of recent evaluations of behavioral strategies. The latter are welcome entries to the evidence base, but much remains unknown on the effectiveness of the wider range of policies. Future researchers can both document these policies in more detail and evaluate them.

5. Conclusion

In this systematic review, we report on the results of 15 experimental or quasi-experimental evaluations of interventions to recruit or retain teachers in hard-to-staff schools in low- and middle-income countries. We find mostly positive impacts of financial incentives on teacher outcomes, and we find suggestive evidence of positive impacts on student learning and attendance. We find promising evidence from recent evaluations of behavioral interventions, providing information about existing incentives or increasing the salience of hard-to-staff school options. Recruiting female teachers to hard-to-staff school poses an even greater challenge. We also provide new evidence that teachers in rural areas in many countries tend to be less skilled and more often absent than their urban-based counterparts.

Future work in this area may proceed along at least two lines. First, most of the studies do not account for spill-over effects. Research exploring these effects can help ensure these programs are not just re-allocating teachers from schools that slightly less disadvantaged to slightly more disadvantaged schools. Second, governments draw on a wide array of policies to attract or retain teachers in hard-to-staff schools, but almost all of the evaluations of large-scale government policies have been of financial incentives. Research evaluating the impact of alternatives—both informational and behavioral interventions, as reported in this review, and alternative policies such as speedier promotion or subsidized, secure housing—will expand the toolbox for policymakers seeking to support teachers in reaching the most disadvantaged students.

Even with the benefit of low-cost behavioral interventions, fully staffing hard-to-staff schools with effective teachers is unlikely to be cheap. Current levels of financial incentives are insufficient to close gaps completely. But with most out-of-school children currently residing in rural areas and children in high-poverty schools achieving the lowest test scores, education systems will need to draw on an array of strategies to strengthen their overall educational performance and invest in broad-based human capital.

References

Ajzenman, N., Bertoni, E., Elacqua, G., Marotta, L., Méndez Vargas, C., 2021a. Altruism or Money? Reducing Teacher Sorting Using Behavioral Strategies in Peru (IZA DP No. 14111). IZA institute of Labor Economics.

Ajzenman, N., Elacqua, G., Marotta, L., Olsen, A.S., 2021b. Order effects and employment decisions: Experimental evidence from a nationwide program.

Alfonso, M., Santiago, A., Bassi, M., 2010. Estimating the Impact of Placing Top University Graduates in Vulnerable Schools in Chile (No. Technical Note IDB-TN-230). Inter-American Development Bank.

Araújo, E., Maeda, A., 2013. How to Recruit and Retain Health Workers in Rural and Remote Areas in Developing Countries: A Guidance Note (HNP Discussion Paper).

Araujo, M.C., Carneiro, P., Cruz-Aguayo, Y., Schady, N., 2016. Teacher Quality and Learning Outcomes in Kindergarten. The Quarterly Journal of Economics 131, 1415–1453. https://doi.org/10.1093/qje/qjw016

Avvisati, F., 2018. In which countries do the most highly qualified and experienced teachers teach in the most difficult schools? OECD, Paris. https://doi.org/10.1787/3ef99aba-en

Banerjee, A.V., Cole, S., Duflo, E., Linden, L., 2007. Remedying Education: Evidence from Two Randomized Experiments in India. Q J Econ 122, 1235–1264. https://doi.org/10.1162/qjec.122.3.1235

Bashir, S., Lockheed, M.E., Ninan, E., Tan, J.-P., 2018. Facing Forward: Schooling for Learning in Africa (No. 130473). The World Bank.

Behrman, J.R., Tincani, M.M., Todd, P.E., Wolpin, K.I., 2016. Teacher Quality in Public and Private Schools under a Voucher System: The Case of Chile. Journal of Labor Economics 34, 319–362. https://doi.org/10.1086/683642

Bertoni, E., Elacqua, G., Hincapié, D., Méndez, C., Paredes, D., 2021. Teachers' Preferences for Proximity and the Implications for Staffing Schools: Evidence from Peru. Education Finance and Policy 1–56. https://doi.org/10.1162/edfp_a_00347

Bertoni, E., Elacqua, G., Jaimovich, A., Rodríguez, J., Santos, H., 2018. Teacher Policies, Incentives, and Labor Markets in Chile, Colombia, and Perú: Implications for Equality. Inter-American Development Bank. https://doi.org/10.18235/0001319

Bertoni, E., Elacqua, G., Marotta, L., Martínez, M., Méndez, C., Montalva, V., Westh Olsen, A.S., Soares, S., Santos, H., 2020. El problema de la escasez de docentes en Latinoamérica y las políticas para enfrentarlo. Inter-American Development Bank.

Bobba, M., Ederer, T., Leon-Ciliotta, G., Neilson, C., Nieddu, M.G., 2021. Teacher Compensation and Structural Inequality: Evidence from Centralized Teacher School Choice in Peru (Working Paper No. 29068), Working Paper Series. National Bureau of Economic Research. https://doi.org/10.3386/w29068

Bold, T., Filmer, D., Martin, G., Molina, E., Stacy, B., Rockmore, C., Svensson, J., Wane, W., 2017. Enrollment without Learning: Teacher Effort, Knowledge, and Skill in Primary Schools in Africa. Journal of Economic Perspectives 31, 185–204. https://doi.org/10.1257/jep.31.4.185

Bold, T., Gauthier, B., Svensson, J., Wane, W., 2010. Delivering service indicators in education and health in Africa : a proposal (No. WPS5327). World Bank.

Bold, T., Kimenyi, M., Mwabu, G., Ng'ang'a, A., Sandefur, J., 2018. Experimental evidence on scaling up education reforms in Kenya. Journal of Public Economics 168, 1–20. https://doi.org/10.1016/j.jpubeco.2018.08.007

Bold, T., Svensson, J., Gauthier, B., Mæstad, O., Wane, W., 2011. Service delivery indicators: Pilot in education and health care in Africa (No. CMI Report R 2011:8). Chr. Michelsen Institute, Bergen, Norway.

Buhl-Wiggers, J., Kerwin, J.T., Smith, J.A., Thornton, R., 2019. Teacher Effectiveness in Africa: Longitudinal and Causal Estimates.

Cabrera, J.M., Webbink, D., 2020. Do Higher Salaries Yield Better Teachers and Better Student Outcomes? J. Human Resources 55, 1222–1257. https://doi.org/10.3368/jhr.55.4.0717-8911R3

Camelo, R., Ponczek, V., 2021. Teacher Turnover and Financial Incentives in Underprivileged Schools: Evidence from a Compensation Policy in a Developing Country. Economics of Education Review 80, 102067. https://doi.org/10.1016/j.econedurev.2020.102067

Carvalho, S., Evans, D., Mendez Acosta, A., 2021. Beyond Average: How to Reach Girls who Face Multiple Sources of Exclusion. Center for Global Development.

Castro, J.F., Esposito, B., 2021. The Effect of Bonuses on Teacher Retention and Student Learning in Rural Schools: A Story of Spillovers. Education Finance and Policy 1–59. https://doi.org/10.1162/edfp_a_00348

Cattaneo, A., Adukia, A., Brown, D., Christiaensen, L., Evans, D., Haakenstad, A., McMenomy, T., Patridge, M., Vaz, S., Weiss, D., 2021. Economic and Social Development along the Urban-Rural Continuum: New Opportunities to Inform Policy.

Chacón, A., Peña, P., 2017. The impact of Enseña por México on student socioemotional skills. Microanalitica.

Chelwa, G., Pellicer, M., Maboshe, M., 2019. Teacher Pay and Educational Outcomes: Evidence from the Rural Hardship Allowance in Zambia. South African Journal of Economics 87, 255–282. https://doi.org/10.1111/saje.12227

Chin, A., 2005. Can redistributing teachers across schools raise educational attainment? Evidence from Operation Blackboard in India. Journal of Development Economics 78, 384–405. https://doi.org/10.1016/j.jdeveco.2004.09.004

Cobbold, C., 2006. Attracting and retaining rural teachers in Ghana: the premise and promise of a district sponsorship scheme. Journal of Education for Teaching 32, 453–469. https://doi.org/10.1080/02607470600982142

Crawfurd, L., Pugatch, T., 2020. Teacher Labor Markets in Developing Countries.

Cumsille, B.R., Fiszbein, A., 2015. Crème de la Crème: The Teach For All Experience and Its Lessons for Policy-Making in Latin America. education policy analysis archives 23, 46–46. https://doi.org/10.14507/epaa.v23.1810

Datta, S., Kingdon, G.G., 2021. The myth of teacher shortage in India. RISE Working Paper 21/072.

de Ree, J., Muralidharan, K., Pradhan, M., Rogers, H., 2018. Double for Nothing? Experimental Evidence on an Unconditional Teacher Salary Increase in Indonesia. The Quarterly Journal of Economics 133, 993–1039. https://doi.org/10.1093/qje/qjx040

Duflo, E., Dupas, P., Kremer, M., 2015. School governance, teacher incentives, and pupil–teacher ratios: Experimental evidence from Kenyan primary schools. Journal of Public Economics 123, 92–110. https://doi.org/10.1016/j.jpubeco.2014.11.008

Eble, A., Hu, F., 2020. Child beliefs, societal beliefs, and teacher-student identity match. Economics of Education Review 77, 101994. https://doi.org/10.1016/j.econedurev.2020.101994

Elacqua, G., Hincapié, D., Hincapié, I., Montalva, V., 2019. Can Financial Incentives Help-Disadvantaged Schools to Attract and Retain High Performing Teachers?: Evidence from Chile. Inter-American Development Bank. https://doi.org/10.18235/0001820

Elacqua, G., Hincapié, D., Vegas, E., Alfonso, M., 2018. Profesión: Profesor en América Latina ¿Por qué se perdió el prestigio docente y cómo recuperarlo? Inter-American Development Bank.

Evans, D.K., Popova, A., 2016. What Really Works to Improve Learning in Developing Countries? An Analysis of Divergent Findings in Systematic Reviews. World Bank Res Obs 31, 242–270. https://doi.org/10.1093/wbro/lkw004

Evans, D.K., Yuan, F., 2018. The Working Conditions of Teachers in Low- and Middle-Income Countries. Presented at the RISE Conference 2018.

Evans, Filmer, D.P., Yuan, F., 2020. Are Teachers in Africa Poorly Paid? Evidence from 15 Countries.

Fagernäs, S., Pelkonen, P., 2012. Preferences and Skills of Indian Public Sector Teachers. IZA Journal of Labor & Development 1, 1–31.

Gad, B.K., 2015. Recruitment and Retention of Public Sector Teachers in Ghana: A Discrete Choice Experiment. University of Ghana.

Global Education Monitoring Report Team, 2020. A new generation: 25 years of efforts for gender equality in education. UNESCO.

Gusenbauer, M., Haddaway, N.R., 2020. Which academic search systems are suitable for systematic reviews or meta-analyses? Evaluating retrieval qualities of Google Scholar, PubMed, and 26 other resources. Research Synthesis Methods 11, 181–217. https://doi.org/10.1002/jrsm.1378

Higgins, J.P.T., Green, S., 2011. Cochrane Handbook for Systematic Reviews of Interventions. The Cochrane Collaboration.

Hinze-Pifer, R., Méndez, C., 2016. Evaluating the Impact of Supplemental Funds on Disadvantaged Schools: Evidence from Chile. University of Chicago.

Kamere, I., Makatiani, M.I., Nzau, A.K., 2019. Policy interventions for attraction and retention of female teachers in rural secondary schools: Perspectives of rural educators in Makueni County, Kenya. MSINGI JOURNAL of the Department of Educational Foundations 1, 50–59.

Lavado, P., Guzmán, R., 2020. Evaluación de impacto de enseña Perú.

Liao, W., Liu, Y., Zhao, P., Li, Q., 2019. Understanding how local actors implement teacher rotation policy in a Chinese context: a sensemaking perspective. Teachers and Teaching 25, 855–873. https://doi.org/10.1080/13540602.2019.1689490

Lim, J., Meer, J., 2020. Persistent Effects of Teacher–Student Gender Matches. J. Human Resources 55, 809–835. https://doi.org/10.3368/jhr.55.3.0218-9314R4

Majgaard, K., Mingat, A., 2012. Education in Sub-Saharan Africa: A Comparative Analysis. World Bank, Washington, DC. https://doi.org/10.1596/978-0-8213-8889-1

Mangham, L.J., Hanson, K., McPake, B., 2009. How to do (or not to do) … Designing a discrete choice experiment for application in a low-income country. Health Policy and Planning 24, 151–158. https://doi.org/10.1093/heapol/czn047

McEwan, P.J., 1999. Recruitment of rural teachers in developing countries: an economic analysis. Teaching and Teacher Education 15, 849–859. https://doi.org/10.1016/S0742-051X(99)00025-6

Mizala, A., Ñopo, H., 2016. Measuring the relative pay of school teachers in Latin America 1997–2007. International Journal of Educational Development 47, 20–32. https://doi.org/10.1016/j.ijedudev.2015.11.014

Mwenda, D.B., Mgomezulu, V.Y., 2018. Impact of Monetary Incentives on Teacher Retention in and Attraction to Rural Primary Schools: Case of the Rural Allowance in Salima District of Malawi. African Educational Research Journal 6, 120–129.

OECD, 2018. Responsive School Systems: Connecting Facilities, Sectors and Programmes for Student Success, OECD Reviews of School Resources. OECD Publishing, Paris.

Ortúzar, M.S., Flores, C., Milesi, C., Cox, C., 2009. Aspectos de la formación inicial docente y su influencia en el rendimiento académico de los alumnos.

Popova, A., Evans, D.K., Breeding, M.E., Arancibia, V., 2018. Teacher Professional Development around the World : The Gap between Evidence and Practice 1–65.

Poti, J., Mutsvangwa, A., Hove, M.L., 2014. Teacher Retention and Quality Education: Impact of Rural Incentives in North-West, South Africa. Mediterranean Journal of Social Sciences 5, 792.

Pugatch, T., Schroeder, E., 2018. Teacher pay and student performance: evidence from the Gambian hardship allowance. Journal of Development Effectiveness 10, 249–276. https://doi.org/10.1080/19439342.2018.1452778

Pugatch, T., Schroeder, E., 2014. Incentives for teacher relocation: Evidence from the Gambian hardship allowance. Economics of Education Review 41, 120–136. https://doi.org/10.1016/j.econedurev.2014.04.003

Rosa, L., 2019. Teacher Preferences in Developing Countries: Evidences from the City of Sao Paulo, Brazi.

See, B.H., Morris, R., Gorard, S., El Soufi, N., 2020a. What works in attracting and retaining teachers in challenging schools and areas? Oxford Review of Education 46, 678–697. https://doi.org/10.1080/03054985.2020.1775566

See, B.H., Morris, R., Gorard, S., Kokotsaki, D., Abdi, S., 2020b. Teacher Recruitment and Retention: A Critical Review of International Evidence of Most Promising Interventions. Education Sciences 10, 262.

Service Delivery Indicators, 2017. SDI Definition of Indicators—Education [WWW Document]. URL https://www.sdindicators.org/indicators

Sisouphanthong, V., Suruga, T., Kyophilavong, P., 2020. Valuation of incentives to recruit and retain teachers in rural schools: Evidence from a choice experiment in Cambodia and Laos. Cogent Education 7, 1724243. https://doi.org/10.1080/2331186X.2020.1724243

Swai, A.E., 2013. The Effects of Incentive Initiatives on Teacher Retention in Tanzania: A Case of the Rukwa Region. Master's Capstone Projects.

Teach for All, 2021. Teach for All Network Partners [WWW Document]. URL https://teachforall.org/network-partners

UNESCO, 2020. A review of the use of contract teachers in sub-Saharan Africa. UNESCO.

Urquiola, M., Vegas, E., 2005. Arbitrary Variation in Teacher Salaries: An Analysis of Teacher Pay in Bolivia, in: Vegas, E. (Ed.), Incentives to Improve Teaching: Lessons from Latin America. The World Bank.

World Bank, 2018. World Development Report 2018: Learning to Realize Education's Promise. Washington, DC.

World Bank, 2021. World Bank Income Classification [WWW Document]. URL https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups (accessed 8.30.21).

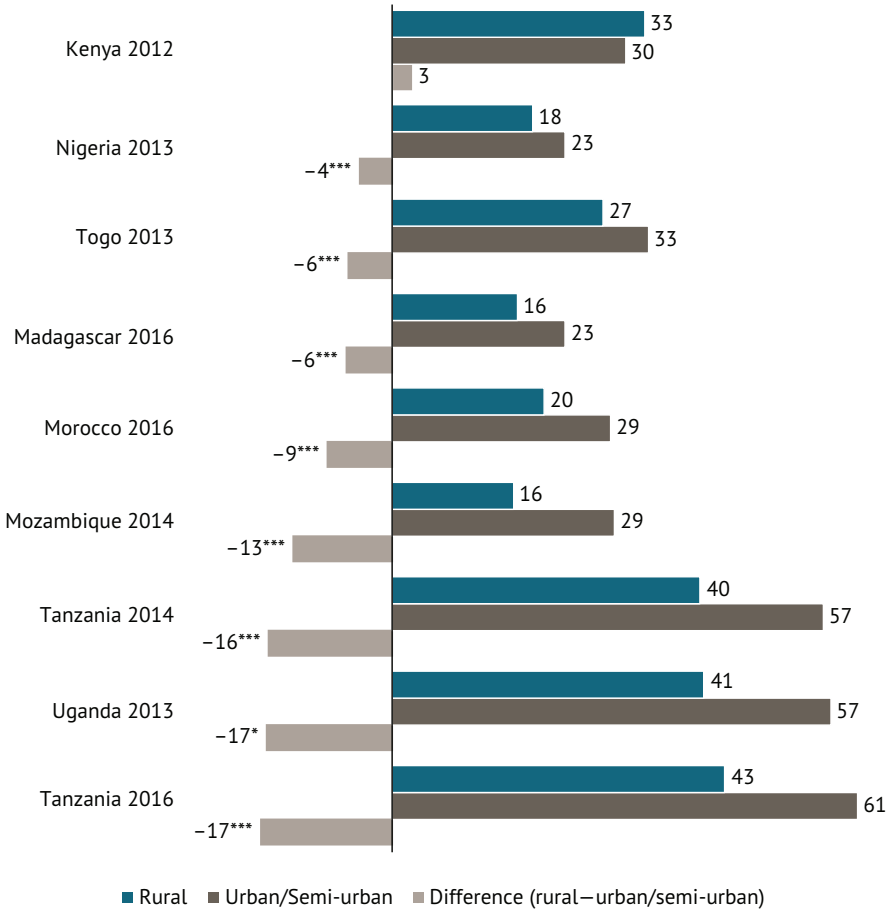
World Bank Microdata Library, 2021. Service Delivery Indicators [WWW Document]. URL https://microdata.worldbank.org/index.php/catalog/sdi

World Health Organization, 2020. Retention of the health workforce in rural and remote areas: a systematic review (Human Resources for Health Observer Series No. 25).

Zhai, X., 2019. Becoming a teacher in rural areas: How curriculum influences government-contracted pre-service physics teachers' motivation. International Journal of Educational Research 94, 77–89. https://doi.org/10.1016/j.ijer.2018.11.012

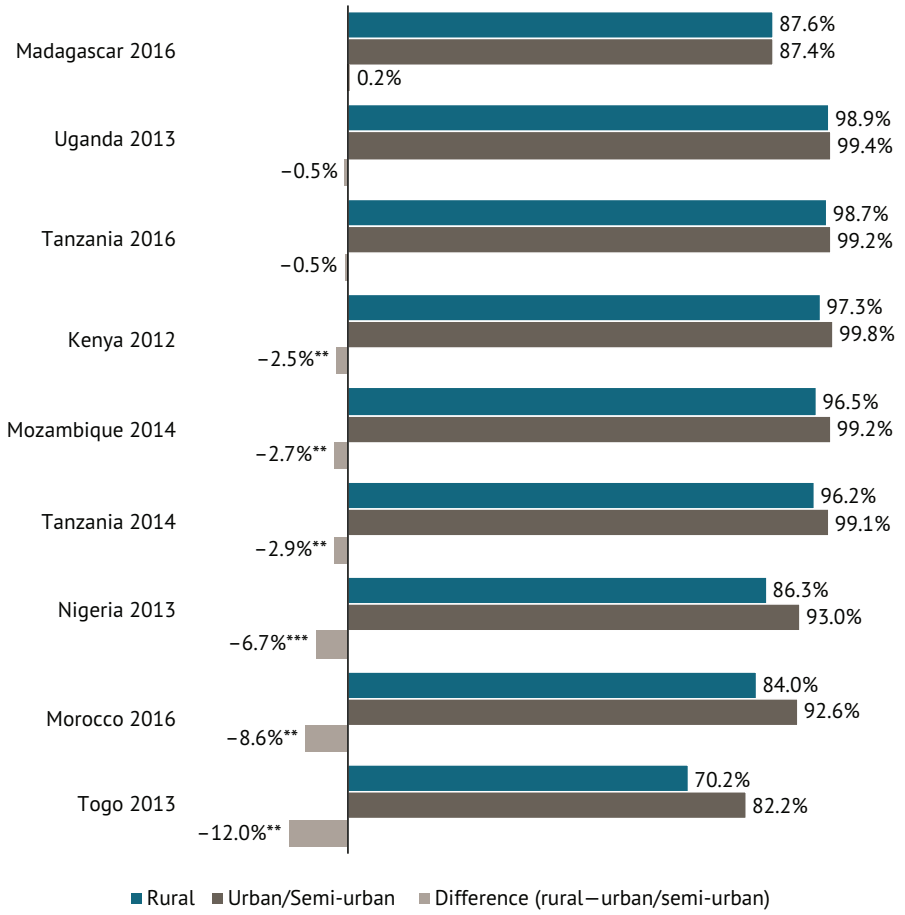
Appendix A. Additional tables and figures

Appendix Figure A1. Observed classroom size in urban and semi-urban vs. rural areas in selected low- and middle-income countries



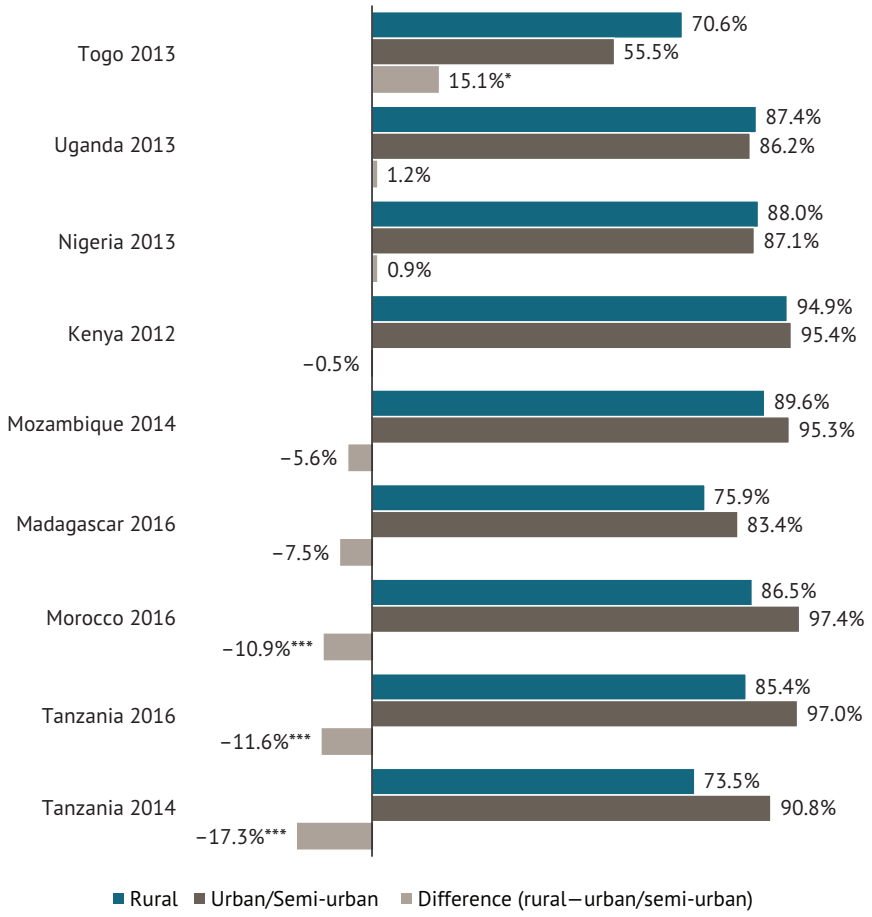
Source: Authors' analysis using data from the World Bank's Service Delivery Indicators Education Survey.
Note: We use the data from the surveys' observed classroom size variable. Averages are first computed at the school-level and aggregated at the country level using school-level weights. Differences in rural and urban/semi-urban rates are tested using bivariate regressions with school-level weights and robust standard errors and are presented here with statistical significance: * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Figure A2. Proportion of students with at least one exercise book in urban and semi-urban vs. rural areas in selected low- and middle-income countries



Source: Authors' analysis using data from the World Bank's Service Delivery Indicators Education Survey.
Note: Averages are first computed at the school-level and aggregated at the country level using school-level weights. Differences in rural and urban/semi-urban rates are tested using bivariate regressions with school-level weights and robust standard errors and are presented here with statistical significance: * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Figure A3. Proportion of classrooms with functioning boards in urban and semi-urban vs. rural areas in selected low- and middle-income countries



Source: Authors' analysis using data from the World Bank's Service Delivery Indicators Education Survey.
Note: Averages are first computed at the school-level and aggregated at the country level using school-level weights. Differences in rural and urban/semi-urban rates are tested using bivariate regressions with school-level weights and robust standard errors and are presented here with statistical significance: * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table A1. List of 9 discrete choice experiments or excluded studies of interventions

Study	Type of Program	Country	Year of Intervention Evaluated
Cobbold (2006)	Financial incentive (district-sponsored allowance for teacher trainers in return for a three-year contract to teach in the district)	Ghana	Introduced in 2000/2001 academic year.
Fagernäs and Pelkonen (2012)	Financial incentive (salary increase for moving to a remote location)	India	The discrete choice experiment was conducted in 2010.
Gad (2015)	Financial and non-financial incentives (incentive packages such as granting of study leave with pay, provision of housing and promotion after three years of work)	Ghana	The discrete choice experiment was conducted in 2015.
Kamere et al. (2019)	Financial incentive and an administrative policy (decentralization of recruitment to the school level and a separate policy on hardship allowance and housing)	Kenya	The decentralization policy signed in 2001. Hardship allowance and housing policy has been in effect since at least 2006.
Liao et al. (2019)	Financial and non-financial incentive (teacher rotation policy that sends urban teachers to rural areas and compensates them with transportation subsidy, professional awards, and early promotion)	China	The policy was issued by China's central government in 2014.
Mwenda and Mgomezulu (2018)	Financial incentive (teacher rural allowance)	Malawi	Policy is already in effect by 2009.
Poti et al. (2014)	Financial incentive (teacher rural allowance)	South Africa	Policy signed in 2008.
Sisouphanthong et al. (2020)	Financial incentive (teacher rural allowance)	Cambodia, Laos	The discrete choice experiment was conducted in 2014 in Laos and in 2015 in Cambodia.
Zhai (2019)	Financial incentive (government-contracted preservice teacher program that provides free education, stipends and guaranteed employment in exchange for teaching in rural areas for at least two years)	China	Policy launched in 2007.

Appendix Table A2. Teacher language competency score in urban and semi-urban vs. rural areas in selected low- and middle-income countries

Score in Language Task (out of 100%)	Urban/ Semi-urban	Rural	Difference (rural—urban/ semi-urban)	Robust SE	Statistical Significance
Kenya 2012	63.9%	63.2%	–0.66%	1.20%	
Madagascar 2016	26.0%	19.7%	–6.32%	1.09%	***
Morocco 2016	39.9%	40.0%	0.10%	1.13%	
Mozambique 2014	31.9%	30.8%	–1.14%	2.12%	
Nigeria 2013	34.5%	27.6%	–6.88%	1.28%	***
Tanzania 2014	37.1%	33.4%	–3.66%	1.46%	**
Tanzania 2016	29.8%	27.3%	–2.45%	0.87%	***
Togo 2013	51.8%	47.9%	–3.84%	2.05%	*
Uganda 2013	56.6%	53.0%	–3.54%	0.01%	**

Source: Authors' analysis using data from the World Bank's Service Delivery Indicators Education Survey.
Note: The teacher numeracy competency score is the percent answered correctly in a task-based assessment based on lower-primary level curriculum (scores are out of 100 percent). Averages are first computed at the school-level and aggregated at the country level using school-level weights. Differences in rural and urban/semi-urban rates are tested using bivariate regressions with school-level weights and robust standard errors and are presented here with statistical significance: * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table A3. Teacher numeracy competency score in urban and semi-urban vs. rural areas in selected low- and middle-income countries

Score in Math Task (out of 100%)	Urban/ Semi-urban	Rural	Difference (rural—urban/ semi-urban)	Robust SE	Statistical Significance
Kenya 2012	75.5%	78.4%	2.93%	1.97%	
Madagascar 2016	23.2%	24.1%	0.93%	1.26%	
Morocco 2016	51.5%	67.5%	16.00%	3.03%	***
Mozambique 2014	24.4%	27.5%	3.13%	2.21%	
Nigeria 2013	44.6%	35.0%	–9.60%	1.85%	***
Tanzania 2014	59.8%	59.5%	–0.32%	1.97%	
Tanzania 2016	61.8%	61.4%	–0.33%	1.67%	
Togo 2013	40.2%	28.8%	–11.44%	3.51%	***
Uganda 2013	61.0%	56.0%	–5.02%	1.73%	***

Source: Authors' analysis using data from the World Bank's Service Delivery Indicators Education Survey.
Note: The teacher numeracy competency score is the percent answered correctly in a task-based assessment based on lower-primary level curriculum (scores are out of 100 percent). Averages are first computed at the school-level and aggregated at the country level using school-level weights. Differences in rural and urban/semi-urban rates are tested using bivariate regressions with school-level weights and robust standard errors and are presented here with statistical significance: * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table A4. Teacher competency score in urban and semi-urban vs. rural areas in selected low- and middle-income countries

Average Score in Pedagogy Tasks (out of 100%)	Urban/ Semi-urban	Rural	Difference (rural—urban/ semi-urban)	Robust SE	Statistical Significance
Kenya 2012	35.7%	36.2%	0.44%	1.83%	
Madagascar 2016	18.2%	15.6%	–2.60%	1.62%	
Morocco 2016	19.9%	24.5%	4.63%	2.05%	**
Mozambique 2014	10.5%	14.4%	3.87%	1.76%	**
Nigeria 2013	14.9%	9.0%	–5.89%	0.92%	***
Tanzania 2014	38.1%	34.8%	–3.31%	1.71%	*
Tanzania 2016	21.1%	19.3%	–1.78%	1.12%	
Togo 2013	19.1%	15.6%	–3.45%	1.51%	**
Uganda 2013	25.8%	22.0%	–3.75%	1.09%	***

Source: Authors' analysis using data from the World Bank's Service Delivery Indicators Education Survey.
Note: The teacher pedagogy competency score is the average of percent answered correctly in task-based (scores are out of 100 percent). Averages are first computed at the school-level and aggregated at the country level using school-level weights. Differences in rural and urban/semi-urban rates are tested using bivariate regressions with school-level weights and robust standard errors and are presented here with statistical significance: * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table A5. Teacher outcomes from studies on incentivizing teachers in hard-to-staff schools

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
Ajzenman et al. (2021a)	Peru	Treatment 1: "altruistic identity" intervention to prime teachers' social-oriented motivations Treatment 2: "extrinsic incentive" intervention targeted information campaign promoting the existing incentives for teachers in underprivileged schools	Randomized controlled trial.	The incentive system was established in 2013. The experiment was implemented in 2019 with outcomes measured shortly after the treatment.	Control: 3,861 teachers Altruistic identity: 3,852 teachers Extrinsic incentive: 3,855 teachers	Both treatments increased rate of teachers applying to disadvantaged schools (driven by male teachers; altruistic treatment has higher impact than extrinsic treatment). The altruistic treatment increased likelihood of actual assignment to disadvantaged schools (higher-performing Bcandidates put disadvantaged schools as primary	Treatment: Altruistic identity Outcome: proportion of disadvantaged schools included in the teachers' choice set Outcome: proportion of disadvantaged schools included in the teachers' choice set (male teachers only) Outcome: proportion of disadvantaged schools included in the teachers' choice set (female teachers only) Outcome: proportion of disadvantaged schools included in the teachers' choice set (baseline high performers only) Outcome: proportion of disadvantaged schools included in the teachers' choice set (baseline low performers only)	0.019 ** 0.0346 ** 0.0107 0.0243 ** 0.011	0.0086 0.0141 0.0107 0.0122 0.012

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
						choices) while the extrinsic treatment did not affect actual assignment (those who chose disadvantaged schools in this treatment were more likely to be lower-performing teachers and did not get their first choice).	Outcome: being an active teacher in a disadvantaged school in 2020	0.0198	0.0176
							Outcome: being an active teacher in a disadvantaged school in 2020 (male teachers only)	0.0444	0.027
							Outcome: being an active teacher in a disadvantaged school in 2020 (female teachers only)	0.0085	0.0245
							Outcome: being an active teacher in a disadvantaged school in 2020 (baseline high performers only)	0.0332	0.0232
							Outcome: being an active teacher in a disadvantaged school in 2020 (baseline low performers only)	0.0196	0.0258
							Treatment: Extrinsic incentive		
							Outcome: proportion of disadvantaged schools included in the teachers' choice set	0.0201 **	0.0086
							Outcome: proportion of disadvantaged schools included in the teachers' choice set (male teachers only)	0.0308 **	0.0138
							Outcome: proportion of disadvantaged schools included in the teachers' choice set (female teachers only)	0.0154	0.0109

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
							Outcome: proportion of disadvantaged schools included in the teachers' choice set (baseline high performers)	0.0132	0.0122
							Outcome: proportion of disadvantaged schools included in the teachers' choice set (baseline low performers)	0.0249 **	0.012
							Outcome: being an active teacher in a disadvantaged school in 2020	0.0373 **	0.0165
							Outcome: being an active teacher in a disadvantaged school in 2020 (male teachers only)	0.057 **	0.0251
							Outcome: being an active teacher in a disadvantaged school in 2020 (female teachers only)	0.0267	0.0223
							Outcome: being an active teacher in a disadvantaged school in 2020 (baseline high performers only)	0.0569 **	0.0221
							Outcome: being an active teacher in a disadvantaged school in 2020 (baseline low performers only)	0.0338	0.0237

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
Ajzenman et al. (2021b)	Ecuador	Zero-cost nationwide government intervention that listed teaching vacancies in hard-to-staff schools were listed first on a job application platform before other schools instead of alphabetically (no change in information or incentives).	Randomized controlled trial.	Program implemented in 2019 and evaluated immediately after the recruitment cycle.	18,133 teacher candidates (half to treatment and half to control)	Teachers were more likely to apply to disadvantaged schools, rank them as higher priority and be assigned to these schools. Teacher quality did not affect response to treatment.	Outcome: percentage of understaffed schools in choice set	0.013 **	0.006
							Outcome: share of understaffed school among first choice	0.052 ***	0.012
							Outcome: at least one understaffed school among first 2 choices	0.027 **	0.011
							Outcome: at least one understaffed school among first 3 choices	0.029 **	0.011
							Outcome: assigned to understaffed school	0.034 ***	0.012
							Outcome: accepted offer in understaffed school	0.031 **	0.012
							Outcome: percentage of understaffed schools in choice set (coefficient of interacting treatment and being low-performer)	–0.011	0.012
							Outcome: share of understaffed school among first choice (coefficient of interacting treatment and being low-performer)	–0.032	0.026
							Outcome: at least one understaffed school among first 2 choices (coefficient of interacting treatment and being low-performer)	–0.017	0.027

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
							Outcome: at least one understaffed school among first 3 choices (coefficient of interacting treatment and being low-performer)	–0.005	0.023
							Outcome: assigned to understaffed school	–0.024	0.024
							Outcome: accepted offer in understaffed school (coefficient of interacting treatment and being low-performer)	–0.0818	0.024
Bobba et al. (2021)	Peru	Government-sponsored wage bonus for teachers in select rural areas categorized by population and travel time to provincial capital computed by GPS. Bonus is up to S/500, equivalent to up to 30 percent of contract teachers' monthly earnings.	Regression discontinuity using population and distance cut-off.	Policy was first implemented in 2014 with increase in bonuses in 2015. Study period is 2015–2018	The main results table report outcomes based on data from up to 925 schools.	Vacancies in bonus schools became more desirable for teacher applicants and the quality of recruited teachers improved but only for contract teaching positions.	Outcome: bonus school is in the list of teachers' preference list (permanent teaching position)	0.177 **	0.068
							Outcome: vacancy is filled (permanent teaching position)	–0.001	0.071
							Outcome: competency score of recruited teachers (permanent teaching position)	–0.014	0.175
							Outcome: rank of teacher that filled the vacant position (contract teaching position) (lower rank has higher competence)	–0.121 ***	0.035
							Outcome: vacancy is filled (contract teaching position)	0.045	0.045
							Outcome: competency score of recruited teachers (contract teaching position)	0.451 ***	0.123

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
Cabrera and Webbink (2020)	Uruguay	Contexto Socio Cultural Crític (CSCC program) provides up to 26% increase in base salary for teachers working poor neighborhoods.	Regression discontinuity around the poverty index threshold.	The program was launched in 1995 and updated in 2005 to use a poverty index cut-off as eligibility criteria. Outcome variables are available until 2013 with administrative data available since 1992 (study does not evaluate long-term effects but outcomes against program participation in year t–1 and t–2)	543 schools	Increased teacher tenure (length of staying in one school) by one year but no significant change in average teacher turn-over (teachers with more tenure are less likely to leave program schools than non-beneficiary schools). Increased average teacher experience by two or three years (teachers with more experience get recruited).	Outcome: average teacher experience Outcome: average length of service of teachers	1.686 *** 0.403 **	0.304 0.191

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
Camelo and Ponczek (2021)	Brazil	ALE program (Adicional por Local de Exercício): "wage premium (24% to 36%) to teachers at disadvantaged schools" based on school location.	Regression discontinuity around the socio-economic index threshold.	Program was launched in 2008. Data for analysis covers 2007 to 2012.	1,422 schools received compensation and 1,324 did not	Reduced teacher turn-over.	Outcome: teacher turnover (2008–09)	–0.048 *	0.026
							Outcome: teacher turnover (2009–10)	–0.064 **	0.028
							Outcome: teacher turnover (2010–11)	–0.028	0.030
							Outcome: teacher turnover (2011–12)	–0.083 **	0.034
							Outcome: teacher turnover (pooled)	–0.050 **	0.024
Castro and Esposito (2021)	Peru	Rural bonuses based on community population and distance from capital	Regression discontinuity along the school's distance in minutes to the nearest provincial capital (120 minutes) and number of inhabitants (500)	Started in 1990, revamped in 2014 to increase bonuses and include more schools. Evaluated in 2016.	9,948 extremely rural schools (treatment group; receives the highest available bonus) 11,575 rural schools (control; receives smaller bonus)	The intervention reduced teacher attrition and reduced vacancies but with negative externality affecting control schools near treatment schools.	Outcome: teacher attrition (% of teachers that leave the school before the end of the academic year) (schools in communities with less than 500 inhabitants)	–1.460 **	0.865
							Outcome: teacher attrition in control schools less than 30 minutes away (schools in communities with less than 500 inhabitants)	1.351	0.966
							Outcome: teacher attrition (schools more than 120 minutes from road)	–4.846 ***	1.755
							Outcome: teacher attrition in control schools less than 30 minutes away (schools more than 120 minutes from capital)	1.350	1.483

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
							Outcome: teacher vacancies filled (schools in communities with less than 500 inhabitants)	1.569 *	0.935
							Outcome teacher vacancies filled in control schools less than 30 minutes away (schools in communities with less than 500 inhabitants)	–2.496 **	1.062
							Outcome: teacher vacancies (schools more than 120 minutes from road)	3.441 *	2.043
							Outcome: teacher vacancies filled in control schools less than 30 minutes away (schools more than 120 minutes from capital)	–3.147 *	1.767
Chelwa et al. (2019)	Zambia	Rural hardship allowance corresponding to a salary increase of 20% "allocated to schools outside a given radius from district centers."	Regression discontinuity by GPS-computed distance to district city centers.	Allowance was implemented in the 1990s, revamped in 2008 (to become a 20% salary increase) and some implementation rules were changed in 2010. Evaluation uses data from 2014 to 2015	3,000 schools, about half received the allowance allocation; final sample is 137 schools (44 pairs across the threshold) due to challenges in implementation and data availability	Some (but weak) positive effect on teacher retention. Some (but weak) positive effect on stock of teachers.	Outcome: log teachers	0.045 *	0.026
							Outcome: teacher tenure	0.29	0.218
							Outcome: share teachers transferred to other school	0.002	0.008
							Outcome: teacher education	0.11	0.016
							Outcome: teacher age	–0.054	0.224

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
Chin (2005)	India	Operation Blackboard is a government initiative to recruit additional teachers for one-teacher primary schools, complemented with provision of equipment packets (blackboards, books, maps, charts, toys, teacher's manuals, and other basic inputs) to all primary schools.	Difference-in-differences by birth cohort (children who started attending primary schools before and after) 1987 when the program was launched) residence (children in states with higher share of one-teacher schools were more exposed to the program	Launched in 1987, the program served all originally targeted schools by 1994.	Recruitment drive for 140,000 teachers as second teachers to one-teacher primary schools	Only a quarter to a half of the teachers were sent to one-teacher schools; since average class size did not decrease, teachers are presumed to have shifted from larger schools to smaller schools instead of being newly recruited.	Outcome: proportion of primary schools with one teacher	–0.0498 ***	0.0122
							Outcome: proportion of primary schools with two teachers	0.0306 ***	0.0107
							Outcome: proportion of primary schools with three teachers	0.0075 ***	0.0021
							Outcome: proportion of primary schools with four teachers	0.0057 ***	0.0018
							Outcome: proportion of primary schools with five or more teachers	0.0053 **	0.0020
							Outcome: teachers per primary section (in primary school only—up to 5th grade only)	0.0869 ***	0.0247
							Outcome: teachers per primary section (in primary sections excluding primary schools)	–0.6750 **	0.2928
							Outcome: teachers per primary section (in all primary sections)	0.0090	0.0529
							Outcome: pupils in grades 1 to 5 per primary section teacher)	1.1954	1.4076

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
							Outcome: population aged 6 to 10 per primary section teacher)	0.9065	1.3913
							Outcome: trained teachers as a percent of all primary section teachers	0.0016	0.0155
							Outcome: female teachers as a percent of all primary section teachers	0.0021	0.0044
Elacqua et al. (2019)	Chile	Additional incentive for teachers (additional 40% of the usual competency-based award) under the Pedagogical Excellence Assignment program (AEP)	Regression discontinuity –schools are considered disadvantaged if 60% or more of students are low income.	The version of AEP evaluated in the study has been implemented between 2012 and 2015. Evaluation uses data from 2011 to 2017.	around 1,500 teachers across three years	Increased retention of talented teachers in disadvantaged schools but no impact on recruiting teachers who were not already working in disadvantaged schools at baseline.	Outcome: probability of teaching in a disadvantaged school (t + 1, all teachers)	–0.05	0.07
							Outcome: probability of teaching in a disadvantaged school (t + 1, teachers already in disadvantaged schools at baseline)	0.04	0.08
							Outcome: probability of teaching in a disadvantaged school (t + 1 teachers not in disadvantaged schools at baseline)	–0.07	0.1
							Outcome: probability of teaching in a disadvantaged school (t + 2, all teachers)	0.05	0.07

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
							Outcome: probability of teaching in a disadvantaged school (t + 2, teachers already in disadvantaged schools at baseline)	0.22 **	0.10
							Outcome: probability of teaching in a disadvantaged school (t + 2 teachers not in disadvantaged schools)	–0.09	0.11
							Outcome: probability of teaching in a disadvantaged school (t + 1, all teachers)	0.18	0.1
Hinze-Pifer and Méndez (2016)	Chile	Difficult Conditions Bonus for disadvantaged schools. Majority of beneficiary teachers receive between 4% to 10% over their base salary, with some receiving 15% or higher.	Regression discontinuity along the Difficult Conditions score—an index of measures of disadvantages including share of low-income students, distance from a large city, and public transit access.	Established in 1996. Data is from 2008–2014. Schools apply to receive the bonus every two years.	2,032 schools (varies over time)	No significant impact on teacher retention; reduced working hours of teachers receiving the bonus	Outcome: end of year retention (%)	–0.438	0.371
							Outcome: contract hours	–0.264 ***	0.092
							Outcome: experience (years)	–0.066	0.187
							Outcome: teacher hours per student	–0.123 *	0.068
							Outcome: contract hours (t + 1)	–0.164	0.104
							Outcome: teacher hours per student (t + 1)	–0.168 **	0.075

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
Pugatch and Schroeder (2014)	Gambia	Hardship allowance that provides 30–40% bonus to teachers in remote locations.	Difference-in-differences and regression discontinuity along the 3-km threshold distance from a main road.	Allowance policy was adopted in 2005. Data is from 2001 and 2003 (pre-treatment years) and 2010–2012 (post-treatment).	244 schools, of which148 are hardship schools and 96 are non-hardship schools	Increased share of qualified/ certified teachers and pupil/ qualified teacher ratio (RD analysis). The intervention did not increase share of female teachers.	Outcome: share of qualified teachers (%) (DD)	0.10 ***	0.03
							Outcome: share of female teachers (%) (DD)	–0.01	0.02
							Outcome: pupil-qualified teacher ratio (DD)	–0.02	9.3
							Outcome: share of qualified teachers (%) (RD)	0.16	0.11
							Outcome: share of female teachers (%) (RD)	0.08	0.09
							Outcome: pupil-qualified teacher ratio (RD)	–27.4 **	12.7
Rosa (2019)	Brazil	San Paolo city pays "wage-premiums [5%–7%] for teachers working in schools in selected neighborhoods" farther from downtown. Area 1: no wage premium	Regression discontinuity along the distance threshold (school to neighborhood boundaries).	Classification of neighborhoods and corresponding wage premium was set up in 1991. Evaluation data from 2010.	546 schools	Wage premium has no effect on teachers' choice of school, still preferring schools with better environment and student outcomes.	Outcome: probability of teachers choosing to be in wage-premium schools (Area 2 vs. Area 1) (using school latitude and longitude)	–0.0004	0.0011
							Outcome: probability of teachers choosing to be in wage-premium schools (Area 2 vs. Area 1) (using school distance to boundary)	–0.0001	0.0011

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
		Area 2: wage-premium of about 5% Area 3: wage-premium of 7%					Outcome: probability of teachers choosing to be in wage-premium schools (Area 3 vs. Area 2) (using school latitude and longitude)	0.0004	0.0011
							Outcome: probability of teachers choosing to be in wage-premium schools (Area 3 vs. Area 2) (using school distance to boundary)	0.0004	0.0010
Swai (2013)	Tanzania	Rukwa Civil Servant Facilitation Fund in Tanzania provides incentive to attract secondary school teachers to the region (cash incentive including signing bonus equivalent to at least one month take home pay, accommodations, and other inputs).	Matching. Retention rates in Rukwa which implements the rural incentive is compared against Kigoma, a neighboring region with no incentive policy in place.	Policy initially implemented in 2004. Data collection/ interviews were held in 2012.	290 teachers from Rukwa and 266 teachers from Kigoma	Retention in rural Rukwa is higher than in rural Kigoma but not statistically different. Within Rukwa, no significant difference in retention rate between teachers recruited through the incentive system and teachers recruited via traditional means.	Outcome: % of teachers who stayed more than 3 years (Rukwa vs Kigoma)	0.002	No statistical significance reported.
							Outcome: % of teachers employed in Rukwa who stayed more than 3 years (recruited via the incentive system vs. recruited via traditional route)	0.003	Not statistically significant.

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE
Urquiola and Vegas (2005)	Bolivia	Salary bonus of about 12.5 percent of total compensation available. Additional bonus is available for teachers depending on seniority and trainings received.	Matching between rural teachers and urban teachers in three cities (La Paz/El Alto, Cochabamba, and Santa Cruz)	Multiple geography bonus with no clear timelines, but the study reflects 2002 salary rates.	1,606 schools from the three cities	Number of hours worked and probability of holding a second job decreased.	Outcome: total hours worked (all cities, no control)	–.7.2 ***	0.5
							Outcome: total hours worked (all cities, controlling for teachers and school characteristics)	–.7.3 ***	0.5
							Outcome: total hours worked (all cities, controlling for teachers and school characteristics, with dummy for teacher experience)	–4.2 ***	0.4
							Outcome: probability of holding more than one job (all cities, no control)	–0.16 ***	0.01
							Outcome: probability of holding more than one job (all cities, with dummy for teacher training)	–0.16 ***	0.01
							Outcome: probability of holding more than one job (all cities, with dummy for teacjer training, with dummy for teacher experience)	–0.09 ***	0.01

Note: * significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table A6. Vote count of teacher-related outcomes from the 15 eligible studies

	Positive, Significant	Positive, Insignificant	Negative, Insignificant	Negative, Significant	Total
All teacher outcomes	41 41%	29 29%	20 20%	9 9%	99 100%
Teacher preferences	12 50%	6 25%	6 25%	0 0%	24 100%
Teacher placement	13 39%	10 30%	7 21%	3 9%	33 100%
Teacher turn-over	9 47%	8 42%	2 11%	0 0%	19 100%
Teacher competence	4 31%	5 38%	4 31%	0 0%	13 100%
Teacher working hours/ probability of holding a second job	3 30%	0 0%	1 10%	6 60%	10 100%

Appendix Table A7. Student outcomes from studies on incentivizing teachers in hard-to-staff schools

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
Bobba et al. (2021)	Peru	Government-sponsored wage bonus for teachers in select rural areas categorized by population and travel time to provincial capital computed by GPS. Bonus is up to S/500, equivalent to up to 30 percent of contract teachers' monthly earnings.	Regression discontinuity using population and distance cut-off.	Policy was first implemented in 2014 with increase in bonuses in 2015. Study period is 2015–2018	The main results table report outcomes based on data from up to 925 schools.	Students in program schools performed better, especially students in schools with short-term vacancies, a potential result of the improved competence of newly recruited contractual teachers (see teacher outcomes in Appendix A1).	Outcome: Spanish test (z-score) (any vacancy)	0.298 **	0.127
							Outcome: Spanish test (z-score) (permanent vacancy)	–0.057	0.190
							Outcome: Spanish test (z-score) (short-term vacancy)	0.317 **	0.137
							Outcome: Math test (z-score) (any vacancy)	0.350 **	0.142
							Outcome: Math test (z-score) (permanent vacancy)	–0.047	0.248
							Outcome: Math test (z-score) (short-term vacancy)	0.470 ***	0.159
Cabrera and Webbink (2020)	Uruguay	Contexto Socio Cultural Crític (CSCC program) provides up to 26% increase in base salary for teachers working poor neighborhoods	Regression discontinuity around the poverty index threshold.	The program was launched in 1995 and updated in 2005 to use a poverty index cut-off as eligibility criteria.	543 schools	Small effect on student performance (test score, attendance, grade-retention, dropout)	Outcome: insufficient student attendance (+/ – 1.5 pts discontinuity)	–0.052	0.046
							Outcome: student grade retention (+/– 1.5 pts discontinuity)	0.014	0.038
							Outcome: student dropout (+/– 1.5 pts discontinuity)	0.039	0.061

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
				Outcome variables are available until 2013 with administrative data available since 1992 (study does not evaluate long-term effects, but outcomes against program participation in year t–1 and t–2)			Outcome: student math test scores	–0.131	0.089
							Outcome: insufficient student attendance (+/– 1.0 pts discontinuity)	–0.153 ***	0.055
							Outcome: student grade retention (+/– 1.0 pts discontinuity)	–0.007	0.047
							Outcome: student dropout (+/– 1.0 pts discontinuity)	–0.056	0.066
Camelo and Ponczek (2021)	Brazil	ALE program (Adicional por Local de Exercício): "wage premium (24% to 36%) to teachers at disadvantaged schools" based on school location	Regression discontinuity around the socio-economic index threshold.	Program was launched in 2008. Data for analysis covers 2007 to 2012.	1,422 schools received compensation and 1,324 did not	No effect on average test score but the program reduced proportion of low-performers as measured by test scores.	Outcome: student proficiency scores in Math (2008)	–0.090	0.085
							Outcome: student proficiency scores in Math (2009)	0.110	0.080
							Outcome: student proficiency scores in Math (2010)	–0.009	0.087
							Outcome: student proficiency scores in Math (2011)	0.046	0.104
							Outcome: student proficiency scores in Math (2012)	0.029	0.077
							Outcome: student proficiency scores in Math (pooled)	0.024	0.071

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
							Outcome: student proficiency scores in Reading (2008)	–0.063	0.073
							Outcome: student proficiency scores in Reading (2009)	0.053	0.073
							Outcome: student proficiency scores in Reading (2010)	–0.034	0.075
							Outcome: student proficiency scores in Reading (2011)	0.026	0.107
							Outcome: student proficiency scores in Reading (2012)	0.000	0.068
							Outcome: student proficiency scores in Reading (pooled)	–0.002	0.064
							Outcome: % of low performers in Math (2008)	–0.023	0.033
							Outcome: % of low performers in Math (2009)	–0.081 **	0.039
							Outcome: % of low performers in Math (2010)	–0.068 *	0.039
							Outcome: % of low performers in Math (2011)	–0.085 **	0.042
							Outcome: % of low performers in Math (2012)	–0.083 **	0.040
							Outcome: % of low performers in Math (pooled)	–0.068 **	0.033
							Outcome: % of low performers in Reading (2008)	–0.036	0.026

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
							Outcome: % of low performers in Reading (2009)	–0.050 **	0.025
							Outcome: % of low performers in Reading (2010)	–0.051	0.032
							Outcome: % of low performers in Reading (2011)	–0.064 *	0.037
							Outcome: % of low performers in Reading (2012)	–0.064 **	0.031
							Outcome: % of low performers in Reading (pooled)	–0.054 **	0.025
Castro and Esposito (2021)	Peru	Rural bonuses based on community population and distance from capital	Regression discontinuity along the school's distance in minutes to the nearest provincial capital (120 minutes) and number of inhabitants (500)	Started in 1990, revamped in 2014 to increase bonuses and include more schools. Evaluated in 2016.	9,948 extremely rural schools (treatment group; receives the highest available bonus) 11,575 rural schools (control; receives smaller bonus)	No clear evidence of impact on test scores.	Outcome: math test scores (standard deviation) (schools in communities with less than 500 inhabitants)	–0.056	0.066
							Outcome: math test scores in control schools less than 30 minutes away (standard deviation) (schools in communities with less than 500 inhabitants)	0.037	0.071
							Outcome: math test scores (standard deviation) (schools in communities with less than 500 inhabitants)	–0.239 *	0.123

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
							Outcome: math test scores in control schools less than 30 minutes away (standard deviation) (schools in communities with less than 500 inhabitants)	0.277 **	0.126
							Outcome: reading comprehension test scores (standard deviation) (schools in communities more than 120 minutes away from provincial capital)	–0.096	0.071
							Outcome: reading comprehension test scores in control schools less than 30 minutes away (standard deviation) (schools in communities more than 120 minutes away from provincial capital)	0.031	0.069
							Outcome: reading comprehension test scores (standard deviation) (schools in communities more than 120 minutes away from provincial capital)	–0.169	0.110
							Outcome: reading comprehension test scores in control schools less than 30 minutes away (standard deviation) (schools in communities more than 120 minutes away from provincial capital)	0.299 ***	0.112

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
Chelwa et al. (2019)	Zambia	Rural hardship allowance corresponding to a salary increase of 20% "allocated to schools outside a given radius from district centers."	Regression discontinuity by GPS-computed distance to district city centers.	Allowance was implemented in the 1990s, revamped in 2008 (to become a 20% salary increase) and some implementation rules were changed in 2010. Evaluation uses data from 2014 to 2015	3,000 schools, about half received the allowance allocation; final sample is 137 schools (44 pairs across the threshold) due to challenges in implementation and data availability	Some evidence of positive impact (significant for boys).	Outcome: proportion of students who score a Division One category—highest level category (boys only)	0.02 *	0.011
							Outcome: proportion of students who score a Division One category—highest level category (girls only)	0.009	0.011
Chin (2005)	India	Operation Blackboard is a government initiative to recruit additional teachers for one-teacher primary schools, complemented with provision of equipment packets (blackboards, books, maps, charts, toys, teacher's manuals, and other basic inputs) to all primary schools.	Difference-in-differences by birth cohort (children who started attending primary schools before and after 1987 when the program was launched) and state of residence (children in states with	Launched in 1987, the program served all originally targeted schools by 1994.	Recruitment drive for 140,000 teachers as second teachers to one-teacher primary schools	Positive impact on primary completion rate especially for girls and poor students.	Outcome: primary school completion rate (girls, basic controls)	0.0161 ***	0.0029
							Outcome: primary school completion rate (girls, household controls)	0.0165 ***	0.0026
							Outcome: primary school completion rate (girls, region-specific trend)	0.0120 ***	0.0028
							Outcome: primary school completion rate (girls, state-specific trend)	0.0093 **	0.0044

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
			higher share of one-teacher schools were more exposed to the program)				Outcome: primary school completion rate (girls, state program x year of birth)	0.0091 **	0.0044
							Outcome: primary school completion rate (boys, basic controls)	0.0164 ***	0.0028
							Outcome: primary school completion rate (boys, household controls)	0.0144 ***	0.0026
							Outcome: primary school completion rate (boys, region-specific trend)	0.0100 ***	0.0027
							Outcome: primary school completion rate (boys, state-specific trend)	0.0034	0.0045
							Outcome: primary school completion rate (boys, state program x year of birth)	0.0027	0.0045
							Outcome: primary school completion rate (girls, household controls, bottom quartile of household expenditure)	0.0295 ***	0.0040
							Outcome: primary school completion rate (girls, region-specific trend, bottom quartile of household expenditure)	0.0248 ***	0.0041
							Outcome: primary school completion rate (girls, state-specific trend, bottom quartile of household expenditure)	0.0216 ***	0.0054

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
							Outcome: primary school completion rate (girls, state program x year of birth, bottom quartile of household expenditure)	0.0223 ***	0.0054
							Outcome: primary school completion rate (boys, household controls, bottom quartile of household expenditure)	0.0196 ***	0.0040
							Outcome: primary school completion rate (boys, region-specific trend, bottom quartile of household expenditure)	0.0149 ***	0.0042
							Outcome: primary school completion rate (boys, state-specific trend, bottom quartile of household expenditure)	0.0070	0.0056
							Outcome: primary school completion rate (boys, state program x year of birth, bottom quartile of household expenditure)	0.0078	0.0055

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
Hinze-Pifer and Méndez (2016)	Chile	Difficult Conditions Bonus for "disadvantaged" schools. Majority of beneficiary teachers receive between 4% to 10% over their base salary, with some receiving 15% or higher.	Regression discontinuity along the Difficult Conditions score - an index of measures of disadvantages including share of low-income students, distance from a large city, and public transit access.	Established in 1996. Data is from 2008–2014. Schools apply to receive the bonus every two years.	2032 schools (varies over time)	No significant impact on performance outcomes	Outcome: 4th Grade math score Outcome: 4th Grade reading score Outcome: 4th Grade math score (t + 1) Outcome: 4th Grade reading score (t + 1)	–0.0194 –0.0132 –0.0212 –0.00948	0.0125 0.0119 0.0135 0.0124
Pugatch and Schroeder (2018)	Gambia	Hardship allowance that provides 30–40% bonus to school teachers in remote locations.	Difference-in-differences and regression discontinuity along the 3-km threshold distance from a main road to be classified as hardship area.	Allowance policy was adopted in 2005. Data for evaluation is from 2012	244 schools, of which148 are hardship schools and 96 are non-hardship schools	No significant impact on performance outcomes except for baseline high performers	Outcome: 4th Grade math score Outcome: 4th Grade reading score Outcome: 4th Grade math score (t + 1) Outcome: 4th Grade reading score (t + 1) Outcome: Grade 3 (all, English) Outcome: Grade 3 (boys, English) Outcome: Grade 3 (girls, English) Outcome: Grade 5 (all, English) Outcome: Grade 5 (boys, English)	–0.0194 –0.0132 –0.0212 –0.00948 0.07 0.07 0.08 0.23 0.21	0.0125 0.0119 0.0135 0.0124 0.09 0.12 0.09 0.17 0.22

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
							Outcome: Grade 5 (girls, English)	0.25 *	0.14
							Outcome: Grade 3 (all, Math)	0.02	0.12
							Outcome: Grade 3 (boys, Math)	0.01	0.13
							Outcome: Grade 3 (girls, Math)	0.02	0.12
							Outcome: Grade 5 (all, Math)	0.20	0.16
							Outcome: Grade 5 (boys, Math)	0.16	0.20
							Outcome: Grade 5 (girls, Math)	0.22	0.15
							Outcome: at or below median of the socio-economic status index which includes family support in education and parents' educational status (all, English)	0.09	0.17
							Outcome: at or below median of the socio-economic status index (boys, English)	–0.04	0.23
							Outcome: at or below median of the socio-economic status index (girls, English)	0.18	0.13
							Outcome: above median of the socio-economic status index (all, English)	0.38 *	0.20

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
							Outcome: above median of the socio-economic status index (boys, English)	0.45 *	0.26
							Outcome: above median of the socio-economic status index (girls, English)	0.33 *	0.18
							Outcome: at or below median of the socio-economic status index which includes family support in education and parents' educational status (all, Math)	0.01	0.16
							Outcome: at or below median of the socio-economic status index (boys, Math)	–0.09	0.20
							Outcome: at or below median of the socio-economic status index (girls, Math)	0.10	0.16
							Outcome: above median of the socio-economic status index (all, Math)	0.41 **	0.19
							Outcome: above median of the socio-economic status index (boys, Math)	0.44 *	0.24
							Outcome: above median of the socio-economic status index (girls, Math)	0.40 **	0.17

Study	Country	Intervention	Research Design	Timeframe	Data/Sample	Outcomes	Specification	Coef.	SE/CI
Urquiola and Vegas (2005)	Bolivia	Salary bonus of about 12.5 percent of total compensation available. Additional bonus is available for teachers depending on seniority and trainings received.	Matching between rural teachers and urban teachers in three cities (La Paz/El Alto, Cochabamba, and Santa Cruz)	Multiple geography bonus with no clear timelines, but the study reflects 2002 salary rates.	1,606 schools from the three cities	No significant impact on test scores and grade repetition; slightly positive and inconsistently significant effect on pass rate and dropout rate	Outcome: third-grade language score (no control)	–0.10	0.12
							Outcome: third-grade language score (controlling for teacher and school characteristics)	–0.11	0.12
							Outcome: third-grade math score (no control)	0.06	0.12
							Outcome: third-grade math score (controlling for teacher and school characteristics)	0.09	0.12
							Outcome: repetition rate (no control)	–0.006 **	0.003
							Outcome: repetition rate (controlling for teacher and school characteristics)	–0.004	0.003
							Outcome: pass rate (no control)	0.014 ***	0.004
							Outcome: pass rate (controlling for teacher and school characteristics)	[+] ***	0.004
							Outcome: dropout rate (no control)	0.009 ***	0.001
							Outcome: dropout rate (controlling for teacher and school characteristics)	0.006 ***	0.001

Note: * significant at 10%; ** significant at 5%; *** significant at 1%. [+] This coefficient is reported as 0.00 and yet is marked at highly statistically significant. In a subset of the sample, adding controls reduces the coefficient by 0.001, so this estimate may be close to 0.013 (i.e., one less than the coefficient above it).

Appendix Table A8. Vote count of student related outcomes from the 15 eligible studies

	Positive, Significant	Positive, Insignificant	Negative, Insignificant	Negative, Significant	Total
All student outcomes	43 42%	36 35%	23 22%	1 1%	103 100%
Student achievement	26 33%	31 39%	21 27%	1 1%	79 100%
Student attendance	17 71%	5 21%	2 8%	0 0%	24 100%