# TEACHERS' PREFERENCES FOR PROXIMITY AND THE IMPLICATIONS FOR STAFFING SCHOOLS: EVIDENCE FROM PERU

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## Abstract

This paper uses the 2015 Peruvian national teacher selection process to explore candidates' rank-ordered preferences for public schools. We show that, in seeking a permanent position, candidates prefer schools that are closer to where they attended their Teacher Education Program and that are located in urban areas. These preferences vary by candidates' attributes: urban location seems to be particularly important for women and higher-performing candidates. Preferences for proximity to previous workplace are weaker for younger candidates and stronger for high performers. Candidates also prefer larger schools located in low-poverty districts, with one teacher per classroom (versus non-single-teacher/multigrade), Spanish language instruction (versus non-bilingual), and access to basic services. A greater understanding of which school characteristics are most valued by teachers can help to design effective policies for attracting candidates to hard-to-staff schools.

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## 1. INTRODUCTION

There is considerable evidence that teachers play a fundamental role in improving educational quality and narrowing racial or socioeconomic achievement gaps (Hanushek and Rivkin 2012; Chetty, Friedman, and Rockoff 2014). Yet, hiring qualified and effective teachers remains one of the biggest challenges in education. This need is even more pressing in schools that serve disadvantaged students, particularly as research shows that teachers have a greater impact on low-performing and low-income pupils (Rivkin, Hanushek, and Kain 2005; Araujo et al. 2016; Elacqua and Marotta 2020).

Peru provides an example of a country whose school system struggles to attract high-quality teachers to vulnerable schools. In 2015, of the 19,630 vacancies advertised for permanent teaching positions, 40 percent of the openings did not receive any applications at all. While these vacancies vary by geographical and socioeconomic level, they are overwhelmingly concentrated in the most disadvantaged areas of the country. In fact, more than 50 percent of the unselected school openings were located in the two highest quintiles of district poverty,[1] and 95 percent were concentrated in rural areas. The Loreto region alone, one of the poorest in the country, accounts for almost 20 percent of the unselected vacancies.[2]

These unselected posts usually end up being assigned to temporary teachers. This raises concerns, given that teachers with temporary contracts may have a negative influence on student learning (Ayala and Sánchez 2017), especially with regard to disadvantaged pupils (Marotta 2019). Moreover, in Peru, most of the temporary teachers that end up occupying "undesired" vacancies are low-performing teachers who did not pass the National Teacher Test (*Prueba Única Nacional* [PUN]). Indeed, in 2016, 69 percent of the temporary teachers ultimately hired for unselected vacancies did not achieve the minimum score on the PUN, while 27 percent did not even take the test.

An examination of Peru's national teacher hiring process allows us to shed light on this topic. Specifically, we seek to better understand teacher candidates' preferences relative to different kinds of public schools in Peru. Which school characteristics drive candidates' preference ranking? How do these preferences vary according to candidates' characteristics? To answer these questions, we use data from the Peruvian Ministry of Education's 2015 Teacher Selection [*Concurso de Nombramiento*], which provides unique information on candidates' ordered preferences. In Peru, when applying for a position as a permanent public school teacher, candidates must first pass the PUN, before they can rank their preferred school vacancies. Our sample thus consists of this last group of candidates. Using a rank-ordered logit model, we analyze how applicants evaluate different vacancy characteristics when constructing their ranking.

We find that candidates prefer (i.e., rank higher) schools that are closer to where they attended their Teacher Education Program (TEP) and that are located in urban areas. These preferences vary, however, by candidates' attributes: urban location seems to be particularly important for women and high-performing candidates. A preference

1. While in the two lowest quintiles of district poverty the unselected vacancies amounted to 26 percent.
2. The Loreto region is located in the Amazon rainforest. For the hiring process, Peru is divided into 26 regions (23 departments, Metropolitan Lima, Lima provinces, and the constitutional province of Callao).

for proximity to previous workplace is weaker for younger candidates and stronger for high performers. Candidates also prefer larger schools located in low-poverty districts, with one teacher per classroom (non-single-teacher/multigrade), Spanish language instruction (non-bilingual), and access to basic services.

Our paper relates to different strands of the literature in labor economics and education. First, it builds on research on teacher labor markets and teacher sorting. When applying to a teaching position, candidates make trade-offs between monetary attributes (wage, bonuses, etc.) and a variety of nonmonetary job characteristics, including location, student characteristics, and working conditions. A vast body of work shows that teachers sort according to specific school characteristics. Studies in the United States demonstrate that teachers prefer schools that are closer to their hometown or to where they completed their teacher education program (Boyd et al. 2005; Engel, Jacob, and Curran 2014). Additionally, applicants sort according to student socioeconomic level (Lankford, Loeb, and Wyckoff 2002; Boyd et al. 2010; Krieg, Theobald, and Goldhaber 2016), student racial and ethnic composition (Hanushek, Kain, and Rivkin 2004; McEwan and Trowbridge 2007; Condron et al. 2013), student achievement (Lankford, Loeb, and Wyckoff 2002; Boyd et al. 2010; Krieg, Theobald, and Goldhaber 2016), and school culture (Jackson 2009). They also tend to prefer schools with better working conditions (Ingersoll 2003; Johnson and Birkeland 2003; Loeb, Darling-Hammond, and Luczak 2005; Ronfeldt 2012; for the Netherlands: Bonhomme, Jolivet and Leuven 2016). As a result of teacher sorting, low-income and low-performing students are more likely to attend schools with less-qualified teachers (Jackson 2009; Sass et al. 2012; Dieterle et al. 2015; Feng and Sass 2018), which in turn has a negative impact on their educational outcomes (Aaronson et al. 2007; Sass et al. 2012).

Second, our study expands the literature on teacher labor supply in Latin America. The scant evidence on teachers' preferences in this region is limited to the work of Jaramillo (2013) for Peru and that of Rosa (2019) for the City of Sao Paulo, Brazil. The former, based on survey data collected for two regions of Peru (Loreto and Lambayeque), suggests the presence of highly regionalized and low-mobility teacher labor markets, where almost 80 percent of the sampled teachers worked in their region of birth or in the region where they graduated from college. Rosa (2019) analyzes one-sided matching in teacher labor markets in Sao Paulo in an effort to better understand the school attributes that are associated with teacher choices. He provides evidence that teacher choices are largely related to school location, student socioeconomic characteristics, and school quality.

Third, this work intersects with the literature on compensating wage differentials. The assumption behind this theory is that the use of financial incentives to attract teachers to high-need schools can provide a compensating differential for potentially unattractive job characteristics (e.g., poverty, low student achievement, racial or ethnic differences), thus enticing candidates to take on positions they might not otherwise accept (Milanowski et al. 2009). In an effort to mitigate teacher sorting and promote an equitable distribution of teachers, governments have pursued compensation strategies through salary adjustments, incentives, or rapid career advancement to offset certain school attributes perceived as undesirable. Although most research supports the conclusion that higher pay improves teacher retention (Guarino et al. 2004) and the quality

of new teachers attracted to a district (Figlio 2002), monetary incentives seem instead to have a small or nonsignificant impact on teachers' preferences for disadvantaged schools (Clotfelter et al. 2008b; Falch 2011; Glazerman et al. 2012; Springer et al. 2016; Bueno and Sass 2019; Elacqua et al. 2019), although some evidence has demonstrated fairly large effects given the magnitude of the incentives provided (e.g., Clotfelter et al. 2008a; Feng and Sass 2018).

We also contribute to the literature on teacher labor markets in several ways. Indeed, ours is the first large-scale empirical assessment of teacher candidates' stated preferences in Latin America.[3] The other two relevant studies focusing on teacher preferences restrict their analysis to a single city (Sao Paolo, in Rosa 2019) or to a sample of regions (in Peru, Jaramillo 2013). Our analysis is instead based on a large census of teacher applicants moving through a national centralized selection process. Moreover, work on teacher preferences mainly comprises empirical studies that examine the determining attributes of a candidate's final job allocation (Boyd et al. 2005; Engel, Jacob, and Curran 2014; Rosa 2019), and those that rely on interview data and teachers' self-reported preferences (Rots et al. 2007; Burns, Grande, and Marable 2008; Ronfeldt, Kwok, and Reininger 2014). In contrast, we examine teachers' official, stated preferences for schools. Understanding which school characteristics are most valued by candidates when applying to a teaching position can help policy makers effectively tackle the staffing challenges experienced by the most disadvantaged schools.

There is, however, a scarcity of studies on policies designed to attract teachers to high-need schools, particularly for developing countries. We aim to fill this gap by generating evidence on the teacher labor supply in Peru. Education systems in Latin America have implemented different strategies to improve teacher shortages in hard-to-staff schools. Several countries, including Peru, provide monetary incentives to teachers who work in rural and remote schools. In Chile and Mexico these incentives rise as teachers advances in their career. Some nations have also introduced nonmonetary incentives such as shorter time requirements before being able to apply for a promotion, greater flexibility in teaching schedules, and more training opportunities. Certain places have established cooperative systems between schools (Chile and Colombia) or hybrid classrooms (Pará, Brazil). Despite these initiatives (which generally have had mixed levels of success), teacher sorting, at the expense of the most vulnerable students, remains a challenge in Latin America (Bertoni et al. 2020).

The remainder of the paper is organized as follows. Section 2 describes the institutional context of the Peruvian public school system. Section 3 introduces the data and provides descriptive statistics. Section 4 presents the empirical strategies used in the analysis, and Section 5 discusses the results. Finally, Section 6 concludes and reflects on several policy implications.

3. Throughout this study, we use "stated preferences" to refer to ranked preferences so as to differentiate from "revealed preferences," which implies preferences revealed by actual choices. We observe what candidates "say" they prefer among a restricted set of options. Although their ranking might reflect their actual preferences among the selected schools, we cannot exclude the possibility that candidates may not have listed their most preferred schools in absolute terms. After candidates select the vacancies, the Ministry of Education assigns applicants to up to two of these openings according to their score on the PUN and their preferences, and then ultimately assigns the candidate to one job, according to their final score and these same preferences.

## 2. INSTITUTIONAL CONTEXT

### Teacher Hiring Process in the Peruvian Public School System

In 2015, the Peruvian government implemented a new teacher selection process, required to apply for a permanent position in the public school system. To be eligible to participate, candidates must hold at least a bachelor's degree in education. The evaluation consists of two phases: a first, national stage and then a second, decentralized stage. Figure A.1 available in the online appendix summarizes the 2015 teacher hiring process in Peru.[4]

The national stage is carried out by the Ministry of Education and includes a standardized written test (PUN) divided into three subtests: logical reasoning (25 percent), reading comprehension (25 percent), and pedagogical knowledge of the specialization (50 percent). To pass the national stage, candidates need to answer at least 60 percent of the questions correctly on each subtest. Applicants are also evaluated within a specific area of specialization relative to the education level (pre-primary/primary/secondary) and subject (e.g., secondary science) they plan to teach.

Only those candidates who score above the minimum required threshold at the national stage can then rank their school preferences, chosen within their area of specialization and in one of the 26 regions of Peru.[5] There are two rounds of school selection. In the first round, candidates can list up to five school preferences. The Ministry of Education then assigns each candidate a maximum of two out of their five preferred institutions, based on their PUN score and their school ranking. Each vacancy can have up to twenty candidates. An applicant with a relatively low score at the national stage might not be assigned to any of their five preferences in the first round. Those who missed the first round or who were not assigned to any of their school preferences can participate in the second round, where there are no limitations on the number of schools they can list.

Once candidates have been assigned to up to two of their preferred schools, they begin the decentralized stage, which is carried out by each school or by the local education administrative units (*Unidad de Gestión Educativa Local* [UGEL]) in the case of single-teacher schools. This stage consists of an evaluation of their resume (25 percent), a personal interview (25 percent), and a classroom observation (50 percent). To pass the decentralized stage, candidates must score a minimum of 30 (out of 50) points on the classroom observation component.

Finally, the Ministry of Education calculates the weighted sum of the scores obtained at the national and decentralized stages (the former has a weight of 67 percent on the final score) and assigns the vacancies based on the final score and on the candidate's preferences.

Once the assignment process has been completed, the candidates who did not manage to get a permanent teaching position are able to apply for a temporary position. Specifically, candidates select one UGEL of their preference that has vacancies in their area of specialization. Candidates are evaluated solely based on their final score on

4. Figure A.1 is available in a separate online appendix that can be accessed on *Education Finance and Policy*'s Web site at https://doi.org/10.1162/edfp_a_00347.
5. A school can have more than one vacancy in the same area of specialization.

the PUN, where no minimum passing score is required. They are hired through a public tender that takes place in each UGEL, in which the applicants are ranked by "merit" in descending order according to their score at the centralized stage. Those with the highest score are the first to choose among the available vacancies of the UGEL.

#### Salary Structure and Incentives

There are a number of possible motives behind candidates' school rankings. One driver consists of monetary incentive policies, designed to encourage teachers to choose hard-to-staff schools. In Peru, since the adoption of the new Teacher Reform Law [*Ley de Reforma Magisterial*] in 2013, instructors receive wage bonuses based on school characteristics and location.

Regardless of the type of contract (permanent or temporary), monthly salaries in Peru comprise a basic wage, bonuses, and benefits. The basic wage is determined according to the teacher salary scale and workday. The salary scale is composed of eight levels, where the eighth is the highest and corresponds to 210 percent of the lowest salary level. All new teachers in the public system automatically start at the first (lowest) salary level. Permanent teachers can increase their salary through public contests after having completed the time requirements for each level, while temporary teachers receive only the salary amount corresponding to the lowest level.

Wage bonuses are based on school characteristics and location. School characteristics include: (i) single-teacher or multigrade school, corresponding to an additional 7percent to 10 percent of the basic salary; and (ii) bilingual school, corresponding to 2.5 percent of the basic salary (and an extra 5 percent if the teacher has a bilingual certification). School location includes: (i) rural areas, corresponding to 3.5 percent, 5 percent, and 25 percent of the basic salary according to the "gradient of rurality," defined at the central level based on population size and accessibility to the nearest provincial capital;[6] (ii) frontier areas, corresponding to 5 percent of the basic salary; and (iii) the area known as Valle de los Ríos Apurímac, Ene y Mantaro (VRAEM), a remote area with high poverty levels, corresponding to 15 percent of the basic salary. Teachers can receive up to five wage bonuses if they are not mutually exclusive, independently of whether their contract is permanent or temporary.[7] There are also nonmonetary incentives, though only for permanent teachers. Specifically, choosing to work in a rural or frontier area increases permanent teachers' reallocation opportunities and shortens the time of service required to apply for a higher salary level.

6. The "most rural" areas (Rural 1) are those with fewer than 500 inhabitants located more than 120 minutes from the province capital. The second category of rurality (Rural 2), henceforth "moderate rural," refers to those areas with less than 500 inhabitants and located between 30 and 120 minutes from the province capital or those located in places with 500–2,000 inhabitants located farther than 120 minutes from the province capital. The final set of rural areas (Rural 3), henceforth "least rural," include those with 500–2,000 inhabitants located closer than 120 minutes from the province capital, or those with less than 500 inhabitants and located less than 30 minutes away from the capital. All other areas are classified as urban.
7. Candidates who obtained a permanent position and who scored in the upper third of the evaluation distribution also receive a monetary bonus (*Bono de Atracción*) of approximately US$2,000 per year for their first three years of service.

## 3. DATA DESCRIPTION

### Sample

This study uses administrative data from the 2015 public school teacher hiring process in Peru. The dataset includes candidates' application by level (pre-primary/primary/secondary) and subject, characteristics such as gender, age, teacher education program attended, and years of public/private teaching experience, scores at every stage of the selection process, ranked school preferences, and final assignment. Moreover, for each school, the dataset includes the characteristics associated with the wage bonuses: type of area (most rural, moderate rural, least rural, urban), school (single teacher, multigrade, multi-teacher), and indicators of whether the school is bilingual, located in a frontier area, or in the VRAEM area. We use this information to calculate the total wage bonus offered at each school based on the latter's characteristics.

Next, we combine data from the 2015 hiring process with school-level data from the 2015 School Census database. This database includes schools' geographical coordinates, enrollment numbers, and access to basic services (electricity, water, and sanitation). In addition, teacher-level information available in the 2015 Vacancy Management and Control System database (NEXUS) allows us to track whether a candidate was already working as a temporary teacher in 2015, and in which school. Furthermore, the availability of georeferenced data for schools and for candidates' TEP means we can compute two measures of distance for each candidate: (i) distance from each selected school to the candidate's TEP, and (ii) distance from each selected school to the candidate's previous workplace (for those who were already employed as temporary teachers at the time of the hiring process). Distances are measured as Euclidean distances in kilometers.[8]

Finally, poverty rates at the district level were gathered from the 2013 Province and District Poverty Map generated by the National Institute of Information and Statistics.[9]

### Descriptive Statistics

Table 1 presents a summary of the 2015 teacher selection process in Peru. On the demand side, only 64 percent of the 19,630 available vacancies were selected by at least one candidate, among those who passed the national stage. This result varies across school levels: Only 50 percent of the vacancies in the pre-primary schools were selected by at least one candidate (column 2/1), compared with 70 percent and 89 percent of those in the primary and secondary schools, respectively. Column 4/1 suggests that the

8. We considered including "travel time" and "travel distance" computed through the *georoute* STATA command, where travel distance is the number of kilometers by car from the first to the second point, and travel time is how long it takes to drive the computed travel distance under normal traffic conditions. Yet, for several reasons, these measures are not the best option for our model. First, travel time is computed assuming "normal traffic conditions," making it less credible for highly busy urban areas in Peru. Second, it is estimated assuming a constant speed for each mode of transport, and thus does not allow us to account for any heterogeneity that could exist between different origins-destinations. Third, the fact that travel distance is measured in terms of "km driven" makes it a less plausible measure in a country where, according to the 2016 National Teacher Survey, just 15 percent of teachers own a car and only 3 percent report driving to the school where they work, compared to the almost 40 percent who declare walking to the school. The figures are similar between men and women and between teachers working in urban and rural areas.

9. For a sample of primary schools, we computed school-averaged student scores on the standardized math and reading tests from the 2014 National Student Evaluation (*Evaluación Censal de Estudiantes* [ECE]).

**Table 1.** Summary Statistics of 2015 Teacher Hiring Process in Peru

| | Total Offered Vacancies | Total Selected Vacancies | Candidates in National Stage | Candidates in Decentralized Stage | Candidates Who Won a Vacancy | Ratios | | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (2)/(1) | (3)/(1) | (4)/(1) | (5)/(1) |
| Pre-primary | 8,896 | 4,356 | 28,775 | 5,654 | 2,432 | 0.49 | 3.23 | 0.64 | 0.27 |
| Primary | 6,460 | 4,496 | 77,594 | 6,597 | 2,949 | 0.7 | 12.01 | 1.02 | 0.46 |
| Primary - Physical education | 55 | 52 | 2,624 | 144 | 38 | 0.95 | 47.71 | 2.62 | 0.69 |
| Secondary (total) | 4,219 | 3,754 | 83,404 | 11,306 | 2,718 | 0.89 | 19.77 | 2.68 | 0.64 |
| Arts | 428 | 378 | 4,807 | 404 | 207 | 0.88 | 11.23 | 0.94 | 0.48 |
| Sciences | 286 | 284 | 9,292 | 817 | 225 | 0.99 | 32.49 | 2.86 | 0.79 |
| Communication | 564 | 563 | 17,317 | 3,277 | 530 | 1.00 | 30.7 | 5.81 | 0.94 |
| Physical education | 229 | 228 | 7,846 | 769 | 205 | 1.00 | 34.26 | 3.36 | 0.9 |
| Religion | 703 | 420 | 2,433 | 212 | 138 | 0.60 | 3.46 | 0.3 | 0.2 |
| Vocational education | 641 | 544 | 11,649 | 1,244 | 355 | 0.85 | 18.17 | 1.94 | 0.55 |
| Civic education | 137 | 133 | 1,491 | 387 | 116 | 0.97 | 10.88 | 2.82 | 0.85 |
| History, Geography, Economics | 172 | 172 | 9,629 | 913 | 149 | 1.00 | 55.98 | 5.31 | 0.87 |
| English | 494 | 469 | 5,178 | 1,040 | 316 | 0.95 | 10.48 | 2.11 | 0.64 |
| Math | 453 | 453 | 11,826 | 1,838 | 387 | 1.00 | 26.11 | 4.06 | 0.85 |
| Humanities | 112 | 110 | 1,936 | 405 | 90 | 0.98 | 17.29 | 3.62 | 0.8 |
| Total | 19,630 | 12,658 | 192,397 | 23,701 | 8,137 | 0.64 | 9.8 | 1.21 | 0.41 |

*Notes:* Total offered vacancies represent the number of vacancies available in the teacher hiring process. Total selected vacancies represent the number of vacancies selected by at least one candidate.

number of available vacancies in pre-primary schools surpasses that of the candidates who succeeded in moving on to the decentralized stage, which indicates a shortage of qualified teachers at this education level. Of the total available positions, only 41 percent were ultimately filled by a permanent teacher, meaning that the remaining 59 percent of the vacancies were offered to temporary teachers. This result varies substantially across education levels: Only 27 percent of the pre-primary vacancies were filled by a permanent teacher, compared respectively to 46 percent and 64 percent of the primary and secondary positions (column 5/1 in table 1).

Table A.1 available in the online appendix summarizes the characteristics of the offered vacancies and whether they were selected by at least one candidate. We observe that 22 percent of the total vacancies were located in urban areas. When looking specifically at unselected vacancies, 59 percent were in the most rural areas (i.e., areas farthest from the province capital, "Rural 1") compared with 5 percent in urban areas. Overall, 46 percent of the rural vacancies had no candidates compared to 8 percent of the urban ones. Moreover, unselected vacancies are mainly found in more disadvantaged schools (i.e., schools offering higher monetary compensations and those located in higher poverty districts). Additionally, unselected vacancies mainly appear in schools that are lower performing, in more remote areas, and lack basic services.[10] Figure A.2 available in the online appendix illustrates the geographical distribution of selected and unselected vacancies, showing a clear concentration of unselected

10. Table A.2 available in the online appendix extends this descriptive evidence by presenting a logit analysis on the probability of an available vacancy in the 2015 teacher hiring process being selected by at least one candidate.

vacancies in the Amazonian area of the country (especially the regions of Loreto, Ucayali, and Madre de Dios).

On the supply side, out of the 192,397 candidates who took the national test, only 25,000 (13 percent) passed. Then, of the 23,701 candidates who passed the PUN and ranked their school preferences, 23,319 participated only in the first selection round, 1,043 participated in both rounds, and 382 participated only in the second round.[11] Our estimation sample comprises the 23,046 candidates who participated only in the first round, for a total of 10,174 selected vacancies across 8,489 schools.[12]

To gain a clearer picture of the group of candidates who form the object of this study, we compare candidates who passed the PUN with those who failed to do so.[13] The former are on average younger and have more years of experience in private schools than those who did not pass. They are also more likely to be female and to have studied at a public university (versus a pedagogical institute) that ranks among the top 15 in the country. Although we do not have information on where candidates live, we assume that the region in which they take the PUN is a good proxy of geographical residence. Specifically, we observe that 22 percent of the candidates who passed the PUN took the test in the Metropolitan region of Lima, compared with 11 percent of those who did not pass. We take these characteristics into account when drawing conclusions relative to the preference set of higher-quality candidates.

Table 2 summarizes the characteristics of the candidates and vacancies in our sample. The applicants were mainly female (72 percent) and below age 35 years (55 percent). Sixty-one percent of the candidates were working as temporary instructors at the time of the 2015 teacher selection. Moreover, candidates selected vacancies that were, on average, 149 km from their TEP and, where applicable, 51 km from the school at which they were employed as temporary teachers. Table 2 also shows that 68 percent of the selected vacancies are rural and 32 percent urban, and that 55 percent are located in single-teacher or multigrade schools (compared with 45 percent in multi-teacher schools). Meanwhile, 18 percent of the selected vacancies were located in bilingual schools. The average district poverty rate is 42 percent and the average school size is about 200 students. On average, 67 percent of the selected vacancies are located in schools that have basic services. Finally, the selected vacancies provide an average wage bonus of around 300 soles (corresponding to around 14 percent of the 2015 basic salary). Table A.4 available in the online appendix provides a complete description of the variables and the data sources.

Table 3 presents vacancies' average characteristics according to candidates' rankings and a test of mean differences between the most (column 1) and the least (column 5) preferred option for each candidate. Although we know that the group of selected vacancies is already quite homogeneous, we observe significant differences between

11. We excluded the 382 candidates who did not register in the first round and only participated in the second round (1.7 percent of total candidates). These candidates choose among the remaining vacancies, thus limiting the analysis of stated preferences. The characteristics of the excluded group do not differ substantially from the group of candidates in the first selection round.
12. With respect to the 23,319 candidates in the first selection round, we lose 273 candidates due to a lack of information on candidates' characteristics.
13. Table A.3 available in the online appendix compares candidates who passed the PUN and those who failed to do so.

**Table 2.** Summary Statistics for the Rank-Ordered Logit Analysis

| | *N* | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| School ranking | 105,061 | 3.09 | 1.41 | 1 | 5 |
| Vacancy-level characteristics | | | | | |
| Urban | 10,168 | 32% | 47% | 0 | 1 |
| Most Rural (Rural 1) | 10,168 | 23% | 42% | 0 | 1 |
| Moderate Rural (Rural 2) | 10,168 | 28% | 45% | 0 | 1 |
| Least Rural (Rural 3) | 10,168 | 17% | 38% | 0 | 1 |
| Multi-teacher | 10,168 | 45% | 50% | 0 | 1 |
| Single-teacher or Multigrade school | 10,168 | 55% | 50% | 0 | 1 |
| Bilingual school | 10,168 | 18% | 38% | 0 | 1 |
| Frontier areas | 10,168 | 7% | 25% | 0 | 1 |
| VRAEM area | 10,168 | 5% | 22% | 0 | 1 |
| Poverty (%) | 10,168 | 42% | 22% | 0 | 97% |
| Basic services | 10,168 | 67% | 47% | 0 | 1 |
| Enrollment (100s) | 10,168 | 2.28 | 3.51 | 0 | 28.7 |
| Wage bonus (Soles) | 10,168 | 299 | 290 | 0 | 1,150 |
| Distance variables | | | | | |
| Distance from Teacher Education Program (km) | 23,046 | 149 | 252 | 0.1 | 1,844 |
| Distance from previous workplace (km) | 13,901 | 51 | 89 | 0 | 1,510 |
| Candidate-level characteristics | | | | | |
| Female | 23,046 | 72% | 45% | 0 | 1 |
| Age $<$ 35 years | 23,046 | 55% | 50% | 0 | 1 |
| High performer | 23,046 | 19% | 39% | 0 | 1 |
| Temporary teacher in 2015 | 23,046 | 61% | 49% | 0 | 1 |

*Notes:* Distance measures as presented represent the sample average of the mean distances in kilometers of the schools in the preference set of each candidate. See Table A.4 available in the online appendix for a complete list of variable descriptions and data sources. VRAEM = Valle de los Ríos Apurímac, Ene y Mantaro.

the most and least preferred option on almost all characteristics associated with wage bonuses. In particular, 62 percent of the vacancies listed as the most preferred option are urban, compared to 56 percent of the least preferred ones and, on average, the two options differ by around 27 soles, or around 1 percent of the basic salary.

## 4. METHODS

The 2015 hiring process data contain ranked preferences for each candidate, which means we can estimate a rank-ordered logit model. This allows us to better understand preferences for certain school characteristics, in that we can analyze how candidates combine attributes of different alternatives into overall evaluations of the attractiveness of schools (Beggs, Cardel, and Hausman 1981; Hausman and Ruud 1987). Previous work that analyzes parental preferences for school characteristics uses similar models (Hastings, Kane, and Staiger 2005, 2006; Abdulkadiroglu, Pathak, and Schellenberg 2017; Beuermann et al. 2018). The coefficients are estimated using the maximum likelihood method.

In this setting, we model candidates' ranking behavior through a constant utility model, where each candidate $i (i = 1, 2, \ldots, I)$ has a choice set $C_i$ consisting of $J_i$ alternatives $(j = 1, 2, \ldots, J_i)$. The choice set of each candidate is the set of available vacancies within one of 26 regions and a specific area of specialization (education level and

**Table 3.** Vacancy Characteristics by Candidates' School Rankings

| | School Ranking | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | *t*-test (1 = 5) | *N* |
| Urban | 62% | 59% | 58% | 57% | 56% | 6.63*** | 105,043 |
| Most Rural (Rural 1) | 8% | 8% | 9% | 9% | 10% | −2.16*** | 105,043 |
| Moderate Rural (Rural 2) | 14% | 16% | 16% | 17% | 18% | −3.89*** | 105,043 |
| Least Rural (Rural 3) | 16% | 17% | 17% | 17% | 16% | −0.58 | 105,043 |
| | *100%* | *100%* | *100%* | *100%* | *100%* | | 105,043 |
| Multi-teacher | 78% | 76% | 75% | 74% | 72% | 0.06*** | 105,043 |
| Single-teacher or Multigrade school | 22% | 24% | 25% | 26% | 28% | −0.06*** | 105,043 |
| | *100%* | *100%* | *100%* | *100%* | *100%* | | 105,043 |
| Bilingual school | 4% | 4% | 5% | 5% | 5% | −0.01*** | 105,043 |
| Frontier areas | 4% | 4% | 4% | 4% | 4% | 0.01*** | 105,043 |
| VRAEM area | 2% | 3% | 2% | 3% | 3% | 0.00 | 105,043 |
| Poverty (%) | 30% | 31% | 31% | 31% | 32% | −0.02*** | 105,043 |
| Basic services | 85% | 83% | 83% | 82% | 81% | 0.04*** | 105,043 |
| Enrollment (100s) | 4.06 | 3.72 | 3.71 | 3.57 | 3.47 | 0.59*** | 105,043 |
| Wage bonus (Soles) | 120.4 | 130.0 | 132.3 | 139.4 | 147.0 | −26.6*** | 105,043 |

*Notes:* Mean of vacancy characteristics according to candidates' rankings are reported. In the school ranking, column 1 indicates candidate's most preferred option while column 5 indicates the least preferred one. The rural and urban categories sum to 100%. The *t*-test determines whether there is a significant difference between the means of vacancies ranked first and those ranked last (fifth). VRAEM = Valle de los Ríos Apurímac, Ene y Mantaro. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

subject [e.g., secondary-sciences]). The $i^{th}$ candidate's utility function from ranking first alternative $j^*$ from $C_i$ takes the form in equation 1:

$$U_{ij^*} = x'_{ij^*}\beta + \varepsilon_{ij^*}, \tag{1}$$

where $x_{ij^*}$ is a vector of alternative $j$ attributes (school-level characteristics) that includes the log distance from the school to the TEP, urban/rural categories (moderate rural, least rural, urban), indicators of whether the school is single-teacher or multigrade, bilingual, located in a frontier area or in the VRAEM area, poverty at the district level, an indicator of whether the school has basic services, enrollment, and a vector of interactive variables relating candidate $i$ to alternative $j$.[14]

If rational choice behavior is assumed, the stated preference implies that alternative $j^*$ is preferred to alternative $j$ if $U_{ij^*} \geq U_{ij}$ for $(j = 1, 2, \ldots, J_i)$.

Because the utility function is partly stochastic, the probability of candidate $i$ ranking first alternative $j^*$ from $C_i$ may be written as equation 2:

$$P_{ij^*} = P(U_{ij^*} \geq U_{ij}, j = 1, 2, \ldots, J_i) = P(\varepsilon_{ij} - \varepsilon_{ij^*} \leq x'_{ij^*} - x'_{ij}, j = 1, 2, \ldots, J_i). \tag{2}$$

14. Among candidates' directly observable school characteristics are the degrees of rurality; the other characteristics, such as the poverty rate of the district, the number of students, the existence of basic services, the distances, and the test scores, can be inferred indirectly.

If the stochastic error terms are assumed to be identically and independently distributed according to the double exponential distribution, the choice probabilities have the form in equation 3 (McFadden, 1974):

$$P_{ij^*} = \frac{\exp(x'_{ij^*}\beta)}{\sum_{j=1}^{J_i} \exp(x'_{ij}\beta)}. \tag{3}$$

If applying the Ranking Choice Theorem (Luce and Suppes 1965) to the stochastic utility model, assuming that the alternative index $j$ is a serial preference index, the joint probability that alternative 1 is preferred may be written as equation 4:

$$P(U_{i1} \geq U_{i2} \geq \cdots \geq U_{ij_i}) = \prod_{j^*=1}^{J_i} P(U_{ij^*} \geq U_{ij}, j = j^*, \ldots, J_i), \tag{4}$$

where $P(U_{i1} \geq U_{i2} \geq \cdots \geq U_{ij_i})$ is the joint probability that alternative 1 is preferred to alternative 2, which is preferred to alternative 3, and so on to alternative $J_i - 1$, which is preferred to alternative $J$ for candidate $i$, with $\beta$ representing the relative importance of the vacancies' characteristics to the sample of candidates. The probability that a candidate $i$ submits a particular ranking of schools within a region and specialization area is a product of standard logit formulas (Hastings, Kane, and Staiger 2006; Train 2009). In the 2015 teacher hiring process, candidates could rank up to five schools, such that our rank-ordered logit model considers up to five alternatives.

#### Potential for Strategic Choice

Candidates that pass the national stage, which consists of a standardized written test (PUN), can select up to five preferred schools. They are then assigned to up to two schools, based on their PUN score and stated preferences. Each vacancy can have up to twenty candidates. In the 2015 teacher hiring process, almost 15 percent of the 10,392 selected vacancies had more than twenty interested candidates (i.e., candidates included the vacancy in their ranking). Within each region and area of specialization, candidates are differentiated based on their PUN scores. The applicant with the highest PUN score is assigned to his or her top two choices. Candidates with the lowest PUN scores are not assigned to any institution if all of the five schools they selected already have twenty candidates. Out of the 23,046 candidates who established their preferences in the first selection round, 86 percent were assigned to their first choice, and only 4 percent were not assigned to any of their preferred schools.

This process could incentivize candidates interested in filling a vacant position to modify their preferences based on their PUN score, their knowledge of other applicants' scores, and their expectations of more highly ranked candidates' preferences. Candidates with low PUN scores might thus misstate their preferences, deciding not to list their most preferred schools if they perceive a low probability of obtaining a given vacancy.

Such candidates might also shift their choice of a school's ranking relative to a specific characteristic (e.g., poverty) if they perceive that they are less competitive for the vacancy. Our analysis of ranked schools would find then poverty to be an important factor in teachers' preferences, though the estimated coefficient might be different (from that with "true preferences") depending on the distribution of poverty among preferred

schools. Moreover, if preferences are multidimensional and teachers have different marginal rates of substitution between school attributes, strategic behavior could cause their expressed preferences to differ from their underlying preferences, in a way that causes the estimates to be biased.[15]

Nevertheless, there are some factors that might hinder strategic behavior. First, the newness of the teacher hiring process itself reduces the chances of strategic hedging. Indeed, 2015 was the first year in which the selection was implemented under the new Teacher Reform Law.[16] Candidates may thus not have known exactly how the slots for the decentralized stage or permanent positions were assigned or how to calculate their relative position within their region and area of specialization. Because candidates' rankings are not publicly available, applicants seeking to size up their competition would have needed to assume that most candidates remain in the same region where they took the test,[17] add up their disaggregated PUN scores, and calculate their own ranking.

Second, if candidates with a low PUN score were behaving strategically, we would expect their preference set to include mainly vacancies that are less in demand. That is, vacancies selected by a lower number of applicants. However, when we examine the selection patterns of candidates who performed in the lowest quintiles of the PUN, we observe that around 70 percent of this group selected highly desired vacancies (i.e., vacancies with more than twenty applicants). In fact, the vacancies included in their preference sets have on average thirty-one applicants.

Though it is possible that some candidates did not list their most preferred schools, their ranking does reflect their preferences among the schools they chose to list. In other words, the first ranked school should be the most preferred alternative among the selected schools, the second ranked school should be the most preferred alternative among the rest, and so on. In what follows, we analyze teacher preferences among ranked schools, seeking to disentangle which school characteristics are associated with higher ranked positions in candidates' preference sets.

## 5. RESULTS

### Preference Parameter Estimates

Table 4 shows the point estimates from the rank-order logit model. The dependent variable is the candidates' school ranking, and the exogenous variables are log distance variables (between the school and TEP, and the school and previous workplace), school characteristics associated with wage bonuses, and other school characteristics (poverty, basic services, and enrollment). The estimates represent the shifts in a candidate's utility for a unit change in the exogeneous variables (Punj and Staelin 1978). We

15. For instance, suppose that Teacher A values both school poverty and distance to the school as well as knows her position within the distribution of national exam scores in her region and the other applicants' preferences. As long as the marginal rate of substitution between poverty and distance for Teacher A differs from the more highly ranked teachers then she may improve her utility by expressing a different preference ordering than that reflected in their underlying preferences. This would lead to differences in the estimated relationships among school characteristics.
16. The hiring processes implemented in 2009 and 2011, under the previous teacher law, similarly had a national and a decentralized stage, but differed somewhat in terms of the evaluation instruments and their weights.
17. Out of the 23,046 candidates who passed the PUN and selected vacancies, 90 percent chose the same region where they took the test.

**Table 4.** Rank-Ordered Logit Results

| Dependent variable: Candidates' school ranking | | | | |
|---|---|---|---|---|
| | Without Interactions | | With Interactions | |
| | All Candidates | Candidates w/Previous Workplace Information | All Candidates | Candidates w/Previous Workplace Information |
| | (1) | (2) | (3) | (4) |
| Distance from TEP | −0.2271*** | −0.1351*** | −0.2539*** | −0.1485*** |
| | (0.0069) | (0.0095) | (0.0152) | (0.0212) |
| Urban | 0.0970*** | −0.0142 | 0.1008*** | −0.0033 |
| | (0.0281) | (0.0356) | (0.0378) | (0.0484) |
| Least Rural (Rural 3) | 0.0898*** | 0.0222 | 0.0951*** | 0.0270 |
| | (0.0240) | (0.0300) | (0.0240) | (0.0301) |
| Moderate Rural (Rural 2) | 0.0207 | 0.0059 | 0.0235 | 0.0074 |
| | (0.0216) | (0.0267) | (0.0216) | (0.0267) |
| Single-teacher or Multigrade school | −0.0646*** | −0.0569* | −0.0555** | −0.0552* |
| | (0.0233) | (0.0302) | (0.0241) | (0.0312) |
| Bilingual school | −0.2214*** | −0.3545*** | −0.2254*** | −0.3608*** |
| | (0.0467) | (0.0607) | (0.0467) | (0.0605) |
| Frontier areas | 0.0296 | −0.0077 | 0.0293 | −0.0072 |
| | (0.0369) | (0.0494) | (0.0369) | (0.0494) |
| VRAEM area | 0.0349 | 0.1273** | 0.0387 | 0.1326** |
| | (0.0435) | (0.0547) | (0.0435) | (0.0547) |
| Poverty (%) | −0.2819*** | −0.1847*** | −0.2822*** | −0.1820*** |
| | (0.0457) | (0.0593) | (0.0457) | (0.0594) |
| Basic services | 0.0400*** | 0.0375** | 0.0394*** | 0.0365** |
| | (0.0138) | (0.0174) | (0.0138) | (0.0174) |
| Enrollment (100s) | 0.0073*** | 0.0011 | 0.0073*** | 0.0009 |
| | (0.0016) | (0.0022) | (0.0016) | (0.0022) |
| Distance from previous workplace | | −0.2319*** | | −0.2852*** |
| | | (0.0038) | | (0.0100) |
| Distance from TEP * Female | | | 0.0274* | 0.0298 |
| | | | (0.0149) | (0.0207) |
| Distance from TEP * Age < 35 | | | 0.0158 | 0.0022 |
| | | | (0.0137) | (0.0190) |
| Distance from TEP * High Performer | | | −0.0096 | −0.0352 |
| | | | (0.0168) | (0.0231) |
| Urban * Female | | | 0.0672** | 0.0539 |
| | | | (0.0312) | (0.0404) |
| Urban * Age < 35 | | | −0.1021*** | −0.1053*** |
| | | | (0.0285) | (0.0373) |
| Urban * High Performer | | | 0.0976*** | 0.1090** |
| | | | (0.0366) | (0.0467) |
| Distance from previous workplace * Female | | | | 0.0417*** |
| | | | | (0.0096) |
| Distance from previous workplace * Age < 35 | | | | 0.0430*** |
| | | | | (0.0079) |
| Distance from previous workplace * High Performer | | | | −0.0293*** |
| | | | | (0.0099) |
| Dist. TEP + Dist. TEP * Female | | | −0.2265*** | −0.1187*** |
| Dist. TEP + Dist. TEP * Age < 35 | | | −0.2381*** | −0.1463*** |
| Dist. TEP + Dist. TEP * High Perf. | | | −0.2635*** | −0.1838*** |
| Urban + Urban * Female | | | 0.168*** | 0.0506 |
| Urban + Urban * Age < 35 | | | −0.0013 | −0.1085** |
| Urban + Urban * High Perf. | | | 0.1984*** | 0.1057* |
| Dist. prev. workplace + Dist. prev. workplace * Female | | | | −0.2435*** |
| Dist. prev. workplace + Dist. prev. workplace * Age < 35 | | | | −0.2422*** |
| Dist. prev. workplace + Dist. prev. workplace * High Perf. | | | | −0.3145*** |
| *N* | 105,043 | 63,389 | 105,043 | 63,389 |
| Candidates | 23,046 | 13,901 | 23,046 | 13,901 |

*Notes:* Distance variables are in logs. Columns 2 and 4 consider the subsample of candidates with previous workplace information. Regarding urban/rural variables, the omitted category is Most Rural (Rural 1). Dist. = distance; perf. = performer; prev. = previous; TEP = Teacher Education Program; VRAEM = Valle de los Ríos Apurímac, Ene y Mantaro. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

investigate the importance that candidates give to each school characteristic by assessing their sign, relative magnitude, statistical significance, and stability across specifications (Beuermann et al. 2018).

Table 4 presents our main results. Columns 1 and 2 include school characteristics, while columns 3 and 4 add interactions between school characteristics and candidate attributes. We find that applicants prefer (i.e., rank higher) schools that are closer to their TEP. Out of the 23,046 candidates in our sample, 68 percent selected vacancies in the same region where they studied. Though many candidates do have teaching experience (8 years on average), the significance of the distance from TEP in shaping the decision is consistent with the literature on the determinants of teacher's initial job placements (Boyd et al. 2005; Krieg, Theobald, and Goldhaber 2016). Moreover, we find that candidates prefer schools with higher enrollment numbers, located in less poor districts, and with access to basic services.

We also include school characteristics associated with wage bonuses: moderate rural (Rural 2), least rural (Rural 3), single-teacher or multigrade, bilingual, frontier areas, and VRAEM area. The rurality base category is composed of the most rural schools (Rural 1), or those located in areas with fewer inhabitants and farthest from the province capital. The coefficients for the least rural (Rural 3) and urban schools have significantly positive effects on a candidate's utility, with a bigger effect for urban schools, signaling a preference for more urban locations. The coefficient for moderate rural schools (Rural 2) is not statistically significant, suggesting that candidates are indifferent between the most rural (Rural 1) and moderate rural (Rural 2) schools. In addition, we find that candidates have weaker preferences for single-teacher/multigrade schools, and bilingual schools. The probability of preferring a single-teacher/multigrade school (to a multiteacher school) is 48 percent, while the probability of preferring a bilingual school (to a non-bilingual school) is 41 percent. Choosing a frontier school or located in VRAEM areas does not have significant effects.[18]

The expected bonuses for working in these schools could alter candidates' original preferences. It is also possible that our estimates understate the degree to which candidates dislike schools associated with bonuses, or that they overestimate the effect if applicants like such schools. Candidates might, for instance, dislike working in bilingual schools, but simultaneously value the wage bonus associated with these institutions, such that our estimates may understate their dislike for this type of institution.[19]

By assessing the sign and magnitudes of the significant point estimates, we can describe scenarios in which candidates are indifferent between varying school types (i.e., their utility would be the same). We investigate what it would take for a candidate to choose a least rural (Rural 3) school in place of an urban school, conditional on other school characteristics being the same. We find that candidates would be willing to

18. Among the variables included in our model, the highest correlations are between urban and single-teacher/multigrade schools (68 percent) and between urban and enrollment (61 percent). The variance inflation factor for urban in our base specification (column 1 in Table 4) is 6.9. We also estimate the rank-order logit model without single-teacher/multigrade schools and enrollment variables and find that urban effects increase (the estimates for the other variables are similar). Because single-teacher/multigrade schools and enrollment have significant effects, we keep them in our specifications in Table 4.

19. There is uncertainty as to how well-informed candidates were about wage bonuses. During the 2015 teacher hiring process, candidates could see the school characteristics associated with bonuses in the application platform, though explicit information (e.g., the amount) was not included.

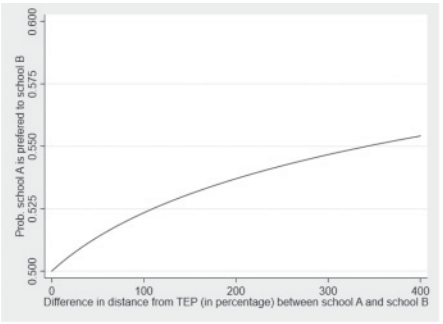
work in a least rural (Rural 3) school instead of an urban school conditional on shorter distance from their TEP, lower poverty rates, or higher enrollment. Comparing the coefficients on distance from TEP, urban, and least rural, the point estimates suggest that candidates would be indifferent between working in a least rural (Rural 3) school or an urban school when the distance between the least rural school and the TEP is 3 percent shorter than the distance between the urban school and the TEP. A comparison with poverty shows that candidates would be indifferent between working in a least rural (Rural 3) school or an urban school when the poverty rate of the least rural school is 3 percentage points lower than the urban one. Regarding enrollment, candidates would be indifferent between working in a least rural (Rural 3) school or an urban school when the enrollment of the least rural school is higher than the urban one by approximately 100 students.

Previous research from the United States suggests that teachers prefer jobs that are closer to their residential location (Engel, Jacob, and Curran 2014; Killeen, Loeb, and Williams 2015; Hanson and Pratt 1988). To reduce the potential that home residence might be endogenous to employment opportunities, other studies include proxies of residency, such as high school location (Boyd et al. 2005; Reininger 2012). Though neither data on candidates' hometown location nor their residential location is available in this case,[20] we do have information on workplace location for the subsample of candidates who were already working as temporary teachers in public schools in 2015.[21] We find that these candidates prefer schools that are closer to their previous workplace location (column 2 in table 4).[22] Furthermore, the inclusion of distance from previous workplace reduces the importance of distance from TEP: The distance from TEP coefficient is 40 percent smaller than in the specification in column 1. This finding highlights the importance of candidates' previous workplace location relative to their TEP location, particularly for this subsample of candidates that has, on average, eight years of experience.

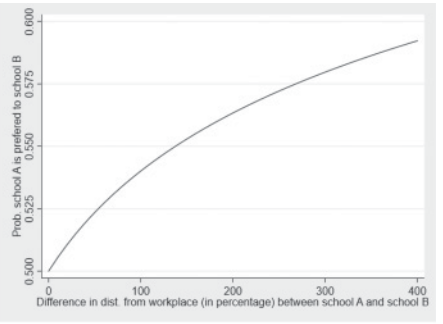
To better understand the relative magnitude and importance of our estimates, we compare two hypothetical schools (A and B) that share all characteristics but one. When compared to school A, school B is 1 standard deviation (SD) (or approximately 89 km) farther away from the previous workplace of a potential candidate, the probability of preferring school B to school A reduces from 50 percent to 44 percent. This drop is higher than the 3 percent reduction in probability of preferring school B over school A when school B is 1 SD (approximately 252 km) farther away from a potential candidate's TEP. Distance from previous workplace (proxy of their residential location) seems to matter much more than distance from TEP for Peruvian teacher candidates. Moreover, when school B is located in a district with a 1 SD higher poverty rate than school A, the probability of preferring school A over B is 51 percent. Figure 1 shows the probability of

20. Jaramillo (2013) analyzes two regions of Peru (Lambayeque and Loreto) and finds that most teachers work in the same region where they were born (77 percent and 85.9 percent, respectively).
21. In 2015, 30 percent of the teachers in the public sector held temporary contracts (Ministry of Education of Peru, unpublished data, November 24, 2018). Moreover, out of the 23,046 candidates that selected vacancies for a permanent position, 61 percent were working as temporary teachers in public schools.
22. Assuming that, on average, temporary teachers choose the closest school to their residence. We cannot distinguish between the preferences of the candidates and those of the hiring schools in determining their workplace as temporary teachers. However, given the short duration of the contract (one school year), teachers might have fewer incentives to move to another region or far away within a region to work as temporary teachers.

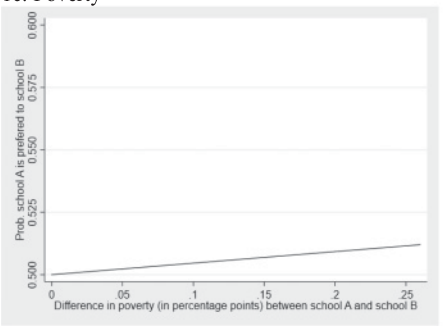
1a. Distance from the TEP location




1b. Distance from workplace




1c. Poverty




*Notes:* School A and school B are two hypothetical schools that share all characteristics but one. The graphs show the probability of preferring school A to school B, as the analyzed characteristic changes values for school B. The probabilities were calculated using the estimated coefficients in Model 2 of table 4. The x-axis shows the difference in the analyzed characteristic between school A and school B until it reaches the 75th percentile of the maximum difference between schools within each candidate choice set. To simplify the comparison, we consider the same x-axis for the distance variables, which corresponds to x-axis of distance from TEP. The y-axis shows the probability that school A is preferred to school B. TEP = Teacher Education Program.

**Figure 1.** Probability of Preferring School A to School B, as a Characteristic of School B Changes

preferring school A to school B for changes in school B values in select characteristics. Figures 1a, 1b, and 1c show that, as school B respectively increases in distance from TEP, in distance from previous workplace, and in poverty rate relative to school A, the probability of preferring school A increases.

Out of the 134,901 candidates with previous workplace information, 93 percent selected vacancies in the same region where they worked in 2015, 67 percent selected vacancies in the same region where they studied, and 65 percent in the same region where they studied and worked.[23] Most candidates do not seem to consider the possibility of moving to another region different from where they had studied, suggesting that teacher labor markets tend to be geographically segmented in Peru. This trend calls for policies able to increase the local supply and quality of teachers in high-deficit regions. With regard to school characteristics associated with wage bonuses, the

23. Although we do not have previous workplace information for 39 percent of the candidates, we would expect similar preferences for proximity to their previous workplace over proximity to TEP. In fact, these candidates have, on average, 7 years of experience, and 70 percent of them select schools in the same region as where they studied.

inclusion of distance from previous workplace eliminates the urban/rural effects and generates a positive effect for schools in the VRAEM area. The probability of preferring a school in the VRAEM area (to one not located in this area) is 53 percent. This might imply that the VRAEM wage bonus of 300 soles (around 14 percent of the base salary, and the second highest bonus), makes these schools more attractive than others. Meanwhile, we continue to observe a significant disutility for bilingual schools and single-teacher/multigrade schools (although the significance level declines for the latter characteristic).

Candidates seem willing to move farther from their previous workplace to teach in schools with basic services and located in wealthier areas. Specifically, a comparison of the coefficient on basic services and poverty with that of distance from previous workplace suggests that candidates are willing to work 17 percent farther away from their previous workplace to teach in a school with basic services and 7 percent farther away from their previous workplace to teach in a school in the 25th percentile of poverty compared to one in the 50th percentile.

In table 5 we include the total wage bonus based on school characteristics in place of the single school characteristics associated with the bonuses.[24] We control for the underlying continuous variables of ruralness: travel time to the province capital and number of inhabitants. We find that candidates prefer schools with a lower total wage bonus (column 1 in table 5), and that neither travel time to the province capital or number of inhabitants is significant. Given that the total wage bonus is a combination of schools' characteristics that we observe candidates to dislike, a negative effect was expected. This result does not, however, imply that candidates do not value wage bonuses or that they would prefer lower bonuses. Rather, it suggests that the dislike for the school characteristics associated with bonuses may be too high, and not sufficiently compensated by current bonuses. Moreover, when controlling for distance from previous workplace (column 2 in table 5), the fact that the total wage bonus is no longer significant may indicate that teachers value their proximity to workplace (proxy of their residential location) more than other school characteristics.[25]

#### Heterogeneous Effects by Candidates' Attributes

Following Boyd et al. (2005) and Krieg, Theobald, and Goldhaber (2016), we explore whether teachers' preferences for proximity to schools vary according to certain individual attributes such as gender, age, and academic performance.

Studies in the United States show that, for most women, job searches tend to proceed from a given residential location. Women generally travel shorter distances to work than men, and they are more likely to work within the local community (Hanson and Pratt 1988). One theory is that women work closer to home because of the constraints of family responsibilities. In Latin America, traditional gender roles persist, in which women take on most of the household duties (Ñopo 2012; OIT 2019). Studies that

24. In order to avoid a multicollinearity problem, we do not include total wage bonus and the school characteristics in the same regression. This issue in fact arises with variance inflation factors greater than 100 for wage bonus, and the urban, least rural, and moderate rural categories.

25. Results in table 5 also show that estimates for distance variables and school characteristics not associated with bonuses are similar to those in table 4, suggesting that they are not particularly sensitive to these alternate specifications.

**Table 5.** Rank-Ordered Logit Results Including Wage Bonus (Soles)

| Dependent variable: Candidates' school ranking | | | | |
|---|---|---|---|---|
| | Without Interactions | | With Interactions | |
| | All Candidates | Candidates w/Previous Workplace Information | All Candidates | Candidates w/Previous Workplace Information |
| | (1) | (2) | (3) | (4) |
| Distance from TEP | −0.2276*** | −0.1361*** | −0.2553*** | −0.1491*** |
| | (0.0070) | (0.0096) | (0.0152) | (0.0212) |
| Wage bonus (soles) | −0.0002*** | −0.0001 | −0.0001 | 0.0000 |
| | (0.0000) | (0.0000) | (0.0001) | (0.0001) |
| Poverty (%) | −0.3028*** | −0.1845*** | −0.3003*** | −0.1802*** |
| | (0.0448) | (0.0580) | (0.0448) | (0.0581) |
| Basic services | 0.0478*** | 0.0425** | 0.0459*** | 0.0407** |
| | (0.0137) | (0.0173) | (0.0137) | (0.0173) |
| Enrollment (100s) | 0.0084*** | 0.0008 | 0.0083*** | 0.0006 |
| | (0.0015) | (0.0021) | (0.0015) | (0.0021) |
| Travel time to province capital (minutes) | −0.0000 | −0.0000 | −0.0000 | −0.0000 |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Population of the locality | 0.0000 | −0.0000 | 0.0000 | −0.0000 |
| | (0.0000) | (0.0000) | (0.0000) | (0.0000) |
| Distance from previous workplace | | −0.2313*** | | −0.2847*** |
| | | (0.0038) | | (0.0100) |
| Distance from TEP * Female | | | 0.0291** | 0.0305 |
| | | | (0.0148) | (0.0206) |
| Distance from TEP * Age < 35 | | | 0.0170 | 0.0029 |
| | | | (0.0136) | (0.0189) |
| Distance from TEP * High Performer | | | −0.0125 | −0.0414* |
| | | | (0.0166) | (0.0229) |
| Wage bonus * Female | | | −0.0004*** | −0.0003*** |
| | | | (0.0001) | (0.0001) |
| Wage bonus * Age < 35 | | | 0.0003*** | 0.0002** |
| | | | (0.0001) | (0.0001) |
| Wage bonus * High Performer | | | −0.0002* | −0.0001 |
| | | | (0.0001) | (0.0001) |
| Distance from previous workplace * Female | | | | 0.0419*** |
| | | | | (0.0096) |
| Distance from previous workplace * Age < 35 | | | | 0.0432*** |
| | | | | (0.0079) |
| Distance from previous workplace * High Performer | | | | −0.0302*** |
| | | | | (0.0099) |
| Dist. TEP + Dist. TEP * Female | | | −0.2262*** | −0.1186*** |
| Dist. TEP + Dist. TEP * Age < 35 | | | −0.2383*** | −0.1462*** |
| Dist. TEP + Dist. TEP * High Perf. | | | −0.2678*** | −0.1905*** |
| Wage bonus + Wage bonus * Female | | | −0.0004*** | −0.0003*** |
| Wage bonus + Wage bonus * Age < 35 | | | 0.0002*** | 0.0003*** |
| Wage bonus + Wage bonus * High Perf. | | | −0.0003*** | −0.0001 |
| Dist. prev. workplace + Dist. prev. workplace * Female | | | | −0.2428*** |
| Dist. prev. workplace + Dist. prev. workplace * Age < 35 | | | | −0.2415*** |
| Dist. prev. workplace + Dist. prev. workplace * High Perf. | | | | −0.3149*** |
| *N* | 105,043 | 63,389 | 105,043 | 63,389 |
| Candidates | 23,046 | 13,901 | 23,046 | 13,901 |

*Notes:* In this specification, we include the total wage bonus based on school characteristics, rather than the school characteristics associated with bonuses. Distance variables are in logs. Columns 2 and 4 consider the subsample of candidates with previous workplace information. Regarding urban/rural variables, the omitted category is Most Rural (Rural 1). Dist. = distance; perf. = performer; prev. = previous; TEP = Teacher Education Program; VRAEM = Valle de los Ríos Apurímac, Ene y Mantaro. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

specifically analyze teacher job markets suggest that women are more likely to work closer to their TEP (Boyd et al. 2005) and to their student teaching placements (Krieg, Theobald, and Goldhaber 2016).

Additionally, the literature argues that, as adults grow older, they become less willing to take risks (Schildberg-Hörisch 2018). Schurer (2015) documents that risk tolerance declines strongly for all socioeconomic groups from late adolescence up to 45 years old. Younger candidates may also have fewer household or family responsibilities, and therefore more flexibility in choosing their work location.[26] Research in the United States suggests that individuals who begin their teaching careers when they are younger are more likely to take jobs farther away from their TEP and their student teaching location, but closer to their hometown (Boyd et al. 2005; Krieg, Theobald, and Goldhaber 2016).

The literature shows mixed results on the impact of teachers' own academic performance and knowledge (as measured by standardized tests) on distance preferences. On the one hand, Boyd et al. (2005) find that more qualified teachers (measured by SAT scores) are slightly more willing to expand their job search away from their hometown. On the other hand, Krieg, Theobald, and Goldhaber (2016) find some evidence that more qualified teachers (measured by college grade point average scores) work in schools closer to their student teaching placement.

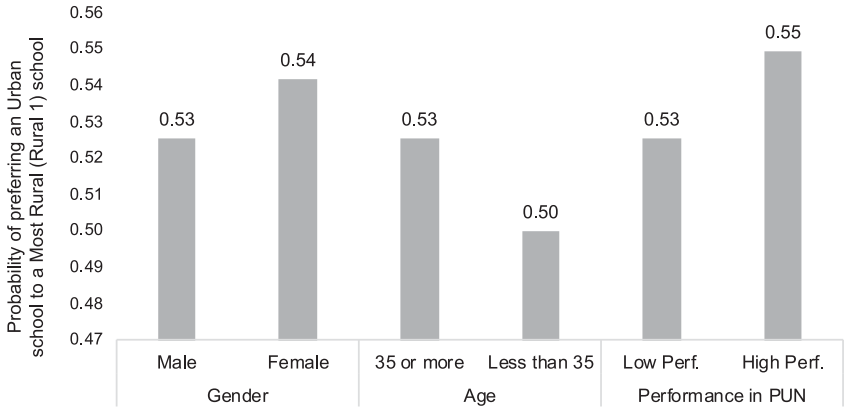
To analyze the heterogenous effects by candidate attributes in Peru, we create three dummy variables for: (i) women; (ii) young candidates, defined as applicants under the age of 35 years, where 35 represents the 50th percentile of the age variable in our sample; and (iii) high performers, or those candidates who scored in the highest quintile on the National Teacher Test. We interact these dummy variables with the log distance variables, average wage bonus, and urban location of schools.

Columns 3 and 4 in table 4 are analogous to columns 1 and 2 with the addition of interactions between school characteristics and candidates' attributes. In column 3 we also include the interactions of log distance from TEP and urban with candidate's attributes.[27] We find that all candidate groups prefer schools that are closer to their TEP, and that women have slightly weaker preferences for proximity to TEP than men. Regarding urban location, all candidates with the exception of young applicants have significant preferences for urban schools, and these are stronger among women and high performers. Figure 2 shows the probability that an urban school is preferred to a most rural (Rural 1) school for candidates with different attributes, holding other school characteristics constant. The probability of preferring an urban school to a most rural school is 55 percent for high performers, compared with 53 percent for low performers.

Column 4 of table 4 adds the interactions between log distance from previous workplace and candidate's attributes for the subsample of candidates with previous workplace information. The results show that, whereas all candidates value proximity to their workplace, high performers show stronger preferences for this school feature

26. While we do not have information on candidates' marital status, we assume that younger applicants are more likely to be single, and thus have more flexibility in terms of moving farther from their residential location while looking for a job.

27. We also analyze the interactions between the candidate's attributes and other school characteristics (enrollment and basic services). These interactions were not significant, and their inclusion did not affect the results of the interactions with distances and urban location.




*Notes:* The probabilities were calculated using the estimated coefficients in Model 3 of table 4. The y-axis shows the probability of preferring an urban school to a most rural school (i.e., areas farthest from the province capital, Rural 1). The x-axis shows candidates' attributes. PUN = *Prueba Unica Nacional* [National Teacher Test].

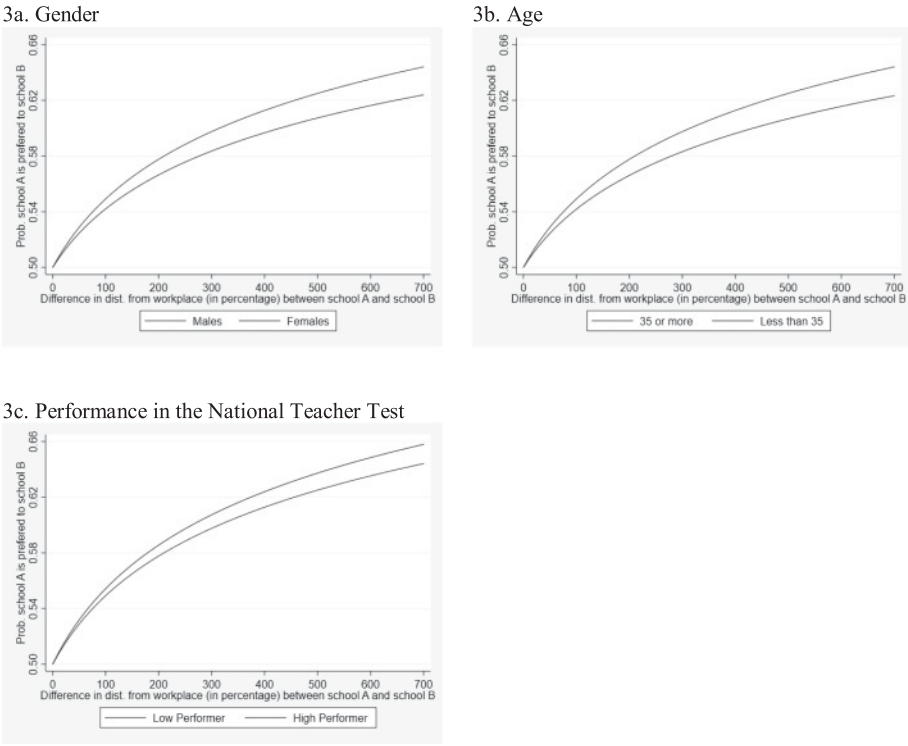
**Figure 2.** Probability of Preferring an Urban School to a Most Rural School by Candidates' Attributes

while women and younger teachers display weaker preferences.[28] Figure 3 shows that, as school B increases in distance from the previous workplace, the probability of preferring school A over school B is greater for high-performers (figure 3c) and lower for women (figure 3a) and for younger teachers (figure 3b).

When we control for distance from previous workplace (column 4 of table 4), the main effect for urban vanishes but, among young candidates and high performers, the interaction terms and combined effects are statistically significant. While high performers prefer urban schools (relative to most rural schools), this is not true of young candidates. Assuming that all other characteristics are similar, this weak preference among young candidates might be driven by the fact that they would not receive a wage bonus for working at urban schools (compared to the 25 percent increase in wages offered in the most rural schools). Finally, all candidates prefer schools closer to their TEP with no significant differences across applicants.

In table 5 we present the same set of specifications, but with the total wage bonus instead of the different school characteristics associated with wage bonuses. Moreover, we interact candidates' attributes with total wage bonus, distance from TEP, and distance from workplace. The wage bonus does not appear to be relevant for candidates in the base category (older men with low performance). We find that female candidates prefer schools that offer lower wage bonuses, while young candidates prefer schools with higher wage bonuses (i.e., schools with characteristics associated with higher bonuses). High performers seem to prefer schools with lower wage bonuses (column 3), but this effect vanishes when we control for distance from workplace (column 4). The results

28. In our sample, women choose schools that, on average, are closer to their workplace than men (mean: 44 km for women compared to 69 km for men). The fact that women have weaker preferences for proximity to workplace implies that, within a given woman's school ranking, her first ranked school is not much closer than her other ranked schools, compared to men. Table A.5 available in the online appendix shows the mean of the distance variables, urban, and wage bonus by candidate group and rank. Both women and men rank highest schools that are closer to their previous workplace, but the difference between the school ranked as most preferred (1st) and that ranked as least preferred (5th) is larger for men than for women (19 km for men versus 12 km for women).




*Notes:* School A and school B are two hypothetical schools that share all characteristics except the distance from previous workplace. These graphs show the probability of preferring school A to school B, as school B increases in distance from previous workplace. The probabilities were calculated using the estimated coefficients in Model 4 of table 4. The x-axis shows the differences until this characteristic reaches the 75th percentile of the maximum difference in distance from previous workplace between schools within each candidate ranking. The y-axis shows the probability that school A is preferred to school B.

**Figure 3.** Probability of Preferring School A to School B, as School B Increases in Distance from Previous Workplace

in table 5 also show that interaction effects between candidates' attributes and distance variables are consistent with the results presented in table 4.[29]

### Analysis by Education Level

As documented in table 1, the shortage of qualified teacher candidates varies by education level. At the pre-primary level, the available vacancies surpass the number of candidates who passed the PUN and who then participate in the decentralized stage. A greater understanding of candidates' preferences by education level could help policy makers tackle staffing challenges, in particular where there are the greatest teacher shortages. In this section, we explore how preferences for vacancies differ across the pre-primary, primary, and secondary levels.

The supply of vacancies in pre-primary and primary schools is quite different from that of secondary schools.[30] Most of the pre-primary and primary schools with

29. As a robustness check, we estimate conditional logit models on the most preferred (first ranked) school for each candidate. The conditional logit results are consistent with the results in tables 4 and 5. Results are available upon request.
30. Table A.6 available in the online appendix shows the characteristics of the vacancies offered by education level.

vacancies are located in the most rural areas (Rural 1) and in single-teacher/multigrade schools. More than one third are bilingual schools and around 10 percent are located in a frontier or the VRAEM area. Because of these characteristics, pre-primary and primary school vacancies offer a wage bonus that is around eight times higher than that of secondary schools. On the contrary, secondary schools' vacancies are mainly available in urban areas, with only around 5 percent of such positions located in a frontier or the VRAEM area. No such vacancies were offered in single-teacher/multigrade or bilingual schools. Moreover, secondary schools tend to be located in lower poverty rate districts and have higher enrollment and access to basic services. In our sample, female candidates represent a stark majority at the pre-primary (99 percent) and primary (77 percent) levels, compared with 56 percent at the secondary level. At each level, between 50 percent and 60 percent of candidates are younger than 35 years old, and between 16 percent and 21 percent attained a high score on the PUN.

Table 6 presents the rank-ordered logit results by education level. We find that all primary and secondary candidates value proximity to their TEP, while among pre-primary applicants, only women show significant preferences for this same variable. Second, some urban (or less-rural) effects are significant for pre-primary and primary when we do not control for distance from previous workplace. Among secondary candidates, high performers seem to prefer urban schools. Both pre-primary and primary applicants have weaker preferences for single-teacher/multigrade schools (compared to multi-teacher schools) and for bilingual schools (compared to non-bilingual schools). As a consequence, bilingual schools in Peru face serious difficulties in finding qualified teachers and those competent in native languages (Bertoni et al. 2020).

Moreover, we find that all applicants prefer schools that are closer to their previous workplace, though primary and secondary younger candidates seem to show weaker preferences for this variable. Interestingly, we find a preference for schools located in the VRAEM area for secondary teachers. This could be due to the fact that only a few secondary schools with vacancies provide bonuses, and that the VRAEM bonus is the second highest bonus available to teachers in the country.

## 6. CONCLUSIONS AND POLICY IMPLICATIONS

In this paper we explore which institutional characteristics drive teacher candidates' school preferences in Peru, and how these vary by candidate attributes. To this end, we analyze the rank-ordered preferences of the 23,046 applicants who selected vacancies for permanent positions in the country's 2015 teacher national hiring process. This study is largely driven by a need to determine effective ways to encourage teachers to work in hard-to-staff schools. A better understanding of the school characteristics most valued by prospective teachers can help in the design of effective policies that improve equity in permanent teacher allocations by attracting qualified candidates to the most disadvantaged institutions.

We find that, in seeking a permanent public-school position, candidates appear to prefer schools (i.e., ranked them higher) that are closer to where they attended their TEP and that are located in urban areas. These preferences vary by candidate attributes: urban location seems to be particularly important for female and high-performing applicants. Candidates' previous workplace location, used here as a proxy of residential location, is more relevant than where they studied, particularly for this subsample of

**Table 6.** Rank-Ordered Logit Results by Education Level

| Dependent variable: Candidates' school ranking | Pre-Primary | | Primary | | Secondary | |
|---|---|---|---|---|---|---|
| | All Candidates (a1) | Candidates w/Previous Workplace Information (a2) | All Candidates (b1) | Candidates w/Previous Workplace Information (b2) | All Candidates (c1) | Candidates w/Previous Workplace Information (c2) |
| Distance from TEP | −0.2060 | −0.1600 | −0.1793*** | −0.0848* | −0.2691*** | −0.1309*** |
| Urban | 0.1189 | −0.2086 | 0.0141 | −0.0519 | 0.0419 | −0.0301 |
| Least Rural (Rural 3) | 0.1920*** | 0.0623 | 0.0515 | −0.0321 | 0.0586 | 0.0257 |
| Moderate Rural (Rural 2) | 0.0807* | 0.0178 | 0.0711** | 0.0577 | −0.0487 | −0.0395 |
| Single-teacher or Multigrade school | −0.1407* | −0.1129 | −0.0847** | −0.1106** | | |
| Bilingual school | −0.2519*** | −0.4201*** | −0.2408*** | −0.3250*** | | |
| Frontier areas | 0.1768** | 0.0100 | 0.2691*** | 0.3628*** | −0.1243** | −0.1859*** |
| VRAEM area | −0.0508 | −0.0137 | −0.1835** | −0.1394 | 0.1393** | 0.2710*** |
| Poverty (%) | −0.2162** | −0.0912 | −0.2314*** | −0.1643 | −0.3403*** | −0.2289*** |
| Basic services | −0.0154 | 0.0098 | 0.0379 | 0.0324 | 0.0791*** | 0.0556* |
| Enrollment (100s) | 0.0312** | 0.0145 | 0.0084** | 0.0051 | 0.0055*** | −0.0023 |
| Distance from previous workplace | | −0.1498*** | | −0.2295*** | | −0.3570*** |
| Distance from TEP * Female | −0.0237 | 0.0020 | 0.0200 | −0.0047 | 0.0036 | 0.0284 |
| Distance from TEP * Age < 35 | 0.0200 | 0.0206 | 0.0028 | 0.0050 | 0.0094 | −0.0166 |
| Distance from TEP * High Performer | −0.0388 | −0.0233 | 0.0284 | 0.0478 | −0.0078 | −0.0941*** |
| Urban * Female | 0.1495 | 0.2623 | 0.0837 | −0.0045 | 0.0542 | 0.0844* |
| Urban * Age < 35 | −0.1530** | −0.0718 | −0.0800 | −0.0748 | −0.0893** | −0.1273** |
| Urban * High Performer | −0.0730 | −0.1373 | 0.0530 | 0.1147 | 0.1738*** | 0.1997*** |
| Distance from previous workplace * Female | | −0.0488 | | −0.0155 | | 0.0516*** |
| Distance from previous workplace * Age < 35 | | 0.0032 | | 0.0646*** | | 0.0314** |
| Distance from previous workplace * High Performer | | −0.0211 | | −0.0614*** | | 0.0184 |
| Dist. TEP + Dist. TEP * Female | −0.2297*** | −0.1579*** | −0.1592*** | −0.0895*** | −0.2655*** | −0.1025*** |
| Dist. TEP + Dist. TEP * Age < 35 | −0.1860 | −0.1394 | −0.1764*** | −0.0798** | −0.2597*** | −0.1475*** |
| Dist. TEP + Dist. TEP * High Perf. | −0.2448 | −0.1833 | −0.1509*** | −0.0370 | −0.2769*** | −0.225*** |

Table 6. Continued.

| Dependent variable: Candidates' school ranking | | | | | | |
|---|---|---|---|---|---|---|
| | Pre-Primary | | Primary | | Secondary | |
| | All Candidates | Candidates w/Previous Workplace Information | All Candidates | Candidates w/Previous Workplace Information | All Candidates | Candidates w/Previous Workplace Information |
| | (a1) | (a2) | (b1) | (b2) | (c1) | (c2) |
| Urban + Urban * Female | 0.2684*** | 0.0537 | 0.0978 | −0.0564 | 0.0961* | 0.0543 |
| Urban + Urban * Age < 35 | −0.0341 | −0.2804 | −0.0659 | −0.1267 | −0.0473 | −0.1574** |
| Urban + Urban * High Perf. | 0.0459 | −0.3459 | 0.0671 | 0.0628 | 0.2158*** | 0.1696** |
| Dist. prev. workplace + Dist. prev. workplace * Female | | −0.1986*** | | −0.245*** | | −0.3054*** |
| Dist. prev. workplace + Dist. prev. workplace * Age < 35 | | −0.1466*** | | −0.1649*** | | −0.3257*** |
| Dist. prev. workplace + Dist. prev. workplace * High Perf. | | −0.1709*** | | −0.2909*** | | −0.3387*** |
| *N* | 26,095 | 16,935 | 31,242 | 18,887 | 47,706 | 27,567 |
| Candidates | 5,519 | 3,578 | 6,586 | 3,989 | 10,900 | 6,334 |

*Notes:* Distance variables are in logs. Columns 2 consider the subsample of candidates with previous workplace information. Regarding urban/rural variables, the omitted category is Most Rural (Rural 1). For completeness, we include results of these estimations without interactions in table A.7 available in the online appendix. Dist. = distance; perf. = performer; prev. = previous; TEP = Teacher Education Program; VRAEM = Valle de los Ríos Apurímac, Ene y Mantaro. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

temporary teachers who have, on average, eight years of experience. Although among this group, this preference is weaker for younger candidates and stronger for high performers. Broadly, candidates prefer larger schools located in low-poverty districts, with Spanish language instruction (non-bilingual), one teacher per classroom (non-single-teacher/multigrade), and with access to basic services.

More attractive wages and better working conditions are likely to influence teachers' openness to choosing a rural school. In light of this, Peru has introduced monetary (and nonmonetary) incentives aimed at encouraging qualified teachers to take jobs farther away from urban areas. These policies endeavor to address the pressing educational challenge of drawing teachers to more disadvantaged areas by compensating them monetarily for the less favorable conditions. Yet, our results suggest that these incentives are not enough to overcome candidates' dislike for the school characteristics associated with wage bonuses. Indeed, among the groups of candidates we analyze, only younger applicants seem to prefer schools that offer higher wage bonuses. This might be due to their higher valuation of wage bonuses, lower risk aversion, and/or their greater flexibility in terms of moving geographically. Among the other candidates, women and high performers have a stronger dislike of the school characteristics associated with wage bonuses. As a result, remote and rural vacancies often end up being filled by less qualified candidates or teachers who do not fulfill the minimum requirements (i.e., candidates who have not passed the PUN).

Peru could benefit from revising the current monetary incentives. Indeed, in their current form, the bonuses reward less-qualified teachers at the lower salary levels. Specifically, the relative weight of the combination of the five wage bonuses on a teacher's base salary is 57 percent for an instructor at the lowest salary level against 27 percent for a teacher at the highest level. While policies designed to indiscriminately retain teachers (e.g., across-the-board policies that raise all teacher salaries at the same rate) may be successful in increasing the status of the profession and the flow of new teachers (Elacqua et al. 2018), they might also result in an increased assignment of low-performing teachers (Guarino et al. 2004).

Future studies should further evaluate the effect of the Peruvian monetary incentives scheme on a series of teacher outcomes (e.g., recruitment and retention). Bobba et al. (2021), for example, study the effect of offering higher teacher wages in rural areas in Peru and finds positive results in terms of the probability that vacancies are filled, increased quality of the newly recruited instructors, and higher teacher retention. Castro and Esposito (2018) find that the Peruvian rural wage bonuses have a positive effect on learning outcomes and on the distribution of teacher skill in public rural schools in Peru. For Chile, Elacqua et al. (2019) evaluate the effect on teacher school choice decisions of a program that provides monetary incentives to talented teachers, with an additional bonus if they work in disadvantaged schools. They observe that while the award was successful in increasing the retention of talented teachers in disadvantaged schools, instructors in non-disadvantaged schools tend to use the award as a quality signal, to either stay or move to even higher performing schools.

Our findings also suggest that some candidates would be indifferent to working in an urban school versus a rural (but close to the city) school if rural poverty rates were marginally lower. While, in the long term, reducing poverty in rural areas is crucial, in the short term, policies can help mitigate the challenging conditions of working in

schools located in poor districts (e.g., better infrastructure, educational inputs, transportation, and housing). Indeed, some education systems in Latin America, such as that in Chile, recognize that working in schools with high proportions of poor students can be more difficult and thus offer higher salaries to teachers in these schools and additional resources for hiring support personnel and providing materials. In this sense, Peru might also consider introducing monetary incentives for teachers working in vulnerable urban areas.

Latin American countries have adopted various strategies to address the issue of high teacher shortages in rural areas. One approach consists of tailored hiring processes. Ecuador and Colombia, for example, organize teacher selection processes exclusively for vacancies in rural areas and intercultural bilingual education, or in post-conflict areas, respectively. Ajzenman et al. (2020) find that simple, low-cost behavioral interventions are effective in encouraging teachers to apply to vacancies in disadvantaged schools in Peru. This result suggests that, at a time when government budgets in many developing countries are being cut, there are feasible, inexpensive interventions that could help to mitigate the shortage of teachers in places with high staffing needs.

Given the relevance of proximity to the TEP for candidates' school preferences, it is important to analyze which areas are "net importers" of teachers. Indeed, rural areas might not produce as high a proportion of teachers as urban areas, and thus might have a less-qualified pool of potential instructors. Schools in rural areas then need to attract teachers from other areas, for which they must pay a premium. In this scenario, "grow your own" programs could help to increase the supply of teachers in rural areas (Boyd et al. 2005). By improving working conditions, supporting high school students, and improving TEP in rural areas, the pool of graduates that are more likely to become teachers in such areas could increase.[31]

Similarly, in light of the preference for proximity to previous workplace, providing more training to temporary teachers who already work in remote schools is another alternative. Understanding the geographical scope of teacher labor markets is crucial to determining which candidates are more willing to work in hard-to-staff schools. With regard to our sample, we have workplace information for 61 percent of the candidates; that is, those who were working as temporary teachers in public schools in 2015. It is also possible that workplace location is endogenous to employment opportunities. Further analysis would benefit from the inclusion of the applicants' residential and hometown locations, particularly in light of studies suggesting that most teachers prefer to teach close to where they grew up or in a school similar to the one they attended as students (Boyd et al. 2005). Unfortunately, this information is not available for candidates in Peru.

Finally, this paper focuses specifically on the preferences of those candidates who passed the national teacher test (PUN) and who were therefore able to submit their school ranking (up to five schools). Yet in 2015, just 13 percent of the 192,397 candidates who took the test attained a passing score. Several changes have since been implemented in the national hiring processes. Candidates who pass the PUN can now rank

31. In 2018, Peru approved new policies to increase the supply and improve the quality of teachers in rural areas. The government is developing a training program that grants a teaching certification to talented young people from indigenous groups, as well as is designing incentives for TEP teachers with high academic competencies and experience in rural education (Supreme Decree N 013-2018-MINEDU).

as many schools as they want, a shift aiming to reduce the number of schools that end up without any applicants and teachers who are not assigned a vacancy. Future work could analyze how modifications to the selection design may affect candidates' preferences. Moreover, our results highlight an urgent need to improve initial and continuous instructor training (since most applicants do not pass the PUN) and to revisit the current wage bonus scheme in an effort to attract effective candidates to vulnerable areas and regions with low teacher supply. Indeed, teachers are the most important factor in improving student learning in schools, particularly for the lowest-performing and most disadvantaged pupils. Hiring competent instructors in schools that serve such students represents a pressing challenge in Peru, and in Latin America as a whole—this challenge must be addressed in order to provide access to quality teachers for all students and thus equalize learning opportunities across the country.

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