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The Chilean Teacher Labor Market

By

Maria del Rosario Rivero

A dissertation submitted in partial satisfaction of the requirements for the degree of

Doctor of Philosophy

in

Education

in the

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of the

University of California, Berkeley

Committee in charge:

Professor Xiaoxia Newton, Chair

Professor Sophia Rabe-Hesketh

Professor Nicholas Jewell

Abstract

The Chilean Teacher Labor Market

By

Maria del Rosario Rivero

Doctor of Philosophy in Education

University of California, Berkeley

Professor Xiaoxia Newton, Chair

In Chile, as many other countries, understanding how high-qualified teachers are distributed across schools and which are the relationships that may lead to teachers' potential sorting are key aspect of the teacher labor market and it is central to addressing student achievement gaps. The first paper uses rich new data on all elementary public school teachers in Chile to describe the variation in average teacher attributes across schools, characterize this variation by school and students characteristics, and understand how the variation in the teacher attributes is associated with both teacher school matching at the start of their teachers' careers, as well as by mobility and attrition among teachers in subsequent years. Results show that teachers are unequally distributed across elementary schools in Chile, with higher proportions of less-qualified teachers working in public, and rural schools. Schools with less qualified teachers also tend to enroll higher proportions of low-income and low-performance students. Teacher career paths are clearly associated with the observed unequal distribution of teacher attributes across schools. Less qualified teachers who work in low-income and low-performing schools are more likely to stay in those schools than are high-qualified teachers, while less-qualified teachers who start working in high-income and high-performing schools are less likely than highly-qualified teachers to stay in those schools.

In sum, the first paper concludes that attracting and retaining good teachers for public schools and especially for low-income children must be part of any effort to break the persistent link between poverty and low academic performance in Chile. The second

paper aimed to advance these efforts by investigating the relationships between teacher characteristics (e.g teacher quality) and school characteristics on the timing of elementary novice teachers' decision to switch to another public school and to leave teaching in the public school system. Results show that conditioning on teacher and school characteristics, teachers with high academic ability are more likely to leave the public school system than those with lower ability. In addition, the results show that it is not more difficult for serving at-risk children schools to retain teachers with most desirable observable characteristics (e.g higher academic ability) than schools serving not at-risk children. For teachers switching between schools, the study concludes that teachers are more likely to leave low performance schools, public and rural schools. Finally, in terms of the timing, the results show that the hazard of risk of switching schools and leaving the public school system is highest during the earlier stage of the teaching career and very similar for both behaviors. If the goal is to minimize the churn of the least effective teachers to maximize the number of highly effective teachers staying in the public school system, particularly in schools that need them the most, these results suggest that some of the hard debates about teacher preferences and motivations are worthwhile.

In moving forward on this debate, the third paper focuses on the relationship between teacher preferences, teacher effectiveness, working conditions and retention. Specifically, the paper uses rich new data on all elementary novice public school teachers in Chile to study how school environments influence teacher trajectories. Specifically, this study creates five indicators (teacher influence, principal support, staff relations, facilities, and school safety) of school working conditions to measure aspect of the school environments in which teachers work. The results of this study conclude that teacher working conditions matter a great deal. Teachers who teach in favorable work environments are less likely to switch schools or to leave teaching in public schools than their peers in schools with less favorable conditions, even after controlling for student demographics and other school and teacher characteristics. These findings suggest that a policy focus on the school working conditions may be a worthwhile way to retain high-qualified teachers in public schools, and in most needed schools. It is surely important to attract more qualified teacher candidates into the teacher profession, but if effective teachers are expected to teach in every classroom, schools need to be a supportive and productive workplace where high-qualified teachers want to work and stay.

DEDICATION

To Lucho, Juanita and my parents, none of this would have been possible without you.

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ABREVIATIONS

Abbreviation	English	Spanish
AEP	Teacher assessment AEP	Evaluación de Asignación de Excelencia Pedagógica
BRP	Professional recognition bonus	Bono de Reconomiento Profesional
CES	National Education Council	Consejo de Educación Superior
CNA	National Board of Accreditacion	Consejo Nacional de Acreditación
DM	Teacher assessment Docente Mas	Evaluación Docente Más
ID	National Teacher Dataset	Idoneidad Docente
ME	Ministry of Education	Ministerio de Educación
SIMCE	National Student Assessment system	Sistema de Medición de la Calidad de la Educación

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I would first like to acknowledge and thank all of those individuals who gave me their time and attention to make this dissertation possible. Especially to Francisco Lagos and his team at the Ministry of Education in Chile. Their commitment to education and research is palpable in their work, their conversations and their desire to continuously improve student learning.

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Third, I must thank my family and friends for their support throughout this long and arduous process. My friends within the PhD program were the first sounding boards when I was just starting to develop my dissertation topic. My friends outside of the program were an essential support. At times, they have been essentially abandoned and yet still answer my calls when I come up for air. For you, your sense of humor and your support I will be eternally grateful.

As for my family, my parents, my husband and children have been my major pillars of strength. They have given me the immense amounts of support, understanding and motivation necessary to come through the other side in one piece. Finally, I must single out my husband, Lucho. He believes from the beginning on this project and his love and support have carried me through the some of the most difficult moments I ever experienced in research.

INTRODUCTION

Understanding the teacher labor market is an important step toward maintaining efficiency and equity within an educational system. Recent research has emphasized the important link between teacher quality and student outcomes, with teacher quality identified as the most impactful school-level influence on pupil learning and achievement (Darling-Hammond, 2000; Hanusheck, Kain, and Rivkin, 1998; Sanders & Rivers, 1996, Aaronson, Barrow and Sander, 2007; Rockoff, 2004; Rivkin, Hanushek and Kain, 2005; Kane, Rockoff and Staiger, 2008). According to Sanders and Rivers (1996), having a high-quality teacher compared to low-quality teacher can provide up to a 50-percentile improvement in student achievement. Also, high-quality teachers can make a tremendous difference in the achievement of low-income students (McCaffrey, Lockwood, Koretz and Hamilton, 2003), and Hanusheck (2010) suggested that having a good teacher for three to five years could eliminate the average gap between children who do and do not receive free or reduced-price lunch and/or the average achievement gap between whites and blacks or Hispanics.

While it is important to acknowledge social factors, including the effects of poverty on families and children, certain long-standing educational practices continually contribute to inequities in student achievement. Understanding how high-qualified teachers are distributed across schools and which are the relationships that may lead to teachers' potential sorting are key aspect of the teacher labor market is central to addressing student achievement gaps.

On the other hand, education reformers have recognized the key role of teachers in classrooms, implementing a variety of policies to improve the quality of school public teachers as well as to attract more qualified teachers into most needed schools. Chile is not the exception. During the last years, policymakers have shown a growing attention on strategies for enhancing teacher quality of public schools. Most of efforts have focused on attracting better teachers' candidates into the profession. The increase of salaries, the expansion of alternative certification, and the creation of scholarships for high academic students are the main implemented policies. For example, the last and most important teacher reform, the scholarship "Beca Vocación de Profesor", seek to improve the overall teacher quality in schools, particularly in public schools[1], paying tuitions and fees costs to more than 20% of prospective teachers in 2011. Other few initiatives aim to enhance high quality teachers to work in most needed schools. For instance, Enseña Chile (equivalent to Teacher for America) work with high academic ability college graduates who commit two years to teach in under-resourced urban and rural public schools.

All these initiatives support the fact that in order to increase student achievement and reduce student achievement gap, the quality of the teacher placed into every classroom is of critical importance, especially into high-needs schools. However, any educational effort will do little to enhance teacher quality in public schools unless high-qualified teachers are willing and committed to work in the public school system. Understanding how teacher qualifications are distributed across schools in the Chilean public education

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[1] It is mandatory for the scholars to work 3 years in the public school system.
[2] Chile has three types of schools: public schools, subsidized private schools (private schools with public funding) and

system and which are the relationships that may lead to teachers' potential sorting are key aspect for policy formulation that targets teacher quality and teacher retention of high quality teachers, specially in most needed schools. If academically gifted teachers choose to leave the most needy public schools in higher proportion, policy responses should appropriately promote teacher retention in these schools, changing factors that determine whether and when teachers decide to leave these type of schools.

This dissertation is a step forward to deepen our understanding about teacher labor market in Chile, teacher carrier trajectories and teacher labor decisions. An incipient literature on the teacher labor market in Chile has documented inequalities in instructional resources and has found that high-qualified teachers are unequally distributed across schools (Cabezas, et. al 2011; Meckes and Bascope, 2010). Less it has been done on studying teachers' career trajectories, and teacher labor market decisions. In sum, there are a few and limited research that study the teacher labor market in Chile.

The results of my dissertation will be essential for schools to reduce the proportion of high-qualified teachers who are leaving teaching in public schools, keeping them teaching in the classrooms. Also, the findings will be a necessary input to design local and centralized educational policies in order to improve the quality of teacher workforce and the distribution of high-qualified teachers in the public school system, impacting the efficiency and equity of the educational system.

DISSERTATION OVERVIEW

This dissertation is organized into three distinct papers. Based on rich new data on all elementary public school teachers in Chile, the first chapter describes the variation in average teacher attributes across schools, characterizes this variation by school and students characteristics, and understands how the variation in the teacher attributes is associated with both teacher school matching at the start of their teachers' careers, as well as by mobility and attrition among teachers in subsequent years.

Results in the first chapter suggested that attracting and retaining good teachers for public schools and especially for low-income children must be part of any effort to break the persistent link between poverty and low academic performance in Chile. Based on administrative teacher data and following career trajectories of elementary novice teachers, the second chapter aimed to advance these efforts by investigating the relationships between teacher characteristics (e.g teacher quality) and school characteristics on the timing of elementary novice teachers' decision to switch to another public school and to leave teaching in the public school system.

The second chapter concludes that, conditioning on teachers and schools characteristics, teachers with high academic ability are more likely to leave the public school system than those with lower ability. A possible explanation for this pattern of teacher trajectories is that teachers prefer to teach in schools that serve high performance students, schools that are private and urban. Another alternative explanation is that teachers prefer to teach in

schools that have better working environments. Based on rich school information and teacher trajectories, the third and final chapter studies how school working environments are related to teacher retention decisions. Specifically, five measures of school working conditions are created (e.g. teachers' influence, principal support, staff relations, facilities, and school safety) and are associated with teachers' decisions of switching schools and leaving teaching in the public school system.

CHAPTER 1: THE DISTRIBUTION OF HIGH-QUALIFIED TEACHERS IN CHILE

Understanding the teacher labor market is an important step toward maintaining equity and efficiency within an educational system. Recent research has emphasized the important link between teacher quality and student outcomes, with teacher quality identified as the most impactful school-level influence on pupil learning and achievement (Darling-Hammond, 2000; Hanusheck, Kain, and Rivkin, 1998; Sanders & Rivers, 1996, Aaronson, Barrow and Sander, 2007; Rockoff, 2004; Rivkin, Hanushek and Kain, 2005; Kane, Rockoff and Staiger, 2008). According to Sanders and Rivers (1996), having a high-quality teacher compared to low-quality teacher can provide up to a 50-percentile improvement in student achievement.

While it is important to acknowledge social factors, including the effects of poverty on families and children, certain long-standing educational practices continually contribute to inequities in student achievement. Understanding how teachers move between schools, as well as what makes an effective teacher, is central to understanding and addressing student achievement gaps. High-quality teachers can make a tremendous difference in the achievement of low-income students (McCaffrey, Lockwood, Koretz and Hamilton, 2003), and Hanusheck (2010) suggested that having a good teacher for three to five years could eliminate the average gap between children who do and do not receive free or reduced-price lunch and/or the average achievement gap between whites and blacks or Hispanics. Consistent exposure to effective teachers can overcome obstacles to learning (Babu and Mendro, 2003; Rivkin et al., 2005).

However, a growing literature finds that teachers "sort" unequally across schools. Studies in the U.S. have found that schools with the highest proportions of poor, non-white, and low performing students tend to employ teachers with the weakest credentials, such as certification status, SAT scores, undergraduate college ranking, and/or experience (Lankford, Loeb and Wyckoff, 2002; Bonesrønning, Falch, and Strøm 2005; Clotfelter, Ladd and Vigdor, 2005; and Peske and Haycock, 2006).

In the Chilean context, data show substantial differences among incoming teachers' test scores. The latest results of the INICIA 2011 test, which evaluates the content and pedagogical knowledge of prospective teachers in Chile, showed that only 5 percent of prospective elementary school teachers answered at least 75 percent of test items correctly, 47 percent scored between 50 and 75 percent correct, and 48 percent answered correctly on less than 50 percent of the items (Ministry of Education, 2011).

We know very little, however, about how teacher qualifications are distributed across schools in the Chilean public education system and the causal relationships that may lead to teachers' potential sorting. An incipient literature on the teacher labor market in Chile has documented inequalities in instructional resources and found that teachers are unequally distributed across schools. A recent study by Cabezas and colleagues (2011) explored the relationship between individual teacher characteristics and several outcomes, including the likelihood of working in a public or private school, the

likelihood of moving between public and private schools, and the likelihood of leaving the teaching profession altogether. Analyzing data from the 2005 and 2009 Teacher Longitudinal Survey (Centro de Microdatos, 2009) using multinomial logit models, the authors found that men, married teachers with higher ability scores, and teachers from families at higher socioeconomic levels were all more likely to work in private schools without public funding. Also, they found that teachers with better qualifications (i.e., more experience, higher ability scores, and graduating from accredited universities) were more likely to work in private schools with public funding than in public schools. Finally, the authors found that teachers were more likely to work in the same type of school (i.e., either publicly or privately administered) as the one they attended as students.

Similarly, Meckes and Bascopé (2010) explored the relationship between the individual characteristics of novice elementary teachers and the likelihood of their working in schools with specific characteristics (i.e., type of administration, student performance, and student socioeconomic background). Using logistic regression, the authors found that teachers with better results on their training programs' exit exams were more likely to work in high-income and high-performing schools than were teachers with the worst results on exit exams. And another recent paper, by Ruffinelli and Guerrero (2009), studied the allocation of a small sample of novice teachers across a set of elementary and middle schools. They found that novice teachers from the most selective undergraduate institutions were more likely to work in private schools than were those who attended less selective institutions. Finally, Ortuzar and colleagues (2009) followed a small sample of novice fourth grade public school teachers, looking at the relationship between their training programs and their schools' performance; they found that teachers who attended weaker training programs (semi-presencial and by distance) were more likely to work in low-performing schools.

There are several limitations to the existing empirical research base, however. First, studies have tended to conceptualize the distribution of teacher qualifications as the individual characteristics of teachers across schools. In other words, the focus has been on whether teachers with specific characteristics are more or less likely to work in specific schools. Secondly, studies have used a small sample of teachers (e.g., a random sample of the teacher labor force and/or a sample of novice elementary teachers). And third, most studies have focused only on a few measures of teacher qualifications, such as their test scores or experience level or the characteristics of their teacher training programs).

Unlike previous studies, this study focuses on the distribution of a variety of attributes across schools for a large sample of elementary school teachers (95% of the total population).[2] The large sample size allows for comparisons that are not possible with a smaller sample of teachers. For example, the data is large enough to study trajectories of novice teachers and to distinguish between several types of teacher career paths. Additionally, this study includes several indicators of teacher qualifications.

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[2] Chile has three types of schools: public schools, subsidized private schools (private schools with public funding) and fee-paying private schools (private schools without public funding). The universe for this study is all teachers who are were teaching in elementary schools with public funding, since fee-paying private schools are out of the scope of educational policies.

This paper has three specific goals relevant to the (in)equality of the Chilean educational system. The first is to analyze how much variation in the average attributes of teachers currently exists across schools. The second goal is to characterize this variation by school and student characteristics, and the third goal is to understand how the variation in the average attributes of teachers is associated with the job matches between teachers and schools at the start of their teaching careers as well as with the mobility and attrition of teachers.

Figure 1 presents my conceptual model for studying teacher sorting in Chile. Teachers have choices about where to start their teaching career, and then, whether to remain in the same school, change schools, or leave the teaching profession. Via their choice of first teaching job, new teachers can impact disparities between schools. Transfers of teachers between schools and the attrition of teachers from the profession may also impact equity, if there are systematic relationships between teacher characteristics and the types of schools they enter or leave. If teachers' decisions of where to teach and how long to teach vary systematically across schools or according to certain student/teacher characteristics, then teachers' choices will lead to unequal sorting of teachers across schools. Assuming that student performance relies on adequate staffing with qualified teachers, the lack of highly-qualified teachers in schools with higher proportions of low-income or low-performing students will be detrimental for the advancement of disadvantaged students, contributing to an increase in the current student achievement gap between low- and high-income students.
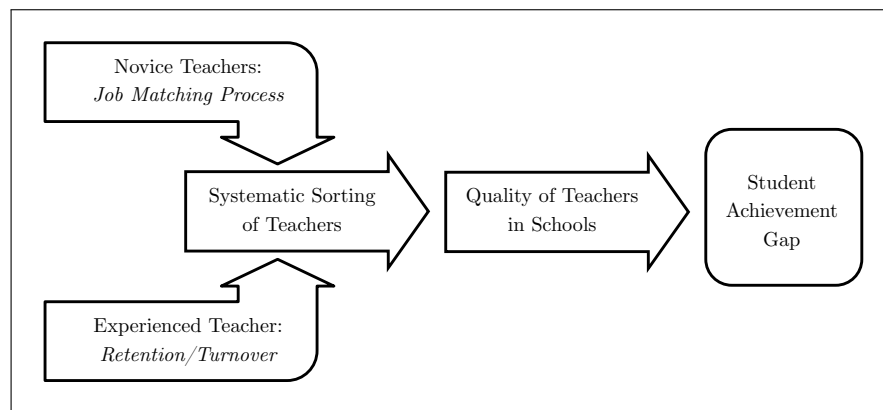
Figure 1: The role of teacher career paths on student achievement gap

A large body of empirical evidence shows that teachers' selection of schools is associated with the socio-economic status of the school. Boyd, Lankford, Loeb and Wyckoff (2002) found that the unequally distribution of high-qualified teachers across schools in New York is impacted by the teacher choice of their first teaching job. According to Planty and colleagues (2008), 21 percent of teachers at high-poverty schools leave their schools annually, compared to 14 percent of their counterparts in low-poverty settings. As

teachers transfer schools within districts, they typically leave schools that enroll lower-income students and enter schools with higher-income students (Hanushek, Kain and Rivkin, 2004). And as teachers leave high-poverty schools, these schools tend to replace them with less-qualified teachers (ibid).

In order to contribute to new knowledge about the Chilean teacher labor market, this paper addresses the following research questions:

1. How much variation in the average attributes of teachers currently exists across schools, across schools within comunas (districts), across comunas within regions, and across regions?

2. How is the variation in the average attributes of teachers associated with the characteristics of schools (e.g., public/private and/or urban/rural) and the characteristics of students (e.g., socioeconomic background and test performance)?

3. How is the variation in the average attributes of teachers associated with their selection of their first teaching job? How is the variation in the average attributes of teachers associated with the decisions of experienced teachers to transfer schools or leave the profession?

The next section offers a brief summary of the literature about measures of teacher quality and their relationship to student learning. Section 3 describes the measures of teacher qualifications that were constructed for this study along with the analytical method, data, and sample of teachers used. Section 4 provides results, and section 5 offers discusses the results.

DISCUSSION OF LITERATURE ON INDICATORS OF TEACHER QUALITY

While there is increasing agreement that more effective teachers produce dramatically greater student achievement than less effective teachers, much less consensus exists on the attributes of teachers that are responsible for these differences. A large body of literature has attempted to measure teacher quality and relate it to student learning.

To summarize the different indicators of teacher quality, Figure 2 presents six different categories that have been commonly used to measure and evaluate the quality of teachers over the last 50 years. For each of the six categories, the figure summarizes the ways that teacher quality is commonly defined as well as the examples of indicators that have been commonly used.

I. **Teacher characteristics**: academic ability that teachers bring with them when they enter college.
    1. Measures of academic ability through test scores and grades (college entrance test (SAT/ACT), Intelligent Test (IQ), Verbal ability (tests), GPA high school
II. **Teacher qualifications established prior to teaching**: knowledge of teaching and learning that teachers bring with them when they enter to the classrooms in the first year
    1. Measures of subject matter knowledge (education course work, number of courses in a subject area, subject-matter education, teacher education coursework performance, college ranking, college selectivity, college GPA, alternative teaching programs such as TFA, major college, master degree
    2. Mix between subject matter knowledge and knowledge in teaching and learning (Certification (PRAXIS I, II, INSTASC), Accreditation (NCATE)
III. **Teacher qualifications when entering teaching:** knowledge of teaching and learning that teachers accumulate after working in classrooms.
    1. Measures of subject matter knowledge and knowledge of teaching and learning (Advanced certification, years of experience)
    2. Measures of participation in continuing leaning (professional development)
IV. **Teacher effectiveness** as determined by **peer or self-rating evaluation**
    1. Peer evaluation (principal's perception of teacher performance, teachers, peer, mentors observation)
    2. Self-rating evaluation (teachers evaluate their own work)
V. **Teacher effectiveness** as determined by **students outcomes**:
    1. Measures of contributions to their students' learning (value added indicators)
VI. **Classroom practices:** ways in which teachers interact with students and the strategies used to accomplish specific teaching tasks (use of formative assessment, use of student-centered teaching approach, so on)

Figure 2: Six categories for examining teacher qualifications

Several studies have examined the relationship between these teacher quality indicators and student learning. Even though the results regarding teacher quality measures have been mixed (Wayne and Youngs, 2003), some teachers' attributes are associated with higher student achievement (Darling-Hammond, 2000; Goe, 2007; Fergursson and Ladd, 2006; Ehrenberg and Brewer, 1994)

Teacher quality has been measured using pre-college indicators (category 1), which tend to be assessed via college entrance test results (SAT and ACT) and college GPA, and by prior teacher characteristics established prior to entering teaching (category 2) such us teachers' degree level and coursework. Studies have shown a consistent positive relationship between college entrance test results and subsequent achievement of the teachers' students (Darling-Hammond, 2000; Goe, 2007; Fergursson and Ladd, 2006; Ehrenberg and Brewer, 1994). However, the results regarding teachers' degree level or coursework and the subsequent achievement of their students have been mixed (Wayne and Youngs, 2003). Many studies have also examined the effect of teacher education

programs on student achievement; for example, some studies using information about the quality of teachers' undergraduate institutions have found an effect on subsequent student outcomes (Ballou and Podgursky, 1996; Ehrenberg and Brewer, 1994; Ferguson and Ladd, 1996; Hanusheck and Pace, 1995).

Among the most historical and common approach to teacher quality measures have been measures of teacher qualification in service (category 3) such us teacher experience and certification (Zumwalt and Craig, 2005). Investigations of the effects of teachers' experience levels and certification status on student achievement have found a positive relationship between a teacher's years of experience and student performance during the teacher's first few years of teaching. But, after about the fifth year of teaching, the relationship is not consistently positive (Darling- Hammond, 2000; Goe, 2007). And measures such as holding a master's degree or a particular certification have not been consistent predictors of improvements in student achievement (Hanusheck, 1986, 1997). In general, these studies find that such individual characteristics of teachers have relatively small or null effects on student performance (Darling- Hammond, 2000; Goldhaber and Anthony, 2004; Cavalluzzo, 2004).

Meanwhile, evidence has consistently found that principals' assessments of teacher quality (category 4) have a significant positive relationship with student achievement (Murrnane, 1975, Arnor et al., 1976; Jacob and Lefgren, 2008). Many of today's researchers have embraced a value-added approach to assessing teacher quality (category 5); such measures examine the contribution that a teacher makes to the academic gains of his or her students (Rivkin et al., 2000; Sanders and Rivers, 1996). However, these measures of teacher quality do not tell us much about what high-quality teachers actually *do* in their classrooms. In response, many researchers prefer to analyze the presence and quality of teacher practices (category 6) in the classroom as an indicator of teacher quality. These studies have found that several teacher practices, such as the quality of the alignment of instruction and assessment and the use of formative assessment, have a significant positive relationship with student learning (Goe, 2007).

Although the effects of most teacher attributes may appear small in comparison to the substantial variation across students in how much they learn in a year, researchers have broadly used all of the indicators described in figure 2.

MEASURES, METHOD, DATA AND SAMPLE

Measures

To document the distribution of teachers across schools, given the data available, this study focuses primarily on teacher qualifications established prior to teaching and when entering teaching (figure 3).[3] For each of these two categories, five measures of average school-level teacher characteristics were created, including teacher experience,

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[3] Appendix 1 explains with more detail how each variable was created and their source.

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performance on state teacher exams (AEP and Docente Mas),[4] the competitiveness of the teacher's undergraduate institution, degree and subject area taught, course assignment, and teacher training program characteristics. Each of these measures, according to the literature discussed in section 2, bears some relationship to student achievement, although the relationship may not always be consistently significant or large in magnitude. This study does not suggest that any of these measures, taken individually, has the power to discriminate well between more and less effective teachers. However, these measures can provide useful insights, particularly because changes in teacher characteristics in the study setting may be influenced by educational policies.

I. Teacher qualifications established prior to teaching:
1. Percentage of teachers with a degree of secondary teacher
2. Percentage of teachers with specialization in any subject
3. Percentage of teachers who attended accredited teacher training programs
4. Percentage of teachers who attended teacher training programs longer than 9 semesters
5. Percentage of teachers who attended competitive undergraduate institutions

II. Teacher qualifications when entering teaching:
1. Percent of teachers with 2 or less teaching experience
2. Percentage of teacher with more than 25 years of experience
3. Percentage of teachers with specialization in their current subject
4. Percentage of exam takers who pass teacher AEP exam (private schools)
5. Percentage of exam takers who pass Docente Mas Exam (public schools)

Figure 3: Measures of teacher quality

Method

Several analyses were conducted to address the first research question. First, the distribution of teachers' attributes across schools was analyzed.[5] The mean, standard deviation, minimum and maximum for each of ten constructed measures were estimated, and examinations of these results across schools offered a first glance at the existence and magnitude of teacher sorting. Subsequent descriptive statistics (e.g., the 10th, 50th and 90th percentiles) allowed me to compare the distributions of teacher attributes across public schools with the lowest qualified teachers compared to those with the most qualified teachers.

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[4] AEP is a voluntary teacher assessment for private schools teachers to reward high performance public school teachers. Docente Mas is a mandatory teacher assessment just for teachers of public schools associated to high stakes policies.
[5] To calculate the proportion of teachers by each teacher attribute, I used two methods. First, I used a simple average where I weighted each teacher with the same weight, independent of his or her hours of teaching. Second, I used a weighted average by the number of hours that a teacher taught in the classroom. I used both methods because I found substantial variability in the numbers of hours teaching.

To better understand how this sorting occurs, I decomposed the variation of each teacher attribute within schools in the same comuna (district), between comunas in the same region, and across regions – primarily using analysis of variance based on one way ANOVA. First, I analyzed results by region, comuna, and schools within comunas independently. In each level, η^2 was the proportion of the variance between groups (e.g regions); η^2 is the ratio between the sum of squares between groups ($\mathcal{SSBetween}$) and the total sum of squares ($\mathcal{SSTotal}$).

$$\eta^2 = \frac{\mathcal{SSBetween}}{\mathcal{SSTotal}} = \frac{\sum(x_j - \bar{x})^2}{\sum(x_{ij} - \bar{x})^2} \tag{1}$$

where:

$$x_j = \text{ group mean } j$$
$$\bar{x} = \text{ grand mean}$$
$$x_{ij} = \text{ individual teacher of school } i \text{ in the group } j$$

Based on equation (1), η^2 for regions was obtained. Then, to estimate the proportion of the variance between comunas within regions, η^2 comunas was calculated and then η^2 comunas by η^2 regions was adjusted, meaning that to estimate the proportion of the variance between comunas within regions, the difference between η^2 comunas and η^2 regions was calculated. Finally, η^2 of school within comunas was calculated.

Parsing variation into within-district, between-district-within-region, and between-region components is useful for assessing the sorting of teachers across schools. For example, if most of the variation in teacher qualifications exists among regions, then systematic sorting of teachers may be reflecting other elements that vary substantially across regions, such the quality of undergraduate institutions or the availability of alternative occupations. In the opposite situation, if most of the variation in teacher attributes exists across schools within the same comuna, then teacher sorting may reflect differences among individual teachers and/or their school preferences.

A second analysis was run to characterize the variation in teacher attributes by school and student characteristics. To address the second research question, first I look at whether schools that have the least qualified teachers have distinctly different characteristics than schools that have the most qualified teachers. For this purpose, I created two categories of schools for each of the 10 teacher quality measures. The first category represents schools with the least qualified teachers, corresponding to those schools that are in the 10th percentile or lower of the distribution of each teacher measure (figure 3). The second category represents schools with the most-qualified teachers, corresponding to those schools that are in the 90th percentile or higher in the distribution of each teacher measure. Then, to characterize where the least/most qualified teachers are teaching and the cadres of students who are taught by these teachers, I analyzed the characteristics of these

groups of schools in terms of their location (rural/urban), type of administration (public/private), socioeconomic index (very low, low, medium, and high SEI)[6] and student achievement (very low, low, medium, and high).[7]

My next analysis assessed the systematic sorting of teachers across schools, specifically examining how teacher quality indicators are distributed across schools with different characteristics. For each teacher attribute, I estimated the proportion of teachers across different locations, school types, socioeconomic classifications, and student achievement strata.

Finally, to understand how the variation in the average attributes of teachers is associated with the job matches between teachers and schools at the start of teachers' careers, as well as by the mobility and attrition of teachers, I conducted several descriptive analyses that followed a cohort of teachers who were novices in 2007 for four years. First I examined the distribution of novice teacher attributes[8] across school characteristics to study how teachers' choice of first teaching job is related to the (in)equality of teachers across schools.

I then conducted several analyses to investigate teachers' transfer and departure decisions and assess different types of teacher career paths — for each teacher attribute I looked at (i) the proportion of teachers that stayed in the same school over time, (ii) the proportion that moved schools once within the public school system, (iii) the proportion who moved schools more than once within the public school system, (iv) the proportion of teachers who moved into the private school system, and (v) the proportion who left the profession. Then, among those teachers who moved schools, I examined the proportions that moved within the same comuna, moved within the same region, or moved to a different region. And within different types of first-teaching-job schools I examined the proportion of teachers who moved, left, and stayed. Finally, for those who quit or transferred, I compared their individual attributes to those of their colleagues who stayed and explored the educational environments to which the teachers moved.

Data

The data for this study were compiled from a number of sources. Bono de Reconocimiento Profesional (BRP) data, collected and maintained by the Chilean Ministry of Education (ME), served as my primary source. Each BRP data file contains rich, individual-level information about all public school teachers employed in Chile in a given academic year, such as the identity of the teacher's school, number of hours and months worked, position held, highest degree earned, institution where they earned highest degree, graduation year, and teaching assignment(s).

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[6] SEI is an aggregated variable derived from a cluster analysis of mother and father education, family income and an index of school vulnerability.

[7] I classified school performance in a national standardized math test called SIMCE into 4 categories: very low (lower than 220), low (between 220 and 249), medium (between 250 and 279) and high (higher than 280).

[8] I only used the initial five teacher attributes from figure 3, since novice teachers do not have experience and therefore do not have on-the-job measures for teacher quality measures.

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These BRP data were supplemented with data on teachers' personal characteristics (i.e., gender, age, years of experience) from the Idoneidad Docente (ID) dataset, which is also maintained by ME. The teacher workforce dataset was also complemented with information on teachers' baccalaureate college, taken from Consejo Nacional de Acreditación (CNA), Consejo de Educación Superior (CES) and Brunner et.al. (2005). Individual scores on teacher assessments (AEP and Docente Mas [DM]) were provided by ME.

Finally, public-use data files from SIMCE (Chile's national assessment system) and from ME yielded such school-level characteristics as average student socioeconomic status and test performance, as well as location and some characteristics of school administration. Appendix 2 explains in more detail the subjects, variables, time period and source of each dataset.

To understand how initial job matches influenced teacher variation, as well as how the mobility and attrition of teachers impacted teacher variation, I linked BRP data from 2007 to 2011 using a unique identification number available for Chilean teachers, then I added all the information described above to this teacher panel.

Sample

This study sample contains 79,418 unique elementary teachers from 5,521 public schools in 2011. This group of teachers represents 95 percent of all public elementary teachers and 68 percent of schools offering grades 1 to 8. Non-classroom teacher leaders were not considered in this study, and schools with fewer than four teachers or fewer than 20 students were removed.[9] Within this sample of elementary schools, 72 percent were located in an urban area, 60 percent served low-income students (i.e., those with low and very low SEI), 53 percent were public schools, and 60 percent had low achieving students.

The sample used in the second stage of my analysis included 1,695 novice elementary school teachers who were working in 1,200 public schools in 2007, a group that represented 60 percent of the novice teachers teaching in public schools that year. Novice teachers working less than 30 hours per week[10] were excluded.[11] Seventy five percent of these teachers were female, 41 percent worked in schools attended by low-income students, 82 percent worked in urban schools, 32 percent worked in public schools and 55 percent worked with low achieving students.

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[9] This exclusion is relevant in the elementary school system because there are a considerable number of small elementary schools in the country. Data from 2,470 elementary schools were deleted, which represented approximately 30 percent of the total elementary public schools when the sample was restricted to only those elementary schools with 4 or more teachers and 20 or more students. However, the exclusion is less relevant considered in terms of student enrollment and the total number of teachers across the country, as these excluded schools serve a small proportion (3 percent) of the total public student enrollment in Chile and employ a small proportion of the total teaching workforce (5 percent).
[10] A full-time teacher in Chile can work 44 hours per week.
[11] A sensitivity analysis was conducted to consider all novice elementary teachers working more than 22 hours a week (78 percent of all novices) found similar results as described in this study.

RESULTS

Question1: How much variation in the average attributes of teachers currently exists across schools, across schools within comunas (districts), across comunas within regions, and across regions?

Table 1 shows the mean, standard deviation, minimum and maximum for each teacher quality attribute. By almost any measure, the qualifications of teachers are unevenly distributed across schools, and this is true across a wide range of teacher attributes. In terms of the quality of the elementary teacher labor force in public schools, the results are striking. For example, the average proportion of teachers who studied in accredited universities is 49 percent and the average proportion of teachers who passed Docente Mas is 50 percent. And across almost all measures the standard deviation was high compared to the mean.

Table 2 displays the 10th, 50th and 90th percentiles of these teacher attributes. As shown, some schools have no teachers with fewer than two years of experience, some have teachers working outside their certification area, has and some employ few teachers possessing a degree longer than nine semesters (the 10th percentile or below). On the other hand, many other schools (90th percentile or above) have a substantial portion of teachers with less than three years of experience (46 percent), who are teaching courses for which they do have a specialization (63 percent), or who possess a degree longer than nine semesters (58 percent). Also notable in the data is the result that only 4 percent of teachers in 500 schools (10th percentile or below) went to highly selective institutions, compared with another 500 schools (90th percentile or above) where 72 percent of the teachers went to highly selective institution.

Table 1: Descriptive statistics for measures of teacher quality

Teacher quality attribute	N	Mean	SD	MIN	MAX
Competitiveness of undergraduate institution					
Highly selective	5,521	0.37*	0.25	0	1
Degree and specialty					
Hold a degree for Secondary education	5,521	0.10	0.14	0	1
Hold an education degree with specialization	5,521	0.42	0.22	0	1
Teacher training program					
Longer than 9 semesters	5,521	0.28	0.21	0	1
Accredited TEP	5,521	0.52	0.23	0	1
Teacher assignment	5,521	0.30	0.23	0	1
Teacher experience					
With less than 2 years of experience	5,521	0.20	0.18	0	1
With more than 25 years of experience	5,521	0.33	0.25	0	1
Performance on teacher assessment					
Passed AEP	2,603	0.08	0.11	0	0.86
Passed Docente Mas	2,918	0.49	0.23	0	1

* E.g the average proportion of teachers across schools with BA from most selective school is 37%.

Table 2: Percentiles 10th, 50th and 90th for measures of teacher quality

Teacher quality attribute	Percentile		
	10th	Median	90th
Competitiveness of undergraduate institution			
Highly selective	0.04*	0.35	0.72
Degree and specialty			
Hold a degree for Secondary education	0	0.05	0.30
Hold a Education degree with specialization	0.13	0.42	0.71
Teacher training program			
Longer than 9 semesters	0	0.24	0.58
Accredited TEP	0.21	0.26	0.63
Teacher assignment	0	0.26	0.63
Teacher experience			
With less than 2 years of experience	0	0.16	0.46
With more than 25 years of experience	0	0.30	0.67
Performance on teacher assessment			
Passed AEP	0	0.06	0.22
Passed Docente Mas	0.27	0.52	0.74

* E.g 10% of schools have 4% teachers who obtained a BA from most selective schools

To analyze how much of the variation in teacher attributes exits across comunas and regions, I decomposed the variation of each teacher quality measure across schools within comunas, across schools between comunas (within regions), and across schools between regions. Although this partition differs across some of the measures, there is a remarkable consistency in the finding that most of the variance in teacher qualifications occurs among schools *within* comunas (table 4.3); the proportion of total variance between schools ranges from 41 to 92 percent.

The substantial sorting of teachers across schools within comunas suggests that the characteristics of schools and/or teacher preferences may be playing an important role in teachers' choosing where to teach. The policy implications of this finding are important, especially when reforms targeting the unequal distribution of teachers are considered. And the sorting that occurs between comunas and between regions suggests that local differences may also be playing a role in teacher sorting. Table 3 indicates that the proportions of teachers who went to highly selective universities and who studied accredited programs across regions are highly variable. This fact may reflect the reality and constraints of teacher preparation programs, and/or the supply of teachers at the regional level. Some regions, such as those in the 1st and 10th percentile, do not have any local selective institutions from which to hire teachers. Other regions do not have an accredited program.

Given that variability in teacher attributes is mostly between schools within comunas, I analyzed in more detail the dispersion of teacher attributes. Graphs 1 and 2 present, from a random sample of 150 comunas, the distribution across schools of the proportion of teachers who hold a degree in education from an accredited institution (graph 1) as well as the distribution across schools of the proportion of teachers with less than 3 years of

experience (graph 2).[12] Each bar represents one comuna, with comunas sorted by their median (the 50th percentile of the proportion of teachers). The grey zone shows the range where 50 percent of the schools in the comuna are situated (i.e., within percentiles 25 and 75).

Table 3: Analysis of variance for measures of teacher quality

Teacher quality attribute	Between regions	Between comunas within regions	Between schools within comunas
Competitiveness of undergraduate institution			
Highly selective	31%	28%	41%
Degree and specialty			
Hold a degree for Secondary education	7%	10%	83%
Hold a Education degree with specialization	9%	20%	71%
Teacher training program			
Longer than 9 semesters	13%	21%	66%
Accredited TEP	32%	24%	44%
Teacher assignment	9%	26%	65%
Teacher experience			
With less than 2 years of experience	2%	6%	92%
With more than 25 years of experience	4%	13%	83%
Performance on teacher assessment			
Passed AEP	4%	5%	91%
Passed Docente Mas	3%	11%	86%

Figures 4 and 5 show that the between-comuna differences in the proportions of teachers from accredited institutions are relatively high in comparison to the between-comuna differences in the proportions of teachers with less than three years of experience.

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[12] I chose these two measures as an example of the two extremes: the highest variability across schools within comunas versus the lowest variability across schools within comunas.

Figure 4: School variation in proportion of teachers from accredited institution across comunas
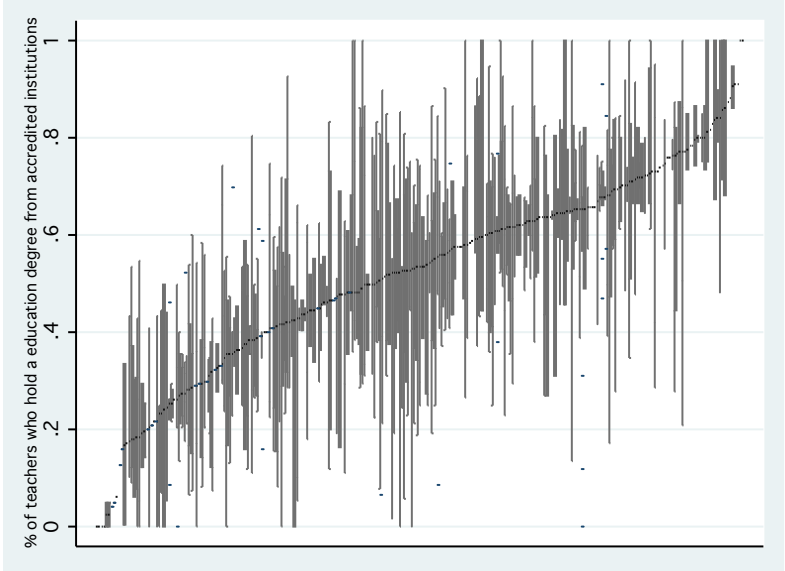
Comunas

Figure 5: School variation in proportion of teachers without experience across comunas
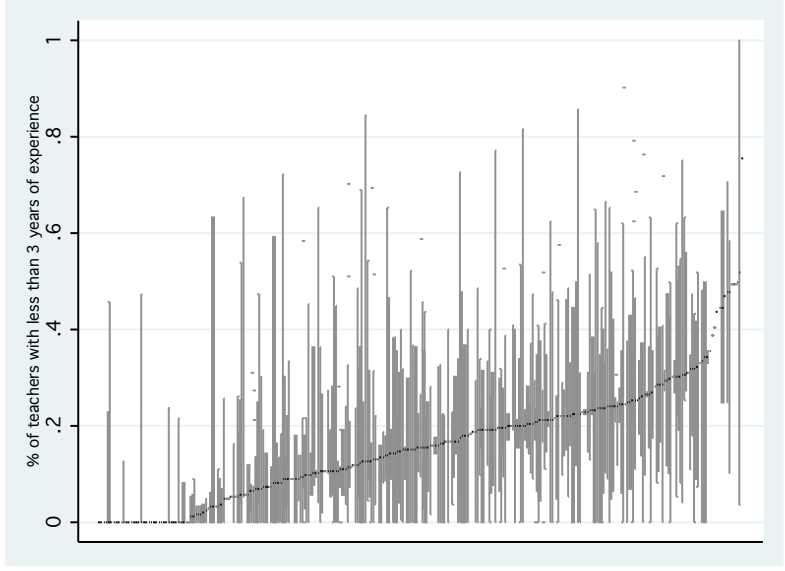
Comunas

Question 2: How is the variation in the average attributes of teachers associated with the characteristics of schools (e.g., public/private and/or urban/rural) and the characteristics of students (e.g., socioeconomic background and test performance)?

While the above analysis describes the extent of teacher sorting, it does not reveal whether there is systematic sorting associated with some teacher characteristics. To explore this, tables 4.A and 4.B display where the least qualified teachers are teaching (corresponding to those schools in percentile 10 or lower in the distribution of each teacher attribute), and where the most qualified teachers are teaching (corresponding to those schools in percentile 90 or above).

Table 4.A: School characteristics of schools of less and greater qualified teachers

Teacher quality attibute	Schools	Student Peformance				Socioeconomic classification			
		Very Low	Low	Medium	High	Very Low	Low	Medium	High
Competitiveness of undergraduate institution									
Highly selective	Low %	23*	45	30	3	31	43	18	9
	High %	18	42	35	6	18	38	32	12
Degree and specialty									
Hold a degree for Secondary education	Low %	25	44	29	2	33	44	17	6
	High %	6	22	56	16	2	13	37	48
Hold a Education degree with specialization	Low %	24	44	29	3	36	44	17	4
	High %	11	33	45	11	14	27	31	29
Teacher training program									
Longer than 9 semesters	Low %	28	41	27	3	46	42	8	3
	High %	15	32	43	10	10	20	36	35
Accredited TEP	Low %	4	40	32	4	24	40	26	10
	High %	15	36	39	10	20	33	26	10
Teacher assignment	Low %	40	43	14	4	27	44	28	2
	High %	20	37	28	16	15	41	37	8
Teacher experience									
With less than 2 years of experience	Low %	26	45	27	2	34	50	13	4
	High %	20	38	37	4	16	30	36	19
With more than 25 years of experience	Low %	18	37	39	5	20	29	33	18
	High %	25	46	29	1	31	55	13	2
Performance on teacher assessment									
Passed AEP	Low %	19	36	40	6	17	34	37	20
	High %	17	29	50	4	10	17	37	36
Passed Docente Mas	Low %	38	43	18	1	42	51	6	0
	High %	18	46	33	4	29	51	18	2

* For example, 23 percent of schools with less-qualified teachers, in terms of the proportion of teachers from highly selective institutions, have very low student performance.

Table 4.B: School characteristics of schools of less and greater qualified teachers

Teacher quality attibute	Schools	Location		Type of school	
		Urban	Rural	Public	Private
Competitiveness of undergraduate institution					
Highly selective	Low %	59*	41	75	25
	High %	72	28	32	68
Degree and specialty					
Hold a degree for Secondary education	Low %	55	45	65	35
	High %	96	4	8	92
Hold a Education degree with specialization	Low %	38	62	62	38
	High %	82	18	32	68
Teacher training program					
Longer than 9 semesters	Low %	31	69	67	33
	High %	89	11	20	80
Accredited TEP	Low %	64	36	48	52
	High %	73	27	38	62
Teacher assignment	Low %	44	56	66	34
	High %	65	35	47	53
Teacher experience					
With less than 2 years of experience	Low %	49	51	80	20
	High %	80	20	13	87
With more than 25 years of experience	Low %	74	26	11	89
	High %	59	41	93	7
Performance on teacher assessment					
Passed AEP	Low %	84	16		
	High %	87	13		
Passed Docente Mas	Low %	35	65		
	High %	53	47		

* For example, 59 percent of schools with less-qualified teachers, in terms of the proportion of teachers from highly selective institutions, are urban schools.

The results are striking. For a variety of teacher attributes, table 4.4 shows that less qualified teachers tend to be employed in higher proportions in public and rural schools and schools with low-income and low-performance students.[13] The highest degree of sorting across schools was evident in the areas of teacher degree and specialization: 80 percent of the schools with low proportions (below 10 percent) of certified teachers enroll low-income students, as compared with only 41 percent of schools with highly-certified teaching staffs (i.e., 70 percent or more certified).

In terms of the distribution across location and type of school administration, the analysis shows that the highest differences are not only observed by degree and specialization variables, but also by teachers' years of experience. Teachers with less than two years of experience tend to work mostly in private schools, whereas teachers with more than 25 years of experience tend to work in public schools. Also, less-qualified teachers are employed in higher proportions in rural schools. For example, 69% of schools with less qualified teachers in terms of length of teacher preparation program are rural compared with 11% of schools with more qualified teachers.

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[13] For simplicity, I classified schools by their average 4th grade math test scores. The results are similar if language exam results were used; the correlation was 0.89.

The results also show that teacher attributes on the job (teacher assignment, teacher experience and performance on teacher assessment) are more equitably distributed across schools with different characteristics. A range from 3 to 35 percentage points of difference is observed between schools with high-qualified teachers v/s less qualified teachers across several school characteristics. For example, 84 percent of the schools with no teachers passing AEP are urban, while 87 percent of schools with a high proportion of AEP-passing teachers are not. And schools with a high proportion of teachers with over 25 years of experience are more likely to be attended by low-income students than schools without teachers with more than 25 years.

Finally, Tables 5 and 6 show the distribution of a variety of teacher attributes across rural and urban areas, type of school administration, and student socioeconomic status, respectively. As expected, these analyses confirm the previous findings. Rural and public schools tend to employ higher proportions of less qualified teachers.

Table 5: Proportion of teachers by school characteristics for measures of teacher quality

Teacher quality attribute	School characteristics			
	Urban	Rural	Public	Private
Competitiveness of undergraduate institution				
Highly selective	**40%**	35%	7%	**20%**
Degree and specialty				
Hold a degree for Secondary education	**12%**	3%	5%	**15%**
Hold a Education degree with specialization	**46%**	32%	38%	**46%**
Teacher training program				
Longer than 9 semesters	**32%**	17%	22%	**35%**
Accredited TEP	**52%**	49%	50%	**54%**
Teacher assignment	**32%**	23%	26%	**33%**
Teacher experience				
With less than 2 years of experience	**22%**	16%	12%	**28%**
With more than 25 years of experience	31%	**38%**	**46%**	17%
Performance on teacher assessment				
Passed AEP	**8%**	6%		
Passed Docente Mas	**51%**	46%		

Table 6: Proportion of teachers by school socioeconomic classification for measures of teacher quality

Teacher quality attribute	School socioeconomic clasification			
	Very Low	Low	Medium	High
Competitiveness of undergraduate institution				
Highly selective	35%	35%	40%	45%
Degree and specialty				
Hold a degree for Secondary education	5%	8%	16%	**28%**
Hold a Education degree with specialization	35%	41%	48%	**58%**
Teacher training program				
Longer than 9 semesters	20%	25%	35%	**44%**
Accredited TEP	49%	50%	53%	**59%**
Teacher assignment	26%	29%	33%	**37%**
Teacher experience				
With less than 2 years of experience	17%	17%	22%	**24%**
With more than 25 years of experience	**39%**	39%	29%	22%
Performance on teacher assessment				
Passed AEP	5%	10%	12%	**15%**
Passed Docente Mas	40%	49%	55%	**61%**

Poor students also tend to be taught by less-qualified teachers. Only 20 percent of teachers who work in low-income schools studied in a teacher training program spanning 10 or more semesters, compared with 44 percent of the teachers working in high-income schools (table 4.6). Moreover, lower performing students are more likely to be enrolled in schools that employ less-skilled teachers. Table 7 shows that schools with average test scores below 220 tend to employ lower-qualified teachers than do schools with higher test scores.

However, some teacher attributes are more equitably distributed. For example, only 8 percent of teachers working in schools with very low performance hold a degree for secondary school teaching, as compared with 26 percent of teachers who work in high performance schools. On the other hand, 35 percent of teachers who work in low performing schools went to highly selective institutions, as compared with 38 percent of teachers working in high performance schools.

Table 8 shows the correlations between each teacher quality attribute and student test scores. The results are similar, indicating that lower-qualified teachers are more likely to teach lower-performance students. Holding a degree in secondary education (0.35) and studying in an accredited university (0.32) have the highest positive correlation with math test scores.

Table 7: Proportion of teachers by school student achievement for measures of teacher quality

Teacher quality attribute	Student achivement			
	Very Low	Low	Medium	High
Competitiveness of undergraduate institution				
Highly selective	35%	36%	37%	**38%**
Degree and specialty				
Hold a degree for Secondary education	8%	10%	17%	**26%**
Hold a Education degree with specialization	40%	43%	49%	**58%**
Teacher training program				
Longer than 9 semesters	27%	29%	34%	**41%**
Accredited TEP	48%	50%	55%	**60%**
Teacher assignment	27%	30%	33%	**37%**
Teacher experience				
With less than 2 years of experience	19%	19%	21%	**22%**
With more than 25 years of experience	**38%**	35%	30%	25%
Performance on teacher assessment				
Passed AEP	8%	8%	9%	**12%**
Passed Docente Mas	38%	50%	54%	**60%**

Table 8: Correlations between measures of teacher quality and students test score

Teacher quality attribute	Test Math Score
Competitiveness of undergraduate institution	
Highly selective	0.02
Degree and specialty	
Hold a degree for Secondary education	0.35
Hold a Education degree with specialization	0.24
Teacher training program	
Longer than 9 semesters	0.21
Accredited TEP	0.32
Teacher assignment	0.15
Teacher experience	
With less than 2 years of experience	0.07
With more than 25 years of experience	-0.18
Performance on teacher assessment	
Passed AEP	0.19
Passed Docente Mas	0.20

In summary, less-qualified teachers are more likely to teach poor, low-performing students in rural and municipal schools. A portion of these differences is due to differences in the average characteristics of teachers across regions and districts, but

differences among schools within districts seem to explain the largest proportion of variation in teacher quality.

Question3: How is the variation in teacher attributes associated with teachers' selection of first teaching job? How is the variation in teacher attributes associated with the decisions of experienced teachers to transfer schools or leave the profession?

New teachers impact the disparities between schools through their choice of first teaching job. Tables 9.A and 9.B show the characteristics of schools employing low- and highly-qualified novice teachers.[14] The results are straightforward. For each teacher attribute, the more-qualified novice teachers are more likely to work in urban, private schools, schools with higher-achieving students, and/or schools with higher income students. Holding a secondary education degree shows the greatest inequalities, as a teacher with a bachelors degree in secondary education is twice as likely to work in schools with high student performance, and teachers without such a degree are three times as likely to work in rural schools than in urban schools and are also three times as likely to work in public schools than private schools.

Table 9.A: School characteristics of schools of less and greater qualified teachers

Teacher quality attibute	Student Peformance 2006				Socioeconomic classification			
	Very Low	Low	Medium	High	Very Low	Low	Medium	High
Competitiveness of undergraduate institution								
Highly selective	18*	35	41	6	12	28	33	27
Not-Highly selective	20	36	41	3	16	28	33	24
Degree and specialty								
Hold a degree for Secondary education	7	32	55	7	3	16	36	45
Not-Hold a degree for Secondary education	21	36	40	3	14	29	33	22
Hold a Education degree with specialization	16	33	46	5	9	21	36	34
Not-Hold a Education degree with specialization	23	37	38	2	15	32	31	22
Teacher training program								
Longer than 9 semesters	20	35	43	3	11	27	34	28
Equal or shorter than 9 semesters	19	36	40	5	14	28	33	25
Accredited TEP	18	35	43	4	11	27	36	27
Not accredited TEP	22	37	38	3	15	20	30	25

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[14] Only proxies of teacher quality correspond to prior working as teacher ability and teacher preparation variables were used.

Table 9.B: School characteristics of schools of less and greater qualified teachers

Teacher quality attibute	Location		Type of school	
	Urban	Rural	Public	Private
Competitiveness of undergraduate institution				
Highly selective	82	18	32	68
Not-Highly selective	77	23	32	68
Degree and specialty				
Hold a degree for Secondary education	94	6	12	88
Not-Hold a degree for Secondary education	79	21	35	65
Hold a Education degree with specialization	87	13	14	86
Not-Hold a Education degree with specialization	7	13	14	86
Teacher training program				
Longer than 9 semesters	81	19	29	71
Equal or shorter than 9 semesters	81	19	35	65
Accredited TEP	4	16	27	73
Not accredited TEP	77	23	40	40

Transfers of teachers between schools and the attrition of teachers may also impact the equity of the teacher quality distribution if there are systematic patterns in the teachers who leave or transfer and/or patterns in the schools they transfer to or depart from. This section summarizes the results of my following a cohort of teachers hired to their first teaching jobs in schools with public funding in 2007 over the first five years of their careers. Table 10 illustrates several career paths of these teachers, and shows that 46 percent of the teachers with no prior teaching experience hired in 2007 remained until 2011 in the same school in which they began their careers. Thirty-four percent had moved to another school with public funding (public or private) within the period, while only 2 percent had moved to the private school system and 17 percent were no longer working as teachers in 2011.

Table 10: Teacher career paths

Teacher career paths	N	%
Stay	773	46
Move one time	466	27
Move more than 1 time	126	7
Move to private school system	34	2
Leave the profession	296	17
Total	1,695	100

In terms of where these teachers moved to, table 11 indicates that almost half of them moved between schools within the same comuna, while only 15% moved to schools in a different region.

Table 11: Type of attrition

Type of attrition	N	%
Move within comuna	258	44
Move within region	233	39
Move between regions	101	17
Total	592	100

To examine the ways in which teachers' career paths might impact the distribution of teacher attributes across schools, Table 12 illustrates some differences in the career paths of teachers across school characteristics. The results show that novice teachers who started working in low-performing schools, low-income schools, rural schools, and public schools tended to leave more (stay less) compared to teachers who started in high-performing schools, high-income schools, urban schools and private schools. The results differ considerably between regions, though. For example, 74 percent of the novice teachers in 2007 in region 3 stayed in the same school through 2011, compared with 38 percent of the novice teachers in region 1. In terms of the type of movement that was observed, I found no systematic relationship between school characteristics and teachers moving from the public school system to the private school system. However, for those teachers who decided to leave the profession, those teachers who started their careers in high performing, high-income, urban or private schools were more likely to leave the profession.

Given that teachers have been shown to gain substantial skills during their first few years of teaching (Rivkin, Hanushek and Kain, 2000), a high exit rate of more experienced teachers may impact the quality of education that students receive in a particular school. Additionally, turnover could have a negative impact as well if more qualified teachers generally transfer or leave the system (leaving behind their less qualified colleagues). This appears to be the case; Table 13 shows that less qualified teachers who began their careers in 2007 tended to stay in their initial schools in higher proportion than did more qualified teachers. For example, only 41 percent of the teachers from preparation programs with 10 or more semesters stayed in their first schools, as compared with 51 percent of teachers with less than 10 semesters.

Table 12: Teacher mobility and attrition by school characteristics

School characteristics	Stay	Move	Move to private school system	Leave the profession
Student Peformance 2006				
Very Low	37	46	16	1
Low	46	34	18	2
Medium	46	28	24	2
High	38	41	19	2
Socioeconomic classification				
Very Low	31	52	16	1
Low	44	36	19	1
Medium	48	32	17	3
High	53	26	18	3
School location				
Urban	49	31	18	2
Rural	32	49	19	0
School type				
Public	43	42	15	0
Private	48	31	19	2
Region				
1	38	40	20	2
2	46	35	13	6
3	74	20	3	3
4	50	31	18	1
5	40	38	21	1
6	41	35	24	0
7	39	47	13	1
8	45	39	14	2
9	43	35	21	1
10	43	39	17	1
11	46	39	15	0
12	60	40	0	0
13	49	30	18	3
14	38	42	21	0
15	39	23	39	0

Note: percentage of teachers by their school attribute in 2007

Table 13: Teacher mobility and attrition of schools of less and greater qualified teachers

Teacher quality attibute	Stay	Move	Move to private school system	Leave the profession
Competitiveness of undergraduate institution				
Highly selective	38*	43	17	2
Not-Highly selective	47	33	17	2
Degree and specialty				
Hold a degree for Secondary education	40	41	19	1
Not-Hold a degree for Secondary education	48	36	14	1
Hold a Education degree with specialization	44	36	17	3
Not-Hold a Education degree with specialization	47	34	17	2
Teacher training program				
Longer than 9 semesters	41	40	17	2
Equal or shorter than 9 semesters	51	31	14	1
Accredited TEP	47	36	16	1
Not accredited TEP	48	37	14	2

To examine the interactions between teacher attributes, school characteristics, and teacher mobility, Figure 6 and 7 show the proportion of low/highly-qualified teachers with subject-area qualifications[15] who stayed in the same school for four years, across school characteristics. Highly qualified teachers appear to show different career paths that less qualified teachers. For example, less qualified teachers working in low-income and low-performing schools were more likely to stay in those schools than were more qualified teachers (figure 6). And, at the same time, less qualified teachers who started working in high-income and high-performing schools were less likely to remain in those schools than were high-qualified teachers. This findings support the fact that teachers' career trajectories are systematically related to inequalities in the distribution of teacher quality across Chile's elementary schools.

Figure 6 also shows that higher proportions of highly qualified teachers remain in schools with higher average student incomes and higher student test performance. However, the proportion of less-qualified teachers who stay in high income and high performing schools is lower than that which remains in low and medium income and low performing schools, thus increasing the observed inequality of qualified teachers across schools.

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[15] I chose this teacher "quality" measure just to exemplify the results. The graphs look very similar for each quality measure.

Figure 6: Percentage of high and low qualified teachers who stay 4 years in the same schools by student performance


Figure 6 chart: Line graph showing % of teachers who stay in the same school after 4 years by student achievement. Low qualified: Very low 39%, Low 50%, Medium 53%, High 38%. High qualified: Very low 35%, Low 40%, Medium 55%, High 56%.
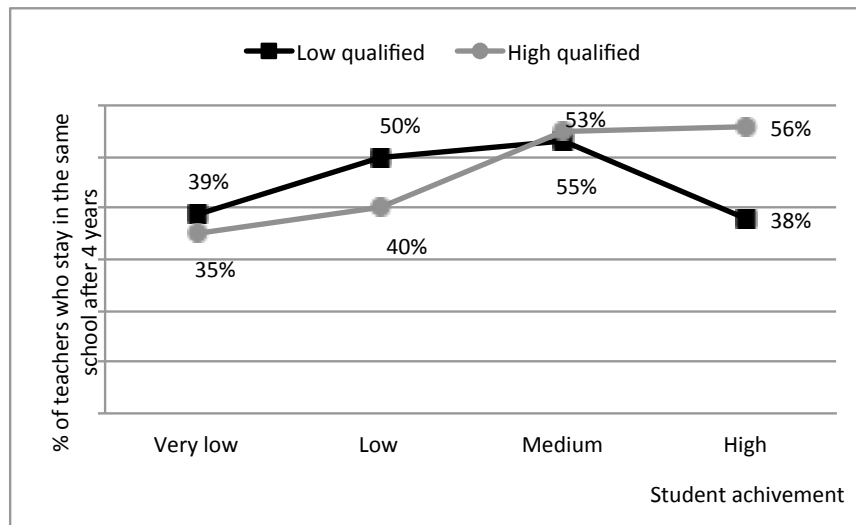
Figure 7: Percentage of high and low qualified teachers who stay in schools by school socioeconomic classification

Figure 7 chart: Line graph showing % of teachers who stay in the same school after 4 years by school socioeconomic classification. Low qualified: Very low 32%, Low 46%, Medium 51%, High 50%. High qualified: Very low 28%, Low 41%, Medium 45%, High 56%.
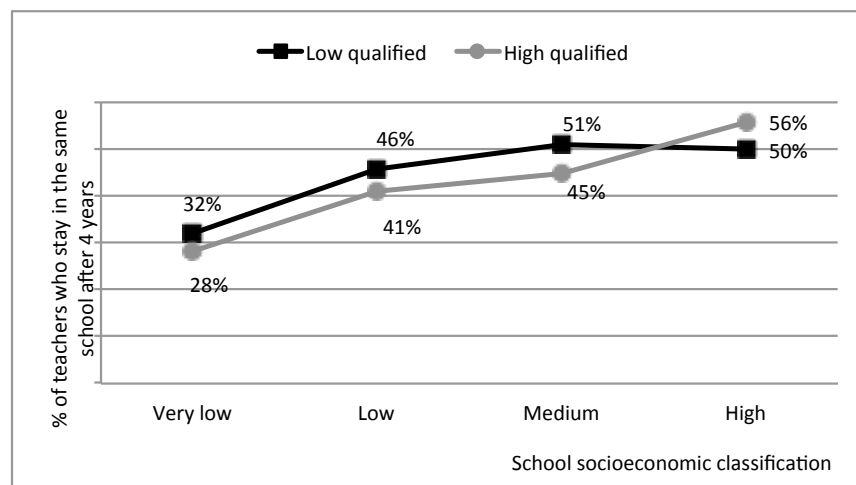
Figure 8 shows the proportion of teachers across school location and school type. The results show that both low and high-qualified teachers tend to remain in urban schools in higher proportions than in rural schools. When school type is analyzed, the results are remarkable. The proportion of less qualified teachers staying in public schools is far higher than in private schools, while, conversely, the proportion of highly-qualified teachers staying in public schools is lower than in private schools.

Figure 8: Percentage of high and low qualified teachers who stay in schools by school location and type of school
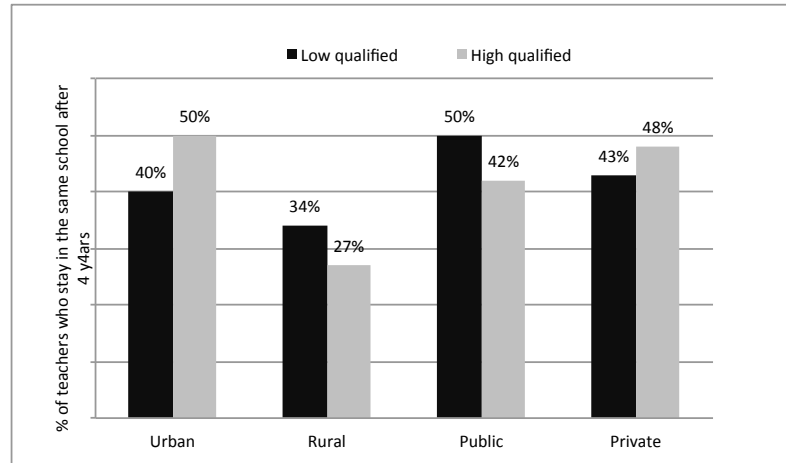
There are also systemic patterns among the school environments that these leavers depart and, in turn, are drawn to, particularly when teachers move across district boundaries. Table 14 illustrates this dynamic for teachers in the 2007 cohort who transferred during the next four years. Teachers generally left schools where students' test scores were lower than the scores in their destination schools. This trend was observed for each type of career path.

Table 14: School characteristics of sending and receiving schools between 2007 and 2011

Teacher career paths	Student Math Test Scores		
	Sending school	Receiving school	Difference in mean test score
Move between schools in public school system	241	248	7
Move to private school system	245	249	4
Move within comuna	238	241	3
Move within region	242	256	14
Move between regions	243	247	4

DISCUSSION AND CONCLUSIONS

By any measure, teacher attributes are unevenly distributed across schools, and differences in the teacher qualifications occur mainly between schools within comunas rather than between schools within regions or across regions. The proportion of the total variance explained by differences between schools within comunas ranges from 41 to 92 percent. Results also suggest that public and rural schools tend to employ higher proportions of less qualified teachers, and schools with less qualified teachers tend to enroll higher proportions of low-income and low-performing students. Findings are consistent when a cohort of novice teachers is followed over time. The most qualified novice teachers are more likely to work in urban, private schools, schools with higher achieving students, and in schools with higher income students.

Teachers make varying career decisions after their first job experience. Only 46 percent of the novice teachers hired in 2007 remained in the same school until 2011. Thirty four percent of the cohort moved to another school with public funding within the period, two percent moved to the private school system, and 17 percent were no longer working as teachers in 2011. Additionally, most of the teachers moved between schools within the same comuna (44 percent) and only 15% moved between schools between regions. And teacher career paths differ depending on the type of school where the teacher begins work. Novice teachers who start working in low-performing, low-income, rural and/or public schools tend to leave more (stay less) compared to teachers who start in high-performing, high-income, urban and/or private schools. Teacher career paths are clearly associated with the unequal distribution of teacher attributes across schools — less qualified teachers working in low-income and/or low-performing schools were more likely to stay in those schools than were highly qualified teachers, while less qualified teachers who started working in high-income and/or high-performing schools were less likely to stay than were high-qualified teachers.

The findings of this study suggest that a policy focus on the distribution of highly qualified teachers across schools may be a worthwhile way to address student achievement gaps. Schools serving low-income and/or low-performing students in public and/or rural schools confront an enormous challenge when it comes to recruiting and retaining highly qualified teachers. The fact that substantial sorting of teachers is found between schools within comunas suggests that the characteristics of schools and/or teacher preferences may be playing an important role in teachers' choosing where to teach.

Policymakers have paid increasing attention to strategies for enhancing teacher quality in public schools. Most of these efforts have focused on attracting better teacher candidates into the profession — for example via increased salaries, expanded alternative certifications, and the creation of teaching scholarships for high-performing students. However, the lack of comprehensive understanding of the teacher labor market poses a key impediment to the development of effective teacher workforce policies.

By documenting the extent and the nature of teacher sorting, this study provides a foundation on which to build more expansive models of teacher sorting and mobility

behavior. It is a first step in understanding teacher career paths in the Chilean teacher labor market. But documenting how the qualifications of teachers differ across schools is not enough to solve the problems caused by inequities or inadequacies in instructional resources. To design and implement effective policies to attract and retain highly qualified teachers in schools that serve low income and/or low-performing students, additional research must be carried out to investigate teachers' preferences as well as the phenomena of teacher attrition and teacher retention. The underlying mechanisms driving the unequal distribution of teachers must be determined.

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APPENDIX

Appendix 1: Teacher quality measures

Teacher quality attribute	Data and description
Competitiveness of undergraduate institution	
Highly competitive	Based on Brunner 2005 classification of selective universities, this variable takes value 1 if a teacher studies a degree in education in the following competitive institutions: PUC, PUCV, UDEC, UDP, UFT, UA HURTADO, U ANDES
Degree and specialty	
Hold a degree for Secondary education	Based on BRP data, this variable takes value 1 if a teacher receives a bonus associated with holding a degree for teaching at secondary level
Hold a Education degree with specialization	Based on BRP data, this variable takes value 1 if a teacher receives a bonus associated with holding a specialization to teach a subject either in elementary and/or secondary schools
Teacher training program	
Longer than 9 semesters	Based on BRP data, this variable takes value 1 if a teacher has a degree in education (elementary, secondary, special education or pre-elementary) longer than 9 semesters.
Accredited TEP	Based on BRP data, this variable takes value 1 if a teacher has a degree in education (elementary, secondary, special education or pre-elementary) in an acrcrediated institution.
Teacher assignment	Based on BRP data, this variable takes value 1 if a teacher has a degree and specialization in the same subject that, at least, one of the classes that he or she was assigned in the school.
Teacher experience	
With less than 2 years of experience	Based on Idoneidad docente data, this variable takes value 1 if a teacher has 2 or less years of experience as a teacher.
With more than 25 years of experience	Based on Idoneidad docente data, this variable takes value 1 if a teacher has 25 or more years of experience as a teacher.
Performance on teacher assessment	
Passed AEP	Based on teacher assessment results data, this variable takes value 1 if a teacher passed AEP assessment and works in a private school.
Passed Docente Mas	Based on teacher assessment results data, this variable takes value 1 if a teacher scored 2.5 or more points in the portfolio section of the test and works in a public school.

Appendix 2: Work force Database

Workforce Database	Personal data	Teacher assessment data	Undergraduate institution data	School data
Universe	All public schools teachers	All individual taking certification exams	All undergraduate institution	All schools
Elements	- Teacher ID - Gender - Experience - Degree attainment - Specialization - Undergraduate Institution - Length of teacher degree - School ID	- Teacher ID - Scores on AEP - Scores in Docente Mas	- Institution univerisity - Accredited - Competitiveness of institution	- School ID - Type of adminsitration - Socioeconomic classification - Urban/rural - SIMCE scores - Location - Student Enrollment - Undergraduate Institution
Time period	March 2007-March 2011	2007-2011	2011	2007-2011
Name of data	Bono de Reconocimiento Profesional (BRP) 2007-2011 and Idoneidad Docente 2007 and 2010	Resultados evaluacion docente	Built based on public information	SIMCE 2006, SIMCE 2011, and Directorio de establecimientos 2007-2010
Source	Ministerio de Educación, Chile	Ministerio de Educación, Chile	Consejo Nacional de Acreditacion (CNA), Consejo de Educacion Superio (CES), Brunner (2005)	Ministerio de Educación, Chile

CHAPTER 2: CAN PUBLIC SCHOOLS KEEP TEACHERS? WHO LEAVE AND WHEN THEY LEAVE

The educational system confronts an enormous challenge: maintaining the equity and quality of the educational system. Policymakers are struggling to improve the low student achievement of many students and reduce the large differences in achievement that exist among socio-economic groups. In many countries, most recent discussion of education has focused on the quality of teachers. Recent research on student achievement identifies the important link between teachers and student outcomes. A great teacher can make a huge difference in the lives of students, especially to low-income students (McCaffrey, et al. 2003). Having a good teacher for three to five years would eliminate the average gap between children who do and do not receive free or reduced-price lunch, and between whites and blacks or Hispanics (Hanusheck, 2010).

Education reformers have recognized the key role of teachers in classrooms, implementing a variety of policies to improve the quality of school public teachers as well as to attract more qualified teachers into most needed schools. Chile is not the exception. During the last years, policymakers have shown a growing attention on strategies for enhancing teacher quality of public schools. Most of efforts have focused on attracting better teachers' candidates into the profession. The increase of salaries, the expansion of alternative certification, and the creation of scholarships for high academic students are the main implemented policies. For example, the last and most important teacher reform, the scholarship "Beca Vocación de Profesor", seek to improve the overall teacher quality in schools, particularly in public schools[16], paying tuitions and fees costs to more than 20% of prospective teachers in 2011. Other few initiatives aim to enhance high quality teachers to work in most needed schools. For instance, Enseña Chile (equivalent to Teacher for America) work with high academic ability college graduates who commit two years to teach in under-resourced urban and rural public schools.

However, the effectiveness of attracting better teacher candidates on the academic quality of public teacher labor force relies crucially on the trajectory of these teachers' career. The impact of these policies on the documented unequal distribution of teachers across schools will also depend on teacher choices. Even though, educational policies (e.g Beca Vocación de Profesor) may success attracting high academic students into teacher career (e.g teacher preparation programs)[17], where new teachers choose to teach, how long teachers stay teaching, when teachers leave, what type of schools they leave, among others, are clearly dynamic choices that impact the desired effects of the policies.

Research on teacher trajectories is vast and diverse, and concludes that attracting and retaining effective teachers for students, specially for more disadvantage students, is vitally important yet quite difficult (Ingersoll, 2001). Specifically, evidence suggests that

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[16] It is mandatory for the scholars to work 3 years in the public school system.

[17] A preliminary evaluation of this policy shows that teacher training programs have atracted more students with high aacdemic ability after the implementation of this policy (Ministerio de Educación, Chile, 2012).

teachers tend to move away from low-performing, high- poverty schools (Hanushek et al., 2004, Boyd, et. al., 2002, 2005, Podgursky et al., 2004), and as a result, these schools have the least-qualified teachers as measured by attributes such as licensure status, the selectivity of the colleges from which they graduated, and their performance on standardized exams (Lankford et al., 2002). Patterns of teacher migration from school to school, especially movement away from schools serving low-income students into schools serving high-income students is also well documented.

A number of studies in recent years have focused on the issue of early career teachers leaving the profession. These studies have found what Ingersoll defines as "Revolving door," where large numbers of teachers depart teaching before retirement, especially during the first years of teaching (Ingersoll, 2001; Ingersoll & Smith, 2003). Scholars report that between 40% and 50% of entering public school teachers leaves teaching within their first 5 years (Ingersoll & Smith, 2003). Evidence also suggests that this "revolving door" effect is even higher for the most academically proficient teachers. Specifically, teachers with higher ACT and licensure test scores, and those who graduate from more- selective colleges, tend to leave teaching earlier than others (Murnane et al. 1991;Hanusheck and Pace, 1995; Stinebrickner 2001, 2002; Henke et al. 2000; Boyd, Lankford, Loeb and Wyckoff, 2002, 2005, Podgursky et al., 2004). Even worst, evidence suggests that these teachers are more likely to leave from the most needy schools (Guarino, et. al 2011, Feng, et a. 2011).

We know very little, however, about career trajectories of teachers in Chile. An emerging literature on the teacher labor market in Chile has documented inequalities in instructional resources and found that teachers are unequally distributed across schools (Ortuzar, et. al 2009; Rufinelli and Guerrero, 2009; Meckes and Bascope, 2010; Cabezas et . al, 2011 and Rivero, 2012). Research on teacher trajectories is scant (e.g teacher turnover or teacher retention). A recent study by Cabezas et.al (2011) explored the relationship between individual teacher characteristics and several outcomes, including the likelihood of moving between public and private schools, and the likelihood of leaving the teaching profession altogether. Analyzing data from the 2005 and 2009 Teacher Longitudinal Survey (Centro de Microdatos, 2009) using multinomial logit models, the authors found that men, married teachers with higher ability scores, and teachers from families at higher socioeconomic levels were all more likely to work in private schools without public funding than woman, single teachers with lower academic ability scores and teachers from families at lower socioeconomic levels. Also, they found that teachers with better qualifications (i.e., more experience, higher ability scores, and graduating from accredited universities) were more likely to work in private schools with public funding than in public schools. Finally, the authors found that teachers were more likely to work in the same type of school (i.e., either publicly or privately administered) as the one they attended as students.

A second study available is the first chapter of this dissertation (Rivero, 2012). This study explored the trajectories of elementary novice teachers during their first four years of teaching and analyzed several outcomes (e.g mobility between schools within the same district, mobility between schools within the same region, mobility between public and private schools, and leaving the profession altogether). Analyzing national data from

2007 to 2011, and using descriptive analysis, the results show that 46 percent of the teachers with no prior teaching experience hired in 2007 remained in the same school in which they began their careers until 2011. Thirty-four percent moved to another school with public funding (public or private), and 20 percent were no longer working as public school teachers in 2011. In addition, the paper found that novice teachers who started working in low-performing schools, low-income schools, rural schools, and public schools tended to move more (stay less) compared to teachers who started in high-performing schools, high-income schools, urban schools and private schools. Attrition also is particularly problematic since teachers who are leaving appear to be the more able teachers. Rivero (2012) also suggests that highly qualified teachers move away from schools serving low-income students and low-performance schools in higher proportions.

The lack of research on teacher trajectories in Chile and the results found in the first chapter of this dissertation suggests that further research in this area is crucial. Based on administrative teacher data and following career trajectories of elementary novice teachers, the purpose of the second paper is to study how labor market decisions of new elementary teachers affect the academic quality of the teacher workforce in public schools, and in particular in the most needy public schools. This question is addressed by using a rich longitudinal national data set of elementary public school teachers that allows to differentiate between 2 patterns of teacher trajectories: 1) switching from their first teaching job to another public school and 2) leaving their first teaching job to another job outside the public school system (e.g. working as a teacher in the private school system or leaving the profession). Based on a discrete-time competitive risk models, the study will look at whether teachers with higher academic ability are more likely to switch to another public school or leave the public school system and if so, when they are switching or leaving. This framework allows for simultaneous examinations of who switches or leaves, when and under what conditions. The primary measure of academic quality used here is teacher PSU score (equivalent to ACT or SAT scores). To my knowledge no published research has ever studied teacher trajectories of novice elementary public school teachers in Chile.

Additionally this paper benefits from rich and detailed data that present several advantages with respect to alternative data sets available. First, it is the first study to look at teacher trajectories that use a national data set in Chile. Second, I am able to link the records of new public school teachers to a master file of PSU scores that gives me important information about the academic quality of new teachers. Third, I am using the full universe of available records of novice elementary public school teachers that permits desegregated analyses of academic quality interactions between students' characteristics such as student performance and student socioeconomic status and teacher academic ability.

In order to contribute to new knowledge about the Chilean teacher labor market, relevant to the equity and quality of educational system, this paper addresses the following research questions:

1. When is a elementary novice teacher at the highest risk of switching to another public school and at the highest risk of leaving teaching in the public school

system in Chile?

2. What individual teacher and school characteristics are associated with the risk of teacher switching to another public school and with the risk of leaving teaching in the public school system in Chile? Specifically, are teacher with higher academic ability more likely to switch or leave their first teaching job in a public school in Chile?

3. Conditional on teacher and school characteristics, are elementary novice teachers with higher academic ability more likely to switch or leave from certain types of schools?

The questions posed in this paper have clear and important policy implications. Increasing the number of new recruits with high academic ability will do little to enhance teacher quality in public schools unless those teachers stay working in classrooms. Whether and when elementary novice teachers with high academic ability choose to leave public schools is important for policy formulation that targets teacher quality and teacher retention of high quality teachers. If academically gifted teachers choose to leave the most needy public schools in higher proportion, policy responses should appropriately promote teacher retention in these schools, changing factors that determine whether and when teachers decide to leave these type of schools.

The paper is structured as follows. In the next section, I review and highlight relevant empirical work on teacher retention and attrition. After the literature review, I describe the data, the outcome, and the explanatory variables. Next, I present my analytic model, followed by the findings. In the final section, I discuss the implications and conclude.

LITERATURE REVIEW

Research on teacher turnover and retention is vast and diverse. Studies use several statistical methods (e.g. survival model, competing risk models, multilevel models), analyze different teacher trajectories (e.g. teacher turnover between schools within the same district, teacher turnover between districts, teacher attrition), explain teacher behaviors using a variety of explanatory variables (e.g. teacher characteristics, school characteristics, school working conditions), and analyze different populations of teachers (e.g. novice teachers, elementary v/s secondary teachers, teachers of specific subjects). Given the focus of this study, the literature review strategically focuses on studies that are relevant to my empirical inquiry and briefly describe the existing knowledge base on factors that influence teacher turnover and retention that are of interest for my research. In general factors can be grouped in two categories: teacher characteristics and school characteristics. This literature review is based on a previous work by Newton, Rivero, Fuller and Dauter (2001).

Teacher Characteristics

The literature review focuses on the following two types of teacher characteristics variables: (1) teacher demographic background (gender, and age), and (2) proxy

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measures of teacher quality and qualification (degrees, academic ability and selectiveness of undergraduate institution). Other variables such us ethnicity were not included since race is not an issue in the Chilean case. Teachers of different demographic backgrounds may have different preferences for working conditions and it is also plausible they have different priorities when faced with the conflict between the family and teaching obligations. Teacher quality and qualifications, on the other hand, signal different alternative opportunities compared to teaching that teachers may have depending on their levels of attractiveness defined by these measures.

Gender, and age. Prior studies on the relationship between gender and teacher turnover have produced mixed results. Some studies find that women had higher turnover rates (migration or attrition) than men (e.g., Gritz & Theobald, 1996; Ingersoll, 2001; Kirby, Berends, & Naftel, 1999); whereas other studies suggest that men are more likely to quit teaching or transfer schools than women (e.g., Boyd et al., 2005; Ingersoll, 2001).

In contrast, the finding on the relationship between age and teacher turnover is fairly consistent (Guarino et al., 2006). Studies in general observe that younger teachers have higher attrition rates and higher migration rates than older teachers until they reach retirement eligible age (Hanushek, Kain, & Rivkin, 2002; Ingersoll, 2001; Kirby et al., 1999).

Degrees, academic ability and selectiveness of undergraduate institution. In general, research has found that better qualified teachers have higher turnover rates than less qualified teachers. Evidence regarding the relationship between degrees and teacher turnover has been mixed. Strunk and Robinson (2006) found no statistically significant relationship between teachers having advanced degrees and their propensity to leave. Kirby et al. (1999) observed that teachers entering teaching with advanced degrees were more likely to leave than those entering teaching with bachelor's degrees or less. Adams (1996), however, showed that elementary teachers with a bachelor's degree were more likely to exit than those with graduate degrees.

Teacher quality has been typically measured by teachers' test scores on standardized examinations (e.g., ACT) and selectiveness of their undergraduate institution.[18] Evidence regarding the relationship between degrees and teacher turnover has consistently shown that teacher quality, measured by academic ability tests, matters when considering teacher switching between schools as well as teacher leaving teaching profession (Henke et al., 2000; Lankford, Loeb, & Wyckoff, 2002; Podgursky, et. al. 2004). At the same time, evidence shows that teacher qualitu, measured by selectiveness of undergraduate institution, is associated with teacher decisions.

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[18] Ferguson and Ladd (1996), for example, found a positive relationship between student achievement scores and teacher ACT scores in Alabama public schools. Ferguson (1991) found a positive association between student test scores and the mean scores on a test of teachers' verbal skills in Texas. An earlier study by Ehrenberg and Brewer (1993) found a positive relationship between a measure of teachers' verbal ability and student achievement scores using a national data set. In addition, several studies find a positive association between the selectivity of the college attended by teachers and measures of student achievement (Ehrenberg & Brewer, 1994; Summers & Wolfe, 1977).

School Characteristics

In addition to the focus on individual teachers' characteristics, the school conditions in which teachers work are also examined. Understanding school conditions is important, as Ingersoll (2001) pointed out, "...research has shown overall conditions of workplace and job sites significantly affect the attachment of employees to the organization" (p. 506). School working conditions encompass a wide variety of facets, ranging from the compensation structure (e.g., salary, bonuses, pension plans, etc.), physical conditions (e.g., space, plants, bathrooms, etc.), school climate (e.g., principal leadership, student composition, etc.), to policies that govern the day-to-day teaching experiences (e.g., curricular mandates, standardized testing and accountability system, etc.).

The study focuses on the set of school characteristics that have the most direct implications for teaching and learning and that have been empirically examined by different scholars in the past. These school factors characterizes different aspects of the working condition that have implications for teacher satisfaction and quit behaviors, including (1) students' social economical backgrounds, (2) academic climate proxied by students' achievement level, (3) school type which indicates different management and governance styles from traditional public schools (i.e., private school and regular public schools), and (4) location which indicates whether the school is located in a urban or rural area.

Students' social economical backgrounds. Research has consistently revealed that teachers have higher turnover rates in schools with higher proportions of low income than teachers in schools with higher income students (Boyd et al., 2005; Carroll, et.al., 2000; Hanushek et al., 2002; Scafidi, et.al., 2003; Shen, 1997; Smith & Ingersoll, 2004). This finding is common across studies that examined data from Georgia, New York, Texas, and Washington in the US (Strunk & Robinson, 2006). The more difficult the working conditions, the less attractive the schools are for teachers, which leads to higher teacher turnover rates.

Academic climate: students' achievement level. Research has found a direct relationship between the level of students' performance at a school and teacher turnover rates. Schools with low-performing students tend to have higher teacher turnover than schools with high-performing students (Hanushek et al., 2002; Murnane et al., 1991; Rees, 1991). Second, students' achievement levels may signal their intrinsic motivation and learning habits. Students with very low academic achievement might have low intrinsic motivation to learn and unproductive disciplinary behaviors, which makes teaching less satisfactory for some teachers. Whitener et al., (1997) found that about 35% of the public school teachers who left teaching is explained by student discipline problems and poor student motivation.

School type and location. Research has suggested that school type is one of the school factors that appear to play a role in teacher turnover (Guarino et al., 2006). For instance, Smith and Ingersoll (2004) and Newton, et. al., (2012) found that charter schools had higher attrition rates than regular public schools. Furthermore, some research has found school type as an important mediating factor in teacher satisfaction and decisions to leave

(Renzulli et al., 2011). Other researchers (e.g., Lankford et al., 2002) showed that large urban schools tended to have higher turnover rates than suburban schools.

In summary, research to date has explored a variety of factors that may influence teacher trajectories, which provides a platform for my own empirical inquiry. I intend to extend the existing knowledge base and make a contribution to the teacher turnover and retention literature in Chile, studying teacher trajectories based on what we already know from USA reserach.

DATA AND SAMPLE

A panel dataset was created on teachers from several administrative data sets maintained by Chilean educational agencies. Data on public elementary novice teachers job come from teacher-level annual files (Bono de Reconocimiento Profesional, BRP) maintained by the Unidad de Estudios. BRP includes individual-level information on the following characteristics of teachers by year: education, the identity of the teacher's school, number of hours and months worked, position held, highest degree earned, institution where they earned highest degree, and graduation year. BRP data was supplemented with data on teachers' personal characteristics (i.e., gender, and age) from the Idoneidad Docente (ID) dataset, which is also maintained by Unidad de Estudios.

Characteristics of schools come from the administrative public-use data files maintained by SIMCE (Chile's national assessment system). This source provided school information regarding students' characteristics such as students' socioeconomic status, students' performance, as well as some schools characteristics such as school administration, and school location.

Then, teacher records were linked to a master data set of PSU[19] scores maintained by Universidad de Chile. PSU scores were only available for individuals taking the tests in 2001 or later. The primary measure of academic quality used in this study is teacher PSU scores.

Finally, institution teacher records were used to create indicators to measure the selectivity of the undergraduate institution that each teacher attended by merging information from Brunner et.al. (2005)[20]. In this study, the selectivity of the undergraduate institution was used as a secondary measure of teacher quality in order to check on the robustness of the results. Appendix 1 explains in more detail the subjects, variables, time period and source of each dataset.

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[19] PSU is the national selection test and it is the main toll used by univeristies to select their students.

[20] Brunner classifies institutions of higher education into several categories—ranging from most competitive to noncompetitive—on the basis of the average college entrance examination scores (PSU). I used this information to create a dichotomous variable indicating whether a teacher's undergraduate institution was "highly competitive," made up of the top Brunner category—most competitive.

Outcome

In this study, I model whether an individual initially teaching in a particular elementary public school (i) remains in that school, (ii) switches to another public school in Chile, or (iii) leaves teaching in the Chilean public school system, either exiting the labor force or taking alternative employment (e.g teaching in the private sector).[21] From the schools' vantage point, both exits look the same: the teacher leaves the school. But there are at least two arguments for more carefully considering the type of move that teachers make. First, each type of move may be differentially motivated. Second, different types of moves have different consequences for the public school system.

A teacher who switches schools may move due to a change in the context of his or her teaching (e.g., school demographics that change from one school to the next). A significant amount of research shows that teacher career transitions are sensitive to working conditions (Ingersoll and Smith 2003), which to some extent can be proxied by the attributes of their students. However, while working conditions would be predicted to be an important factor in within-teaching employment decisions, they may be completely irrelevant for the teacher who has concluded, "teaching isn't for me".

More than just being driven by different factors, these different move types are likely to have very different impacts on the educational system. Teachers who leave the public school system represent a loss to the teacher workforce (that may or may not affect its overall quality), whereas teachers who switches schools portend a possible redistribution of teacher quality within the system.

In this study the outcome focuses on the timing of a teacher's decision to switch from their first teaching job to another public school or to leave the public school system (i.e., the propensity of a teacher switching or leaving the public system at a time point given that he or she has not switched or left). In other words, for first year teachers hired by any of the elementary public schools in Chile in 2007, I asked the question of how long a teacher stays teaching in the first assigned school before he or she switches to another public school or before he or she leaves the public school system. So the central outcome of the analysis focused on time to event, with two events defined as teacher switching from the first teaching public school to another public school or as teacher leaving their first teaching school to work outside the public school system.

For all teachers who do not switch to another public school system or leave the public school system, the last event is incomplete and noted as a censored observation. The number of unique teachers was 1,696, where 27% of them switch to another public school and another 27% of them leave the public school system within their 4 first years of experience. In total, the sample included 4,749 observations: 460 teachers switch to another public school; 463 teachers leave the public school system; and 3,826

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[21] It is not possible to observe whether teachers who are leaving the public school system are actually leaving teaching or teaching in the private school system in 2011.

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observations are censored.

Explanatory Variables

I study the 5 years between the 2007 academic year and the 2011 academic year.[22] The sample contains 1.696 novice elementary teachers who began teaching in 2007 in any elementary public school in Chile. These teachers work in 1,201 elementary public schools across Chile. Variable definitions and summary statistics of the characteristics of teachers and their schools are listed in Table 1. I report summary statistics from the first year of each first teaching job. As shown in Table 1, the sample of new teachers is overwhelmingly female (79%), 40 percent are younger than 25 years old and only 5 percent are older than 50 years old. Almost all teachers have a major in education (97%) and only 40 percent of them have a specialization in a subject. These teachers work in 1,201 elementary schools, 14% work in schools attend by low- income students, 81% work in urban schools, 31% work in regular public schools and 10% work with low achievement students.

For measures of teacher quality, Table 1 shows that 14% of teachers score 600 or more on average in PSU Math and Spanish tests and 14% went to selective undergraduate institutions. As shown in Table 1, the measure of academic ability for new teachers is not available for all new teachers. Scores for new teachers who took PSU before 1999 are not available. Scores were available only for teachers who took PSU between 1999 and 2005. In other words, 69% of the sample of new teachers was tested. The fact that 31% of the sample has not available PSU scores could lead to biased estimations of the relationship between teacher and school characteristics and teacher behaviors. To check this potential problem, college selectivity was used as a check on robustness of the results. College selectivity is a reliable variable to check the problem for several reasons. First, college selectivity is highly correlated to PSU scores since the main tool used by universities to select their students are PSU scores. Second, college selectivity is a common proxy of teacher quality. Finally, it is a measure available for the whole sample.

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[22] The academic calendar starts in March and ends in December.

Table 1: Variable definitions and sample values (means)

Variable	Mean
Teacher characteristics	
Female - Teacher is female	0.79
Young - Teacher is younger than 25 years	0.40
Old - Teacher is older than 50 years	0.05
Title in Education - Teacher has a bachelor's degree in education	0.97
Specialization - Teacher has a subject specialization	0.40
Special education - Teacher subject assigment is special education	0.07
Academic ability - Teacher average score in Math and Spanish PSU test equal or higher than 600*	0.17
Highly selective - Teacher went to a highly selective undergraduate institution	0.14
School characteristics and organizational context	0.14
Low income - School that attends very low income students	0.52
Low achiving - School that has very low performance	0.30
Private - Teacher teachers in a private school with public funding	0.69
Urban - Teacher teaches in a urban school	0.81

N = 1.696 novice teachers

* N = 1,167 novice teachers

Table 2 contains the number of teachers in each of the transition categories under study. Defining a teaching job to be employment at a particular elementary public school, a teacher is defined to make a transition when he/she leaves his/her first teaching job. Of the 1,696 new teachers in the sample, 773 (46 percent) remain at the same school through the end of the sample period, and thus have a censored spell. However, Table 2 indicates that a large proportion of new teachers end their first teaching spell by switching schools or leaving the public school system. During the sample period, 27 percent of all teachers end their first teaching job by moving to another public school in Chile and 27 percent of all teachers end their first teaching job by leaving the public school system.

Table 2: Teacher transitions

Teacher transition	Number of teachers	Percentage of teachers
Same school	773	46%
Switch to a new public school	460	27%
Leave the public school system	463	27%
Total	1,696	100%

STATISTICAL MODEL: DISCRETE TIME COMPETING RISK MODELS

As many other researchers (Gates, et. al., 2006; Scafidi, et. al., 2007; Guarino 2011), this study employ discrete-time competing risk models to estimate the risk that individual teachers switch from their current teaching position to another school or leave the public school system given their own characteristics and the characteristics of the school in which they teach. I model teacher transitions using a competing risks framework because I am interested to know when novice teachers are more likely to switch or leave. Therefore, there are several transitions that a teacher can make. Specifically, the study seeks to identify individual- and school-level factors that predict the probability that a teacher (a) remains in his/her first teaching job in a public school, (b) migrates from his/her first teaching job for another public school within the educational public school system, and (c) leaves the national public school system.

In order to describe the discrete-time competing risk models, I first explain the key concepts in discrete-time framework that characterize the distribution of discrete-time event occurrence data. I then present the statistical model of the discrete-time framework for one event (i.e., teacher switching schools), before extending it to two events (i.e., teacher switching schools and teacher leaving teaching in the public school system).

The literature on teacher trajectories typically focuses on the probability or hazard of turnover at a specific point in time (Boyd, et. al 2005; Gates, et. al 2006; Goldhaber, 2007; Donalson and Jhonson, 2010; Guarino, 2011 and Feng, 2011). Hazard models are conceptually appealing for studies of teacher migration and attrition. They measure the risk of switching schools or leaving teaching given the length of time the teacher has been with a school or in the school system. Accounting for time is important because we know that new teachers are substantially more vulnerable to switch and to leave than more established teachers. Using discrete time hazard models also allows to estimate the statistical relationship between a set of factors that influence teacher decisions and the length of time that teacher spends in each career transition. Survival analysis is appropriate for addressing the research questions since the method incorporates the effects of predictors on event occurrence whose effects are constant as well as those whose effects are not constant. Another advantage of this method is that rather than imputing event times for censored cases, the hazard function includes data for both non censored and censored cases and it does not eliminate teachers or arbitrarily impute their event times when the information is not available.

The analysis is built from a basic discrete time hazard model. Discrete-time survival regression analysis examines the hazard function that a person switches a school or leaves teaching in a public school in a given year conditional on not having switched/left before that year. In other words, the model assumes that for each teacher the event is nonrepeatable, therefore the event occurrence is conditional. Following Singer and Willet's (2003) proposed framework for investigating event occurrence, discrete-time hazard, h_{ij} is defined as the conditional probability that individual i will experience the target event in time period j, given that he or she did not experience the event prior to j:

$$h_{ij} = \Pr\left(T_i = j / T_i \geq j, Z_{1ij} = z_{1ij}, Z_{2ij} = z_{2ij}, \dots . Z_{pij} = z_{pij}\right) \qquad (1)$$

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The probabilities h_{ij}, as Cox (1972) proposed, can be reparameterized so that they have a logistic dependence on the predictors and the time periods, as the following equation shows.

$$\log\left(\frac{h_{ij}}{1-h_{ij}}\right) = \alpha_1 D_{1ij} + \alpha_2 D_{2ij} \quad .... + \alpha_n D_{nij} \quad + \beta_1 Z_{1ij} + \beta_2 Z_{2ij} + \cdots . + \beta_p Z_{pij} \qquad (2)$$

where D_{1ij} to D_{nij} are dummy variables with coefficients $\alpha_1, \alpha_2 \dots \alpha_n \dots$ for the time period, Z_{1ij} to Z_{pij} are covariates with coefficients $\beta_1, \beta_2 \dots \beta_p$. Therefore, the conditional log-odds that the event will occur in each time period, given that it did not occur before, is a linear function of the α parameters, capturing the baseline hazard (when the covariates are zero), and the slope parameters, describing the effects of the predictors on the baseline hazard function.

Equation 3 can be extended to account for the k "competing risks" in equation 4:

$$\log\left(\frac{h_{ije}}{1-h_{ije}}\right) = \alpha_1 D_{1ije} + \alpha_2 D_{2ije} \quad .. + \alpha_n D_{nije} \quad + \beta_1 Z_{1ije} + \beta_2 Z_{2ije} . + \left(\beta_p Z_{pije}\right) \qquad (3)$$

$$where\ e = 1,2$$

To estimate the competing risk model a data set was constructed that includes one observation for each unit of time that each teacher is at risk (i.e., one observation for each year we observe them in the data as a teacher). For each observation, the dependent variable identifies the type of transition, if any, that will occur during this period (i.e., what position the person has in the next year).

Discrete time hazard models create two potential problems caused by left and right-censored information. In this study, left-censoring concerns are resolved by using a sample of novice teachers. In other words, the beginning of the observation period does coincide with the beginning of the teachers' careers in the public school system, which removes the potential problem that some of the teachers were already at risk of migration or exiting before our observation started. In terms of the right-censoring problem, it is assumed that in this case, censoring is non-informative because it happened only because the observation period ended.

On the other hand, a key assumption of the method used is the independence of irrelevant alternatives (IIA). This assumption states that the relative probability of any two outcomes is not altered by the inclusion of other possible outcomes. In this case, IIA implies that the relative probability of swtching from his/her first teaching job in a public school to another school is not affected by whether I consider dropping out as another possible outcome. Reserchers might be concerned, for example, that unobserved characteristics of individuals that make them more likely to drop out also make them more or less likely to move from one school to another if they do not drop out. A test for the IIA assumption, based on Hausman and McFadden (1984), was used. The results show that there is not evidence that IIA has been violated and therefore, it is assumed that IIA is a valid assumption. In other words, according to Hausman and McFadden (1984),

dropping one category from the model should not change the estimated coefficients.

Another potential problem for the estimation is the potential correlation between observations from the same school. However, teachers are very disperse across schools since we are using only novice teachers who started working in 2007 in all elementary public schools in Chile. Specifically, the sample of 1,696 teachers is distributed across 1,201 schools. More than 70% of the teachers are the only novice teacher hired in a specific school in 2007, and only 12% of sample of teachers are clustered in schools with 3 or more new teachers.[23]

In summary, this study use a discrete time competing risk model which is implemented by estimating a multinomial logit model (Allison, 1982, 1984) using maximum likelihood with three possible types of events: remain as a public teacher but switch schools, leave teaching in the public school system, and with remaining in the same school treated as censoring. The analysis sample includes all novice elementary public school teachers who were employed in a teacher position in a public school in 2007.

RESULTS

The primary goal of the analysis is to focus on investigating two intertwined aspects of teacher career trajectories in Chile. These two aspects are: (1) how long a teacher stays teaching in the first teaching job before the teacher switches to another public school and before the teacher leaves teaching in the public school system; and (2) how the hazard of switching and leaving is related to individual teacher characteristics and school contextual factors. This section presents the results of the analysis. Some descriptive statistics are presented, and then the findings based on the discrete-time competing risk models.

Question 1: When is a teacher at the highest risk of swithcing to another public school and at the highest risk of leaving the public school system in Chile?

Table 3 presents data describing the career survival at their first teaching job in a public school of 1,696 elementary teachers hired by any elementary public school in Chile in 2007. The numbers indicate whether and if so, when these teachers switched or left the first teaching job in a public school between the first year of observation period and 2011, which was the last year of observation period. As shown by the numbers under "hazard" column in Table 3, elementary school teachers were at the highest risk of exiting (switching or leaving) their first teaching job initially during the first year of teaching at those schools. This risk of exit decreases over time.

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[23] It is important to mention that when the estimated models take into account the fact that 30% of teachers are nested across schools, the estimated standard errors and p-values are very similar than when clustering is not taken into account (the findings don't change).

Table 3: Descriptive Statistics of Teacher Hazard of exiting (switching or leaving)

Year	Total Begin	Exit (Move or Leave)	Right Censored	Stay	Hazard
2007-2008	1,696	429	-	1,267	0.253
2008-2009	1,267	297	-	970	0.234
2009-2010	970	154	-	816	0.159
2010-2011	816	43	773	773	0.053

Table 4 presents data describing the career survival at their first teaching job in a public school of switching to another public school or of leaving the public school system, respectively. As shown by the numbers under "hazard" columns in Table 4, when both events are analyzed independently, elementary school teachers were at the highest risk of moving and leaving their first teaching job initially during the first year of teaching at those schools. This risk for both events decreases over time. In addition, the risk (i.e the hazard probabilities) of switching to another public school was very similar than to the risk of leaving the public school system.

Table 4: Descriptive Statistics of Elementary Teacher Hazard of moving

Year	Total Begin	Switch	Leave	Right Censored	Stay	Hazard Switch	Hazard Leave
2007-2008*	1,696	218	211	-	1,267	0.147	0.143
2008-2009	1,267	149	148	-	970	0.133	0.132
2009-2010	970	76	78	-	816	0.085	0.087
2010-2011	816	17	26	773	773	0.022	0.033

* It means that 1,696 novice elementary public school teachers started working in 2007. 218 teachers were working in a different elementary public school at the beginning of 2008. 211 teachers were not working in any public school at the beginning of 2008.

Figure 1 graphs the hazard function for three events: 1) exit the first teaching job (switching or leaving), 2) switching to another public school, and 3) leaving teaching in the public school system.

Figure 1: Hazard Function
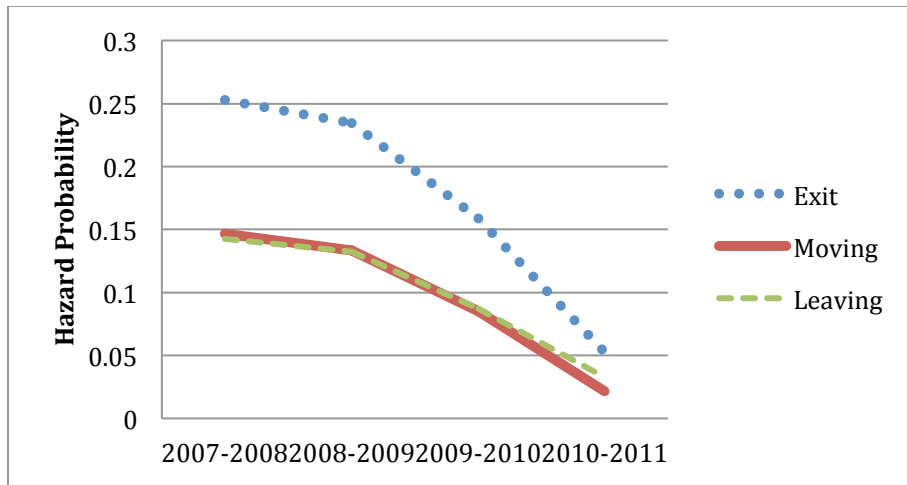
Based on the sample hazard probabilities, the sample survival probabilities under the assumption of independent censoring (i.e., non-informative) can be estimated. Figure 2 displays the estimated survival function based on the sample hazard function for three events.

Figure 2: Survival Function
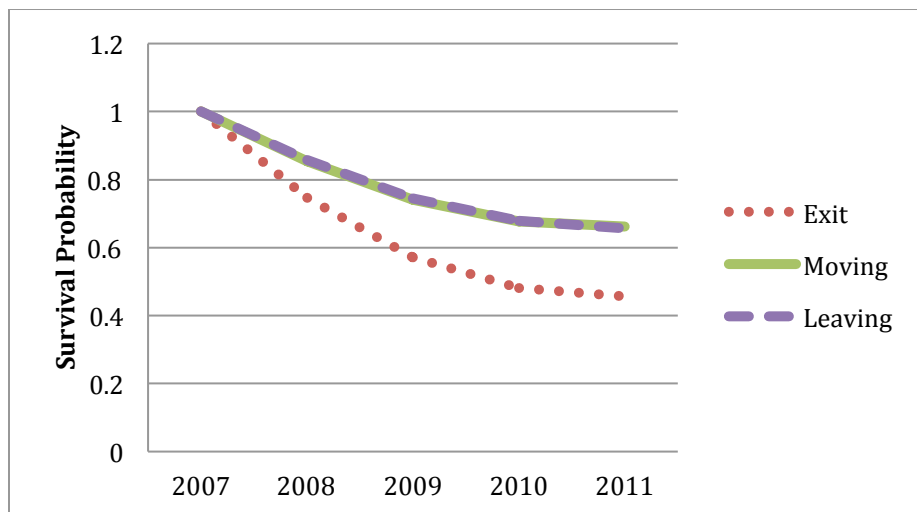
As can be seen in Figure 3, survival probabilities of staying compared to leaving and the survival probability of staying compared to switch to another public school are very similar. This is not surprising, because the hazard probability of switching to another public school was very similar to the hazard probability of leaving the public school system as shown previously. Consequently, for the sampled teachers observed, the

estimated median survival lifetime for elementary public teachers of staying in their first teaching job was roughly three years.

Question 2: What individual teacher and school characteristics are associated with the risk of teacher switching to another public school and with the risk of leaving the public school system in Chile? Specifically, are teachers with higher academic ability more likely to switch/leave their first teaching job in a public school in Chile?

The results are organized around teacher and school predictors of the hazard function for switching or leaving the first assigned schools. Results from four different specifications of the discrete-time competing risk model are presented in Table 5. First are presented results of model 1, the simplest model estimation that does not include school-teachers cross level interactions 1). Then, results from models 2, 3 and 4 are discussed. Models 2 and 3 concludes school teacher cross level interactions in order to address question 3. Finally, model 4 is similar to model 1 but use an alternative measure of teacher quality: selectiveness of undergraduate institution. The numbers presented in Table 5 correspond to the estimated coefficients.

Teacher characteristics

Teacher demographic background: Gender and age. As shown in Table 6, there was no statistically significant difference between male and female teachers in their hazard of moving and their hazard of leaving their first teaching job.

In terms of age, Table 5 indicates that young and older elementary school teachers are not more or less likely to switch or to leave their first teaching school than middle-aged teachers. However, when teacher quality is measured by how selective is teacher's undergraduate institution (model 4), the odds of switching to another public schools for young teachers were 22% higher than that for middle-aged teachers (coefficient: 0.212, odd ratios; 1.22; p value: 0.072)

Teacher quality and qualifications: degrees, academic ability and how selective is teacher undergraduate institution. Table 5 shows that there is not evidence that, compared to teachers who had not a title in education, teachers who had a title in education were more likely to switch from a public school to another public school. However, teachers who had not a title in education were likely to leave the public school system (coefficient; -1.49; odd ratio: 0.86; p value: 0.005). No other statistically significant differences were observed between teachers in terms of their degrees (e.g specialty).

With respect to teacher academic ability, Table 5 indicates no evidence that teachers with higher academic ability were more or less likely to switch from their first teaching school to another public school within the system. However, teachers with higher academic ability were more likely to leave the public school system than those with lower academic ability. In other word, the odds of leaving for teachers with higher academic ability were

about 31% higher than that for low academic ability teachers (coefficient; 0.27; odd ratio: 1.31; p value: 0.078).

Estimates of model 4 provide a robustness check of the effect of teacher academic ability on teacher switching schools and teaching leaving teaching in the public school system. Recall from Table 1 that roughly 30% of new teachers are not PSU-tested. Teachers with missing PSU scores are excluded from the estimation sample in models (1), (2) and (3). In model (4) in Table 5, an alternative measure of teacher quality—the selectivity of the undergraduate institution attended by the teachers was used, a measure available for virtually the entire sample. Undergraduate college selectivity is a dummy variable indicating whether the teacher graduated from an institution in the most selective classifications in Brunner, et. al 2005. The coefficient for the most selective teachers has an leaving hazard 43% higher than a teacher graduating from a less selective college (coefficient; 0.236; odd ratio: 1.43; p value: 0.01), which confirm the findings if models 1, 2 and 3.

Table 5: Models results

Variable	Model 1	Model 2	Model 3	Model 4
Number of person period observation Outcome 1 (Switching schools)	3,039	3,039	3,039	4,749
Baseline Hazard				
D2 Interval 2-3	- 0.052 (0.147)	- 0.049 (0.147)	- 0.052 (0.147)	- 0.031 (0.126)
D3 Interval 3-4	- 0.441*** (0.178)	- 0.440*** (0.175)	- 0.441*** (0.175)	- 0.468*** (0.153)
D4 Interval 4-5	- 1.946*** (0.1320)	- 1.946*** (0.320)	- 1.945*** (0.320)	- 1.993*** (0.283)
Teacher characteristics				
Female	0.035 (0.167)	0.028 (0.167)	0.035 (0.167)	-0.028 (0.140)
Young	0.110 (0.131)	0.113 (0.131)	0.110 (0.131)	0.212* (0.114)
Old	0.449 (1.100)	0.485 (1.100)	0.550 (1.100)	0.138 (0.260)
Title	0.483 (1.061)	0.483 (1.061)	0.482 (1.062)	-0.796 (0.525)
Specialization	0.185 (0.137)	0.200 (0.137)	0.187 (0.137)	0.125 (0.120)
Academic ability	0.004 (0.165)	-0.089 (0.178)	-0.008 (0.173)	
Highly selective				0.104 (0.159)
School characteristics and organizational context				
Low income	0.218 (0.231)	0.091 (0.250)	0.220 (0.231)	0.057 (0.199)
Low achieving	0.592*** (0.213)	0.602*** (0.213)	0.568*** (0.230)	0.531*** (0.230)
Private	- 0.253** (0.146)	- 0.246* (0.147)	- 0.250** (0.147)	- 0.329*** (0.121)
Urban	- 0.464*** (0.201)	- 0.466** (0.201)	- 0.464*** (0.202)	- 0.408*** (0.175)

School teacher cross level interaction

	(1)	(2)	(3)	(4)
Academic ability*Low income			0.731 (0.481)	
Academic ability*Low achieving			0.173 (0.586)	
Constant	-1.980* (1.074)	-1.950* (1.075)	-1.987* (1.074)	0.732 (1.074)

Outcome 2 (Leaving teaching)

Baseline Hazard

	(1)	(2)	(3)	(4)
D2 Interval 2-3	- 0.149 (0.150)	- 0.150 (0.150)	- 0.149 (0.150)	- 0.147 (0.124)
D3 Interval 3-4	- 0.516*** (0.178)	-0.517*** (0.178)	- 0.516*** (0.178)	-0.535*** (0.149)
D4 Interval 4-5	- 1.485*** (0.259)	-1.485*** (0.259)	- 1.484*** (0.259)	-1.569*** (0.222)

Teacher characteristics

	(1)	(2)	(3)	(4)
Female	- 0.013 (0.166)	- 0.011 (0.166)	- 0.014 (0.166)	- 0.200 (0.129)
Young	0.022 (0.131)	0.022 (0.131)	0.023 (0.131)	-0.036 (0.113)
Old	0.293 (1.090)	0.297 (1.090)	0.298 (1.090)	0.202 (0.239)
Title	- 1.494*** (0.536)	-1.481*** (0.537)	- 1.496*** (0.536)	-1.129*** (0.463)
Specialization	- 0.055 (0.140)	- 0.060 (0.140)	- 0.051 (0.141)	- 0.026 (0.118)
Academic ability	0.271** (0.153)	0.294** (0.159)	0.249* (0.159)	
Highly selective				0.350* (0.144)

School characteristics and organizational context

	(1)	(2)	(3)	(4)
Low income	0.476** (0.267)	0.524** (0.282)	0.484** (0.267)	0.142** (0.209)

Low achieving	0.287	0.279	0.221	0.273
	(0.254)	(0.259)	(0.280)	(0.209)
Private	0.505**	0.502**	0.515**	0.319**
	(0.172)	(0.172)	(0.173)	(0.131)
Urban	- 0.064	- 0.062	- 0.064	- 0.240
	(0.243)	(0.244)	(0.243)	(0.189)
School teacher cross level interaction				
Academic ability*Low income		- 0.280		
		(0.607)		
Academic ability*Low achieving			0.403	0.403
			(0.647)	(0.647)
				-0.814
Constant	-0.810	-0.826	-0.814	
	(0.577)	(0.578)	(0.577)	(0.577)

* <.10, ** <.05, *** <0.01

School characteristics

Students' social economical background. School demographics in terms of socioeconomic index of the school (SEI is an aggregated variable derived from a cluster analysis of mother and father education, family income and an index of school vulnerability) were examined. Results in Table 5 shows that the social economical background of students at the school was not related to teacher switching schools. In contrast, teachers who started working in schools who attend socioeconomically disadvantaged students were more likely to leave the public school system who those who started in school with more socioeconomically advantaged student (coefficient; 0.48; odd ratio: 1.61; p value: 0.07).

Academic climate: Students' achievement level whether the school score less than 220 points on the national reading test as a proxy for bad academic climate at a school. Results in Table 5 suggests that the achievement level of students at a school was a significant predictor of teacher mobility. Specifically, the odd of teacher moving in school where students score less than 220 points were almost twice that of teacher leaving in schools (coefficient; 0.59; odd ratio: 1.81; p value: 0.00). In contrast, the academic climate at the school was not related to teacher attrition from their first school.

For those who move, there are also systemic patterns among the school environments that these leavers depart and, in turn, are drawn to. Table 6 illustrates this dynamic for teachers in the 2007 cohort who switched during the next four years. Teachers generally left schools where students' test scores were lower than the scores in their destination schools. Table 6 shows that the difference in mean test score between receiving and sending school was 7 points for teacher who switch from one public school to another public school.

Table 6: School characteristics of sending and receiving schools between 2007 and 2011

Teacher career paths	Student Math Test Scores		
	Sending school	Receiving school	Difference in mean test score
Move between schools in public school system	241	248	7
Move to private school system	245	249	4

*The difference in mean test score is statistically significant.

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Organizational context: regular public v/s private school.[24] At both behaviors, the results show that there is a relationship between teacher desicions and the organizational context. Specifically, teacher who started in private schools had approximately 21% lower odds of switching schools than regular public school teachers. In contrast, private school teachers had higher odds of leaving the system than public school teachers (coefficient: 0.50; odd-ratio: 1.65; p value: 0.00). Specifically, the odds of teachers leaving private schools were 65% higher than that of teachers leaving regular public schools.

Urbanicity. I focused on the urban/rural location of the school. Results indicate that teachers who started working in rural schools were more likely to switch to another public school compared to those teacher who started working in school located in urban areas (coefficient: -0-46; odd-ratio: 0.63; p value: 0.08). In contrast, school location was not a statistically significant predictor of leaving the public school system.

Question 3: Conditional on teachers and school characteristics, are teachers with higher academic ability more likely to leave certain types of schools?

In terms of the cross-level interaction effects between teacher academic ability and school characteristics, models (2) and (3) provide the effect of these interactions on teacher mobility and attrition. Building on the exiting theory and empirical studies (Golhaber, et. al. 2009; Guarino, 2011), the potential impact of the interactions between teacher quality and school characteristics were tested. Specifically, I tested the interaction terms between teacher quality and students' socio economical background and school climate. The results are presented in Table 6, models 2 and 3.The results show that teacher with higher academic ability who started working in schools of low-income students were not more/less likely to move or leave from their first teaching job. In addition, results from model (3) evidence that teachers with higher academic ability who started working in low performance schools were not more/less likely to move or leave their first teaching job than those with lower academic ability who started in low performance schools.

Other interactions were tested between teacher academic ability and school characteristics (e.g. school administration and urbanicity). Both were not a statistically significant predictor of teacher moving from one school to another or leaving the public school system, regardless the behavior.

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[24] There are two types of public schools in Chile: 1) regular public schools: schools with public funding and administered by municipalities (similar to districts) and 2) private schools: schools with public funding and administered privately (similar to charters).

SUMMARY AND DISCUSSION

Attracting and retaining effective teachers for students, especially for more disadvantaged students, has attracted increasing attention in research and policy community. This study explores these issues through discrete-time competing risk analysis, taking advantage of a longitudinal data gathered from the Ministry of Education in Chile. These data provide a unique opportunity to examine how individual, school characteristics, and organizational context influence teachers behaviors. In particular, the study focuses on investigating the relationships between teacher quality and school characteristics and the timing of teachers' decisions to switch from their first teaching job to another public school and to leave teaching in the public school system. These analyses have produced several important findings.

To begin with, the results show that conditioning on teacher and school characteristics, teacher with high academic ability are more likely to leave the public school system than those with lower ability. These patterns are different when another teacher behavior is observed. Specifically, the results evidence that teachers with higher academic ability were not more likely to switch to another public school within the educational system. In addition, even though the findings provide strong evidence that schools serving at-risk children struggle to retain teachers, the results show that it is not more difficult for these schools to retain teachers with most desirable observable characteristics (e.g higher academic ability).

Secondly, the study has generated several new findings that add knowledge to the limited literature in Chile. First, in terms of teacher characteristics, the results show that teacher demographics such as gender and age were not significant predictors of teacher behaviors. Second, though the research literature seems consistent in stating that teachers in schools with higher proportion of students from poverty backgrounds have higher turnover rates, the results of this study shows that these relationship vary depending on the teacher behavior analyzed. In particular, the study found that student socio economical background is related to the likelihood of teacher leaving teaching in the public school system, but not to the likelihood of switching from one school to another public school. Third, in terms of school characteristics and school context, the results also show differences between teacher behaviors. Specifically, school climate (proxied by student performance), school administration and school location were significant predictors of teacher switching schools, but not of teacher leaving the public school system.

Implications of findings

Understanding who switches and leaves, when and under what conditions, is important for formulating policies that target teacher retention and attrition, especially in most needed schools. First, the results suggest both similarities and differences in the patterns of the relationships between who and when a teacher is likely to switch schools and who and when a teacher is likely to leave and under what conditions. These results imply that policy formulation needs to take into account what works for whom and in what context depending on the trajectories of teachers. In other words, from a policy perspective,

teacher retention and teacher attrition can have different strategies to be improved.

With respect to the policy target formulation, the findings offer some important insights. First, the findings concluded that more academically talented individuals (based their performance on ability tests and on the selectivity of their college) are more likely to leave the teaching profession while they do not appear systematically more likely to switch schools. This finding is crucially important in the Chilean context, since Beca Vocacion de Profesor is currently funding students with high academic ability (measured by the same measured used in this study) to improve the quality of teacher workforce in public schools. However, based on these results, the success of this policy may depend on implementing other complementary policies to retain these high ability teachers in the system, given that they are more likely to leave the public school system[25].

Second, in terms of the timing of policy intervention, the results show that the hazard of risk of switching schools and leaving teaching in the public school system is highest during the earlier stage of teaching career and very similar for both behaviors. The implication of this finding is that intervention for teacher retention in particular schools and teacher retention within the public school system should pay particular attention to early career teachers. Even tough there are enough evidence to support the fact that the first years of teaching are critically complex for novice teachers (Ingersoll, 2001), in Chile there is not any educational policy to support novice teacher in their first year of teaching (.e.g mentoring programs). In addition, there is limited research on how Chilean public schools support teachers in their first years. This finding points the importance of further research examining school and administrative support to new teachers. The third paper of my dissertation will advance in this gap of the research.

Third, apart from who scwitch and leave and when, the study allows to focus on other school characteristics and organization context. The results show that teachers were less likely to switch and leave from private schools than public schools. This results means that there could be something about working in private schools that might have led to less frequent movement than working in a regular public school. This finding points the importance of further examining organizational factors and working conditions of these schools instead of solely focusing on the characteristic of teachers and students. The third paper of my dissertation will advance this gap in the research.

Finally, together, the findings suggest that keeping new teachers in the schools that need them most is an exceedingly difficult challenge for schools. This is particular problematic for schools since teachers who leave a school are typically replaced by novice teachers again (Rockoff, 2004). In other words, after few years, when teachers know better how to teacher, they switch schools and leave the schools and inexperienced teachers fulfill their vacancies.

In sum, if the goal is to minimize the churn of the least effective teachers to maximize the number of highly effective teachers staying in the system and staying in schools that need them the most, these results suggest that some of the hard debates about teacher

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[25] It is important to mention that this study does not intent to evaluate the success of Beca Vocación de Profesor.

preferences and teacher motivations are worthwhile. the policy community will be well served by research that focuses specifically on the relationship between teacher preferences, teacher effectiveness, working conditions and retention.

Limitations and further research

In the light of the debate of the use of value added to measure teacher quality and effectiveness, this study uses imperfect measures of teacher quality. In fact, more recent papers in the literature of teacher turnover in the US have found that high quality teachers measured by value-added indicators are less likely to switch and to leave the profession that low quality teachers (Boyd, et al. (2007) and Goldhaber, et. al., 2007; and Guarino, et. al 2011). However, even though this study does not use value added indicators as measure of teacher quality, it uses an important approach to teacher quality since the study uses ability measure (PSU test scores), the same measure currently used by policymakers. This study can be improved in the future adding measures of value added to define teacher quality.

A second limitation of this study is that teacher salary was not included among the teacher characteristic due to the lack of individual teacher salary data available. However, given that the public and private schools in Chile follows a standard salary schedule largely based on teacher education and years of teacher experience, both variables were incorporated in the model to partially account for earning difference among teachers. In addition, private schools can pay higher salaries to attract better teachers if they want. While data available does not allow to estimate salary differences between public and private schools, national sample data taken from Encuesta Longitudinal Docente (2009) shows that salary for first-years teachers are similar in regular public schools and private schools .

A third limitation is that few policy amenable predictors were included to predict teacher behaviors. The lack of this information in a longitudinal dataset does not allow it. However, this study does include several school characteristics that predict teachers' behaviors. Recent research has identified several school organization factors that predict teacher behaviors such us teacher influence, teacher workload, teacher assignment, administrative support, staff relations, student behavior, facilities, and safety (see Ingersoll, 2001, Darling-Hammond, 2003; Glaser, 2003; Hirsch & Emerick, 2007; Loeb et al., 2005; Grissom, 2008; and Boyd. et al 2011). Overall, this study highlights an important area for further research. Further research can add these predictors in order to have more information to design educational policies to improve the distribution of teacher across schools as well as teacher quality of the public teacher workforce. Also, this information will help administrators and principals who want to retain new teachers to design strategies at the school level to keep them at their school.

Finally, this study cannot distinguish between teachers who switch voluntary from one public school to another school from those who switch involuntary (e.g. fired). However, given a special labor regulation for teachers in Chile that makes difficult to remove a teacher from a public school, it is not expected a high proportion of teachers switching schools involuntary. In case of the private school there is not any special regulation to

protect them to be fired and unfortunately there is not any evidence of the proportion of teachers who are fired from these type of school.

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APPENDIX

Appendix 1: Work force Database

Workforce Database	Personal data	Teacher assessment data	Undergraduate institution data	School data
Universe	All public schools teachers	All individual taking PSU test	All undergraduate institution	All schools
Elements	- Teacher ID - Gender - Experience - Age - Degree attainment - Specialization - Undergraduate Institution - School ID	- Teacher ID - Scores on PSU	- Institution univerisity - Competitiveness of institution	- School ID - Type of adminsitration - Socioeconomic classification - Urban/rural - SIMCE scores - Location
Time period	March 2007-March 2011	2007-2011	2011	2007-2011
Name of data	Bono de Reconocimiento Profesional (BRP) 2007-2011 and Idoneidad Docente 2007 and 2010	Resultados PSU	Built based on public information	SIMCE 2006, SIMCE 2011, and Directorio de establecimientos 2007-2010
Source	Ministerio de Educación, Chile	Ministerio de Educación, Chile	Brunner (2005)	Ministerio de Educación, Chile

CHAPTER 3: HOW SCHOOL ENVIRONMENTS MATTERS? THE INFLUENCE OF SCHOOL WORKING CONDITIONS ON TEACHER RETENTION DECISIONS

The educational system confronts an enormous challenge: maintaining the equity and quality of the educational system. Policymakers are struggling to improve the low student achievement of many students and reduce the large differences in achievement that exist among socio-economic groups. In many countries, most recent discussion of education has focused on the quality of teachers. Recent research on student achievement identifies the important link between teachers and student outcomes. A great teacher can make a huge difference in the lives of students, especially to low-income students (McCaffrey, et. al. 2003). Having a good teacher for three to five years would eliminate the average gap between children who do and do not receive free or reduced-price lunch, and between whites and blacks or Hispanics (Hanusheck, 2010).

Education reformers have recognized the key role of teachers in classrooms, implementing a variety of policies to improve the quality of school public teachers as well as to attract more qualified teachers into most needed schools. During the last years, policymakers have shown a growing attention on strategies for enhancing teacher quality of public schools in Chile. The increase of salaries, the expansion of alternative certifications, and the creation of scholarships for high academic students are the main implemented policies. For example, the last and most important teacher reform, the scholarship "Beca Vocación de Profesor", seek to improve the overall teacher quality in schools, particularly in public schools[26], paying tuitions and fees costs to more than 20% of prospective teachers in 2011. Few initiatives aim to enhance high quality teachers to work in most needed schools. For instance, Enseña Chile (equivalent to Teacher for America) work with high academic ability college graduates who commit two years to teach in under-resourced urban and rural public schools.

However, the effectiveness of these policies on the academic quality of public teacher labor force relies crucially on the trajectory of teachers and their retention decisions. The impact of these policies on the documented unequal distribution of teachers across schools will also depend on teacher choices. In fact, research on teacher retention concludes that attracting and retaining effective teachers for students, specially for more disadvantage students, is vitally important yet quite difficult (Ingersoll, 2001). Specifically, evidence suggests that teachers tend to move away from low-performing, high- poverty schools (Hanushek et. al., 2004; Boyd et. al., 2002; Boyd et. al., 2005; Podgursky et al., 2004), and as a result, these schools have the least-qualified teachers as measured by attributes such as licensure status, the selectivity of the colleges from which they graduated, and their performance on standardized exams (Lankford et. al., 2002). Patterns of teacher migration from school to school, especially movement away from schools serving low-income students into schools serving high-income students is also well documented.

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[26] It is mandatory for the scholars to work 3 years in the public school system.

Chile is not the exception. The second chapter of this dissertation concludes that, conditioning on teachers and schools characteristics, teachers with high academic ability are more likely to leave the public school system than those with lower ability. In addition, related to teacher migration from schools to school, the paper shows that elementary novice school teachers in Chile are more likely to leave low performance schools, public and rural schools.

A possible explanation for this pattern of teacher trajectories is that teachers prefer to teach in schools that serve high performance students, schools that are private and urban. In this case, these preferences enable schools that serve low performance students, schools that are public and rural, to attract, select, and retain more effective teachers.

Another alternative explanation is that teachers prefer to teach in schools that have better working environments. Working environments are those aspects or conditions of school environment and culture that affect the quality of teaching and learning, such as school safety, availability of facilities and resources, appropriate teaching assignments, teacher involvement in school decision-making process, administrative support to the instructional process and positive relationships between teachers and between teachers and school leaders (Johnson, 2006; Center for Teaching Quality, 2007). The hypothesis is that teachers, instead of choosing to leave low-achieving students, they may leave the dysfunctional schools that these students often must attend.

The former explanation is supported by recent evidence from large-scale datasets. These studies suggest that the inequality distribution of effective teachers across schools may reflect teachers' preferences for better working environments, rather than different preferences about types of school and students characteristics (Ladd, 2011; Johnson, et. al., 2012). Empirical evidence suggests that poor working environments tend to prevail in the public and rural schools that low-performance students attend (Ladd, 2011; Johnson et. al., 2012).

Even though substantial research literature has documented teacher transitions, far less research effort has gone into understanding what features of the working environments drive teacher decisions to stay and leave schools (Boyd et. al 2011; Ladd, 2011). For the Chilean case, an incipient literature on teacher trajectories has emerged in the last few years. Recent studies have examined teacher retention decisions and how teachers and school characteristics are related to teachers' decision to stay and leave schools. However, to my knowledge, there is not any study in Chile that examines how school working environments influence teacher trajectories and teacher decisions to stay, to switch and to leave teaching in public schools.

The lack of research on the relationship between school working conditions and teacher retention decisions in Chile and the results found in the first and second chapters of this dissertation suggests that further research in this area is crucial. Based on administrative teacher data and following career trajectories of elementary novice teachers, the purpose of the third paper is to study how school working environments are related to teacher retention decisions. This question is addressed by using a rich national data set of elementary public school teachers that allows to differentiate between 2 patterns of

teacher trajectories: 1) switching from one public school to another public school and 2) leaving the public school system to another job outside the public school system (e.g. working as a teacher in the private school system or leaving the profession). Also, the study benefits from using rich teachers, and students' questionnaires that allow to generate five measures of school working conditions (e.g. teachers' influence, principal support, staff relations, facilities, and school safety). Another advantage of the data available is that, unlike most of empirical studies that related teacher working conditions and teacher retention decisions allows studying the actual behavior of teachers, instead of teacher career intentions.

Based on descriptive analysis and multinomial logit models, the study will look at whether teachers who work in schools with poorer working conditions are more likely to switch to another public school or to leave the public school system that those teachers who work in better school environments.

In order to contribute to new knowledge about the Chilean teacher labor market, relevant to the equity and quality of educational system, this paper addresses the following research questions:

1. To what extent do teachers' working conditions vary together across schools? And How are these school-level characteristics distributed across school contexts?

2. What is the relationship between school working conditions (e.g teachers' influence, principal support, staff relations, facilities, and school safety,) and teacher decisions (e.g teachers switch schools and teachers leave teaching in the public school system)?

The questions posed in this paper have clear and important policy implications. Policymakers agree that in order to increase student achievement, the quality of the teacher placed into every classroom is of critical importance. In addition, policymakers are especially compelled by the challenge to place the most qualified, into high-needs schools (Cavaluzzo, 2004; Fisher & Dickenson, 2005; Goldhaber & Anthony, 2004; Goldhaber et. al., 2003; Ladd, 2011). This study is a step forward to deepen our understanding about how schools and policymakers can support teachers in order to reduce the proportion of high qualified teachers who are leaving teaching in public schools, and therefore, to improve the quality of teacher workforce and the distribution of high-qualified teachers in the public school system. If school environments are influencing teacher retention decisions, many implemented policies, such as increasing the number of new recruits with high academic ability and the increases of teacher salaries, may not be as effective as they could be at improving the quality of public school teachers and their distribution across schools.

The paper is structured as follows. In the next section, I review and highlight relevant empirical work on teachers working conditions and their relationship to teachers' decisions. After the literature review, I describe the data, the sample, the outcome, and the explanatory variables. Next, I present the method section, followed by the findings. In

the final section, I discuss the implications and conclude.

LITERATURE REVIEW

Research on teacher turnover and retention is vast and diverse. Studies use several statistical methods (e.g. multiple logit models, survival model, competing risk models, and multilevel models), analyze different teacher decisions (e.g. teacher turnover between schools within the same district, teacher turnover between districts, and teacher leaving the profession), explain teacher behaviors using a variety of explanatory variables (e.g. teacher characteristics, school characteristics, and school working conditions), and analyze different populations of teachers (e.g. novice teachers, elementary v/s secondary teachers, and teachers of specific subjects). Given the focus of this study, the literature review strategically focuses on studies that are relevant to my empirical inquiry and briefly describe the existing knowledge base on the theoretical and empirical literature on how school working conditions influence teacher trajectories and teacher retention decisions.

Researchers working in this vein have identified several dimensions of the school environment that are associated with teacher job satisfaction and teacher commitment to their current school, that influence their teacher career plans. Particularly, most of the studies have used the following school working conditions to measure how is the school environments in which teachers work: teacher influence, administrative support, staff relations, student behavior, facilities, and school safety (see Boyd. et. al 2011; Darling-Hammond, 2003; Glaser, 2003; Hirsch & Emerick, 2007; Ladd, 2011; Loeb et. al., 2005; Boyd et. al., 2011; Papay et. al., 2011; Johnson, 2006). The research to date on each of these factors is reviewed below.

Teacher influence refers to the teachers' autonomy to teach in their classrooms as well as their possibilities to participate in school decision-making process. Teacher show high levels of job satisfaction and find that teachers are more likely to stay teaching when they perceive that the school has a process of decision-making that is democratic and participative (Bloger, 2002; Boyd et. al. 2011; Futernick, 2007). Research on teacher influence and teacher retention decisions also concludes that teachers are more likely to stay in schools where they perceive themselves with more autonomy on their work in the classroom (Boyd. et. al. 2010; Boyd et. al. 2011; and Johnson, 2006).

For example, Ingersoll (2001) and Grissom (2008), using multiple regression analysis and controlling for teachers and students characteristics, found that schools in which teachers have more influence and participation in the school decision-making process have lower teacher turnover rates. In addition, Allenswoth (2009) found that, for both elementary and high schools, teacher retention was 5 percentage points higher in schools with substantial teacher influence, compared to those schools were teachers had little influence over their classrooms and schools. Also, according to Buckley, Schneider, and Shang (2004), the primary reason of teachers for leaving the classroom is the lack of control over classroom decisions, such as designing discipline policy and selecting curriculum. Finally, in studies reviewed by Firestone and Pennell (1993), the authors

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concluded that teachers' autonomy in making classroom decisions and participating in school decision-making process are both significant predictors of teacher commitment to their schools, as well as significant predictors of the likelihood of teacher staying in schools.

Central to any discussion of school working conditions is the support of the *school principal* and administration. As Johnson (2006) recognize "schools will be more attractive to teachers when they are organized for productive collegial work under principals' effective leadership." In other words, principal support refers to the extent to which principals lead the instructional process, supervise and support teachers' work in order to improve their teaching (Johnson, 2006). Several indicators have been used to measure principal support such as teacher supervision to their work (Boyd et. al., 2010; Johnson, 2006; and Futernick, 2007), teacher support in the classrooms (Ingersoll, 2001; and Corbell 2009), professional development opportunities (Boyd et .al. 2010, Berry, 2010; and Johnson, 2006), and the appropriateness of teacher assignment (Ingersoll, 2002; and Corbell 2009), among others.

Considerable research on school leadership has focused on the relationship between principal support and teacher retention and has found that administrative support is a key factor in teachers' decisions to leave or stay their schools. Several researchers have concluded that teachers are more likely to stay when they perceive high levels of school leadership (Boyd et. al 2009; Allensworth et. al. 2009; Boyd et. al. 2011; Johnson, 2004; Ladd, 2009; and Weiss, 1999). For example, Boyd et. al. (2009) and Allensworth et. al. (2009) studied New York City and Chicago teachers respectively, and concluded that school working conditions, especially administrative support, are significant predictors of teacher staying at schools. In addition, Boyd, et. al (2011) found that schools where teachers view their principals as strong instructional leaders tended to have better relationships among teachers and higher proportion of teachers staying at schools. Another example is Johnson (2004) who found that teachers are more likely to stay in teaching when they feel more supported by school administrators.

Along with the research focus on principal support, another important and common school working condition used in the literature is the *staff relations*. The relation between staff members refers to the social and professional relations in schools and includes the relationship between school leaders and teachers, as well as the interactions among teachers (Boyd et. al., 2010; and Ladd, 2011). Several researchers have studied the relationship between staff relation and teacher satisfaction and motivation. These studies have found that a positive social climate and social support are positively related to teacher satisfaction and motivation (Day et. al 2007). Additionally, researchers have studied the relationship between staff relation and teacher retention decisions (Coggshall, 2006; Allensworth et. al. 2009; Boyd. et. al. 2011, DuFour and Eajer, 1998, and Glaser, 2003). These researchers have concluded that teachers are more likely to leave their classrooms when they are less satisfied with their relationship to the school, to their colleagues and to the principal (Coggshall, 2006; Boyd. et. al. 2011, DuFour and Eajer, 1998; and Glaser, 2003). For example, Allensworth et. al. (2009) studied teachers in Chicago and found that teachers who perceived that their working relationship were trusting and positive and who perceived that had a collaborative work environment are

more likely to stay teaching in their schools.

Inadequate *facilities* and resources are also likely to reduce a teacher's willingness to stay in a school. Facilities refer to the equipment and infrastructure that allow teacher to do their jobs. Many factors contribute to the quality of the school building such as the quality of the infrastructure (air quality, thermal comfort, classroom light, noise levels, among others), the availability of some educational resources (teacher room, science lab) and the availability of pedagogical resources such as textbooks, and TIC's. As Johnson (2006) pointed out "when facilities are unsafe or are badly configured for teaching and learning, or when teachers have access to insufficient supplies, teachers are likely to feel unsupported and to be less successful than they otherwise would be."

Numerous studies have looked at the relationship between school facilities and recourses and students achievement, but fewer researchers have studied the relationship between facilities and recourses and teacher job satisfaction and their retention decisions. For example, Buckley (2004) has concluded that have an adequate illumination and temperature in the classroom are significant predictors of teacher job satisfaction and teachers' retention decisions. Other studies (Berry et. al., 2008; Boyd et. al. 2011; and Loeb et. al., 2005) have also concluded that teachers who work in schools with better equipment and infrastructure are more likely to stay teaching at school.

Finally, another school working condition that appears to play a key role in keeping teachers in the field is the *school safety*. School safety refers to the school conditions that affect the well-being of students, teachers and school staff (Boyd et. al. 2010). According to Boyd et. al (2011), school safety is a broad concept that includes several ways of measuring such as measures of student discipline problems, bullying, robbery, and violence. Also, it can be measured by responses to school climate surveys that measure the perception of students, parents and staff about school safety.

Few studies have related school safety conditions and teacher retention decisions. For example, Boyd et. al., (2011), using multinomial model and controlling for students and teacher characteristics, have found that teachers who work in schools with fewer safety conditions are less likely to stay in the school. Another example is Allenswoth (2009). This study, controlling for students characteristics, found that school safety is, particularly in high schools, highly predictive of teacher stability.

DATA AND SAMPLE

This study combines national-wide surveys of teachers and students with teacher trajectories data and demographic teacher and student data from the Ministry of Education. Specifically, this paper is based upon data from the teachers and students surveys of the Sistema de Medición de la Calidad de la Educación (SIMCE) in 2009. Surveys were administered to fourth and eight grade teachers who work in elementary schools in Chile, as well as to fourth and eight grade students in Chile. Teacher surveys consist of 44 multiple choice or Likert-scale questions designed to capture detailed

information about how Chilean educators view teaching and learning conditions in their schools. The survey also includes questions about basic demographics information, and teachers' perceptions on several issues related with students' performance. Student surveys consist of 26 multiple choice or Likert-scale questions designed to capture detailed information about how Chilean students view teaching and learning conditions in schools. The survey also includes questions about basic demographics information, and students' perceptions on several issues related with their performance. The response rates are high, 90% for teachers' survey and 86% for students' surveys. To have more detail see Appendix 1.

Sample

The sample consists on all novice teachers who worked in elementary schools in Chile in 2009. Then, the sample was restricted to novice teachers working in schools where at least 4 teachers responded to the survey and for which there are data from at least 10 students, since it was not valid and reliable to create working conditions measures with fewer teachers and students per school. These restrictions yield a sample of 1.337 novice teachers, compared to just over 1.795 novice teachers nation-wide. Selected characteristics of the teachers included in the sample were compared with other novice teachers (see Appendix 2). On nearly every observable characteristic, teachers in the sample look very similar to those who are not included. In other words, the data suggest that the final sample is broadly representative of novice teachers across Chile.

Outcome

In this study, I model whether an individual initially teaching in a particular elementary public school (i) remains in that school, (ii) switches to another public school in Chile, or (iii) leaves teaching in the Chilean public school system, either exiting the labor force or taking alternative employment (e.g teaching in the private sector).[27]

In this study the outcome focuses on how school working conditions are related to teacher retention decisions (i.e., the propensity of a teacher switching or leaving the public system). The sample contains 1.377 novice elementary teachers who began teaching in 2009 in 943 elementary public schools in Chile, where 9% of them were teaching in a different public school in 2010 and another 16% of them were not teaching in the public school system in 2010.

Explanatory variables

Five measures of teacher working conditions were developed that reveals the school environment in which teachers work. These measures were constructed based on several items from teacher and student surveys. In developing these measures, the starting point was the literature review that examines the school working conditions that contribute to a

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[27] It is not possible to observe whether teachers who are leaving the public school system are actually leaving teaching or teaching in the private school system in 2010.

better school environment and the relationship between these working conditions and teacher commitment, teacher satisfaction, as well as teacher trajectories. Then, several items from student and teacher surveys that closely correspond to each school working condition were selected. After that, a traditional item analysis and a principal factor analysis were conducted to examine the statistical properties of each measure of school working condition. Using the data, the items that do not fit statistically in each of the designed measures of school working conditions were removed. After a process of iterating between statistical properties of the items and the theoretical concepts they represent, the following five measures of school working conditions were developed, each of them based on 2 or more survey items:

- Teacher influence: the extent to which teachers are involved in the school decision-making process as well as their autonomy to teach in the classrooms.
- Principal support: the extent to which principals lead the instructional process, and supervise and support teachers' work in order to improve their teaching.
- Staff relations: the extent to which teachers have positive professional relations in school, including the relationship between school leaders and teachers and interactions among teachers.
- Facilities: the extent to which teachers work in a school with more facilities that enables them to be productive[28].
- Safety: the extent to which students, teachers and school staff work in a safe school environment.

Table 1 present all survey items that were used to create each of the school working condition measures. For each measure, the internal consistency reliability exceeds 0.7. Factor analysis (principal components) suggests that each measures captures only one underlying construct and composite were formed using factor scores.

Each of the individual items, except those measuring infrastructure and safety, comes from teachers' responses on a 5-point scale. The teacher influence indicator has an alpha of 0.85 and comprises three items. On average, teachers perceive that they have more autonomy in the classroom than opportunities to setting and discussing school pedagogical goals. Then, the principal support measure has an alpha of 0.92 and includes six items, with administrators being rated highest on being responsible for students' performance and lowest on supporting teachers to improve their performance. The staff relation measure has an alpha of 0.78 and comprises three items. The teachers are being the most positive about their relationships with students and less positive abut their relation with other staff members. Since the infrastructure measure includes only two dichotomous survey items, a factor score was not calculated. Instead, the infrastructure variable represents the sum of the items. Thirty five percent of the students surveyed report that the school has a science lab, and only 11% of the students surveyed report that their schools have a language lab. The school safety measure, including five of the survey items, has an alpha of 0.84. On average, the teachers declare that it is more likely to be insulted and mocked by students and less likely to be threatened by students.

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[28] Data on facilities is accurate since students' responses tended to be consistent within a school (over 90%).

Table 1: Desciptives from teacher and student surveys

Item	Number	Mean	Std. Deviation	Factor Loadings
Teacher Influence (α=0.85)a d				
The school assists an independet work	36,378	1.734	0.824	0.368
The school involves teachers in seeting up pedagogical goals	35,246	1.800	0.890	0.369
The school promotes teachers to discuss about pedagogical issues	36,578	2.014	1.005	0.378
Principal support (α=0.92) a d				
After observation and supervision, the principal helps and supports teachers to imporve their performance	32,443	2.059	1.036	0.210
The principal suggests teachers specific pedagogical strategies to improve student learning	36,849	1.899	0.942	0.200
The principal assesses students learning goals using tests	36,763	1.959	1.042	0.200
The principal is responsible for students performance	36,494	1.653	0.825	0.200
The principal promotes teacher learning (workshops, scholarships, time)	36,578	1.845	1.003	0.200
The principal supports teacher to focus on teaching and learning through reducing externa or administrative work	35,250	1.808	1.002	0.200
Staff relations (α=0.78) a d				
The relatioship between teachers is good	36,802	1.687	0.830	0.414
The relationship between teachers and students is good	37,304	1.596	0.653	0.387
The relationship between teachers and adminitrative team is good	36,992	1.852	0.901	0.396
Facilities b e				
School has a science lab	215,700	0.35		
School has a lenguage lab	215,700	0.11		
School safety (α=0.84) c d				
How often does theft happen?	37,347	2.383	0.609	0.239
How often do students' fights happen?	37,339	2.317	0.637	0.264
How often do insults and mocks between students happen?	35,118	2.100	0.671	0.270
How often do threat happen?	37,240	2.564	0.607	0.267
How often do stduents destroy or damage the school?	37,396	2.547	0.606	0.234

a Response were 1 (strongly agrre), 2 (agree), 3 (neither agree or desagree), 4 (desagree) and 5 (stringly desagree)

dichotomous items.

c Responses were 1 (always or almost always), 2 (sometimes) and 3 (never or almost never)

d Teacher survey

e Student survey

To create the measures based on teacher and student responses of survey items, first, for each teacher, the items were standardized and each measure was created. Then, using weighs from the factor analysis, their weighted sum was computed. Thus, each measure has a mean of zero and standard deviation of one to allow for a more meaningful comparison of the different schools working conditions measures.

The next step was, based on each measure for each teacher, school-level averages were

constructed for each school working conditions. In other words, school-level average measures were created that includes fourth and eight grade teachers and eight grade students in a given school.

Administrative data on teachers and schools

Survey responses were used to created school working conditions measures. Then, these measures were matched to administrative data provided by the Ministry of Education. Specifically, data on teachers' characteristics come from the teacher-level annual file (Bono de Reconocimiento Profesional, BRP) maintained by the Unidad de Estudios. BRP includes individual-level information on the following characteristics of teachers: education, the identity of the teacher's school, number of hours and months worked, position held, and highest degree earned. BRP data was supplemented with data on teachers' personal characteristics (i.e., gender, and age) from the Idoneidad Docente (ID) dataset, which is also maintained by Unidad de Estudios.

Characteristics of schools come from the administrative public-use data files maintained by SIMCE. This source provided school information regarding students' characteristics such as students' socioeconomic status, students' performance, as well as some schools characteristics such as school administration, and school location.

Finally, teacher records were linked to a master data set of PSU[29] scores maintained by Universidad de Chile.

Variable definitions and summary statistics of the characteristics of novice teachers and their schools are listed in Table 2. As shown in Table 2, the sample of new teachers is overwhelmingly female (79%), 35 percent are younger than 25 years old and only 4 percent are older than 50 years old. Almost all teachers have a major in education (96%) and only 39 percent of them have a specialization in a subject. These teachers work in 943 elementary schools, 13% work in schools attend by low- income students, 87% work in urban schools, 37% work in regular public schools and 10% work with low achievement students.

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[29] PSU is the national selection test and it is the main toll used by universities to select their students.

Table 2: Descriptive statistics for novice teachers and their schools

Variable	Mean
Teachers	
Female	79%
Young	35%
Old	4%
Title	96%
Specialization	39%
Academic ability	10%
Schools	
Low income	13%
Private	62%
Urban	87%
Low achiving	10%

METHOD

Several analyses were conducted to address the first and second research questions. First, the distribution of school working conditions across schools was analyzed. The mean, standard deviation, minimum and maximum for each of five school working conditions were estimated, and examinations of these results across schools offered how working conditions vary across elementary public schools in Chile.

A second analysis was run to characterize the variation of school working conditions by school and student characteristics. Specifically, I examined how school working conditions are distributed across schools with different characteristics. For each school (socioeconomic classifications, and student achievement) and student characteristics (locations, and school types), the school working conditions measures were analyzed.

Finally, a multinomial logistic regression was conducted (equation (1)) to study how the variation in the school working conditions is associated with the teacher decisions about staying, switching schools or leaving teaching in the public school system.

$$\log\left(\frac{h_{ij}}{1-h_{ij}}\right) = \beta_1 Z_{1ij} + \beta_2 Z_{2ij} + \beta_3 Z_{3ij} \qquad (1)$$

The dependent variable is a three-category measure indicating whether in the following

school year the teacher (a) stayed at the same school, (b) moved to another public school in Chile, or (c) left the public school system. The models control for teacher background characteristics (Z_{1ij}), including gender, age, major, specialization, and teacher academic ability. The models also include controls for school characteristics (Z_{2ij}) that might affect teacher retention—students' socioeconomic status, students' performance, school type (public or private) and urbanicity. After controlling for these teacher and school characteristics, the relationship between school working conditions (Z_{3ij}) and teacher trajectories are explored.

The variables of interest are the five school working conditions (teacher influence, principal support, staff relations, facilities, and school safety). The contribution of each school working condition is analyzed separately. Then the contribution of each measure is analyzed simultaneously including all five measures in the models at the same time.

RESULTS

The primary goal of the analysis is to focus on investigating two intertwined aspects of teacher retention decisions in Chile. These two aspects are how school working conditions vary across schools and across different school and students characteristics; and how school working conditions are related to teacher decisions of switching and leaving a public school in Chile. This section presents the results of the analysis. Some descriptive statistics are presented, and then the findings based on the multinomial logit models.

Question 1: To what extent do school working conditions vary together across schools? And how are these school-level characteristics distributed across school contexts?

Table 3 shows the mean, standard deviation, minimum and maximum for each measure of school working conditions. By any measure, the school working conditions are unevenly distributed across schools.

Table 3: Descriptive statistics for measures of school working conditions

Variable	Number	Mean	Std. Deviation	Min	Max
Teacher influence	1,337	0.056	0.608	-1.054	3.088
Principal support	1,337	0.025	0.690	-1.054	3.744
Staff relation	1,337	0.002	0.360	-1.072	2.438
Facilities	1,337	1.951	0.901	0.000	4.000
School safety	1,337	0.009	0.365	-2.828	1.247

Tables 4 and 5 show the means of a variety of school working conditions across student performance, rural and urban areas, student socioeconomic status, and type of school administration respectively. As expected, these analyses confirm the previous findings (Boyd, et. al, 2011). Rural and public schools tend to have worst school working conditions compared to urban and private schools, on average. Also, schools attended by student from higher socioeconomic status and who have better students performance show better school working conditions that those schools attended by students with lower socioeconomic status and with students who have lower student' performance.

Table 4.A: School working conditions by students' performance and urbanicity

	Number	Lower student performance	Higher student performance	Urban	Rural
Teacher influence	1,337	0.097	0.049	0.113	0.079
Principal support	1,337	0.180	0.004	0.083	0.038
Staff relation	1,337	0.274	0.059	0.001	0.093
Facilities	1,337	2.194	1.930	2.140	1.929
School safety	1,337	0.726	0.027	0.140	0.137

Table 4.B: School working conditions by student socioeconomic status and school type

	Number	Lower socioeconomic status	Higher socioeconomic status	Public	Private
Teacher influence	1,337	0.069	0.037	0.087	0.002
Principal support	1,337	0.044	0.033	0.021	0.023
Staff relation	1,337	0.143	0.072	0.219	0.002
Facilities	1,337	2.091	1.934	1.994	1.931
School safety	1,337	0.288	0.073	0.366	0.060

Question 2: What is the relationship between teachers' working conditions (e.g teachers influence, principal support, staff relations, facilities, and safety) and teacher behaviors (e.g teachers switch schools and teachers leave teaching un the public school system)?

As described above teachers' and students' survey responses were used to create five measures of school working conditions: teacher influence, principal support, staff relations, facilities, and safety. Table 5 reports the correlations among the factors aggregated to the school level. Not surprisingly, schools with more positive working

conditions on one dimension also tend to have more positive working conditions on the other dimensions. The principal support factor is particularly highly correlated with both teachers' influence and staff relations.

Table 5: Correlations between school working conditions measures

	Teacher influence	Principal support	Staff relation	Facilities	School safety
Teacher influence	-				
Principal support	0.666*	-			
Staff relation	0.586*	0.589*	-		
Facilities	0.02	0.063	0.066	-	
School safety	0.282*	0.296*	0.300*	0.025	-

Then, a multinomial logistic regression was used to study the relationship between the five school working conditions and teachers' decision to switch and to leave elementary public schools in Chile. Table 6 presents the results for elementary novice teachers with and without school working conditions but including teacher characteristics and school characteristics. Table 7 includes the estimates with each school working condition entered separately and a full model with all factors entered together. The results of both models are presented because of the relatively high correlation among the measures of school working conditions (see Table 5). Conceptually, the effects of these school context factors are not independent. For example, we might expect that supportive principals are able to maintain a safe school environment, compared to those principals who are less supportive to teachers work. While conceptually there are concerns about a lack of independence, a multicollinearity among the school working conditions measures was statistically checked by looking at how the magnitude of the coefficients, and how their significance changed when correlated variables are added to the model. The results show that while multicollinearity may be a conceptual concern, it is not a statistical problem.

Table 6: Results of models without and with school working conditions

| Variables | Without school working conditions | | | | With school working conditions - Full model | | | |
	Switching schools		Leaving schools		Switching schools		Leaving schools	
Teachers								
Female	-0.133	(0.243)	0.035	(0.187)	-0.226	(0.247)	0.032	(0.190)
Young	0.445**	(0.205)	-0.176	(0.167)	0.474**	(0.214)	-0.061	(0.166)
Old	0.131	(0.495)	-0.194	(0.401)	0.276	(0.504)	-0.037	(0.407)
Title	-0.059	(0.549)	-0.752**	(.0330)	-0.261	(0.557)	-0.741**	(0.345)
Specialization	-0.124	(0.213)	0.032	(0.160)	-0.228	(0.219)	-0.136	(0.140)
Academic ability	0.006	(0.354)	0.157**	(0.240)	0.001	(0.358)	0.189**	(0.242)
School								
Low income	0.372	(0.329)	0.470**	(0.270)	0.582	(0.325)	0.519**	(0.280)
Private	-0.407**	(0.211)	0.285*	(0.170)	-0.439**	(0.234)	0.456**	(0.185)
Urban	-0.265	(0.311)	-0.340	(0.268)	-0.584**	(0.325)	-0.549	(0.266)
Low achiving	0.364**	(0.352)	0.205	(0.260)	0.765**	(0.325)	0.340	(0.273)

The base model in Table 6 with only teacher characteristics and school characteristics shows that, consistent with prior research, teachers are more likely to switch from schools with low students performance and from private schools. Also the results show that teachers major are less likely to leave teaching in the public school system. As previous evidence (chapter 2), teachers with higher academic ability are more likely to leave than those teachers with lower academic ability. The second set of columns in Table 6 show that once we control for school context factors (coefficient presented in Table 7), the coefficients that were significant in the models that do not include schools working conditions are still significant, but their magnitude changes a little. In addition, after controlling for school working conditions, teachers who work in urban schools are less likely to switch schools.

Table 7 presents the results for specifications in which the five school working conditions are added to the model, first separately and then simultaneously. All of the variables in Table 6 are included in the models reported in Table 7, but the coefficients associated with these variables are omitted. When each school working condition was added separately to this model, the results show that school working conditions significantly predict teachers' decisions to leave the public school system. More specifically, the results show that teachers' and students' perceptions of staff relations and facilities, respectively, are related to decisions of teachers to leave the public school system but not to switch schools. On the other hand, teachers' perceptions of teacher influence, principal support, and school safety are related to both decisions: to switch schools and to leave teaching in public schools. In all cases, the relationships are negative—that is, the more positively the teachers perceive these school contextual factors, the less likely they are to transfer to another school within the public school system or to leave teaching in the public school system.

Table 7: Results of model with school working conditions entered separately and results of full model (coefficients)

| Variables | Model with school working conditions entered separatly | | | | Full model | | | |
	Switching schools		Leaving schools		Switching schools		Leaving schools	
Teacher influence	0.488*	(0.157)	0.269**	(0.119)	0.697*	(0.266)	0.409**	(0.202)
Principal support	0.192***	(0.140)	0.119***	(0.106)	0.512***	(0.248)	0.408***	(0.182)
Staff relation	0.175	(0.161)	0.333*	(0.120)	0.080	(0.223)	0.268***	(0.163)
Facilities	0.121	(0.113)	0.148***	(0.081)	0.143	(0.118)	0.148***	(0.083)
School safety	0.350*	(0.146)	0.338*	(0.110)	0.271***	(0.163)	0.244**	(0.122)

In the full model, including all five school working conditions and the controls, the school working conditions that significantly predict teacher decisions are the same than when each school working condition was added one by one. However, the magnitude generally changes a little. Table 8 shows the odd ratios of all five school working conditions. The results show that teacher influence has the highest effect on teacher decisions of switching and leaving schools. Then, principal support and school safety seems to be more important working conditions for teachers choices than staff relation and school facilities.

Table 8: Results of model with school working conditions entered separately and results of full model (odd-ratios)

| Variables | Model with school working conditions entered separatly | | Full model | |
	Switching schools	Leaving schools	Switching schools	Leaving schools
Teacher influence	1.629*	1.309**	1.972*	1.505**
Principal support	1.212***	1.126***	1.669***	1.504***
Staff relation	1.191	1.395*	1.083	1.307***
Facilities	1.129	1.160***	1.154	1.148***
School safety	1.419*	1.402*	1.311***	1.276**

SUMMARY AND DISCUSSION

Good teachers often cite school working conditions as the reason they leave low-performing schools (Bloger, 2003; Berry et al. 2006; and Futernick, 2007). In the same line, the results of this study conclude that school working conditions matter a great deal. Teachers who teach in favorable work environments are less likely to switch schools or to leave teaching in public schools than their peers in schools with less favorable school working conditions, even after controlling for student demographics and other school and teacher characteristics. These results are aligned with a growing empirical literature that examines the relationship between school working conditions and teacher career

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decisions (Boyd et al., 2011; Ladd, 2011, Weiss, 1999; Allensworth et. al. 2009; Jhonson, 2004; Loeb et. al 2005). All these evidence together strongly suggest that teacher decisions of switching and leaving teaching in the public school system are driven by teachers leaving unsupportive and less favorable work environments, where may be attended by low-income and low-performance students.

The findings of this study suggest that a policy focus on the school working conditions may be a worthwhile way to address teacher retention and teacher quality issues. As Ingersoll 2003 suggests "the working conditions identified by new teachers as factors in their decision to leave teaching—lack of administrative support, poor student discipline and student motivation, and lack of participation in decision making—may offer a more effective focus for improvement efforts."

Even though policymakers have paid increasing attention to strategies for enhancing teacher quality in public schools, most of these efforts have focused on attracting better teacher candidates into the profession — for example via increased salaries, expanded alternative certifications, and the creation of teaching scholarships for high-performing students. However, the results of this study show that, in order to enhance teacher quality in public schools and to improve the distribution of highly qualified teachers across schools, school principals and school administrators need to work on creating an orderly school environment. In other words, recruiting more teachers will not solve the high proportion of teachers who are switching schools and leaving teaching in the public school system if school working conditions are not improved.

By documenting the relationship between school working conditions and teacher trajectories, this study provides a foundation on which to start to design teacher retention policies in order to improve teacher quality in schools and the distribution of highly qualified teachers across schools. This study is a first step in understanding the relationship between school working conditions and teacher career paths in the Chilean teacher labor market. Such findings are important because working conditions are more responsive to changes in policy and administrative practice than other factors, such as student characteristics.

However, the findings do not provide simple answers for policymakers. School working conditions are not factors that can be readily manipulated. The fact that teachers seek supportive principals, collaborative colleagues, and a positive school culture does not translate easily into legislation or administrative regulation.

To design and implement effective policies to attract and retain highly qualified teachers in schools that serve low income and/or low-performing students, additional research must be carried out. The design and the implementation process of educational policies oriented to improve the relation between staff members or to improve the school safety are out of the scope of this study. However, researchers have carried out several studies in this area looking at how to improve the school environments in which teachers work. For example, several school administrators in the USA have supported new teachers providing mentors in order to help teachers to work through the first year of teaching. Another example is that some schools and districts have introduced policies and practices

that are meant to promote more collaboration among teachers (Kakay et a. 2011). Chile has to learn in this line. There is not any educational public policy initiative designed to support teaching and to promote a better school environment. Those seeking to improve schooling must understand the important links between the teacher workplace, effective teaching, and teacher retention decisions.

In sum, it is surely important to have higher salaries and teachers with high academic ability, but if teachers are to achieve success with their students they also must be able to have more autonomy in the classrooms, participate in setting schools goals, to be able tocount on their colleagues, and their principal, to work in safe environments where students respect each other, among others, to make success possible. From a policy perspective, what is clear, however, is that guaranteeing an effective teacher for all students—especially for low income students—cannot be accomplished simply by offering financial rewards or mandating the reassignment of effective teachers. Rather, if the school is known to be a supportive and productive workplace, good teachers will come, they will stay, and their students will learn.

Limitations and further research

Evidence continues to mount that school working conditions play an important role in both teachers' career choices and their students' learning. However, we still have much to learn about the school working conditions that matter most to teachers and how they influence school working environment and teaching and learning. The results and implications of this study should be interpreted cautiously. This study has several data limitations to create schools working conditions measures and to study the relationship between the school environment and teacher retention decisions. First, each of the school measures was created based on four and eighth grade teachers' surveys, which is a small sample of elementary teachers in each school. Second, the literature identifies more school working conditions that are related to teacher retention decisions such as student discipline, but teacher surveys do not have reliable information to create measures for other school working conditions. Third, teacher and students surveys were not designed to measure the school working conditions identified in this study.

However, even though the limitations of the data used, this study is an important progress on the literature of teacher trajectories in Chile and teacher retention decisions, since it is the first study, to my knowledge, that look at the relationship between school working conditions and teacher retention decisions. This study can be enriched in the future by improving school working conditions measures to describe school environments. Future work would particularly benefit from additional measures of school working conditions, which teachers' survey do not fully capture. Sources with closer analysis such as interviews and observations will allow to create more reliable and valid measures of schools working conditions as well as will allow to generate more knowledge in order to identify and design educational policies that can be done to ensure that all schools became places where teachers do their best work.

A second limitation of this study is that teacher salary was not included among the teacher characteristic due to the lack of individual teacher salary data available. However, given that the public and private schools in Chile follows a standard salary schedule largely based on teacher education and years of teacher experience, both variables were incorporated in the model to partially account for earning difference among teachers. In addition, private schools can pay higher salaries to attract better teachers if they want. While data available does not allow to estimate salary differences between public and private schools, national sample data taken from Encuesta Longitudinal Docente (2009) shows that salary for first-years teachers are similar in regular public schools and private schools.

Finally, this study cannot distinguish between teachers who switch voluntarily from one public school to another school from those who switch involuntarily (e.g. fired). However, given a special labor regulation for teachers in Chile that makes it difficult to remove a teacher from a public school, it is not expected that a high proportion of teachers switched schools involuntary. In case of the private school there is not any special regulation to protect them to be fired and unfortunately there is not any evidence of the proportion of teachers who are fired from these types of school.

Overall, this study highlights an important area for educational policy. If policymakers want to influence teachers' trajectories working conditions and the quality of the school environment must be taken into account. Improving school working conditions will be a complement of other educational policies that aim to improve teacher retention of high-qualified teachers in the public school system. In addition, future research in this area must be carried out. This line of research will support to policymakers to design educational policies to improve the distribution of teacher across schools as well as teacher quality of the public teacher workforce. Also, this new knowledge will help administrators and principals who want to retain teachers to design strategies at the school level to improve their school working conditions, and therefore, to keep high-qualified teachers at their school.

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APPENDIX

Appendix 1: Work force Database

Workforce Database	Personal data and trayectories	Teacher quality data	School data	School working conditions data
Universe	All public schools teachers	All individual taking PSU test	All schools	All schools
Elements	- Teacher ID - Gender - Experience - Age - Degree attainment - Specialization - School ID	- Teacher ID - Scores on PSU	- School ID - Type of administration - Socioeconomic classification - Urban/rural - SIMCE scores - Location	- School ID - Teacher influence - Principal support - School safety - Infraestructure - Staff relation
Time period	March 2009-March 2010	1999-2011	2010	2010
Name of data	Bono de Reconocimiento Profesional (BRP) 2009-2010 and Idoneidad Docente 2009 and 2010	Resultados PSU	SIMCE 2010, and Directorio de establecimientos 2010	Cuestioanrios SIMCE 2010
Source	Ministerio de Educación, Chile	Ministerio de Educación, Chile	Ministerio de Educación, Chile	Ministerio de Educación, Chile

Appendix 2: Teacher Characteristics of the all novice teachers and study sample

Variable	All teachers	Sample
Female	80%	79%
Young	34%	35%
Old	4%	4%
Title	96%	96%
Specialization	37%	39%
Academic ability	9%	10%