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The Link of Teacher Career Paths on the Distribution of High Qualified Teachers: A Chilean Case Study

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Abstract: This paper uses rich data of 79,418 elementary teachers from 5,521 schools in Chile to study the extent of teacher sorting and its association with teacher career paths. A complete analysis of ten measures of teacher quality shows that highly qualified teachers are unequally distributed across schools. Some schools present a large concentration of highly qualified teachers while others do not even have a single one. Schools with a low concentration of highly qualified teachers are more likely to be public and rural, & have a bigger enrollment of low-income and low-performance students. Thus, it is precisely those schools that are most in need. This paper combines the analysis of teacher sorting with teacher career decisions and finds that teacher career paths are associated with the unequal distribution of teachers. At the start of their careers, less qualified teachers are more likely to teach in rural, public, low-income and low-performance schools. These teachers are then more likely to stay in those schools, while less qualified teachers who start working in high-income and high-performing schools are less likely to stay there compared with highly qualified teachers. Education reforms have recognized the key role of teachers. However, efforts have focused on increasing the quality of the teaching workforce and do not target any specific types of schools. This study discusses the lack of targeted policies and educational inequality, & proposes the need for an educational reform.

Key words: Teacher Sorting; Teacher Career Paths; Teacher Placement; Teacher Policy; Unequal Distribution; Educational Inequality; Chile

La Relación entre las Trayectorias Laborales Docentes y la Distribución de los Profesores Calificados: El Caso Chileno

Resumen: Este paper utiliza una base de datos única que incluye 79.418 profesores de primaria de 5.521 establecimientos educacionales en Chile para estudiar el distribución de los docentes calificados en Chile y sus asociación con las trayectorias laborales docentes. Un completo análisis de 10 medidas de la calificaciones de los docentes evidencian que docentes con mejores calificaciones están desigualmente distribuidos en los establecimientos. Algunos establecimientos muestran altas concentraciones de profesores con altas calificaciones mientras otros no tienen si quiera uno. Establecimientos con baja concentración de profesores altamente calificados son públicos y rurales y tienen una mayor proporción de alumnos de bajos ingresos y con bajo desempeño. Justamente aquellas escuelas que más los necesitan. Este paper combina este análisis con las trayectorias laborales de los docentes y encuentra que estas trayectorias están asociadas a la distribución desigual de los docentes altamente calificados. Al principio de sus carreras, los profesores menos calificados trabajan en mayor proporción en establecimientos rurales, públicos y con alumnos de bajos ingresos y bajo desempeño. Estos profesores tiene mayor probabilidad de mantenerse en estos establecimientos, mientras que profesores con bajas calificaciones que comienzan sus carreras en establecimientos con alumnos con altos ingresos y alto desempeño tienen menor probabilidad de quedarse que aquellos profesores con altas calificaciones que comienzan en establecimientos similares. Las reformas educaciones han reconocido el rol clave de los docentes. Sin embargo, los esfuerzos han estado focalizados en mejorar la calidad de la fuerza laboral docente y no se focalizan en algún tipo de establecimiento. Este estudio discute la falta de políticas docentes focalizadas en mejorar la calidad docentes en aquellos establecimientos que mas lo necesitan y propone la necesidad de una reforma educacional que lo incorpore.

Palabras clave: distribución de profesores; trayectorias laborales docentes, mercado laboral de profesores; políticas docentes; estratificación; segmentación; Chile

A Relação entre as Trajetórias de Professores que Trabalham e a Distribuição de Professores Qualificados: O Caso Chileno

Resumo: Este trabalho usa um único banco de dados que inclui 79.418 professores primários em 5521 instituições de ensino no Chile para estudar a distribuição de trabalhadores qualificados no Chile e sua parceria com os professores de ensino. Uma análise completa das 10 medidas de qualificação dos professores mostram que os professores com melhores qualificações são desigualmente distribuídos no local. Alguns estabelecimentos que apresentaram altas concentrações de professores com altas pontuações, enquanto outros não têm sequer um. Estabelecimentos com baixa concentração de professores altamente qualificados são públicos e rural e têm uma maior proporção de estudantes de baixa renda, baixa realização Precisamente essas escolas mais necessitadas. Este trabalho combina essa análise com os planos de carreira dos professores e descobriram que essas trajetórias são associados com a distribuição desigual de professores altamente qualificados. No início de suas carreiras, os professores menos qualificados trabalham em maior proporção em setores rurais, instalações públicas e com estudantes de baixa renda e baixo desempenho. Estes professores são mais propensos a permanecer nesses estabelecimentos, enquanto os professores pouco qualificados que começam suas carreiras em escolas com alunos com rendimentos elevados e alto desempenho são menos propensos a ficar do que aqueles professores com alta pontuação a partir de estabelecimentos similares. As reformas de educação têm reconhecido o papel fundamental dos professores. No entanto, os esforços têm sido direcionados

na melhoria da qualidade da força de trabalho e não se concentra no tipo de estabelecimento. Este estudo discute a falta de políticas educacionais direcionadas em melhorar a qualidade do professor nos estabelecimentos que mais precisam e sugere a necessidade de uma reforma educacional que incorpore isso.

Palavras-chave: distribuição de professores, planos de carreira docente, mercado de trabalho dos professores, políticas de trabalho, estratificação, segmentação

Introduction

In recent years, there has been growing attention over educational policies and especially on strategies for enhancing and strengthening the teaching profession, both worldwide and in Latin America. Recent research on student achievement recognizes the important link between teacher quality and student outcomes, with teacher quality identified as the most impactful school-level influence on student learning and achievement (Aaronson, Barrow, & Sander, 2007; Darling-Hammond, 2000; Rockoff, 2004; Hanushek & Kain, 2005; Hanushek, Kain, & Rivkin, 1998; Sanders & Rivers, 1996). A great teacher can make a huge difference in the lives of students, especially low-income students (McCaffrey et al., 2003; Hanushek, 2010).

Educational reforms have recognized the key role of teachers in classrooms. To improve teacher quality, there is a general consensus on the need to attract high-achieving students, make teaching an attractive career choice, raise the quality of teacher education programs and continuous teaching trainings, promote careers that contribute to professional development, guarantee decent teacher pay, & retain effective teachers in the educational system (OECD, 2011b; PREAL, 2006; UNESCO, 2010a; UNESCO, 2010b; World Bank, 2005).

In fact, several efforts in the region have been implemented to improve the quality of the teacher workforce. During the last two decades, the main focus of these policies has been on enhancing teacher knowledge through continuous improvement of teacher training programs and teacher continuing education (UNESCO/OREALC, 2013). On the contrary, less attention has been paid on professional development and working conditions of teachers. Chile, Colombia, Ecuador and Peru have been pioneers in professional development within the region. For example, Chile has created several monetary incentives associated to better teacher performance based on agreed standards in order to identify and retain high quality teachers. Colombia has raised the requirements to enter the teaching profession in public schools through the centralization of teacher selection process and recruitment; while Ecuador and Peru have come up with a set of policies that promote the teaching career, which contributes towards the development of the teaching profession (UNESCO/OREALC, 2013).¹

These educational policies may succeed in improving teacher quality workforce. However, the impact and effectiveness of these teacher policies on the equity and quality of the educational system will depend on the teacher career paths. Dynamic choices such as where new teachers are teaching, how long teachers remain teaching, when do teachers leave the profession, what type of schools teachers are more likely to leave, among others, would impact the desired effects of teacher policies on educational quality as well as its indirect effects on educational equity.

This paper uses Chile as a case study to address educational inequality by understanding the uneven distribution of effective teachers across schools, & its relationship with teacher career paths. First, this research studies the variation in the ten measures of teacher quality that currently exist across schools and the occurrence of this variation across schools within districts, across districts

¹ For a detailed compilation of the relevant experiences of teacher educational policies in Latin America, see Orelac / Unesco, 2013.

between regions and between regions. Second, it characterizes the inequity in the quality of teachers by associating the variation of these teacher quality measures with the characteristics of schools and the students. Finally, this research assesses how the inequity in teacher quality across schools is associated with the teachers' decisions at the start of their teaching profession, as well as with the mobility and attrition of teachers throughout their careers.

Disparities in teacher quality have been documented in the region (Cabezas et al., 2011; Luschei, 2012, 2013; Meckes & Bascopé, 2012; Ruffinelli & Guerrero, 2009; Ortuzar et al., 2009; Valenzuela & Sevilla, 2012). But little is known about the extent of teacher inequality across schools and its association with teacher choices. The understanding of teacher sorting and teachers' career paths is central to address potential student achievement gaps by designing effective policies to attract more qualified teachers into schools that need them the most. It is a known fact that high-quality teachers can make a tremendous difference in the achievement of low-income students.

Chile is a good starting point for studying teacher inequality and its association with teacher choices. The nation is a regional pioneer in designing and implementing several teachers' educational policies. For example, in 2003, it established professional teaching standards at the national level through a participatory process and measures teacher performance in a standardized way using a set of instruments (CPEIP, 2005a, 2005b; OECD, 2013). In addition, a rich longitudinal data set is available for a large sample size of public and private subsidized elementary teachers², which enables (1) the characterization of teacher quality using over ten different measures, (2) the monitoring of a large number of novice teachers for several years and, (3) the study of different types of teaching career paths for those teachers.

The next section offers a conceptual model to study teacher career paths. Section 3 presents a brief summary of existing literature about the measures of teacher quality and their relationship to student learning as well as the distribution of teachers and the relationship between teachers and school where they work. Section 4 describes the Chilean context about initial teacher training, teacher evaluation and teacher recruitment. Section 5 describes in detail the measures of teacher qualifications that were constructed for this study along with the analytical method, data, & sample of teachers used. Section 6 presents the results, & Section 7 discusses the results.

Conceptual Model

Figure 1 presents the conceptual model for studying the role of teacher career paths on student achievement gap. First, new teachers, via the job matching process of their first teaching job³, can impact on the sorting of teachers between schools, if there are systematic relationships between teacher effectiveness and the types of schools they enter. Second, if the teachers' decisions of where to teach and how long to teach vary systematically across schools or according to certain student/teacher characteristics, then the teachers' choices will lead to unequal sorting of effective 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 students will be detrimental for the advancement of disadvantaged students. On the other side of teacher sorting, the presence of high qualified teachers in schools with higher proportions of

² Chile has three types of schools, characterized by their financing mechanisms and administration methods: (1) "public schools," managed by the municipalities, which receive a government subsidy and constitute 46% of primary school enrollment in Chile, (2) "government-subsidized private schools" which constitute 47% of primary school enrollment in Chile, & (3) "private paid schools," which do not receive government subsidies and educate 7% of the nation's primary school students. This study includes only teachers who work in the "public school system" (public schools and government-subsidized private schools) and does not include teachers who work in private paid schools.

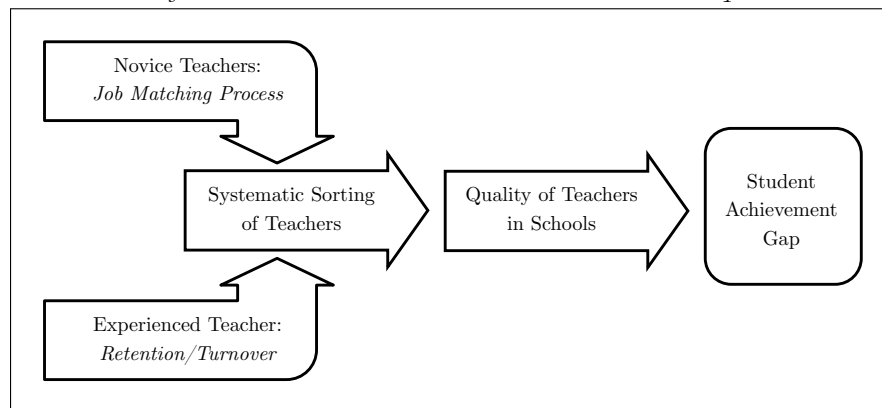
³ The job matching process is the result between teacher's choices and the schools or districts hiring practices.

high-income students will improve student learning, contributing to an increase in the current student achievement gap between low- and high-income students.

The factors that may affect teacher hiring and, therefore, the distribution in different schools have been thoroughly studied from different perspectives. A possible explanation for these patterns of teacher trajectories is that high/low qualified teachers prefer to teach in schools that serve high/low income students. Another alternative explanation is that teachers prefer to teach in schools that have better working environments⁴. Economists have proposed a model of hedonic prices (Antos & Rosen, 1975), which assumes that teachers have specific preferences for salary and working conditions, whereas employers differentiate based on the salary they can offer and on their preferences for specific teacher attributes (Boyd et al., 2011; Loeb et al., 2005; Ladd, 2011). Several studies have found that teacher career paths are driven by teachers leaving unsupportive and less favorable work environments, where may be attended by low-income students (Allensworth et al., 2009; Boyd et al., 2011; Center for Teaching Quality, 2007; Johnson, 2004, 2006; Ladd, 2011; Loeb et al., 2005; Weiss, 1999).

Figure 1:

The Role link of Teacher Career Paths on Student Achievement Gap



These explanations are both plausible in the Chilean case where teacher recruitment is a decentralized process (OECD, 2013). On one side, teachers can decide which school they want to apply for a job and, on the other, schools and municipalities hire the best applicants and develop their own recruitment and selection process to hire their teachers (more detail in the Chilean context section).

Literature Review

While there is increasing agreement that more effective teachers dramatically enhance student achievements than less effective teachers, there is a low consensus 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.

⁴ Such as school safety, availability of facilities and resources, compensation, 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, among others.

The following sections present a summary of different measures to identify high-qualified teachers and its relationship with students outcomes and then describes a summary of the literature that study the distribution of high-qualified teachers.

Teacher Quality

To summarize the different indicators of teacher quality, Figure 2 presents three different categories and several measures that have been commonly used to measure and evaluate the quality of teachers over the last 50 years. For each of the three categories, Figure 2 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. a. Measures of academic ability through test scores and grades: college entrance test, intelligent Test (IQ), verbal ability (tests), high school GPA.
II.	Teacher qualifications established prior to teaching: knowledge of teaching and learning that teachers bring with them when they enter the classrooms in the first year a. 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's degree b. Mix between subject matter knowledge and knowledge in teaching and learning: Certification, Accreditation.
III.	Teacher qualifications and teacher effectiveness after entering teaching: knowledge of teaching and learning that teachers accumulate after working in classrooms. a. Measures of subject matter knowledge and knowledge of teaching and learning: advanced certification, years of experience. b. Measures of participation in continuing learning: professional development c. Measures of teacher effectiveness: peer evaluation, (principal's perception of teacher performance, teachers, peer, mentors observation); self-rating evaluation (teachers evaluate their own work), students' outcomes (value-added indicators), observation of classroom practices (use of formative assessment, use of student-centered teaching approach, among others.)

Figure 2. Three 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 & Young, 2003), some teachers' attributes are associated with higher student achievement (Darling-Hammond, 2000; Ehrenberg & Brewer, 1994; Fergusson & Ladd, 2006; Goe, 2007).

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, & by prior teacher characteristics established before entering the teaching profession (Category 2), such as teachers' academic 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; Ehrenberg & Brewer, 1994; Fergusson & Ladd, 2006). However, the results regarding teachers' degree level or coursework and the subsequent achievement of their students have been mixed (Wayne & Young, 2003). Many studies have also examined the effect of teacher education programs on student achievement; for example, some studies that utilized information about the quality of teachers' undergraduate institutions have found an effect on

subsequent student outcomes (Ballou & Podgursky, 1996; Ehrenberg & Brewer, 1994; Ferguson & Ladd, 1996; Hanusheck & Pace, 1995).

Among the most historical and common approaches to teacher quality measures are measures of teacher qualification in service (Category 3), such as years of teacher experience and certification (Zumwalt & Craig, 2005). Investigations about the effects of teachers' experience levels and certification status on student achievement have found a positive relationship between the number of years of experience and student performance during the teacher's first few years of teaching. However, after about the fifth year of teaching, the relationship is not consistently positive (Darling-Hammond, 2000; Goe, 2007). Holding a master's degree or a particular certification is not a consistent predictor of higher 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 (Cavalluzzo, 2004; Darling-Hammond, 2000; Goldhaber & Anthony, 2004). Meanwhile, evidence has consistently found that the principals' appraisal of teachers' performance has a significant positive relationship with student achievement (Arnor et al., 1976; Murnane, 1975; Jacob & Lefgren, 2008). Many of today's researchers have embraced a value-added approach to assessing teacher quality; such measures examine the contribution that a teacher makes to the academic gains of his or her students (Rivkin et al., 2000; Sanders & 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 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.

In Latin American and, in particular, in Chile, several studies have examined the relationship between teacher quality indicators and student learning. The Second Comparative study in the region run by LLECE (Laboratorio Latinoamericano de Evaluación de la Calidad de la Educación) analyzed several factors that are related to students learning and found that the years of teaching experience have an impact on students' performance for 16 Latin American countries that participate in the study. Also, Gertel, Guiliadori, Herrero, & Fresoli, (2000), Mizala et al., (2000), & Gálvez-Sobral and Moreno (2009) have found that teacher experience have a significant positive relationship with student learning in Argentina, Bolivia, & Guatemala respectively. On the contrary, Lushei (2012) studied some states in Mexico and found that teachers' scores on tests or training evaluations are significantly and positively related to student achievement in both states, while education levels and experience are not.

Research in Chile is not the exception and their findings corroborate what other studies have found in Latin American countries and other developed countries. Measuring teacher quality by teacher qualification in service, such as years of teacher experience and teacher's evaluation results on national teacher evaluation programme, investigations have found a consistent and positive relationship between teachers' experience levels and teacher performance and student achievement (Bravo, Falck, Gonzalez, Manzi, & Peirano, 2008; León, Manzi, & Paredes, 2009; Lara, Mizala, & Repetto, 2010). The most recent study go further calculated correlations between teachers' value-added estimates and their results based on the evaluation system's multiple measures of teaching quality, which include a portfolio of classroom teaching artefacts and a video-taped lesson, a peer interview, supervisor assessments and a self-assessment (Valencia, Palacios, Santelices, Jimenez, & Manzi, 2014). The authors have found a medium-size positive relationship between value-added

estimates in mathematics and teachers' portfolio results, while relationships with the other instruments were weaker.

Distribution of Teachers across Schools

There is a growing body of literature regarding the unequal distribution of teachers across schools. Studies in the US and England have found that schools with the highest proportions of poor, non-white, & low performing students tend to employ teachers with the weakest credentials, such as certification status, SAT scores, undergraduate college ranking, and/or experience (Allen, Burgess, & Mayo, 2012; Bonesrønning, Falch, & Strøm, 2005; Lankford, Loeb, & Wyckoff, 2002; Peske & Haycock, 2006).

There is also empirical evidence that the teachers' selection of schools is associated with the school's socio-economic status. Several authors have studied the distribution of novice teachers and have found that higher proportions of teachers with the weakest credentials are concentrated on poor and low performing schools (Allen, Burgess, & Mayo, 2012; Boyd, Lankford, Loeb, & Wyckoff, 2002). But after a teacher's first job, the distribution of highly qualified teachers tends to be even more unequal when teachers start to move between schools or even leave the teaching profession. Planty et al. (2008) found that 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 to schools within districts, they typically leave schools that enroll lower-income students and enter schools with higher-income students (Hanushek, Kain, & Rivkin, 2004). And when teachers leave high-poverty schools, these schools tend to replace them with less qualified teachers (Hanushek, Kain, & Rivkin, 2004).

Emerging literature on the teacher labor market in Chile has documented inequalities in teacher quality across schools, the relationship between individual characteristics of novice and experienced teachers, & the likelihood of working in schools with specific characteristics. These studies have used several measures of teacher quality, such as higher admission test scores, selectivity and accreditation of undergraduate institutions, type of teacher training program (presential, mixed or distance), teacher-training programs exit exams scores, & years of experience.

The first 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 those who attended less selective teacher training institutions. The same year, Ortuzar et.al. (2009) studied a small sample of novice fourth grade public school teachers, focusing on the relationship between their training programs and their schools performance. They found that teachers who attended weaker training programs (mixed and distance) were more likely to work in low-performing schools. Meckes and Bascopé (2012) explored the relationship between the individual characteristics of novice elementary teachers and the likelihood of their placement in schools with specific characteristics (i.e., type of administration, student performance, & student socioeconomic background). Using logistic regression, the authors found that teachers with higher scores on their national and training programs exit exams were more likely to work in high-income and high-performing schools than teachers with lower scores in their exit exams.

Similarly, Cabezas et al. (2011) explored the relationship between individual teacher characteristics and several outcomes, including the likelihood of (1) working in a public or private school, (2) moving between public and private schools, & (3) 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 exit exam scores, & teachers from families at higher socioeconomic levels were more likely to work in private paid schools. Also, they found that teachers with better qualifications (i.e.,

more experience, higher admission test scores, & 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. In a complementary study based on data from a large panel of teachers between 1999 and 2009, Valenzuela and Sevilla (2012) found less mobility and less retirement rates in public, socioeconomically disadvantaged and low-performing schools. In other words, teachers who enter such schools are less likely to leave the first school they choose to work in.

In this light, this study aims to move beyond what has already been empirically researched in Chile and the region in several ways. First, it combines the analysis of teacher sorting with teacher career decisions, assessing how the inequity in the quality of teachers across schools is associated with the teachers' decisions at the start of their teaching careers, as well as with the mobility and attrition of teachers throughout their profession. Second, it provides a comprehensive picture of the unequal distribution of teacher quality using ten measures of teacher quality; some of them completely new for the previous studies, such as holding a degree for secondary education and performance in a teacher assessment after they enter in the teaching profession. Third, its results are highly reliable since unlike previous studies, which are based on small samples, this study is based on 95% of elementary teachers who work in public and private subsidized schools in Chile (79,418 teachers distributed in 5,521 schools). Finally, it analyzes the distribution of teachers from a different perspective, creating measures of concentration of highly qualified teachers across Chilean schools, instead of regression models that combine student characteristics and teacher behaviors.

Chilean Context: Initial Teacher Training, Teacher Evaluation and Teacher Recruitment

In the 1980s, a large number of new institutions and programs were established since Chile stimulated the participation of private institutions in tertiary education. Later, many new private universities and institutes of higher education joined traditional universities. The growth in the number of programs and student enrolment was even higher in the first decade of the 21st century and was particularly striking compared to other degree programs. The sharp increase in initial teacher training programs of primary teachers during this period was mainly due to an increase in enrollment and in the number of programs in the private sector. Total enrollment in these private universities grew by 812%, & the number of programs offered grew by 735%, a rate that is ahead of the growth observed in traditional universities (Dominguez, Bascope, Meckes, & San Martín, 2012).

On the other side, the explosive growth was at the expense of the academic selectivity of students. For example, in 2000, 43% of graduates came from selective universities, whereas in 2008, only 23% of graduates had studied at selective universities (Dominguez, Bascope, Meckes, & San Martín, 2012). This phenomenon is in part explained by the fact that it is not mandatory to use the national university entrance exam (PSU) as part of the application process for institutions of higher education.

As part of the efforts to improve the quality of teaching workforce, in 2007 the accreditation of teacher education programs became mandatory for all institutions by quality assurance procedures within higher education. After this policy, it became a prerequisite for entering the teaching profession having teacher education qualifications from an accredited institution (or having an equivalent degree from a foreign institution). Then, in 2009, the Chilean government launched the Program for the Promotion of Quality in Initial Teacher Education (Programa de Fomento a la Calidad de la Formación Inicial Docente, Programa INICIA) to improve the quality of graduates

from initial teacher education through the improvement of the training provided by teacher education institutions. INICIA (in English, START), is a voluntary exit exam for students who were graduating from primary school teaching degree programs. The exam assessed graduates' subject knowledge in the disciplines that they would teach, as well as general abilities, such as writing and their use of information and communication technologies. In 2012, 50 institutions and 1.443 of their graduates took this exam. This represents approximately 80% of the institutions that offer primary education degrees, & almost 13% of the students graduating from those degree programs (MINEDUC, 2013). Currently, in order to work as a teacher, there is no need to take this qualifying examination following graduation from an initial teacher education program.

In addition, to strengthen the teaching profession and to improve the quality of education, in 2003, Chile created a National Teacher Evaluation System (Docente Más), a mandatory evaluation process just for teachers of public schools with 2 or more years of experience (70,000 approximately). Teachers are evaluated with four different instruments (self evaluation, peer assessment, supervisor assessment and a portfolio). Each teacher is assessed every 4 years. In case a teacher gets lower performance level (unsatisfactory or basic), he or she has to be reassessed (following next year or two years respectively). On the other hand, teachers with good results (Competent and Outstanding) can postulate to the Program for the Variable Individual Performance Allowance (Variable Incentive Individual Performance, AVDI). To get this salary increase, teachers must take a pedagogical and subject knowledge standardized test, & depending on their results, they obtain a salary benefit for a period that goes from 2 to 4 years.

Formal teacher evaluation in Chile comprises a range of programs. Docente Mas and AVDI are complemented by a range of reward programs which involve some type of evaluation: the Program for the Accreditation of Pedagogical Excellence Allowance (AEP) a voluntary teacher assessment covering the entire subsidized school sector; and the National System for Performance Evaluation (SNED), which provides group rewards for teaching bodies of given publicly subsidized schools. In addition to the formal programs outlined above, private schools (both subsidized and non- subsidized) autonomously organize their own performance teacher evaluation systems and any school is free to organize extra internal systems of teacher evaluation.

In terms of the teacher recruitment, schools and administrators who run education within the municipality have the authority to make their own decisions. In the municipal school sector, the recruitment of teachers is organized by municipal education authorities. Open public recruitment processes are organized at least once a year with vacancies published in a national circulation newspaper. A commission formed by the Head of the municipal Education Administration Department or the municipally controlled non-profit corporation which runs education within the municipality, the director of the school associated with the job vacancy and a selected teacher reviews applications. Applicants are rated according to professional performance, seniority and training taken and are ranked in a list. The municipality's Mayor then appoints the teacher ranked at the top of the list. In the private school sector (subsidized private and non-subsidized private schools), schools' administrators have discretion in organizing their recruitment processes.

Measures, Methodolgy, Data and Sample

Measures

Given the data available, this study focuses mainly on teacher qualifications established prior to teaching and when entering teaching (Figure 3)⁵. For each of these two categories, five measures of average school-level teacher characteristics were created, including the teachers' academic degree

⁵ Appendix 1 explains in more detail how each variable was created and their source.

levels⁶ and degree specializations, teacher training program characteristics, the competitiveness of the teachers' undergraduate institutions, teacher experience, course assignment⁷, & performance on national teacher performance assessment (AEP and Docente Mas)⁸. For each school, I calculated the concentration of highly qualified teachers for each of the measures. As mentioned in the literature review, each teacher quality measure bears some relationship to student achievement, although the relationship may not always be consistently significant or large in magnitude.

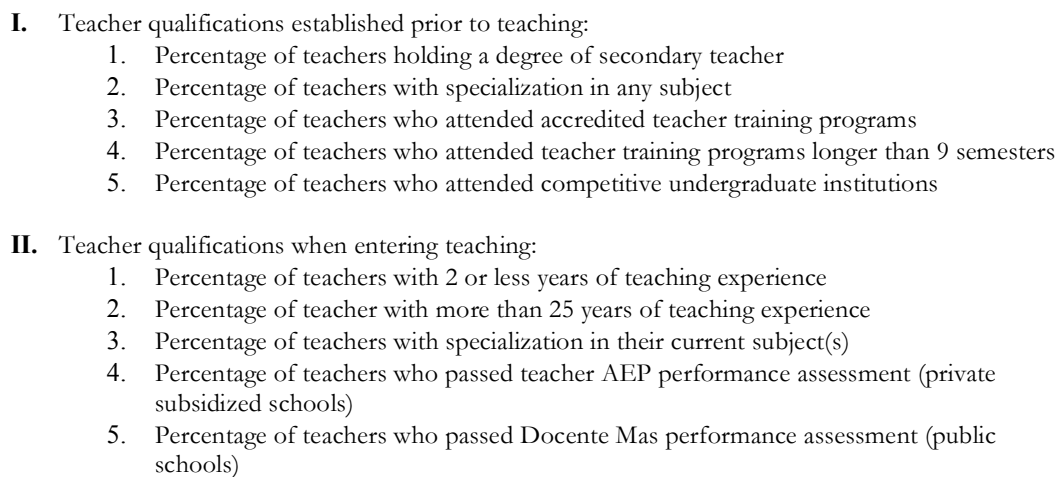
- 
- I.** Teacher qualifications established prior to teaching:
 1. Percentage of teachers holding a degree of secondary teacher
 2. Percentage of teachers with specialization in any subject
 3. Percentage of teachers who attended accredited teacher training programs
 4. Percentage of teachers who attended teacher training programs longer than 9 semesters
 5. Percentage of teachers who attended competitive undergraduate institutions
 - II.** Teacher qualifications when entering teaching:
 1. Percentage of teachers with 2 or less years of teaching experience
 2. Percentage of teacher with more than 25 years of teaching experience
 3. Percentage of teachers with specialization in their current subject(s)
 4. Percentage of teachers who passed teacher AEP performance assessment (private subsidized schools)
 5. Percentage of teachers who passed Docente Mas performance assessment (public schools)

Figure 3. Measures of Teacher Quality

Methodology

The method used in the paper to address the research questions is based of Lankford et al (2002). To better understand how this sorting occurs, I decomposed the variation of each teacher attribute within schools in the same comuna (district), between districts in the same region, & across regions – primarily using analysis of variance based on one way ANOVA. First, I analyzed results by region, district, & schools within districts 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 ($SS_{Between}$) and the total sum of squares (SS_{Total}).

⁶ Holding a degree for secondary education is considered as better qualification to teach in elementary school since teacher-training programs for secondary teachers have more courses in a subject area.

⁷ Course assignment measures whether teachers has a specialization in the current subject that are teaching or not.

⁸ More information about these measures is in the Chilean context section.

$$\eta^2 = \frac{SS_{Between}}{SS_{Total}} = \frac{\sum (x_j - \bar{x})^2}{\sum (x_{ij} - \bar{x})^2} \quad (1)$$

where:

x_j = group mean j

\bar{x} = grand mean

x_{ij} = individual teacher of school i in the group j

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

Parsing variation into within-district, between-district-within-region, & 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 the 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 district, 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. First I looked 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 characteristics of students who are taught by these teachers, I analyzed the features of these groups of schools in terms of their location (rural/urban), type of administration (public/private⁹), socioeconomic index (very low, low, medium, & high SEI)¹⁰ and student achievement (very low, low, medium, & high).¹¹

The next analysis assessed the systematic sorting of teachers across schools, specifically examining how teacher quality indicators are distributed across schools locations (urban vs. rural), school administration (public vs. private), student socioeconomic status, & student achievement strata (very low, low, medium and high achievement).

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 their careers, as well as by the mobility and attrition of teachers, I conducted several descriptive analyses that followed a cohort of

⁹ For simplicity, in this study government-subsidized private schools are referred as private schools interchangeable.

¹⁰ SEI is an aggregated variable derived from a cluster analysis of the parent(s) education, family income and an index of school vulnerability.

¹¹ 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).

teachers who were novices in 2007 for four years. First, I examined the distribution of novice teacher attributes¹² across school to study how the teachers' choice of their first teaching jobs is related to the (in)equality of teachers across schools.

For the cohort of novice teachers in 2007, I conducted several analyses to investigate teachers' transfer and departure decisions, & 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 system¹³, (iv) the proportion of teachers who moved into the private paid school system, & (v) the proportion who left the profession. Then, among those teachers who moved schools, I examined the proportions that moved within the same district, within the same region, or to a different region. Within different types of first-teaching-job schools, I examined the proportion of teachers who moved, left, & stayed. Finally, for those who quit or transferred, I compared their individual attributes to those of their colleagues who stayed and described the educational environments where the teachers have moved to.

Data

The data for this study was compiled from a number of sources. Bono de Reconocimiento Profesional (BRP) data, collected and maintained by the Chilean Ministry of Education (MOE), 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 id number of the teacher's school, number of hours and months worked, position held, highest degree earned, institution where they earned highest degree, graduation year, & teaching assignment(s). These BRP data were supplemented with data on teachers' personal characteristics (i.e., gender, age, years of experience, etc.) from the Idoneidad Docente (ID) dataset, which is also maintained by MOE. The teacher workforce dataset (BRP) was also complemented with information on the 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 MOE.

Finally, public-use data files from SIMCE (Chile's national assessment system) and from MOE yielded school-level characteristics, such 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 the 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,

¹² 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 assessment.

¹³ For simplicity, I use the term "public school system" to refer to public schools and government-subsidized private schools).

& schools with fewer than four teachers or fewer than 20 students were removed.¹⁴ 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, & 60 percent had low-achieving students.

The sample used in the second analysis include 1,695 novice elementary school teachers who were working in 1,200 public or subsidized private 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 week¹⁵ were excluded¹⁶. Seventy five percent of these teachers were female, 82 percent worked in urban schools, followed by schools attended by low-achieving students (55 percent), low-income students (41 percent), & public schools (32 percent).

Results

How much variation in the average attributes of teachers currently exists across schools, across schools within districts, across districts within regions, & across regions?

First, to analyze the quality of the elementary teacher, the mean, standard deviation, minimum and maximum for each teacher quality attribute were calculated (Appendix 2). In terms of the quality of the labor force in public schools, the results are significant. For example, the average proportion of teachers who studied in accredited universities is only 49 percent and the average proportion of teachers who passed the teacher performance assessment is only 50 percent. In terms of the variation, & across almost all measures of teacher quality, the standard deviation was high compared to the mean.

In order to analyze the variation of each teacher attribute across schools, Table 1 displays the 10th, 50th and 90th percentiles of these teacher elements. By any measure, the qualifications of teachers are unevenly distributed across schools, & this is true across a wide range of teacher attributes - those that are measuring teacher quality based on their previous qualifications, as well as those they held when entering the profession. As shown in Table 1, there are more than 500 hundred schools (10 percent) where almost all their teachers went to non-selective institutions, where only 13% of their teachers do specialize in the area(s) that they are teaching, or where all of their teachers possess a degree from a program which was shorter than nine semesters.

¹⁴ Schools with few teachers were excluded since one teacher represent 25% or more of the school-level teacher characteristics created in this study. 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, & 20 or more students. However, the exclusion is less relevant when 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).

¹⁵ A full-time teacher in Chile works 44 hours per week.

¹⁶ 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.

Table 1
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
<i>Degree and specialty</i>			
Hold a degree for Secondary education	0	0.05	0.30
Hold a Education degree with specialization	0.13	0.42	0.71
<i>Teacher training program</i>			
Longer than 9 semesters	0	0.24	0.58
Accredited TEP	0.21	0.26	0.63
<i>Teacher assignment</i>	0	0.26	0.63
<i>Teacher experience</i>			
With less than 2 years of experience	0	0.16	0.46
With more than 25 years of experience	0	0.30	0.67
<i>Performance on teacher assessment</i>			
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

On the other hand, another 500 hundred elementary schools of the public system (90th percentile or above) have a substantial portion of teachers who went to selective institutions (72 percent of their teachers), or are teaching subjects for which they do have a specialization (63 percent), or possess a degree from a teacher training program, which was longer than nine semesters (58 percent). Also notable in the data is the result that only 1 out of 4 teachers in more than 500 schools (10th percentile or below) passed the teacher performance assessment, compared with another 500 schools (90th percentile or above) where 3 of 4 teachers succeeded in the test. Teacher performance on AEP and holding a degree for secondary education show a more equitable distribution compared to other measures.

To have a more detailed picture of the unequal concentration of highly qualified teachers across schools, the variation in teacher attributes throughout different levels of organizations was analyzed. Table 2 decomposed the variation of each teacher quality measure across schools within districts, between districts, & between regions. Although this partition differs across some of the measures, there is a remarkable consistency in the findings that most of the variance in teacher qualifications occurs among schools within districts (Table 2); the proportion of total variance between schools ranges from 41 to 92 percent. This variability may be driven by differences in teacher preferences and/or schools preferences, & efficiency in teacher hiring practices.

Table 2
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%
<i>Degree and specialty</i>			
Hold a degree for Secondary education	7%	10%	83%
Hold a Education degree with specialization	9%	20%	71%
<i>Teacher training program</i>			
Longer than 9 semesters	13%	21%	66%
Accredited TEP	32%	24%	44%
<i>Teacher assignment</i>	9%	26%	65%
<i>Teacher experience</i>			
With less than 2 years of experience	2%	6%	92%
With more than 25 years of experience	4%	13%	83%
<i>Performance on teacher assessment</i>			
Passed AEP	4%	5%	91%
Passed Docente Mas	3%	11%	86%

However, the results show a difference between the measures. Teacher quality measures established prior to the teaching career show a higher proportion of variance between regions and between districts within regions than those measures established when entering the teaching profession. This fact may reflect the reality and constraints of teacher preparation programs, and/or the supply of teachers at different geographical and organizational levels (region and districts) given their own preferences. Also it may be driven by differences in the municipality resources and their district hiring practices, & efficiency in hiring teachers. 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. Then, in a lower scale, some districts may present constraints of high qualified teachers who hold a degree with specialization, leading to a high variance between districts within regions in this measure, as well as to the variable that measures teacher assignment.

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 certain school and student characteristics. To explore this, Tables 3, 4 and 5 analyze the characteristics of students and schools of two groups of schools: (1) those who hired the lowest concentration of highly qualified teachers (corresponding to those schools in percentile 10 or lower in the distribution of each teacher attribute), & (2) those who hired the highest concentration of high qualified teachers (corresponding to those schools in percentile 90 or above).

The results are also striking. For all of the teacher attributes, Tables 3 to 5 show that less qualified teachers tend to be employed in higher proportions in schools with low-income and low-

performance students, & in public and rural schools¹⁷. The highest degree of teacher sorting across schools was evident in the areas of teacher degree, teacher specialization, the length of the teacher training programs, & the years of experience, particularly when school socioeconomic level, localization and type of administration is analyzed. For example, Table 3 shows that 85% of those schools with the highest concentration of highly qualified teachers, in terms of holding a degree for secondary education, are attended by medium and high income students, compared with only 23% of those schools with the lowest concentration of highly qualified teachers.

Table 3

School Characteristics of Schools of Lowest and Highest Concentration of High Qualified Teachers by Socioeconomic Classification

Teacher quality attribute	Schools	Socioeconomic classification	
		Very Low-Low	Medium-High
Competitiveness of undergraduate institution			
Highly selective	Low concentration	73%*	27%
	High concentration	56%	44%
<i>Degree and specialty</i>			
Hold a degree for Secondary education	Low concentration	77%	23%
	High concentration	15%	85%
Hold a Education degree with specialization	Low concentration	80%	20%
	High concentration	40%	60%
<i>Teacher training program</i>			
Longer than 9 semesters	Low concentration	89%	11%
	High concentration	29%	71%
Accredited TEP	Low concentration	64%	36%
	High concentration	53%	47%
<i>Teacher assignment</i>	Low concentration	71%	29%
	High concentration	55%	45%
<i>Teacher experience</i>			
With less than 2 years of experience	Low concentration	83%	17%
	High concentration	45%	55%
With more than 25 years of experience	Low concentration	49%	51%
	High concentration	85%	15%
<i>Performance on teacher assessment</i>			
Passed AEP	Low concentration	51%	49%
	High concentration	27%	73%
Passed Docente Mas	Low concentration	94%	6%
	High concentration	80%	20%

* For example, 73 percent of schools with lowest concentration of high qualified teachers , in terms of the proportion of teachers from highly selective institutions, are attended by low or very low income students.

Similarly, teacher sorting is observed for other school characteristics. For the same teacher attribute, Table 5 shows that 96% and 92% of schools with the highest concentration of highly-qualified teachers are urban or private, compared with 55% and 35% of urban and private schools which has the lowest concentration of highly qualified teachers. Also, another attribute that shows a

¹⁷ 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 between test scores was 0.89.

large unequal distribution across schools is years of experience. In particular, Table 5 shows that only 7% of schools with the highest concentration of teachers with more than 25 years of experience are private, compared with 89% of low-income schools with lowest concentration of these teachers. The opposite pattern is observed for inexperienced teachers: only 13% of schools with the highest concentration of inexperienced teachers are public, compared with 80% of public schools with lowest concentration of these teachers.

Table 4

Characteristics of Schools with the Lowest and Highest Concentration of High - Qualified Teachers by Student Performance

Teacher quality attribute	Schools	Student Performance	
		Very Low-Low	Medium-High
Competitiveness of undergraduate institution			
Highly selective	Low concentration	68%	32%
	High concentration	60%	40%
<i>Degree and specialty</i>			
Hold a degree for Secondary education	Low concentration	69%	31%
	High concentration	28%	72%
Hold a Education degree with specialization	Low concentration	68%	32%
	High concentration	44%	56%
<i>Teacher training program</i>			
Longer than 9 semesters	Low concentration	69%	31%
	High concentration	47%	53%
Accredited TEP	Low concentration	64%	36%
	High concentration	51%	49%
<i>Teacher assignment</i>	Low concentration	83%	17%
	High concentration	57%	43%
<i>Teacher experience</i>			
With less than 2 years of experience	Low concentration	71%	29%
	High concentration	58%	42%
With more than 25 years of experience	Low concentration	55%	45%
	High concentration	71%	29%
<i>Performance on teacher assessment</i>			
Passed AEP	Low concentration	55%	45%
	High concentration	46%	54%
Passed Docente Mas	Low concentration	81%	19%
	High concentration	64%	36%

Table 5
Characteristics of Schools with the Lowest and Highest Concentration of Highly Qualified Teachers by Location and School Type

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

Finally, the distribution of a variety of teacher attributes across rural and urban areas, type of school administration, & student socioeconomic status were analyzed. The results are presented in Appendix 3. As expected, these analyses confirm the previous findings. Rural and public schools tend to employ higher proportions of less qualified teachers and poor students also tend to be taught by less qualified teachers. Moreover, lower performing students are more likely to be enrolled in schools that employ less-skilled teachers. For example, 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.

In summary, some schools present a high concentration of highly qualified teachers whereas other schools show no signs of hiring any highly qualified teachers. Findings indicate that less-qualified teachers are more likely to teach poor, low-performing students in rural and public schools (unequal distribution). 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 indicate the largest deviation in teacher quality.

How is the variation in teacher attributes associated with the teachers' choice of their first job placement? 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 given the conditions of the teacher labor market. Tables 6 and 7 show the characteristics of schools employing low- and highly-qualified novice teachers¹⁸. 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 or a degree with specialization indicate the greatest degree of inequality, as a teacher with a bachelor's degree in secondary education or a degree with specialization is twice as likely to work in schools with high student performance, & teachers without such a degree are three times as likely to work in rural schools than in urban schools, & are also three times as likely to work in public schools than private schools. Interestingly enough, some of teacher attributes related to the teacher training program institution (selectivity of the program, length of the program and accredited teacher training program) are more equally distributed. For example, teachers who went to highly selective institutions are only slightly more likely to work in schools with higher-achieving students, and/or schools with higher income students in urban or private schools, compared with those who went to not-so highly selective institutions.

Table 6

Student Performance and Socioeconomic Classification of Schools with Less and Highly Qualified Novice Teachers

Teacher quality attribute	Student Performance 2006		Socioeconomic classification	
	Very Low-Low	Medium-High	Very Low-Low	Medium-High
Competitiveness of undergraduate institution				
Highly selective	53%	47%	40%	60%
Not-Highly selective	56%	44%	44%	57%
Degree and specialty				
Hold a degree for Secondary education	38%	62%	19%	81%
Not-Hold a degree for Secondary education	57%	43%	43%	55%
Hold a Education degree with specialization	49%	51%	30%	70%
Not-Hold a Education degree with specialization	60%	40%	47%	53%
Teacher training program				
Longer than 9 semesters	54%	46%	38%	62%
Equal or shorter than 9 semesters	55%	45%	42%	58%
Accredited TEP	53%	47%	38%	63%
Not accredited TEP	59%	41%	35%	55%

¹⁸ Only proxies of teacher quality that correspond to prior working experience with regards to teacher ability and teacher preparation variables were used.

Table 7

Location and Types of Schools with Less and Highly Qualified Novice Teachers

Teacher quality attribute	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%
<i>Degree and specialty</i>				
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	77%	23%	40%	60%
<i>Teacher training program</i>				
Longer than 9 semesters	81%	19%	29%	71%
Equal or shorter than 9 semesters	81%	19%	35%	65%
Accredited TEP	84%	16%	27%	73%
Not accredited TEP	77%	23%	35%	55%

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 following the cohort of teachers hired from their first teaching jobs in schools with public funding in 2007 throughout the first five years of their careers.

These teachers show different career paths. From the total sample of 1,695 elementary public schools teachers with no prior teaching experience who were hired in 2007, 46 percent of them remained until 2011 in the same school where 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 paid schools, & 17 percent were no longer working as teachers in 2011. In terms of where these teachers moved to, the results indicate that almost half of them moved between schools within the same district, while only 15% moved to schools in a different region.

To examine the ways in which the teachers' career paths might impact the distribution of teacher attributes across schools, Table 8 illustrates some differences in the career progression of teachers across school and students characteristics. The results show that novice teachers who started working in low-performing schools, low-income schools, rural schools, & public schools tended to leave more compared to teachers who started in high-performing schools, high-income schools, urban schools and private schools. In addition, Table 8 shows that results differ considerably between regions. 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 1¹⁹.

Given that teachers have been shown to gain substantial skills during their first few years of teaching (Rivkin, Hanushek, & Kain, 2000), a high exit rate of more experienced teachers may impact the quality of education that students receive in a particular school. Additionally, the turnover

¹⁹ Region 1 is the northeast region in Chile whereas Region 12 is the southeast one.

could have a negative impact, if more qualified teachers transfer or leave the profession (leaving behind their less qualified colleagues to hold the fort). This appears to be the case as depicted in Table 9, which shows the teacher career paths for five teacher quality attributes. The results show that, for almost all measures, less qualified teachers who began their careers in 2007 tended to stay in their initial schools in higher proportion than the other more qualified teachers. For example, 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. On the other hand, teachers who hold a degree of specialization or a degree from an accredited institution exhibit a more similar career path with those who not hold these qualifications, compared to other measures of teacher quality.

Table 8
*Teacher Career Paths by School Characteristics 2007-2011*²⁰

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

²⁰ School characteristics were measured in 2006 and 2007.

Table 9
Teacher Career Paths of Less and Greater Qualified Teachers 2007-2011

Teacher quality attribute	Stay	Move	Move to private school system	Leave the profession
Competitiveness of undergraduate institution				
Highly selective	38%	43%	2%	17%
Not-Highly selective	47%	33%	2%	17%
Degree and specialty				
Hold a degree for Secondary education	40%	41%	1%	19%
Not-Hold a degree for Secondary education	48%	36%	1%	15%
Hold a Education degree with specialization	44%	36%	3%	17%
Not-Hold a Education degree with specialization	47%	34%	2%	17%
Teacher training program				
Longer than 9 semesters	41%	40%	2%	17%
Equal or shorter than 9 semesters	51%	31%	1%	17%
Accredited TEP	47%	36%	1%	16%
Not accredited TEP	48%	36%	2%	14%

To examine how teacher sorting is associated with teacher career paths, I analyzed the interactions between teacher quality attributes, school characteristics, & teacher career paths. For each of the five quality measures studied, the analyses revealed evidence that highly qualified teachers who started in high-performing schools, high-income schools, urban schools or private schools are more likely to stay in these type of schools than less qualified teachers, & at the same time, those highly qualified teachers who started in low-performing schools, low-income schools, rural schools or public schools are less likely to stay than less qualified teachers who started in similar types of schools. However, the results show some differences between teacher quality attributes. The selectivity and the accreditation of the undergraduate institution where the teacher studied show fewer differences in teacher career paths between lower and highly-qualified teachers (range between 3% and 12%), while holding a degree for secondary education, a degree with specialization or a degree from a program which was longer than 9 semesters, show higher differences between the teachers.

This findings support the fact that teachers' career paths are systematically related to inequalities in the distribution of teacher quality across Chile's elementary schools. Figures 4 and 5 show the proportion of low and highly qualified teachers with subject-area qualifications²¹ who stayed in the same school for four years, across the various school characteristics. Both figures show that highly qualified teachers appear to indicate different career paths, in terms of schools and students characteristics, than those less qualified teachers. For example, less qualified teachers working in low-income and low-performing schools were 10% and 20%, respectively, more likely to stay in those schools than more qualified teachers who started in similar types of schools (Figure 6). At the same time, high qualified teachers who started working in high-income and high-performing schools were 12% and 47%, respectively, more likely to remain in those schools than the lower-qualified teachers.

Figure 4 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, & low performing schools, thus increasing the observed inequality of qualified teachers across schools.

When other teacher career paths, such as moving from the public school system to the private

²¹ I chose this teacher "quality" measure just to exemplify the results. The graphs look very similar for each quality measure.

school system, & leaving the profession altogether are analyzed, I found no systematic relationship between school and students' characteristics and teachers' qualifications.

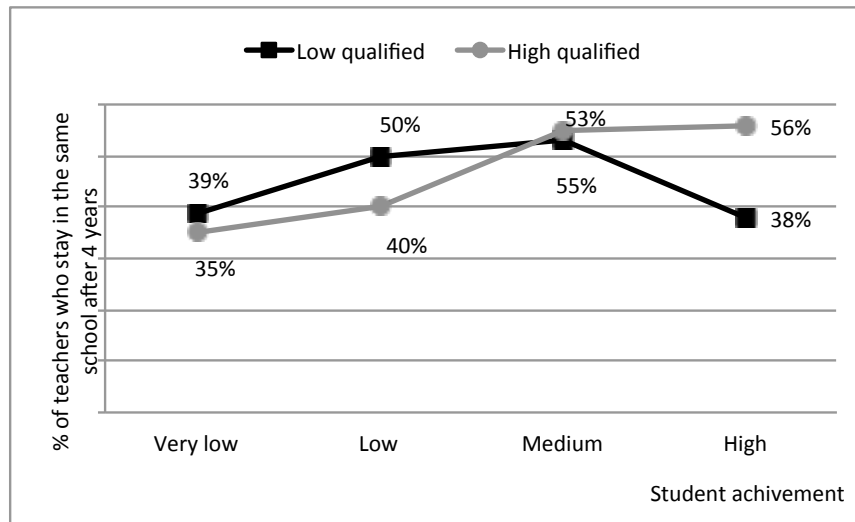


Figure 4. Percentage of High and Low Qualified Teachers Who Stayed in the Same School for 4 Years by Student Performance

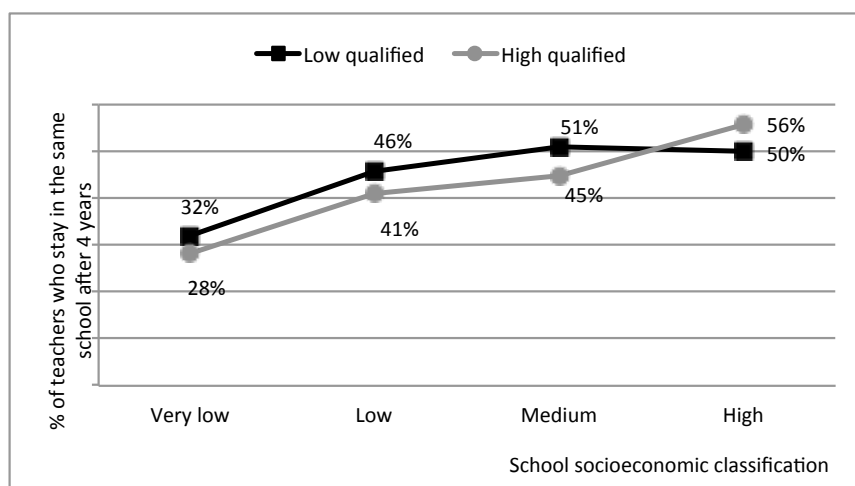


Figure 5. Percentage of High and Low Qualified Teachers Who Stayed in the Same School for 4 Years by School Socioeconomic Classification

Figure 6 shows the proportion of teachers across school location and school type. The results show that both low and highly qualified teachers tend to remain in urban schools in higher proportions than in rural schools. When school type is analyzed, the results show that the proportion of less qualified teachers staying in public schools is higher than in private schools, while, conversely, the proportion of highly-qualified teachers staying in public schools is lower than in private schools.

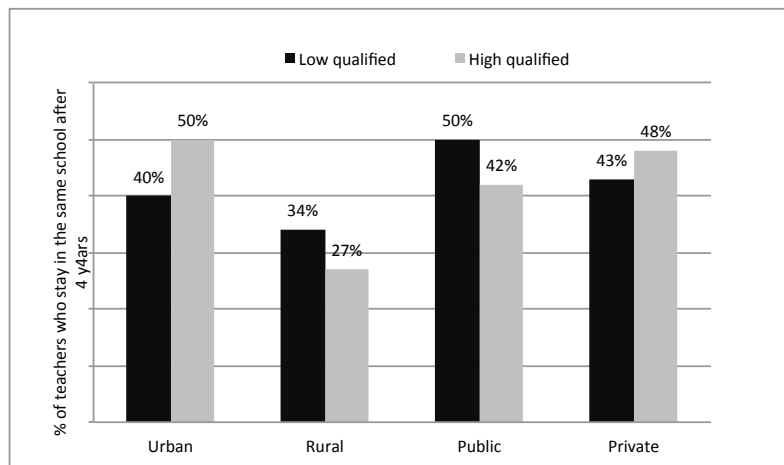


Figure 6. Percentage of High and Low Qualified Teachers Who Stayed in the Same School for 4 Years by School Location and Type of School

There are also systemic patterns among the school environments that teachers move to across district boundaries within a region. Table 10 illustrates this phenomenon for the cohort of teachers in 2007 that transferred during the next four years. Teachers generally left schools where students' test scores were lower than the scores in their destination schools. These differences are statistically significant when teachers move between schools in the public school system or when they move between districts within regions. Other teacher career paths show a difference of 3 and 4 points, but they are not considered as statistically significant.

Table 10
Characteristics of Sending (2007) and Receiving Schools (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

* Statically significant at 5%

Discussion and Conclusions

Policymakers and schools have important challenges ahead of them. Findings from this study have shown that some schools present a high concentration of highly qualified teachers while other schools do not hire any of them, thus, impacting the learning of their students. When the school and students characteristics are analyzed, the reality is that the schools that are most in need of high quality teachers are the ones that present a lower concentration of high quality teachers. The results also suggest that teacher career paths play an important role on the unequal distribution, making the study of first-teaching-job placement patterns and teacher mobility the key aspects to ensure progress. The differences observed in the distribution of teacher quality are remarkable in size in comparison with the findings of Lankford et. al (2002) in New York State. These findings

emphasize the need of an educational reform that addresses this educational inequality in Chile. In this sense, the results of this study are a step forward, especially in adding new evidence to the discussion for policy formulation.

To better understand how teacher sorting occurs, this study decomposed the variation of each teacher attribute within schools in the same district, between districts in the same region, & across regions. On one hand, the substantial sorting of high quality teachers across schools within districts suggests that teachers' preferences may play an important role in them choosing where to teach. Schools preferences and their efficiency in hiring teachers are equally important as well. On the other hand, the reality and constraints of teacher preparation programs, and/or the supply of high quality teachers at different geographical and organizational levels (regions and districts) may be affecting the unequal distribution too. The results above have shown that teacher quality measures established prior to the teaching career show a higher proportion of variance between regions and between districts within regions, than those measures established when entering the teaching profession. Also, differences in municipality resources and district hiring practices, & efficiency in hiring teachers may also impact the extent of the teacher sorting.

As previous studies in the region have found, the most qualified novice teachers are more likely to work in urban, private schools, schools with higher achieving students, & in schools with higher income students. These results confirm that the unequal distribution of highly qualified teachers start at the point when novice teachers are hired, suggesting that teacher policy may do well to focus in this crucial period of the teachers' career path. In addition, first-job placements years are particularly important if mobility rates are considered. This study shows that almost 50% of teachers are working in the same schools after 5 years, which compounds the unequal distribution problem over time.

After their first job experience, teachers vary in their career decisions. The results conclude that the distribution of high qualified teachers is driven by teachers' decisions of mobility between schools, thus, reproducing and increasing the unequal distribution of high quality teachers observed from the beginning of their careers. This study found that 34% of novice teachers move between public schools in 5 years, & less qualified teachers who are working in low-income and/or low-performing schools were more likely to stay in those schools than the highly qualified teachers. The less qualified teachers who started working in high-income and/or high-performing schools were less likely to stay on than the highly qualified teachers.

Smart recruitment and retention of high quality teachers have become popular strategy to reduce the achievement gap in developed countries. However, this has not been the case for the countries in the Latin American region. As the introduction presents, some policies in the region have aimed to improve the quality of the teacher workforce by attracting better teachers to the teaching profession as well as by enhancing teacher knowledge through continuous improvement of teacher training programs. For example, the last and most important educational reform in Chile occurred when the "Beca Vocación de Profesor" scholarship, which subsidized the tuition fees and other living costs, was given to more than 20% of prospective teachers who are high achieving students and are committed to teach for 3 years in the public school system.

However, these policies did not focus on any specific types of schools within the public schools system. Non-targeted policies are unlikely to reduce disparities in teacher quality across schools and student achievement gaps since without any incentive or regulation highly qualified teachers are less likely to be recruited by the schools that they need them the most. The lack of these targeted policies and the results presented in this study highlight the need to be take the teacher career paths into account when designing reforms targeting gaps in student achievements.

By documenting the extent and the nature of teacher sorting, this study provides a foundation on which to build more expansive models of teacher career paths. It is a first step in

studying the extent of teacher sorting and the role of teacher career paths not only in the Chilean teacher labor market, but also the region. However, 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 on the teaching career and the underlying mechanisms driving these career paths need to be undertaken. By understanding the factors that motivate teachers to work in specific schools, move between schools or to leave the profession; as well as how teachers find their schools and how schools/districts find their teachers, one would have the key to design policies that will help low-performing schools to attract, recruit and retain high quality teachers in the schools that are most in need of them.

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