



Teacher quality and student achievement in Chile: Linking teachers' contribution and observable characteristics



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ARTICLE INFO

Keywords:

Teacher quality
Chile
Student achievement
Value-added
Fixed effects
Teacher experience

ABSTRACT

While there is wide consensus regarding the importance of quality of teachers in student achievement; yet, accounting for teacher effects remain a puzzling task. In Chile, research on teacher quality has predominantly relied on cross-sectional data, and largely focused on identifying teacher attributes related to teaching quality. Only have few studies addressed the problem of non-random assignment of students to teachers. This paper attempts to fill these gaps. On the basis of pseudo-longitudinal data for 2011 from the Education Quality Measurement System and teachers' administrative records, we employed value-added and fixed-effect models correcting for sorting-bias, to assess the overall contribution of teachers to student achievement and identify which teacher characteristics enhance teacher effectiveness. We find that teacher contribution to students' learning in mathematics and language is very significant. In addition, teaching experience has a significant non-linear impact on test scores in math but not in reading. Both junior and senior teachers are effective in the educational system. We discuss the policy implications and limitations of these results.

1. Introduction

Today, most scholars agree that teachers can make a substantive difference in students' academic achievement (Koedel et al., 2015). Yet, accounting for teacher effects remains a somewhat puzzling task. Studies differ regarding to what extent teachers matter and which teacher attributes improve academic performance (Aaronson et al., 2007a; Pivovarov et al., 2016).

These mixed findings might be attributed to a wide array of factors, with the lack of adequate data being one of the main reasons for the inconclusive results. Information available to scholars makes it difficult to identify teacher effects, especially when the assignment of students to teachers and schools is nonrandom (Dieterle et al., 2015; Rockoff, 2004a). While research—mostly from the United States—shows that the quality of teachers is critical for students' learning, they also reveal that teachers vary widely in their ability to produce student learning gains (Bruns and Luque, 2015), and that little of the variance in student achievement is associated with specific teachers characteristics (Rivkin et al., 2005a). As a response to these problems, recent studies have employed quasi-experimental designs to provide a broader picture of teacher quality¹ measures that includes both overall information—such as value-added estimates—and the role that particular teacher features have on students' learning

(Bacher-Hicks et al., 2014; Chetty et al., 2014; Rothstein, 2017).

What do we know about the performance of teachers in Latin America, and especially in Chile? To date, the evidence is limited. This is because most countries do not count on classroom-level data necessary to establish the value added by individual teachers to students' learning. Overall, existing research indicates that the teacher workforce in Latin America cannot be considered of high quality compared to industrialized countries; however, some Latin American educational systems have exhibited progress in teacher quality during the last decade, particularly in Chile (Bruns and Luque, 2015). In recent years, Chilean governments have introduced several reforms aimed at improving the working conditions and training of teachers (Ávalos and Valenzuela, 2016) along with policies oriented to improve the educational quality of the system (Contreras and Rau, 2012). While some studies have attempted to examine the quality of teachers within the context of institutional change, most of these efforts have focused on assessing how indicators of teacher quality relate to student achievement (Lara et al., 2010; Toledo and Valenzuela, 2015). Only recently have a couple of studies employed value-added estimations (Santelices et al., 2015; Taut et al., 2016). Even though these studies discuss rich information about teacher rankings and their accuracy, they do not provide estimates of the total contribution of teachers to student learning.

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¹ Hanushek (2002) points out that the analysis of teacher quality has been heavily weighted toward studies of the United States, leaving out international experiences.

In this paper, we addressed this gap, presenting new evidence on teacher quality in Chile. Our study is guided by the following questions: “How much do teachers matter?” and “Are human capital teacher attributes associated with student achievement?” We provide answers to both questions by employing different methodological approaches and data from several sources. The analysis utilizes the academic achievement data of 8th grade students for mathematics and language from the Education Quality Measurement System (SIMCE) for 2011. We matched this information with teacher data from administrative records, students’ socioeconomic information and SIMCE tests scores of the same cohort for 2007. Our analysis of these data proceeds in three steps. The first step evaluates the assignment of students to teachers by analyzing the association between several teacher characteristics and observed student characteristics, controlling for school fixed effects. On the basis of the findings, the second and third steps evaluate the overall teachers’ contribution and the influence of specific teacher characteristics—education and experience—on student achievement. To measure the impact of teacher quality, we used a research design that restricts the sample to students in schools with more than one teacher in order to break the correlation between school and teachers. Using this design, we estimated measures of teacher quality with student achievements models that incorporate teacher information, controlling for a rich set of student and classroom covariates. Importantly, we also controlled for previous test scores and fixed effects for schools, accounting for assignment within and between schools.

Our paper proceeds as follows. The next section describes the Chilean educational context. Section 3 discusses the literature on teacher quality; we briefly review the international literature as well research in Chile. In Section 4, we present the data, variables and methods. Section five presents the results and, in the final section, we discuss the main findings and their policy implications.

2. The Chilean setting

Chile provides an interesting context for exploring the contribution of teachers to students’ academic achievement. Chile is a middle income country with the highest GDP per capita among Latin American countries but also the large socioeconomic inequalities (Ávalos and Valenzuela, 2016). Numerous public policies have been implemented over the last three decades in order to improve students’ performance. In 1981, a school financing system was introduced which had the effect of liberalizing the school system (Contreras et al., 2016). As consequence of this reform, the school system was structured such that there are now three types of schools: public municipal, private subsidized (or voucher), and private schools with no subsidies.² While there is no consensus regarding the effect of this reform on student performance (Hsieh and Urquiola, 2006; Mizala and Torche, 2012), the evidence consistently shows that this system has generated high levels of socioeconomic segregation (Puga, 2011; Valenzuela et al., 2014). Until recently private voucher schools were able to select the students they admit.³ Unlike for-profit private voucher schools, which are able to target and select more advantaged pupils, non-profit private voucher schools have accommodated larger proportions of low-income or vulnerable students (Hsieh and Urquiola, 2006; Elacqua, 2012).

Over the past two decades, educational policies have been largely oriented toward improving learning conditions in the school system. Evidence suggests that policies such as extending the school day, increasing resources to public schools with poor students, and improving teacher accountability, have had positive effects on school performance (Bellei, 2009; Contreras and Rau, 2012). While Chile compares well with other Latin American countries, it still remains below the average of OECD countries in PISA tests.

As part of the greater emphasis on teacher accountability, in 2003 a

teacher evaluation system was introduced, which is mandatory for all municipal school teachers (Taut et al., 2016). In Chile, there are around 180,000 teachers. Of these, 44% are employed in the public municipal schools, 46% are employed in private voucher schools, and 10% are employed in private schools. Most of teachers are educated in universities, where they are awarded a degree and a teacher qualification that enables them to practice after graduation without further certification (Ávalos and Valenzuela, 2016). Public school teachers are governed by the Teacher Statute and wages are based on uniform pay scales independent of merit, making it nearly impossible to dismiss under-performing teachers. By contrast, private schools have more flexible criteria for hiring, dismissal and promotion (Mizala and Torche, 2012). The more flexible regulations and working conditions of the private school sector attract better teacher candidates to their classrooms. Evidence suggests that there is a positive sorting of teachers between schools according to the socioeconomic status and academic performance of their students in the Chilean school system (Lara et al., 2010; Meckes and Bascopé, 2012; Mizala and Torche, 2012; Toledo and Valenzuela, 2015). Evidence about within-school assignment is scarce. Recent findings by Toledo and Valenzuela (2015) indicate that students from less advantaged backgrounds have fewer opportunities to access to more qualified teachers, whereas those from more advantaged backgrounds have access to more favorable learning conditions. This evidence suggests some nonrandom assignment of students to teachers within schools, which may have important consequences for the estimation of teacher effects on students’ performance; we will address this issue in this article.

3. The literature

3.1. International evidence

Studies on the overall contribution of teachers to student performance in high income countries—mostly from the United States—have largely employed value-added (VA) models.⁴ These models rest on the specification of an education production function in which student performance is modelled as a cumulative function of past and present child, family and school inputs (Dieterle et al., 2015; Harris and Sass, 2011). As we mentioned previously, the key methodological challenge for VA estimates is the nonrandom assignment of students and teachers in the school system.⁵ International evidence suggests that there is a positive matching between students and teacher attributes across and within schools (Clotfelter et al., 2007; Kalogrides, Loeb, and Bêteille, 2013a). Recent research suggests that the most significant control refers to prior achievement (Chetty et al., 2016, 2014; Koedel et al., 2015). Chetty et al. (2014) how that the inclusion of the lagged achievement measure significantly reduces bias estimates in VA models.

Consistent with earlier findings, recent estimations find that teachers matter, although there is a substantial variation in teacher performance as measured by VA models. Research suggests that teacher effects on students’ academic performance vary between small and moderate (Aaronson et al., 2007b; Kane et al., 2008; McCaffrey et al., 2009; Rivkin et al., 2005a; Rockoff, 2004b). A consistent finding across studies reveals that one standard deviation increase in teacher quality translates into approximately a 0.1–0.2 standard deviation gain in academic achievement in elementary schools (Rivkin et al., 2005a; Rockoff, 2004b).⁶ Lockwood and McCaffrey (2009) add that teacher

⁴ When using VA estimates, researchers and policy makers ponder the contribution that each teacher makes to the student learning process in a given period and compare it with the influence of other teachers.

⁵ The problem of assignment refers to both within- and between-school variances. Between-school nonrandom assignment arises because schools with the best labor conditions are more likely to hire better teachers; whereas within-school nonrandom assignment occurs because more effective teachers tend to be assigned to high-achieving students and classes.

⁶ Similarly, in a study conducted Araujo et al. (2016) about Ecuador, researchers also found that one standard deviation increase in teacher quality resulted in 0.13 and 0.11 higher test scores in language and mathematics respectively.

² Private voucher schools account for approximately 55 percent of school enrollment.

³ According to the new Law of Inclusion, schools that receive public funding will not be able to select their students.

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