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Towards an optimal teacher salary schedule: Designing base salary to attract and retain effective teachers☆

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ABSTRACT

This study presents the literature's first estimates of the effect of teacher pay on the distribution of experience among teachers hired by public school districts. Overall, a 1% increase in base salary for teachers of a particular experience level increases the proportion of the targeted teachers hired by 0.04–0.08 percentage points. Pay increases have the largest effect on hire rates among teachers with 2–3 years of experience and the effect diminishes with experience. I show that higher teacher salaries provide a dual benefit of retaining and attracting a more effective distribution of teachers. Districts may also improve student achievement growth at no cost by reshaping their salary schedules so that they are increasing and concave in teacher experience.

It is now clear that teacher quality is paramount in determining both immediate and long-term student outcomes (Chetty, Friedman, & Rockoff, 2014). It is much less clear how policy makers can improve teacher quality. With teacher salaries, however, policy makers have an obvious policy lever at their disposal that has the potential to improve teacher effectiveness. Much of the current research in this area focuses on whether performance pay can achieve this goal; this paper aims to advance our understanding of how base salaries may be redesigned in ways that can improve teacher quality and student outcomes.

By adjusting base salaries, policy makers can potentially affect teacher quality through many mechanisms. Higher salaries might attract or retain teachers with higher innate teaching ability or increase morale, which could increase teacher effort. Higher base salaries can retain teachers for longer careers, which allow them to gain valuable experience. At the state level, higher salaries might attract more able individuals to the teaching profession. At the school or district level, higher salaries might lure high-ability or experienced teachers away from competing schools or districts.

While teacher salaries have the potential to affect productivity through a variety of pathways, evidence supporting these effects is scarce. Prior studies suggest that higher teacher salaries are modestly effective in retaining and attracting teachers graduating from more selective universities (Clotfelter, Ladd, & Vigdor, 2011; Figlio, 2002) and teachers scoring higher on the SAT college entrance exam (Ballou & Podgursky, 1995). However, a series of studies fail to find evidence that these teacher qualifications are strongly related to teacher productivity (Aaronson, Barrow, & Sander, 2007; Clotfelter, Ladd, & Vigdor, 2006, 2007, 2010; Harris & Sass, 2011).

There is some evidence that teacher certification exam scores are positively related to teacher productivity (Clotfelter et al., 2006, 2007, 2010; Goldhaber, 2007;

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Wiswall, 2013); however, the evidence on whether higher salaries attract and retain teachers with higher certification scores is mixed. Clotfelter et al. (2011) and Hanushek, Kain, and Rivkin (1999) find that higher salaries increase a school's chance of hiring a teacher with high certification scores, but higher salaries can also be counterproductive in terms of retention effects. Clotfelter et al. (2011) find that, although higher salaries improve the retention rates of teachers with high certification scores, higher salaries are more effective in retaining teachers with low certification scores.

One area of consensus in the literature is that teacher experience matters. Value-added research consistently shows that experienced teachers are more productive than novice teachers (Clotfelter et al., 2006, 2007, 2010; Harris & Sass, 2011; Ladd & Sorensen, 2014; Rivkin, Hanushek, & Kain, 2005; Wiswall, 2013). Also, on average, an individual teacher's productivity (value-added) increases over his or her career (Harris & Sass, 2011; Ladd & Sorensen, 2014; Papay & Kraft, in press; Rockoff, 2004; Wiswall, 2013). That is, the return to teaching experience exists both within a teacher over time and across teachers (comparing different teachers with differing experience levels). Furthermore, the within-teacher return to experience is typically larger than the across-teacher experience effect.[1] This suggests that the fixed component of teacher quality (teaching ability) is negatively correlated with experience. In other words, the evidence suggests that experienced teachers are more productive than novice teachers, the most able teachers (teachers with higher fixed productivity) are more likely to quit teaching, and individual teachers gain in productivity with experience.

Given the evidence regarding the relationship between experience and teacher productivity, it is here that the link between higher base salaries and teacher quality is strongest. Several studies show that higher salaries reduce teacher attrition (Clotfelter, Glennie, Ladd, & Vigdor, 2008; Clotfelter et al., 2011; Hanushek, Kain, & Rivkin, 2004; Hendricks, 2014; Imazeki, 2005; Podgursky, Monroe, & Watson, 2004). This suggests that higher salaries are likely to retain more of the most able teachers, and those teachers are likely to improve over time.

While this retention effect of higher salaries is an important finding, it is only one of potentially many mechanisms through which salaries may affect teacher quality. This study is motivated by the evidence that experienced teachers are more productive on average, and it provides evidence on a separate mechanism that links changes in base salaries to teacher experience and productivity. In this work, I examine whether changes in a district's salary schedule affect the distribution of experience among its new teacher hires.

I am able to uncover this effect using plausibly exogenous experience-specific variation in district salary schedules in Texas over a 16 year panel. Across years, districts in Texas tend not to shift their salary schedules up or down. Instead, districts impose differential changes in salaries across experience groups. For example, a district may increase pay for veteran teachers at the same time that it decreases pay for novice teachers. Some of this differential variation is caused by changes in the state minimum salary schedule, which is a plausibly exogenous source of variation. I exploit this differential variation in salaries across teacher experience levels to identify the effect of salaries on the distribution of experience among a district's new hires. That is, if salaries affect the distribution of hires, then when a district increases pay for veteran teachers and decreases pay for novice teachers the district should be able to hire a higher proportion of veteran teachers relative to novice teachers under the new salary schedule.

Using this research design, I find that a 1% increase in base salary for teachers of a particular experience level increases the proportion of the targeted teachers hired by 0.04–0.08 percentage points. When the effects are allowed to vary by teacher experience, I find that pay has the largest effect on hire rates among teachers with 2–3 years of experience and the effect diminishes with experience. Changes in starting salaries are not related to the hire rates of teachers with 0–1 years of experience, which suggests that either new teachers are relatively unresponsive to salary changes or that principals prefer to hire the most experienced applicants.

This result, combined with the retention effects estimated in Hendricks (2014) and our current knowledge of the relationship between experience and productivity, has significant policy implications. First, these results suggest that higher teacher salaries provide dual benefits in terms of retaining and attracting a more experienced (and effective) distribution of teachers. Second, this study's results and those in Hendricks (2014) suggest that novice teachers are most responsive to changes in salary, both in terms of retention and selection effects. Combining this with our knowledge of the relationship between teacher experience and productivity suggests that districts may also improve student achievement growth at no cost by reshaping their salary schedules.

Districts in the sample used in this analysis typically employ a salary schedule that is increasing and convex in teacher experience, which is not designed to maximize student achievement growth. A more efficiently designed salary schedule, which I derive in a simulation, is increasing and concave, so that novice teachers receive larger annual raises than do veteran teachers. A concave salary schedule improves student achievement growth primarily by retaining more teachers, who then gain in experience and productivity over time. While the concave schedule has significant retention benefits, it does not significantly alter the distribution of experience (and productivity) among teachers a school district is able to hire.

This work is organized as follows. Section 1 describes the data; Section 2 presents the conceptual framework; Section 3 presents the empirical model; Section 4 presents the results; Section 5 discusses the implications of the results for district policy and student achievement; Section 6 concludes.

[1] Across-teacher estimates of the return to experience typically reveal returns up to 5 years of experience, after which additional experience does not predict additional productivity (Clotfelter et al., 2006, 2007, 2010; Rivkin et al., 2005). In contrast, within-teacher estimates of the return to experience reveal productivity returns that persist well beyond 5 years of experience (Harris & Sass, 2011; Ladd & Sorensen, 2014; Papay & Kraft, in press; Rockoff, 2004; Wiswall, 2013). Also, studies that estimate both within- and across-teacher experience returns with the same sample typically find that within-teacher experience returns are larger (Ladd & Sorensen, 2014; Wiswall, 2013). Harris and Sass (2011) find larger within-teacher experience returns relative to across-teacher returns in middle schools, but they find the opposite in elementary schools.