TEACHER RETENTION: ESTIMATING AND UNDERSTANDING THE EFFECTS OF FINANCIAL INCENTIVES IN DENVER

by

ELEANOR SPINDLER FULBECK

M.S., Fordham University, 2005

B.A., New York University, 2003

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written by Eleanor Spindler Fulbeck

has been approved for the School of Education, Department of Educational Foundations, Policy, and Practice

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Kevin Welner, Ph.D. (co-chair)

_____

Edward Wiley, Ph.D. (co-chair)

_____

Derek Briggs, Ph.D.

_____

Margaret Eisenhart, Ph.D.

_____

Claudia Mills, Ph.D.

_____

Paul Teske, Ph.D.

Date _____

The final copy of this thesis has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.

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Fulbeck, Eleanor Spindler (Ph.D., Education, Educational Foundations, Policy, and Practice)

Teacher Retention: Estimating and Understanding the Effects of Financial Incentives in Denver

Dissertation directed by Kevin Welner, Ph.D., and Edward Wiley, Ph.D.

ABSTRACT

Extensive teacher mobility can undermine policy efforts to develop a high-quality workforce. As one response, policymakers have increasingly championed financial incentives as a way to retain teachers. In January, 2006, Denver Public School District, the Denver Classroom Teachers' Association, and Denver voters approved and funded one of the most prominent alternative teacher compensation reforms in the United States: the *Professional Compensation System for Teachers* ("ProComp"). This dissertation studies ProComp and endeavors to contribute to research on the potential of financial incentives to increase teacher retention. The study draws on panel data and teacher interview data to investigate three inter-related questions: the extent to which ProComp has increased retention rates, the relationship between retention and teacher quality, and the reasons underlying these effects. Beyond the effects observed for schools in the district as a whole, special attention is paid to the effects of ProComp on retention rates at schools that serve high concentrations of poor students – schools where teachers are eligible to receive a financial incentive to stay.

Findings suggest teachers do respond to financial incentives, albeit at a seemingly low level. Furthermore, analyses point to a greater impact on retention rates for schools with high ProComp participation and for the high-poverty schools where teachers are eligible for the retention incentive. These gains also appear to be associated with above-average teacher quality, although the direction of this relationship is unknown. Analyses of teacher interview data do not

rule out the possibility that some teachers may respond to financial incentives, but these interviews do suggest their responses may be tempered by the importance of non-pecuniary factors.

This dissertation is intended to contribute to the slim body of literature about financial incentives as a policy lever to increase teacher retention. While improved retention is not a silver bullet for providing all children with access to high-quality teachers and a better education, it is an important step. Programs such as ProComp and research about its effects contribute valuable insight about the potential of financial incentives to improve retention, particularly at high-poverty schools.

DEDICATION

I dedicate this dissertation to my wonderful family. Particularly to my supportive and patient husband, J.C., who has put up with these many years of research and to our wonderful dogs, Kona and Milo, who always remind me to take some time to enjoy life. I must also thank my loving parents, great siblings, and terrific in-laws for their encouragement and understanding. Finally, I dedicate this work to my late grandfather, Dr. James H. Stone, who believed in diligence, science, art, and the pursuit of academic excellence.

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Introduction

Research Problem

In January, 2006, Denver Public School District, the Denver Classroom Teachers' Association, and Denver voters approved and funded one of the most prominent alternative teacher compensation reforms[1] in the United States: the *Professional Compensation System for Teachers* ("ProComp"). Via a combination of ten financial incentives, ProComp seeks to increase student achievement by motivating teachers to improve their instructional practices and by attracting and retaining high-quality teachers to work in the district. This study focuses on the extent to which ProComp has increased retention rates in the district, the relationship between retention and teacher quality,[2] and the reasons underlying these effects. Beyond the examination of effects on all schools in the district, special attention is paid to the effects of ProComp on retention rates at schools that serve high concentrations of poor students.

This research is quite timely as recent education policy discussions have focused on the importance of high-quality teachers for student success. Research suggests that of all the school-specific factors malleable by public policy, teachers have the greatest impact on the quality of a student's education (Rivkin, Hanushek, & Kain, 2000; Rockoff, 2004; Sanders & Rivers, 1996; Sunderman & Kim, 2005). Improved access to high-quality teachers has been advanced as one of the most promising education policy solutions for increasing low student test-score achievement and reducing the persistent gap in test-score achievement.

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[1] Broadly conceived, alternative teacher compensation includes pay-for-performance and merit pay programs that pay teachers for performance outcomes, professional development, and other desirable behaviors. Traditional "single-salary" schedules provide teachers with pay increases according to years of teaching experience and post-baccalaureate educational attainment.

[2] Although the concept of teacher quality will be explained fully throughout this dissertation, it is useful to briefly define how it has been conceptualized here. Quality has been operationalized as teacher value-added estimates in reading and mathematics and as years of teaching experience.

However, it is difficult to retain teachers, particularly in certain schools. While some turnover may be beneficial for individual teachers and even for the schools at which they work, the rate of turnover at some schools is very high and has detrimental impacts from a business perspective (e.g., the costs of recruiting and training) and from an educational perspective (e.g., disruption of school-wide learning) (Boyd et al., 2011; Ingersoll, 2004). High rates of teacher turnover often result in vacancies that are filled by new and less-experienced teachers who research suggests are often less effective (Chiat & Miller, 2009a). These harmful effects are exacerbated at high-poverty schools. As such, students who attend high-poverty schools have less access to high-quality teachers and to educational opportunities that later yield future educational and life opportunities. Providing students at high-poverty schools with access to a stable, high-quality set of teachers throughout their K-12 education would mitigate some of the inequalities pervasive throughout our education system and larger society.

Unfortunately, there is no definitive method for how best to retain teachers. Research suggests there are multiple reasons for high teacher turnover (Boe, Cook & Sunderland, 2008; Ingersoll, 2001). One such reason consistently cited in the literature is teacher job dissatisfaction related to low salaries. Thus, it is possible that by offering financial incentives, through a program such as ProComp, teachers would become more satisfied with their jobs and retention would increase. Financial incentives for teachers, either as part of an alternative teacher compensation program or as a stand-alone incentive, have been championed by policymakers as one way to make the teaching profession and specific schools or subjects more attractive to more people (Baratz-Snowden, 2007; Chiat & Miller, 2009a; Sawchuk, 2009).

As of yet however, the enthusiasm for financial incentives has not been grounded in empirical research. At best, evidence that financial incentives can help retain teachers is mixed

(Bracey & Molnar, 2003; Jacobson, 2006). Though improved retention is not a silver bullet for providing all children with access to high-quality teachers and a better education, investigating whether the availability of financial incentives has *any* measurable effect on teacher retention is an important first step in exploring this question.

Estimating the effect of financial incentives on retention rates across the district and specifically at high-poverty schools is not, in and of itself, enough to allow one to evaluate the benefit for schools. Critical readers will also want to know which types of teachers are retained after the implementation of ProComp and whether effects on retention are associated with any changes in overall teacher quality and effectiveness. An exploration of the relationship between retention and teacher quality is particularly important because it is not clear that increases in retention rates are associated with improved overall teacher quality (Clotfelter, Ladd & Vigdor, 2010).

For example, if ProComp serves to increase the attractiveness of teaching in Denver Public Schools (DPS), the teachers retained may be higher-quality teachers who are both experienced and effective at raising student test scores. On the other hand, if ProComp does not increase the attractiveness of teaching in DPS or if high-quality teachers are less responsive to financial incentives, those who do respond to ProComp may be of lower-quality – perhaps those at the very beginning or end of their teaching careers or those with few other job prospects. Unintentionally retaining lower-quality teachers is of particular concern in high-poverty schools, given evidence that suggests lower-quality teachers tend be disproportionately concentrated in these schools and that teachers do not necessarily prioritize financial compensation when making their employment decisions (Clotfelter, Ladd, & Vigdor, 2006; Hanushek, Kain, & Rivkin, 2004; Milanowski et al., 2009; Smith & Ingersoll, 2004; Wyckoff, Boyd, Lankford & Loeb, 2003).

Accordingly, this study explores the relationship between retention and quality to get a sense of the degree to which schools may have benefited from improved retention.

In addition to estimating the effect of ProComp on teacher retention rates and exploring the relationship between retention and teacher quality, this study also endeavors to identify reasons behind observed effects. Via teacher interviews, I seek to understand how – if at all – teachers, when making their employment decisions at the end of the year, consider (a) ProComp, (b) a specific ProComp incentive available to teachers who work at high-poverty schools, and/or (c) the way in which high-poverty schools are labeled under ProComp (termed "Hard to Serve").[3] Such an understanding of teachers' feelings, beliefs, and employment decision processes inform my interpretation of the estimated effects of ProComp on retention rates, provided insight into the mechanisms driving teacher responses – or lack thereof – to financial incentives, and is expected to make a novel contribution to the extant research about the effects of financial incentives on teacher retention.

In the remainder of this chapter, I provide a brief background on ProComp and ProComp's Hard to Serve (HTS) incentive, awarded to teachers who work at the district's most high-poverty schools. Subsequently, I explain how this study is expected to contribute to the literature on financial incentives and teacher retention. This chapter concludes with an overview of the forthcoming chapters in this dissertation and presents the formal research questions crafted to guide this study.

[3] It was important to ask teachers about both the incentive and the label "Hard to Serve," separate and apart from the bonus, because some teachers may consider this label to be synonymous with the "Failing School" label under NCLB. If teachers in Denver did associate the "Hard to Serve" label with the "Failing School" label this would have the potential to impact retention as critics claim the "Failing School" label makes it more difficult for schools to attract and retain high-quality teachers (Darling-Hammond, 2007).

Background

Although teacher compensation that departs from the traditional "single-salary schedule" is not new (Murnane & Cohen, 1986), it has recently gained popularity in policy circles as an approach for increasing student achievement and improving teacher quality (Honawar, 2007; Chiat & Miller, 2009b; Adams et al., 2009). Historically, alternative teacher compensation plans have been met with strong resistance from teachers unions (Harris, 2007), which have primarily opposed alternative teacher compensation plans that link teacher pay to student achievement and that are not established via collective bargaining. ProComp has gained national attention as one of the only teacher compensation reforms jointly conceived of and implemented by the district and local teachers' union (Gonring, Teske, & Jupp, 2007).

The apparent success of Denver in overcoming much of the political opposition from the local teachers union was likely due to the early partnership between Denver Public School District (DPS) and the Denver Classroom Teachers Association (DCTA), an affiliate of the National Education Association (NEA); DPS and DCTA jointly developed the pilot and final ProComp plan (Baratz-Snowden, 2007). Additionally, ProComp came about at a time when the federal government began to show interest in financially supporting alternative teacher compensation plans. The Bush administration prioritized teacher compensation reform, allocating nearly $100 million to alternative compensation systems through its Teacher Incentive Fund (TIF) program. Denver's ProComp received a $22.6 million TIF grant and was backed by Denver voters via a 2005 referendum to levy $25 million in annual taxes to pay for the program.

Denver's ProComp

DPS is the second largest school district in Colorado, serving approximately 80,000 students in 152 schools with roughly 4,500 teachers. The majority of students who attend DPS

are Latino, and over 72 percent qualify for the federally sponsored free- or reduced-price lunch program, a commonly used indicator of poverty. Like many large, urban districts, DPS is plagued with low test-score achievement and a shortage of high-quality teachers (Council for Great City Schools, 2009). In the last decade, DPS has tried to address these issues via numerous education reform measures – school choice, charter schools, reconstitution of low-performing schools, and alternative-certification teacher programs. Of all these reforms, DPS has received the most attention for its teacher compensation program.

DPS has a long history of leadership in teacher compensation reform. In 1921, it became one of the first school districts in the nation to pay teachers with a single-salary schedule, the approach now used to determine pay for the majority of teachers in the United States (Gratz, 2009). In 1994, DPS created a committee to begin looking at alternative ways to compensate teachers, and by 1999 a two-year alternative teacher compensation pilot program had been developed (Gonring, Teske & Jupp, 2007). Backed by several prominent Denver foundations with interests in education, this pilot program was later extended to four years. In 2004, DPS made several adjustments to the program, learning from strengths and weakness highlighted in an evaluation report conducted by the Community Training and Assistance Center (Gonring, Teske & Jupp, 2007). ProComp was approved by teachers and financially backed by Denver voters in 2004 and 2005.

Fully implemented throughout DPS in January, 2006, incumbent teachers could opt into ProComp or continue to be paid based on the DPS single salary schedule (see Appendix A). Teachers who were hired on or after January 1, 2006 were required to participate in ProComp. Under ProComp, teachers can receive salary increases and/or annual incentives by doing one or more of the following:

- Obtain Advanced Degrees and Certifications
- Complete Specialized Professional Development
- Demonstrate Proficient Practice Through a Comprehensive Professional Evaluation System
- Work at a HTS School or in a Hard to Staff Position
- Satisfy Classroom Learning Objectives
- Exceed Student Achievement Expectations on the State Assessment (CSAP)
- Work at a School with Distinguished Achievement
- Work at a School for which the Rate of Growth Toward Distinguished Student Achievement and Attendance is Rated "High"

There is no limit to the number of incentives a teacher can earn in a single year; however some are specific to subject/grade or school location. The comprehensive design of ProComp has been championed by President Obama as a model for design and implementation of teacher compensation reform, and a growing number of districts have used ProComp as a guide for developing similar reforms (Meyer, 2008).

More recently, ProComp has also received national attention because of tense district-union negotiations on how to best allocate available funding (Honawar, 2008a; 2008b). DPS proposed amendments to ProComp that would change some incentives from salary increases to annual incentives and redirect more money to new teachers. The DCTA, however, opposed any changes to ProComp so shortly after it had been implemented and argued the district's proposal would be unfair to veteran teachers. Just before the start of the 2008-09 school year, a compromise between DPS and the DCTA was finally negotiated, resulting in two new incentives and changes in incentives attached to several elements (see Appendix B for details about

incentives included in the first and second iterations of ProComp). As a result of these negotiations, both the amount and availability of the HTS incentive more than doubled. Importantly, these negotiations did not impact ProComp funding sources. ProComp continues to be financially backed through 2013 via a mill levy (property tax) approved by Denver voters.

ProComp's Hard to Serve Incentive

The HTS incentive available to teachers under ProComp is a market-based incentive aimed at retaining teachers to work at high-poverty schools. The HTS school designation and accompanying incentive are intended for the schools serving the highest concentrations of poor students. With the explicit aim of improving retention at these schools (as opposed to recruiting new teachers), the incentive amount (approximately $2,400) is modest. In their book detailing the design and implementation of ProComp, Gonring, Teske and Jupp (2007) explain the intention behind this decision: "DPS and the DCTA decided not to use bonuses large enough to attract teachers from throughout the district to work in these assignments; instead they chose incentives sized to retain teachers and stabilize the rate of turnover over time" (p. 19). Perhaps relying on people's preference for the familiar, as well as extant studies of teacher employment patterns, the district and union realized that the level of an incentive amount that would likely be required to motivate a teacher to *come* to a HTS school was substantially more than the amount required to *keep* a teacher already working at such a school. By tying a moderate incentive to positions at HTS schools, the designers of ProComp intended to temper turnover at these schools rather than increase applications for available positions at these schools.

Recent survey data[4] from DPS teachers and principals suggested that the ProComp incentives for educators who teach at HTS schools are widely supported. Nevertheless, data from the 2007 and 2008 surveys suggest teachers who were employed at HTS schools reported the HTS incentive did little to encourage them to remain at those schools. In 2009 and 2010, slightly more teachers reported the HTS incentive encouraged them to remain at their HTS schools though the percentage of teachers who agreed was still relatively small (e.g., in 2010, approximately 35% of teachers who were working in a HTS school at the time of data collection indicated the incentive would encourage them to remain at their schools). These results are difficult to put into the context of extant research because, despite the increased prevalence of financial incentives to attract and retain teachers to work at HTS schools, there is little evaluative research to date on the effects of financial incentives on teacher retention (Holley, Barnett, & Ritter, 2007; Jacobson, 2006). This study seeks to mitigate the dearth of research in this area.

Expected Contribution to Financial Incentives and Retention Literature

This dissertation is intended to contribute to the slim body of research about the effects of financial incentives on teacher retention and to add to the on-going conversation about how to provide all students with access to a high-quality education. The study is especially important because it examines the effects of one of the most trendy education policy reforms – financial incentives – on one of the most prominent education policy concerns – teacher retention, particularly at high-poverty schools. The study also considers the overall quality and effectiveness of teachers retained. This research comes at a time when there is much enthusiasm for and action aimed at improving teacher retention and quality via financial incentives, yet there

[4] In 2007, 2008, 2009, and 2010 DPS teachers and principals were surveyed regarding their attitudes and beliefs about ProComp and the HTS incentive specifically. Response rates on the teacher survey were moderately high: between 52-55% responded. Principal response rates were approximately 80% for all four years the survey was administered.

also exists only scant evidence about both the intended and unintended effects of such a policy approach.

Understanding whether and how financial incentives increase teacher retention across the district and at high-poverty schools, and whether such changes have occurred concurrent with changes in teacher quality, may yield important insights about how to improve access to a high-quality education for all students. Findings from this study have the potential to inform education policy at the federal, state, and local levels. Currently, alternative teacher compensation programs have a central role in federal education policy reform via TIF and competitive grants available to states under *Race to the Top*. Alternative teacher compensation, included in the Obama administration's "Blueprint" for reauthorizing the Elementary and Secondary Education Act (ESEA), is expected to play a central role in future education reform efforts (U.S. Department of Education, 2010). As ProComp has been in existence longer than any comparable alternative teacher compensation, local and federal policy-makers are closely watching Denver to see whether this program yields positive results with regard to improved student achievement and increased teacher retention and quality.

ProComp is an established, fully-funded, and comprehensive alternative teacher compensation reform. It therefore has all the pieces in place and accordingly provides a unique context in which to explore the effect of financial incentives on teacher retention. Effects of ProComp on retention rates should not be contaminated with implementation inconsistencies, inadequate resources, or incomplete information. If financial incentives help to retain teachers, one would expect to see evidence of this under ProComp.

In addition to the unique opportunity provided by ProComp to study the effects of financial incentives on teachers' employment decisions in a high-profile policy context, the data

I have are exceptional. District human resource and school characteristic data are available for six years prior and four years subsequent to the implementation of ProComp, which makes it possible to attempt to isolate the effects of ProComp from other overall trends that might impact retention. Rich interview data from a purposefully selected sample of teachers provided explanatory insights for trends identified quantitatively. The mixed-method design of my study capitalizes on the extensive data available.

The stability of the ProComp program, the unique access to data, and the study design should enable findings from this dissertation to contribute to the limited body of research about the effects of financial incentives on teacher retention. Given high turnover rates and the shortage of high-quality teachers, especially in high-poverty schools, findings from this study could play a major role in informing future efforts to improve teacher retention and increase access to a high-quality education for our nation's neediest students.

Overview of Chapters and Research Questions

Chapters 2 and 3 are intended to provide the details necessary to fully understand the research problem that motivated this study and the analytical tasks I employ to address the primary research questions. Specifically, Chapter 2 reviews the existing body of research on alternative teacher compensation and financial incentives, their effectiveness at improving teacher retention, and commonly used measures of teacher quality. Chapter 3 covers this dissertation's methodology for estimating effects on retention rates, exploring the relationship between retention and overall teacher quality, and understanding the mechanisms that contribute to ProComp's impact on retention rates. Chapters 4 and 5 present findings from quantitative and qualitative analyses, respectively. Chapter 6 provides a discussion of the results, presents the study's limitations, and identifies several areas for future research.

The analytic tasks carried out in this dissertation are driven by four key research questions:

1. To what extent do ProComp and the HTS incentive alter teacher retention rates across the district and at high-poverty schools?
2. What is the relationship between retention and teacher quality?
3. What do teachers report about how ProComp and the HTS incentive are or are not factored into their end-of-the-year employment decisions?
4. What do teachers report about how the HTS designation of their school (separate and apart from the financial incentive itself) is or is not factored into their end-of-the-year employment decisions?

These research questions were developed to capitalize on the available data and determine what the effects of financial incentives are on retention rates in DPS and why these effects are observed. This study also seeks to validate the assumed benefit of improved retention by exploring the relationship between retention and overall teacher quality. In sum, this dissertation examines Denver's ProComp and its impact on teacher retention rates across the district generally and at high-poverty schools specifically.

Chapter 2

Literature Review

The design of this study and interpretation of findings presented in subsequent chapters is informed by research on alternative teacher compensation, teacher retention, and teacher quality. This chapter is structured as follows. The first section presents a brief history of alternative teacher compensation and the use of financial incentives in education reform. As ProComp combines several different types of incentives (i.e., knowledge- performance-, and market-based), each of these are explained in turn. The theory of action underlying the way each type of incentive is expected to yield increases in student test-score achievement and improvements in teacher quality is also explained. The second section covers extant research on teacher retention. This review includes studies that have examined the impact of overall compensation on retention as well as those that have investigated targeted financial incentives aimed specifically at increasing retention at high-poverty schools. Because this dissertation explores the relationship between retention and teacher quality, the third section considers the extensive empirical literature on teacher quality and effectiveness. The review of teacher quality research is intended simply to provide an overview of the common ways in which teacher quality is defined and to explain the rationale for the definitions of quality and effectiveness adopted in this study. I include a brief discussion of the ways in which the literature reviewed informs this study at the end of each of these sections.

Alternative Teacher Compensation and Financial Incentives

As explained in Chapter 1, "alternative" teacher compensation is used herein to refer to any teacher compensation structure that departs from the traditional single-salary or fixed-salary schedule. At its most basic, alternative teacher compensation is intended to align the interests of teachers with the goals of the district in which they work (Adams et al., 2009). These programs have attracted bipartisan support in policy discussions as an approach to increase student test-

score achievement and to attract and retain high-quality teachers (Baratz-Snowden, 2007). The Obama administration and Congress recently passed the American Recovery and Reinvestment Act of 2009 (ARRA), which provides additional financial support to the Teacher Incentive Fund (TIF) (Hoff, 2008). Created in an appropriations bill in 2006, TIF initially provided $99 million in competitive five-year grants to states, school districts, and nonprofit organizations that support "efforts to develop and implement performance-based teacher and principal compensation systems in high-need schools" (U.S. Department of Education, 2008, N.P.). ARRA added another $200 million in funding to support these programs (Chiat & Miller, 2009a; Sawchuk, 2009). Further, the Obama Administration's 2011 budget request designated an additional $950 million for a new Teacher and Leader Innovation Fund to support the development and implementation of performance-oriented approaches to recruiting, retaining, and rewarding highly effective teachers (U.S. Department of Education, 2010).

This section reviews alternative teacher compensation programs by first briefly recounting the history of alternative teacher compensation. Next, literature that helps to explain the recent renewed interest in these programs is reviewed. Following this, several types of financial incentives are described, with special consideration to the theories of action that underlies each. Key challenges of and criticisms about alternative teacher compensation programs are reviewed last.

History

The first established system of alternative teacher compensation dates back to 1862, when teachers in England were "paid for results." Under this system, teachers' salaries were tied to student attendance and the number of students who passed examinations. Evidence suggests there was little reason to believe this program had its intended effect of encouraging teachers to

perform at higher levels. In fact, there is some indication unintended consequences arose as a result of this program that were contradictory to established quality teaching practices (Harris, 2007; Rapple, 1992). In his review of the English "pay for results" system, Rapple (1992) explains, "passing the examination and gaining the grant [money] was frequently the sole aim of the teacher, little attention being paid to understanding the process of this subject and their application in day-to-day life" (p. 307). Rapple goes on to describe data suggesting teachers also corrected student answers on tests and padded attendance counts so as to earn additional money.

School districts in the United States began experimenting with teacher pay early in the 20th century. Consistent with the focus on efficiency that dominated both public and private sectors during the Progressive Era, many administrators were interested in attaching teacher pay to student performance. The earliest programs were often contentious, pitting administrators against teachers, and these programs were not endorsed by teachers unions (Harris, 2007). By 1928, teacher dissatisfaction and problems with developing reliable measures of performance contributed to the end of most of these programs (Murnane & Cohen, 1986).

Interest in alterative teacher compensation programs arose again after the launch of *Sputnik* in 1957 and after the release of *A Nation at Risk* in 1983 (Conley & Odden, 1995; Harris, 2007). Both events left policy makers and educators searching for ways to improve student achievement, particularly as measured by standardized assessments, and to promote an image of a strong, stable, and well-educated country. Yet once again, these programs were short-lived. In their review of early alternative teacher compensation programs, Murnane and Cohen (1986) concluded teaching was not a profession that lent itself to performance-related compensation systems because of the difficulty related to monitoring teacher performance. Their "nature of teaching" hypothesis contended teacher performance is more difficult to monitor than

performance in many other professions (e.g., home sales of a Realtor or billable hours of a doctor) because teachers do not produce output that is easily measured. As such, it is difficult to ascertain the "value-add" of an individual teacher or group of teachers because outputs of teacher performance (e.g., student test scores) are influenced by many other factors.

Early efforts to develop and implement alternative teacher compensation programs struggled with how to create a reliable process to identify effective teachers, develop standardized assessments across schools, ensure fair treatment during supervisor evaluations, fulfill administrative duties, and stretch limited funds (Baratz-Snowden, 2007; Harris, 2007; Murnane & Cohen, 1986; Podgursky & Springer, 2006). These problems echo many critics' concerns about alternative teacher compensation programs today. Yet, despite these persistent challenges, there has been a recent surge in interest in these programs.

Renewed Interest

The history of alternative teacher compensation programs is lengthy but has little programmatic consistency and no record of programs successfully sustained for any length of time. However, proponents of alternative teacher compensation argue developments in educational research and data collection may make this latest round different from earlier movements. In the first publication of a series on alternative teacher compensation by the Economic Policy Institute, Adams et al. (2009) explain there are three important developments in the study of K-12 education that have contributed to the renewed interest in alternative teacher compensation programs. First, a large body of empirical research exists today suggesting teachers are the most important resource schools can contribute to student test-score achievement. Second, many districts now collect data that enable them to link student test scores

to individual teachers. Finally, sophisticated statistical models of teacher "value-add" have been developed that many think provide reasonably accurate estimates of teacher effectiveness.

The growing interest in alternative teacher compensation may also be a response to criticisms surrounding NCLB (Baratz-Snowden, 2007). Though many states had policies that rewarded or punished schools and their staff based on test scores by the mid-1990s, NCLB federalized this approach and, in some ways, made it more punitive (Adams et al., 2009). Among the numerous criticisms of NCLB's requirement for adequate yearly progress is that sanctions are made at the school level. Proponents of alternative teacher compensation argue these programs allow for a more appropriate form of accountability because they can be tailored to reward or punish individual teachers rather than entire schools (Baratz-Snowden, 2007).

Renewed interest in alternative teacher compensation is also likely motivated by the relatively stagnant improvement in student test scores, concerns about international student test score rankings (comparisons of U.S. scores to those of other nations), and the test-score gap within the U.S. that continues along socioeconomic and racial lines (Baratz-Snowden, 2007; Harris, 2007). Policymakers, educational researchers, district and school officials, and parents have long sought strategies to improve student test-score achievement. The logic driving alternative teacher compensation rests upon the belief that high-quality, effective teachers can improve student learning and test scores and thus, if the right combination of financial incentives improves access to high-quality, effective teachers, this will ultimately raise student test scores.

Types of Programs

Since the early 20th century, the vast majority of public school teachers have been paid based on years of experience and post-baccalaureate educational attainment (Conley & Odden, 1995). This is a system of uniform pay steps that ensures teachers with the same years of

experience and same level of education earn the same salary within a given district. The single-salary schedule applies to all full-time teachers, regardless of subject or grade level. Typically, rows in a single-salary schedule indicate years of experience and columns indicate levels of post-baccalaureate education and/or advanced certifications obtained. Historically, this uniform pay system was important to foster greater gender and racial access and fair pay in the teaching profession (Podgursky, 2008). The single-salary schedule has some advantages, including perceived objectivity, minimal monitoring, collegiality, and predictability (Harris, 2007). However, it has also received much criticism. Most frequently, the single-salary schedule has been criticized for preventing public school leaders and administrators from adjusting individual teacher's salaries to reflect performance, skills, and market-force realities such as a reduced supply of teachers for some schools and positions (Baratz-Snowden, 2007; Harris, 2007; Podgursky & Springer, 2010). Another common criticism is that the teacher characteristics used to set the single-salary schedule – years of teaching experience and education level – are at best only weakly correlated with student test-score outcomes (Podgursky & Springer, 2006).

"Alternative teacher compensation" is a broad label that requires clarification as there are several ways in which teacher pay can depart from the single-salary schedule and not all deviations should be considered alternative compensation programs. For example, a one-time bonus given to all teachers *in lieu* of a pay increase is a deviation from the single-salary schedule but would not be considered an alternative compensation program (Adams et al., 2009). The most prominent types of financial incentives offered as alternative teacher compensation include: knowledge- and skill-based pay, merit- and performance-based pay, and market-based pay (Gratz, 2009; Milanowski, 2002; Podgursky & Springer, 2006). These financial incentives can be

applied individually or in conjunction with one another to reward or punish individual teachers, groups of teachers (e.g., by subject area or grade), or entire schools.

Knowledge- and Skill-Based Programs

Most similar to the single-salary schedule, knowledge- and skill-based programs are input-based. They provide pay increases to teachers who demonstrate – usually through some form of performance assessment – that they have acquired and can apply classroom relevant knowledge and skills (Milanowski, 2002). The goal is to establish a pay system that motivates teachers to acquire and demonstrate application of knowledge and skills that more directly contribute to improved student test scores. Proponents of knowledge- and skill-based programs contend they are more straightforward than performance-based programs because teachers know exactly what they need to do (e.g., attend professional development, complete an advanced course) in order to earn the additional pay. Because it is not always as clear what specific actions a teacher can take to improve student test scores, knowledge- and skill-based programs have this advantage over merit- or performance-pay programs (Baratz-Snowden, 2007; Milanowski, 2002).

As a strategy to ultimately increase student test scores via more effective teachers and improved instructional capacity, the theory of action underlying knowledge- and skill-based alternative teacher compensation programs is three-fold. First, teachers will respond to financial incentives and will change their behavior and the way they work in order to earn them. Second, alternative teacher compensation programs will help attract and retain higher-quality, effective teachers who are good at the activities and tasks attached to incentives. Third, incentives will reinforce a normative vision of quality instruction that supports teacher skill-seeking and efforts

to improve practice, which in turn contribute to improved student test-score achievement (Adams et al., 2009; Milanowski, 2002).

Merit- and Performance-Based Programs

Unlike knowledge- and skill-based programs, merit- and performance-based programs are essentially output-based systems of pay that attach financial rewards to some direct metric of student performance or to a professional evaluation. Though not as common, some rewards can also be made based on a comparison across workers rather than on an *a priori* standard. Some economists (see for example Lazear, 1986) have argued such "tournament" pay systems promote greater employee effort and performance. However, others do not recommend alternative teacher compensations follow such a system due to the inherent challenges in comparing teachers that may teach different subjects or grades (Adams et al., 2009).

There are several common variations in performance-based programs. First, level of performance pay can either be based on individual performance or the combined efforts of a group of teachers. Each comes with its own set of advantages and drawbacks. Individual performance awards may provide some motivation for high performers to keep teaching, while deterring low performers from remaining. Some claim this prevents an individual teacher's performance from being muted or enhanced by others (Harris, 2007). But individual rewards may result in goal displacement, where teachers focus only on the activities and subjects linked to rewards, at the expense of other activities that benefit the students or the entire school. Furthermore, because models to estimate a teacher's contribution to student test scores are not exact, the ability to consistently and accurately credit the right teacher with the right amount of reward for performance remains elusive (Buddin et al., 2007; National Research Council, 2011).

Problems around accurately determining individual teacher productivity lead some to prefer group incentives. Group incentives recognize the collaborative nature of teaching and school effectiveness by rewarding groups of teachers or entire schools collectively. It is also plausible that the use of group incentives may contribute to a positive work environment. However, a difficulty with group incentives is that they allow for "free riders" – where an individual can put forth little effort and still receive a financial reward. The larger the group, the greater the free rider problem. Group incentives also provide little motivation for the more effective teachers to improve, though some evidence suggests less effective teachers exert greater effort as a result of peer pressure (Adams et al., 2009). In this sense the free rider problem might be mitigated by the desire not to let other coworkers down. Like programs that award individual teachers, programs that rely on group incentives also risk possible goal displacement.

Other variations to performance-based programs are related to how recipients are rewarded and how employees are identified to receive rewards. A reward can either be added to the base salary or distributed only at the time of high performance (i.e., a bonus). While teachers tend to prefer the former, there is evidence to suggest most programs use one-time bonuses to reward performance (Adams et al., 2009). The way in which employees are identified to receive rewards can also vary between formulaic identification and judgmental identification. Formulas (e.g., commissions) were not historically used in education performance-based plans though there is a considerable effort to move towards this way of identifying teachers for rewards (Adams et al., 2009) because they are considered more transparent. Judgments (e.g., bonus tied to appraisal and historic merit pay plans) come with a myriad of problems. Discrimination, strategic manipulation, halo effects (favorable overall rating based on outstanding performance

on only a single duty), central tendency (rating all employees towards the scale mid-point, regardless of performance), and recency effects (greater emphasis on recent performance) are all potential threats to the reliability and validity to judgmental identification (Adams et al., 2009). However, the use of multiple supervisors or managers does have the ability to lessen some of these potential problems.

Merit- and performance-based programs have a different underlying theoretical argument than knowledge- and skill-based programs. Lazear (1986) is among the many who argue that paying teachers for output such as student test scores – as opposed to paying them for input such as newly obtained skills – is preferable. He reasoned rewards for performance at an individual level via some publicly known formulaic measures of output provide the strongest incentives for teachers to produce as desired. There are two ways in which this is thought to occur. First, teachers are encouraged to exert high effort. Second, high-productivity teachers choose to remain in the job in which they are rewarded, while low-productivity teachers leave the profession. These two processes are frequently referred to as "motivational effects" and "selection effects."

In subsequent work, Lazear (2003) extended his argument suggesting performance-based pay will increase the overall quality and effectiveness of teachers via hiring practices and labor market selection. He argues hiring practices in the teaching profession are different from most professions because there is very little information available on a teacher's previous performance. Lazear noted that in many professions prior performance assessments and pay raises serve as indicators of employee quality and effectiveness. However, the single-salary schedule and tenure largely prevent differentiated earnings that reflect a teacher's performance. Lazear maintained that adoption of an alternative teacher compensation program that links pay to performance would generate a record of teacher performance. With this record, the overall

quality and effectiveness of the teaching profession would improve because principals would have more information at the time of hiring and be better able to offer the most qualified teacher the job.

In addition to having more information to hire higher-quality and more effective teachers from the start, Lazear (2003) argued overall teacher quality and effectiveness will be improved through labor market selection. He reasoned an alternative teacher compensation program that includes performance-based incentives may attract and retain teachers who excel at the activities to which incentives have been linked and deter teachers who do not. Accordingly, overall teacher quality and effectiveness should improve because individuals who choose to become teachers will be more likely to be good at the activities that are rewarded.

Lazear's (1986; 2003) theory has intuitive appeal and, for employees who produce a clear individual output measure (e.g., units sold or dollars of profit) it seems tenable to translate a maximized profit into performance pay (Adams et al., 2007). Public school teachers, however, do not sell a product and it is not immediately clear how to define an appropriate composite of student learning (output) that measures teacher performance in producing that learning. While student test scores presumably capture a portion of what has been learned, even the best tests miss some skills completely and measure others imperfectly (National Research Council, 2011). What's more, it is not easy to disentangle an individual teacher's contribution from the mix of other teachers, students, resources, and a myriad of other factors associated with student test scores (McCaffrey et al., 2003). As such, Lazear's theory of action would not only require that a consensus be reached as to what student outcomes are important but would also require that issues in measuring those outcomes be resolved.

Market-Based Programs

The basic assumption behind the use of financial incentives to attract teachers to and retain them at hard-to-staff schools or positions is that the incentives provide a compensating differential for potentially unattractive job characteristics associated with low student test scores, student or community poverty, race or ethnicity (a comfort issue for some teachers and an outright bias issue for others); the incentives might also help attract teachers to positions that are historically difficult to fill (Hanushek, 2007; Milanowski et al., 2009). Many districts have financial incentives – either stand-alone or as part of a larger alternative teacher compensation program – to attract teachers to and retain them at hard-to-staff schools or positions (Baratz-Snowden, 2007; Makkonen & Arnold, 2005; Podgursky, 2008).

Market-based incentives serve to increase the overall compensation for teachers who work at certain schools or in particular positions in order to make them more attractive. In their review of empirical studies on teacher recruitment and retention, Guarino, Santibanez and Daley (2006) set forth the basic economic principle driving the supply of teachers as follows: "Individuals will become or remain teachers if teaching represents the most attractive activity to pursue among all activities available to them" (p. 175). *Attractive*, they explain, is defined as desirable in terms of accessibility and overall compensation. A teacher's sense of fulfillment in the school and/or position and the working conditions are also likely to contribute to the overall attractiveness of a school and/or position. While accessibility – or ease of entry into the profession or a given school – is not something easily altered by alternative teacher compensation programs such as ProComp, overall compensation clearly would be influenced by such efforts.

As with other professions, the labor market for teachers is within and influenced by the larger labor market. Demand for teachers is driven by several factors: student enrollments, target class size, teaching load expectations and norms, and budgetary constraints (Guarino, Santibanez, & Daley, 2006). Shortages of teachers in the overall labor market or in a given school or position occur when demand exceeds supply. Although this can result from increases in demand, decreases in supply, or both simultaneously, continual shortages of teachers at high-poverty schools are thought to stem from an insufficient supply of qualified teachers who *want* to work at these schools (Ingersoll, 2004; Podgursky & Springer, 2010). Market-based incentives attempt to increase the supply of qualified teachers for these schools.

Prominent Criticisms

Alternative teacher compensation programs are not a silver bullet to improving teacher retention, quality, student learning, or test scores. They have a myriad of weaknesses and many critics. Surveys of teacher attitudes suggest the greatest support for alternative teacher compensation programs that are knowledge-/skill- and market-based, as opposed to performance-based (Chiat & Miller, 2009b). The way in which teachers can earn rewards under these types of alternative teacher compensation programs is relatively clear, and a majority of teachers say additional pay for increasing one's knowledge and skills or for working in a hard-to-staff school or position is fair. Thus, the main criticism of knowledge- and skill-based programs and market-based programs is that they are (or would be) ineffective (Milanowski et al., 2009).

Performance-based programs are also subject to criticisms of ineffectiveness. In a recent publication from the National Research Council's *Committee on Incentives and Test-Based Accountability*, the authors reviewed fifteen performance-based alternative teacher compensation programs and found little or no effect on student test scores associated with any of the programs

(National Research Council, 2011). There are also further criticisms of performance-based programs. First, it is very difficult to disentangle an individual teacher's contributions to student test scores because there are a variety of factors –at home and at school – that contribute to a student's observed scores (Buddin et al., 2007; McCaffrey et al., 2003). The commonly used performance measures of student achievement or student growth on standardized assessments are not clean measures of teacher effectiveness. Performance measures include sampling error and can be confounded by uncontrolled student background characteristics. Thus, value-add models that rely on these performance measures are imprecise and may misidentify some teachers for rewards or punishments (Briggs & Domingue, 2011).

A second criticism of performance-based programs is that they promote *goal distortion*. Kerr (1975) described goal distortion as "the folly of rewarding A while hoping for B" (p. 35). In the context of education, performance-based programs can result in goal distortion when the system only rewards gains in test scores that occur in some (tested) subjects and grade levels while trying to accomplish the goal of "improving student achievement" generally (Adams et al., 2009; Podgursky & Springer, 2006). This consequence is also described as "teaching to the test", "curriculum distortion", and "narrowing of the curriculum." Goal distortion raises serious concerns about how much genuine gain in reading and mathematics learning (not just test scores) is necessary to offset the reduction of resources now spent on other subjects and educational goals (science, art, social science, music, physical education, character building, civic engagement, etc.).

A third criticism of performance-based programs is that it can erode teachers' intrinsic motivation and cause them to focus only on producing the outcomes for which they are rewarded (Deci, Koestner, & Ryan, 2001). Related to this, many teachers have also expressed anger at

performance-based programs because they insinuate teachers are awaiting additional pay before they are willing to do what is necessary improve their students' learning and test scores (Jacob & Springer, 2008). Given the earnings disadvantage teachers face in the broader labor market, most did not join the profession in a singular pursuit of money (Allegretto, Corcoran & Mishel, 2008). Consequently, it is not necessarily surprising that some teachers have reported negative feelings towards performance-based alternative teacher compensation programs.

Since performance-based programs invite goal distortion and can lead to gaming and corruption, it would not be surprising to see improvement in average student test-score performance on the narrow goals those programs measure (Adams et al., 2009). However, there is little empirical evidence on this issue. The little that is known suggests financial incentives have had some effect on student test scores abroad (Glewwe, Ilias & Kremer, 2003; Muralidharan & Sundararaman, 2006) but not domestically (Glazerman & Seifullah, 2010; Springer et al., 2010; also see National Research Council, 2011 for a comprehensive review of test-score achievement outcomes related to 15 alternative teacher compensation programs).

Application to Study

Alternative teacher compensation programs have a long history (Murnane & Cohen, 1986) that has been riddled with challenges similar to those faced by efforts today: how to create a reliable and valid process to identify effective teachers, goal distortion, narrowing of the curriculum, teacher/union support, and the ability to stretch limited funds. ProComp is a unique alternative teacher compensation reform because it has successfully overcome some of these challenges. ProComp has teacher/union support and is fully-funded through 2013. It attempts to limit goal distortion and narrowing of the curriculum by offering financial incentives to teachers who increase their knowledge and skills and to those who do not teach a tested grade or subject

area. Of course, reliably identifying effective teachers remains a methodological challenge that ProComp is not able to address.

In addition to financial incentives that are knowledge- and skill-based, ProComp also includes the other two types of incentives explained above: performance-based and market-based incentives. While knowledge- and skill-based incentives are expected to improve teachers' professional practice, performance-based incentives are expected to alter the composition of the teacher workforce by attracting and retaining teachers who are best able to accomplish the tasks and outcomes to which the incentives are attached. Market-based incentives are expected to offset challenges in evenly distributing the supply of teachers to certain schools and positions by making these more attractive through additional pay. Theoretically, the inclusion of both performance-based and market-based incentives in ProComp should yield changes in retention across the district and in schools targeted by the market-based incentives (i.e., HTS schools).

Though ProComp is not immune to the criticisms of alternative teacher compensation described above, they are relevant to this study only in the extent to which they directly or indirectly impact teachers' employment decisions. The criticism most salient to this study is that most frequently leveled at market-based incentives: such incentives do not influence teachers' employment decisions and therefore will have no (or perhaps, only a limited) effect. To better understand this criticism and how it may play out in Denver, I turn to the substantial empirical literature on teacher retention.

Teacher Retention

Despite criticisms of alternative teacher compensation, it is an undeniably popular education reform. Most recently, two prominent studies conducted in Chicago and Nashville examined the impact of financial incentives on student test scores and found no effect

(Glazerman & Seifullah, 2010; Springer et al., 2010). However, critics argue these studies failed to examine one of the most promising hypotheses about incentive pay: Incentives might serve to attract and retain a different population of teachers, thus changing the overall quality and effectiveness of the teacher workforce (Anderson, 2010; Sawchuk, 2010). Accordingly, evaluations of alternative teacher compensation programs may be wise to examine teacher outcomes (e.g., retention, quality, effectiveness, etc.) prior to examining student test-score outcomes.

This section considers the evidence on teacher retention by reviewing substantial extant literature about teacher preferences, sorting patterns, the subsequent challenges of retaining high-quality, effective teachers to work in high-poverty schools, and the use of compensation policies to increase retention. First, evidence documenting well-established patterns of teacher preferences and sorting is reviewed. Second, literature that examines disparate retention of different types of teachers is examined. Third, various policies that rely on compensation to promote retention generally and those that rely on targeted financial incentives to increase retention at high-poverty schools are reviewed.

Preferences and Sorting

Teachers differ from other school resources because they have preferences about whether to teach, what to teach, and where to teach (Wyckoff et al., 2003). Once teachers have elected to teach, they may change schools as they progress in their careers, gaining more experience, seniority, and opportunities to act on their preferences (Murnane, 1981). In the most recent report of teacher turnover patterns published by the *National Center for Education Statistics*, it is estimated that 17 percent of elementary and secondary teachers left public and private schools at the end of the 2003-04 school year (Panty et al., 2008). Approximately half of these exits (8

percent) were due to transfers to a different school; the other half of these exits (9 percent) were because teachers left the profession. The report also showed high-poverty public schools had much higher rates of teacher turnover than low-poverty[5] schools (21 versus 14 percent) and argued much of that difference was due to the high transfer rate among teachers in the high- versus low-poverty schools (11 versus 6 percent).

In their study of teacher preferences and sorting patterns in New York City, Wyckoff et al. (2003) argued teacher sorting is attributable to both student factors (e.g., test scores, race, socioeconomic status, and first language) and teacher factors (e.g., geographically limited labor markets, working conditions, personal K-12 educational experience). They go on to suggest, as they had in earlier studies, that teachers tend to favor schools with better working conditions and that serve more advantaged student populations (Lankford, Loeb, & Wyckoff, 2002; Wyckoff et al., 2003**).** These findings are corroborated in other studies of teacher preferences and sorting patterns (Clotfelter, Ladd, & Vigdor, 2006; Hanushek, Kain, & Rivkin, 2004; Smith & Ingersoll, 2004).

Hanushek, Kain, and Rivkin (2004) tracked more than 300,000 public elementary school teachers in Texas during the mid-1990s, finding a strong relationship between student characteristics and teacher turnover. In particular, schools that served more students of color had markedly higher rates of attrition among white teachers, though the authors found African American and Latino teachers were less likely than white teachers to leave these schools. Results from this study also suggested transitions[6] between schools were much more strongly related to

[5] Schools were considered high poverty if 75 percent or more of their students were considered eligible for free- or reduced-price lunch. It is interesting to note this is the most conservative threshold used to identify HTS schools under ProComp. Schools were considered low poverty if less than 15 percent of their students were considered eligible for free- or reduced price lunch.

[6] Hanushek et al. (2004) defined teacher transitions to include: 1) change to a new school in the same district; 2) change to a new school in a different district; and 3) change to exit Texas Public Schools. The authors noted they did

characteristics of the students than to differences in salary, especially for female teachers with less than six years of teaching experience. Since schools with large numbers of academically disadvantaged non-white students tended to lose more teachers each year, Hanushek et al. argued these schools actually had a different supply curve than other, more affluent schools with higher rates of teacher retention. That is, these hard-to-staff schools actually required a much larger supply of teachers each year than schools in middle and upper middle class communities because of the higher proportion of teachers that sought to improve their employment arrangement by switching to another school each year.

There are likely multiple factors that contribute to attrition of some white teachers from schools that serve more students of color. Grant and Gillette (2006) suggest attrition of white teachers may be related to their preparation: the majority of new teachers and teacher educators are predominately white. As such, new teachers have a limited opportunity to gain perspectives or insights on culture or diversity from people of color during their preparation to become teachers. Upon entering schools that serve large numbers of students of color, some new white teachers may be uncomfortable working with students who are racially or culturally different from them; others may be outright biased. Furthermore, some white teachers may find it difficult to teach students of color, in part, because they do not view these students as bringing valuable knowledge and skills to the classroom (the deficit perspective) or because they make little effort to know or understand their students' communities (culturally responsive teaching) (Ladson-Billings, 1995).

In addition to students' race, class, and test scores, Ingersoll (2001) found factors related to the organizational characteristics and conditions of schools can either attract or repel teachers.

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not have data that allowed them to determine whether teachers who exited Texas Public School remained in teaching in another capacity (e.g., private school) or exited the profession altogether.

Drawing on data collected in the 1990-91 School and Staffing Survey and the 1991-92 Teacher Follow-up Survey, Ingersoll identified the most common reasons given by teachers who left their schools or the profession altogether. Some reasons for teacher dissatisfaction included: 1) student discipline problems and personal safety concerns; 2) lack of on-site support and intervention for students experiencing learning difficulties; 3) poor administrative leadership and support; 4) unhealthy or unattractive physical building; 5) lack of student academic success; and 6) excessive classroom intrusions; 7) low salaries compared to nearby districts or other professions that require similar education and training. This list suggests teachers are most likely to remain at schools that have an environment which is conducive to teaching and learning, where safety and order are prioritized, and where teachers feel supported by the administrative leaders (McElroy, LaCour, & Cortese, 2007).

Like Hanushek et al. (2004), Ingersoll (2001) concluded school staffing problems are primarily due to excess demand resulting from a "revolving door" – where large numbers of teachers depart from their jobs because of dissatisfaction or to pursue other jobs outside the teaching profession. Though the conclusions from these two studies – that some schools have a different supply curve or an excess demand for teachers – were similar, the way authors of each of these studies reached their conclusion is different. Hanushek and colleagues argued certain schools have higher rates of teacher attrition because of student characteristics. On the other hand, Ingersoll argued some schools have higher rates of teacher attrition as a result of certain school characteristics and organization. Though Ingersoll considered the student population served by the school to be a contributor to that school's overall characteristics, he acknowledged there are many other factors besides students that contribute to the characteristics and organization of a given school.

The different reasons why teachers might disproportionately leave certain schools (e.g., student characteristics or administrative leadership/support) have different implications for what policies might be effective in promoting retention. While the composition of public school students is generally beyond the influence of educational policy,[7] school factors may be more readily influenced by policy. For example, targeted policies that enforce stricter safety standards, require the buildings be comfortable and safe, and prioritize professional development may indirectly improve teacher retention if they serve to improve job satisfaction. To the extent school characteristics and organization influence teacher satisfaction, such policies may help increase teacher retention.

Teacher Type

In addition to evidence that suggests teachers tend to leave certain schools at higher rates than others, research also suggests different types of teachers are more likely to leave certain schools, or teaching altogether, than others. In particular, high-quality teachers are more likely to leave, especially if the school serves students who are impoverished and low-achieving (Lankford, Loeb & Wyckoff, 2002). Though teacher quality can clearly be defined in a number of ways, there is specific evidence to suggest teachers with higher measured ability on aptitude tests (e.g., SAT, ACT) and certification tests (e.g., Praxis) have a greater probability of leaving and that retention rates also vary by education level (Boyd et al., 2011; Guarino, Santibanez, & Daley, 2006; Lankford, Loeb, & Wyckoff, 2002).

[7] There are some exceptions in which education policy has influenced the composition of students that attend certain schools (e.g., school choice/open-enrollment policies, limited curricular offerings like the International Baccalaureate program or the Advanced Placement program, and busing programs between neighborhoods or districts). However, recent court decisions have all but precluded the possibility of this strategy to promote racial equity within schools (Orfield & Frankenberg, 2011; Welner & Spindler, 2009).

In a recent extension of earlier work on teacher turnover and effectiveness in Texas, Hanushek and Rivkin (2010) found that, while teacher turnover is greater in high-poverty schools, those who leave do not appear to be more effective – as defined by teacher value-added estimates – than those who remain. Similarly, West and Chingos (2008) found no evidence that schools are disproportionately losing their most effective novice teachers in their study of teacher retention and effectiveness in Florida in the early-2000s. However, the data from Florida did suggest there was room for greater retention of the most effective teachers, also defined by teacher value-added estimates. The authors concluded the majority of the state's most effective teachers did not remain in their initial schools after four years.

Somewhat in contrast to these two studies, findings from a recent study that examined teacher employment patterns in North Carolina after the end of a mandatory student busing policy found that increases in the proportion of low-income, minority students in schools lead to declines in teacher quality and effectiveness as measured by experience, certification test scores, and estimated effectiveness via a value-added model (Jackson, 2009). Thus, research indicates high-poverty schools have higher turnover and thus more inexperienced teachers but is mixed about whether turnover at these schools results in decreased overall teacher effectiveness, when defined as teacher value-added estimates.

Teachers with different positions also appear to have different rates of retention. Research suggests secondary teachers, particularly those that teach mathematics and science, are more likely to leave than elementary school teachers (Henke, Zahn, & Carroll, 2001; Ingersoll, 2001; Kirby et al., 1999). Ingersoll (2001) found that teachers of mathematics and science were more likely to leave than teachers of other subject specialties. Kirby et al. (1999) found that

departmental teachers – especially science teachers – had lower retention rates than elementary school teachers in their study of Texas teaching cohorts between 1987 and 1996.

Thus, extant literature on teacher retention suggests that different types of teachers are more or less likely to leave teaching. Teachers with higher scores on standardized tests and certification exams, more education, and who are at the beginning or end of their teaching careers are more likely to leave their schools. However, most research does not suggest teachers with higher value-add estimates tend to leave at greater rates than less effective teachers (for the exception, see Jackson, 2009). Secondary teachers – especially those who teach mathematics or science – are also more likely to leave than elementary school teachers. Finally, evidence from Hanushek et al.'s (2004) study reviewed in the previous section, suggests white teachers and female teachers may also be more likely to leave. Given this evidence, states, districts, and more recently, the federal government, have been experimenting with ways to retain more high-quality, effective teachers, particularly in high-poverty schools.

Compensation to Promote Retention Generally

There is a substantial body of research that focuses on policies aimed to promote retention, though rarely with a specific consideration to the retention of high-quality, effective teachers (Guarino, Santibanez, & Daley, 2006; West & Chingos, 2008). As such, this section reviews various compensation policies aimed at increasing teacher retention, but not with consideration of increasing the retention of high-quality, effective teachers specifically. Combined with the following section, these studies best inform the design, expectations, and interpretation of the findings for this research.

Most studies that examine specific policies to improve retention rely on compensation as the key policy lever. Compensation policies can either take the form of overall salary

differentials (e.g., between two districts) or of alternative teacher compensation programs (e.g., financial incentives). Several descriptive studies offer evidence to suggest compensation is positively associated with retention (Imazeki, 2005; Ingersoll, 2001; Kirby et al., 1999; Lankford, Loeb & Wyckoff, 2002; Podgursky, Monroe & Watson, 2004). For example, Lankford et al. (2002) examined teachers who transferred schools in New York between 1993 and 1998 to determine whether they experienced salary increases in their receiving school. Their descriptive analysis tracking this cohort of teachers suggested teachers who transferred experienced increases in salary of between 4 and 15 percent.[8] In a study conducted from 1987 to 1995, Kirby et al. (1999) found that a $1,000 increase in salary was associated with reduced attrition from the Texas State Education System by approximately three percent overall and six percent among Latino and African American teachers. Similarly, Ingersoll (2001) found compensation for advanced teachers (those with a master's degree and 20 years or more of experience) also had a significant but small positive impact on teacher retention. After controlling for teacher characteristics, he found $1,000 difference in compensation was associated with a difference of three percent in the odds of voluntary (i.e., excluding teachers who retired or were terminated) teacher departure.

Research examining retention policies that rely on financial incentives as the key policy lever also exist, but are less numerous and the findings from these studies tend to be less optimistic than those that examined retention as a function of compensation differentials. Incentives designed to increase retention of teachers can include: 1) pay differentials; 2) teacher support and development; 3) housing assistance; 4) tuition subsidies; and 5) loan forgiveness

[8] It is likely increases in salary are accompanied by other student and school factors that teachers are generally attracted to: high-achieving, wealthy, non-minority students and schools located in the suburbs rather than in urban areas. It is not clear from this study whether and how much salary differentials – as opposed to these other factors – impact transfer decisions.

(David, 2008; Milanowski et al., 2009). Often, retention incentives are used in conjunction with recruitment incentives (e.g., signing bonuses, assistance with relocation and moving costs). For example, in 1998 Massachusetts offered perspective teachers a $20,000 signing bonus (spread out over four years to increase retention) as well as an accelerated path to certification. More recently, the U.S. Department of Education commissioned the development and study of the "Talent Transfer Initiative." This new program is designed to identify participating district's most effective teachers (based on value-added estimates) and offer them a generous financial incentive ($20,000 for two years) for moving to and staying at its low-performing schools. Effective teachers already working in low-performing schools are given retention incentives ($10,000 for two years) to remain in their school (Talent Transfer Initiative Website, 2009).[9] Charlotte-Mecklenburg in North Carolina and Miami-Dade in Florida have also experimented with financial incentives (Milanowski et al., 2009).

However, at least one study suggests financial incentives have no effect on retention. In a recent evaluation report of Chicago's Teacher Advancement Program (TAP), a prominent alternative teacher compensation program, Glazerman and Seifullah (2010) examined retention after the second year of program implementation. In this analysis, the authors defined "retention" as the percentage of teachers returning to the district or school from one year to the next. Via propensity score matching methods, TAP schools were matched with non-TAP schools and regression-adjusted means of teacher retention were then compared. The authors found no difference in teacher retention at the district- or school-level as a result of TAP. The regression

[9] Unfortunately, evaluations about the effects of the Massachusetts signing bonus and Talent Transfer Initiative were not located, in the case of the former, or have not yet been completed, in the latter case.

model controlled for a battery of factors[10] and the authors tried several different methods of matching TAP schools with non-TAP schools. Findings were robust to all sensitivity analyses.

Compensation to Promote Retention at High-Poverty Schools

Although no evidence of increased retention was observed as a result of Chicago's TAP program (Glazerman & Seifullah, 2010), most empirical literature suggests increases in compensation are associated with greater teacher retention (Imazeki, 2005; Ingersoll, 2001; Kirby et al., 1999; Lankford, Loeb & Wyckoff, 2002; Podgursky, Monroe & Watson, 2004). Yet, little is known about how effective policies that rely on financial incentives are at promoting retention specifically in high-poverty schools (Milanowski et al., 2009). In response to concerns about high teacher turnover in high-poverty schools, districts and states have implemented targeted financial incentives to attract and retain teachers at high-poverty schools (Darling-Hammond & Prince, 2007). Using the 2003-04 Schools and Staffing Survey, Podgursky (2008) estimates approximately five percent of districts reported providing financial incentives to teachers who worked in "less desirable locations." Johnson (2005) estimates at least seventeen states have implemented targeted financial incentives to attract and retain teachers at impoverished schools. Though growing, the research on alternative teacher compensation in general is small and research on the effects of offering financial incentives for working in high-poverty schools is smaller still (Podgursky & Springer, 2010). Despite this, there are six studies that have examined the effects of financial incentives on retention specifically at high-poverty schools. These studies are summarized below in chronological order.

[10] The regression model in Glazerman & Seifullah's (2010) teacher retention analyses controlled for: teacher education, teaching assignment, years of service, retention at the school the year prior to TAP, student achievement, student race/ethnicity, student poverty, and school size.

Bruno and Negrete (1983) examined the effectiveness of paying teachers a substantial financial incentive (11 percent of salary) for working in seven racially isolated schools. The authors surveyed a randomly selected sample of teachers from these schools and conducted a descriptive analysis of the types of teachers "purchased" with the financial incentive and compared retention rates at the schools to the previous year. They concluded such "combat pay" was not effective at retaining teachers to work at these schools. Furthermore, they found the teachers more likely to be retained after the bonus were more a function of supply side changes (young, inexperienced, or probationary teachers) rather than demand side changes (older, more experienced, licensed teachers who found the schools more attractive because of the salary increment). Given the fact that young, inexperienced, and probationary teachers were more likely to work at racially isolated schools before implementation of the incentive program, the authors concluded the money would be better spent reducing class size, improving building conditions, or other non-pecuniary benefits.

More recently, Clotfelter, Glennie, Ladd, & Vigdor (2008) found a moderately-sized retention bonus ($1,800, approximately 5 percent of salary) offered to teachers in North Carolina between 2001 and 2004 had no effect on retention for eligible teachers. Using a difference-in-differences modeling strategy,[11] the authors estimated the retention bonus, which targeted licensed mathematics, science, and special education teachers working in high-poverty or academically failing secondary schools (N=146 schools; N=1,992 teachers), was negative and not statistically significant. However, the authors point out that survey evidence suggested many eligible teachers did not understand the criteria to participate in the program and thus, results may have been subject to negative bias stemming from design and implementation flaws.

[11] This approach will be discussed in detail in the next chapter.

Steele, Murnane, and Willett (2009) studied retention effects of the Governor's Teaching Fellowship (GTF) incentive offered from 2000 to 2002 in California. The GTF was a competitive $20,000 incentive that sought to attract academically talented, novice teachers to low-performing schools and retain them at those schools for at least four years. GTF recipients who did not complete their four-year commitments would have to repay the state $5,000 for each year of unfulfilled commitment. All else being equal, GTF recipients had an incentive to stay in low-performing schools longer than non-recipients. However, after analyzing employment decisions of over 27,000 individuals who pursued teaching licenses in California from 1998 to 2003 via a descriptive discrete-time hazard model,[12] the authors found no difference in the hazard probabilities of exit for GTF recipients and non-recipients. Roughly 75 percent of GTF recipients and the non-recipient comparison group remained teaching in a low-performing school into the fourth year. Although no difference was observed between the two groups, the authors are careful to point out that the descriptive approach they employed did not account for any unobserved differences between the GTF recipient group and the non-recipient group, thereby limiting their ability to conclude whether GTF influenced retention rates either positively or negatively. Given that this dissertation relies on an observational – rather than experimental – design, conclusions from this study are subject to similar limitations.

A report published by the National Center on Performance Incentives on the Texas Educator Excellence Grant (TEEG)[13] after the third year of implementation suggests financial

[12] Originally used to predict mortality in medical experiments, a discrete-time hazard model assesses the probability of event occurrence at a specific time, conditional on "surviving" until that time and other predictors (Singer & Willet, 2003). When used in studies of teacher retention, researchers define the event as exit from the school; the hazard rate is a function of cumulative factors that may – or may not – contribute to the likelihood of event occurrence at a specific time. Steele et al.'s study is considered descriptive as it relied on data collected from a non-experimental setting.

[13] Only high-poverty schools are eligible to participate in TEEG and the sister-alternative compensation program: Governor's Educator Excellence Grant (GEEG).

incentives were associated with small, significant increases in retention, provided the bonus amount was large enough. Via probit regression analyses,[14] Springer et al. (2009) compared the probability of exit for teachers in TEEG versus non-TEEG schools and within TEEG schools where teachers earned different bonus amounts.[15] The authors found no evidence to suggest TEEG schools had lower turnover than matched non-TEEG schools, and actually observed a significant increase in turnover in TEEG schools in the first year of implementation. The authors speculate this may be due to very small bonuses received by some teachers and noted that when turnover rates across TEEG schools were compared, turnover decreased as the amount of the financial incentive increased. In line with common sense, their findings suggest the size of financial incentives matter for effectively promoting teacher retention in high-poverty schools.

Drawing in part on their earlier study, Clotfelter, Ladd, and Vigdor (2010) examined longitudinal data from 1995-2004 for teachers in North Carolina to investigate their responses to salary differentials that arose as a result of annual bonuses, ranging from $1500-5000. The authors paid particular attention to the differential responses of teachers with strong qualifications compared to those with average qualifications (defined via four proxies: average licensure test scores, competitiveness of undergraduate institution, years of teaching experience, National Board certification status). Using a discrete-time hazard model similar to that employed by Steel et al. (2009), the authors examine how both salary and school demographics affect teachers' decisions to leave their current schools. They find some evidence to suggest salary differentials reduce turnover in high-poverty schools but conclude they are less effective for retaining teachers with strong pre-service qualifications (i.e., average licensure test scores and

[14] Probit regression models are used when the outcome variable has two discrete outcomes (e.g., a teacher stays or leaves their school) (Wooldridge, 2006).
[15] Schools that participate in TEEG design their own alternative teacher compensation plan. Thus, bonus awards for desired outcomes varied from school to school.

competitiveness of undergraduate institution in this study) than other teachers in schools with high proportions of non-white students. The authors state: "…no salary differentials would be large enough to compensate [high-quality teachers] for being in schools with concentrations of [high-poverty, non-white] students" (p. 40). As such, these findings suggest financial incentives may be able to increase retention but not necessarily of high-quality teachers in high-poverty schools.

Most recently, Hough, Loeb and Plank (2011) released the first of three reports stemming from their evaluation of San Francisco's Quality Teacher and Education Act (QTEA) alternative compensation program. Under QTEA, teachers earn a variety of financial incentives, including a $2000 annual bonus for working in Hard to Staff schools. After descriptively analyzing survey data and coding interview data from teachers and principals, the authors found a majority of all teachers (not only those eligible to receive the Hard to Staff bonus) reported QTEA did not impact their decision to stay in their current school. Interesting, however, principals in Hard to Staff schools were more likely than principals in non-Hard to Staff schools to report a positive effect on teacher retention: 48% of those in Hard to Staff schools reported QTEA and the Hard to Staff bonus "helped a little" or "helped a lot" while only 18% reported QTEA helped retention in non-Hard to Staff schools.

Some researchers argue the null effects of increased compensation via financial incentives might be a result, at least in part, of the research that indicates teachers often prioritize other job characteristics over compensation. Milanowski et al. (2009) argue, along with others (see for example Boyd et al., 2011; Ingersoll, 2001; Kirby, Berends, & Naftel, 1999) that administrator support, collegial support, student characteristics, class size, and school facilities may all be more influential than compensation in teachers' employment decisions. These factors,

along with compensation and others, are likely to be considered when teachers judge whether staying in their current school is as attractive or better than their other employment opportunities. Despite the intuitiveness that teachers make trade-offs when making employment decisions, there is little research to address how teachers make trade-offs and how much of a financial incentive would be needed to make a given school more attractive (Milanowski et al., 2009).

The few studies that have examined the effects of financial incentives on teacher retention at high-poverty schools raise questions about the ability of financial incentives to affect teacher employment decisions and also suggest the complicated nature of the challenges for retaining high-quality, effective teachers to work at high-poverty schools (Darling-Hammond, 2003; Milanowski et al., 2007). Clearly, far more research – across a variety of contexts and compensation programs – is needed on the potential effectiveness of financial incentives given the current interest in them as a policy to promote retention, particularly of high-quality, effective teachers and at high-poverty schools.

Application to Study

It is well established that teachers' preferences about where to teach result in higher rates of teacher turnover and fewer high-quality and effective teachers at high-poverty schools relative to wealthier schools. While research suggests student, teacher, and school factors all contribute to teacher turnover, ProComp targets teacher dissatisfaction with low salaries by offering financial incentives as a way to increase the attractiveness of teaching in Denver generally and in high-poverty schools specifically.

Descriptive studies that have examined the role of compensation – either in the form of salary differentials or financial incentives – generally found salary increases were associated with improvements in retention (Imazeki, 2005; Ingersoll, 2001; Kirby et al., 1999; Lankford,

Loeb & Wyckoff, 2002). However, as noted above, the one evaluation that examined retention generally as a result of an alternative teacher compensation program – Chicago's TAP – found no effect on retention for TAP schools when compared with matched non-TAP schools. Like this dissertation, the TAP evaluation used longitudinal data to estimate the effect of an alternative teacher compensation reform on retention. The quasi-experimental matching approach employed by the authors is rigorous and should yield reliable results. However, such a matching scheme is not possible in this study, as all schools in DPS participate in ProComp and because data from other districts were not available. Thus, it is not possible to match ProComp schools to similar non-ProComp schools.

I identified six studies described above that examined the impacts of financial incentives on retention specifically at high-poverty schools. Although the studies reviewed ranged in their generalizability to this study and the rigor of methods employed, all but two found financial incentives had no effect on teacher retention (exceptions were Springer et al.'s 2009 report of TEEG, but only if incentives were large enough and Clotfelter et al.'s 2010 report of retention in North Carolina, but not of high-quality teachers). Bruno and Negrete's (1983) and Springer et al.'s (2009) studies inform this study the least. The former is not generalizable because of the small sample and reliance on self-reported survey data. The latter evaluation has a large sample and the authors employed rigorous methods. However, the structure of TEEG is such that there is little use in comparing outcomes from TEEG to those from ProComp (e.g., only high-poverty schools can participate in TEEG, each school designs their own compensation system so bonuses varied in their amount and frequency).

Additionally, Hough et al.'s (2011) San Francisco first year evaluation report does not provide much evidence to inform this study as it presents only teacher and principal reports from

surveys and case studies. While these reports support survey data from DPS described in the previous chapter, this report does not actually analyze teacher retention data. That said, future reports of QTEA are likely to be generalizable to studies of ProComp.

Both of Clotfelter et al.'s (2008; 2010) North Carolina studies and Steele et al.'s (2009) California study are most informative for this dissertation. One reason for this is because these three studies all had large sample sizes. Further, the North Carolina studies and California study employ rigorous methods to estimate the effect of the financial incentive on teacher retention in a descriptive context. Accordingly, the research design and interpretation of findings presented in the next three chapters will draw on these three studies as well as Chicago's TAP study.

Teacher Quality

High-quality, effective teachers are valuable but difficult to define. Nearly all observers of the educational process, including administrators, teachers, parents, students, policy makers, and researchers, recognize the importance of high-quality teachers and many believe they can recognize good teaching when they see it (Clotfelter, Ladd & Vigdor, 2006). Unfortunately, however, there is no definitive list of teacher characteristics/qualities that matter most for student learning and test-score performance. Articulating what aspects and characteristics of a teacher contribute to – or better, allow one to predict – the quality and effectiveness of their teaching is challenging. Corcoran, Evans, and Schwab (2004) explain, "Ideally, teacher quality would be measured using a multi-dimensional vector of those characteristics that are positively associated with outputs of the educational process" (p. 453). However, there are at least two complications that make it unlikely this ideal will soon be met.

The first complication stems from the fact that we do not have the ability to reliably measure many teacher characteristics that might influence educational outputs. Many

characteristics such as patience, energy, empathy, respect, authenticity, flexibility, passion, confidence, communication skills, creativity, and compassion are likely related to student learning and success in the classroom but are not easily measured. The second complication is related to the narrow way in which "outputs of the educational process" are currently defined. In the present era of accountability and with the implementation of the No Child Left Behind Act (NCLB), student achievement on standardized assessments is often the *only* output examined for evidence of a good education or high-quality teaching (Adams et al., 2009). Few educators or parents would, however, deny that there are many other valuable skills we hope students will obtain from a public education (such as understanding of democracy, sense of civic duty, responsibility, and communication skills, as well as deep and persistent academic learning objectives) that are not generally measureable on a standardized assessment. These outputs are not currently considered in the process of identifying high-quality, effective teachers.

Thus rather than the ideal multi-dimensional process of measuring teacher quality espoused by Corcoran and colleagues (2006), teacher quality is regretfully often limited to observable and quantifiable characteristics measured to determine their effect on student test-score gains. Until recently, such qualifications were typically limited to years of teaching experience and educational attainment (Clotfelter et al., 2010; Wyckoff et al., 2003). Lately, researchers have also begun to employ data about teacher performance on certification exams and aptitude exams (e.g., SAT or ACT), undergraduate institution, type of teacher preparation program, classroom observations, and comparisons of certification areas with current teaching assignments. Most recently, developments in value-added models allow researchers to estimate teacher effectiveness via variation in student growth on standardized assessments, though there are serious technical issues which raise questions about the validity and reliability of these

estimates. Taken together, these observable measures are often used individually or in some combination to define teacher quality and effectiveness.

This section considers extant literature on teacher quality, starting with a brief discussion of how the term "teacher quality" might be separated into several categories that more appropriately capture the characteristics, qualities, and outcomes actually considered in references to "quality." The next section examines measures of teacher characteristics, qualities, and outcomes, separating these into those that are input-based (i.e., things a teacher brings with him/her into the classroom) and output-based (i.e., outcomes related to the teacher). Although I find it unfortunate that comparisons of quality and effectiveness measures are most often made only on the basis of the availability of the data and the ability to impact student-test score gains that is what is available in most of the literature. As such, this discussion of teacher quality and effectiveness measures also compares data availability and effects on student test-scores. Considering the comparison of different measures of teacher quality and effectiveness, the final section explains the rationale for the multiple-measure definition of teacher quality and effectiveness adopted in this study.

Categories of Teacher Quality

In her recent policy brief on teacher assessment and evaluation, Hinchey (2010) argues policy makers (and others) would be wise to clarify what they mean when they discuss teacher "quality." Hinchey proposes three separate categories: quality, performance, and effectiveness. She goes on to explain teacher *quality* is related to teachers' characteristics, such as education, years of teaching experience, pedagogical knowledge, and their expectations for student learning. Teacher *performance* refers to the activities of a teacher inside the classroom, such as their instructional practices, and outside the classroom, such as communication with parents. Teacher

effectiveness refers to teachers' effects on students' test scores, graduation, and attitudes/behavior. As no performance data are available for this study, measures reviewed below are limited to those related to teacher quality and effectiveness.

Common observable measures of teacher quality can be thought of as input-based measures; those that teachers bring with them into the classroom. Measures of teacher effectiveness can be thought of as output-based measures because they are considered to be produced by the teacher. Commonly used input- and output-based measures of teacher quality and effectiveness are described below and the strengths and weaknesses of each for increasing test-score performance are considered in turn.

Input-Based Measures of Quality

There are six common input-based measures of teacher quality: 1) teaching experience; 2) educational attainment; 3) academic ability and aptitude; 4) quality of undergraduate institution; 5) content and pedagogical knowledge; and 6) teaching preparation program type. Years of teaching experience and educational attainment have an obvious advantage over other input-based measures in that they are straight-forward and easily measured. However, research suggests they explain little or no variation in student test-score outcomes (Aaronson, Barrow & Sander, 2007). Inexperienced teachers (those with less than three years of experience) have been shown to have a slight negative effect on student test scores, though the benefits of experience appear to level off after five years (Clotfelter, Ladd & Vigdor, 2010; King Rice, 2010). A possible reason for these experience effects may be that senior teachers do not always continue to grow and learn and may become tired and uninspired in their jobs (Darling-Hammond, 2000). Educational attainment (e.g., earning a Master's degree) has not been shown to explain much variation in student test scores (Roza & Miller, 2009). This may be due to the fact that one can

pursue advanced degrees in a variety of subject areas that may or may not improve teacher effectiveness. Of these two measures, research suggests years of experience, especially early in a teacher's career, has a stronger impact on teacher effectiveness (as measured by value-added estimates) than advanced degrees (King Rice, 2010).

On the other hand, the academic quality of a teacher's undergraduate institution (often measured through standardized assessments such as the SAT or ACT and college/university rankings) and the teacher's content and pedagogical knowledge (often measured through a certification assessments such as the Praxis) are more complicated to measure, but evidence suggests they may explain more variation in student test-score gains than teaching experience (after the first several years) or educational attainment (Clotfelter et al., 2010; Clotfelter, Ladd & Vigdor, 2007; Goldhaber, 2008). Verbal ability in particular is believed to be related to the test scores of a teacher's students as it is thought to provide a measure of one's ability to convey ideas in a clear and convincing manner (Kuenzi, 2008).

Results from studies relating teachers' subject matter knowledge to student test scores are somewhat mixed. A review of such studies by Byrne (1983) found 17 with a positive relationship and 14 with no relationship. As Darling-Hammond (2000) points out, this is logical if you consider that, while subject matter knowledge is necessary for high-quality instruction, returns to subject matter expertise may grow smaller after exceeding the demands of the curricula being taught.

Studies of pedagogical knowledge suggest a more definitive positive effect on student test scores (Byrne, 1985). For example, Hill, Rowan and Ball (2005) explored whether and how teachers' mathematical knowledge for teaching contributes to gains in first and third grade students' mathematics test scores at 115 elementary schools. The authors found that teachers'

mathematical knowledge was significantly related to student test-score gain. Hill and Ball went on to develop a written instrument for measuring teachers' job-specific mathematical knowledge, known as Mathematical Knowledge for Teaching (MKT). In another study, Kane, Rockoff and Staiger (2007), compared the MKT and a general cognitive ability instrument, finding that the MKT was a significant predictor of student test-score outcomes, but cognitive ability was not. This suggests knowledge of how to teach the subject to various kinds of students may have a greater effect on student test-score performance than subject-matter knowledge itself.

Teacher preparation programs attempt to combine both subject-matter knowledge and knowledge about teaching and learning. However these programs vary greatly. Traditional programs are generally offered through a college or university education department and are structured such that graduates are prepared to meet a given state's teacher licensing requirements. Teachers prepared in these programs often complete a period of student teaching in which they "shadow" a senior teacher in the grade and subject area they plan to teach. Even within this traditional teacher education sector, there is substantial variation in approaches and quality between programs (Darling-Hammond, Chung, & Frelow, 2002).

In the mid-1990s several alternative teacher preparation programs were founded. These programs – the most prominent being Teach for America – set aside only a short period of time to prepare recent college graduates to teach. Often, these teachers do not meet state licensing requirements and are thus given a temporary or provisional teaching license. Though evidence on student test-score outcomes is mixed – for example, there is some recent research that suggests alternatively certified teachers are as effective or even more effective than their traditionally prepared, certified counterparts (see Kane, Rockoff & Staiger, 2008) – research suggests teachers who are traditionally prepared and fully licensed by the state often have greater facility planning

curriculum, managing the classroom, and identifying students' learning needs (Clotfelter, Ladd & Vigdor, 2007; Darling-Hammond, 1990). Teachers who are traditionally prepared also tend to have greater retention rates than those prepared via an alternative program or who do not have a state teaching license (Heilig & Jez, 2010; Kane, Rockoff & Staiger, 2008). Given this, one would ideally like to account for teacher preparation in a study of retention. Though discussed in more detail in the next chapter, these data were unfortunately not available and thus, preparation program was not considered in this study.

Output-Based Measures of Effectiveness

Output-based measures of teacher effectiveness most commonly include the following: 1) student proficiency or growth on standardized assessments; 2) drop-out rates; 3) graduation rates; 4) college matriculation and graduation; and 5) advanced-placement course taking. Of these output-based measures, student performance on standardized assessments has undeniably received more attention than the others as a measure of teacher effectiveness. Given this and the availability of data for this study, it is the measure focused on here.

At any given point, student test scores are a cumulative function of current and prior family, community, and school experiences. However, datasets containing all these variables are rarely available and thus analyses often study only the current relationship between student test scores and school factors. This approach is clearly susceptible to omitted variable biases from a number of sources and thus another approach has been developed.

The alternative approach, often referred to as "value-added models" (VAM), seeks to estimate the contribution of schools and teachers to students' learning as represented by test-score trajectories. VAM includes a variety of sophisticated statistical techniques that use one or more years of prior student test scores, as well as other data, to adjust for preexisting differences

among students when calculating contributions to student test performance (National Research Council & National Academy of Education, 2010). Such adjustments are obtained in a given year by predicting test scores, based on prior scores and other factors, and comparing it to the score that was actually observed. The difference between the predicted and observed score – known as a residual – is then attributed to the student's teacher or school (Briggs & Domingue, 2011). VAMs differ in the number of years of data they employ, the kinds of statistical adjustments they make, how they handle missing data, and how teachers are linked to students (Braun, 2005).

VAMs have many proponents who believe they may ultimately offer a more defensible foundation for teacher evaluation than methods based on student proficiency on assessments or a proportion of students who meet a fixed standard of performance (Koedel & Betts, 2007). Indeed, the logic behind using VAM estimates to evaluate teachers is sound: if good teaching is critical to student learning, then student learning (or its absence) as measured by standardized assessments should indicate the quality of teaching students have received.

However, creating a system that uses this reasoning is far from straightforward (Braun, 2005; Harris, 2009; National Research Council & National Academy of Education, 2010). Braun (2005) cautions, that treating VAM estimates as an accurate indicator of a teacher's relative contribution to student test scores is the same as making a causal interpretation. Such causal interpretations are most credible when students are randomly sorted into classes and teachers are randomly assigned to those classes. In reality, classroom assignment of students and teachers is far from random and thus, causal interpretations of VAM estimates can be misleading (Braun, 2005).

There is widespread agreement that VAM estimates should not be used as the sole basis for making consequential decisions about teachers (Adams et al., 2009; Braun, 2005; Jennings & Corcoran, 2009; McCaffrey et al., 2003; Welner, 2008). In addition to limitations that stem from non-random assignment, VAMs have multiple technical and practical challenges that limit the ability to generate valid and reliable estimates. Technical concerns include how to 1) address the presence of random measurement error; 2) vertically scale assessments across grades, subjects, and students of varying ability; 3) determine what factors (in addition to prior test scores) to include in the model; 4) address missing data; 5) measure the persistence of effects over time; and 6) determine the appropriate percentage of teacher "value add" to a given student, particularly in secondary grades (Braun, 2005; Harris, 2009; National Research Council & National Academy of Education, 2010; McCaffrey et al., 2003). VAMs also have practical challenges with regard to transparency and determinations of how much growth is expected or enough (Jennings & Corcoran, 2009).

Beyond these technical and practical considerations, there lies perhaps an even more important point for why VAM estimates should not be the sole criteria for making high-stakes decisions about teachers. These models rely on tests that typically fall short of providing a complete measure of student learning or achievement, not to mention other desired educational outcomes.[16] Some aspects of student learning are difficult or even impossible to assess with current tests and, even for those aspects that can be tested, questions are limited due to time and cost constraints. Thus, only a subset of the content a student may – or may not – have learned is tested (National Research Council, 2011). The degree to which test scores are representative of actual student learning is somewhat dependent on which parts of the curriculum teacher has

[16] See earlier discussion in section on criticisms of performance-based alternative teacher compensation programs. A focus on using these tests as the sole measure of teacher effectiveness necessarily excludes teachers who do not teach in tested subjects or grades and (inadvertently) can cause a narrowing of the curriculum.

focused on and which content areas appear in the test. Accordingly, one must be cautious not only of the challenges specific to VAMs but also of the interpretive burden placed on test scores that are the basis of VAM estimates (Braun, 2005).

Application to Study

As mentioned in Chapter 1, the definition adopted for this study uses two measures – one of teacher quality and one of teacher effectiveness. Teacher quality is measured in this study by years of teaching experience; effectiveness is measured using value-added estimates in reading and mathematics. This decision was a result of my desire to define both quality and effectiveness using an input-based measure (years of teaching experience) and an output-based measure (value-added estimates). Additionally, this decision was a result of the data available. Though imperfect, the use of multiple measures to identify overall teacher quality and effectiveness is an attempt to mitigate some of the weaknesses and limitations that plague each of these measures when used in isolation. For example, if a school with large changes in retention rates also experiences improvements in average years of teaching experience and aggregate value-added estimates of student growth, one would be more confident that there are changes in overall teacher quality at that school than if an increase was only observed in average years of teaching experience. These measures of teacher quality and effectiveness will be described in further detail in the following chapter.

Chapter 3

Methodology

This study builds on the extant literature that can be summarized by two major conclusions. First, teachers, for the most part, respond to compensation when making their employment decisions. When working conditions are controlled for, the evidence shows teachers are attracted to positions with higher salaries and that they are more likely to leave their current school or to leave the teaching profession altogether when given the opportunity (Hanushek, Kain, & Rivkin, 2004; Imazeki, 2005; Podgursky, Monroe & Watson, 2004). Thus, higher teacher salaries (in their current positions) may increase retention (Guarino, Santibanez, & Daley, 2006).

Second, teachers care about certain non-pecuniary aspects of their job. Research suggests teachers, by and large, prefer to work in schools with students who are high-achieving, affluent, and white. In studies of teacher retention, these preferences reveal themselves directly through the estimated effect of certain school characteristics, and in comparisons of the schools between which teachers transfer (Hanushek, Kain, & Rivkin, 2004; Jackson, 2009; Lankford, Loeb & Wyckoff, 2002). Furthermore, research suggests organizational characteristics and working conditions, such as administrative support and condition of the school building, influence teacher retention (Ingersoll, 2001; Milanowski et al., 2009).

Taken together, an obvious policy response to these key conclusions from the literature would be to use salary differentials to increase the attractiveness of teaching as a profession generally, in a particular district, and in certain schools (Clotfelter et al., 2010; Guarino, Santibanez & Daley, 2006). By providing financial incentives to teachers across the district and specifically in high-poverty schools, ProComp is expected to alter retention in Denver Public Schools (DPS). If Lazear's (2003) "selection effect" theory is operating in DPS, school-level retention may have decreased immediately following the implementation of ProComp as

teachers move to new districts or schools that best match their preferences and allow them to maximize their earnings potential. After teachers have sorted themselves into and out of the district and into and out of schools that best match their preferences, one would then anticipate a steady increase in retention, if ProComp works to increase retention. However, given research that indicates the importance of non-pecuniary factors for teachers' employment decisions (Hanushek, Kain, & Rivkin, 2004; Ingersoll, 2001; Jackson, 2009; Lankford, Loeb & Wyckoff, 2002) and that suggests teachers do not prioritize pecuniary compensation (Milanowski et al., 2009), the extent to which teachers may respond to financial incentives is not clear. This is one reason why this study includes teacher interviews to help explain observed effects of ProComp on retention.

This chapter details the data examined and the methodological approaches applied in this study to estimate the effect of ProComp on retention and understand why those effects were observed. First, I describe the teachers and schools of interest. Because there are some restrictions about who can participate in ProComp and which schools can be designated "HTS", it is important to be clear about the data used to generate findings presented in subsequent chapters. In the next section, I explain the three primary sources of data: 1) district human resource data, 2) school characteristic data, and 3) teacher interview data. Since measures of teacher retention and quality and the identification of HTS schools can be operationalized in a number of ways, this section also details the ways in which these outcomes have been specified in this study. I present descriptive statistics in the third section to illustrate patterns in the data and explain how these descriptive statistics informed certain decisions about the research design. Considering the three studies most similar to this one (Clotfelter et al.'s 2008 and 2010 North

Carolina studies and Steele et al.'s 2009 California study) and the data, I present and explain the empirical approaches I employ in the fourth section.

Teachers and Schools of Interest

Most teachers are able to participate in ProComp and *most* schools in the district are eligible to be designated "HTS" should their student population meet or exceed the threshold of students eligible to receive free- or reduced-price lunch (FRL). However, because ProComp and subsequent financial bonuses are not universally available to all teachers in DPS and because all schools cannot be designated "HTS", it is important to specify the sample of teachers and schools included in this study.

Teachers

Incentives offered under ProComp, including the HTS incentive, are available to DPS teachers,[17] though the population of teachers eligible to participate in ProComp is constrained in several ways. To be eligible to participate in ProComp, teachers must be members of the DCTA union (roughly 90% of DPS teachers are members of DCTA). Importantly, teachers who work at charter schools are not DCTA union members and are therefore ineligible to participate in ProComp. Additionally, charter schools cannot be designated "HTS" or any of the other ProComp designations tied to financial incentives. To earn any incentive available under ProComp, teachers must be actively enrolled in the ProComp pay system.[18] While some incentives are limited to teachers who teach in tested grades and subject areas, all teachers are potentially eligible to receive the HTS incentive. Given these requirements, the sample of

[17] ProComp incentives are also available for student-services professionals (SSPs). These employees include – but are not limited to – school psychologists, nurses, social workers, and speech therapists. For the purposes of this study, however, SSPs have been excluded.

[18] ProComp incentives are not limited to full-time teachers. If a teacher has part-time employment in the district or splits time between schools, they are eligible to receive a percentage of the earned incentive that is equivalent to their full-time employee (FTE) status.

teachers eligible to participate in ProComp and with subsequent potential to receive the HTS incentive is roughly between 3,900 and 4,200 teachers each year.

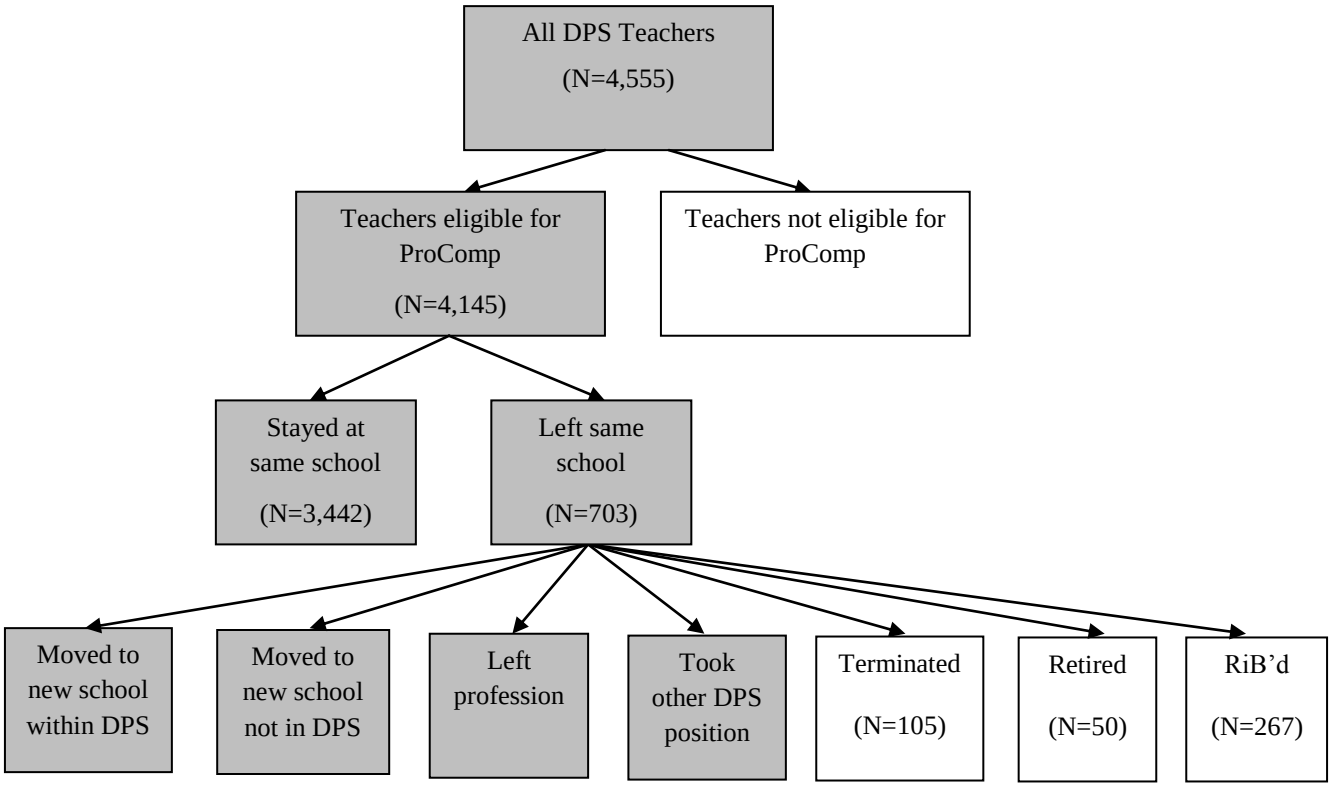
In addition to establishing which teachers are eligible to participate in ProComp, it is also important to specify which teachers are included in analyses of retention. Although seemingly straightforward, retention can be operationalized in a number of ways. Ideally, one would like to measure retention rates including only teachers who are at least minimally competent to choose to remain at their current school from one year to the next. As such, retention analyses exclude teachers who were terminated and those who retired at the end of a given year. These analyses also exclude teachers who left their schools involuntarily at the end of a given year because of a reduction in available teaching positions – known as a "Reduction in Building" (RiB).

Ideally, I would have liked to have considered teachers' preparation type (i.e., traditional or alternative preparation) as research reviewed in the previous chapter suggests preparation type may impact teacher retention and effectiveness (Clotfelter, Ladd & Vigdor, 2007; Kane, Rockoff & Staiger, 2008). Although DPS has hired teachers from three different alternative teacher preparation programs (Teach for America, Denver Teaching Fellows, and Denver Teachers in Residency), data tracking teacher preparation type is only available for the last two years (2009-10 and 2010-11). As such, I am not able to account for teacher preparation type in my analyses; alternatively prepared teachers are included along with other teachers in all analyses of retention and quality. Based on extant research I anticipate any bias from the inclusion of these teachers on retention effects to be minimal.[19]

[19] The number of teachers who participate in alternative preparation programs is minimal for the years in which data is available (e.g., there were 259 alternatively prepared teachers – roughly 6% of all teachers – in DPS in 2009-10).

Figure 3.1 shows the teachers eligible to participate in ProComp, as well as the sample of teachers included in the retention analyses.

Figure 3.1. *Teachers Eligible for ProComp and Included in Retention Analyses*



Notes: The numbers presented in Figure 3.1 are based on DPS human resources data from the 2009-10 school year. RiB'd ("Reduction in Building"), are those teachers who left their schools involuntarily at the end of a given year because of a reduction in the number of available teaching positions.

In the figure above, the gray boxes represent groups of teachers included in the analyses, while white boxes represent groups of teachers who are excluded. Because this study does not endeavor to track teachers who chose to leave their current schools, the number of teachers who voluntarily left their schools in a given year (represented by the four gray boxes in the bottom row) has not been identified. Furthermore, in the absence of a state-wide teacher identifier, one could only ever distinguish between voluntary leavers who move to a new school within DPS or took a non-teaching position within DPS and those who did not. Once teachers leave DPS, there

is currently no way to determine whether they moved to a new school outside of the district or left the profession entirely.

This study examines teacher retention with schools as the principal unit of analysis. For each year, the teachers included in retention analyses are those eligible for ProComp who either stayed in their same school or who left their school and: 1) moved to a new school within or outside DPS; 2) left the profession; or 3) took a non-teaching DPS position. The percent of teachers retained at a given school is calculated from one year to the next as follows:

Retention (for a given school in a single year) =

Numerator: Number of teachers who stayed at same school from one year to the next

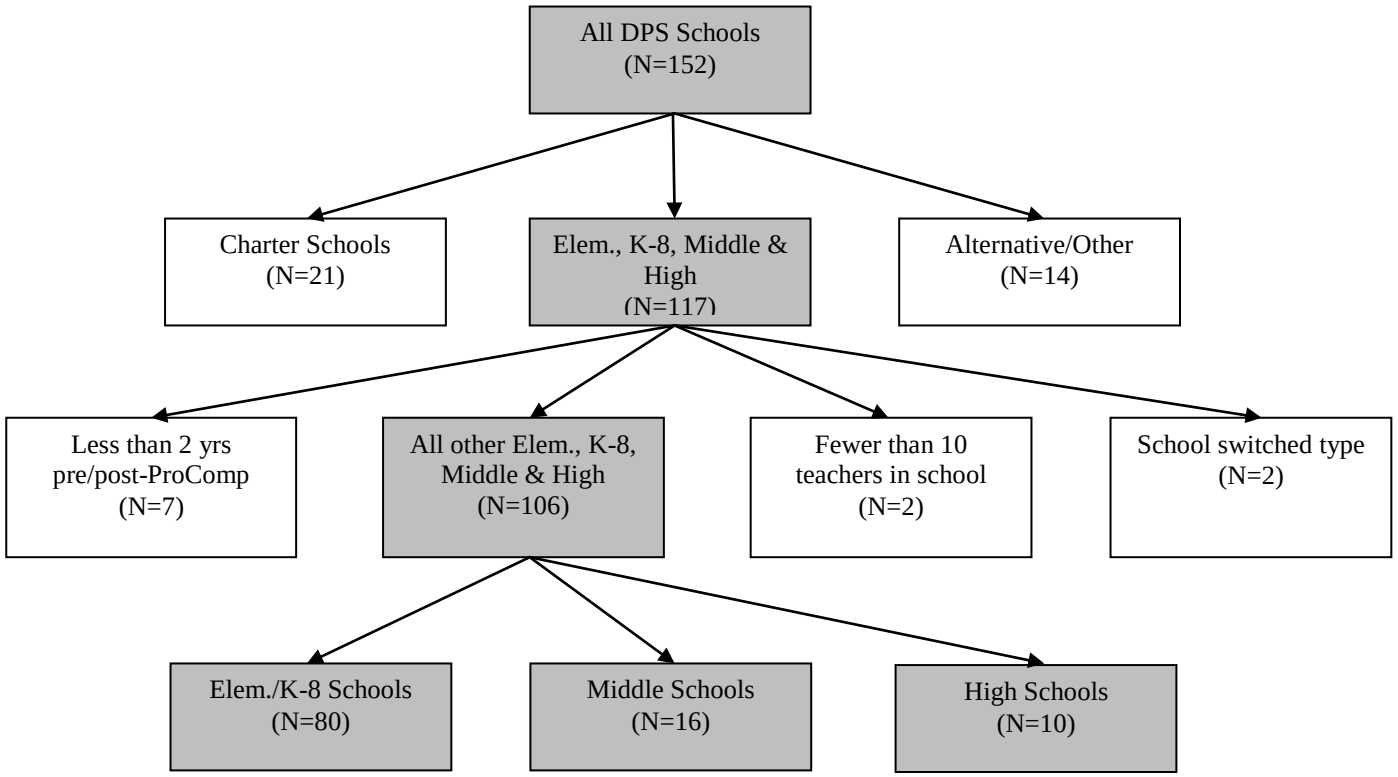
Denominator: Number of teachers eligible for ProComp who either stayed in the same school, or left school and: 1) moved to a new school within or outside DPS; 2) left the profession; or 3) took a non-teaching DPS position

Because many teachers wait to quit or move schools until the end of the summer, it is important for retention rates to be calculated after the start of the subsequent year. As such, teachers' school locations for each year are determined at the end of October.

Schools

As with teachers, most schools are included in analyses of retention. Figure 3.2 presents the schools that are included in the study.

Figure 3.2. *Schools Eligible for ProComp Designations and Included in Retention Analyses*



Note: The numbers presented in Figure 3.2 are based on school characteristic data from the 2009-10 school year.

Because charter schools are not eligible for ProComp designations (nor are teachers who work at charter schools eligible to join ProComp), they have been removed from the sample. Although alternative schools are eligible for ProComp designations (and teachers who work at alternative schools are eligible to participate in ProComp), these schools have also been removed from the sample because they tend to have few teachers and are designed to serve students with special circumstances. As such, retention trends from these schools are not generalizable to the larger population of DPS schools. Schools that were not in existence for a minimum of two years prior to the implementation of ProComp and a minimum of two years subsequent the implementation of ProComp have also been removed from the sample because it is not be possible to determine the retention rates for these schools before and after the implementation of ProComp. Schools

with fewer than ten teachers have been removed from the sample as retention rates calculated from such a small number of teachers are likely to be quite volatile. Finally, there are two schools that switched school types (e.g., from middle schools to K-8 schools). Because it is expected that retention rates may differ across school types, these schools have also been removed from the sample. Applying the restrictions described above resulted 104 to 115 schools included in the retention analyses in a given year.

Having specified which teachers and schools are included in retention analyses, it is important to clarify how schools are designated HTS during both iterations of ProComp. A different formula was used to designate schools "HTS" under the first iteration of ProComp (2006-07 and 2007-08) than is used under the second iteration of ProComp (2008-09 to present). Table 3.1 shows the differences in the HTS incentive between the first iteration of ProComp and the second.

Table 3.1. *Changes in HTS Incentive from First to Second Iterations of ProComp*

	1st ProComp (2006-07 & 2007-08)	2nd ProComp (2008-09 to Present)
Identification of Schools	FRL, Medicaid, ELL, Special Ed, & Crime Rates [a]	Percentage of FRL [b]
Approximate N of Schools	30	65
Duration of Designation	3 years	1 year
Approximate Incentive Amount	$1,030	$2,400
Percent of Base Pay	3%	6.4%

[a] *See Appendix C for further details.*

[b] *FRL thresholds are set to vary by school type (see Appendix D for further details):*

- *87+% FRL – Elementary/K-8 Schools*
- *85+% FRL – Middle Schools*
- *75+% FRL – High Schools*
- *All "Provision II" Schools (those that provide free breakfast, lunch, and snacks to all their students)*
- *All "Alternative" Schools (those that enroll students because of special circumstances)*

As explained in Chapter 1, the HTS designation was originally reserved for the most high-need schools in the district (Gonring, Teske, & Jupp, 2007) but changed as a result of 2008-09

contract negotiations. Presently, the HTS designation identifies roughly half of the schools in DPS that have the highest concentrations of poor students. The approximate numbers shown in Table 3.1 include all schools identified as "HTS" under each set of criteria. After applying the school restrictions explained above (e.g., at least 10 teachers, two years of data before and after ProComp, etc.), the number of schools identified as "HTS" is less. In the first iteration of ProComp HTS included in the analyses ranged from 19 to 26 schools each year; under the second iteration of ProComp, the number of schools included in the analyses ranged from 47 to 53 schools each year. The number of schools *ever* identified as "HTS" under either iteration of ProComp and included in the analyses is 53 schools.

Data Sources and Measures

To estimate and understand the effects of ProComp on teacher retention, three data sources are used: 1) district human resource data; 2) school characteristic data; and 3) teacher interview data.

Quantitative Data

Human resource and school characteristic data are available for the last decade (2001-02 to 2010-11). Four years (2001-02 to 2004-05) fall before the implementation of ProComp; six years (2005-06 to 2010-11) fall after the implementation. The first source, DPS human resource data, contains longitudinally linked teacher professional assignment records, information on teacher characteristics, and teacher-school matches. Table 3.2 shows the variables available in the DPS human resource data. I draw on these variables to determine the extent to which ProComp influenced retention rates and to identify overall teacher quality. Additionally, these data were used to randomly select teachers to interview (explained in detail below).

Table 3.2. *Available Variables in Human Resource Data*

Variable Name	Description	Type	Longitudinal Variation
Year	School Year	Continuous	Varying
Employee_ID	DPS Employee ID	Identification	Invariant
Location	School Location	Categorical	Varying
Retained	Retention Indicator	Categorical	Varying
Years_Exp	Years of Teaching Experience	Continuous	Varying
Math_SGP	Math Median Student Growth Percentile	Continuous	Varying
Read_SGP	Read Median Student Growth Percentile	Continuous	Varying
Highest_Degree	Highest Degree Earned	Categorical	Varying
MA+	Master's Degree or Higher	Categorical	Varying
Hire_Date	DPS Hire Date	Date	Invariant
New	New Teacher Indicator	Categorical	Invariant
Start_Date	Position Start Date	Date	Invariant
End_Date	Position End Date	Date	Invariant
Pay_Step	Teacher Pay Step	Categorical	Varying
PC_Eligibility_Date	ProComp Eligibility Date	Date	Invariant
PC_Optin_Date	ProComp Opt-In Date	Date	Invariant
PC_Optin_Type	ProComp Opt-In Type	Categorical	Invariant
Pre-PC_Pay_Step	Pre-ProComp Pay Step	Categorical	Invariant
Grade	Grade Taught	Categorical	Varying
Female	Indicator of Female	Categorical	Invariant
Race	Teacher Race/Ethnicity	Categorical	Invariant
Minority	Minority Status	Categorical	Invariant
Age	Teacher Age	Continuous	Varying

DPS and ProComp school-level information is the second data source from which this study draws. These data include information considered for the identification of HTS schools. After the implementation of ProComp in 2006, these data also include information about which schools were designated HTS under both iterations of ProComp. Table 3.3 shows the relevant variables available from the DPS and ProComp school characteristic data. These variables enable me to identify school type, schools HTS designations under the two iterations of ProComp (the "HTS" variable), and to identify schools that *would* have been designated HTS prior to the implementation of ProComp and under each iteration of ProComp via the Historical HTS variables.

Table 3.3. *Available Variables in School Characteristic Data*

Variable	Description	Type	Longitudinal Variation
Year	School Year	Continuous	Varying
DPS_No	DPS School Number	Identification	Invariant
CDE_No	CDE School Number	Identification	Invariant
Name	School Name	Identification	Invariant
Type	School Type (Grades, Theme, etc.)	Categorical	Invariant
FRL	Percent FRL	Continuous	Varying
Agg_Math_SGP	School-Level Math Student Growth Percentiles	Continuous	Varying
Agg_Read_SGP	School-Level Read Student Growth Percentiles	Continuous	Varying
Agg_PC	School-Level ProComp Participation	Continuous	Varying
PC_Change	Change in ProComp Participation	Continuous	Varying
HTS	HTS Status	Categorical	Varying
HTS_1	Historical HTS Status Using 1st PC Criteria	Categorical	Varying
HTS_2	Historical HTS Status Using 2nd PC Criteria	Categorical	Varying
HTS_3	Historical HTS Status Using Percent FRL	Categorical	Varying

Because DPS human resources data and school characteristic data are available for the last decade, there are nine transition periods between school years in which a teacher could either remain at their same school or not. There are four transition periods before the implementation of ProComp and five transition periods after implementation. Table 3.4 shows how these data are distributed over time with regard to ProComp.

Table 3.4. *Distribution of Longitudinal Panel Data*

Period No.	Period Name	Transition Periods	Pre-/Post-PC?
1	200102	2001-02 to 2002-03	Pre
2	200203	2002-03 to 2003-04	Pre
3	200304	2003-04 to 2004-05	Pre
4	200405	2004-05 to 2005-06	Pre
5	200506	2005-06 to 2006-07	Post
6	200607	2006-07 to 2007-08	Post
7	200708	2007-08 to 2008-09	Post
8	200809	2008-09 to 2009-10	Post
9	200910	2009-10 to 2010-11	Post

Because there are some complications in operationalizing ProComp for analyses presented in the next chapter, it is the first measure explained in the following section.

Measures

Variables included in the retention analyses can be measured in several different ways. As such, the way in which I have operationalized each variable is explained in turn below. Additional details about measures used to determine overall teacher quality are also presented in this section.

ProComp. Although ProComp was implemented throughout DPS on January 1, 2006 there are at least two difficulties in defining it for the purposes of this study. The first complication is that it was implemented in the middle of the 2005-06 school year, rather than at the beginning or end of the year. As such, different time points in the 2005-06 school year are both before and after ProComp. There is no straightforward way to deal with this challenge without removing this year entirely, which is not desirable. Instead, I included 2005-06 retention in both the pre- and post-ProComp (as shown above in Table 3.4). Readers will recall that teacher location was determined in October of each year. For this reason the 2005-06 retention rates are actually determined before the implementation of ProComp. Thus I assume that the transition period from 2004-05 to 2005-06 is not affected by ProComp.[20]

Of course, it therefore follows that retention rates from the transition period of 2005-06 to 2006-07 may be biased by the fact that 2005-06 retention rates are calculated before ProComp was implemented. If ProComp impacts retention rates immediately after implementation, one would expect to see a greater change in retention rates during this transition period. However, as I explain immediately below, retention rates are averaged before and after ProComp (four and

[20] Although ProComp was not yet implemented in October, 2005, it is likely teachers were aware of the program. Though funding had yet to be approved for it, pilot programs had been in place for two years and DPS and the DCTA were preparing to hold a vote to approve the program around this time. It is feasible that retention at this time may have been influenced by teachers' opinions about the program, even before it was approved, funded, and implemented.

six years, respectively) so any bias in this first transition period should be somewhat mitigated as a result.

The second complication of ProComp is that not all teachers are required to participate and those who have the option can chose to participate at several different times over the course of five years. As mentioned previously, this study estimates the effect of ProComp on retention rates using schools as the principal unit of analysis. Thus, for each year, the percentage of teachers who participate in ProComp is calculated at the school level to provide a proxy for the "exposure" to ProComp for a given school in a single year.

Retention Rates. Teacher retention within a given school is operationalized as the percentage of teachers retained from one year to the next. If in a given year a teacher is employed at the same school they taught at the year before, they would be considered "retained". The number of retained teachers from one year to the next is determined for each school over the last decade. In a given year, the percent of teachers who stay at each school is calculated by dividing the number of teachers who stay by the total number of teachers[21] at that school the previous year. For example, if 100 teachers work at a given school in October 2007-08 and 90 of the same teachers also work there in October of 2008-09, that school had a 90% retention rate from 2007-08 to 2008-09.

Hard to Serve Schools. Since the criteria for identifying HTS schools and number of schools designated "HTS" changed as a result of 2008-09 ProComp negotiations, there are several possible ways to identify HTS schools for the retention analyses. The most obvious way to identify HTS schools is simply by whether they are designated "HTS" or not in a given year.

[21] The total number of teachers eligible to be retained excludes teachers who retire, are terminated, or who are RiB'd (see Figure 3.1). Teachers prepared via an alternative preparation program are included in the total number of teachers eligible to be retained.

However, it is not as straightforward as it might seem because it is possible for a school to be designated "HTS" in the first year of a transition period and not in the second or vice-versa. This is problematic in comparisons that examine the effect of ProComp over time for schools as a function of HTS status. Fortunately, from one year to the next, very few schools have their HTS status change (less than 6% of schools moved from HTS to non-HTS or from non-HTS to HTS from one year to the next).[22] For regression analyses, schools are coded as HTS=1 in post-ProComp time periods if they are ever designated "HTS" in either of the years included in any given transition period (see Appendix E for frequencies of schools that changed HTS status from year to year).

However, for descriptive analyses, it is important to be able to compare groups of schools over time. As HTS schools obviously did not exist prior to ProComp (though clearly, high-poverty schools existed), there are at least three different ways to identify HTS schools historically. The first is to code schools as HTS=1 across all years of available data if they are ever HTS under the *first* iteration of ProComp ("HTS_1" variable in Table 3.1). This is the most conservative group of HTS schools, and all schools designated "HTS" under the first criteria are also designated "HTS" under the second criteria. The second way is to code schools as HTS=1 across all years of available data if they are ever HTS under the *second* iteration of ProComp ("HTS_2" variable in Table 3.1). The third way is to code schools HTS=1 across all years of available data if the percentage of students eligible for FRL meets or exceeds thresholds used for HTS designation under the second iteration of ProComp ("HTS_3" variable in Table 3.1). Although I tried each of these approaches in turn, descriptive analyses presented below relied on schools identified as HTS under the first iteration of ProComp ("HTS_1"). Schools compared on

[22] The exception to this was from 2007-08 to 2008-09 as a result of changes to the HTS incentive.

HTS status as designated under the first iteration are presented because these schools are the ones most likely to have actually been designated "HTS" in all post-ProComp years (i.e., they are the *most* HTS schools).

Quality. As briefly discussed in previous chapters, overall teacher quality is operationalized in two ways: 1) aggregated student growth percentiles in reading and mathematics as an estimate of value-added and 2) average years of teaching experience. These measures of teacher quality are examined in aggregate at the school-level and are explained in more detail below.

Student growth percentile (SGP) data are available at the school-level starting in 2003-04 and continuing through 2009-10.[23] These data were generated by the Colorado Department of Education (CDE), using the Colorado Growth Model (CGM). The CGM produces student growth percentiles (SGPs) that represent normative measures of change in student test-score achievement over time. That is, SGPs, provide an estimate of individual student growth relative to students with similar score histories. CDE has made these data – aggregated up to the school-level – publically available.

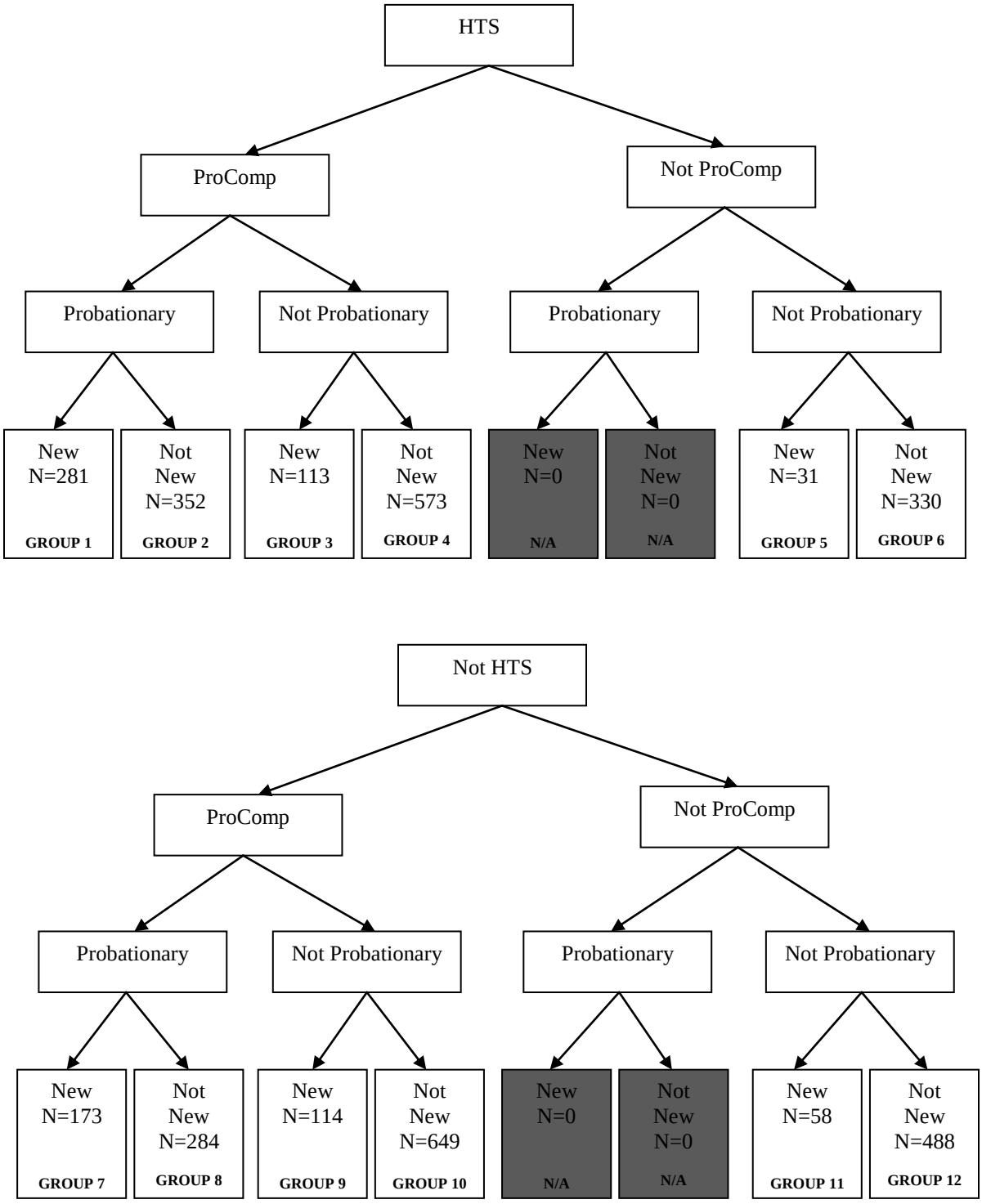
Years of teaching experience data are available starting from 2001-02 and continuing through 2010-11. Importantly, these data are available for all teachers; teachers included in school-level calculations are not limited to those who teach in a tested subject or grade. Average years of teaching experience is another measure used in this study to explore the relationship between retention rates and overall teacher quality.

[23] However many schools – particularly small elementary schools – are missing median SGPs because small numbers of students did not allow for reliable median percentiles to be calculated.

Qualitative Data

Teacher interviews provide the third data source. Semi-structured interviews were conducted with a purposefully selected sample of 24 teachers in the winter of 2010 to understand how – if at all – they consider ProComp, the HTS incentive, and the HTS school designation when making their employment decisions at the end of each school year. Interviews were conducted individually, as it seemed possible the interview topics (e.g., impoverished students and financial compensation) may be sensitive issues for some teachers. Teachers were purposefully selected for individual interviews based on the following variables: (a) current school's HTS status, (b) ProComp participation status, (c) probationary status, and (d) whether new to current school. The combination of these factors yields 16 different interview groups, as shown in Figure 3.3.

Figure 3.3. *Interview Selection Criteria*



However, four of these groups are obsolete because new teachers to the district (who enter as probationary teachers) are required to join ProComp. These groups have been shaded out in the figure below, resulting in a total of twelve relevant interview groups.

Within each of these twelve interview groups, the pool of teachers currently employed in fulltime teaching positions in DPS was identified. As with data used for retention analyses, data used to select teachers for interviews was limited to include only teachers who are eligible for ProComp and who work at Elementary, K-8, Middle, and High Schools.[24] Teachers within each interview group (numbers have been provided in the figure above) were then randomly selected via an online random number generator (http://www.random.org/). Teachers were selected and invited to participate in the interview, via email, until there were two teachers in each group, for a total of 24 teachers (see Appendix F for copies of electronic interview invitations sent to teachers and principals). The rate of refusal (or ignore) was quite high, perhaps owing to the time of year, workload demands, or disinterest. Although not tracked separately for each interview group, the refusal rate did not exceed 80% for any given group. In other words, no more than ten teachers from each interview group were invited before two teachers agreed to participate.

By sorting teachers into interview groups based on the school and teacher characteristics listed above, I hoped to gather data that is as representative of teachers' decision processes, feelings, and beliefs as possible, given the small number of interviews. I identified these characteristics to select teachers for interviews because it seems likely teachers' consideration of ProComp, the HTS incentive, and the HTS designation of their current school may differ based on these factors. For example, it is reasonable to assume a probationary teacher who is also a ProComp participant may be more likely than a tenured, non-ProComp teacher to consider

[24] Teachers who work at alternative and charter schools were excluded.

ProComp and HTS incentive when making employment decisions at the end of the school year. This is because – in general – probationary teachers have fewer job opportunities than tenured teachers which may influence the likelihood they will stay at their current schools (Guarino, Santibanez & Daley, 2006).

In addition, it is reasonable to assume ProComp teachers may be more likely to consider the HTS incentive and HTS designation of their current school than non-ProComp teachers because they are eligible to receive the financial incentive attached to HTS schools. Similarly, the length of time a teacher has been working at his or her current school may influence the way in which he or she considers the HTS incentive and HTS designation when making employment decisions at the end of the year; teachers who have been at their current schools for multiple years have probably formed relationships and may be more likely to stay at their current schools as a result. Finally, the HTS designation of a teachers' current school is important to consider in the selection of interview participants because teachers who work in schools designated "HTS" likely consider the HTS incentive and designation of their school in a different way than teachers who do not work in a HTS school when making decisions about where to work.

Teachers were invited to participate in interviews in such a way that certain distributions of demographic characteristics are fixed. For example, half of the respondents (N=12) taught in HTS schools; half were new to their schools; two-thirds (N=16) participated in ProComp; and one-third (N=8) were probationary teachers. Other teacher characteristics are not fixed and these, as well as the four characteristics used to stratify the sample of teachers invited to participate, are shown in Table 3.5. Despite being a relatively small sample, interview respondents are representative of the district across school type, gender, race, and years of teaching experience.

Table 3.5. *Characteristics of Interview Participants*

	Demographic Characteristic	Percent (N)
School Type		
	Elementary	41.7% (10)
	K-8	16.7% (4)
	Middle	25% (6)
	High	16.7% (4)
	Hard to Serve	50% (12)
Position Type		
	CSAP Grade/Subject	58.3% (14)
Teacher		
	ProComp	66.7% (16)
	Probationary	33.3% (8)
	New to School	50% (12)
	Master's Degree+	50% (12)
	Average Years Experience	10.21 Years
	Alternative Program	12.5% (3)
	Female	79.2% (19)
	Caucasian/Non-Hispanic	70.8% (17)

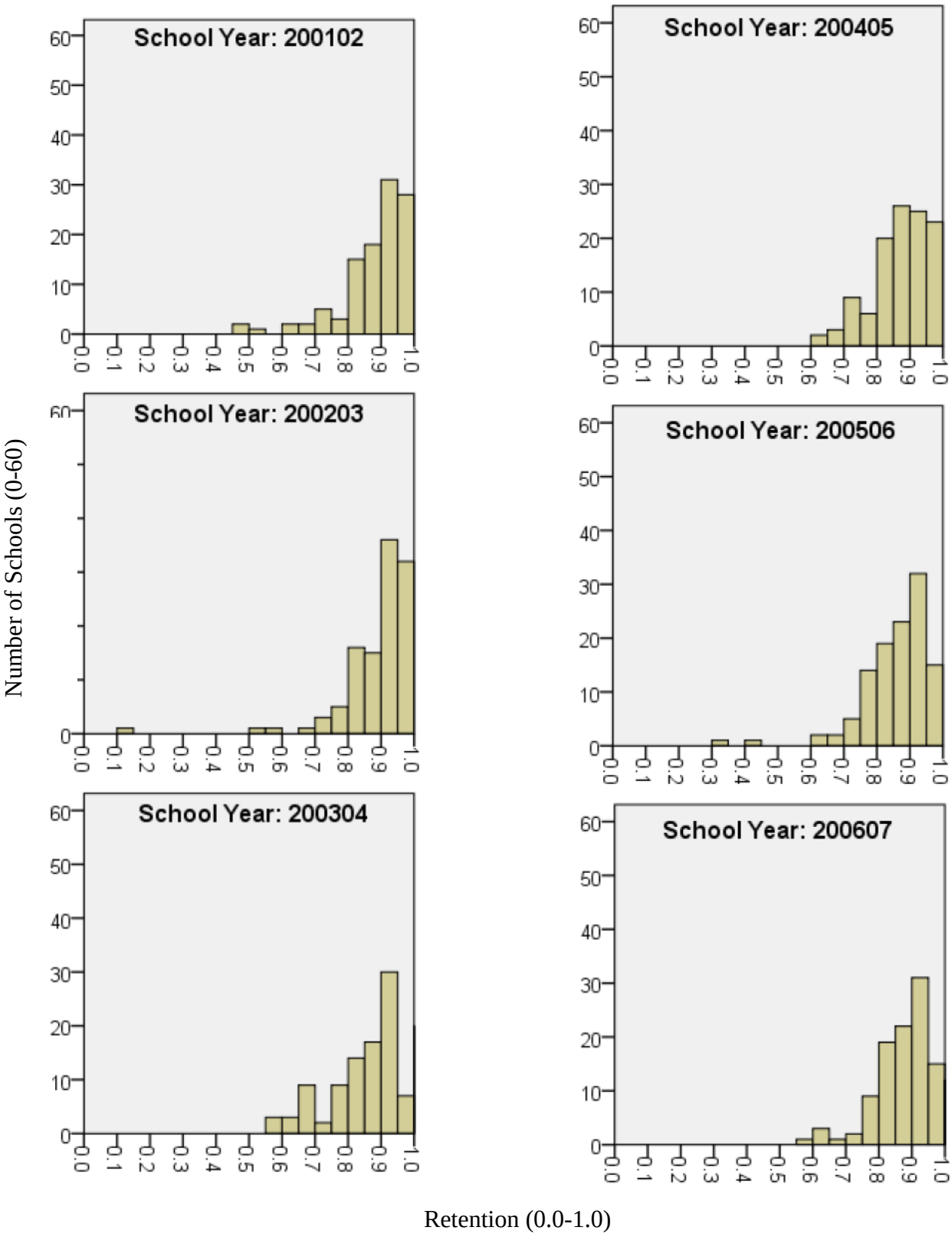
Interviews began on November 15, 2010 and were conducted through December 3, 2010. DPS had a break during this time for the Thanksgiving Holiday and thus interviews were constrained to just 12 school days during this time period. Though no interviews were conducted on two of the available days, there were several days in which as many as four interviews were conducted. Interviews lasted between 21 and 60 minutes, with the average interview lasting 33 minutes. All interviews were audio-recorded and participants were asked to sign a consent form for both the interview and to be audio-recorded (see Appendix G for consent form). Prior to the start of each interview, teachers were reminded that they were not required to answer any question(s) that made them feel uncomfortable and could choose to stop the interview at any point in time. Teachers were also asked to select a pseudonym which was stated on the audio recording and is used herein and in all subsequent work to identify their responses. After the interviews were conducted, audio-recordings were transcribed in full. Together, transcriptions of the interviews total over 500 pages.

During the interviews, I asked teachers about their employment decisions, ProComp, and the HTS incentive and school designation. Example questions included: 1) How do you think about your employment options – school and position – at the end of each school year; 2) Can you take me through the process of how you made the decision to work here last year? What are the factors you consider when making employment decisions each year; and 3) Are there ways ProComp has affected you as a teacher and/or your employment decisions? Additionally, teachers who work at HTS schools were asked other questions about the HTS designation of their school, the degree to which they feel compensated by the HTS incentive, and the extent to which ProComp and the HTS incentive specifically are factored into their employment decisions (see Appendix H for full interview protocol). Qualitative data collected and analyzed from these interviews provide information about the extent to which teachers consider ProComp and the HTS incentive when making their year-end employment decisions. These data also provide information about the types of trade-offs teachers make and how they weigh their various employment options.

Exploring the Data

Before conducting any empirical analyses of retention, it is important to determine whether there is in fact variation in the outcome variable (retention) and primary independent variable (ProComp). Without variation in the data, there would be no change to model. I first present school-level average retention rates and ProComp participation via a series of paneled histograms. Figure 3.4 shows histograms of average retention rate paneled by year for the last decade (2001-02 through 2010-11). The proportion of teachers retained (from 0.0 – 1.0) is plotted on the x-axis; the number of schools (from 0 – 60) is plotted on the y-axis.

Figure 3.4. *Distribution of School Retention Rates*



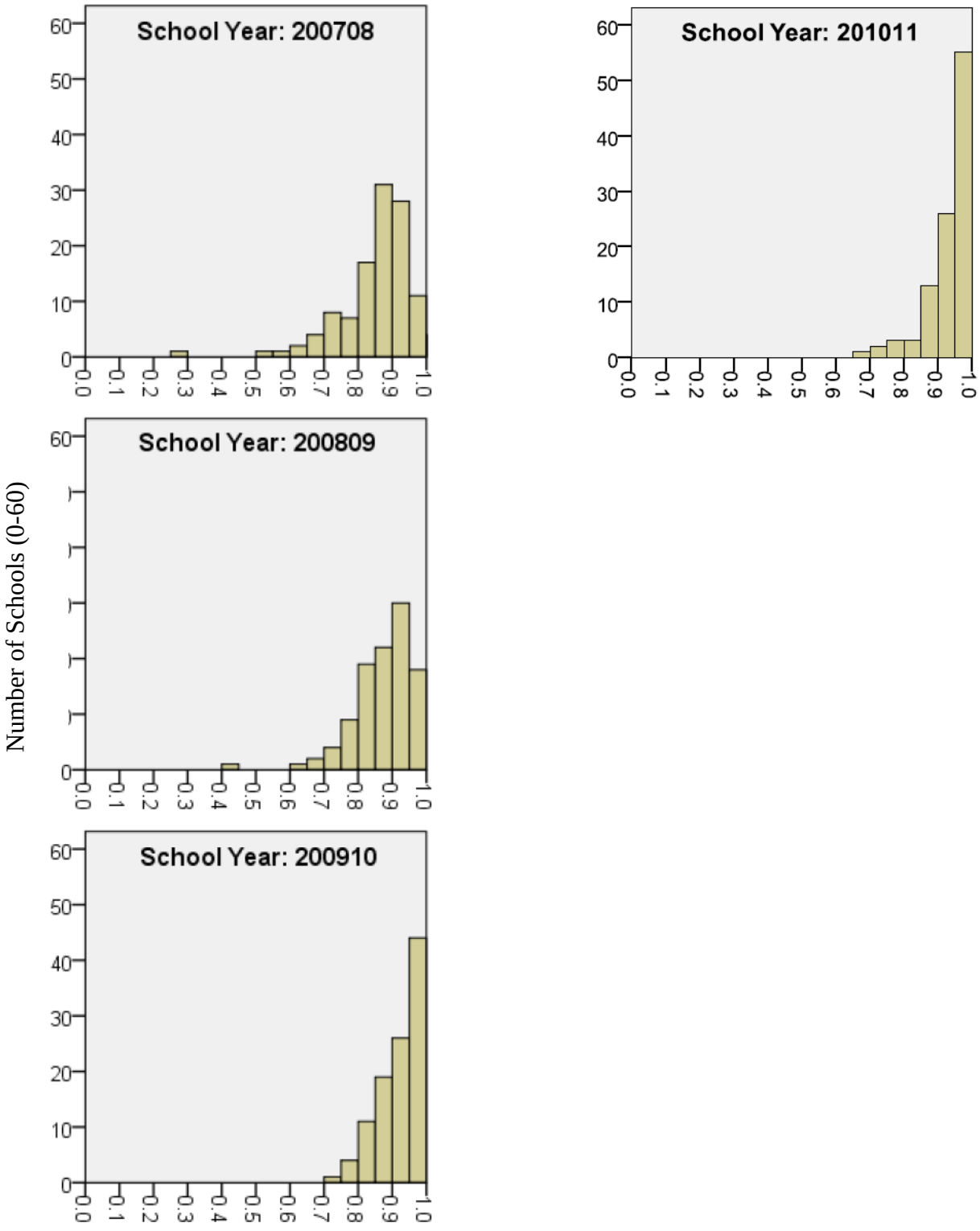

School Year: 200708
School Year: 201011
School Year: 200809
School Year: 200910
Number of Schools (0-60)
Retention (0.0-1.0)

Figure 3.4 shows retention rates generally remain in the upper half of the possible range, and suggests they may be increasing over time. Importantly, these histograms indicate there is variation in average school-level retention rates.

Descriptive statistics of school-level retention rates are presented in Table 3.6.

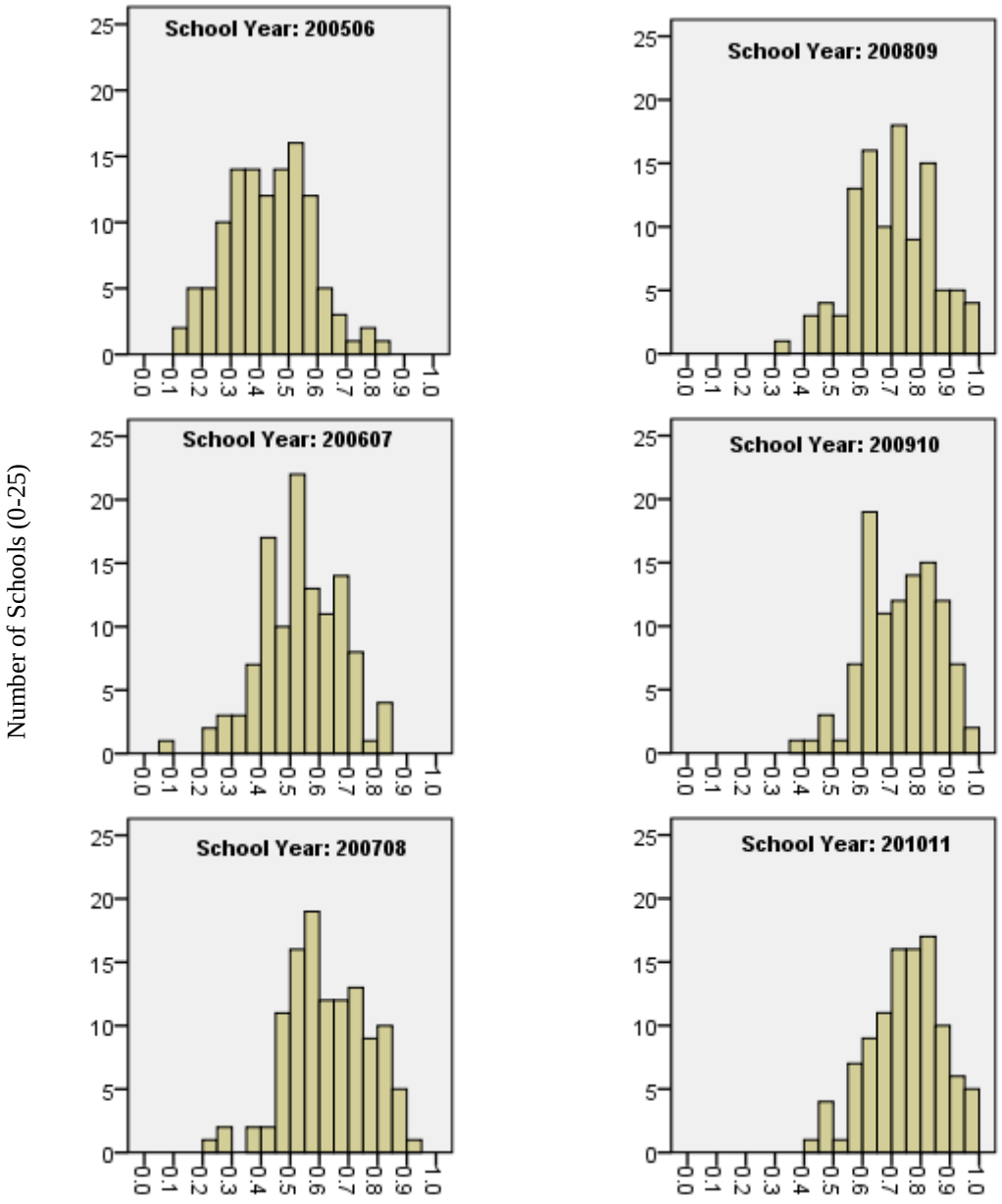
Table 3.6. *Descriptive Statistics of School-Level Retention Rates*

	N	Minimum	Maximum	Mean	SD
2001-02	107	0.462	1.000	0.884	0.107
2002-03	111	0.100	1.000	0.893	0.116
2003-04	114	0.556	1.000	0.862	0.110
2004-05	114	0.643	1.000	0.871	0.088
2005-06	114	0.300	1.000	0.857	0.108
2006-07	115	0.591	1.000	0.871	0.087
2007-08	115	0.286	1.000	0.855	0.107
2008-09	105	0.444	1.000	0.866	0.088
2009-10	106	0.733	1.000	0.914	0.065
2010-11	103	0.680	1.000	0.923	0.062

Average retention over the past decade is roughly 87%; it is also about 87% before the implementation of ProComp but approximately 88% after implementation. Thus, retention appears to have increased slightly in the years after ProComp was implemented. Because school-level retention is calculated in this study only to include those teachers who had at least a minimal choice in whether to remain at their current school from one year to the next, these averages are slightly higher than the most recent national average of teacher retention of 85% (Keigher, 2010).

Next a series of histograms is presented for each year of ProComp (2005-06 through 2010-11). Along the x-axis, the school-level proportion of teachers who participate in ProComp (from 0.0 – 1.0) is plotted; along the y-axis, the number of schools (from 0-25 schools) is plotted. Figure 3.5 shows these histograms.

Figure 3.5. *ProComp Participation Over Time*



Starting in the 2005-06 school year, it is clear the distribution of school-level ProComp participation shifts right, increasing over time. Given that teachers new to DPS are required to join ProComp, this is exactly the trend readers should expect to observe. Although it is clear there is variation in the availability of ProComp (not available before implementation; available after), these descriptive statistics indicate there is also variation in the exposure to ProComp (increased participation over time).

Descriptive statistics of school-level ProComp participation are presented in Table 3.7. As is observable in Figure 3.5, Table 3.7 shows mean ProComp participation increase each year. The median has been provided here as well because it is used in analyses presented in the next chapter to identify schools with "high" ProComp participation.

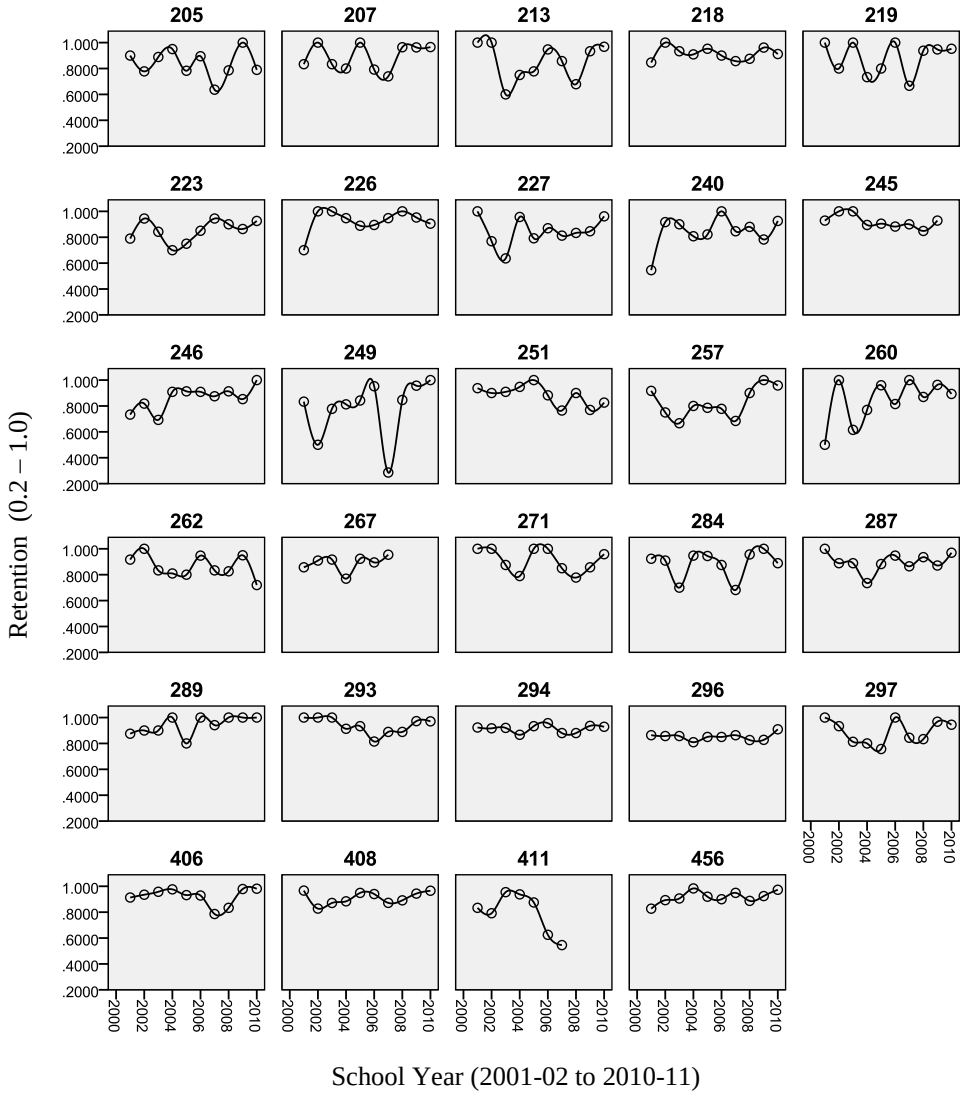
Table 3.7. *Descriptive Statistics of School-Level ProComp Participation*

	N	Minimum	Maximum	Median	Mean	SD
2005-06	115	0.120	0.800	0.424	0.428	0.144
2006-07	115	0.071	0.826	0.536	0.533	0.138
2007-08	115	0.235	0.944	0.611	0.630	0.138
2008-09	105	0.333	0.958	0.710	0.704	0.136
2009-10	106	0.385	1.000	0.744	0.732	0.126
2010-11	103	0.400	1.000	0.765	0.748	0.126

The paneled histograms and the tables of descriptive statistics of retention and ProComp participation suggest there is sufficient variation in both the outcome and substantive predictors to warrant further analysis. Accordingly, I next present descriptive analyses that illustrate the way retention changes over time. In order to determine whether it is plausible to assume linearity – and thus defensible to fit a linear model of change to the data – I randomly select 25% of schools in the data and plot their empirical retention. I first present nonparametric plots that include smoothed fit lines. The advantage of this approach is that it does not require a specific

functional form (e.g., straight line, quadratic, or some other curve). Figure 3.6 presents nonparametric empirical plots of retention for the randomly selected schools.

Figure 3.6. *Nonparametric Trajectories of Retention Rates, Superimposed on Empirical Growth Plots*



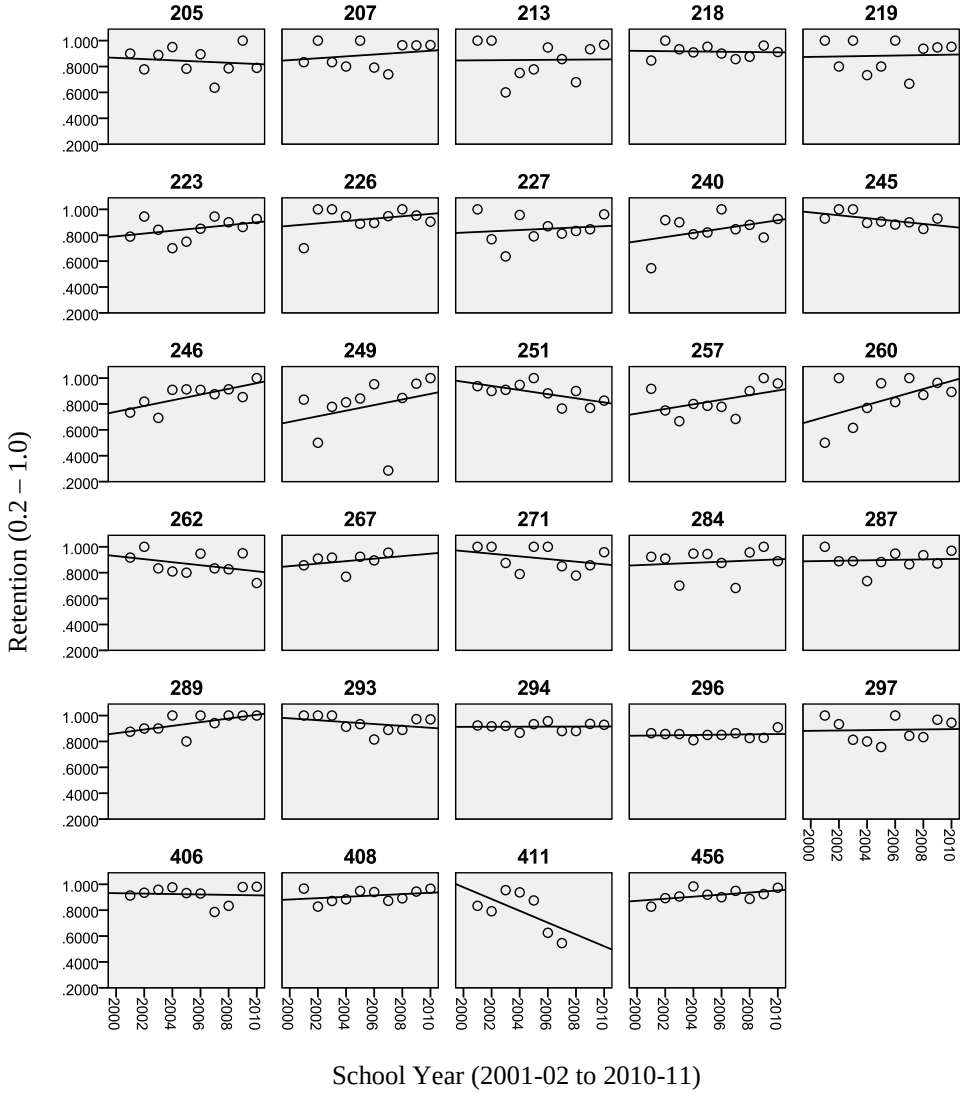
Along the x-axis, the year-to-year time periods are plotted such that "2002" represents the transition between 2002-03 and 2003-04 and "2010" represents the transition between 2009-10

and 2010-11. The percent of teachers retained, from 0.2 to 1.0 is plotted along the y-axis. The number above each plot represents the DPS school number for that school.

In general, retention rates do not appear to be very linear, though linear is more plausible for some schools (e.g., 456) than others (e.g., 260). Of course, when looking at retention within a single school, the number of teachers impacts variability of retention from one year to the next. This is clearly visible here as elementary schools (those with numbers in the 200s) have greater variability in retention, in general, than secondary schools (those with numbers in the 400s).

Out of curiosity, I also plotted a straight line of best fit to the retention data, even though they did not appear linear. Figure 3.7 shows the empirical growth plots of retention with linear trajectories superimposed.

Figure 3.7. *Linear Trajectories of Retention Rates, Superimposed on Empirical Growth Plots*



Taken together, Figures 3.6 and 3.7 strongly suggest that retention rates do *not* follow a linear pattern of change. However, as it is possible to fit a model that accounts for retention rates separately before and after the implementation of ProComp, the assumption of linearity could be satisfied if retention rates are linear in each of these time periods. Smoothed trajectories superimposed on retention rates before and after ProComp are thus presented below. Figure 3.8

shows smoothed retention trajectories before the implementation of ProComp; Figure 3.9 shows smoothed retention trajectories after implementation.

Figure 3.8. *Nonparametric Trajectories of Retention Rates, Superimposed on Empirical Growth Plots Before ProComp*

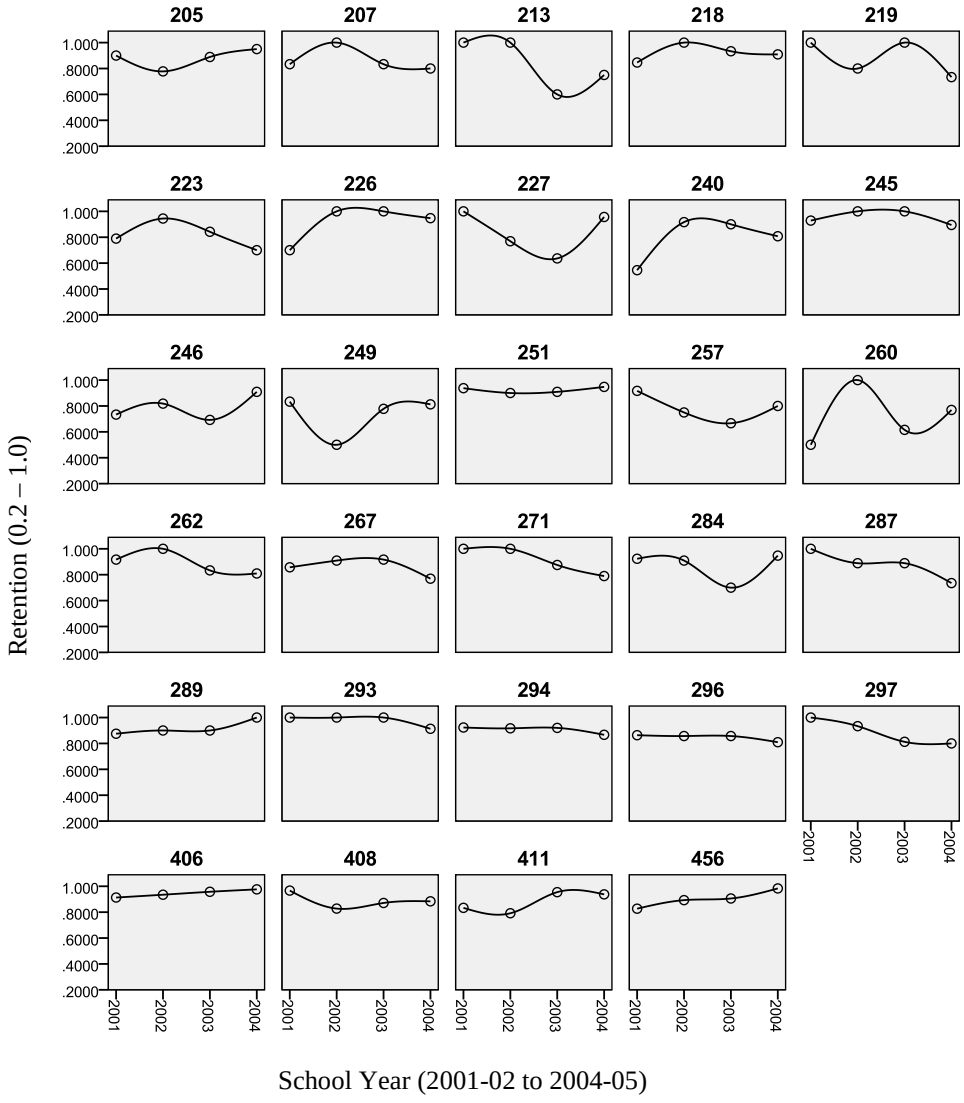
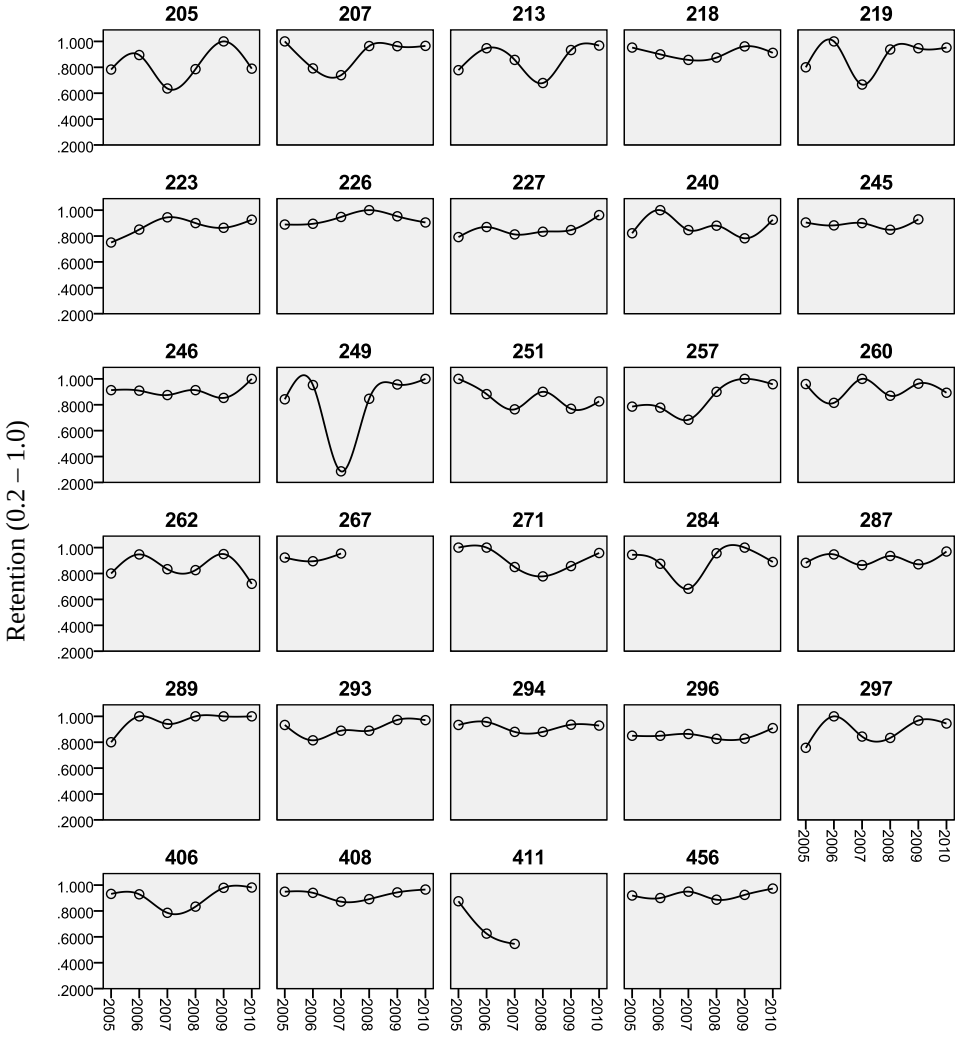


Figure 3.9. *Smooth Nonparametric Trajectories of Retention Rates, Superimposed on Empirical Growth Plots After ProComp*



In plotting the retention trajectories separately before and after ProComp, it is clear that change in retention rarely follows a linear form (the obvious exception is pre-ProComp for school 406). Given that retention trajectories are generally not linear, it is not defensible to fit a linear model of change to the data. In this case, a nonparametric model of change is more justifiable to estimate the additive effect of ProComp on retention rates.

Analytic Approach

This section explains the analytic approaches used to examine data described previously. I first explain the longitudinal school-level differences approach that I use to analyze teacher retention as well as the descriptive approach that I use to explore associated changes in overall teacher quality. Next, I explain the analytic approach I use to analyze the qualitative teacher interview data.

Estimating Retention Effects

This study seeks to estimate the effect of ProComp on retention rates using longitudinal data in a non-experimental context. The challenge in this analysis is to mitigate potential sources of bias that may be introduced into estimated effects of ProComp through the omission of confounding variables – that is, events other than ProComp that may have occurred simultaneously and also affected retention. In the absence of a randomized experiment, and without some statistical adjustments, it is likely that estimated effects of ProComp on retention rates would be biased. In particular, estimated effects may be biased by factors that jointly drive ProComp participation rates and the likelihood of remaining at a school, and particularly of remaining at a HTS school. I attempt to reduce these threats to validity via a quasi-experimental approach.

Of the studies reviewed in the previous chapter, Clotfelter, et al. (2008; 2010) and Steele, et al. (2009) are most similar to this one. The first Clotfelter, et al. (2008) examined retention rates in specific subject areas (as the incentive targeted hard-to-staff positions) via a difference-in-differences regression model, while the second (2010) combined a similar difference-in-differences approach with probit regression models to estimate the probability that individual teachers would make certain employment decisions. Steele, et al. (2009) examined individual

teachers' probability of exit at the end of the school year via a discrete-time hazard model. Of these approaches, the difference-in-differences regression model is most appropriate to examine ProComp's impact on school-level retention.

A difference-in-differences regression model attempts to control for omitted variable bias in the absence of random assignment (Meyer, 1995; Imbens & Woolridge, 2009). To do so, this approach relies upon longitudinal data to attempt to isolate the effects of ProComp from other long-term trends in retention rates. This approach requires the assumption that retention trends prior to the implementation of ProComp represent an appropriate counterfactual for the outcome that would have been had ProComp not been implemented.

As an alternative to difference-in-differences, I also considered an interrupted time-series linear regression model (Campbell & Ross, 1968; Glass, 1997). Like the difference-in-differences model, the interrupted time-series approach relies on longitudinal data to attempt to control for omitted variable bias. In some ways interrupted time-series is more specific than difference-in-differences because it allows one to estimate the change in intercept and/or slope after the "interruption" (an intervention, such as the implementation of ProComp), while accounting for historical level and slope. However, in order for intercept and slope estimates from a linear interrupted time-series regression to be meaningful in this context, one would have to assume that within-school retention trends are in fact linear.

As shown in Figures 3.6 – 3.9, the assumption of linearity in within-school retention trends is not plausible in this study. The difference-in-differences model requires fewer assumptions than the linear interrupted time-series model because it does not require any particular distribution of the data. Given this, I estimate the additive effect of ProComp on changes in retention rates via a difference-in-differences regression model.

In this investigation, schools represent the primary unit of analysis, and the variable representing the implementation of ProComp serves as the key policy parameter of interest. Because the implementation of ProComp is considered the treatment of interest in this analysis, change in retention rates before ProComp comprises one form of "control" against which the "treatment" (ProComp implementation) can be compared. I assume in applying this approach that change in retention rates before ProComp provides a reasonable comparison for change in retention rates after ProComp. This approach treats the implementation of ProComp as an exogenous policy shock; as such, if assumptions do in fact hold, the model will support causal inferences about ProComp's effects on retention rates.

Separating potential reasons for effects into those essentially related to ProComp and those concurrent but unrelated to ProComp is the principal task of this analysis. The key threats to validity in this study stem from selection (e.g., factors that may influence both ProComp participation and retention) and differential school "history" (e.g., past influences that may explain observed change in retention rates). Certain school characteristics, such as school climate, location, and leadership, may represent sources of both selection and historical bias. In order to account for school characteristics that may influence retention rates, I include school fixed-effects in the analysis. By including school fixed-effects (i.e., dummy variables for N-1 schools) I can account for overall differences in average retention change to make schools' changes in retention from control periods to treatment periods more comparable. By taking the within-school difference in retention rates, all constant school factors are accounted for. In essence, each school serves as its own control. This approach yields a more accurate estimate of the effect of ProComp on retention rates as it should be free from biases that would otherwise have been introduced by constant school characteristics. Importantly, however, school fixed-

effects cannot account for any time-varying factors. I still need to be wary of any changes (such as the economic recession) that occurred after the implementation of ProComp and that may influence changes in retention from one year to the next. To the extent possible, these time varying factors are accounted for in the regression model.

Formal Model

Using the difference in year-to-year within-school retention as the outcome, the basic difference-in-differences model for this analysis can be formally specified as:

$$R_{st} - R_{s(t-1)} = \alpha + \beta PC_t + \mu_s + \nu_{st}$$

where the outcome $R_{st} - R_{s(t-1)}$ is the average difference in retention for school *s*; PC_t is an indicator of whether time *t* was before or after the implementation of ProComp; μ_s captures individual school fixed-effects; and ν_{st} is the random disturbance term. This model is specified such that the average difference in within-school retention is a function of the overall change in retention for all schools across all years (α), the difference in average year-to-year differences before ProComp subtracted from the average year-to-year differences after ProComp (β), and the school-by-year error (ν). The causal parameter of interest is the marginal effect difference of ProComp implementation on average gains in retention (β).

In addition to estimating retention effects of ProComp in this way, I also specifically examine any differential effects of ProComp on retention at HTS schools relative to those not designated as such. The relationship between ProComp and HTS status is the key interaction of interest in this analysis. In addition to HTS status, other covariates are added to the basic model to minimize threats to validity. These include: a) changes to ProComp/start of the economic

recession (both in 2008-09), b) type of school; c) starting level retention; and d) percent of new or probationary teachers.

In this approach, the "first" difference is represented by the within-school change in retention from one year to the next. The "second" difference is represented by subtracting the average difference in retention gains *before* the implementation of ProComp from the average difference in retention gains *after* implementation of ProComp. Because changes in retention observed prior to the implementation of ProComp are likely related to some underlying trend in retention caused by omitted variables, taking this "second" difference should help me to isolate the impact of ProComp on retention gains after the implementation of ProComp. If ProComp impacts year-to-year change in retention, one would expect to see an increase, on average, in retention in the years after implementation. If teachers move around after the implementation of ProComp to maximize their earning potential and preferences (i.e., "selection effects," Lazear, 2003) there may be a drop in school-level retention immediately following implementation and then an increase over time.

Exploring the Relationship between Retention and Quality

One of the main goals of ProComp is to improve overall teacher quality in DPS by attracting and retaining high-quality teachers. If ProComp works to make teaching in DPS and in certain schools more attractive, one would expect to observe increases in retention. Such increases are desirable because high rates of teacher turnover are disruptive and require schools to hire new teachers, who are generally less effective than those who have taught for at least three years (Clotfelter, Ladd & Vigdor, 2010; King Rice, 2010). Accordingly, if retention increases and fewer new teachers are required to fill vacancies, overall teacher quality and effectiveness may improve. Ideally, it would not only be interesting to investigate the effect of

ProComp on retention rates, but also the direct effect of ProComp on teacher quality. Although such an examination is important, it is beyond the scope of this study due to both time and data constraints. This research is only able include a secondary consideration of teacher quality.

In this secondary analysis, I am unable to determine whether increases in retention yielded improvements in overall quality or whether improvements in overall quality resulted in increased retention. Instead, I attempt to explore the extent to which above-average quality, consistent with Lazear's (2003) "selection effect" theory, is observed in schools that have had the greatest retention. As described above, teacher quality is operationalized as both median school-level student growth percentiles (SGPs) for reading and mathematics and as average years experience in a given school and year. All measures of teacher quality have been aggregated to the school level in this analysis.

I explore the relationship between retention and quality descriptively using four different approaches to characterize the potential relationship. In particular, I investigate whether schools have above-average overall teacher quality if they have the greatest retention 1) changes in the last decade; 2) changes after the implementation of ProComp; 3) changes from 2009-10; and 4) percent of teachers retained in 2009-10. In each of these descriptive analyses, I compare mean overall teacher quality for schools with retention change or retention percent in the top quartile to the mean overall teacher quality of all schools to see whether schools with greater changes in retention or the highest levels of retention also have above-average overall teacher quality.

Understanding the Effects of ProComp

The primary tasks to analyze the interview data were to categorize the data through a series of organizational and thematic codes and to identify emergent patterns (Miles & Huberman, 1994). Prior to transcribing and coding the data, I first listened to all audio-

recordings of the interviews and wrote memos to capture my initial thoughts (Maxwell, 2005). Memos were not written about each interview, but rather, I used these memos to record concerns, themes, and reflections about how I felt a given interview had gone or about something specific a respondent had said in the interview.

After listening to the audio recordings and writing the memos, I uploaded interview transcriptions into the qualitative data management software, ATLAS.ti (Muhr, 2004). Existing research, the research questions for this study, and questions from the interview protocol provided the basis for a preliminary list of codes. These preliminary codes – such as "Process: Job Placement" and "Knowledge of ProComp" – were used mainly to organize the data. After I coded the data with these preliminary organizational codes, I then re-read the transcripts a second time and coded sections of the transcripts with thematic codes in an effort to identify emergent patterns in the data. Thematic codes were also informed by existing research, the research questions, and questions in the interview protocol. Additionally, thematic codes were created to identify reoccurring themes in the data that were not anticipated. Examples of thematic codes include "Unpredictability of ProComp" and "Teacher Accountability" (see Appendix I for Code Book listing both organizational and thematic codes).

Once I had coded all data with both organizational and thematic codes, I then examined the individual codes to determine if they were all necessary (Mishler, 1986). I removed redundant codes and codes that were seldom used and re-coded segments formerly coded with those codes. I also examined codes that were used the most frequently to determine whether it was advantageous to further delineate the data. However, I decided the most commonly used codes – "Influence on job decisions: Administration," "Process: Job Placement," "Ways to

increase HTS retention," and "Influence on job decisions: Students" – were all best left as more general codes from which I could describe the range of related responses.

Once codes were finalized, I identified emergent patterns in the data. These were identified by the frequency of codes and the research questions of interest (Questions 3 and 4). These key patterns were next described and supported via direct quotes from the interviews. The narrative explaining key patterns from the interview data was then sent (as a summary and in full, upon request) to all interview respondents. Interview respondents were invited to respond with comments or questions with the hope that any misinterpretation(s) on my part could be corrected. Unfortunately, only two teachers replied, and then only to request the full narrative describing the key findings. Although the lack of response from teachers may indicate they largely agree with my interpretation of their words, it is feasible respondents did not review the key patterns I identified in the interview data.

This analysis may strengthen, weaken, or challenge findings from the quantitative analysis of retention by helping to reveal the mechanism(s) underlying teacher responses to financial incentives offered under ProComp for teachers across the district, and particularly those who work at HTS schools. These data provide important insight into how – if at all – teachers consider ProComp, the HTS incentive, and HTS school designation when making their employment decisions at the end of the year.

This chapter has specified the teachers and schools of interest, described the empirical data, and explained the analytic approaches employed in this study. The next two chapters present findings from the analyses explained above. Chapter 4 details results from the quasi-experimental retention analyses and descriptive teacher quality analyses; Chapter 5 presents emergent findings from the interview analyses.

Chapter 4

The Impact of ProComp on Retention Rates

The investigations in this chapter seek primarily to answer Research Question 1:

To what extent do ProComp and the HTS incentive alter teacher retention rates across the district and at high-poverty schools?

This analysis begins by describing changes in retention rates in order to illustrate general trends in the data. I then attempt to isolate the effect of ProComp and the HTS incentive from other factors that may have contributed to changes in retention rates via the difference-in-differences regression model explained previously.

Estimating the effect of ProComp on retention rates is the first essential step in understanding whether the program has achieved the benefits its supporters have anticipated. However, it is also important to consider the characteristics of the teachers who are retained. In order to more fully understand the impact ProComp has had on the composition of the DPS teacher workforce, I conduct a secondary investigation into the relationship between retention rates and teacher quality and effectiveness. This descriptive analysis is related to Research Question 2:

What is the relationship between retention and teacher quality?

I explore whether schools with the greatest retention also have higher overall teacher quality by comparing quality and effectiveness in these schools to that in all other schools.

Descriptive Findings

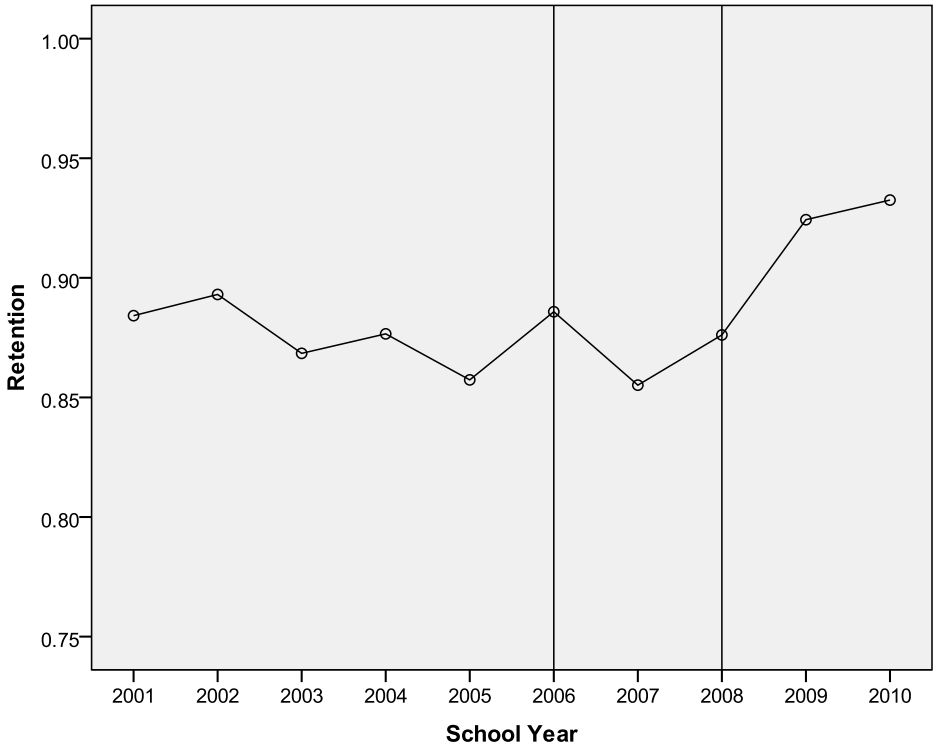
District Average Retention Rates

Although I have previously reported that schools vary in levels of teacher retention and ProComp participation, I have yet to report the general trends in retention rates over time. In this section, I present average retention rates graphically to provide a sense for whether retention

generally increased, decreased, or remained unchanged over time. Several line graphs are presented to illustrate the degree to which retention rates differ for schools as a function of ProComp participation level and HTS status. In these graphs, retention is plotted on the y-axis (ranging from 0.75 to 1.00) and school year is plotted on the x-axis (ranging from 2001-02 to 2010-11). Vertical lines reflect the first full year of ProComp implementation (2006-07 school year) and the point at which ProComp was changed as a result of contract negotiations (2008-09 school year). As average retention has been calculated at the school level, retention rates plotted in these graphs indicate the proportion of teachers who have remained in their same schools, on average, from one year to the next.

Figure 4.1 shows average retention rates for all schools in the district (N=115).

Figure 4.1. *Trends in School-Level Retention Rates*



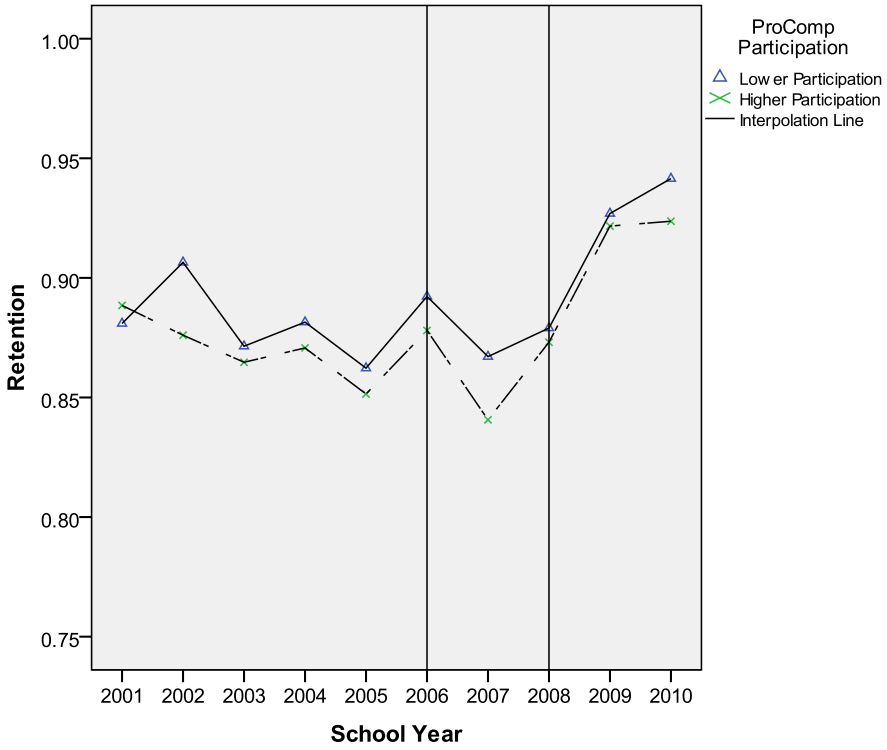
This plot suggests a slight downward trend in retention rates prior to the implementation of ProComp and a moderate increase after implementation. However, a steady increase in retention rates is not observable until 2008-09. The 2008-09 school year marked the first year after the change to ProComp and the HTS incentive. This year was also the same time the economic recession is thought to have begun (Isidore, 2008). Both events could feasibly have positively impacted retention rates. Because programmatic changes to ProComp and the economic recession occurred at the same time, it is not possible to disentangle the potential effects each of these events may have on retention rates. Nonetheless, it is important to account for effects specific to the 2008-09 school year in subsequent analyses to determine the extent to which observed increases in retention rates are explained by changes to ProComp, the recession, or both.

Average retention appears to dip in the 2007-08 school year – the year following the first full year of ProComp implementation. While this decrease does not appear larger than the decrease observed the year before ProComp was implemented (2004-05), the pattern is consistent with Lazear's (2003) selection effect theory. Theoretically, if selection effects are at play in Denver, teachers may switch schools, positions, or both to maximize their earning potential.

Figure 4.2 shows average retention rates as a function of the percentage of teachers who participate in ProComp.[25] With the exception of the first year, schools with high ProComp participation (N=52) had lower retention rates than those with low ProComp participation (N=63).

[25] For the purposes of this comparison, I identified schools as "high" participation if the percent of teachers participating in ProComp met or exceeded the median percent of participation across the whole district in the most recent year (2010-11) and identified them as "low" otherwise.

Figure 4.2. *Trends in School-Level Retention Rates as a Function of ProComp Participation*

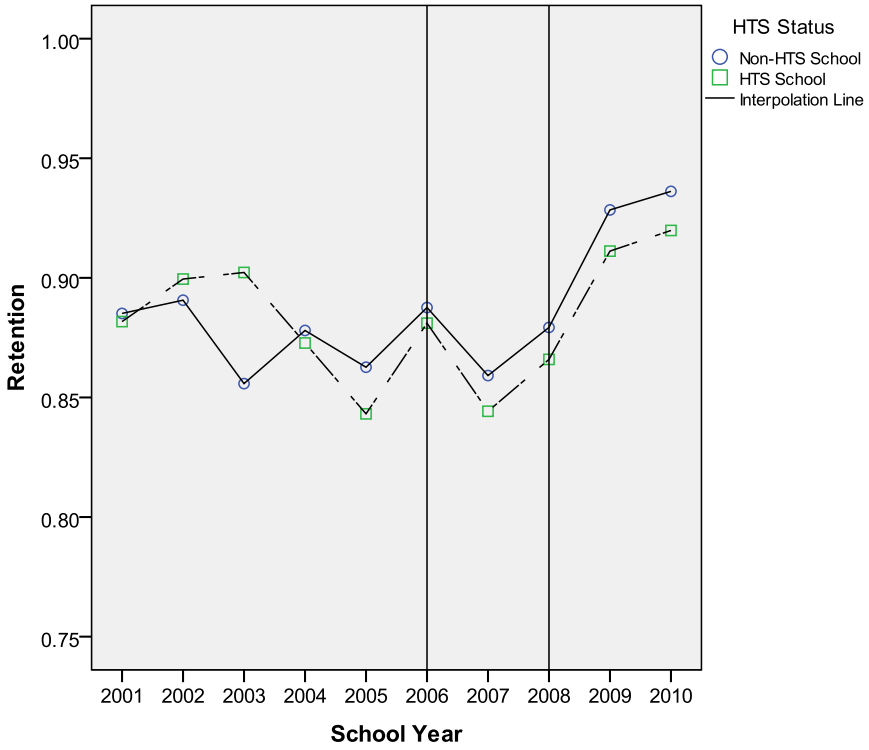


If ProComp does in fact work to increase retention, one would expect to observe the opposite pattern: Schools with higher ProComp participation should have higher average retention rates (after the implementation of the program). It is possible that the lower retention observed in high ProComp participation schools could be related to the number of new teachers in a school. High numbers of new teachers indicate historical turnover and result in increased ProComp participation because teachers who are new to DPS are required to join ProComp. Thus, the number of new teachers could be contributing to high ProComp participation and indicative of historically low retention. Like programmatic changes and the start of the recession in 2008-09, the number of new teachers is considered in subsequent analyses.

Figure 4.3 shows average retention rates as a function of HTS status. Though the 2008-09 upward trend in retention rates remains, there is a clear difference between average retention

rates of HTS schools (N=31) relative to non-HTS schools (N=84).[26] With the exception of the first three years, average retention rates of HTS schools lagged behind that of non-HTS schools. This is not surprising, given a substantial empirical literature that indicates high-poverty schools generally have higher rates of teacher turnover than schools that serve wealthier students (Lankford, Loeb, & Wyckoff, 2002; Panty et al., 2008; Wyckoff et al., 2003).

Figure 4.3 *Trends in School-Level Retention Rates as a Function of HTS Status*

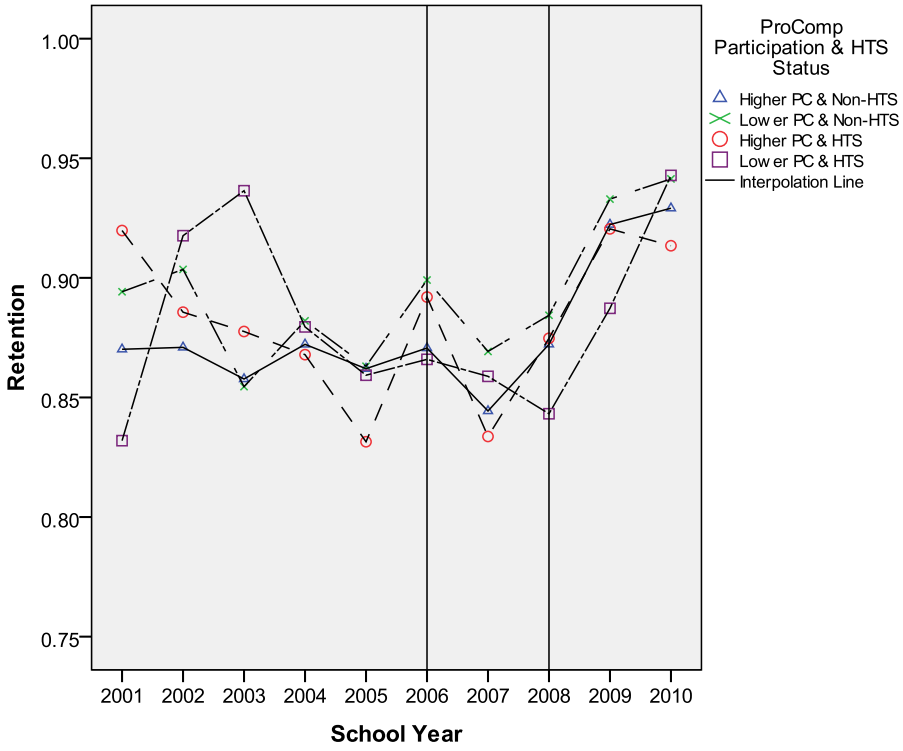


When compared in this way, HTS school retention rates do not appear to improve more than non-HTS school retention rates after the implementation of ProComp or after changes to ProComp were made and the recession began: HTS schools continue to have lower average retention rates than non-HTS schools.

[26] For the purposes of this comparison, I identified schools as "HTS" if they were ever identified as such under the *first* iteration of ProComp and as "non-HTS" otherwise. See Chapter 3 and Appendix C for details on first ProComp iteration HTS criteria.

Figure 4.4 shows average retention rates as a function of HTS status and ProComp participation levels.

Figure 4.4. *Trends in School-Level Retention Rates as a Function of HTS Status and ProComp Participation*



Higher participation non-HTS schools (N=34, depicted with △ marker), lower participation non-HTS schools (N=63, depicted with X marker), and HTS schools with high ProComp participation (N=18, depicted with○ marker) appear to follow a similar pattern of small, relatively sustained increases in retention rates starting in 2008-09. HTS schools with low ProComp participation (N=13, depicted with □ marker), however, seem to follow a different pattern. These schools had lower starting retention, a large spike in retention in the 2003-04 school year, and the greatest gains in retention after 2008-09. Although average retention for this group of schools was lowest in 2008-09, increases in retention after were so great that these schools had similar levels of average retention as non-HTS schools with low ProComp

participation and surpassed the average retention of the two other groups. Reasons behind the greater change in retention rates for this group of schools is not immediately clear but may be related to the small number of schools in this group. These trends and the impact of ProComp on these different groups of schools is further explored through the regression analyses.

Descriptive Statistics

Line plots of average school-level retention rates suggest an increase in retention starting in 2008-09 and that HTS schools with low ProComp participation saw the greatest increase during this time period. Relevant descriptive statistics are presented next for the two time-varying continuous variables included in the regression models. Variables that are constant or binary indicators are not presented because they either remain the same over time (e.g., indicator for changes to ProComp/start of the recession) or have set distributions (e.g., rules for HTS schools are such that roughly half of all eligible schools are designated "HTS" each year). Descriptive statistics for average starting retention remain constant after the first year and are thus included for 2001-02 only.

Table 4.1 shows the relevant univariate descriptive statistics for the time-varying continuous variables included in the regression models.

Table 4.1. *Descriptive Statistics for Time-Varying Continuous Variables*

Variable	Year-to-Year	N	Minimum	Maximum	Mean	SD
Change in Retention						
	2001-02 to 2002-03	107	-0.333	0.500	0.014	0.138
	2002-03 to 2003-04	110	-0.400	0.318	-0.025	0.126
	2003-04 to 2004-05	113	-0.273	0.389	0.008	0.134
	2004-05 to 2005-06	113	-0.489	0.283	-0.020	0.122
	2005-06 to 2006-07	114	-0.250	0.292	0.031	0.109
	2006-07 to 2007-08	115	-0.667	0.273	-0.031	0.125
	2007-08 to 2008-09	106	-0.270	0.561	0.019	0.122
	2008-09 to 2009-10	105	-0.183	0.487	0.049	0.108
	2009-10 to 2010-11	103	-0.249	0.173	0.008	0.079
New Teachers						
	2001-02 to 2002-03	110	0	0.670	0.135	0.108
	2002-03 to 2003-04	115	0	0.610	0.110	0.108
	2003-04 to 2004-05	115	0	0.210	0.051	0.052
	2004-05 to 2005-06	115	0	0.280	0.076	0.058
	2005-06 to 2006-07	115	0	0.530	0.111	0.098
	2006-07 to 2007-08	115	0	0.410	0.084	0.071
	2007-08 to 2008-09	115	0	0.610	0.114	0.096
	2008-09 to 2009-10	106	0	0.390	0.118	0.078
	2009-10 to 2010-11	105	0	0.310	0.093	0.067
Starting Retention						
	2001-02 to 2002-03	107	0.462	1.000	0.874	0.107

This table confirms the pattern illustrated in the figures above: average retention rates decreased slightly before the implementation of ProComp and increased moderately after implementation. Mean annual change in retention before ProComp is -0.6 percentage points; after ProComp it is 1.5 percentage points. Descriptive statistics also indicate the average proportion of new teachers increased slightly after the implementation of ProComp from 9.3% to 10.4%. Although subsequent models account for each school's starting retention separately, these descriptive statistics also provide readers with a sense for the range (46.2% to 100%) and mean (87.4%) of starting retention across all schools.

Inferential Findings

Having illustrated trends in retention rates for different schools over time and shown the relevant descriptive statistics for time-varying continuous variables included in the regression models, I now present results of the estimated the effect of ProComp on observed increases in retention rates generated from the difference-in-differences model discussed in the previous chapter. Results from these regression analyses indicate that, on average, ProComp has had a small, positive effect on school-level retention rates. These effects are more pronounced for schools with higher ProComp participation than for schools with lower ProComp participation. Additionally, the estimated effects of ProComp on retention rates appear larger for HTS schools than for non-HTS schools.

Retention analyses are presented in three phases. The first set of analyses estimate the effect of ProComp on retention rates; the second set of analyses estimate the effect of ProComp as a function of HTS status. In these two phases, models include only substantive variables. The third set of analyses include the substantive variables of ProComp and HTS status, as well as several conditioning variables that attempt to account for possible sources of bias.

Throughout these analyses, ProComp is defined in two ways: 1) as a binary indicator of implementation, that takes on a value of 1 after ProComp was implemented and 0 before implementation; and 2) as a binary indicator of ProComp participation, that takes on a value of 1 if a school had participation *at or above* the median ProComp participation in a given year and a 0 otherwise. The first way of defining ProComp examines the potential effects of ProComp as a policy by comparing changes in retention rates as a function simply of implementation. The second way of defining ProComp is a more nuanced approach that recognizes that the effect of ProComp on retention rates may vary as a function of the number of teachers who participate in

ProComp in a given year and school. In other words, models that consider ProComp participation ask a more specific question than those that rely only on a simple indicator of implementation: To what degree do changes in retention rates vary as a function of ProComp participation? If ProComp works to increase retention, one would expect higher retention in the subset of schools with participation at or above the median, and thus a positive estimate of the effect of ProComp on retention rates. Moreover, accounting for ProComp participation helps isolate the effect of ProComp from other factors that may impact retention after the implementation of ProComp, which is a weakness of considering only the implementation of ProComp.

Operationally, "exposure" to ProComp separates schools into those with participation at or above the median and those with participation below the median in a given year.[27] As defined here, the median measure is normative. That is, schools are identified as having ProComp participation that is either above or below the median relative to all other schools each year. The median is newly calculated each year to account for increasing ProComp participation that is a function of the program's rules (i.e., new teacher are required to join) and, possibly, of teacher buy-in. As shown in Chapter 3, median ProComp participation increases rapidly in the years following implementation and then more gradually in recent years, ranging from 42.4% to 76.5% in a given year.

School fixed-effects are included in all models in an effort to mitigate bias from any constant school factors that may influence retention rates. The reference school omitted from

[27] I considered several different ways of defining exposure to ProComp including median, quartiles, and continuous percent of ProComp participants. However, there was very little additional information gained from using the more complicated exposure measures of quartiles or percent so I decided the median was the best way to define exposure to ProComp.

each model by including school fixed-effects was selected because it had an average change in retention rates of 0 and is not a HTS school.

Effects of ProComp on Retention Rates (Phase 1)

This section presents results from analyses that estimate the effects of ProComp on retention rates. Table 4.2 summarizes results from the first two models that are fit to the data. The full population of schools (N=115) are specified as "treatment" schools for Model 1. In Model 2, a subset of the schools with ProComp participation at or above the median in a given year (N=59) are specified as "treatment" schools.

Table 4.2. *Unconditional Effects of ProComp on Retention Rates*

Variables	Model 1	Model 2
Intercept	-0.011	-0.012
	(0.043)	(0.043)
ProComp	0.021*	
	(0.008)	
PC Participation ($\geq$ Median)		0.027*
		(0.011)
PC Participation (< Median)		0.014
		(0.011)
R-Squared	0.025	0.026

**P < 0.01; *P < 0.05

Models 1 and 2 are the most basic models fit to the data as they include only a substantive variable for ProComp. Because school fixed-effects are included in all of these models, coefficient estimates for the intercept represent the average retention change for the omitted school. Although reported according to convention, these estimates are not interpretable and should therefore be ignored in Table 4.2 and in all subsequent tables of regression results.

Model 1 compares average changes in school-level retention before and after the implementation of ProComp. Parameter estimates from this model suggest the effect of ProComp on average annual increases in retention is 2.1 percentage points. That is, annual changes in retention after ProComp tend to be 2.1 percentage points higher, on average, than annual changes in retention before ProComp. Readers can also see this from the line graph illustrated in Figure 4.1 and the descriptive statistics presented in Table 4.1: The average change in retention over all years before ProComp is about -0.6 percentage points before and about 1.5 percentage points after ProComp. The difference between average change in retention is 2.1 percentage points. Operationally, the estimated effect of ProComp in Model 1 is simply a yearly weighted average of the difference in retention rates after ProComp implementation.

To evaluate the magnitude of this effect estimate, as well as the explanatory power of Model 1, I draw on several commonly used statistical criteria. According to conventional tests of significance, the effect estimate of ProComp is statistically significant with a p-value of less than 0.05. In the context of classical inference, this is typically interpreted as follows: Given sample estimates, there is a 5% chance the true population estimate is nonzero. However, such an interpretation of statistical significance assumes the data represent a sample of a larger population. In the context of this study, for which models include the entire population of schools, statistical significance has no clear interpretation. Nonetheless, estimates of statistical significance are included in the table above (along with standard errors for all coefficient estimates) because readers commonly expect such statistics to be included in results such as these. Though mentioned here and included in tables of regression results, statistical significance is not discussed in narrative interpretations of subsequent models.

The R^2 coefficient in the Table 4.2 provides a measure of explanatory power of each model – that is, the variability in the outcome associated with variables included in each model. For Model 1, this estimate suggests ProComp accounts for just 2.5% of the variability in changes in retention rates. While clearly there are many things that affect changes in retention rates, there is little evidence to suggest such changes are systematically related ProComp as it has been defined here.

Substantively, the estimated effect of ProComp in Model 1 – 2.1 percentage points – may appear quite small given that retention could theoretically range from 0 to 100%. Retention in DPS, however, does not effectively range from 0 to 100% but from roughly 50 to 100% with a mean of approximately 87%. Relative to this more restricted range, an effect of 2.1 percentage points could be interpreted as more substantial in magnitude – 2.1/50 is 4.2% of the effective range. This estimate yields an effect size of 0.16, which is still considered small according to Cohen's conventions. However, the effect size does not take into account the obvious "ceiling" for retention.

The "ceiling" for retention is 100%: school-level retention cannot exceed this. The effect of this ceiling is likely to restrict the magnitude of changes possible for schools that start with higher retention because possible gains in retention are limited. Considering the parameter estimate of the effect of ProComp generated from Model 1 is not conditioned on starting retention, the magnitude of the 2.1 percent effect estimate seems more impressive.

Because factors not accounted for in the model may drive retention rates, readers should be wary of interpreting this aggregated effect as evidence that ProComp causes increases in retention rates. For example, any impacts from factors that occur after the implementation of ProComp – such as the recession – would be (errantly) attributed to ProComp in this model.

Further, time-varying factors that may influence retention are not accounted for in this approach. As such, subsequent analyses include conditioning variables that attempt to account for some potential sources of bias. In other words, because this effect estimate is generated from a model that has yet to be conditioned on variables that may bias the estimate, readers should be wary of the 2.1 percent ProComp estimate generated of Model 1.

Like Model 1, Model 2 compares average changes in school-level retention before and after ProComp but this model does so with ProComp defined as a function of rates of ProComp participation. Parameter estimates from Model 2 suggest the effect of ProComp on the average change in retention rates is 2.7 percentage points for schools with participation at the median percent or higher and 1.4 percentage points for schools with participation below the median percent participation. The explanatory power of this model is similarly weak to that of Model 1: $R^2 = 2.6\%$.

These effect estimates appear to be meaningful for higher participation schools but seem less so for lower participation schools. For higher participation schools, a 2.7 point increase in annual retention is 5.4% of the effective range; for lower participation schools, a 1.4 point increase in annual retention is 2.8% of the effective range. The effect sizes of these estimates remains small: for high participation schools the effect size is 0.21 and for low participation schools it is 0.11. Substantively, this suggests ProComp has had small positive effects but may be less meaningful for schools with ProComp participation that is below the median percent.

Estimates from Model 2 provide some evidence to suggest ProComp may impact school-level retention differentially as a function of participation. ProComp participation (as defined here) suggests a difference in average change of annual retention rates of 1.3 percentage points between schools at or above the median and those below the median. Again, the positive

difference is expected if ProComp does in fact increase retention. However, as with Model 1, estimates from Model 2 are not conditioned on variables that may bias these estimates. Furthermore, it is feasible these estimates are subject to selection bias as there may be factors that drive both ProComp participation and retention. Again, these variables are factored out of the model if they are constant but not if the vary over time.

Effects of ProComp on Retention Rates as a Function of HTS Status (Phase 2)

The estimated effects of ProComp for HTS schools is of particular interest in this dissertation and extant research has yet to conclude that financial incentives improve retention at high-poverty schools (for the exception – provided incentives are large enough – see Springer et al., 2009). This section presents results from more complex analyses that estimate the effects of ProComp on retention rates as a function of HTS status. Table 4.3 summarizes results from models that include variables for ProComp (implementation and participation), HTS status, and the interaction of ProComp and HTS status.

Table 4.3. *Unconditional Effects of ProComp on Retention Rates as a Function of HTS Status*

Variables	Model 3	Model 4
Intercept	-0.006	-0.005
	(0.043)	(0.043)
ProComp	0.011	
	(0.010)	
PC Participation (≥ Median)		0.008
		(0.014)
PC Participation (< Median)		0.014
		(0.013)
HTS	-0.017	-0.015
	(0.032)	(0.032)
ProComp*HTS	0.039	
	(0.033)	
PC Participation (≥ Median) * HTS		0.053
		(0.035)
PC Participation (< Median) * HTS		0.013
		(0.037)
R-Squared	0.028	0.031

**P < 0.01; *P < 0.05

Parameter estimates from Model 3 suggest the effect of ProComp on average annual retention is 3.3 percentage points for HTS schools and 1.1 percentage points for non-HTS schools.[28] Relative to the restricted range of retention in DPS (roughly 50-100%), a 3.3 percent effect in annual retention for HTS schools a 2.7 point increase in annual retention is 6.6% of the effective range. This yields a medium effect size of 0.25. On the other hand, a 1.1 percent effect in annual retention for non-HTS schools is 2.2% of the effective range with a small effect size of 0.08. Thus, the conditional parameter estimate of the effect of ProComp associated with changes in annual retention rates for non-HTS clearly not as large as the effect for HTS schools.

[28] Simple calculations are required to obtain parameter estimates of the effect of ProComp from this set of more complex models. These calculations and tables specifying the comparisons made in each model are provided in Appendix J.

The addition of the HTS indicator and the interaction between ProComp and HTS status in Model 3 adds little explanatory power relative to the model that included only an indicator for ProComp (R^2 =2.8%, as compared to R^2 =2.5% for Model 1). This suggests that, although there is great variation in retention rates, very little of this variation is systematically related to ProComp and HTS status.

Effect estimates from Model 3 suggest, on average, HTS schools outperformed non-HTS schools on retention gains after the implementation of ProComp. While it is feasible these differences are due to ProComp, it is hard to attribute these differential effects to the program entirely. In particular, factors that occur after the implementation of ProComp and that affect HTS schools differently than non-HTS schools (e.g., the number of new teachers) have the potential to bias these estimates. As with estimated effects generated from unconditional models presented previously, readers should be cautious about interpreting effect estimates from Model 3 as evidence that ProComp causes differential increases in retention rates for HTS schools relative to non-HTS schools. This model does not include conditioning variables that attempt to account for some potential sources of bias.

Model 4 yields unconditional parameter estimates of the effect of ProComp as a function of both participation and HTS status. Parameter estimates from Model 4 suggest the effect of ProComp on average annual retention is 4.6 percentage points for higher participation HTS schools and 0.8 percentage points for higher participation non-HTS schools. These effect estimates appear to be meaningful for higher participation HTS schools but seem less so for higher participation non-HTS schools. Relative to the restricted scale of retention in DPS, a 4.6 point effect in annual retention for HTS schools is 9.2% of the effective range; a 0.8 point effect in annual retention for non-HTS schools is only 1.6% of the effective range. The effect size for

high participation HTS schools is 0.36 and just 0.06 for non-HTS schools. Substantively, this suggests ProComp may be less meaningful for higher participation non-HTS schools than for higher participation HTS schools.

For schools with ProComp participation that is below the median percent, Model 4 suggests the effect of ProComp on average annual retention is 1.2 percentage points for HTS schools and 1.4 percentage points for non-HTS schools. The boost in retention rates for higher participation HTS schools is not observed for lower participation HTS schools. In essence, the effect of ProComp for lower participation schools does not appear to be a function of HTS status. Substantively, effect estimates for lower participation schools are relatively small in magnitude when considered against the restricted range of retention in DPS. Effect estimates is roughly 2.5% of the effective range and yields and effect size of roughly 0.1. In defining ProComp as a measure of participation, Model 4 adds some additional explanatory power relative to previous models, though overall, it still explains very little of the variation in retention rates (R^2 = 3.1%).

Thus, parameter estimates from Model 4 suggests HTS schools had greater gains in retention after the implementation of ProComp provided they also had ProComp participation at or above the median percent. These analyses introduce more nuance into one's understanding of how ProComp is associated with retention rates for different types of schools. ProComp appears to have a greater effect on HTS school relative to non-HTS schools but this effect is not present for schools with lower ProComp participation. Although the positive difference between higher and lower participation schools is anticipated if ProComp does in fact increase retention, the positive difference between higher participation HTS schools and higher participation non-HTS schools is not necessarily expected. This difference (between HTS and non-HTS higher

participation schools) suggests that, in schools where there are many ProComp participants, teachers may respond to the HTS incentive.

These effects, however, are not conditioned on variables that may bias these estimates. Additionally, concerns about selection bias and events that occur after the implementation of ProComp and that affect HTS schools differently than non-HTS schools (e.g., number of new teachers) have the potential to bias these estimates. As such, readers should be cautious about interpreting effect estimates from Model 4 as evidence that ProComp causes differential increases in retention rates for higher participation HTS schools relative to higher participation non-HTS schools and lower participation schools.

Conditional Effects of ProComp on Retention Rates as a Function of HTS Status (Phase 3)

The following analyses specify models that attempt to further minimize potential sources of bias on parameter estimates for effects associated with ProComp described above. By including covariates in the model, I attempt to isolate the effect of ProComp from effects these variables may have on retention rates. I explore the sensitivity of parameter estimates for effects associated with ProComp by fitting a number of models to the data that included the following variables:

1. Changes to ProComp and Start of Economic Recession: Indicator for 2008-09 school year
2. Starting Retention: Proportion of teachers retained in 2001-02 or first year for which retention data was available for each school
3. New Teachers: Proportion of new teachers in a given year and school

4. School Grade Level: Categorical variable indicating whether school is an Elementary/K-8, Middle, or High School

These variables are included in the models because they represent factors that have potential to influence retention rates. For example, if teachers respond to financial incentives, one would assume the changes made to ProComp, especially the increase in size and availability of the HTS incentive, might influence retention rates upward. It is also reasonable to assume that the economic recession and increase in unemployment would increase retention rates. Changes to ProComp and the start of the recession are both possible sources of positive bias. Because these factors are confounded with the implementation of ProComp, any potential boost in retention from these factors may (errantly) be attributed to ProComp.

To attempt to account for the "ceiling effect" discussed earlier, starting retention is also included in conditional models. For schools with high starting retention – and little room for positive gains in retention – the ceiling effect may introduce negative bias into parameter estimates of the effect of ProComp associated with retention rates. Furthermore, school grade level is included in conditional models to account for any difference in retention trends across different types of schools (e.g., elementary schools as compared to middle schools). Because elementary and K-8 schools are often smaller than secondary schools, including variables to represent school grade level should also help account for differences in school size.

Lastly, the proportion of new teachers is included in the conditional models. Recall that the line plot presented in Figure 4.4 suggested HTS schools with low ProComp participation had greater gains in retention than HTS schools with high ProComp participation. I hypothesize this might be related to the number new teachers in a school as new teachers help explain high ProComp participation and may indicate historical turnover. Moreover, because new teachers are

more likely to work in high-poverty schools (Clotfelter, Ladd, & Vigdor, 2010; Hanushek, 2007), it is essential to include a variable representing the proportion of new teachers.

Models 5-8 represent analyses conducted to test the robustness of estimates from Models 1-4. Results from all four models are summarized in Table 4.4 to aid readers in comparing the conditional models to the unconditional models. There are four appropriate comparisons readers can make between models in Table 4.4: 1) Models 1 and 5; 2) Models 2 and 6; 3) Models 3 and 7; and 4) Models 4 and 8.

Table 4.4. *Conditional Effects of ProComp on Retention Rates*

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Intercept	-0.011	-0.012	-0.006	-0.005	-0.846	-1.031	-0.930	-0.858
	(0.043)	(0.043)	(0.043)	(0.043)	(2.701)	(2.751)	(2.702)	(2.721)
ProComp	0.021*		0.011		0.017*		0.009	
	(0.008)		(0.010)		(0.009)		(0.010)	
PC Participation (≥ Median)		0.027*		0.008		0.022*		0.006
		(0.011)		(0.014)		(0.011)		(0.014)
PC Participation (< Median)		0.014		0.014		0.012		0.011
		(0.011)		(0.013)		(0.011)		(0.032)
HTS			-0.017	-0.015			-0.012	-0.011
			(0.032)	(0.032)			(0.032)	(0.032)
ProComp*HTS			0.039				0.032	
			(0.033)				(0.033)	
PC Participation (≥ Median) * HTS				0.053				0.044
				(0.035)				(0.035)
PC Participation (< Median) * HTS				0.013				0.013
				(0.037)				(0.037)
Starting Retention					0.904	1.104	1.000	0.923
					(2.926)	(2.941)	(2.927)	(2.947)
New Teachers					0.222**	0.219**	0.219**	0.210**
					(0.059)	(0.059)	(0.059)	(0.059)
Changes/Recession					0.003	0.003	0.000	0.000
					(0.014)	(0.014)	(0.014)	(0.014)
Middle School					0.073	0.090	0.080	0.074
					(0.233)	(0.234)	(0.233)	(0.235)
High School					-0.038	-0.039	-0.040	-0.039
					(0.067)	(0.067)	(0.067)	(0.067)
R-Squared	0.025	0.026	0.028	0.031	0.041	0.042	0.044	0.045

**P < 0.01; *P < 0.05

Conditional models yield slightly smaller parameter estimates for the effect of ProComp associated with retention rates. Model 5 suggests the effect of ProComp on the average change in retention is 1.7 percentage points as compared to the 2.1 point estimate generated from Model 1. This suggests parameter estimates from the unconditional models reflect bias due to omitted variables. While smaller, the 1.7 point effect estimate is meaningful nonetheless. In relation to

the restricted range of retention in DPS (approximately 50 to 100%), a 1.7 point effect on annual retention is 3.4% of the effective range and yields and effect size of 0.13. Model 5 also has greater explanatory power than Model 1(R^2 = 4.1% as compared to 2.5%), but still fails to account for much of the variation in retention rates.

Estimated effects for conditional variables are similar in magnitude for Models 5-8. For Model 5, these estimates suggest that every 1 percent increase in starting retention is associated with a 90 percentage point decrease in annual retention rates. Though quite large in magnitude, this is estimate is not surprising as one should expect less change in retention at schools that started with higher levels of retention. The estimated effect for the proportion of new teachers suggests that every 1 percent increase in new teachers is associated with a 22 percentage point increase in annual retention rates. This is also logical as vacancies resulting from teacher turnover are often filled by new teachers. The coefficient estimate for the time ProComp changed and the recession started suggests only a 3 percent increase in retention rates this year. Thus, these factors appear to have a negligible effect on retention rates, at least as they are currently defined. Estimated effects for school grade level suggest that, relative to elementary/K-8 schools, retention gains are 7 percentage points higher for middle schools and 4 percentage points lower for high schools.

Parameter estimates from Model 6 suggest the effect of ProComp on the average change in retention is 2.2 percentage points for schools with participation at the median percent or higher and 1.2 percentage points for schools with below-median participation. While slightly smaller in magnitude, these estimates are substantively similar to those generated from the unconditional model (Model 2). Like Model 5, this model also has more relative explanatory power (R^2 = 4.2%).

As with unconditional models, ProComp appears to have a greater substantive impact on higher participation schools than on lower participation schools. A 2.2 point increase in annual retention for higher participation schools is 4.4% of the effective range and a 1.2 point increase for lower participation schools is 2.4% of the effective range. These estimates yield effect sizes of 0.17 and 0.9.

Model 7 suggests the effect of ProComp on the average change in retention is 2.9 percentage points for HTS schools and 0.9 percentage points for non-HTS schools. Although these effect estimates are smaller than those from the unconditional model, the positive difference between HTS schools and non-HTS schools remains. Furthermore, the magnitude of the effect estimate for HTS schools seems meaningful. A 2.9 point effect in annual retention for HTS schools is 5.8% of the effective range. On the other hand, a 0.9 point effect in annual retention for non-HTS schools is only 1.8% of the effective range. Thus, the estimated effect of ProComp associated with retention rates for non-HTS schools may not be practically significant. These estimates yield effect sizes of 0.22 and 0.07. The explanatory power of Model 7 is an improvement over the unconditional model but still explains relatively little of the total variation in retention rates (R^2 =4.4%).

Model 8 yields conditional parameter estimates of the effect of ProComp as a function of both participation and HTS status. For higher participation schools, parameter estimates suggest the effect of ProComp on average annual retention is 3.9 percentage points for HTS schools and 0.6 percentage points for non-HTS schools. These effect estimates appear to be meaningful for higher participation HTS schools but seem less so for higher participation non-HTS schools. Relative to the restricted scale of retention in DPS, a 3.8 point effect is 7.8% of the effective range, while a 0.6 point effect in annual retention for non-HTS schools is only 1.2% of the

effective range. These estimates yield effect sizes of 0.3 and 0.05. Arguably, this suggests ProComp is less meaningful for non-HTS schools than for HTS schools with participation at or above the median percent.

For schools with ProComp participation below the median percent, parameter estimates from Model 8 suggests the effect of ProComp on average annual retention is 1.3 percentage points for HTS schools and 1.1 percentage points for non-HTS schools. As with estimates generated from the unconditional model (Model 4), parameter estimates from Model 8 suggest there is not a substantial difference in the estimated effect of ProComp as a function of HTS status for schools with lower participation. Moreover, estimated effects of ProComp for lower participation schools are relatively small in magnitude – roughly 2.4% of the effective range, with an effect size of roughly 0.09. As is true of all other conditional models, the explanatory power of Model 8 is an improvement over the unconditional model but still explains relatively little of the total variation in retention rates (R^2 =4.5%).

Parameter estimates from Model 8 suggest HTS schools had greater gains in retention after the implementation of ProComp provided they are higher participation schools. This pattern mirrors that observed for the unconditional model presented above (Model 4), though effects from this model are expected to be a more accurate estimates of the effect of ProComp because they are isolated from effects of factors represented by the conditioning variables.

The more complex models presented above include conditioning variables to decrease bias in the parameter estimates for substantive variables representing ProComp and HTS status. However, the inclusion of these conditioning variables in this set of models begs the question of whether one would expect the effects associated with ProComp and HTS to differ as a function of the conditioning variables. For example, coefficient estimates suggest the proportion of new

teachers positively affect changes in retention – the more new teachers in a school, the larger the expected changes in retention. In addition to the effect of new teachers on retention rates, it is also possible there may be a differential effect of ProComp on retention rates *as a function of* new teachers.

To test the effect of ProComp as a function of the conditioning variables, I specify a series of models that include interaction terms between substantive and conditioning variables (see Appendix L for table summarizing the results from these models). Parameter estimates of the effect of ProComp appear to be sensitive to the proportion of new teachers and grade level but are robust to the inclusion of variables representing changes to ProComp/start of the recession and starting retention. This is logical as there are reasons to believe the effect of ProComp may differ as a function of the proportion of new teachers and grade level. For example, one might expect ProComp to have a larger effect on average retention rates in schools with larger numbers of new teachers, even accounting for participation, because these teachers have joined DPS after the implementation of ProComp. The decision of these teachers to work in DPS may be a result of their support for incentive pay or, at least, a sign that they are not opposed to such programs. Accordingly, these sensitivity tests suggest a larger effect of ProComp on retention rates at schools with more new teachers. Furthermore, results suggest the effect of ProComp is greatest for middle schools, followed by elementary/K-8 schools, and then high schools.

Summary of Retention Analyses

Parameter estimates from the conditional models are expected to be more accurate estimates of the effect of ProComp associated with retention rates because they are isolated from factors represented by conditioning variables. As such, readers should consider the parameter

estimates generated from the conditional models (Models 5-8) to be the estimated effects of ProComp on retention rates.

To sum, parameter estimates of the effect of ProComp associated with retention rates from models including conditioning variables are presented in Table 4.5.

Table 4.5. *Estimated Effects of ProComp a Function of Participation and HTS Status*

Schools	All	HTS	Non-HTS
All	1.7	2.9	0.9
Higher Participation	2.2	3.9	0.6
Lower Participation	1.2	1.3	1.1

These estimates suggest ProComp has had a greater impact on retention rates for schools with higher ProComp participation and for HTS schools. Arguably, these findings have important policy implications as they suggest teachers may respond to ProComp and the HTS incentive, particularly in schools that have many ProComp participants. However, when considering effects associated with ProComp, readers should keep in mind that there may be factors that drive both ProComp participation and retention. Selection bias (and other sources of bias) is factored out of estimated effects if they are constant but not if they vary over time. Additionally, other events that occurred after ProComp and differentially affect schools depending on HTS status (e.g., Teach for America) have potential to bias these estimates. Nevertheless, these analyses point to the positive effect of ProComp on average retention rates. These findings are notable as similar studies, with incentives ranging from $1800 to $5000, have not found effects of financial incentives on teacher retention (Clotfelter, Glennie, Ladd, & Vigdor, 2008; Steele, Murnane & Willett, 2009) and some research suggests that teachers do not respond to financial incentives (Milanowski et al., 2009).

Retention and Teacher Quality

Having determined the impact of ProComp on changes in retention rates, I next explore the question of *who* was retained. This analysis is purely descriptive; I am unable to determine whether increased retention yielded improved overall quality or whether improvements in overall quality resulted in increased retention. Rather, this analysis investigates whether above-average quality is observed in schools that had greater changes in retention and higher levels of retention. As detailed in Chapter 3, teacher quality is operationalized as both median school-level student growth percentiles (SGPs) for reading and mathematics and as average years experience in a given school and year.

I first present descriptive statistics for each of the teacher quality measures over time and then yearly change in these measures. Student growth data is not available for 2001-02 or 2002-03 because the current state assessment – the Colorado Student Assessment Program (CSAP) – was not developed at that time. Additionally, these data are not available for the most recent year (2010-11) because the state does not release test-score achievement data until late summer.

Table 4.6 shows descriptive statistics of teacher quality measures within each year.

Table 4.6. *Descriptive Statistics for Teacher Quality Variables*

Variable	Year	N	Minimum	Maximum	Mean	SD
Math SGPs						
	2003-04	113	29	74	44.26	10.03
	2004-05	113	26	70	45.24	9.87
	2005-06	114	17	77	46.44	12.69
	2006-07	114	14	85	50.92	13.60
	2007-08	113	16	84	51.33	11.56
	2008-09	104	25	85	52.97	11.75
	2009-10	103	32	86	54.38	10.62
Reading SGPs						
	2003-04	113	24	72	44.89	9.09
	2004-05	113	24	93	46.12	11.26
	2005-06	114	28	83	48.57	10.27
	2006-07	114	19	91	46.74	11.24
	2007-08	113	18	74	51.70	9.28
	2008-09	104	23	77	50.24	9.89
	2009-10	103	37	92	54.52	8.41
Years Experience						
	2001-02	110	2.54	14.93	8.38	2.51
	2002-03	114	2.86	16.75	8.32	2.62
	2003-04	115	3.00	14.78	8.30	2.41
	2004-05	115	2.40	15.25	8.71	2.37
	2005-06	115	2.24	15.07	8.49	2.48
	2006-07	115	3.50	15.52	8.85	2.31
	2007-08	115	2.76	16.00	8.88	2.58
	2008-09	106	3.08	15.27	8.64	2.41
	2009-10	105	4.09	15.16	8.86	2.30
	2010-11	103	4.09	15.53	9.16	2.48

Readers will notice mean SGPs are often slightly above or below the 50th percentile because these data are normed to the entire state of Colorado, not just DPS. School-level mean years of teaching experience, however, remains fairly constant over time.

Table 4.7 shows descriptive statistics of the year-to-year change in teacher quality measures. When viewed this way, it becomes clear that SGPs are very volatile; both the mean and range of these measures vary greatly from one year to the next. As such, it is not clear how accurately these measures capture overall teacher quality as opposed to say, measurement error (McCaffrey et al., 2003). Thus, it is important to examine these measures over time and within a single year. Furthermore, it is important to examine teacher quality operationalized as years of teaching experience because there is far less variability in this measure relative to SGPs.

Table 4.7. *Descriptive Statistics for Year-to-Year Change in Teacher Quality Variables*

Variable	Year-to-Year	N	Minimum	Maximum	Mean	SD
Math SGPs						
	2003-04 to 2004-05	111	-18	20	0.46	8.83
	2004-05 to 2005-06	112	-39	18	1.70	12.53
	2005-06 to 2006-07	113	-63	57	4.65	14.87
	2006-07 to 2007-08	112	-45	44	0.35	13.99
	2007-08 to 2008-09	103	-28	45	1.50	11.84
	2008-09 to 2009-10	102	-35	41	1.59	11.42
Reading SGPs						
	2003-04 to 2004-05	111	-23	30	1.40	11.32
	2004-05 to 2005-06	112	-24	29	2.05	10.40
	2005-06 to 2006-07	113	-28	31	-1.84	10.16
	2006-07 to 2007-08	112	-53	29	5.05	11.72
	2007-08 to 2008-09	103	-51	59	-1.70	12.03
	2008-09 to 2009-10	102	-14	41	4.25	9.58
Years Experience						
	2001-02 to 2002-03	109	-4.46	7.08	0.03	1.52
	2002-03 to 2003-04	113	-5.43	4.71	-0.01	1.76
	2003-04 to 2004-05	114	-3.61	3.14	-0.40	1.13
	2004-05 to 2005-06	114	-6.76	5.00	-0.22	1.40
	2005-06 to 2006-07	114	-3.23	3.31	0.36	1.24
	2006-07 to 2007-08	114	-6.81	4.19	0.03	1.42
	2007-08 to 2008-09	105	-3.50	2.24	-0.28	1.06
	2008-09 to 2009-10	104	-4.25	3.71	0.25	1.14
	2009-10 to 2010-11	102	-3.10	3.22	0.29	1.04

Next, I present scatterplots of the relationship between retention and overall teacher quality. This relationship is presented over time (i.e., change in retention and quality) and within a single year (i.e., levels of retention and quality) to give a sense for whether the relationship differs as a function of time. Data from the 2009-10 school year is presented to illustrate the relationship between retention and quality in a single year for two reasons. First, it is the most recent year for which all teacher quality measures are available. Second, if there is a selection effect of ProComp, teachers may move around immediately after implementation to maximize their earning potential and satisfy their teaching preferences. As such, the year(s) immediately following the implementation of ProComp may not be as representative of the average effect of ProComp on retention as the most recent year.

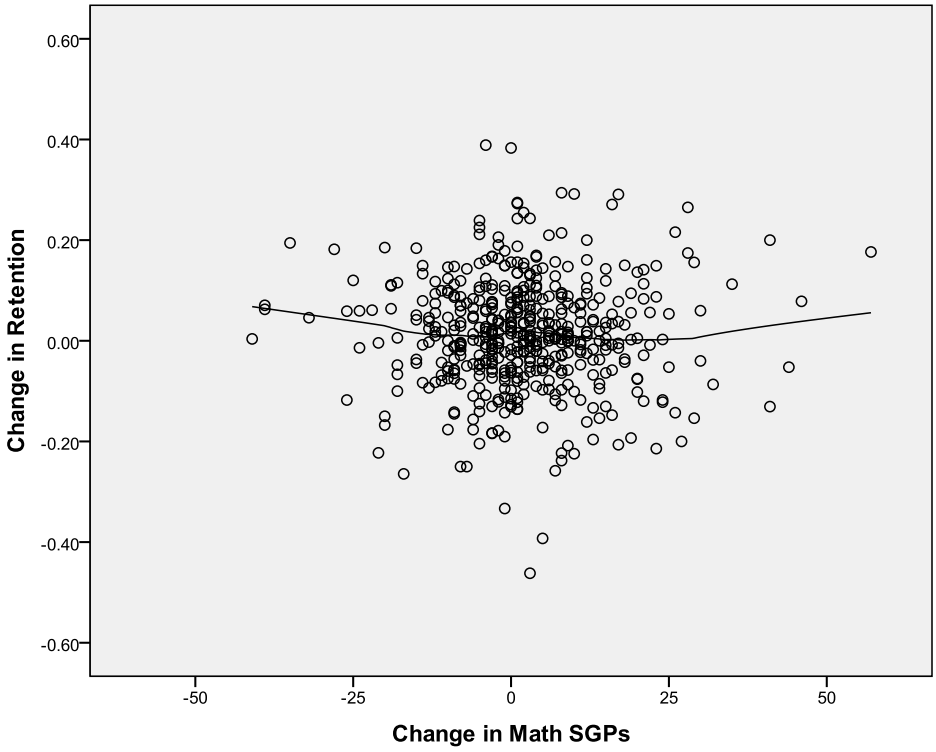
Scatterplots below examine this relationship via four different descriptive approaches:

1. Changes in retention and changes in overall teacher quality over last decade (SGPs: 2001-02 to 2009-10; years experience 2001-02 to 2010-11)
2. Changes in post-ProComp retention and changes in post-ProComp overall teacher quality (SGPs: 2005-06 to 2009-10; years experience: 2005-06 to 2010-11)
3. Changes in retention and changes in overall teacher quality from 2008-09 to 2009-10
4. Snapshot of retention level and overall teacher quality level in 2009-10

Plots representing the relationship between retention and median SGPs for mathematics are presented below; plots of retention and median SGPs for reading and years of teaching experience are in Appendix L. Three outliers have been removed from plots of changes from the last decade and after the implementation of ProComp (Figures 4.5 and 4.6, as well as corresponding figures of median SGPs for reading and years of teaching experience in Appendix L). Each of these three schools has observations across multiple years that are atypical of other schools in the district. This is likely related to the small size of these schools: all are elementary schools that have only 11 to 21 ProComp-eligible teachers employed at each school in any given year. Because I am concerned the observations for these schools are more a function of the small number of teachers who work at each, rather than the relationship between changes in retention and changes in overall teacher quality, I removed them from plots that examine change across multiple years.

Figure 4.5 shows the relationship between changes in retention and changes in median SGPs for mathematics over the last decade.

Figure 4.5. *Changes in Retention and Median SGPs for Mathematics over Last Decade (2001-02 to 2010-11)*



A smoothed line of best fit[29] is superimposed on the scatterplot above and those that follow to allow readers to get a sense of the relationship between changes in retention and changes in overall teacher quality.

Figure 4.6 shows the relationship between changes in retention and changes in median SGPs for mathematics after the implementation of ProComp.

[29] The smoothed line is fit to the data via the Epanechnikov kernel function.

Figure 4.6. *Changes Retention and Median SGPs for Mathematics After ProComp (2005-06 to 2010-11)*

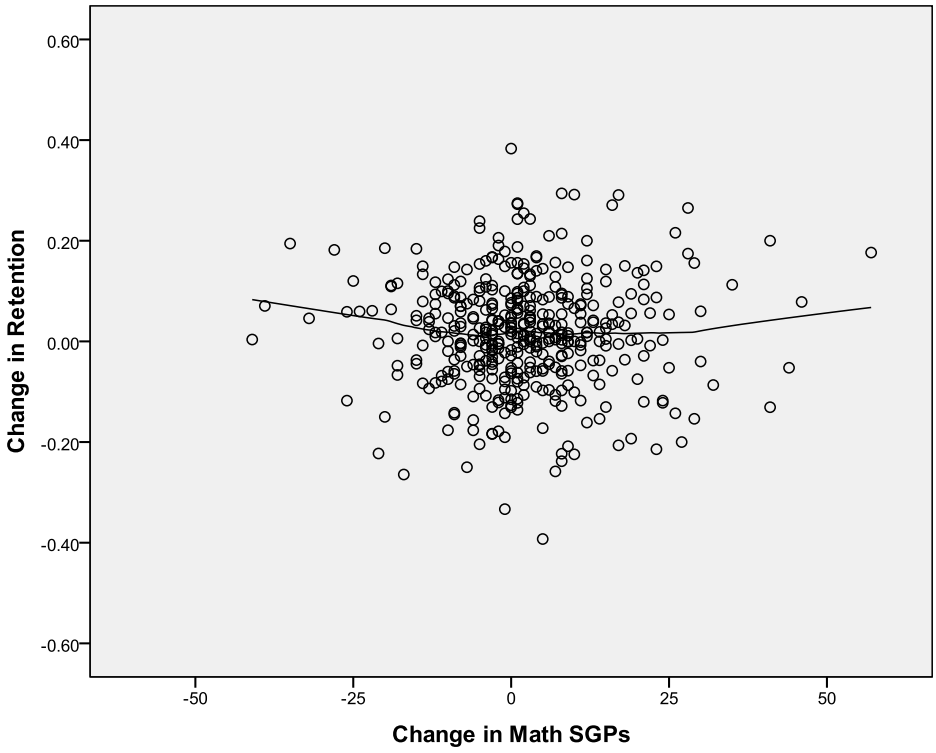
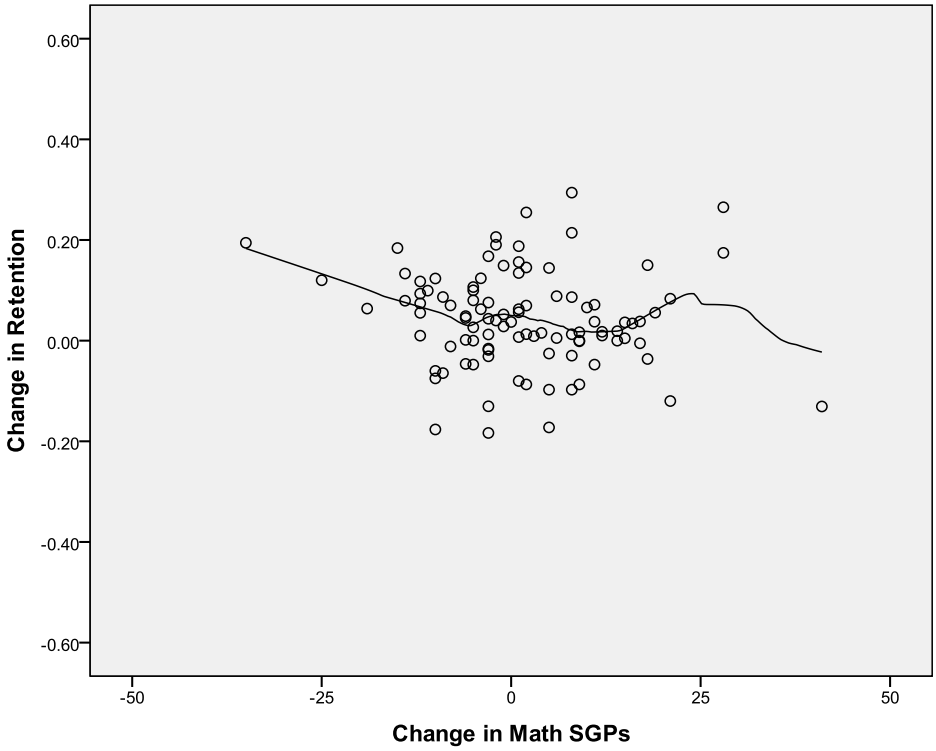


Figure 4.7 shows the relationship between changes in retention and changes in median SGPs for mathematics from 2008-09 to 2009-10.

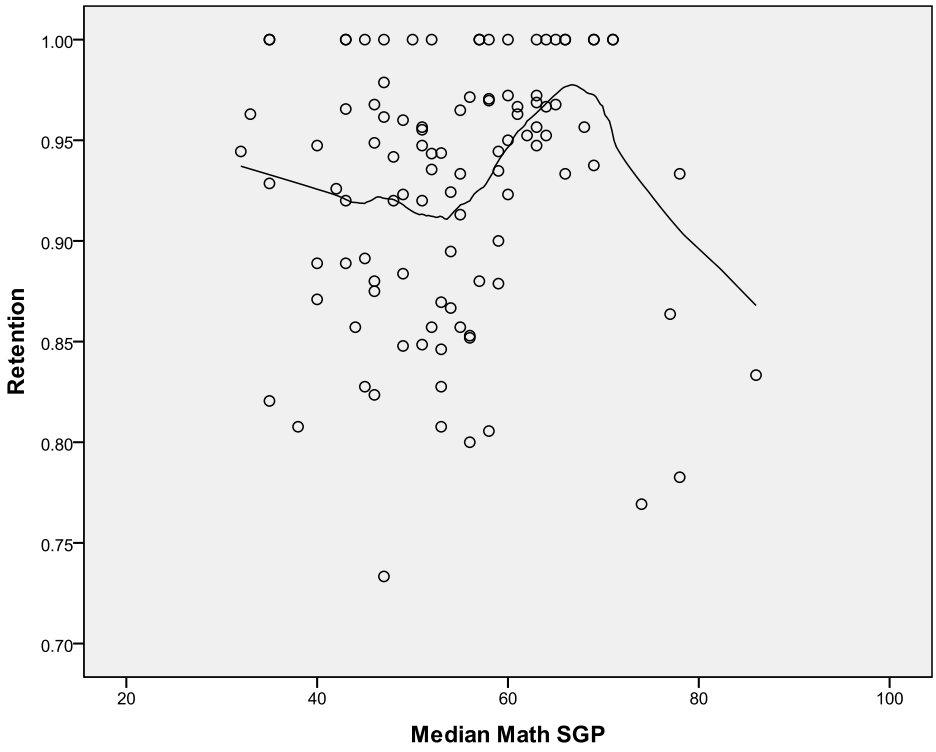
Figure 4.7. *Changes Retention and Median SGPs for Mathematics from 2008-09 to 2009-10*



As readers can see from Figures 4.5-4.7, there does not appear to be a linear relationship between changes in retention and changes in median SGPs for mathematics.

A similar plot is presented in Figure 4.8 that shows the relationship between retention level (as opposed to change in retention) and median SGPs for mathematics for 2009-10. This is presented to illustrate the relationship between retention and overall teacher quality within a single year to see the extent to which it differs from the relationship between changes in retention and changes overall teacher quality.

Figure 4.8. *2009-10 Retention and Median SGPs for Mathematics*



Although the relationship between retention and quality is clearly affected by a strong ceiling effect, there does not appear to be a linear relationship in the 2009-10 school year. Accordingly, analytic approaches to describe the relationship between these two variables are somewhat limited (e.g., Pearson's Correlation is not appropriate as an estimate of the relationship).

As readers can see, there does not appear to be any linear relationship between retention levels in 2009-10 and median overall teacher quality either. However, there may still be a relationship between retention and quality, albeit nonlinear. To explore this possibility, I compare mean overall teacher quality for schools with average retention changes or 2009-10 retention level that was in the top quartile to the mean overall teacher quality of all schools to see whether schools with greater changes in retention or the highest levels of retention in 2009-10 also had above average overall teacher quality. As with the scatterplots, four different time

periods are examined to compare retention and overall teacher quality: 1) changes over the last decade; 2) changes after ProComp; 3) changes from 2008-09 to 2009-10; and level in 2009-10.

Table 4.8 shows these descriptive statistics for all schools first and then for the subset of schools with retention change or level in the top quartile separately for the four descriptive comparisons listed above.

Table 4.8. *Higher Overall Teacher Quality for Schools with the Highest Retention*

Retention:	Decade Change (2001-02 to 2010-11)		Post-ProComp Change (2005-06 to 2010-11)		Year Change 2008-09 to 2009-10		Snapshot 2009-10	
	All Schools	*Top Quartile*	*All Schools*	*Top Quartile*	*All Schools*	*Top Quartile*	*All Schools*	*Top Quartile*
Reading SGPs	1.54	1.97	1.55	1.82	1.59	2.92	54.52	55.58
Math SGPs	2.18	2.30	2.23	2.30	4.25	6.12	54.38	56.54
Years Experience	0.096	0.140	0.123	0.291	0.253	0.421	8.86	9.04

Across each of these four ways of comparing the data, one can observe that schools with average changes in or 2009-10 levels of retention in the top quartile also have teacher quality changes or levels that are above average. This is true regardless of the way in which teacher quality is defined. Although there is no attempt to establish directionality, this exploratory analysis suggests there may be a positive, nonlinear relationship between retention and teacher quality. Although purely descriptive, these findings warrant further consideration in follow-up studies as prior research not only raises questions about the potential effects of financial incentives on teacher retention (Clotfelter, Glennie, Ladd, & Vigdor, 2008; Steele, Murnane, & Willett, 2009) but, suggests that high-quality teachers are even less likely to respond to financial incentives than average teachers (Clotfelter, Ladd, & Vigdor, 2010).

The following chapter presents the interview analyses that provide some information about why effects presented in this chapter are observed. Although these data are not rich enough

to allow one to sort out differential responses to financial incentives as a function of quality, they do enumerate the factors teachers consider when making their employment decisions and provide insight about the extent to which ProComp and the HTS incentive factor into such decisions.

Chapter 5

Understanding the Impact of ProComp on Retention and Other Employment Decisions

Findings presented in the previous chapter suggest the effect of ProComp on average change in retention rates is practically significant. This chapter presents interview findings to help explain why these meaningful effects are observed. In addition to helping readers understand the quantitative results, interview findings highlight several challenges that may limit the possibility of future ProComp effects that are larger in magnitude than those found in this study.

This chapter is primarily related to Research Question 3:

What do teachers report about how ProComp and the HTS incentive are or are not factored into their end-of-the-year employment decisions?

Analyses to answer this question focus on understanding how teachers make their employment decisions and the role of ProComp and the HTS incentive in these decisions.

Additionally, this chapter deals with Research Question 4:

What do teachers report about how the HTS designation of their school (separate and apart from the financial incentive itself) is or is not factored into their end-of-the-year employment decisions?

Unlike Question 3, analyses to answer this question focus on the label "Hard to Serve" and seek to understand teachers' perceptions of this label and the extent to which those views influence their employment decisions.

Although this chapter addresses Research Questions 3 and 4, the distinction between these two questions is largely set aside in order to present the key patterns that emerged from the interview data. These patterns effectively answer Research Questions 3 and 4, in addition to providing other insights into teachers' employment decisions in the context of financial

incentives. All interview segments presented below are identified with a pseudonym selected by the respondent. In addition, respondents are identified by their ProComp participation status, probationary status, and the HTS status of the school in which they taught at the time the interview took place.

Interview Findings

Findings from teacher interview data fall into five distinct categories, each of which are presented and explained below. Though this study focuses specifically on retention, interview respondents sometimes responded more generally about employment decisions they make beyond their decisions about whether to remain in their current school. Where appropriate, data on general employment decisions have been included in these findings.

Pattern 1: Teachers Consider Many Factors When Making Employment Decisions

Perhaps one of the most readily apparent, though unsurprising, patterns to emerge from analyses of the interview data is that teachers take many different factors into account when deciding where to work and whether or not to stay in that post from one year to the next. The most frequently cited factors that influence interview respondents' employment decisions are administration, students, colleagues, compensation, type of school, climate of school, and position. Table 5.1 lists the factors mentioned in the interviews as being influential on teachers' employment decisions. The number of times each factor was cited is also listed to give a sense for the frequency of each factor.

Table 5.1. *Frequency of Influential Factors for Employment Decisions*

Factor	Frequency
Administration	97
Students	60
Colleagues	45
Compensation	43
Type of School	38
Position	35
School Climate	31
Geography	24
Parents	23
District	22
Vacancies	22
ProComp	21
School Restructuring	20
Enjoy Teaching	15
New to Teaching	14
Technology Access	12
New Experience	11
Retirement	10
Autonomy	8
Culture of Students	8
Economy	7
Equal Opportunity	5
RIB'd	4

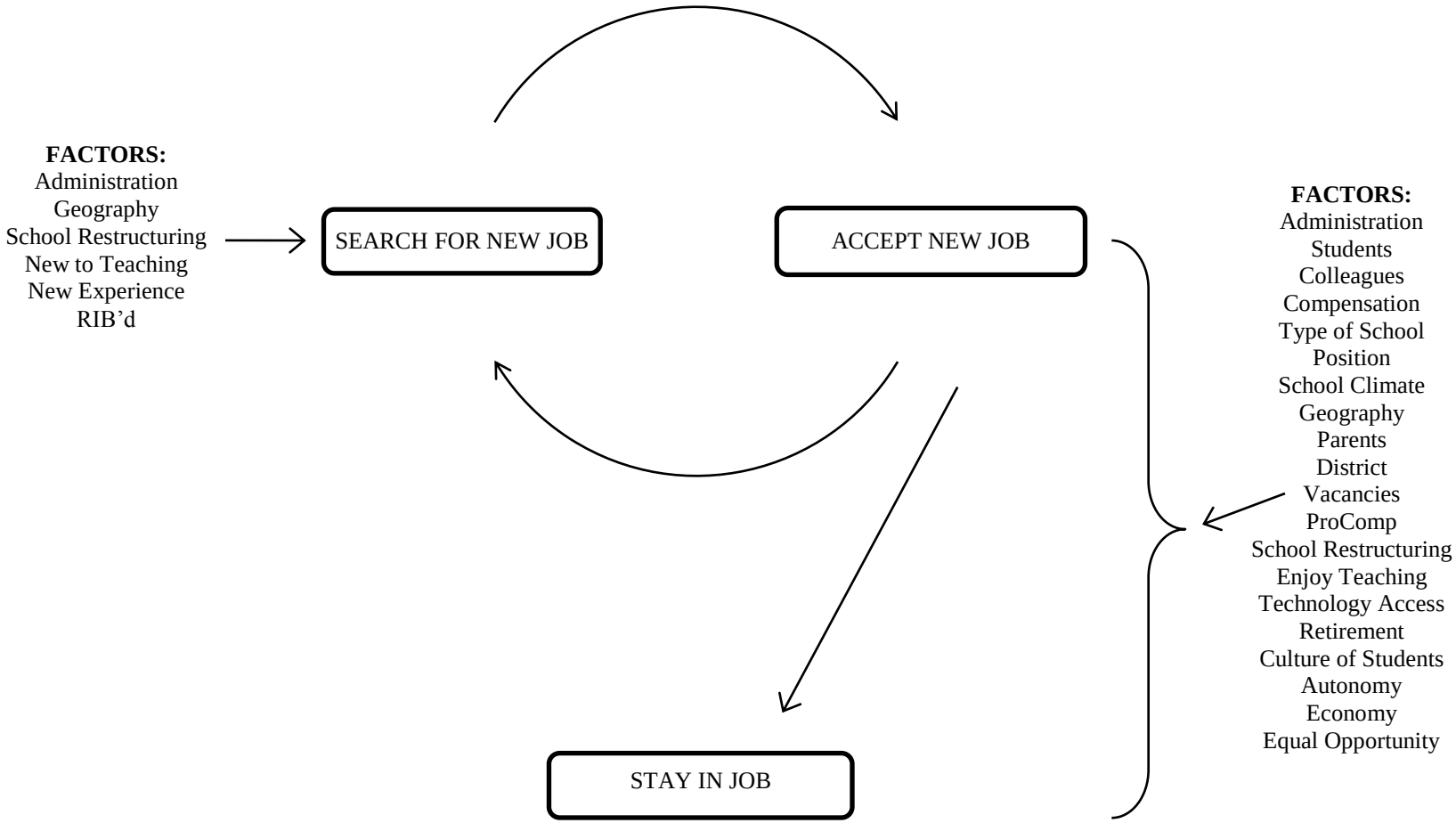
Note: Frequencies displayed in the table below represent the number of times a given factor was mentioned (i.e., the number of interview segments coded with a particular influential factor), rather than the number of respondents who referred to it.

Although these data were collected from a small sample of teachers, it is clear from Table 5.1 that school administration is very influential in respondents' employment decisions; it was mentioned more than twice as often as most other factors. Furthermore, the influence of school administrators on employment decisions was brought up at least once in all but three of the interviews.

The model in Figure 5.1 attempts to map these factors onto some of the key employment decisions teachers make. The logic model depicts the main policy problem of the "revolving door" at some schools (Ingersoll, 2001) and shows three different employment decisions: 1) look for a new job; 2) accept an available job; and 3) remain in current job. Factors cited in the data as triggers that may prompt respondents to search for a new job are listed on the left side of the model. Factors cited in the data as considerations when looking for a new job or deciding whether or not to stay in one's current job are listed on the right side of the model. Both sets of factors appear in order of frequency.

Most factors were mentioned as influential on employment decisions when teachers were deciding whether to accept a new job or stay in a current job. Along with factors that require teachers to search for a new job (new to teaching, school restructuring, or RiB'd), several factors appeared to be important enough to influence teachers to voluntarily search for a new job. Factors cited as reasons teachers may voluntarily search for a new job included administration, geography, and the desire for a new experience. Given that it is probably more difficult to leave a job than accept or remain in a familiar one, these factors may be more influential on teachers' employment decisions than others mentioned in the interviews.

Figure 5.1. *Logic Model: Considerations for Different Employment Decisions*



In addition to factors that may prompt teachers to voluntarily search for a new job, there are factors that force teachers (involuntarily) to search for a new job. Some of these, like the restructuring of a school, influence not only the search for a job but also seem to factor into teachers' decisions about selecting a new job. For example, John, a veteran teacher voluntarily enrolled in ProComp and who was teaching in a HTS school, described the restructuring of his previous school as a disturbing event that triggered his search for a new job:

> It was very emotional, because it was my only school. At that point I had known all of the families for [a relatively large number of] years. I had known the kids since they were four years old. I had zero discipline problems because I knew older brothers and sisters. We were not failing. We were not a bad school. We were the good school, but our numbers were dropping because the families were moving out of the area. So they combined three schools into one K-8, and unfortunately that school was one of them. It was a very emotional year for all of us. We were a very tight, close staff. We were like family. We fought and laughed and had babies and partied and went to funerals and weddings. It was just a very emotional time. We had the choice to go to the K-8, but the principal was a very dynamic lady and she kind of scared off a lot of the people. I could have easily just stayed there…but I made the choice to look elsewhere.

Describing the process of looking for a new job, Julie, a veteran teacher not enrolled in ProComp and who was teaching in a non-HTS school, explained the influence of the previous restructuring of a school at which she had interviewed: "It was a school where a lot of the staff – like, the reason the position was open was because a lot of the former teachers had been asked to re-interview. So I was like, 'That's weird.'" Julie went on to explain that the idea of "taking

someone else's job" made her uncomfortable and that the previous restructuring contributed to her decision not to accept a position at that school.

In addition to school restructuring, school administration was cited by respondents as both prompting the search for a new job and as influencing whether a respondent accepted or stayed in a given job. For example, when I asked Meg, a veteran teacher voluntarily enrolled in ProComp and who was teaching at a non-HTS school, to explain her reasons for leaving her last job she replied,

> Do you want to real reason? [laughs] We got a new principal at [that school]. And, it seemed to be like, all of the teachers – like, I worked there 19 years, and it was like, I was watching all the teachers slowly and gradually leaving. They were like, 'OK, I can retire, I'm out of here.' She's very condescending to people, very micromanagement. The people that worked there weren't used to that, so it was a big adjustment. When you've been teaching and you're working in a high-achieving school, we'd always been an excellent school. She did not make it an excellent school, but she wanted to take the credit. It was just like, "This doesn't really work," for a lot of people.

Another teacher, Zoe, a veteran teacher not enrolled in ProComp who had left her job at a HTS school and was now working in a non-HTS school, also cited the administration as main reason for her departure. As Zoe explained,

> I moved because of the principal. Awful, awful, awful leadership at [that HTS school]…her leadership skills were awful. She didn't understand the dual language program. She wasn't a good leader. She didn't know how to make decisions. The decisions she made weren't always in the best interest of the students. She had favorites. It wasn't a healthy environment. So a bunch of us ended up leaving. It was a big exodus.

In addition to prompting teachers to search for a new job, administration was also cited as being the reason a respondent chose and/or decided to stay with a particular job. As Billy, a veteran teacher not enrolled in ProComp and who was teaching at a HTS school said,

> First off, like I said, the administration makes all the difference within a school. It absolutely does. Coming from the last school I was in, where it was stressful. And it wasn't just me, it was everyone in the building, stressed, tense, no one had a good rapport with the principal. It was just a negative place. And then you get here and the principal I did have, she was here the first three years I was here, she moved on to an assistant superintendent type of thing. There was a reason the school was run so well. Yeah. I'll stay here probably as long as the principal's here. And from there I'll see what the next deal is.

From Billy's comment, it is not clear whether "everyone in the building [was] stressed [and] tense" *because of* the principal or *in addition to* having a bad principal. However, another teacher's comment suggests she enjoyed most aspects of her school *except* her principal. Maggie, a veteran teacher voluntarily enrolled in ProComp and who was teaching in a non-HTS school, said:

> My first position was working in [a HTS school], so at that time, a large percentage of kids – the majority – were African American. I loved working with what we would call 'Hard to Serve' students now. I loved working with those kids. It was very rewarding. The reason I left the area was because there was an administrator who came in and totally turned everything upside-down and I said, 'I won't work for someone like this.'

Such statements suggest what has already been claimed by some education reformers (e.g., New Leaders for New Schools): Teachers may be leaving HTS schools more as a result of

poor leadership (Boyd et al., 2011) than because of challenges related to working with high concentrations of poor students. If high-poverty schools generally have less-supportive principals and if teachers prioritize administration over compensation, then poor leadership may actually drive teacher turnover in high-poverty schools as opposed to teachers' preferences about which students to teach as others have claimed (Hanushek, Kain, & Rivkin, 2004; Lankford, Loeb, & Wyckoff, 2002). Moreover, some teachers suggest the importance of school administration is so great that the additional money offered to ProComp teachers who work in HTS schools may only ever have a relatively limited influence on teachers' employment decisions. Indeed, Meg said, "[The money is] not as important as a good principal – leadership is more important than money. While the money is nice, the leadership will make or break it." Based on emergent patterns in the data, school administration clearly has a substantial influence on respondents' employment decisions.

In addition to school administration, some of the other factors frequently cited as influential in teachers' employment decisions are potentially malleable by education policy. The factor most relevant to this study – compensation – is clearly one that can be influenced by policy. However, teachers' responses about the influence of compensation and ProComp on their employment decisions do not suggest that ProComp was very influential on the employment decisions of most respondents.

Pattern 2: ProComp Did Not Appear to Influence Many Employment Decisions

When I asked respondents about ProComp in general and the extent to which it factored into their employment decisions, two themes emerged. First, it was clear respondents had thought extensively about ProComp, regardless of whether or not they participated in the program. Opinions varied and appeared connected to their participation, or lack thereof, in

ProComp. Although details of ProComp were a bit unclear to some of the respondents, the teachers I spoke with were generally knowledgeable about the program. Second, regardless of whether or not they held favorable opinions of ProComp, respondents overwhelmingly reported they did not consider ProComp generally (as opposed to specific incentives available under ProComp) when making their employment decisions. All 24 teachers interviewed indicated that ProComp did not play a central role in their employment decision-making processes.

As explained by Kate, a probationary teacher automatically enrolled in ProComp who was teaching in a non-HTS school, "ProComp to me, that's the system I'm getting paid in because that's where I am and that's the system we have here, so that's what I have. It's really not driving me one way or the other." This feeling was echoed by Debbie, a veteran teacher voluntarily enrolled in ProComp who was teaching in a non-HTS school. Debbie said, "I don't think a whole lot about ProComp when I'm setting up my yearly plans. ProComp would not make me leave or stay [in my current school]."

Kathy, a probationary teacher automatically enrolled in ProComp who was teaching in a non-HTS school, reasoned the tradeoff for receiving additional pay from ProComp and dissatisfaction with a given school was not worth it. She said,

> I think the incentive is awesome, but me personally, if I'm not happy in a building, I'm not gonna stay just because of money. So I would rather take a pay cut and be happy and be supported by other staff and be able to meet my kids' needs than just stay because I'm getting a bonus. I think it's good that they give bonuses to the teachers, but I don't know that that necessarily attracts or keeps teachers.

When I asked Kathy if there was an amount of money that would prompt her to go to or stay at a school in which she was unhappy, she replied, "None." Thus, at least for her, non-pecuniary

factors seemed to strongly outweigh financial compensation when it came to making employment decisions.

While ultimately echoing the responses of other teachers, Rebecca, a probationary teacher automatically enrolled in ProComp who was teaching in a HTS school, provided an additional perspective on the impact of the financial incentives available under ProComp:

> I would be lying if I didn't say that the money was nice. It's helped me get a duplex in the area that I want to live in with the amenities that I wanted. I was able to buy a washer and dryer with that extra [money] a month that I get from that. So yeah, there's something to say for that, absolutely. But at the end of the day, for me, it's neither here nor there.

These comments about the influence of ProComp on employment decisions suggested that, though appreciated, the incentives earned under ProComp do not exert much – if any – influence on respondents' decisions to stay or leave their current job. Interestingly, this pattern was observed regardless of respondents' opinions about the program generally. Respondents who supported ProComp and reported positive views of the program, as well as those who reported negative feelings towards the program stated the additional pay available through ProComp was of little consequence when they made their employment decisions.

Pattern 3: Opinions Mixed About Influence of HTS Incentive

When respondents were asked to specifically consider the extent to which the $2400 annual HTS incentive – as opposed to ProComp generally – influenced their employment decisions, the opinions were mixed. While 21 of the 24 respondents indicated they did not feel

the incentive amount was enough to influence their employment decisions, two respondents reported that it was adequate and one indicated he was unsure.

Maria, a probationary teacher automatically enrolled in ProComp who was teaching in a HTS school, explained she did not believe the HTS incentive was large enough:

> The money they gave us, it's not enough. … I wish I can get more, because, it's tough. I go home and I have dreams about my students, my behavioral students…. the incentive, it's not worth it. I don't care if they give me $2,500. I'd rather go to another school to make my life easier.

Maria's statement seemed to suggest the incentive amount was not enough on its own, regardless of how it compared to dollar amounts attached to other incentives in ProComp. However, Frank, who was also a probationary teacher automatically enrolled in ProComp who was teaching in a HTS school, seemed to indicate the HTS incentive amount was not enough *because* it was the same amount as incentives awarded to ProComp teachers working in Top Performing schools (i.e., schools with high test-score achievement). He said,

> If you're in a Top Performing school, you get the same amount we do. I feel like if we got a little more than the Top Performing schools, it would help. If I'm a tenured teacher and I'm trying to pick whether I'm gonna go to a high-performing school or a HTS school, why would I go to the HTS school when the bonus is the same as at the other place, and you're probably not gonna face half the challenges there that you are here? So some sort of financial incentive beyond what we have just because of that, I think would make more sense.

Thus for Frank, the dollar amount attached to the HTS incentive was not enough because it was the same amount awarded to teachers who worked in a school where teachers were rewarded for students' high test scores. Frank further argued that the challenges teachers face at HTS schools are more numerous and more emotional than those faced by teachers in Top Performing schools and so incentive amounts for teachers in HTS schools should be greater to compensate for the different and more abundant challenges teachers in these schools face. As such, it may be important to consider not only the absolute amount of the HTS incentive but also the amount relative to other incentives available under ProComp.

Meg highlighted another challenge faced by teachers in HTS schools while explaining why she did not believe the HTS incentive amount was enough. She pointed out that in addition to the daily challenges teachers in HTS schools face while working with high concentrations of poor students, they also often face additional scrutiny and pressure from administrators, the media, and the public about their students' low achievement. She said,

> I just think the money is not enough. It's like, if you're working – 'cause now I'm working in a more low-income area, and it's like, those teachers work just as hard or harder than the ones in the high-performing schools, but the microscope is put on them to raise test scores. It's like, "What are you not doing? What more can you do? Why are you doing this?"

Indeed, assessment-based accountability policies at the state level have created standards and increased oversight of schools, especially those with low-achieving students, over the last decade. Coupled with the pressures of NCLB, teachers at high-poverty, low-achieving schools are often subjected to additional scrutiny (Boyd et al., 2008). This pressure poses an additional challenge to efforts, like targeted financial incentives, that aim to increase the attractiveness of

working at a high-poverty school. Consequently, even larger financial incentives (or a combination of financial incentives and non-pecuniary supports) may be needed in DPS to make jobs at HTS schools more attractive to a greater number of teachers.

However, not all teachers believed the HTS incentive amount was insufficient. Two of the 24 teachers – both of whom were in ProComp and taught at HTS schools – indicated that the current HTS incentive was large enough for them to consider when making their employment decisions. Reese, a probationary teacher automatically enrolled in ProComp who was teaching in a HTS school said, "The HTS incentive is a good amount right now. As long as it sticks with the cost of living, that's fine. I think is appropriate and I'm glad I have it, and it would persuade me in the future, definitely." Carrie, a veteran teacher who voluntarily joined ProComp, also indicated the HTS incentive was set at the right amount. She said, "It has a huge influence on my decision, yeah. I'd say yes, to be really quite honest. Yes…. If you want the best teachers to go to a [HTS school], then the money matters."

These two teachers, who presumably differ in their base pay as a result of years of experience and the way in which they entered into ProComp, both indicated the HTS incentive is enough to influence their employment decisions. This suggests that the extent to which the HTS incentive influences teachers' employment decisions may have less to do with the relative amount of the incentive to their base salary and more to do with their preferences about where to work. Or perhaps, this is suggestive of these teachers' general responsiveness to money as an incentive as opposed to other factors that influence their employment decisions.

Respondents' opinions are mixed about whether or not the current HTS incentive amount of $2400 annually is large enough to influence teachers' employment decisions. While a majority of respondents did not believe the amount is enough, two reported that it is. These opinions did

not appear to be predicted by years experience and base salary level, or ProComp participation status. Not surprisingly, the two respondents who believe the HTS incentive is large enough to influence teachers' employment decisions work at HTS schools. However, all other teachers at HTS schools indicated the amount was not large enough. Thus, it may simply be the case that teachers' employment decisions are influenced by the HTS incentive differently depending on their current financial situation, family demands, and preferences about where to teach.

Pattern 4: Non-Pecuniary Supports, in lieu of or in addition to, the HTS Incentive, may make HTS Schools Attractive

Regardless of whether or not respondents believe the HTS incentive is large enough to influence teachers' employment decisions, all suggested additional, non-pecuniary supports had the potential to make jobs at HTS schools more attractive. Such supports were put forth as ways to reduce some of the challenges of teaching, and particularly of teaching in high-poverty schools. The most common suggestion to improve retention at HTS schools was to reduce the number of students for each teacher via smaller classes or the addition of a paraprofessional or another person to support teachers in the classroom.

For example, Kate said,

> I think the biggest changes I would want to see that would attract me to [a HTS] school is, 'We offer smaller class sizes, because we know our students have tough backgrounds, they have a lot of trouble, attendance is an issue.' To me, if they look at that and say, "OK, we're gonna make sure our classes are smaller, that's what we're doing in our school," that would be something I might go for. Because it's not just paying teachers more for rougher spots, it's trying to do something about making that rough situation easier for the teacher and the students and better for both of them.

This belief was echoed by Billy who said, “Everyone knows smaller class sizes. If teachers knew they were gonna have a max of 20 kids, you’re gonna retain a lot more teachers… I think the smaller class would mean a lot more to the teachers than a bonus.” Thus, Billy’s comment suggests the money currently allotted for the HTS incentive may be better spent reducing class sizes at HTS schools.

Recall that the HTS criteria are set such at that roughly half of all DPS schools are designated “HTS” and that approximately 75% of all DCTA teachers ($N \approx 4{,}150$) participate in ProComp. Thus, about 1,450 teachers are eligible to receive the $2400 HTS incentive. If one assumes these teachers are full-time employees, the total payout for all HTS incentives is around $3.5 million, annually. Used another way, this money could hire over 60 teachers, paying them $55,000 a year. That is, HTS incentive money could be used to hire about one extra teacher for every HTS school. Though this would perhaps be welcomed by principals and teachers at HTS schools, it is not clear whether class sizes could be effectively be reduced with the addition of just one new teacher. Furthermore, there are clearly political and legal barriers to reallocating ProComp funds for other uses.

In addition to reducing the number of students per teacher via class size reduction or inclusion of a paraprofessional, respondents also suggested offering teachers at HTS schools additional materials/technology, common planning/prep time, support to hold students/parents accountable for homework and attendance, and to ensure various school specialists (psychologist, nurse, etc.) are in the building and accessible to support students. Like reducing the student-to-teacher ratio, the suggestion of supporting students’ mental, emotional, and physical health was one mentioned by multiple respondents. For example, Ann, a veteran teacher not enrolled in ProComp who was teaching in a non-HTS school, said, “Maybe the [HTS]

schools really do need to have the medical clinic with a full-time nurse, full-time social worker. That would work. A psychiatrist, too." In this same vein, Zoe stressed the importance of having these student supports. She said,

> They could provide more social services in terms of – the fact that a lot of schools have had their social services cut, the nurse, the psychologist, and the social worker, makes absolutely no sense to me, because if kids don't have certain things in place, they're not going to do well in the classroom.

Zoe's comment highlighted some of the additional challenges teachers may face when working in schools with high concentrations of poor students. While teachers in both HTS schools and non-HTS schools would probably welcome smaller class sizes, teachers in non-HTS schools likely have fewer students that require in-school health services than those in HTS schools.

Respondents' comments suggest it may be possible to increase teacher retention at HTS schools by offering targeted non-pecuniary supports for students and teachers in these schools. By working to alleviate some of the common challenges teachers face in HTS schools, these supports, in addition to or in lieu of the HTS incentive, may serve to make these jobs more attractive to more teachers. It would follow that if jobs at these schools become more attractive, retention will increase and it may also be easier to attract and recruit higher-quality teachers to fill vacancies when they appear. Moreover, these resources also have direct benefits for students, as teachers suggest in their interviews.

Pattern 5: HTS Label Did Not Appear to Yield Unintended Consequences

One of the things not yet examined in the research about retention and financial incentives is the extent to which labeling schools – separate and apart from the incentive itself –

to receive targeted incentives influences teachers' employment decisions. I speculated the label "Hard to Serve" might serve to attract some teachers and repel other teachers, depending on their preferences about where to teach and tolerance for risk (as teachers in HTS schools are more likely to have to reapply for their jobs than those who work in non-HTS schools as result of school redesign). Surprisingly, respondents did not express much, if any, concern about the label "Hard to Serve" though some did worry that the incentive might yield some unintended consequences for HTS schools.

When I asked respondents how they felt about the HTS label, most indicated it was an appropriate way to identify schools. Reese explained, "I think it's completely appropriate. It is hard to serve. Factually speaking-well, I guess it's not factually, it's my opinion, but I would consider my students 'hard to serve.'" Although none of the teachers I interviewed suggested the label should be done away with entirely, a few suggested other names they thought had fewer negative connotations. Some of the other labels suggested by respondents included: 1) high priority; 2) high needs; and 3) at-risk. Respondents who suggested these alternative labels believed they would still convey something about the student population that was primarily served by the school but may have more positive associations for teachers who may be considering jobs at those schools.

Although some respondents thought minor tweaks to the label could potentially make HTS schools appear more attractive to teachers looking for new jobs, many said the label would not have an impact on those already working in HTS schools. Related to Finding 3 described earlier – that the HTS incentive did not influence most respondents' employment decisions – respondents explained that teachers in HTS schools worked there because they wanted to, not because of the label or the incentive. For example, when asked about the label "Hard to Serve,"

Mary, a probationary teacher automatically enrolled in ProComp who was teaching in a non-HTS school,[30] responded

> I actually specifically looked for HTS schools, not because of the money attached to it, but because that's the population of kids I like to work with. [In my previous non-teaching job]… most of my students had no hope, didn't feel like they would ever do anything, and I wanted to be somebody who they could go to who had faith in them and could hopefully instill some hope in their life. That was the same thing I was looking for when I came [here]. I wanted to be able to be some hope for some people, help be a part of that.

Thus, the label "Hard to Serve" was useful for Mary in identifying schools that she was potentially interested in. This sentiment was echoed by others, including Connie, a veteran teacher not enrolled in ProComp who was teaching in a HTS school. Connie said, "I do know I wanted to be in the HTS schools. I chose to stay – the needier the school, the better, because [the students] just need so much help."

When asked to reflect on the HTS label, respondents did not express much – if any – concern about the label, separate and apart from the incentive itself. However, several respondents did suggest that the incentive had the potential to attract and retain teachers to work in HTS schools that might not be the best teachers for these schools. For example, Stephanie, a veteran teacher not enrolled in ProComp who was teaching in a non-HTS school said,

> Over four years, that's $10,000. So there's $10,000, but is that teacher there because they really and truly care about the kids at that school? Or are they just putting in their time

[30] Although Mary's school was not designated "Hard to Serve" at the time of the interview, it had previously been a HTS school when she first started there in 2008-09.

> because they need that money? So in some ways this whole thing of ProComp attracting the people that should go there, it could really backfire on 'em. And I think it has. There are people that say despicable things about the children, but they don't want to move. Why should they take a pay cut?

Stephanie's comment suggests the availability of the HTS incentive may serve to retain teachers in HTS schools that do not actually like working with the students who attend those schools. Julie also raised concerns about the incentive but for slightly different reasons. She explained,

> I hate to say this, but you're attracting people who really need money, and I'm not sure that they're the best teachers…. If you're that desperate for money, is that the best teacher? My assumption about those people would be that they're probably right out of grad school and are maybe low on the pay scale, so that amount makes a bigger difference to them. In my pay scale, it doesn't make that much difference to me, when you break it down over a year. It's not hardly gonna be anything…. But when a first-year teacher makes $35,000 a year, that [HTS incentive] might make a difference. But that's not a good teacher, necessarily. Experienced teachers who are making $60,000 and $70,000 a year are not gonna quit their jobs to get an extra $2,500.

While Julie and Stephanie were both concerned that the HTS bonus may ultimately attract the "wrong" type of teacher to go to and stay at HTS schools, how they thought about a teacher that is "wrong" for a HTS school was different. Stephanie raised concerns about teachers not liking the students they work with and saying "despicable things" about them. Julie raised concerns about the incentive attracting teachers at the beginning of their careers – teachers who research indicates are not the most effective teachers. Both are potential unintended consequences of offering additional pay to teachers for working in HTS schools.

Understanding the Impact of ProComp

So, how should one make sense of the estimated effect of ProComp, particularly the question of whether results are large enough to be practically significant to policy makers, given the main patterns that emerged from the teacher interviews? For the most part, interview findings do not help make a case that ProComp has had a meaningful impact on retention rates. Interview findings suggest what has been found previously in studies of retention and financial compensation (Milanowski et al., 2009): Teachers prioritize other, non-pecuniary factors over financial compensation. There does not appear to be any evidence to suggest this varied by respondents' ProComp participation status or the HTS status of their school.[31]

This first pattern to emerge from the interview data – that teachers consider many different factors when making their employment decisions – may in part explain the weak explanatory power of the regression models I fit to the quantitative data. Interview analyses point to many, mostly non-pecuniary, factors that influence their decisions and leave little reason to suspect ProComp and the HTS incentive are systematically related to changes in retention rates.

Rather, interview analyses suggest school administration is more important to teachers than financial compensation. Some respondents even indicated school administrators were the *reason* they left jobs at HTS schools and that ProComp and/or the HTS incentive *could not* compensate for poor administration, regardless of the incentive amount offered. Similar to patterns of teacher distribution across schools, new research (Loeb et al., in press, as cited in Boyd et al., 2011) has found high-poverty schools with high concentrations of non-white, low-achieving students tend to have principals with fewer other job opportunities, such as new

[31] Nevertheless, the two teachers who indicated they would consider the HTS incentive when making their employment decisions were both teachers in HTS schools.

principals. If HTS schools are more likely to have lower-quality principals and if teachers' employment decisions are more likely influenced by school administration than financial compensation, the magnitude of effects that ProComp and the HTS incentive can ever have on retention in HTS may be limited to those observed in this study.

That said, interview analyses do not rule out the possibility that some teachers may respond to financial incentives, albeit at a low level. With regard to ProComp as a whole, respondents indicated they do not consider it to be a factor in making their employment decisions. And yet, small positive effects of ProComp are estimated. It is possible this apparent discrepancy might be related to the representativeness of the sample; a different sample of teachers may have yielded different results. It may also be the case that many respondents, particularly those who are new to teaching or preparing for retirement, have not made a major employment decision (i.e., leave, accept, or stay in a given job) in the absence of ProComp (new teachers) or since the implementation of ProComp (veteran teachers). As such, teachers may not know the extent to which ProComp would (or could) factor into their employment decisions.

Interview analyses do not provide evidence to suggest the HTS label has had any influence on teachers' employment patterns. Relating back to the first pattern, teachers explained they worked in certain schools because they like the principal, the students, and their colleagues. The HTS designation, in and of itself, does not appear to attract or repel teachers from working in these schools. With regard to the HTS incentive, two teachers indicated they would consider it when making their employment decisions and one teacher indicated he was unsure. This is interesting considering these same teachers said they would not factor ProComp generally into their employment decisions. The affirmative responses of these two teachers (and perhaps the respondent who was unsure as well) may be related to the wide-spread support among teachers

for market-based pay (Milanowski et al., 2009). Recall that in Chapter 1, survey evidence suggests a majority of DPS teachers support the HTS incentive and the companion incentive for hard-to-staff positions. Moreover, these affirmative responses may help explain why the effect of ProComp is greater for HTS schools relative to non-HTS schools.

Effects of ProComp estimated in this study and possible effects of the program in the future may be small for another reason. In addition to the important influence non-pecuniary factors exert on teachers' employment decisions, interview data also suggest money is not a very important factor in most teachers' employment decisions. It is a subtle distinction: Not only do teachers prioritize non-pecuniary factors over compensation, but money – on its own – does not matter much for teachers' employment decisions. Statements from the interviews suggest a pretty strongly held teacher norm that 'good teachers do not (or are not supposed to) work for money.' Examples of this norm inferred from statements above include: "the best teachers are not in it for the money"; "if you are at a school for the money, you probably don't truly care about the kids you teach"; "you have to be foolish or desperate to choose money over teaching the kids you want to teach."

If this norm is a major factor in the way teachers construct identities as good teachers, then ProComp may rely on an economic incentive model that, for the most part, teachers do not share. The financial incentives may only motivate a relatively small subset of teachers. Although there is not enough data here to make such a definitive claim about norms, a belief like this among teachers would have important policy implications for programs such as ProComp. Extensions of this study and future interview findings from Hough et al.'s (2011) evaluation of San Francisco's QTEA alternative teacher compensation plan may help to determine the extent to which the norm 'I'm not in it for the money' is widely held by teachers.

Chapter 6

Discussion

Implications for Financial Incentives and Retention

For the better part of the past decade, policy makers have been searching for ways to increase teacher recruitment and retention. Some scholars attribute this need to the fact that "baby boomer" generation teachers are approaching retirement age (e.g., Alliance for Excellent Education, 2008), while others suggest the greater demand for teachers is driven primarily by persistent teacher turnover (e.g., Ingersoll, 2004). Prior research has shown that, while the overall retention of teachers may be comparable to other professions (Henke, Zahn, & Carroll, 2001) certain schools have a very difficult time retaining teachers, particularly those considered to be high-quality and effective teachers. Research has also shown that schools with high teacher turnover are likely to serve large populations of low-performing, non-white, and low-income students – the very students apt to be most in need of a steady and supportive education (Boyd et al., 2011; Clotfelter, Ladd, & Vigdor, 2006; Hanushek, Kain, & Rivkin, 2004; Wyckoff et al., 2003). While extant research has characterized the problem of turnover, it has done little to identify successful avenues of reform to increase retention.

One reason for high teacher turnover consistently cited is job dissatisfaction related to low salaries (Boe, Cook & Sunderland, 2008; Ingersoll, 2001; Milanowski et al., 2009). Thus, it would stand to reason that by offering financial incentives, through a program such as ProComp, teachers may become more satisfied with their jobs and retention might increase. Currently, there is a great deal of enthusiasm for such financial incentives as one way to make the teaching profession and specific schools or subjects more attractive to more people (Baratz-Snowden, 2007; Chiat & Miller, 2009a; Sawchuk, 2009). As of yet, however, this enthusiasm has not been grounded in empirical research. At best, evidence that financial incentives can help retain teachers is mixed (Clotfelter et al., 2008; Springer et al., 2009; Steele et al., 2009).

This dissertation endeavors to contribute to research on the potential of financial incentives to increase teacher retention. The study used panel data and teacher interview data to investigate the extent to which ProComp has increased retention rates in the district and at high-poverty schools, the relationship between retention and teacher quality, and the reasons underlying the observed effects. This chapter summarizes the central findings detailed in Chapters 4 and 5, highlights some key limitations of this study, and proposes several directions for further research.

Research Question 1 comprises an examination into the effects of ProComp on school-level retention rates. Line graphs and descriptive statistics indicate a slight decrease in average retention rates before the implementation of ProComp and a moderate increase in average retention rates after implementation. Results from the difference-in-differences approach suggest ProComp has had a small, positive effect on average annual retention rates. Furthermore, findings suggest a greater impact on retention rates for schools with high ProComp participation and for HTS schools. Arguably, these findings have important policy implications as they suggest teachers may respond to ProComp and the HTS incentive, particularly in schools that have many ProComp participants. This is particularly compelling in light of prior research that suggests financial incentives generally do not impact retention (e.g., Clotfelter et al., 2008; Glazerman & Seifullah, 2010; Steele et al., 2009).

To get a sense of the ways in which retention might be related to teacher quality, Research Question 2 constituted a descriptive analysis that explores the extent to which above-average quality is observed in schools that had the greatest retention. This analysis does not target the causal relationship between retention rates and overall teacher quality, but rather, descriptively compares quality in schools with the greatest retention relative to all schools.

Teacher quality was operationalized to provide an input-based measure of quality (average years of teaching experience) as well as an output-based measure of effectiveness (median school-level student growth percentiles – SGPs – for reading and mathematics).

Although scatterplots suggest no *linear* relationship between retention and teacher quality, comparisons of overall quality for schools with the greatest retention to all schools do suggest a possible *nonlinear* relationship. Overall teacher quality is above average in schools with the greatest change in average retention rates during the last decade, during the period after the implementation of ProComp, from 2008-09 to 2009-10, and in the most recent year (2009-10) for which SGP data are available. The apparent positive relationship between retention and teacher quality warrants further investigation.

Chapter 5 (Research Questions 3 and 4) details the central findings that emerged from teacher interviews. These findings suggest that, while teachers appreciate the additional pay they can earn under ProComp, most do not consider ProComp and the HTS incentive to be important factors when making their employment decisions. Rather, responses suggest non-pecuniary factors are more influential in teachers' decisions about where to work and whether to remain in their current school. Findings point to the importance of school administration, in particular, for teacher retention. This is not surprising given extant research that indicates school leaders matter for teachers and students (Harris, Rutledge, Ingle, & Thompson, 2010) and recent studies of teacher retention that have arrived at similar conclusions (Boyd et al., 2011).

Despite concerns that the label "Hard to Serve" might have unintended consequences on retention at these schools, analyses suggest this is unlikely. Like the financial incentive attached to it, teachers indicated that the HTS designation of a school is not a major factor in their employment decisions. Respondents explained teachers worked at HTS schools because they

wanted to work with that particular student population, had a good relationship with the principal, and/or enjoyed the school climate; for the most part, neither the money nor the designation of the HTS incentive appears to factor into teachers' employment decisions.

Findings from this dissertation suggest teachers do respond to financial incentives, albeit at a seemingly low level. The positive effects found for ProComp logically beg the question of how one might increase the magnitude of these effects. The policy community may want to consider the availability and amount of financial incentives, particularly those that target teacher retention at high-poverty schools. Interview analyses suggest teachers, for the most part, do not consider the amount of the individual incentives available under ProComp, including the $2400 HTS incentive, large enough to influence their employment decisions. In addition to the absolute amount of the incentives available under ProComp, findings also indicate that, in the context of an alternative teacher compensation program, the relative amount of the incentive is important. Specific to Denver, analyses point to the importance of making the HTS incentive amount larger than the incentive amounts for schools with high performance and growth on standardized assessments. Accordingly, larger financial incentives for teachers who work at high-poverty schools may yield more substantial effects on retention.

Although findings suggest teachers do respond to financial incentives, their responses may be tempered by the importance of financial compensation relative to other non-pecuniary factors. As suggested by prior research (Boyd et al., 2011; Milanowski et al., 2009), the incentives teachers are more likely to respond to involve school leadership and working conditions. This study does not allow a comparative judgment between the two types of incentives, but it does suggest the value of an incentive plan – and evaluation thereof – that offers these non-pecuniary incentives as part of the menu.

In addition to the important influence non-pecuniary factors exert on teachers' employment decisions, interview findings suggest a norm among teachers that 'good teachers don't (or aren't supposed to) work for money.' If this norm is a major factor in the way teachers construct identities as good teachers, then ProComp may rely on an economic incentive model that many teachers rebuff. Depending on how widespread this feeling is, such financial incentives may only motivate a relatively small subset of teachers. Although there are not enough rich data in this study to make such a definitive claim about norms, a belief of this nature among teachers would have important policy implications for alternative teacher compensation programs such as ProComp.

In thinking about the generalizability of this study, it is important to remember that ProComp is one of the only comprehensive and fully-funded alternative teacher compensation programs in the nation. This makes the financial incentives available to teachers under ProComp, particularly for teaching at a HTS school, qualitatively different from a stand-alone incentive for at least two reasons. First, only teachers who participate in ProComp are eligible to receive financial incentives. Importantly, ProComp participants have selected in the program voluntarily (if they taught in the district prior to implementation) or have selected to work in DPS after the implementation of ProComp. Teachers who joined DPS after ProComp were presumably aware of the program and the requirement that they participate in it. Accordingly, it is reasonable to assume teachers who participate in ProComp are, at a minimum, not strongly opposed to it. It may be that ProComp participants' acceptance (or support) of ProComp contributes to retention. However, one must also be aware of other factors, such as financial need or comfort with the familiar, that might jointly drive ProComp participation and retention.

Second, ProComp is an established and fully-funded reform that includes a variety of different financial incentives: ProComp includes knowledge/skill-based, performance-based, and market-based incentives. Because of the many and varied incentives available under ProComp, teachers may respond differently to this alternative teacher compensation program than they would to another program or a stand-alone incentive. While findings from this study offer evidence to suggest financial incentives impact retention, results are more generalizable to comprehensive alternative teacher compensation programs than to stand-alone incentives.

Limitations

This study is a step in understanding the role of financial incentives regarding teacher retention, and more generally concerning all teacher employment decisions. This section explains the limitations of each of the analyses in this dissertation.

Limitations and Threats to Validity of the Retention Analysis

Though the aim of the retention analyses is to make a causal claim about the effect of ProComp on retention rates, one of the most substantial limitations of this study is its reliance on observational data. However, the quasi-experimental approach I employed may support causal claims despite the use of observational data. Such claims though, are warranted only insofar as the assumptions underlying the model hold. Despite efforts to isolate the effect of ProComp on retention rates, there is always the risk that omitted variables may bias effect estimates in the absence of random assignment.

The unbiasedness of the effect estimates from difference-in-differences approach being used depends on the assumption that change in retention rates before ProComp provides a reasonable counterfactual for change in retention rates that would have been observed if

ProComp had not been implemented. Time-varying factors that may affect retention rates differently in one period but not the other are not accounted for in using this approach. Such time-varying factors that have the potential to bias retention effect estimates include, but are not limited to: principal/leadership turnover, changes to curriculum, lagged effects of the economic downturn, maturation of ProComp, and the introduction of several non-traditional teacher preparation programs into DPS. Additionally, DPS introduced the *Denver Plan* during the 2005-06 school year (the same year ProComp was implemented). Described as "strategic vision and action plan," this effort seeks to increase student achievement, and improve high school graduation rates, college preparation, and college matriculation rates (Denver Public Schools, 2010).

These time-varying factors can be separated into those that affect *the entire district* (i.e., lagged effects of the economic downturn, introduction of the *Denver Plan*, and maturation of ProComp) and those that might only affect *certain schools*. Additionally, there is little reason to suspect lagged effects of the economic downturn or the *Denver Plan* would differentially affect schools as a function of ProComp participation. If these factors do in fact influence retention rates, one would expect all schools to be impacted equally. In contrast, any bias introduced by maturation of ProComp would likely have a greater effect on schools with higher ProComp participation. The direction of this potential bias is not clear but it is possible the maturation of ProComp has impacted estimates in this study, particularly those that explicitly account for ProComp participation. Thus, it was important to model the effect of ProComp as an indicator of implementation that captured its estimated effect on all schools, as well as a variable representing the level of ProComp participation within a given school.

Historical threats to validity that only affect *certain schools* (i.e., changes in principal/leadership, curriculum, and the introduction of non-traditional teacher preparation programs) are also problematic to the extent that they are related to ProComp participation and HTS status. Generally principal/leadership or curriculum changes are specific to a single school, though DPS has recently started to restructure all schools in the Northeast quadrant of the district, and one could conceive of curricular changes that would affect a broad set of schools. The data available do not, unfortunately, allow me to identify schools that have had changes in principals/leadership or curricula so is not possible to know when or where such changes occurred. However, some research suggests, in addition to generally higher rates of teacher turnover, high-poverty schools also have higher principal turnover (Gates et al., 2005). Therefore, it is feasible that changes in principal/leadership have disproportionately occurred in HTS schools.

As explained in Chapter 3, DPS has begun to keep records on teacher preparation program type. These programs began in DPS in 2008-09, and data are available for the two most recent years (2009-10 and 2010-11). Owing to the data limitations, alternatively prepared teachers are included in all analyses in this study. This is chiefly important when one considers the differential effects observed for HTS schools relative to non-HTS schools, as two of the alternative preparation programs in DPS (Teach for America and Denver Teaching Fellows) specifically place teachers in HTS schools. Participants of these programs are required to teach in a high-poverty school for 2-3 years. Research suggests, after they have completed this brief commitment, a majority of non-traditionally prepared teachers leave high-poverty schools to teach in more affluent schools or pursue a different career (Heilig & Jez, 2010). Accordingly, non-traditionally prepared teachers have the potential to bias estimates of the effect of ProComp,

particularly for HTS schools. This bias would likely be positive in the short-term (as these teachers are required to fulfill their 2-3 year commitment) and negative in the long-term (as they leave after their teaching obligation is completed).

Limitations and Threats to Validity of the Exploratory Teacher Quality Analysis

The analysis of teacher quality is descriptive in nature and thus offers no information about the direction of the relationship between retention and teacher quality (i.e., whether changes in retention yielded improvements in overall teacher quality or whether improvements in overall teacher quality resulted in increased retention). Rather, it offers descriptive evidence suggesting there may be a positive, nonlinear relationship between retention and quality.

This positive relationship, however, assumes measures of teacher quality are reliable from one year to the next. It is not clear how defensible this assumption is for aggregated student growth percentile (SGP) measures used in this study to represent teacher effectiveness. Analyses conducted by the Colorado Department of Education (CDE) on Colorado Growth Model school-level SGPs across years suggest they are only moderately correlated (around 0.5 for writing and math and around 0.4 for reading) (Marie Huchton, personal communication, March 22, 2010). Although one should not dismiss that descriptive analyses of retention and teacher quality suggest a positive relationship, it will be important to further investigate the reliability of longitudinal SGP measures and the relationship between retention and quality in follow-up studies.

Limitations and Threats to Validity of the Interview Analysis

The most notable limitation in the interview analysis is with regard to the representativeness of the teachers who were interviewed. Though I made an effort to interview a

representative sample of teachers, the number of teachers is admittedly small. Furthermore, it is possible the characteristics used to stratify the sample (ProComp participation, HTS school status, probationary status, and whether the teacher was new to his/her school) are not the only possible relevant dimensions of contrast. Perhaps other factors, such as years of teaching experience (a proxy for retirement and base salary) or total compensation earned, may be relevant in differentiating teachers' responses to financial incentives. A different stratification strategy might have yielded a sample of teachers who felt differently about ProComp and the HTS incentive.

The representativeness of the sample might also be compromised if those who agreed to participate differ from those who refused in the ways they consider ProComp and the HTS incentive when making their employment decisions. Although teachers were randomly invited to participate in the interviews, there may be something different about those who agreed to participate from those who did not. As discussed in Chapter 3, the refusal rate was high (roughly 80% of those invited declined to participate) and teachers who chose to participate in the interviews probably had stronger feelings about ProComp – either positive or negative – than those who declined.

The validity of findings from this analysis may also be threatened if respondents tried to answer interview prompts in a socially desirable way. For example, some teachers – especially if they are new or young teachers – may have felt pressure to express support of ProComp, regardless of their true feelings. Other teachers may have felt they should not place a premium on financial compensation, regardless of their true feelings, because of a suspected norm among teachers that 'good teachers don't (or aren't supposed to) work for money.' To the extent possible, I asked follow-up questions of teachers so that their feelings, beliefs, and employment

decision processes could be explained in multiple ways. Findings from this analysis are the result of similar responses across multiple questions, which do not necessarily insure against socially desirable responses, but does help to make teachers' feelings, beliefs, and decision processes more clear.

Future Research

A few possible extensions to this research that may be pursued in the coming years are discussed in this section. These are presented as they relate to each of the research questions asked in this study. First, with respect to estimating ProComp's effect on school-level retention rates, it might be appropriate to examine a nonlinear interrupted time-series model. This approach would build on findings from this study by not only providing an estimate of the average change in retention but also an estimate for the change in level (i.e., the change in intercept) and the change in growth (i.e., the change in slope) of retention over time. Estimates of the change in level after ProComp implementation (and after changes to ProComp) would allow one to tease out the extent to which "selection effects" (Lazear, 2003) are present after the implementation of ProComp in DPS.

A second extension would be to examine the extent to which ProComp impacts the probability of certain teacher employment decisions. Models that might be appropriate in this context include discrete-time hazard models or probit models. These models would continue to allow one to capitalize on the longitudinal data available but would also make use of teacher-level retention data. Discrete-time hazard models and probit models would yield estimates of ProComp's effect on the probability that teachers would make certain employment decisions. In the case of the former model, estimates would suggest the effect of ProComp on the probability teachers leave their current school; estimates from the latter model would suggest the effect of

ProComp on the probability of several employment decisions (e.g., stay, leave district, or migrate to a different school within the district). However, because teachers are clustered in schools, it is unlikely employment decisions are independent among teachers who work in the same school. Such nesting in the data suggests consideration of a multilevel approach to modeling teachers' employment decisions (Singer & Willett, 2003). These modeling approaches were beyond the scope of this study due to time and data restrictions but each may be fruitful in upcoming efforts to estimate the effect of financial incentives on retention and other teacher employment decisions.

The investigation of retention and quality is perhaps the most obvious part of this study to extend. Rather than simply describing the relationship between retention and quality, follow-up studies may employ regression models that attempt to estimate the direct effect of ProComp on teacher quality. Like retention, quality may not be independent among teachers at the same school. As such, multilevel models may also be appropriate for future analyses of teacher quality. In addition to accounting for dependence between teachers in the same school, multilevel models would allow differences in teacher quality to vary at more than one level (i.e., time, teacher, school). This approach would allow one to determine how teacher quality has changed over time and whether one can predict differences in these changes according to ProComp (implementation and/or participation).

Moreover, additional ways of defining teacher quality should be considered in follow-up studies. Ideally, quality could be examined in DPS using a new teacher evaluation effort – Measuring Effective Teaching Project (MET Project) – that has recently been introduced to the district (The Gates Foundation, 2011). The MET Project attempts to measure teacher quality beyond estimates of teacher impact on student test scores by examining teacher quality,

performance, and effectiveness. This multiple-measure approach examines five sources of data: 1) classroom observations and teacher reflections; 2) teachers' pedagogical content knowledge; 3) students' perceptions of classroom instructional environment; 4) teachers' perceptions of working conditions and instructional support at their schools; and 5) student achievement gains on state and supplemental assessments. These data are then combined to form a composite index of teacher quality. If available, data of the composite index of teacher quality would provide a multidimensional measure of quality that would seem far more reliable than the proxies of quality and effectiveness used in this study.

Finally, to increase the representativeness of findings from interview analyses, it may be appropriate to determine the extent to which a larger sample of teachers agrees with the findings from this study. The most apparent way to gain data from a larger sample would be to survey teachers (in Denver or another district that offers financial incentives). Patterns that emerged from the interview data collected for this study could be included as statements in survey item prompts and respondents could use a Likert scale to indicate the degree to which they agree with the statements. This instrument could also be used to collect valuable data to further explore how widespread the norm that 'teachers don't work for money' is among teachers.

Given the research base pointing to the importance of teachers and disproportionate teacher turnover at many high-poverty schools, many efforts are underway to improve teacher retention. While improved retention is not a silver bullet for providing all children with access to high-quality teachers and a better education, it is an important first step. Programs such as ProComp and research about its effects contribute valuable insight about the potential of financial incentives to improve retention, particularly at high-poverty schools.

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Appendices

Chapter 1 Appendices

Appendix A

Table A.1. *DPS Single Salary Schedule*

STEP	Education	Bachelors Degree (BA)	BA+30	BA+60	Master Degree (MA)	MA+30	MA+60	PhD
1	Base	$36,635	$36,904	$37,172	$40,201	$40,201	$40,949	$43,522
2	1 YR	$36,910	$37,257	$37,603	$40,555	$40,555	$42,920	$45,609
3	2 Yrs	$37,013	$37,494	$39,099	$40,791	$41,877	$44,666	$47,477
4	3 Yrs	$37,201	$37,697	$40,559	$40,944	$43,471	$48,339	$51,391
5	4 Yrs	$37,539	$39,262	$42,283	$42,558	$45,301	$48,339	$51,391
6	5 Yrs	$37,765	$40,930	$44,080	$44,227	$47,216	$50,378	$53,578
7	6 Yrs	$39,357	$42,666	$45,930	$45,963	$49,240	$52,509	$55,879
8	7 Yrs	$41,015	$44,437	$47,875	$47,875	$51,331	$54,750	$58,276
9	8 Yrs	$42,731	$46,344	$49,916	$49,916	$53,516	$57,146	$60,781
10	9 Yrs	$44,546	$48,313	$52,068	$52,068	$55,830	$59,578	$63,398
11	10 Yrs	$46,427	$50,335	$54,271	$54,270	$58,176	$62,136	$66,135
12	11 Yrs	$48,408	$52,486	$56,605	$56,605	$60,732	$64,816	$68,981
13	12 Yrs	$50,882	$55,173	$59,610	$59,610	$63,755	$68,068	$72,408

Source: Denver Public School District Website. Retrieved January 2, 2010 from: http://hr.dpsk12.org/dcta_salary_schedule

Appendix B

Table B.1. *Financial Incentives for First and Second Iterations of ProComp*

First iteration of ProComp (2005-06 to 2007-08)

Components Index $35,568	Knowledge and Skills			Professional Evaluation		Market Incentives		Student Growth		
Element	Professional Development Units	Grad Degree/Nat. License & Certificates	Tuition Reimburse	Probationary	Non-Probationary	Hard to Staff Position	Hard to Serve School	Student Growth Objectives	CSAP Expectations	Distinguished Schools
	2% of Index Salary Increase	9% of Index Salary Increase	$1,000 Lifetime Account	1% of Index Salary when rated satisfactory	3% of Index Salary when rated satisfactory	3% of Index Bonus	3 % of Index Bonus	1% Index Salary if both objectives met 1% Index Bonus if 1 objective met	3% of Index sustainable increase for exceeding expectations; 3% Index sustainable decrease for falling below expectations	2% of Index Bonus
$ Amount	$711	$3,201	$1,000	$356	$1,067	$1,067	$1,067	$356	$1,067	$711
Builds pension & highest salary?	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Second iteration of ProComp (2008-09 to present)

Component of Index $37,551	Knowledge and Skills			Comprehensive Professional Evaluation		Market Incentives		Student Growth			
Element	Professional Development Unit	Advanced Degree and License	Tuition and Student Loan Reimbursement	Probationary	Non-Probationary	Hard to Serve School	Hard to Staff Assignment	Student Growth Objectives	Exceeds CSAP Expectations	Top Performing Schools	High Growth School
Description of Element	Providing ongoing professional development – tied to the needs of our students -- is a central strategy to help you expand your skills, improve student performance, and advance your career with the district.	Compensation for Graduate Degree or Advanced Licenses or Certificates.	Reimbursement for tuition or for outstanding student loans.	Increases for new teachers based on a satisfactory evaluation.	Increases based on a satisfactory evaluation.	Designed to attract teachers to schools with a high free and reduced lunch percentage.	Designed to attract teachers to roles with high vacancy rate and high turnover.	Incentive paid for meeting student growth objectives.	Teachers whose assigned student's growth in CSAP scores exceed district expectations.	Teachers in schools designated as a "Top Performing School" based on the DPS School Performance Framework.	Teachers in schools designated as a "High Growth School" on the DPS School Performance Framework.
Eligibility and Payout	Base building for 1st PDU earned in if 14 or fewer years of service. 2nd PDU earned is banked and paid based on years of service at payout. (14 or less is base building. >14 is non-base building) [1]	Paid upon receipt of documentation that the license or certification is active and current.	Paid upon receipt of evidence of payment for and satisfactory completion of coursework; $4,000 lifetime account; no more than $1,000 per year.	Requires Satisfactory Evaluation: If unsatisfactory, ineligible for CPE increase.	Payable only to teachers who have a formal evaluation during service credit years 1-14.	Teachers currently serving in schools designated "Hard-to-Serve".	Teachers currently serving in designated "Hard-to-Staff" positions.	Base building when 2 SGOs are met, non base-building when only 1 SGO is met during prior school year [4]	Paid based on assigned student CSAP growth percentiles. Paid based on results from prior school year.	Paid based on performance during the prior school year.	Paid based on performance during the prior school year.
Affect on Base Salary	Base Building [2]	Base Building	Non-Base Building	Base Building	Base Building	Non-Base Building	Non-Base Building	Base Building [4]	Non-Base Building	Non-Base Building	Non-Base Building
Percent of Index	2%	9% per degree or license. Eligible once every 3 yrs	N/A	1% every year	3% every three years	6.4%	6.4%	1%	6.4%	6.4%	6.4%
Dollar Amount	$751	$3,380	Actual expense up to $1000/yr, $4000 lifetime	$376	$1,127	$2,403 $200.27/mo	$2403 ($200.27 per mo) x (# of assignments held)	$376.00	$2,403.26	$2,403.26	$2,403.26
Builds pension and highest average salary	Yes	Yes	No [3]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Payment Type and Frequency	Monthly installments upon submission of proper documents	Monthly installments upon submission of proper documents	Up to $1000 per year upon submission of proper documents	Prorated over 12 months. If unsatisfactory delayed at least 1 yr	Prorated over 12 months. If unsatisfactory delayed at least 1 yr	Monthly installment upon completion of service each month	Monthly installment upon completion of service each month	1 objective: Paid lump sum. 2 objectives: Paid in monthly installments	Paid lump sum in the year following assessment	Paid lump sum in the year following assessment	Paid lump sum in the year following assessment

Source: ProComp Website. Retrieved January 14, 2010 from: http://denverprocomp.dpsk12.org/

Chapter 3 Appendices

Appendix C

Hard-to-Serve School Eligibility (2006-07 to 2007-08 school years)

Technical Description of Data Analysis to Identify Hard-to-Serve Schools for 2007-08.

(December 14, 2006, Produced by: Jennifer Sharp Silverstein)

Step 1: Data Sources

Hard to Serve requires the following information:

- School level ELL status
- School level FRL status
- Percent of students on Medicaid
- Percent of students in Center Programs
- Individual student crime level data, aggregated to school level

An excel file with school level data was created using 2006 October count data. The file include the above variables, except the crime data. The crime data used SPSS and was based on the student primary residence and attached to student's school.

All alternative schools and charter schools were excluded from the analysis.

Step 2: Replicating crime index

The crime data had the following variables:

1. Homicide
2. **Sexual Assault**
3. **Robbery**
4. **Aggravated Assault**
5. Burglary
6. Larceny
7. Theft from motor vehicle
8. Auto Theft
9. Arson
10. **Other Assault**
11. Forgery
12. **Criminal Mischief**

13. Weapons

14. Other Sexual Offenses

15. Drug Abuse

16. Against family (domestic)

17. Disorderly

18. Other

Using previous year's approach, only bolded variables were used in a factor analysis. Factor analysis, using principal components analysis, yielded two factors with eigenvalues exceeding 1. The first factor accounted for 50.9% of the variance. The first factor component weights for 2006 and 2007 are provided in Table 1. The first factor score was used for each student and identified as the crime factor. The student level scores were aggregated to the school level and the school's mean score became the crime factor for that school.

Table C.1. *Principal Component Matrix for Crime Analysis 2006 and 2007*

	Component	
	2006	2007
Sexual Assault	.229	.578
Robbery	.780	.737
Aggravated Assault	.840	.874
Other Assault	.874	.865
Criminal Mischief	.856	.833
Weapons	.646	.625
Other Sex Offenses	.803	.575
Drug Abuse	.573	.735
Against Family (Domestic)	.627	.562
Disorderly Conduct	.717	.686

Extraction Method: Principal Component Analysis.

Step 3: School level database

In SPSS, a school level data base was created. Five variables were used (ELL percent, FRL percent, Crime factor, Medicaid percent, and Center Programs) in the analysis. Z-values were calculated and saved across all schools. Descriptive statistics for these are shown in Table 2.

Table C.2. *Descriptive Statistics for Five School-level Variables*

	N	Minimum	Maximum	Mean	Std. Deviation
FRL percent	122	6.16	96.79	66.58	23.113
Center Program percent	122	.00	22.00	2.85	3.968
ELL percent	122	1.16	72.46	30.81	21.693
Medicaid percent	122	2.90	61.10	27.45	11.484
Crime Factor	122	-.99	2.72	.07	.635

Step 4: Weighted Average of School Level Variables

The z-scores were given equal weight across the schools. Schools were then sorted by education level. Then the schools were sorted by the average z-score of the 5 components. Using DCTA staff member counts, the number of staff members were expressed as percentages and cumulated from the highest to lowest average z-score. The schools staffed by the first 15% of DCTA members, starting with the highest average score, were identified as Hard to Serve. Following the same procedure as previous years, a school was included if the preceding school failed to reach a cumulative 15%, even if the difference was small. For example, if a previous school had a cumulative percent of 14.9%, the next school would be included regardless of whether the cumulative percentage significantly exceeded 15%.

Step 5: 2007 Hard to Serve Schools

Below are the 2007 Hard to Serve schools by education level. Schools that have been identified as Hard to Serve in previous years have been included on the list, along with their status. The rule is that schools are identified as Hard to Serve for three years. If a school is identified as Hard to Serve in consecutive years, the school's three years start over (Ashley Elementary).

Elementary

School Name	2005	2006	2007	Status
WHITEMAN ELEMENTARY SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
FAIRVIEW ELEMENTARY SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
WYMAN ELEMENTARY SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
GILPIN K-8 SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
BARRETT ELEMENTARY SCHOOL			**X**	**Year 1 of 3**
DEL PUEBLO ELEMENTARY SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
REMINGTON ELEMENTARY SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
MONTCLAIR ELEMENTARY SCHOOL		**X**	**X**	**Year 1 of 3**
FAIRMONT K-8 SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
MITCHELL ELEMENTARY SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
GREENLEE K-8 SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
VALDEZ ELEMENTARY SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
CHELTENHAM ELEMENTARY SCHOOL	**X**	**X**	**X**	**Year 1 of 3**
ASHLEY ELEMENTARY SCHOOL		**X**	**X**	**Year 1 of 3**
PHILIPS ELEMENTARY SCHOOL			**X**	**Year 1 of 3**
SCHENCK ELEMENTARY SCHOOL			**X**	**Year 1 of 3**
COLUMBIAN ELEMENTARY SCHOOL		**X**		**Year 2 of 3**
GARDEN PLACE ELEMENTARY SCHOOL	**X**			**Year 3 of 3**
CASTRO ELEMENTARY SCHOOL	**X**			**Year 3 of 3**
HARRINGTON ELEMENTARY SCHOOL	**X**			**Year 3 of 3**
BRYANT WEBSTER K-8 SCHOOL		**X**		**Year 2 of 3**

Middle

School Name	2005	2006	2007	Status
HORACE MANN MIDDLE SCHOOL		**X**	**X**	**Year 1 of 3**
PLACE MIDDLE SCHOOL			**X**	**Year 1 of 3**
SMILEY MIDDLE SCHOOL			**X**	**Year 1 of 3**
BRUCE RANDOLPH SCHOOL	**X**		**X**	**Year 1 of 3**
MERRILL MIDDLE SCHOOL	X			Year 3 of 3
HILL MIDDLE SCHOOL	X	X		Year 2 of 3
RISHEL MIDDLE SCHOOL		X		Year 2 of 3
LAKE MIDDLE SCHOOL	X			Year 3 of 3

High

School Name	2005	2006	2007	Status
WEST HIGH SCHOOL		**X**	**X**	**Year 1 of 3**
NORTH HIGH SCHOOL	**X**		**X**	**Year 1 of 3**
ABRAHAM LINCOLN HIGH SCHOOL	X			Year 3 of 3

All school information is included in an excel file.

Source: Market Incentives Work Group Report. Presented to the ProComp Transition Team, 2005.

Appendix D

Hard-to-Serve School Eligibility (2008-09 to present school year)

The employee must work at a hard-to-serve school. The hard-to-serve designation is based on the percentage of free and reduced price lunches served. The calculation is as of October 31 of the prior school year (October count).

Guideline FRL percentages:

- 87+% Elementary
- 85+% Middle School
- 75+% High School.
- All "Provision II" schools
- All "Alternative" schools

Employee must be actively enrolled in ProComp and be in a status of active with benefits (AB), leave with pay (LP), leave summer pay/benefits (LR), or FMLA leave (LF status in Lawson, which is currently unused), with a current or pending CDE license or authorization at the time of serving. Approved authorizations include:

1. A1 - Auth Adjunct Teacher
2. A10 - Temporary Teacher
3. A12 - JROTC Authorization (A new rule will be created for ROTC)
4. A2 - Intern
5. A3SN - Emergency Special Services Authorization
6. A3TN - Emergency Teacher Authorization
7. A6SN - Type VI Auth, Temp Special Services
8. A6TN - Type VI Auth, Temp Teacher
9. A7 - Authorization: Teacher in Residence
10. AISN - Authorization: Interim Special Services
11. AITN - Authorization: Interim Teacher
12. ATL - Alternative Teacher License
13. ATLW - Alternative Teacher License Waiver
14. INSL - Initial Special Services License
15. INTL - Initial Teacher License
16. LIFE - Life License

17. PFSL - Professional Special Services License
18. PFSM - Professional Special Services Lic-Master
19. PFTL - Professional Teacher License
20. PFTM - Professional Teacher Lic-Master
21. PVSL - Provisional Special Services License
22. PVTL - Provisional Teacher License
23. TIR - Teacher in Residence
24. TFA - Teach for America
25. DTF - Denver Teaching Fellows
26. ATLWD - District issued license replacing DTF and TFA.

Pending Licenses:

1. ALT APPL: Alternative License Applied - CDE
2. EMERG-APPL: Emergency Authorization Applied - CDE
3. REGLICAPPL: Regula License Applied - CDE
4. TIR APPL: TIR Authorization Applied - CDE

- Teacher must be assigned to a school on the Transition Team approved list of Hard-to-Serve schools during time of service. Note: Transition Team approves the list of Hard-to-Serve Schools by January of the previous year for the contract year to come. For example, the Transition Team approved the list of Hard-to-Serve schools in January of 2008 for the 2008/2009 contract year.
- Employee must serve at least one full day in that month in a qualified status at a Hard-to-Serve school to qualify for the Hard-to-Serve incentive for that month.
  Output F-005: If an employee does not serve the minimum one day in any given month, they do not qualify for the Hard-to-Serve incentive that month. Payout will be denied. Employee must be enrolled in ProComp and in a status of active with benefits (AB), leave with pay (LP), leave summer pay/benefits (LR), or FMLA leave (LF status in Lawson, which is currently unused) and have an active CDE license or approved authorization at the time of payout to qualify for payout.
- Employees that are in qualified status and successfully serve in a month during September through April qualify for payment for that month.
- Employees that are in qualified status and successfully serve in the month of May are eligible for payment in May. In addition, if they continue to remain actively enrolled in ProComp and are in AB, LF, LP or LR status, they will also receive payment over the summer months (June - August). (The employee does not have to have a current CDE license or approved authorization over the summer months to qualify for payout during the summer months.)

- Compensation is given in the same month served if the employee is identified by that months' payroll deadline. If the employee is in qualified status and successfully serves in any given month, but is not identified by that month's Payroll deadline, the employee is eligible for retroactive payment for that month to be paid in the first available payroll cycle.
- Employees that are in qualified status and successfully serve in the month of May are eligible for payment in May. In addition, if they continue to remain actively enrolled in ProComp and are in AB, LF, LP or LR status, they will also receive payment over the summer months (June - August). (The employee does not have to have a current CDE license or approved authorization over the summer months to qualify for payout during the summer months.)
- Employees will receive a percentage of the incentive that equals their FTE status at time of payout.
- The maximum payout is 1.0 FTE.
- The FTE status at time of payout multiplied by the employee's "distribution percentage" at designated Hard-to-Serve schools determines the percentage of the incentive the employee will receive, regardless of FTE at time of service. For example, an employee with 1.0 FTE who allocates time equally between two schools, but only one of the schools is designated Hard to Serve, will receive half of the total amount of the Hard to Serve incentive.
- If the employee has been RIB'd to another school that is not listed as Hard-to-Serve through no fault of their own at any point during the contract year, they may be eligible to continue to receive a Hard-to-Serve incentive.

Payment Eligibility

- Employees that are in qualified status and successfully serve during September through May are eligible for payment for that month.
- Employees that are in qualified status and successfully serve in the month of May are eligible for payment during June, July and August if they continue to remain actively enrolled in ProComp and are in a status of active with benefits (AB), leave with pay (LP), leave summer pay/benefits (LR), or FMLA leave (LF status in Lawson, which is currently unused).
- Compensation is given in the same month served if the employee is identified by that month's payroll deadline. If the employee is in qualified status and successfully serves in any given month, but is not identified by that month's Payroll deadline, the employee is eligible for retroactive payment for that month to be paid in the first available payroll cycle.

Payment Amount

- Hard-to-Serve incentives are paid out monthly as 1/12 of the annual amount.

- The maximum payout for this incentive is 1.0 FTE multiplied by the incentive amount.
- Your payment is prorated by the FTE at the school served. For example, an employee with 1.0 FTE who allocates time equally between two schools, but only one of the schools is designated Hard to Serve, will receive half of the total amount of the Hard to Serve incentive.

Source: ProComp Website. Retrieved February 1, 2010 from: http://denverprocomp.dpsk12.org/eligibility/hard_schools

Appendix E

Table E.1. *HTS Status from Year-to-Year*

Year-to-Year Transition Period	HTS Status	Frequency	Percent
2001-02 to 2002-03	0 to 0	115	100.0
2002-03 to 2003-04	0 to 0	115	100.0
2003-04 to 2004-05	0 to 0	115	100.0
2004-05 to 2005-06	0 to 0	96	83.5
	0 to 1	19	16.5
2005-06 to 2006-07	0 to 0	89	77.4
	1 to 1	19	16.5
	1 to 0	7	6.1
2006-07 to 2007-08	0 to 0	84	73.0
	1 to 1	26	22.6
	1 to 0	5	4.3
2007-08 to 2008-09	0 to 0	54	47.0
	1 to 1	24	20.9
	0 to 1	1	0.9
	1 to 0	28	24.3
2008-09 to 2009-10	0 to 0	53	46.1
	1 to 1	47	40.9
	0 to 1	4	3.5
	1 to 0	2	1.7
2009-10 to 2010-11	0 to 0	51	44.3
	1 to 1	46	40.0
	0 to 1	1	0.9
	1 to 0	6	5.2

Note: Missing values have been excluded.

Appendix F

Interview Invitation Letters to Teachers and Principals

Dear Colleagues,

Two years ago, DPS and DCTA agreed to significant changes to ProComp to increase the amount of incentives that teachers can receive for teaching in a Hard to Serve school. DPS and the DCTA have contracted with researchers from the University o f Colorado at Boulder to conduct an evaluation of ProComp.

In the next few days, a teacher or teachers at your school may be receiving an email requesting their participation in a voluntary interview regarding ProComp generally and the Hard to Serve schools incentive. We are asking you to encourage your teachers to participate in this interview as it is important that we get their feedback so that we can understand better how well our Hard to Serve incentive is aligned with DPS's goals of attracting and retaining great teachers, ensuring equitable distribution of those teachers in high-needs schools, and improving student achievement.

This interview is being conducted by an independent evaluator. DPS has contracted with Dr. Ed Wiley and the University of Colorado, Boulder (UCB) to conduct an internal evaluation of Denver's *Professional Compensation System for Teachers*, "ProComp." The UCB Evaluation Team has designed a comprehensive study to evaluate the impact of ProComp on student achievement and the hiring and retention of quality educators, with a particular focus on the effects of specific ProComp incentives on these and other outcomes.

These conversations will take place at a time and location convenient for teacher participants, will not disrupt instruction time, and will last between 45-75 minutes. A $10 gift card to *Peet's Coffee & Tea* will be provided to teacher participants as a gesture of gratitude for their willingness to participate in this part of the internal evaluation. No preparation on the part of teacher participants is required and teacher responses will be collected under a pseudonym.

The participation of your teachers will provide valuable data to help DPS continue to gauge ongoing efforts to make ProComp the best it can be. The participation of your teachers and their assistance in the evaluation process is vital and greatly appreciated.

Best,

Shayne Spalten

Chief Human Resources Officer

Denver Public Schools

Dear Colleagues,

Two years ago, DPS and DCTA agreed to significant changes to ProComp to increase the amount of incentives that teachers can receive for teaching in a Hard to Serve school. In the next few days, you may be receiving an email requesting your participation in a voluntary interview regarding ProComp generally and Hard to Serve schools specifically. Your feedback is important to better understanding how well our Hard to Serve incentive is aligned with our goals of attracting and retaining great teachers and administrators, ensuring equitable distribution of those teachers and administrators in high-needs schools, and improving student achievement.

This interview is being conducted by an independent evaluator. DPS has contracted with Dr. Ed Wiley and the University of Colorado, Boulder (UCB) to conduct the internal evaluation of Denver's *Professional Compensation System for Teachers*, "ProComp," including the impact of particular incentives, like the hard-to-serve incentive on the goals of attracting and retaining great teachers.

Your participation in these interviews is entirely voluntary and no preparation is required. Your responses will be collected under a pseudonym and school names will be replaced with numbers so that; no information that could identify you will be shared by the evaluators with DPS or DCTA. The conversations will take place at a time and location convenient for you, will not be disruptive to instruction time, and will last between 45-75 minutes. You will receive a$10 gift card to *Peet's Coffee & Tea* as a gesture of gratitude for your willingness to participate in this part of the internal evaluation.

In the next few days staff from the UCB Evaluation Team will be in contact to invite you to participate in the study and to schedule a convenient time and location for the interview.

Thank you again for your participation and assistance in the evaluation process.

Best,

Shayne Spalten

Chief Human Resources Officer

Denver Public Schools

Dear [INSERT TEACHER'S NAME HERE],

A few days ago you received an email from Shayne Spalten, DPS Chief Human Resources Officer, regarding interviews that will be conducted this semester as part of an evaluation of Teacher ProComp.

We are an independent evaluation team, led by Dr. Ed Wiley, from the University of Colorado, Boulder. **We would like to invite you to participate in a confidential, voluntary interview about ProComp generally and the Hard to Serve incentive specifically.**

These conversations will take place at a time and location convenient for you between November 15th and December 3rd, will not disrupt instruction time, and will last between 45-75 minutes. Your responses will be collected under a pseudonym and school names will be replaced with numbers so that no information that could identify you will be shared with DPS or DCTA. We are interviewing both teachers who participate in ProComp and those who do not, as well as those who work in schools designated Hard to Serve and those who do not. No preparation is required for the interview.

A $10 gift card to Peet's Coffee & Tea will be provided to you at the interview as a gesture of gratitude for your willingness to participate in this part of the evaluation of ProComp.

Your feedback is important to better understand how well our Hard to Serve incentive is aligned with DPS's goals of attracting and retaining great teachers, ensuring equitable distribution of those teachers in high-needs schools, and improving student achievement. Your participation in this interview is greatly appreciated.

Please take a moment to respond to this interview with 3 times and locations that would work best for you to meet between November 15th and December 3rd.* Interviewers are happy to meet you during the week or on weekends at your school or other location convenient for you.

Thank you in advance for your participation and your invaluable assistance in the evaluation of ProComp.

Warmest regards,

Ellie Fulbeck, Eleanor.Spindler@Colorado.edu, *Doctoral Candidate and Research Assistant on the ProComp Evaluation*

and

Dr. Ed Wiley, Ed.Wiley@Colorado.edu, *Principal Investigator on the ProComp Evaluation*

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*If you are unable to meet between November 15th and December 3rd, please email an alternative day/time to meet and we will do our best to accommodate your schedule.

Appendix G

Teacher Consent to be Interviewed

My name is Eleanor Fulbeck and I work with Dr. Ed Wiley on the ProComp Evaluation Team at the University of Colorado, Boulder in the School of Education. As part of our evaluation, we are interested in learning about the extent to which ProComp and the Hard to Serve incentive and accompanying school designation are factored into teachers' end-of-the-year employment decisions. I would like to conduct a confidential interview with you to find out what you have to say about ProComp and the Hard to Serve incentive and how it has affected you. The goal of this study is to learn about the effects of ProComp and the Hard to Serve incentive on teachers' employment decisions and to learn how teachers feel about this financial incentive. This interview is confidential: all of your statements in interview transcripts and subsequent written work will be tied to a pseudonym of your choice. Using pseudonyms helps to protect your identity, in the event that interview data is used in future reports, articles, or books. Additionally, schools will not be identified by name but rather by the percent of teachers who participate in ProComp, it's Hard to Serve status, and the grade levels served by the school.

If you agree to participate in this study, you will be interviewed individually at a date, time, and location that fits your schedule. You will be compensated for your time and effort with a $10 gift card to *Peet's Coffee & Tea*. The interview will last between 45-75 minutes, and what you say will be audio-recorded so we will have a good record of your words. The questions will ask about your decisions and feelings about ProComp, the Hard to Serve incentive, and your school. Your participation is entirely voluntary and you are free to decline to answer any questions during the interview.

If you have any questions about this research, or would like to see the results when the study is finished, you can email me at eleanor.spindler@colorado.edu or call me at (303) 345-1321 before, during and after the research. If you have questions about your rights as a research subject, you can contact the Human Subjects Research Coordinator at 1380 Lawrence St., Suite 300, or call 303-556-4060. You will receive a copy of this consent form to keep for your records. Thank you.

If you agree to participate, please sign below:

_____ _____

Teacher Signature Date

If you agree to have your interview audio-recorded, please initial below:

_____

Teacher Initials

_____ _____

Researcher's Signature Date

Appendix H

Teacher Interview Protocol

NAME

HARD TO SERVE Status/PC Status/PROBATIONARY Status/NEW or not?

EMAIL, PHONE

TIME, DAY, LOCATION OF INTERVIEW

PRE-INTERVIEW

- Introduce self
  - Former teacher in NYC
  - Familiar with challenges of teaching in a large urban district
  - As someone in grad school now, notably one of the teachers who left the profession
- Introduce study
  - Under direction of Dr. Ed Wiley, researchers at CU Boulder have contracted with DPS and DCTA to conduct an independent evaluation of Teacher ProComp
  - Talking to teachers and examining retention trends from the last 10 years in DPS to learn about how teachers make decisions about where to work at the end of the year and – if applicable – the extent to which ProComp and the Hard to Serve bonus are factored into these decisions
  - Feedback is particularly important because previous research has largely neglected teachers' voices
- Interview is confidential
  - No information that could identify you or your school will be shared with DPS or DCTA
  - You will select a pseudonym
  - Schools will be identified by their Hard to Serve status and percent of ProComp participation
- Pseudonym
  - Selected pseudonym:

    _____
- Consent form
  - Two copies – one for each of us for our records
  - You sign one for our records and keep one for your records
- Reminder: interview is voluntary
  - Can decide not to answer any particular question at any time
  - Can terminate the interview at any time
- Turn on tape recorder
  - Ask you to state pseudonym into the recorder

INTERVIEW PROTOCOL

**********I want to understand how – if at all – ProComp fits into your life**********

1. Can you talk to me about how you became a teacher?
    a. What made you want to teach?
    b. What made you want to teach in Denver?

2. How long have you been a teacher?
    a. In the district?
    b. In this school?
    c. In this subject/grade area?

3. How do you think about your employment options each school year?
    a. School?
    b. Position?

4. For example, can you take me through the process of how you made the decision to work here last year?
    a. What are the various factors you considered?

5. When you came to DPS did you have a choice about whether or not to join ProComp?

6. How did that make you feel?

7. Are there ways ProComp affected you as a teacher?

    a. Your employment decisions?

[QUESTIONS 8-12 ARE ONLY FOR TEACHERS IN HARD TO SERVE SCHOOLS]

8. Are there ways the Hard to Serve school designation and accompanying bonus has affected you as a teacher?
    a. Your employment decisions?

9. How do you feel about the "Hard to Serve" designation of your school?

   a. Does it make you feel as though you are being acknowledged for working with a special-needs student population?
   b. Does it raise any concerns for you?
   c. [IF ANSWERS TO BOTH A & B ABOVE] How do you balance the pros and cons of the Hard to Serve designation and associated financial bonus?

10. Was the "Hard to Serve" designation of your school one of the reasons you chose to stay teaching at this school? Why? Why not?

11. Do you think the "Hard to Serve" designation of your school has helped to retain high-quality teachers to the school? If so, how? If not, why not?

12. Was the "Hard to Serve" designation of your school one of the reasons you chose to join ProComp? Why? Why not?

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13. Is there anything more the district could do to [attract you to work]/[keep you teaching] at a Hard to Serve school?

14. How has ProComp affected the district as a whole?

   a. Schools within the district?

15. Is there anything else you'd like to add about working at your school, the district, or how you make your employment decisions?

16. Is there anything else you'd like to add about ProComp or the Hard to Serve bonus?

POST-INTERVIEW

- Okay to follow-up in the future?
  - Best time, day, and phone number to reach you at: _____
- Summary of findings will be available in the Spring if interested
- Coffee Card
- Thank you so much for your time

Appendix I

Code Book

Organizational and thematic codes developed to categorize the teacher interview data are presented below. Each code is identified by name and defined. Then the "parent" code is listed and an example of an interview segment coded with that code is presented. The frequency of each code represents the number of segments that were coded with that code, as opposed to the number of interviews.

Alternative Certification

Definition: Teacher prepared by alternative certification program (i.e., Teach for America, Denver Teaching Fellows, or Denver Teachers in Residency)

Parent: N/A

Example: I'm actually involved in an alternative route to licensure right now. I am part of Teach for America Colorado. Teach for America, you commit two years to teaching in a low-income school. I was placed in Colorado, that was my first choice, so I was excited about that, but I actually didn't decide until my junior year of college that I might want to be a teacher. That's why as opposed to changing my major I thought Teach for America would be a good way to do it, and also I totally support their mission of closing the achievement gap, so I wanted to be a part of that as well.

Frequency: 24

Challenge: Administration

Definition: Challenges of working in current or former school that stem from school administration

Parent: Challenge

Example: I think I just clash very much with this administration's view of how we deal with the children.

Frequency: 20

Challenge: Curriculum

Definition: Challenges of working in current or former school that stem from curriculum or curricular changes

Parent: Challenge

Example: Last year's curriculum was entirely different than what I'm doing this year. And I don't know about next year.

Frequency: 3

Challenge: District

Definition: Challenges of working in current or former district

Parent: Challenge

Example: It did not work, and you're gonna do it again, and you're trying to be heroic because in two years you want to be in Congress. You want a big, splashy name for yourself.

Frequency: 19

Challenge: Emotional

Definition: Emotional challenges of working in current or former school

Parent: Challenge

Example: Yeah. But there's a reason so many teachers drop. It's not because of all that stuff, it's because it's hard. It's not paid really that well, and a little bonus like that means nothing. It really means nothing if you're going home crying every night, you know?

Frequency: 21

Challenge: Lack of Autonomy

Definition: Challenges of working in current or former school that stem from lack of autonomy (usually from school administration but district was also cited)

Parent: Challenge

Example: Mm-hmm. Although I am told that I am teaching this curriculum in this way in this fashion at this pacing rate, and yet then I'm being held responsible for whether my students grow or not. If I'm gonna be given the responsibility, give me the professional acknowledgment of my ability to determine what my students and what curriculum they need. That doesn't happen.

Frequency: 6

Challenge: Lack of Support

Definition: Feeling unsupported by administration, colleagues and/or parents in current or former school

Parent: Challenge

Example: I think the biggest complaint I hear, because we have people come to our school who've been at other schools, is really just lack of support from parents, from administrators, from anyone. It's easy to feel isolated there.

Frequency: 5

Challenge: Lack of Time

Definition: Lack of time to accomplish teaching-related tasks – sometimes specific to current or former and other times a comment on the teaching profession more generally

Parent: Challenge

Example: I work constantly. That's why it was so difficult to schedule this time. I have 50 other things that I need to be doing, and I work all weekend.

Frequency: 17

Challenge: Low Pay

Definition: Challenge of the teaching profession

Parent: Challenge

Example: Yeah, this is my first year in the adult world, period, so that was kind of a shock, too, and just learning how that works. So I think the pay is fine, but I just don't see a way that I can really move up significantly through the years. What if four years from now I want to start a family? How am I supposed to pay for a kid? I think ProComp would maybe come into the picture at that point for me.

Frequency: 8

Challenge: Many Responsibilities

Definition: Challenges of having many responsibilities ("wearing many hats") – sometimes specific to current or former and other times a comment on the teaching profession more generally

Parent: Challenge

Example: Yeah. Because you're planning and you're grading and you're communicating with parents and then you have to go make transparencies?

Frequency: 15

Challenge: New to Teaching

Definition: Challenges related to being a new teacher

Parent: Challenge

Example: Just being able to do a second year, because this is my first year, so I'm just figuring out what to do, I'm learning the curriculum, learning the students, the school, the policies.

Frequency: 14

Challenge: Pressure to Increase Achievement

Definition: Challenges of balancing teaching responsibilities under pressure to increase student test-score achievement – sometimes specific to current or former and other times a comment on increased teacher accountability more generally

Parent: Challenge

Example: But the problem is, you don't get away with anything, because someone who's a very important someone, their kid is in your class. This is their only chance to get the best education they can get. You had better not screw it up. If their kid is not doing well on the tests, you're on the chopping block. It doesn't matter what is going in your family or whether or not your husband died or anything. None of that really matters, really all that matters is their kid. That's just how it is. And you have to learn how to deal with that. And you have to learn how to put up boundaries. But you also have to be really tough.

Frequency: 15

Challenge: School

Definition: Challenges of working in current or former school

Parent: Challenge

Example: So if you have teachers-I see a lot of times, too, there are teachers still in DPS, even with ProComp, they're like, "I can't take this anymore." Their goal is to get out of a school like this.

Frequency: 8

Challenge: Students

Definition: Challenges of working with current or former students

Parent: Challenge

Example: A different attitude, probably. Here you just give them a pencil and they throw it away. There, they keep a pencil.

Frequency: 29

Cheating

Definition: Cheating on tests – sometimes related to ProComp and sometimes more generally related to increased teacher accountability to improve student test scores

Parent: N/A

Example: Sometimes we get kids that are coming in here, and I see their previous CSAP scores, and I'm going, "Wait a minute. What is this, if you've got a kid that doesn't know 5 plus 2 is 7 in the fourth grade and they're proficient? How is that possible at the other school?" And it's not like one or two. And I'm not gonna say the school, but we've got a couple kids from this one school that is near us, and they all come in with these great CSAP scores, and they come here and they're with me as an intervention.

Frequency: 10

Complaint about PC

Definition: Complaint about ProComp generally or about specific incentives of ProComp that are not the HTS incentive

Parent: ProComp

Example: So the base-building opportunities are not that great, and the amount of money that they're giving us when we are working hard to get a PDU is really not that much.

Frequency: 5

Differences btwn HTS Schools

Definition: Qualification of the differences between two high-poverty schools

Parent: HTS

Example: Even though it's hard-to-serve, it's not as hard to serve as the northeast neighborhood schools. I think the level of poverty and second language learners are drastically different. There is a smaller group of middle-class families that attend [this school] that really give it a different vibe that I had no idea. I had never worked with that. But it's an instant feel.

Frequency: 8

Divisiveness of PC

Definition: Worries about the observed or potential of ProComp to divide teachers

Parent: ProComp

Example: I think my biggest concern is that they do divide the teachers like that. Especially when it's something that I personally felt like I should have gotten acknowledged for those scores in some way. I don't mind them getting the money, but I feel like I should have gotten some kind of-something.

Frequency: 18

Fairness of PC

Definition: Perceived fairness – or lack thereof – of ProComp

Parent: ProComp

Example: Even though I believe that we also have to involve the community and parents and it can't just be the teacher's fault if kids don't do well, teachers should be paid for what they show, for what they do with their students. That makes sense. A businessman in Wall Street gets paid because he does well with clients. If he doesn't do well with clients, he doesn't get the money he wants.

Frequency: 29

Future plans

Definition: Future employment decision plans related to retirement, leaving, or staying

Parent: N/A

Example: I'm retiring in May.

Frequency: 13

HTS Bonus

Definition: Perceptions of the HTS bonus – specifically the dollar amount rewarded to teachers who work in HTS schools

Parent: HTS

Example: I don't know, the hard-to-serve- [pause] I don't know what would attract teachers. Because the district that I came from, if it was located in DPS, I know for sure it'd be hard-to-serve. 93% of our students were free and reduced lunch at the school where I came from. So personally, what would attract me, the bonus would, but I don't know and I've never worked in one of those schools, but I think it would be help in the classroom.

Frequency: 10

HTS Label

Definition: Perceptions of the HTS label – specifically term "Hard to Serve," separate and apart from the money

Parent: HTS

Example: I like "at-risk" kids better than "hard-to-serve," because at-risk kids have a number of different characteristics. "Hard-to-serve" makes you feel like, "Oh, they're really hard to deal with." I don't like that word.

Frequency: 54

Impact of PC

Definition: Impact of ProComp on teacher, school, or district

Parent: ProComp

Example: So I think that it's definitely-there's been definitely some effects, positive and negative, across the district. I would hope more positive, for younger teachers, newer in their career teachers, having that, I think it is generally a pretty positive thing, based on my interaction with people.

Frequency: 17

Influence on job decisions: Administration

Definition: Influence to leave, accept, or stay in a job stemming from school administration

Parent: Influence

Example: It's like, once you have a bad principal, you're out of there. You either stay and suffer or you leave.

Frequency: 97

Influence on job decisions: Autonomy

Definition: Influence to leave, accept, or stay in a job stemming from autonomy

Parent: Influence

Example: Exactly. And probably the most successful principals that I've had have said, "I realize that you're a good teacher, you're a professional, I don't need to be in your room every day, but I'll come in, I'll do your evaluation," but then steps back.

Frequency: 8

Influence on job decisions: Colleagues

Definition: Influence to leave, accept, or stay in a job stemming from collegues

Parent: Influence

Example: That's why I like [this school]. Always we are finding solutions, looking for solutions. That's why I think most of us are staying more time at [this school], and there are very good teachers that are staying longer time. Even though we have new teachers, probably they will stay. We want to work as a team but also think about, like, in three years what's going to happen. We really can see the difference.

Frequency: 43

Influence on job decisions: Connection to Culture

Definition: Influence to leave, accept, or stay in a job stemming from teacher's connection to students' culture or school culture

Parent: Influence

Example: But the thing that kept me here, it's because I'm Mexican, I'm gonna say, like, 95% of this population is Mexican, so I can motivate them and I can inspire them or doing something with them, and so I said, I'm gonna try one more year to see what happens.

Frequency: 8

Influence on job decisions: District

Definition: Influence to leave, accept, or stay in a job stemming from the district

Parent: Influence

Example: I'm a Denver public school graduate, so I had my heart in DPS and I wanted to come back to it. So that was part of it. So that's why I only applied for jobs after in DPS. That's where I received a DPS education, and I wanted to give back to my community.

Frequency: 22

Influence on job decisions: Economy

Definition: Influence to leave, accept, or stay in a job stemming from the economy and recession

Parent: Influence

Example: Yeah. And I've been here for two years, so at the time, there was tons of cutbacks and everything, so I actually did not receive a call from any of the schools, including this one. I actually came into the school to talk to the principal and I gave him my resume and introduced myself. So then he asked for me to come in the next day for an interview. I didn't even really get any calls from any of the other schools at all, just because of the economic times and things were tough. He had even told me that there was, like, 200-plus applicants for this one position, so I was really kind of lucky for just getting the job, any job.

Frequency: 7

Influence on job decisions: Enjoy profession

Definition: Influence to leave, accept, or stay in a job stemming from enjoyment of teaching and a sense of fulfillment

Parent: Influence

Example: People for the most part that get into teaching that are successful with it and want to do it, it's because they love it. It's not because of the pay, obviously. So these little bonuses are nice, but they don't really mean all that much.

Frequency: 15

Influence on job decisions: Equal Education

Definition: Influence to leave, accept, or stay in a job stemming from desire to increase access for all students to an equal, high-quality education

Parent: Influence

Example: would probably be easier to teach at a very high-income-but I feel like that's not where the major problems are. They'll probably still get into college. One of the things that I read [online] was that 9% of Hispanic students from Colorado went to college. To me, that's almost offensive. How is it that low? When I looked at the demographics of the school, and I heard in the interview that it was 90% Hispanic, I said, "There's a chance to plug in that gap, to get them on the right track through high school so they can make it to college and at least bump that up a little bit. I know I'm not gonna make the singular difference between 9% and 10%, but I can try."

Frequency: 5

Influence on job decisions: Financial Incentives

Definition: Influence to leave, accept, or stay in a job stemming from financial incentives (not specific to ProComp)

Parent: Influence

Example: It has its good incentives, but for the most part, it's not about the money, it's about the research in general, about what's goin' on in my school per se.

Frequency: 18

Influence on job decisions: Geography

Definition: Influence to leave, accept, or stay in a job stemming from location of school and/or teacher's home

Parent: Influence

Example: I live downtown and I like to be able to ride my bike to work.

Frequency: 24

Influence on job decisions: HTS Bonus

Definition: Influence to leave, accept, or stay in a job stemming from the HTS bonus (separate from the label, students served, etc.)

Parent: Influence

Example: A couple thousand dollars' difference, I'd rather have a school that I like that has good kids and good staff that want to stay there. I'd rather have that than a couple thousand dollars' difference.

Frequency: 46

Influence on job decisions: HTS School

Definition: Influence to leave, accept, or stay in a job because of the HTS school (separate from the bonus)

Parent: Influence

Example: I think having been in DPS before and having been at a hard-to-serve school and knowing how much I loved it and that that is really where I'm supposed to be, working with the kids, working with the families, being able to speak the language to them and making those connections, I knew immediately that that's where I wanted to be.

Frequency: 31

Influence on job decisions: New Experience

Definition: Influence to leave, accept, or stay in a job to pursue a new experience

Parent: Influence

Example: I love change, and since I started in the [northeast] area and they were growing, and I loved [my old school] and I thought to myself, "Well, the community is changing, and since I like change, let me see what [my current school] has to offer me." I just like the idea of meeting new people, and I said, "They're very close by each other, [these two schools], but I'd like to be in a new building." I was ready for the change.

Frequency: 11

Influence on job decisions: Parents

Definition: Influence to leave, accept, or stay in a job stemming from parental involvement or lack thereof

Parent: Influence

Example: They're stressed about whether or not their kids get the "right" class and the "right" teacher. There's a lot of pressure from parents and from ourselves and from our principal that I think if we were in a different school and we weren't under so many spotlights, that we could get away with a lot more.

Frequency: 23

Influence on job decisions: Pay

Definition: Influence to leave, accept, or stay in a job because of pay (separate from ProComp)

Parent: Influence

Example: Also got pregnant. Yay, wonderful-but changed my life. I had this little house. I crunched the numbers. Who had the best starting salary for me? Denver gave 10 years credit, which, I had 14, they'd only give 10, but OK. Everybody else would only give you five years.

Frequency: 43

Influence on job decisions: Position

Definition: Influence to leave, accept, or stay in a job because of a particular position

Parent: Influence

Example: I was really, really excited about it. First of all, this was teaching eighth grade science, which is really what I wanted to do. I wanted mid-level-I didn't really want sixth grade, I didn't want seniors in high school, so I was like, "Oh, this is perfect."

Frequency: 35

Influence on job decisions: ProComp

Definition: Influence to leave, accept, or stay in a job stemming from ProComp generally, as opposed to the HTS incentive specifically

Parent: Influence

Example: (Would ProComp make you more likely to stay working in DPS?)

I think it's more the personal connection than anything. ProComp is a very nice little bonus to me to that, as long as it's-keep working on it and keep developing on it.

Frequency: 21

Influence on job decisions: Retirement

Definition: Influence to leave, accept, or stay in a job stemming from retirement plans or concerns

Parent: Influence

Example: Oh, yeah. Right now, especially at my point in my career, retirement is certainly looming large for me, so I need to make sure that my salary is as big as it can be. So any move would definitely be influenced by that, definitely.

Frequency: 10

Influence on job decisions: RIB'd

Definition: Leaving and searching for a new job because of being RiB'd

Parent: Influence

Example: I spent 10 years teaching at [my old school], and when the enrollment went down there and the enrollment moved up at [this school], I got sent over here. It wasn't a transfer that I initiated.

Frequency: 4

Influence on job decisions: School

Definition: Influence to leave, accept, or stay in a job stemming from the school generally

Parent: Influence

Example: The interview was smooth. People were relaxed. You could tell people were heading in the right direction. It was just a nice setting, and then when I got here, I found out how good of a deal they have here.

Frequency: 38

Influence on job decisions: School Redesign

Definition: Influence to leave, accept, or stay in a job stemming from school redesign

Parent: Influence

Example: We actually have-the first year I was here, we all lost our jobs, 'cause the school closed down, so we all scattered. There were maybe three or four of us from [my old school] who were hired onto [this school].

Frequency: 20

Influence on job decisions: School Reputation

Definition: Influence to leave, accept, or stay in a job stemming from school reputation

Parent: Influence

Example: I heard the students were fun to work with, and I heard it was a very vocal and strong staff, which I like. That's actually why I ended up here.

Frequency: 5

Influence on job decisions: Students

Definition: Influence to leave, accept, or stay in a job because of the students

Parent: Influence

Example: I love the population of kids in this school. I love the diversity.

Frequency: 60

Influence on job decisions: Student Achievement

Definition: Influence to leave, accept, or stay in a job stemming from student test-score achievement

Parent: Influence

Example: It's a top-achieving school, high standards. You have a variety of kids from all different levels. We have a gifted and talented program. It seems like we're making a difference. A lot of people like to send their kids from all over Denver. We have some top teachers. It's an overall highly rated school.

Frequency: 5

Influence on job decisions: Technology Access

Definition: Influence to leave, accept, or stay in a job because of access to technology

Parent: Influence

Example: Technology would also play a major role in my decision, access to it in my classroom.

Frequency: 12

Influence on job decisions: Vacancies

Definition: Influence to leave, accept, or stay in a job stemming from vacancies or lack thereof

Parent: Influence

Example: Yeah! So I did some long-term subbing at [a high school] for about six months, and they gave me a call downtown and said, "We need to at [this school], there's an opening."

Frequency: 22

Influence on joining PC: Money

Definition: Money influential in joining ProComp for voluntary participants

Parent: Joining ProComp

Example: Money. Simply money. I was at-actually, you're supposed to go when you're off the salary schedule, but at some times, I was advising people, like, they were coming to me about when they should go in, so for me, it made sense to go in at year 12, because of my position. And ProComp at the time was built on your base.

Frequency: 5

Knowledge of PC

Definition: Knowledge that ProComp existed in DPS or understanding of specific parts of ProComp

Parent: ProComp

Example: I kind of knew that they did incentive-based pay. I didn't understand ProComp in its fullest, because there's that whole matrix that kind of breaks it down and shows, like, what incentives you can get. So I didn't understand it completely, but then DPS requires that you have a mentor, so last year I had a mentor, and she's also on ProComp, so she kind of helped me to understand a little bit better.

Frequency: 19

Negative feelings towards PC

Definition: Feelings of dislike, distrust, and discomfort with ProComp

Parent: ProComp

Example: All the different bonuses that you can get through it, I think it's garbage. The PDUs, all that stuff, it's just little hoops that teachers are jumping through, and it doesn't affect their teaching. All this stuff, it's all about the money for the district. It's obvious. It's about lowering the base salary of teachers so that in the long term it's gonna be cheaper for the district. This year at North, the entire freshman class, they did Teach for America, where-I mean, they get paid pennies on the dollar, because the corporation, business, pays a large chunk, so DPS doesn't have to pay that much. It's all about cutting corners. They want to chase out the older teachers with all this stuff. They can say it's about-pay for performance is a fantastic idea, but I don't know how you can pull that off. This definitely doesn't do it. People aren't becoming better teachers. They're not more motivated getting a little bonus because you work in a tougher school. It's a nice little carrot for everyone, but that's what it is, just a little carrot.

Frequency: 52

Positive feelings towards PC

Definition: Feelings of support, appreciation, and affirmation for ProComp

Parent: ProComp

Example: I really like the philosophy with ProComp, where you're not just getting paid for an extra year, a teacher who's been here 30 years, that doesn't mean they're a better teacher. There's teachers that maybe shouldn't be there. So I liked the idea that ProComp rewards you for what you're doing. I think that makes a lot of sense. Other jobs, that's how it is. I think that makes sense.

Frequency: 45

Preference of step over PC

Definition: Indicating preference for single-salary schedule over ProComp

Parent: ProComp

Example: Knowing that I'm working on my master's right now and that would have increased my steps even more, from a selfish, the-way-I'm-paid perspective, I for sure would have done the step option and not gone into ProComp, because I know in my heart I'm still gonna do what I believe I need to do to increase student achievement, no matter what, so you don't have to pay for my performance. Don't worry about me, I'll take care of it, kind of thing. So yeah, I would have chosen the steps if I was given the choice.

Frequency: 6

Pressure to Join ProComp

Definition: Pressure or lack of pressure to join ProComp

Parent: ProComp

Example: And I think I'm at the top of the pay scale, too. I've only got 10 years in the district, goin' on 10, but it's just the idea that yeah, I made my choice, but quit rubbin' it in. Every time you acknowledge people, you're rubbin' it in that I made the wrong choice.

(You get that sense?)

That's the message I'm getting. I made the wrong choice.

Frequency: 11

Process: Job Placement

Definition: The process of finding and securing a teaching job in DPS

Parent: Process

Example: (How did you find out that this particular school had a job opening?)

It was all online, on the HR website or whatever.

(Did you apply for other jobs, too?)

I did apply for a lot of other schools, too.

(All within DPS?)

All over.

Frequency: 63

Process: Participating in PC

Definition: The process of joining or participating in ProComp

Parent: Process

Example: No, I've been in ProComp-wait, maybe I have only been in ProComp-two or three years, something like that, a very short time. Because I went to this ProComp meeting and because somebody said, "Why aren't we getting this money?" and I'm like, "Yeah, you're right, we should be getting this $4,000 like everybody else." So we went to a meeting, and one of the teachers, they gave me money to join. And I'm like, "OK, great, sign me up."

Frequency: 34

Process: RIB'd

Definition: The process of being RiB'd and the emotions that accompany this experience

Parent: Process

Example: [laughs] It was-um, a bizarre process, OK? I was notified that the funds for my position that I had held for 18 years no longer existed and that the limited funds they had they were gonna use another way, so that I was being RIB'd, in a year that I was being evaluated, but got an outstanding evaluation from my then supervisor. So it was startling to find out all of a sudden that that was happening. The job prospects at DPS at the time were bleak, but I was assured placement. I had responded to different employment opportunities off of an employment site at DPS and had interviewed at one or two.

Frequency: 3

School Different from Teacher's Own

Definition: Difference between teacher's own schooling experience and the school s/he currently teaches in

Parent: Process

Example: There's a reason that they call this a hard-to-serve school, and I didn't really think about it until October, when the first marking period was closing and I really started to see, "Whoa, this is not my high school experience." I graduated not that long ago. I remember high school fairly well, and my school for sure would not have been considered hard-to-serve at all.

Frequency: 3

Suggestions for improving PC

Definition: Suggestion(s) for how to improve ProComp

Parent: ProComp

Example: I think what would be a really nice thing is if you get awarded teachers, teachers that have gotten the best teacher, whatever, and could somehow fit them in schools to mentor. I think mentoring, I think having a ProComp mentor teacher in a school would be a huge bonus.

Frequency: 36

Teacher Accountability

Definition: Teacher accountability generally and as it relates to ProComp

Parent: N/A

Example: I'm really happy about the fact that they give you your stoplight. I feel like that's interesting information. I'm all about transparency. I'm all about knowing where you stack up. I think that that's important information to have.

Frequency: 31

Teacher Evaluation

Definition: Teacher evaluation generally and as it relates to ProComp

Parent: N/A

Example: I feel like with teaching, it's very hard to measure that, because your end product, you can't measure your end product. I don't know what a good way, but I do know you have a relationship with your principal, you have a relationship with your colleagues, you have a relationship with your parents and your students, you have how they do on tests, you have what do you do in the classroom every day. And I feel it's so personal, like people are here to measure you, measure your worth as a person. Based off of one day when you came in and you watched me? What other job do you come and watch someone doing their job and decide if they're good at it?

Frequency: 18

Unintended Consequences of PC

Definition: Actual or possible unintended consequences of ProComp

Parent: ProComp

Example: You know what I'd be worried about? Attracting teachers that shouldn't be there. We've got some teachers right now that do not belong in this school. They see these kids as lazy, they don't see them as at-risk. They even use the word "lazy." They don't have behavior management under their belt, so they see them as children who don't know how to act rather than, "I need to go get some more classes." And I wish-that's what the PDUs don't do, the ProComp. They don't dictate to these teachers what they need to go get. They just say, "You figure out a PDU." I have seen teachers use the same PDU, change it a little. They take the easy route.

Frequency: 20

Unpredictability of PC

Definition: Unpredictability of ProComp generally or of certain incentives available under ProComp

Parent: ProComp

Example: It's like, "What? Now you've changed the rules *again*?" I just read them again and found all these other changes. This is taxpayer money that is earmarked for this specific reason. So why do the rules keep changing? That's not what was presented to the public. I have a problem with that.

Frequency: 26

Ways to up HTS Retention

Definition: Ways – in addition to ProComp – to increase teacher retention at HTS schools

Parent: HTS

Example: I think the-I'm not working in that setting, but what I hear from other people is really being able to feel supported, that if we're going to in, we're gonna be able to have the resources to go in and that people are going to give us the time to go and if we're restructuring and we're gonna go and put the work in to rebuild the school, that we get the opportunity to rebuild it and time to see how the effects are and the support to-if it's in materials or time or having professional development on some sort of specific need, I think really being able to have that. Because I think, my hope would be that teachers who are going to hard-to-serve schools are saying, "I really do want to make a difference. I really want to work at my craft and get better." Really taking it as a professional move and not like, "This is my job, I'm gonna go there to get more money." That they would want to continue to learn and do better, so being able to have that freedom-not freedom, because I just don't think you can turn 'em loose, but the ability to say, "OK, we'll give you some creative time and energy and space to see what's being effective with these children."

Frequency: 61

Work hard, regardless of money

Definition: Teachers work hard regardless of the money (generally or from ProComp)

Parent: N/A

Example: The idea that we would even consider putting a bonus if test scores rise is absolutely absurd in many, many teacher's eyes, because it doesn't work. A teacher works hard. I think anybody in education works hard.

Frequency: 12

Worries about PC

Definition: Concerns about ProComp

Parent: ProComp

Example: (What reservations do you have?)

One of the biggest ones was the fact that the idea of ProComp would, in my estimation, divide teachers sharing ideas. And so what once was an environment where teachers worked together and they talked about similar problems, "I have this kid, I'm doing this curriculum thing that's not working, what do you do, do you give me an idea?" it used to flourish. Once ProComp came into being, people started becoming a little more selfish about, "What do I want to share? I can make more money if I keep this to myself and I develop it."

Frequency: 8

Chapter 4 Appendices

Appendix J

Comparison and Calculation Tables for Difference-in-Differences Models

Unconditional Estimates of ProComp on Retention Rates as a Function of HTS Status

Table L.1. *Model 1*

	Average within-school difference
PC=0	Intercept – only applicable to omitted school
PC=1	2.1%

Table L.2. *Model 2*

	Median+=0	Median+=1
PC=0	Intercept – only applicable to omitted school	Intercept – only applicable to omitted school
PC=1	1.4%	2.7%

Table L.3. *Model 3*

	HTS=0	HTS=1
PC=0	Intercept – only applicable to omitted school	-1.7%
PC=1	1.1%	1.1-1.7+3.9=3.3%

Table L.4. *Model 4*

	Median+ =0		Median+ =1	
	HTS=0	HTS=1	HTS=0	HTS=1
PC=0	Intercept – only applicable to omitted school	-1.5%	Intercept – only applicable to omitted school	-1.5%
PC=1	1.4%	1.4-1.5+1.3=1.2%	0.8%	0.8-1.5+5.3=4.6%

Conditional Estimates of ProComp on Retention Rates as a Function of HTS Status

Table L.5. *Model 5*

	Average within-school difference
PC=0	Intercept – only applicable to omitted school
PC=1	1.7%

Table L.6. *Model 6*

	Median+=0	Median+=1
PC=0	Intercept – only applicable to omitted school	Intercept – only applicable to omitted school
PC=1	1.2%	2.2%

Table L.7. *Model 7*

	HTS=0	HTS=1
PC=0	Intercept – only applicable to omitted school	-1.2%
PC=1	0.9%	0.9-1.2+3.2=2.9%

Table L.8. *Model 8*

	Median+ =0		Median+ =1	
	HTS=0	HTS=1	HTS=0	HTS=1
PC=0	Intercept – only applicable to omitted school	-1.1%	Intercept – only applicable to omitted school	-1.1%
PC=1	1.1%	1.1-1.1+1.3=1.3%	0.6%	0.6-1.1+4.4=3.9%

Appendix K

Variables	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14
Intercept	-0.956	-0.853	-0.846	-0.759	-0.773	-0.905
	(2.708)	(2.703)	(2.701)	(2.693)	(2.717)	(2.711)
ProComp	0.010	0.021*	0.017*	-0.013*	0.012	0.014
	(0.013)	(0.010)	(0.009)	(0.059)	(0.016)	(0.012)
HTS					0.032	0.032
					(0.068)	(0.038)
Changes/Recession	0.002	0.003	0.003	0.002	0.000	0.000
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Starting Retention	1.027	0.909	0.904	0.805	0.829	0.970
	(2.933)	(2.928)	(2.926)	(2.918)	(2.944)	(2.937)
New Teachers	0.183*	0.223**	0.222**	0.220**	0.191*	0.222**
	(0.084)	(0.059)	(0.059)	(0.058)	(0.084)	(0.059)
Middle School	0.082	0.080	0.073	0.072	0.069	0.092
	(0.233)	(0.233)	(0.233)	(0.232)	(0.234)	(0.234)
High School	-0.040	-0.024	-0.038	-0.038	-0.032	-0.028
	(0.067)	(0.069)	(0.067)	(0.067)	(0.068)	(0.069)
ProComp*HTS					-0.030	-0.010
					(0.070)	(0.040)
ProComp*New Teachers	0.071				-0.028	
	(0.109)				(0.130)	
ProComp*Middle School		-0.012				-0.025
		(0.023)				(0.029)
ProComp*High School		-0.026				-0.020
		(0.028)				(0.033)
ProComp*Changes/Recession			N/A			
ProComp*Starting Retention				0.167		
				(0.066)		
HTS*New Teachers					-0.486	
					(0.647)	
HTS*Middle School						-0.218**
						(0.080)
HTS*High School						0.007
						(0.107)
ProComp*HTS*New Tchrs					0.647	
					(0.685)	
ProComp*HTS*Middle Schl						0.213**
						(0.084)
ProComp*HTS*High School						-0.017
						(0.109)
R-squared	0.042	0.042	0.041	0.048	0.043	0.053

Appendix L

Scatterplots of the Relationship between Retention and Quality

Figure L.1. *Changes in Retention and Changes in Median SGPs for Reading Over Last Decade*

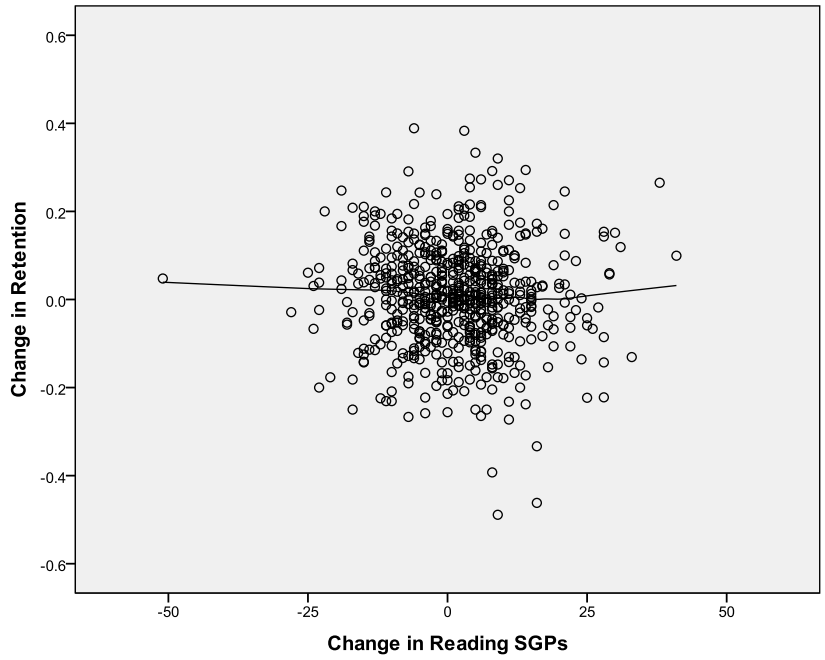

Figure L.2. *Changes in Retention and Changes in Average Years of Teaching Experience Over Last Decade*

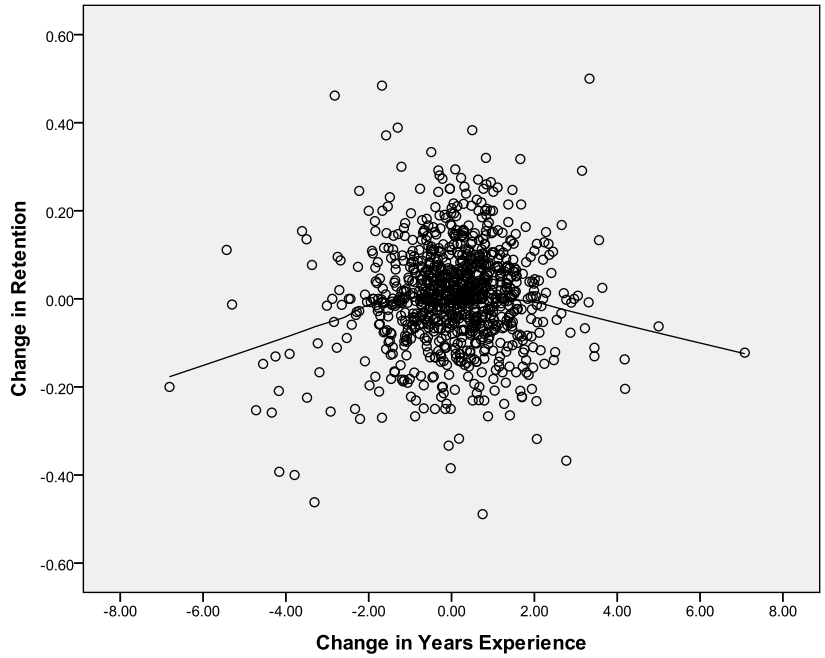

Figure L.3. *Changes in Retention and Changes in Median SGPs for Reading After ProComp*

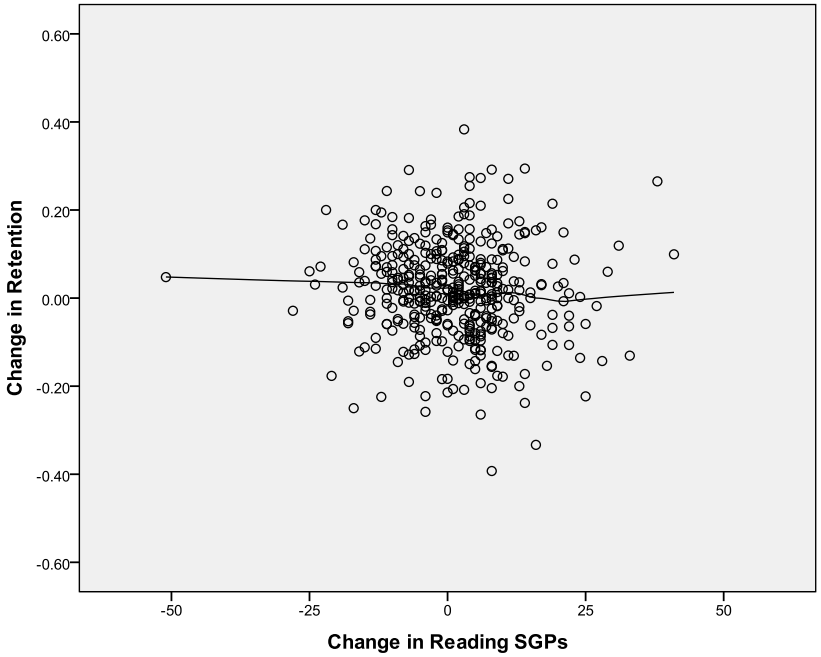

Figure L.4. *Changes in Retention and Changes in Average Years of Teaching Experience After ProComp*

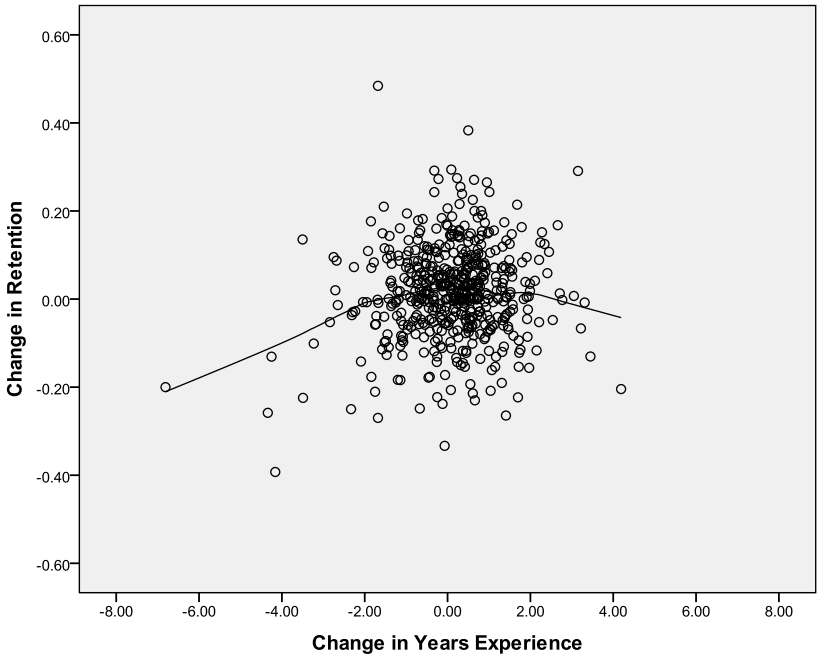

Figure L.5. *Changes in Retention and Changes in Median SGPs for Reading from 2008-09 to 2009-10*

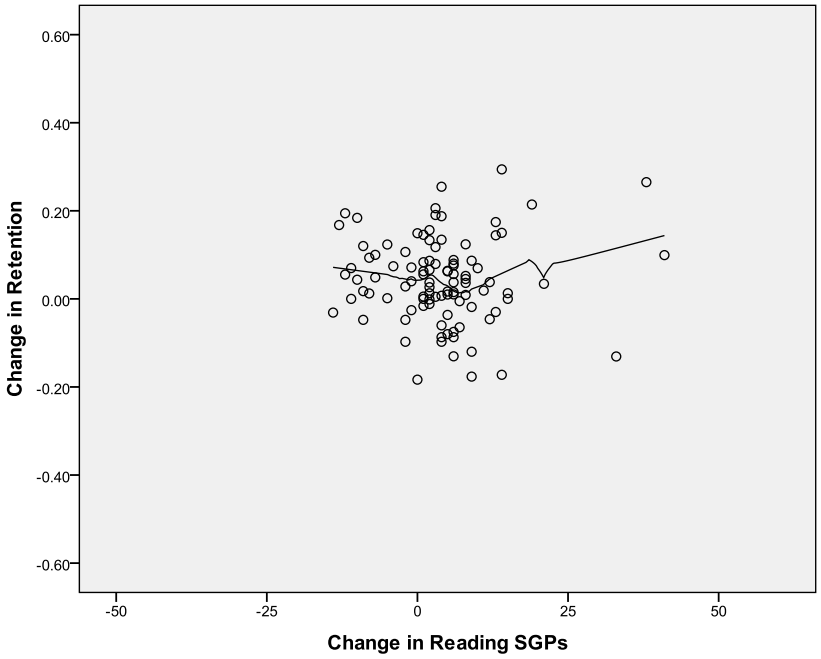

Figure L.6. *Changes in Retention and Changes in Average Years of Teaching Experience from 2008-09 to 2009-10*

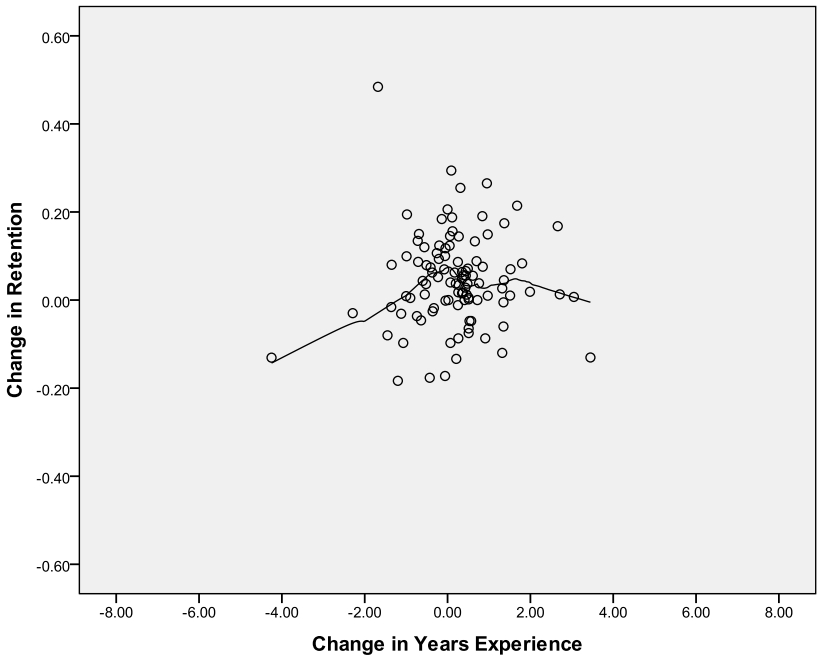

Figure L.7. *Retention and Median SGPs for Reading in 2009-10*

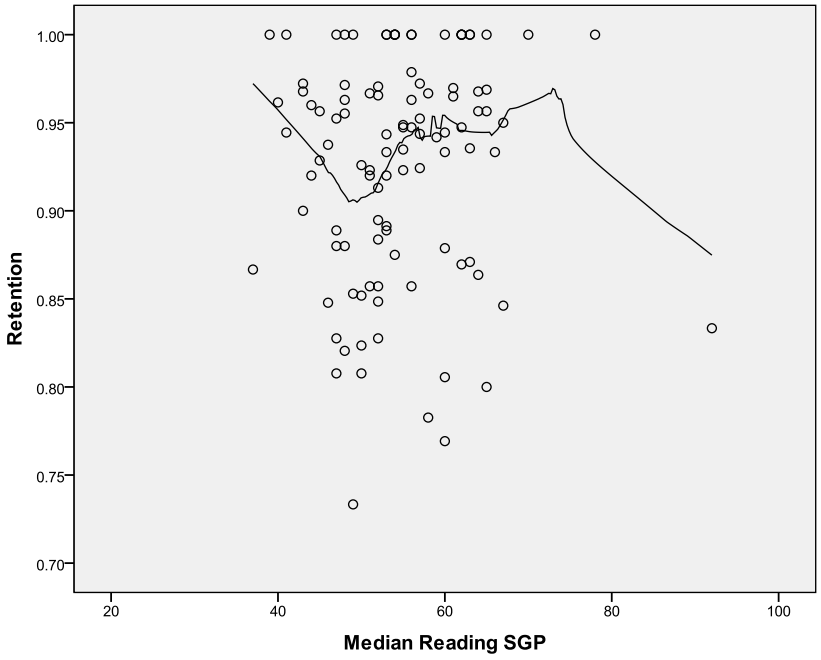

Figure L.8. *Retention and Average Years of Teaching Experience in 2009-10*