An Examination of Teacher Tenure Reform in Tennessee: Turnover, Performance, and Sense-Making

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CHAPTER 1

OVERVIEW

Does tenure reform make a difference within the K–12 teaching profession? The state of Tennessee provides a prime setting to explore this question. In 2011, the Tennessee General Assembly legislated a number of changes to the tenure eligibility process for public school teachers. In Tennessee, tenure status guarantees stricter due process (Tenn. Code. Ann. § 49-5-512–513) and protects tenured teacher contracts from non-renewal, with the exception of staff layoffs due to budget cuts and low school enrollment (Tenn. Code. Ann. § 49-5-502(a)). Prior to the 2011 reform, teachers received tenure after teaching three years within a district to complete the required three-year probation period. All teachers who received tenure prior to the passage of the law were grandfathered under the previous system and remained unaffected. In contrast, teachers without tenure prior to 2011 were required to receive the highest two categories on the state's five-category effectiveness rating ("Above Expectation" or "Significantly Above Expectation") during the final two years of an extended five-year probation period in order to become eligible for tenure. Teachers who did not receive tenure status at the end of their fiveyear probation period were either rehired under a year-to-year contract or dismissed. In addition, tenure reform effectively made tenure status non-permanent for newly tenured teachers. Teachers who received tenure could later be reverted to probation status if they received one of the lowest performance ratings ("Below Expectation" or "Significantly Below Expectation") for two consecutive years.

A brief document review of district employee handbooks and policy memos across the seven districts in Tennessee with highest student enrollment found little variation in dismissal proceedings, benefits attached to tenure, and the tenure eligibility process. Often times, districts directly referenced state law to describe the district-specific tenure process. The districts included in the document review include Davidson County School District, Hamilton County School District, Knox County Schools, Rutherford County Schools, Shelby County Schools, Sumner County Schools, Williamson County Schools, and Wilson County School District.

This dissertation presents a series of three studies—organized as chapters—that seek to contribute to the emerging empirical literature examining the effects of tenure policy reform within K–12 education. The three studies extend prior work by focusing on the Tennessee context to quantify the effects of tenure reform on both teacher performance and turnover and explore the ways in which school-based administrators and teacher have made sense of changes to the tenure eligibility process.

The first chapter of the dissertation focuses on changes to three categories of teacher turnover—within-district transfers, across-district transfers, and state exits—in the wake of tenure reform in Tennessee. The aim of the study is to separately estimate the extent to which the introduction of reforms to the tenure eligibility process influenced teacher turnover and attrition. This study takes advantage of rich administrative data compiled under the partnership between the Tennessee Department of Education (TDOE) and the Tennessee Education Research Alliance (TERA) at Vanderbilt University. To estimate the causal effect of reformed tenure eligibility requirements on teacher turnover, I leverage a difference-in-difference (DD) analytic strategy by comparing teachers affected by the comprehensive set of tenure reforms to teachers that were grandfathered under the previous tenure system. In auxiliary analyses using a regression discontinuity (RD) design, I also exploit the arguably exogenous variation in concentrations of teachers on either side of sharp performance cutoffs that determine tenure status as well as the longitudinal nature of available data before and after the implementation of tenure reform in Tennessee to estimate the impact of tenure eligibility on teacher turnover and attrition decisions under the reformed system.

The second chapter of the dissertation similarly focuses on the effect of reformed tenure policies on teacher performance. Using the same set of data as the previous study and similar DD

and RD analytic strategies, this study assesses whether and to what extent the introduction of reforms to the tenure eligibility process affected teacher performance. For the purpose of this study, I define teacher performance as a teacher's impact on student achievement on state standardized exams—that is, the value he or she adds apart from other factors that affect achievement, such as individual ability, family environment, past schooling, and the influence of peers.

The final chapter of the dissertation seeks to explore how administrators and teachers communicate and understand changes to tenure policy. The state department of education has not set out to craft explicit policy for how to communicate the implications of tenure reform to district- and school-level administrators and teachers. In effect, decisions for how to explain and orient teachers to changes to the tenure process are largely left to the devices of local district- and school-based staff. The third study of the dissertation attempts to reveal whether misconceptions about the tenure process are present in a large, urban district—Metro Nashville Public Schools (MNPS)—using an in-depth interview protocol specifically designed to prompt participants on their knowledge and perceptions of the reformed tenure process in Tennessee. Using qualitative data from interviews with school administrators and teachers, this study attempts to contextualize the primary quantitative analyses by offering insight into how school-based staff understand and perceive tenure reform and behave in reaction to the law change.

The three presented studies are among the first studies to examine the effect of recent large-scale tenure reform on teachers. Results from the first two quantitative studies add to the emerging evidence base on the effects of K–12 teacher tenure policy reform by approximating the causal effect of tenure reforms in Tennessee on teacher labor market outcomes that are conceivably most proximate to student academic performance: turnover and teacher performance. In addition, the third study provides supplemental in-depth qualitative data to

reveal how teachers and administrators understand and communicate changes to tenure policy. The full body of work that I present will not only help to inform how teachers react to tenure policy reform and the potential benefits and challenges of these reform efforts, but also identify ways to better communicate changes to tenure policy to better support educators throughout the tenure eligibility process.

CHAPTER 2

WHO STAYS, WHO LEAVES? CHANGES IN TEACHER TRANSFER AND ATTRITION IN THE TENURE REFORM ERA IN TENNESSEE

Introduction

Little empirical research to date has directly informed whether and how recent tenure reforms have impacted the K–12 teaching profession, yet the prevailing public discourse surrounding the effects of teacher tenure in public education is starkly divided. Recent court cases such as Vergara v. California (2016), which ultimately upheld statewide tenure laws in the K–12 California public school system, underscore large-scale efforts to abolish tenure entirely. However, a more moderate debate continually argues the effects of tenure as well as whether and how tenure policies can and should be reformed. On one side, reformers highlight how traditional forms of tenure restrict administrators' ability to fire ineffective teachers, involve substantial legal costs related to due process, and nullify useful performance mechanisms by granting lifetime job protection (Goldhaber & Walch, 2016). Conversely, critics of reform contend that traditional tenure policies, which typically grant lifetime tenure, make teaching a more secure and attractive profession and improve the quality of the teaching force by drawing and retaining more talented candidates to teaching (Kahlenberg, 2016).

A number of states have enacted a variety of tenure reforms in recent years, thereby potentially transforming the landscape and traditionally protected structure of the teacher labor market. Some states have increased the number of years a teacher must remain within the pretenure probation period, ostensibly to allow administrators more time to assess teacher quality prior to granting tenure (Goldhaber & Walch, 2016). Other states have implemented what are

arguably more stark reforms that require teachers to demonstrate effectiveness in order to receive tenure. Indeed, as of 2015, 23 states required evidence of teacher effectiveness to determine tenure decisions while no state had such a policy only six years earlier (Doherty & Jacobs, 2015).

Several simulation studies suggest that policies designed to selectively grant tenure and retain teachers based on early-career performance may improve the quality of the teacher workforce (Goldhaber & Hansen, 2010; Winters & Cowen, 2013a; Winters & Cowen, 2013b; Rothstein, 2015); however, only few studies have begun to examine the effect of recent tenure reform across several states, including Washington (Goldhaber, Hansen, & Walch, 2016), New York (Waite, Miller, Loeb, & Wyckoff, 2016), and Louisiana (Strunk, Barret, & Lincove, 2017). Recent evidence from Louisiana provides perhaps the most comprehensive and compelling assessment of recent tenure reform on teacher turnover thus far. After the Louisiana state legislature made tenure status contingent upon teachers receiving highly-effective ratings for five out of six consecutive years and installing a threat of tenure removal upon receiving only one year of ineffective ratings, the study found that that the overall exit rate for all traditional public school teachers increased by 1.5 percentage points per year (Strunk, Barret, & Lincove, 2017). Further, the increase in observed attrition was particularly concentrated among teachers nearing retirement and for teachers in low performing school settings.

However, tenure reform varies state to state. Unlike Louisiana, tenure reform legislation in Tennessee requires fewer years of demonstrated effectiveness for tenure eligibility and includes a strict grandfather clause that exempts teachers who already had tenure from having to fulfill the newly added eligibility requirements to maintain tenure status. In this regard, the state of Tennessee provides a prime setting to further explore the impact of more moderate tenure reforms on teacher turnover patterns. Tenure for primary and secondary school teachers was

redefined in Tennessee in April 2011, when the state legislature approved changes to the tenure process that extended the probation period from three to five years, formally required teachers to receive two consecutive years of effective ratings under the state's newly established educator evaluation system, and eliminated the permanency of tenure status by revoking tenure protections for teachers receiving ineffective ratings for two consecutive years (Tenn. Code. Ann. § 49-5-501–515). However, teachers who had already received tenure prior to the passage of tenure reform in 2011 remained unaffected and were grandfathered under previous tenure rules.

This current study contributes to the emerging empirical literature examining the effects of tenure policy reform on the K–12 teaching workforce by focusing on the Tennessee context and leveraging rich statewide administrative data. I exploit the longitudinal nature of available data before and after the implementation of tenure reform to estimate the impact on teacher transfer and attrition from the state's public school system using a difference-in-difference (DD) analytic framework. In this analysis, I compare teachers who were grandfathered under the previous tenure system to teachers who barely completed the pre-tenure probation period prior to the passage of the law—and were thus affected by legislated tenure reforms—in order to identify the comprehensive effect of tenure reform on transfer within and exit from the state's public schooling system.

In contrast with Strunk et al. (2017), I find that tenure reforms in Tennessee *decreased* school transfer within the district by 1.3 percentage points and *decreased* attrition from the state public schooling system by 1.5 percentage points. Results from auxiliary regression analyses suggest that teachers with weaker tenure protections and high rated levels of effectiveness under the state evaluation system are being retained at higher rates. Thus, the observed decreases in

transfer and exit rates may be indicative of a practice in which administrators are—to the extent possible—selectively retaining effective teachers with weaker tenure protections as teachers with traditional tenure protections are naturally "counseled-out."

In the sections that follow, I first describe the policy context and recent tenure reforms in Tennessee in more detail. Next, I delineate a general framework to situate an understanding of the hypothetical effects of tenure reform on teacher transfer and attrition patterns. I then describe the data sources as well as the primary analytic strategy for estimating the impact of recent tenure reform with respect to the following research question: To what degree did the introduction of the comprehensive set of tenure reforms in Tennessee affect transfer and attrition within the teacher workforce? In addition to examining the average effect of tenure reform, I present findings on the heterogeneous effects by school context to assess if any observed effects are moderated by whether teachers taught in hard-to-staff schools (i.e., schools with a relatively high share of low-income or minority students). I also explore heterogeneity among teachers based on their rated effectiveness as well as by cohorts of teachers at different points in time.

Finally, I conclude with a discussion of policy implications of the findings.²

Background on Tenure Reform and the Tennessee State Context

Over the past decade, Tennessee has supported a variety of education reforms with the aim of generating improved student achievement. President Obama's Race to the Top (RTTT) initiative, a competitive grant program created under the American Recovery and Reinvestment Act of 2009, served as the impetus for the most recent wave of education reforms in the state.

present and discuss these results in more detail in Appendix A.

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As an extension, I consider whether the specific set of reforms that linked teacher evaluation ratings to tenure decisions affected the likelihood of turnover and attrition for teachers who face the prospect of receiving tenure. This auxiliary analysis leverages a regression discontinuity (RD) design to exploit the arguably exogenous variation in concentrations of teachers on either side of sharp performance cutoffs that determine tenure status. I

One of the most integral features of the federal RTTT reforms was the implementation of a comprehensive educator evaluation system designed to inform human capital decisions, including, but not limited to individual and group professional development plans, hiring, assignment and promotion, compensation, and tenure and dismissal (USDOE, 2010).

In July 2011, the Tennessee State Board of Education approved the Tennessee Educator Acceleration Model (TEAM) as the new default evaluation model across the state. In addition, the state board approved three alternate teacher evaluation models for districts that demonstrate satisfactory performance: Project Coach (COACH), Teacher Effectiveness Measure (TEM), and Teacher Instructional Growth for Effectiveness and Results (TIGER). A fifth model, the Achievement Framework for Excellent Teaching (AFET) was first approved for use during the 2013–14 school year.³ All of the approved evaluation models utilize a distinct composite measure to monitor teacher performance called the level of overall effectiveness (LOE). The LOE score comprises a combination of qualitative data (i.e., classroom observations, student surveys, portfolios), student growth data, and student achievement data approved by the state and selected through mutual agreement a priori by the educator and evaluator. In short, annual evaluations differentiate teacher performance based a teacher's composite LOE score, grouping teachers into five discrete effectiveness categories (Level 1: "Significantly Below Expectation"; Level 2: "Below Expectation"; Level 3: "At Expectation"; Level 4: "Above Expectation"; and Level 5: "Significantly Above Expectation").

Tennessee's recent reforms to the tenure process leverage the newly implemented educator evaluation system to determine a teacher's eligibility for tenure status. In April 2011, a

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The first year that the reformed educator evaluation system was implemented statewide in Tennessee was the 2011–12 school year. In that year, there were a total of 135 districts throughout the state; 122 districts used the TEAM evaluation model, 11 received approval to use the TIGER model, 1 used TEM, and 1 used COACH. The AFET model was later approved for use in the Achievement School District, which comprised of the lowest performing schools throughout the state.

Table 1: Major changes to teacher tenure process, passed April 2011

Tenure Characteristic	Before 2011 Reform	After 2011 Reform
Probation period required to become eligible for tenure	Teacher completes three academic years within the district	Teacher completes five academic years within the district
Evaluation scores required to become eligible for tenure	Did not apply	Teacher must receive evaluation scores "Above Expectation" or higher (Level 4 or 5) during the last two years of the probationary period
Removal of tenure status	Did not apply	Teacher receives evaluation scores "Below Expectation" or lower (Level 1 or 2) for two consecutive years

Source: Tenn. Code Ann. § 49-5-501-515.

few months prior to the approval of evaluation reform, the Tennessee General Assembly voted to redefine tenure for primary and secondary public school teachers (Tenn. Code. Ann. § 49-5-501–515). Tennessee state law stipulates that tenure is a continuing employment status for teachers who have met the requirements of a probationary period and who cannot be fired without just cause and due process. All public school teachers in Tennessee work under contract until they receive a dismissal notice or their contract is not renewed. However, with tenure, teachers' contracts are automatically renewed until they resign, retire, or are dismissed for cause. Table 1 highlights the recent changes to the tenure process in Tennessee.

Prior to the 2011 reform, teachers received tenure after teaching three years within a district to complete the required three-year probation period. All teachers who received tenure prior to the passage of the law remained unaffected. In contrast, teachers without tenure prior to the law were required to receive the highest two categories on the state's five-category effectiveness rating ("Above Expectation" or "Significantly Above Expectation") during the

final two years of an extended five-year probation period in order to become eligible for tenure. Teachers who do not receive tenure status at the end of their five-year probation period could be either rehired under a year-to-year contract or dismissed.

Aside from extending the probation period and linking evaluation results to tenure eligibility, tenure reform laws effectively made tenure status non-permanent for newly tenured teachers. Tennessee's educator evaluation system is generally considered a "moderate-stakes" system, since teachers are not automatically dismissed upon receiving ineffective evaluation ratings. Under the new law, teachers who receive tenure can later return to probation status if they receive one of the lowest performance ratings ("Below expectation" or "Significantly Below Expectation") for two consecutive years, which could be grounds for dismissal. However, an alternate option would be to revert a teacher back to probation status and renew their contract from year-to-year.

In addition to the tenure and evaluation reforms passed and implemented in 2011, Tennessee concurrently passed several other policy reforms specifically designed to affect the K–12 teacher workforce, including collective bargaining reform and district wide alternative salary initiatives. First, in June of 2011, Governor Bill Haslam signed a bill prohibiting collective bargaining across the state's K–12 public schooling system. Prior to that point, teachers determined their own bargaining status with district-specific union certification elections (Education Professional Negotiations Act of 1978). Districts with bargaining status mandated a procedure for labor negotiations, involving district managers and union representatives who proposed an ideal contract and engaged in efforts to reach a compromise.

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⁴ The concurrent implementation of other reform initiatives serves as a plausibly confounding factor when estimating the impact of tenure reform on teacher performance; I explore the extent to which this is the case with regard to the 2011 collective bargaining reform and alternative salary initiatives in the "Threats to Validity" section, below.

District administrators were allowed to negotiate various aspects of teacher compensation and working conditions (e.g., salaries, fringe benefits, leaves of absence, and payroll deduction of union dues) and, if a compromise was not within reach, either side could request assistance from external arbitrators (Quinby, 2018). In 2011, the collective bargaining procedure was replaced with a "meet and confer" process, in which school-district administrators became the sole arbiters of labor disputes (Professional Educators' Collaborative Conferencing Act). The passage of this law was largely considered an effort to de-unionize the teaching profession. Under the reformed collective bargaining rules, teachers were still permitted to confer with administrators through an elected representative body, but were only allowed to discuss salaries and benefits, not school staffing or payroll deduction of union dues.

Finally, beginning in the 2011–12 school year, the state launched three separate initiatives to support strategic teacher compensation plans in the Tennessee public schooling system: the Competitive Supplemental Fund (CSF), the Innovation Acceleration Fund (IAF), and the Tennessee Teacher Incentive Fund (TN TIF). All three initiatives supported district efforts to implement alternative means to compensate teachers that differed from the standard state-wide Minimum Salary Schedule, which paid teachers based on highest degree earned and teaching experience. CSF, IAF, and TN TIF targeted about \$30 million of funding over the duration of five years to 14 districts, which served almost 200 schools across the state (Ballou, Canon, Elhert, Wu, Doan, Taylor, & Springer, 2016). The implemented compensation plans varied across the 14 districts, but generally provided performance bonuses to highly effective teachers as well as extra pay for professional development and leadership activities. In addition, a few plans provided financial incentives to teachers who agreed to work in hard-to-staff schools and subjects. The payout amounts allocated to eligible teachers were relatively small. In 2014–15, the

average payout was roughly \$1,500 with only 3 percent of awards amounting to larger than \$5,000 (Ballou et al., 2016). Despite the level of investment provided across CSF, IAF, and TN TIF, a formal evaluation found no discernable evidence that they increased teacher retention or improved student achievement in reading or math in participating schools (Ballou et al., 2016).

Framework

Similar to previous research on teacher labor markets (e.g., Boyd, Lankford, Loeb, Ronfeldt, & Wyckoff, 2011), I distinguish between demand-side and supply-side dynamics to situate an understanding of the underlying mechanisms that drive changes to voluntary and involuntary teacher transfer and attrition for the purpose of this study. This general framework equally applies to understanding possible impacts to teacher turnover in response to tenure policy reforms that "weaken" traditional job protections vis-à-vis the extension of the pre-tenure probation period, the linkage of tenure eligibility to demonstrated teacher effectiveness, and the designation of tenure status as non-permanent. As I will explain below, changes to administrator staffing decisions (demand) and changes to teacher preferences to remain in or leave their current position or teaching profession (supply) in reaction to weakened tenure protections may in fact counteract one another.

First, on the demand-side, hiring and retention policies and practices within the teaching profession that are responsive to performance signals explain how the linkage of tenure to performance may affect teacher turnover. Scholars have long postulated that a general goal of the human capital management process is for managers to improve organizational effectiveness by identifying and distinguishing employees in need of targeted development or dismissal from talented employees deserving of promotion and targeted retention incentives (e.g., Armstrong, 2001). However, traditional tenure protections seemingly contradict the stated functions of the

human capital management process, since lifetime job protections were granted to teachers upon teaching a certain number of years—typically three to five years—regardless of their performance on the job. Policymakers have openly claimed that recent changes to the tenure process have, at least in part, been designed to facilitate the human capital management process so that administrators can more readily make staffing decisions in response to teacher performance signals (Chait, 2010; Friedersforf, 2014; Garrison, 2014).

In the case of recent tenure reforms in the K-12 education system, linking job protections associated with tenure status to teacher performance evaluations was designed to provide administrators with more flexibility to selectively retain and dismiss teachers based on performance. Low performing teachers ineligible for tenure became comparatively more vulnerable to dismissal, whereas high performing teachers continued to benefit from automatic contract renewal. Indeed, prior research suggests that—when given the ability and supports to do so—principals make strategic staffing decisions based on teacher effectiveness information (Cohen-Vogel, 2011; Goldring, Neumerski, Cannata, Drake, Grissom, Rubin, & Schuermann, 2014; Grissom, Kalogrides, & Loeb, 2017; Grissom, Rubin, Neumerski, Cannata, Drake, Goldring, & Schuermann, 2017). In addition, prior qualitative work conducted in Tennessee suggests that principals perceive that assigning tenure protections based on teacher evaluation ratings improves their ability to strategically reassign ineffective teachers (Lomascolo, 2016). In this regard, discounting a teacher's performance level, principals may place higher value on retaining teachers with weakened tenure protections to more effectively make staffing decisions in the short-term or near future. The comprehensive effect of tenure reform on transfer and attrition rates within the teacher labor market would, therefore, be a function of the degree to

which administrators employ selective retention and dismissal practices as well as how dependent those practices are on the effectiveness composition of their teaching staff.

However, tenure reform could also impact teacher retention from the supply-side. The notion of risk aversion, which arises from the broader theory of economic rational choice, provides a conceptual underpinning to understand the supply-side linkage between reformed tenure eligibility requirements and teacher transfer and attrition. Risk aversion implies that, when introduced to large-scale uncertainty, individuals behave in such a way as to reduce uncertainty in favor of a less risky alternative (Rabin, 2000). Within the context of the K–12 teaching profession, risk aversion suggests that the removal of lifetime job protections may induce increased exit from the workforce. However, this effect may also be a function of a teacher's level of effectiveness, as ineffective teachers who are ineligible (or anticipate they will be ineligible) for the job securities afforded through tenure may prefer to switch to a school or profession with lower risk and opportunity cost. In contrast, effective teachers who receive (or anticipate they will receive) tenure may be more likely to remain in their current position.

Specific teacher background characteristics and school contextual factors may moderate the demand and supply dynamics described in this section. As stated above, the impact of recent tenure reforms may differ based on a teacher's prior rated effectiveness since administrators may be selectively retaining or dismissing teachers based on their rated effectiveness. Further, teachers with varying effectiveness levels might have vastly different expectations for receiving job protections associated with tenure status and may therefore choose to transfer and exit their school settings at different rates.

The characteristics of a teacher's school setting are an additional consideration for understanding the potential effects of tenure on transfer and attrition. Stated simply, teachers

teaching in hard-to-staff schools may be more concerned with the job protections associated with tenure and accordingly would exhibit differential changes in their transfer and retention patterns. Further, administrators may find it more challenging to selectively retain or dismiss teachers in hard-to-staff settings with little assurance that they will be able to replace teachers with more effective candidates.

Data and Sample

To analyze the effects of tenure reform and tenure eligibility on teacher transfer and attrition, I utilize statewide administrative data for Tennessee from 2001–02 through 2015–16 representing all classroom K–12 public teachers throughout the state. School placement information drawn from these data permits construction of three binary measures representing whether a teacher (1) transferred schools within the district the following year; (2) transferred districts within the state; and (3) exited the state public schooling system. Other administrative information substantially enriches these data, including teacher demographic and background information and evaluation results as well as student background information that I aggregate to yield measures on school-level student characteristics of a teacher's school.

Using school placement and teacher evaluation information, I am able to estimate the number of teachers who became eligible for tenure throughout the state. Prior to passage of tenure reform in 2011, about 4,300 to 6,500 teachers in any given year (6.7 to 10.0 percent of the teaching workforce) became eligible for tenure by completing the required three-year probation within their district. After tenure reform was passed, only about 1,600 teachers (2.2 percent of the teaching workforce) achieved the required evaluation ratings to receive tenure in each of the

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I distinguish transfer within and across districts, because the tenure probation system—both before and after the 2011 reform—imposes an incentive for teachers to remain teaching within the same district; therefore, any changes to teacher turnover patterns are likely to be confined to changes to within-district turnover.

subsequent years. The precipitous drop in newly tenure-eligible teachers post-reform illustrates the restrictive nature of the reformed tenure process, which motivates an investigation of potential dynamic turnover responses within the teacher labor market.

Estimating the Comprehensive Effect of Tenure Reform on Teacher Turnover

To estimate the comprehensive effect of tenure reform on turnover patterns within the general teacher workforce, I utilize administrative data during the years before and after the passage of the 2011 tenure reform legislation. Figure 1 presents overall trends in transfer and exit rates for all full time classroom teachers in the state throughout the available panel of data. The vertical dashed line displays the onset of tenure reform occurring in April 2011. The rate of within-district transfer steadily declines into the post-reform period from approximately 9 percent to 7 percent. In contrast, the rate of transfer across districts remains relatively constant (hovering around 2 percent) with a slight increase in the post-reform period to 3 percent while attrition from the state public school system ranges from about 8 percent to 10 percent within any given year.

While much of the fluctuations in transfer and attrition rates occur near the timing of tenure reform, these observed changes certainly cannot be attributed to reforms to the tenure process, especially since the state's current educator evaluation system was also fully implemented for the first time in 2011. To better estimate the impact of tenure reform, for the remaining analyses I focus on a sample of four cohorts of teachers that include the last two entering cohorts who were capable of receiving tenure under the older tenure process (i.e., teachers who began teaching in the state in the 2007–08 and 2008–09 school years and could thus complete the three year probation period prior to tenure reform in April 2011, hereafter called the "Grandfathered" teacher group) as well as the first two entering cohorts of teachers

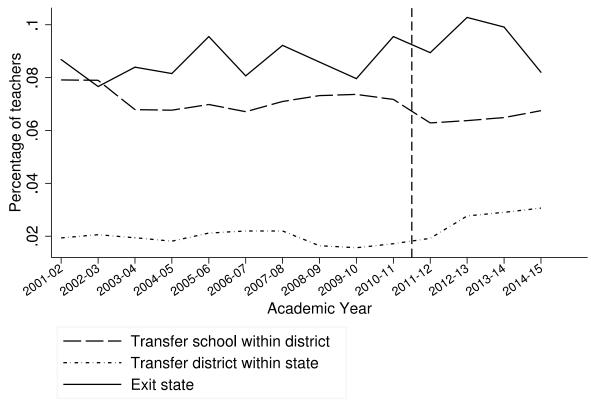


Figure 1. Percentage of Transfers and Exits, 2001–02 Through 2014–15

Note: Vertical dashed line marks beginning of tenure reform passed in April 2011.

who were affected by tenure reform (i.e., teachers who began teaching in the state in 2009–10 and 2010–11 and could not complete the standard three-year probation period before tenure reform, hereafter called the "*New Tenure*" teacher group). Note that all cohorts of teachers included in the analytic sample began teaching in the state prior to the passage of the law, but the first two entering cohorts were not affected by tenure reform while the latter two entering cohorts were.

Table 2 provides descriptive information of all teachers by analytic group during the pretenure reform period beginning in 2009–10 (when at least one cohort affected by tenure reform had began teaching in the state). As shown, there are notable differences across both groups of teachers. We would expect differences in years of experience across both groups, since, by

Table 2. Summary statistics for DD analytic sample by teacher group, pre-tenure reform (2009–10 through 2010–11)

		Subject to New Tenure	Grandfathered Under Old	Me	an
	Overall	Policy	Tenure Policy	Differ	ence
	(1)	(2)	(3)	(4): (2)	-(3)
Teacher characteristics					
Race/ethnicity					
Black	0.13	0.13	0.13	< 0.01	***
Other minority	0.01	0.01	0.01	< 0.01	***
Education level					
Masters	0.41	0.38	0.44	-0.06	***
More than masters	0.09	0.07	0.11	-0.04	***
Female	0.77	0.76	0.78	-0.02	***
Age	36.11	34.61	37.47	-2.40	***
Years of experience	5.57	4.39	6.64	-2.25	***
School characteristics					
Pct. students black	0.26	0.28	0.24	0.04	***
Pct. students other minority	0.10	0.10	0.09	0.01	***
Pct. students female	0.48	0.48	0.48	< 0.01	**
Pct. students special education	0.16	0.16	0.16	< 0.01	**
Pct. students non-native English speaker	0.09	0.09	0.09	< 0.01	***
Pct. students FRPL-eligible	0.58	0.58	0.57	0.01	***
Student enrollment	784.34	782.50	786.02	-3.52	
Number of observations	33185	13930	19255		

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Statistical significance tested using t test and chi-square to compare across teacher groups. Sample restricted to teachers entering between academic years 2007–08 through 2010–11.

definition, *Grandfathered* teachers entered the workforce earlier than the *New Tenure* teacher group. In addition to having fewer years of experience, teachers subjected to new tenure laws have, on average, lower levels of education, are younger, and work in schools with a higher composition of racial/ethnic minority students compared to teachers grandfathered under the old system. While these differences across both groups are small in magnitude, they are generally statistically significant beyond the 0.05 level.

Method

This analysis relies on a DD analytic approach to more rigorously compare the cohorts of teachers subjected to the reformed tenure legislation to the cohorts of teachers who were grandfathered under the previous tenure process. I estimate the following ordinary least squares (OLS) linear probability model separately for each category of turnover:

$$\begin{aligned} Y_{jskt} &= \beta_0 + \beta_1 NewTenure_j + \delta_0 PostReform_t + \delta_1 NewTenure_j \times \\ &PostReform_t + \pmb{X_{jskt}}\Theta + \pmb{S_{skt}}\Psi + \gamma_k + \varepsilon_{jskt}. \end{aligned} \tag{1}$$

The Y_{jskt} term represents a series of dichotomous regressands for whether teacher j in school s in district k at time t transferred schools within the district, transferred districts within the state, or exited the state public school system in the following year. Transfer within or departure from the state schooling system is modeled as a function of whether teacher j entered the public school system such that they could not complete three years of teaching in their district prior to the passage of tenure reform and was thus subjected to new tenure reforms ($NewTenure_i$) and an interaction between NewTenure; and whether tenure reform legislation from 2011 was passed and implemented ($PostReform_t$). I also include a vector (X_{iskt}) of individual teacher characteristics, such as a teacher's race, degree held, years of teaching experience⁶ as well as the year a teacher entered the TN public school system to control for fixed characteristics associated with cohorts of teachers that entered the state public school system within the same year. The model also includes a vector (S_{skt}) of school characteristics, such as student racial composition, percentage of free and reduced lunch (FRPL) eligible students, and school size as well as a district fixed effect (γ_k) to account for time invariant district characteristics. Finally, I cluster standard errors at the district-year level to account for correlations among teachers associated with school openings and closures in the same district in the same year.⁷

In model (1), coefficient β_1 captures permanent differences between New Tenure teachers and Grandfathered teachers while coefficient δ_0 captures the difference in the outcome Y_{iskt} before and after the introduction of tenure reform. The primary coefficient of interest for this

⁶ I operationalize years of experience as a series of categorical variables to capture the non-linear influence years of experience has on teacher turnover.

⁷ I also estimate alternative models with standard errors clustered at the district and teacher level. The level of statistical significance remains consistent across all model results regardless of the chosen clustering method.

analysis is δ_1 , which isolates the differential change in periods before and after the introduction of tenure reform across cohorts of teachers that were and were not affected by tenure reform. Although tenure reform was passed simultaneously with reforms to the teacher evaluation system, both *New Tenure* teachers and *Grandfathered* teachers were evaluated similarly and subject to the same set of incentives with the exception of tenure eligibility. Consequently, coefficient δ_1 does not estimate a differential effect of the 2011 educator evaluation reforms on teacher turnover across both groups of teachers, but instead provides a plausibly exogenous estimate of the impact of Tennessee's tenure reform law on teacher transfer and attrition.

To address whether tenure reform affects teacher turnover patterns, model (1) will test the hypothesis that teachers subjected to new tenure reforms experience a change in the likelihood of departure to another school or district or from the state public school system in the post-reform period ($\delta_1 \neq 0$). A statistically significant and negative δ_1 estimate may be indicative that *New Tenure* teachers are exhibiting risk-averse transfer and exit behavior. Alternatively, a positive δ_1 estimate may reveal alternate mechanisms in which, for example, administrators are selectively retaining *New Tenure* teachers to leverage the performance-based nature of the reformed tenure system.

Under a DD framework, the comparison groups are not required to be equivalent at baseline. Instead, the key identifying assumptions for the difference-in-difference estimator are that differences across groups are fixed and time invariant and the treatment is the only factor altering these differences over time. If the groups of teachers have different trends or trajectories pre-reform period, it would violate these identifying assumptions and indicate a biased estimation of the impact of tenure reform. I test the parallel trends assumption in two ways, both using graphical evidence and time-disaggregated or event time models to assess pre-reform

deviations across analytic teacher groups (*New Tenure* and *Grandfathered* teachers). Results from these tests are presented and discussed in full detail in the "Results" section below (Figure 2 and Table 3), and show no visual or statistically significant differences between teacher groups in the pre-reform years.

In addition to estimating the average effect of tenure reform on teacher transfer and exit rates, I also investigate the possibility that tenure reform has a heterogeneous effect based on school context and teacher characteristics. First, I investigate whether the introduction of tenure reform affects transfer and exit rates of teachers equitably based on whether they teach in schools with a high composition of minority or FRPL-eligible student populations. To do so, I estimate a difference-in-difference (DDD), or triple difference models by interacting the treatment and post-reform indicators with an indicator for whether a teacher's school was in the upper quintile of school-level percentage of minority or FRPL-eligible students in the state during a given year.⁸

As an auxiliary analysis, I examine whether the observed effects are concentrated in a particular cohort of the *New Tenure* teacher group (i.e., teachers that entered in the 2009–10 school year versus those that entered in 2010–11). I do so by estimating a model similar to model (1), with the $NewTenure_j$ and $PostReform_t$ indicators and their associated interactions disaggregated by each teacher cohort and school year, respectively. By disaggregating effects across cohorts and years, I am able to assess whether they fade or become more pronounced for teachers in years that they were capable of reach the post-probation phase (the *New Teacher* cohort entering in the 2009–10 school year would be able to complete the typical five-year probation period for the first time in 2014–15).

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⁸ Out of all teachers within the analytic sample, at least 21.8 percent are located in a school with a high composition of minority students in a given year; at least 19.0 percent are in a high poverty school in a given year.

Finally, I also investigate whether changes in transfer and attrition are heterogeneous for teachers based on their level of effectiveness in the post-reform period. This can help approximate whether any effects on teacher turnover associated with tenure reform are concentrated among more effective teachers that are capable of becoming eligible for tenure or among less effective teachers who face the prospect of being denied tenure. To explore whether tenure reform particularly affects transfer and attrition for various categories of teachers with regard to their rated effectiveness, I use the composite LOE evaluation ratings—the effectiveness measure directly tied to tenure eligibility decisions that combine observation and student test score information—as the main measure of effectiveness. Ideally, a triple difference model with teacher composite LOE evaluation ratings would also inform whether tenure reform effects are heterogeneous by teacher quality. However, because the onset of the current educator evaluation system in Tennessee did not occur until tenure reform was passed, the LOE rating system was implemented only during the post-reform period; therefore, I can only estimate how turnover rates differ by LOE ratings across groups of teachers post-reform using auxiliary regression models, which I discuss in more depth below.

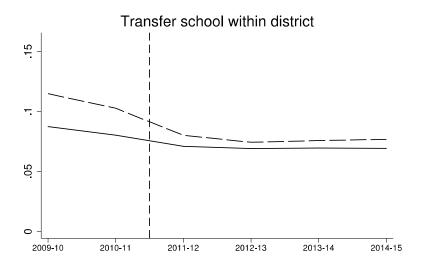
In the sections that follow, I present results from the main DD models—model (1)—estimating the impact of tenure reform on teacher transfer and attrition. I next present results for estimating the heterogeneous impact of tenure reform by school context and teacher cohort as well as results from auxiliary regressions modeling heterogeneous changes in exit and transfer rates by LOE and across teacher groups during the post-reform period. Lastly, I discuss and present a number of validity checks and sensitivity tests to demonstrate the robustness of my findings.

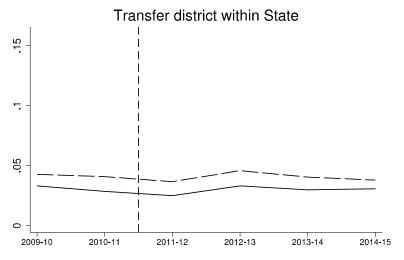
Main Findings on Tenure Reform Effects on Teacher Transfer and Attrition

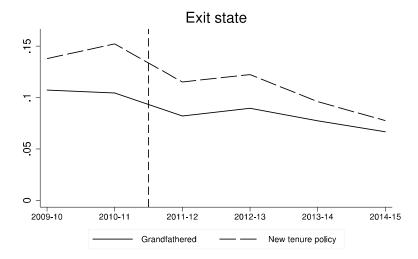
I begin my analysis with graphical descriptions of changes in transfer and attrition rates for *New Tenure* and *Grandfathered* teachers over time, which I present in Figure 2. A number of notable trends are apparent. First, Figure 2 provides visual evidence that the underlying parallel trends assumption is met as *New Tenure* teachers and *Grandfathered* teachers exhibit similar trends in transfer and attrition in the pre-reform period (the introduction of tenure reform is marked by the vertical dashed line). Second, Figure 2 provides suggestive evidence that teachers receiving tenure under the reformed tenure system experienced a decline in within-district transfer and attrition relative to teachers grandfathered under the previous tenure system. In contrast, the difference in across-district transfer rates remained relatively stable across both groups.

I more formally estimate changes in state attrition between *New Tenure* teachers and *Grandfathered* teachers using the DD model specified in model (1). Table 3 shows the main DD model estimates separately for each category of turnover and attrition. Main model estimates—columns (1a), (2a), and (3a)—confirm the general patterns reflected in Figure 2 and are statistically significant beyond the 0.05 level even after controlling for observable teacher and school characteristics and district fixed effects. Results from column (1a) suggest that teachers subjected to new tenure policy reforms are an additional 1.3 percentage points less likely to transfer schools within the district in the post-reform period. Given that within-district transfer was about 7 percent among all public school teachers throughout the state prior to the passage of tenure reform in 2011 (Figure 1), the estimated decline in within-district transfer rates associated with the passage of tenure reform represents a substantial decrease of approximately 18.6 percent.

Figure 2. Percentage of Transfers and Exits by Teacher Group, 2009–10 Through 2014–15







Note: 95% CI displayed. Vertical dashed line marks beginning of tenure reform passed in April 2011.

Table 3. DD model estimates of the probability of teacher transfer and exit

	Transfer sch	nool within district	Transfer dis	trict within state	Ex	tit state
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)
Intercept	-0.006	-0.015	0.034	0.030	0.276	0.276
	(0.165)	(0.166)	(0.114)	(0.114)	(0.201)	(0.198)
New Tenure cohort	0.021 ***	0.021 ***	0.011 ***	0.013 ***	0.052 ***	0.054 ***
	(0.004)	(0.005)	(0.003)	(0.004)	(0.006)	(0.006)
Post Reform	-0.014 ***		0.001		-0.019 ***	
	(0.004)		(0.002)		(0.004)	
2010		0.007		0.004		-0.004
		(0.006)		(0.003)		(0.006)
2012		-0.010 *		-0.003		-0.021 ***
		(0.005)		(0.003)		(0.005)
2013		-0.011 *		0.006 *		-0.009 *
		(0.006)		(0.004)		(0.005)
2014		-0.010 *		0.004		-0.022 ***
		(0.005)		(0.004)		(0.006)
2015		-0.010 *		0.006 *		-0.037 ***
		(0.006)		(0.003)		(0.006)
New Tenure x Post Reform	-0.013 ***		-0.002		-0.015 **	
	(0.005)		(0.003)		(0.006)	
New Tenure x 2010	, ,	0.012	` ,	-0.001	, ,	-0.015
		(0.009)		(0.005)		(0.010)
New Tenure x 2012		-0.009		-0.002		-0.012
		(0.006)		(0.005)		(0.011)
New Tenure x 2013		-0.014 **		-0.001		-0.011
		(0.006)		(0.005)		(0.011)
New Tenure x 2014		-0.011 *		-0.003		-0.023 ***
		(0.006)		(0.005)		(0.007)
New Tenure x 2015		-0.010		-0.006		-0.030 ***
1,0 1/ 1011010 11 2010		(0.006)		(0.005)		(0.007)
Teacher covariates	X	X	X	X	X	X
School covariates	X	X	X	X	X	X
District fixed effects	X	X	X	X	X	X
N (Teacher-year)	92815	92815	92815	92815	92815	92815

Notes: *** p<0.01; ** p<0.05; * p<0.10. Standard errors shown in parentheses are clustered by district and year. Each column within a panel is a separate regression. Observations for teachers during the 2012–2015 school years are coded as "Post Reform." Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

Similarly, column (3a) shows that teachers affected by tenure reform exited the state public school system 1.5 percentage points less in the post-reform period, which represents a 15.6 percent decline in state attrition from the pre-tenure reform attrition rate among teachers across the state. Results show no statistically significant difference in transfer rates across districts.

For each turnover outcome, I also present models that fully disaggregate years in Table 3 columns (1b), (2b), and (3b). The event time models presented in Table 3 are useful for two reasons. First, they provide a more formal test of pre-reform deviations in transfer and attrition by including a full set of year indicators and their interactions with the treatment indicator, omitting as a reference category the year prior to the implementation of tenure reform (here, the 2010–11 school year). The time-disaggregated estimates—columns (1b), (2b), and (3b)—demonstrate no pre-trend deviation in turnover or attrition by teacher group, since the coefficients on the interactions between the treatment indicator and 2010—estimated relative to the 2011 holdout year—are small and not statistically significant. The second benefit of the time-disaggregated models is that, in principle, they test how impacts evolve over time. Results indicate that the largest and most statistically significant impact on within-district transfers occur in 2013 and fades out thereafter. In contrast, the impact on state attrition becomes observable during the final two years of available data.

Heterogeneity of Comprehensive Effects of Tenure Reform by School Context

To examine whether the effect of tenure reform on teacher turnover is particularly pronounced for teachers in hard-to-staff school settings, I estimate triple difference models for various measures of school context. First, Table 4 shows heterogeneity of the effect of tenure reform by whether a teacher's school contained a high proportion of minority students (i.e.,

Table 4. Heterogeneity of DD model estimates of tenure effect, by school composition of

minority students Transfer Transfer school within district district within state Exit state (2) (3) (1) 0.028 0.276 Intercept -0.006(0.166)(0.116)(0.200)*** *** New Tenure cohort 0.025 0.011 0.049 (0.004)(0.003)(0.005)Post Reform -0.015 -0.003 -0.016(0.004)(0.002)(0.004)School w/ High Minority Composition 0.023 -0.0020.022 (0.012)(0.006)(0.010)New Tenure x Post Reform -0.015 0.001 -0.015 (0.005)(0.003)(0.005)New Tenure x School w/ High Minority Composition -0.0130.003 0.010 (0.010)(0.006)(0.012)Post Reform x School w/ High Minority Composition 0.010 0.020 *** -0.015(0.011)(0.005)(0.010)New Tenure x Post Reform x School w/ 0.005 -0.013 0.002 **High Minority Composition** (0.012)(0.006)(0.018)Teacher covariates X X X School covariates X X X X District fixed effects X X

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Standard errors shown in parentheses are clustered by district and year. Each column within a panel is a separate regression. Observations for teachers during the 2012–2015 school years are coded as "Post Reform." Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

N (Teacher-year)

92815

92815

92815

upper quintile of schools within the state) using a triple differences framework. Results for within-district transfers and state attrition suggest that impacts do not differ across school settings with a high proportion of minority students, as the triple interaction is not statistically Table 5. Heterogeneity of DD model estimates of tenure effect, by school poverty status

	Transfer school within district	Transfer district within state	Exit state	
	(1)	(2)	(3)	
Intercept	0.017	0.039	0.266	
•	(0.164)	(0.112)	(0.201)	
New Tenure cohort	0.027 ***	0.011 ***	0.005 ***	
	(0.004)	(0.003)	(0.005)	
Post Reform	-0.013 ***	-0.002	-0.016 ***	
	(0.004)	(0.002)	(0.004)	
High-Poverty School	0.028 **	-0.006 *	0.016 ***	
	(0.011)	(0.004)	(0.010)	
New Tenure x Post Reform	-0.018 ***	0.000	-0.015 ***	
	(0.005)	(0.003)	(0.005)	
New Tenure x High-Poverty School	-0.028 ***	0.003	0.008	
	(0.010)	(0.005)	(0.015)	
Post Reform x High-Poverty School	0.002	0.016 ***	-0.015 *	
	(0.012)	(0.005)	(0.009)	
New Tenure x Post Reform x High-				
Poverty School	0.023 *	-0.010	0.003	
	(0.012)	(0.007)	(0.017)	
Teacher covariates	X	X	X	
School covariates	X	X	X	
District fixed effects	X	X	X	
N (Teacher-year)	92815	92815	92815	

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Standard errors shown in parentheses are clustered by district and year. Each column within a panel is a separate regression. Observations for teachers during the 2012–2015 school years are coded as "Post Reform." Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

significant at conventional levels. That is to say, the estimated decrease in within-district transfer and state attrition associated with the implementation of tenure reform is not observably different in schools with a greater proportion of minority students. However, results indicate that tenure reform is estimated to reduce the probability of across-district transfer by 1.3 percentage points for teachers teaching in schools with a high proportion of minority students.

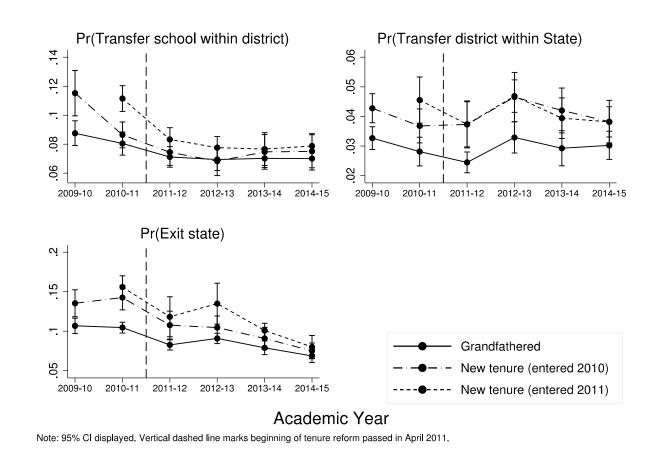
Table 5 similarly shows the heterogeneity of the effect of tenure reform by school poverty status. Recall, I use the percentage of FRPL-eligible students as the measure for student poverty and define high poverty to include schools in the upper quintile of school percentage of students who are FRPL-eligible throughout the state. Similar to before, the negative impact of tenure reform on within-district transfer and state attrition rates are not statistically different for teachers teaching in high poverty and more affluent school settings.

Heterogeneity of Comprehensive Effects of Tenure Reform by Teacher Cohort

Figure 3 displays predicted probabilities from DD model estimates, but disaggregated for *New Tenure* teacher cohorts. As shown, the estimated declines in school transfer and state exit are observably the same across cohorts, even as teachers in the earlier *New Teacher* cohort (entering in the 2009–10 school year) would have been able to enter the post-probation phase in 2014–15. These results suggest that the declines in within-district transfer and state attrition associated with tenure reform are not specific to the pre-tenure probation period and do not dissipate once teachers are capable of receiving tenure under the reformed system.

Heterogeneity of Comprehensive Effects of Tenure Reform by Prior Rated Effectiveness

To examine whether declines in with-in district transfer and state attrition during the post-reform period are more pronounced for teachers based on their level of effectiveness, I utilize the set of available evaluation data from 2011–12 through 2014–2015 to identify whether teachers received an LOE rating required for tenure eligibility indicating they were "Above expectation" (i.e., Level 4 rating or higher) in a given year. Similar to the previous DD analyses, this approach compares turnover outcomes between *New Tenure* teachers and *Grandfathered* teachers, and also estimates how the difference in turnover outcomes across both groups varies Figure 3. DD Effect by Cohort

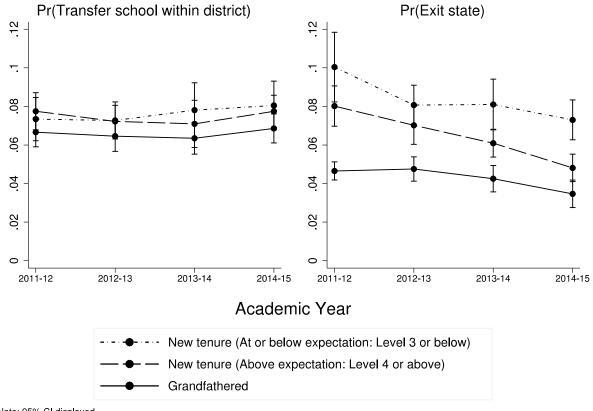


by LOE ratings within each year during the post-reform period. Therefore, I estimate a model of the following form:

$$Y_{jskt} = \beta_0 + \lambda_t + \lambda_t \times NewTenure_j + \lambda_t \times AboveExpectation_{jt} + \lambda_t \times NewTenure_j \times AboveExpectation_{jt} + X_{jskt}\Theta + S_{skt}\Psi + \gamma_k + \varepsilon_{jskt}. \tag{2}$$

In the above model, $AboveExpectation_{jt}$ represents a binary indicator for whether teacher j received a Level 4 evaluation rating or higher in year t. In addition to teacher and school covariates and district fixed effects, the above model also incorporates a year fixed effect (λ_t) as well as interactions with $NewTenure_j$ and $AboveExpectation_{jt}$. I include these interactions with year fixed effects because the relationship between turnover rates and being rated "Above Expectation" or higher for NewTenure teachers may change differently over time compared to

Figure 4. Predicted Probability of Transfer/Exit by Teacher Group and LOE, Post-Reform (2011–12 Through 2014–15)



Note: 95% CI displayed.

Grandfathered teachers. What we might expect to see is that if there are observable differences in turnover for *New Tenure* teachers in the post-reform period, these differences may be larger in magnitude for those that are rated "Above Expectation." As before, standard errors are clustered at the district-year level.

Figure 4 presents predicted probabilities generated from estimates using model (2) throughout the post-reform period. Here, I focus on the predicted probability of within-district transfer and state attrition, since tenure reform appears to have significantly impacted these two forms of mobility. As shown, the predicted probability of within-district transfer is statistically indistinguishable across both groups of teachers throughout the post-reform period, regardless of their rated level of effectiveness. However, Figure 4 indicates that the decrease in probability of

state exit observed among teachers affected by the new tenure law appears to be driven by decreased exits among teachers rated above expectations under the state educator evaluation system. Notably, this finding suggests that declines in attrition associated with tenure reform are likely concreted among highly effective teachers with evaluation ratings that would satisfy the tenure eligibility requirements.

Threats to Validity

I identify several potential threats to the validity of my findings and provide additional evidence to rule out each threat as an unlikely source of bias. First, I perform falsification tests to ensure that my results are robust and valid by re-estimating model (1) among samples of cohorts not affected by the state's legislated reforms to the tenure process. I focus on two samples of unaffected cohorts: (1) the last four entering cohorts grandfathered under the old tenure process (i.e., teachers entering the state public school system between the school years 2006–07 through 2008–09) and (2) the first four entering cohorts observed in the available data (i.e., teachers entering between 2002–03 through 2005–06). Further, I also simulate the timing of the onset of tenure reform to four years after the first entering cohort appearing in the placebo sample to address concerns that estimated impacts are due to natural deviations in transfer and exit rates across cohorts occurring early in teachers' careers. Results of these falsification tests are provided in Table 6. In general, tenure reform had no impact among samples of untreated teacher cohorts, and in the few instances in which the impact of tenure reform is statistically significant the coefficient of interest is positive and in the opposite direction of the negative estimated impacts found in the main results. In other words, falsification tests reveal no evidence that negative estimated impacts on within-district transfers and state attrition are due to differential trends between the treatment and control teachers in omitted variables, or other potential sources of bias.

Table 6. Placebo test: DD model estimates among untreated cohorts

	Transfer school	Transfer district		
	within district	within state	Exit state	
	(1)	(2)	(3)	
Placebo: Sample restricted	d to last 4 entering coh	norts before reform (2006 to 20	09); Post reform starting 2012	
New Tenure x Post Reform	0.002	0.002	0.009 **	
	(0.004)	(0.002)	(0.004)	
	N = 129258	N = 129258	N = 129258	
Placebo: Sample restricted	d to last 4 entering coh	norts before reform (2006 to 20	09); Post reform starting 2010	
New Tenure x Post Reform	0.012 ***	-0.002	-0.004	
	(0.004)	(0.002)	(0.005)	
	N = 129258	N = 129258	N = 129258	
Placebo: Sample restricted to	o first 4 entering coho	erts observed in panel (2003 to	2006); Post reform starting 201	2
New Tenure x Post Reform	-0.006	-0.001	-0.002	
	(0.004)	(0.002)	(0.004)	
	N = 165750	N = 165750	N = 165750	
Placebo: Sample restricted to	o first 4 entering coho	erts observed in panel (2003 to	2006); Post reform starting 200	<u> </u>
New Tenure x Post Reform	0.007 *	0.001	-0.007	
	(0.004)	(0.002)	(0.004)	
	N = 165750	N = 165750	N = 165750	

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Standard errors shown in parentheses are clustered by district and year. Each column within a panel is a separate regression. Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

Another concern that poses a potential threat to my results is that differences across the New Tenure and Grandfathered teacher group may not be fixed over time; that is, there may be dynamic differences across both groups of teachers. One potential reason for dynamic differences includes differing reactions across both teacher groups to the Great Recession (2007– 2012), especially since *New Tenure* cohorts entered the teacher labor market in later years as the recession was winding down. I conduct various graphical checks to assess differences in indicators over time to assess whether teacher labor market conditions were particularly dissimilar during years that New Tenure cohorts entered the labor market (i.e., the 2009–10 and 2010–11 school years). The results of these checks are provided in Appendix B. In general, I find no strong indication that conditions were dissimilar in years that New Tenure cohorts entered the market, as there was no observable decline in teaching positions (Figure B.1) and the average school enrollment remained virtually steady (Figure B.2) around the time of passage of tenure reform in 2011. As for the number of possible temporary teaching positions—due to temporary leave, for example—I examined the number of temporary exiting teachers in any given year (i.e., exiting teachers who re-entered the market in later years). While there is a slight decline in temporary exiting teaching teachers from approximately 1,500 in 2001–02 to 600 in 2013–14, this declining trend may be a byproduct of a shortened time frame to observe former teachers who re-enter the labor market in later years. Nevertheless, the trend in decline in temporary exiters remains virtually constant in the years immediately prior to tenure reform in 2011 (Figure B.3), which suggests there may be little difference in temporary teaching positions as *New Tenure* cohorts entered the labor market.

Finally, I conduct checks for whether observed effects are concentrated in districts that experienced concurrent collective bargaining and alternative salary reforms that may have

Table 7. Sensitivity analysis: DD logit model marginal effects

	Transfer school within district	Transfer district within state	Exit state
	(1)	(2)	(3)
Logit Model			
(Marginal Effect)	-0.014 ***	< 0.000	-0.015 **
	(0.004)	(0.003)	(0.007)
Teacher covariates	X	X	X
School covariates	X	X	X
District fixed effects	X	X	X
N (Teacher-year)	92815	92815	92815

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Standard errors shown in parentheses are clustered by district and year. Each column within a panel is a separate regression. Observations for teachers during the 2012–2015 school years are coded as "Post Reform." Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

affected the teacher labor market, which I also more thoroughly discuss in Appendix B. Results from these checks suggest that declines in within-district transfer and school attrition are not solely concentrated in districts that were most affected by collective bargaining reform (Table B.1) or in districts implementing alternative modes of teacher compensation (Table B.2), as the magnitude of DD model estimates are relatively similar for districts that were and were not affected by these reforms.

Sensitivity Analyses

I investigate the sensitivity of my main results to modifications in the model, presented in Table 3. First, I estimate a logit model for binary outcomes rather than the linear probability model in model (1). The statistical significance of results (marginal effects are shown in Table 7) is quite similar to the main results and suggests that tenure reform reduced the probability of within-district transfer and state attrition by 1.4 percentage points and 1.5 percentage points, respectively.

I also re-estimate my analyses by clustering standard errors at the teacher as well as the district level to address concerns that errors are likely to be correlated for the same teacher or district across years, which cause over-rejection of true null hypotheses in DD applications (Bertrand, Duflo, & Mullainathan, 2004). I find that the level of statistical significance remains consistent across all models regardless of the method for clustering standard errors.

Discussion

Tenure reform, motivated in part by concerns for administrator's inability to employ human capital management decisions, has the potential to affect teacher turnover. Overall, I find evidence that the introduction of comprehensive tenure reforms in Tennessee—which simultaneously extended the pre-tenure probation period, required evidence of effectiveness for tenure eligibility, and revoked tenure status for teachers with consecutive ineffective ratings—decreased the probability of within-district transfer and exit from the state among newly entering teachers throughout the state. Further, results from triple difference models indicate the reduction in transfer and attrition was consistent for teachers in school settings with a high composition of minority students and high poverty. Finally, auxiliary regressions, which compared teachers by their rated effectiveness according to the measure most directly tied to the tenure eligibility process (i.e., composite LOE), indicated that the decrease in attrition observed in the post-reform period was primarily concentrated among teachers rated as effective under the state evaluation system.

The observed negative comprehensive impact on within-district transfer and state attrition observed from this study—at least in part—contradict tenure reform effects that may be found in other state settings. In particular, research examining tenure reforms in Louisiana revealed that changes to the state's tenure process resulted in increased attrition of equal magnitude to the

decrease in attrition observed in this study (Strunk et al., 2017). There are perhaps very plausible reasons for the differences in impacts across both state settings. First, the tenure statute passed in Louisiana did not grandfather tenured teachers to maintain former tenure rules whereas Tennessee did maintain previous tenure procedures for teachers who already received tenure prior to the passage of tenure reform (Strunk et al., 2017; Tenn. Code Ann. § 49-5-501–515). Results from Louisiana suggest that increased attrition was primarily concentrated among teachers nearing retirement (Strunk et al., 2017). These teachers, for the most part, once had lifetime tenure protections and could thereafter lose tenure status upon receiving ineffective ratings once tenure reform was passed. In Tennessee, no teachers with tenure status prior to legislated changes in 2011 experienced a removal of job protections regardless of their effectiveness ratings. Thus, the contrasting effect found in this study and the Louisiana case may reflect the absence of increased exits among previously tenured teachers in response to the loss of permanent job protections in Tennessee.

A second consequence of grandfathering traditional job protections for teachers who already received tenure prior to the onset of tenure reform in Tennessee was that the law effectively created two distinct categories of teachers: grandfathered teachers with lifetime job protections regardless of rated effectiveness and teachers who recently entered their district and could only achieve and maintain similar job protections by demonstrating continuous effectiveness under the state's performance evaluation system. In this regard, it is plausible that administrators have reason to selectively retain and privilege teachers based on this distinction. Indeed, qualitative research suggests that some administrators do perceive that the reformed tenure eligibility process based on teacher evaluation ratings supports their ability to strategically reassign ineffective teachers (Lomascolo, 2016; Rodriguez, 2018). Therefore, the negative

impact on within-district and transfers and attrition found in this study may be indicative of administrators employing a practice to selectively retain teachers who can no longer receive tenure under the traditional tenure system as they may place more value in their increased ability to manage and assign these staff when necessary.

In addition to examining the comprehensive effect of tenure reform among newly entered teachers in the labor market, I examined the effect of tenure eligibility on turnover patterns among teachers with evaluation ratings on either side of the newly defined performance eligibility threshold (Appendix A). While I confirm several forms of evidence that affirm the discontinuous eligibility rule as a valid quasi-experiment under a regression discontinuity (RD) analytic framework, I find no observable impact of tenure eligibility on teacher turnover among teachers near the performance threshold. The lack of an observed effect on teacher turnover may be due to various reasons. First, teachers may not be incentivized by tenure, especially considering that tenure itself is no longer as strong of a job protection as it traditionally was given its nonpermanent nature under the reformed tenure system. Alternatively, teachers may not be aware or generally unclear about how the current tenure process functions—for example, they may not understand the specific threshold marks they need to receive tenure, nor the timing of their probation period. Indeed, interviews with pre-tenure teachers in Metro Nashville Public Schools indicate that teachers are generally unaware of the specific aspects of the reformed tenure process (I present these findings in Chapter 4). Lastly, the localness of the RD method may mask any potential effect that tenure eligibility has on teacher turnover. Perhaps tenure eligibility may have an effect on teachers' decision to exit their school but only among teachers far from the defined tenure eligibility thresholds.

As a matter of policy and practice, this study highlights the importance of a complete grandfather clause as a central aspect within tenure reform. By guaranteeing that tenured teachers remain unaffected by any changes to the tenure process, tenure reforms packaged with a full grandfather clause may result in declines in turnover, or at the very least may help evade a mass departure of veteran teachers from the workforce. Further, auxiliary RD analyses indicate that tenure eligibility may not have induced comparably similar teachers to differentiate their turnover patterns, which highlights the importance of guidance for teachers to understand the existing process to become eligible for incentives and protections associated with tenure. Tenure eligibility could theoretically reduce teacher turnover in a pro-effectiveness direction from the supply-side; that is, teachers identified as sufficiently effective to receive tenure under the current evaluation and tenure systems may very well be less likely to depart from their teaching position if they better understood the tenure process. Thus, a well-designed tenure system may not be sufficient to achieve desired teacher turnover outcomes; supports to acclimate and inform the workforce may also be necessary.

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Appendix A. Estimating the Direct Effect of Tenure Eligibility on Teacher Turnover

I leverage a regression discontinuity (RD) design to estimate the impact of tenure eligibility on teacher turnover patterns. The RD analytic design aims to isolate the causal effect on teacher performance by exploiting a discontinuity in the probability of remaining on-track to receive tenure conditional on a teacher's LOE score, which serves as the measure that determines tenure eligibility under the reformed tenure system and running, or forcing variable in the RD analysis. Because a teacher's eligibility for tenure is determined by a score on a continuous variable with a strict cutoff (i.e., new teachers with LOE \geq 350 in their final two years of probation are on-track to receive tenure), teachers immediately on the other side of the threshold serve as a control to estimate an unbiased "local average treatment effect" (LATE) of eligibility to gain tenure within specified bandwidths. Further, the longitudinal nature of the data permits an estimation of RD effects across several cohorts of teachers before and after the implementation of the tenure reform law to assess whether effects are concentrated during particular post-reform years.

The following sub-sections describe the analytic samples of interest, proposed model specifications, and assumptions and limitations of the RD analysis in more depth followed by a discussion of main and heterogeneous results.

Method

Given that Tennessee's reformed evaluation system was first implemented during the 2011–12 school year, evaluation data for the continuous LOE composite measure (i.e., the running variable in the current analysis) is first available for 2012. This analysis therefore uses available state administrative data from 2011–12 and onward to identify samples comprised of repeated cross-sections of teachers who are in distinct stages of the typical probation and tenure

phase. I focus on two samples of teachers. First, I estimate the effect of remaining on-track to receive tenure in the fourth year of probation by using a pooled sample of repeated cross-sections of teachers who taught in a district for four consecutive years, which I henceforth refer to as the sample of "4th year probation teachers." Second, I examine the effect of remaining on-track to receive tenure through the fifth year of probation. To do so, I use a second sample of teachers who taught in a district for five years and who received an effective score in the previous year, which for the sake of simplicity I refer to as the sample of "5th year probation teachers"; these are the subset of teachers who would become eligible for tenure if they receive a second consecutive score above the tenure eligibility threshold (LOE ≥ 350).

For both the 4th and 5th year probation teacher samples, I estimate the following analytic model using local linear regressions separately for data pooled across years and for each year individually:

$$Y_{js} = \alpha I \left(LOE_j \ge 350 \right) + f \left(LOE_j \right) + X_{js}\Theta + S_s \Psi + \varepsilon_{js}. \tag{A.1}$$

In model A.1, Y_{js} represents the outcome of interest for teacher j in school s: transferred schools within district, transferred districts within state, or exit state public school system the following year. The running variable LOE determines whether a teacher remained on-track to receive tenure if they scored above the required effectiveness cutoff ($LOE_j \ge 350$). The α coefficient represents the estimated difference in the outcome of interest between teachers on either side of the performance cutoff. That is, α identifies the "discontinuity" or "jump" in transfer or attrition rates for teachers with ratings that satisfy the reformed tenure eligibility requirements. More specifically, α represents an intent-to-treat (ITT) causal effect of remaining on-track to receive tenure on subsequent teacher turnover among teachers near the performance threshold. The model also includes a vector of observable teacher and school characteristics, represented by X_{js}

and S_s , and conditions for flexible functional form assumptions on either side of the cutoff before and after the implementation of tenure reform, which I assume to be a local linear relationship. To address whether tenure eligibility alters teacher turnover patterns, model (A.1) will test the hypothesis that remaining on-track to receive tenure impacts the likelihood of departure to another school or district or from the state public school system among a sample of teachers nearing the end of the five-year pre-tenure probation period ($\alpha \neq 0$).

Assumptions and Limitations of the RD Identification Strategy

The key theory for causal inference within the RD framework is that teachers with similar underlying LOE scores are similar in other respects, and thus—conditional on the underlying score—the discontinuous rating assignments can be viewed as effectively random (Imbens & Lemieux, 2008; Lee & Lemieux, 2010). The RD design remains a credible approach for identifying the causal effects of tenure eligibility on teacher turnover subject to several assumptions, particularly the absence of covariate baseline imbalances and manipulation of the running variable around the cutoff determining treatment (i.e., being on-track to gain tenure).

I perform two tests that are commonly used to detect potential violations of these RD assumptions. The first test examines whether there are baseline imbalances between teachers on either side of the tenure eligibility cutoff. If other variables were discontinuous at the main thresholds, it would suggest that individuals with similar forcing-variable values near the cutoffs are not otherwise similar. To determine whether other discontinuities in the data are present and align with the main discontinuities in teachers' evaluation scores, I estimate a series of reduced-form models similar to model (A.1) with each teacher and school covariate as the dependent variable. As described by Lee and Lemiex (2010) and others, the concern is whether the

Table A.1. Auxiliary RD model estimates, covariate balance in the probation teacher samples

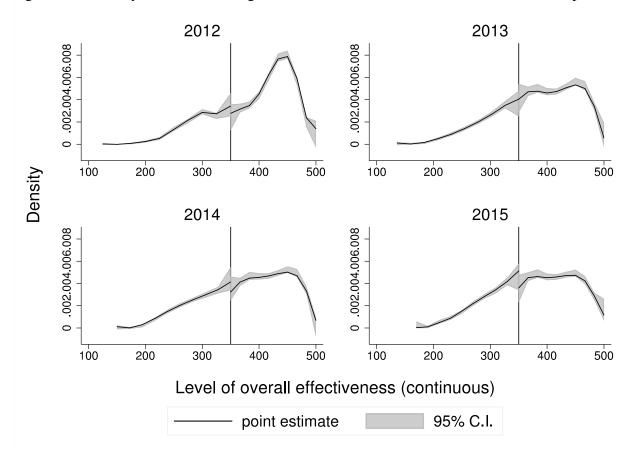
5th year probation teachers, previously rated "above 4th year probation teachers expectation" Teacher covariate 2012-13 2013-14 2014-15 2013-14 2014-15 Teacher characteristics Tested subject/grade 0.061 0.062 0.025 0.037 0.038 (0.068)(0.065)(0.063)(0.117)(0.100)Minority/non-white 0.016 -0.021 0.028 0.020 0.055 (0.041)(0.043)(0.049)(0.044)(0.078)Masters or more 0.039 -0.053 0.017 0.024 0.077 (0.040)(0.045)(0.031)(0.049)(0.070)Female -0.009 0.109 -0.0480.045 0.078 (0.067)(0.066)(0.051)(0.078)(0.085)Age 0.266 0.107 -0.788-0.771-2.288(1.540)(1.541)(1.264)(2.265)(2.505)Years of experience 0.530 -0.962-0.4490.381 -0.375 (0.873)(0.774)(0.639)(1.270)(1.263)School Characteristics Pct. minority/non-white 0.003 0.000 0.009 0.013 -0.006(0.016)(0.013)(0.016)(0.021)(0.022)Pct. female 0.003 0.002 0.005-0.0040.002 (0.004)(0.009)(0.004)(0.014)(0.010)Pct. special education -0.009 0.010 -0.004-0.006 0.010 (0.008)(0.011)(0.007)(0.013)(0.013)Pct. non-native English 0.003 0.007 -0.004 -0.007 -0.027speaker (0.019)(0.014)(0.018)(0.028)(0.030)Pct. FRPL-eligible 0.039 0.037 -0.0120.014 0.022 0.030 0.038 0.045 0.051 0.035 Student enrollment -10.240 -40.599 10.082 82.866 -59.897 (58.710)(62.226)(52.522)(104.787)(98.202)

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Robust standard errors in parentheses. All models condition on a linear spline of the assignment variable and are estimated by samples defined by a mean square error (MSE)-optimal bandwidth.

observed baseline covariates are "locally" balanced on either side of the cutoff of interest, which should be the case if the treatment indicator is not statistically significant.

The auxiliary regression results in Table A.1 provide evidence that observed teacher traits are quite similar on both sides of these thresholds. That is, for each unique teacher and school trait, I could not reject the null hypothesis of covariate balance in either the 4th or 5th year

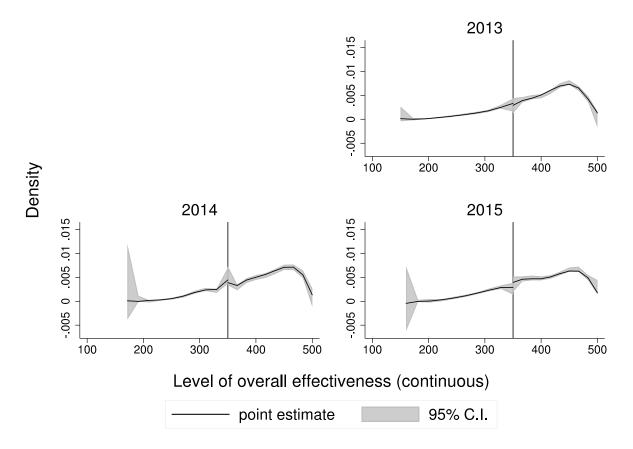
Figure A.1. Density of the LOE Assignment Variable, 4th Year Probation Teacher Sample



teacher samples, implying the absence of support for credible internal validity threat.

Density tests are also commonly used to validate RD designs. These tests look for evidence of "bunching" of the running variable around the discontinuity and can be useful for detecting manipulating behavior. In instances where the running variable is not smoothly distributed around the discontinuity point, the concern is that the lack of smoothness could reflect unobserved differences between individuals near the threshold (i.e., the manipulation may be non-random). Since a large proportion of the LOE scores are generated (and aggregated) based on student achievement data, it is likely that such manipulation did not occur. To test for manipulating behavior around the tenure eligibility thresholds, I also present statistical evidence that speaks to these concerns.

Figure A.2. Density of the LOE Assignment Variable, 5th Year Probation Teacher Sample Previously Rated "Above Expectation"



In each of the year-specific analytical samples (i.e., 4th year probation teachers in school years 2011–12 through 2014–15 and 5th year probation teachers previously rated effective in 2012–13 through 2014–15), density tests (Cattaneo, Jansson, & Ma, 2017a; 2017b) fail to reject the null hypothesis that the distribution of observations is smoothly distributed around each threshold. The absolute values of the test statistics are not larger than 1.58. Figures A.1 and A.2 graphically illustrate that teacher observations do not appear to cluster on one side of a threshold (which would have suggested manipulation).

Main Findings on Tenure Eligibility Effects on Teacher Transfer and Attrition

Figures A.3 through A.8 provide graphical illustrations of the RD results. Figures A.3, A.4, and A.5 plot, during each year, teachers' LOE scores during their 4th year of probation,

Figure A.3. Tenure Eligibility Effects on Transferring Schools Within District, 4th Year Probation Teacher Sample

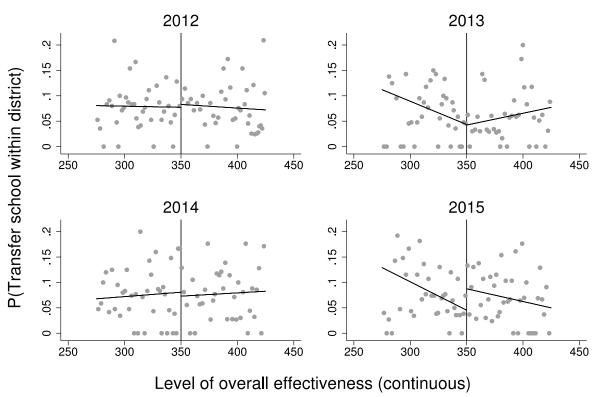


Figure A.4. Tenure Eligibility Effects on Transferring Districts Within State, 4th Year Probation Teacher Sample

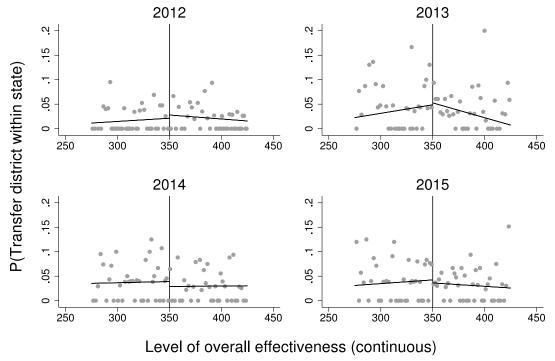


Figure A.5. Tenure Eligibility Effects on Exiting State, 4th Year Probation Teacher Sample

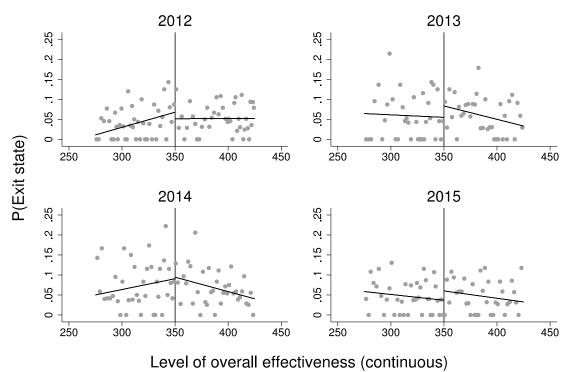


Figure A.6. Tenure Eligibility Effects on Transferring Schools Within District, 5th Year Probation Teacher Sample Previously Rated "Above Expectation"

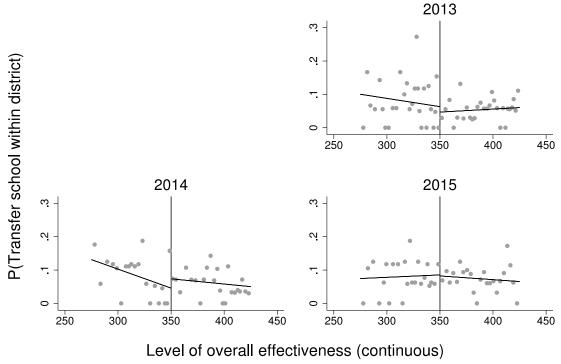


Figure A.7. Tenure Eligibility Effects on Transferring Districts Within State, 5th Year Probation Teacher Sample Previously Rated "Above Expectation"

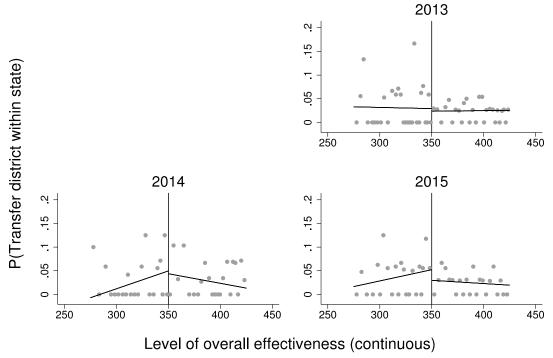
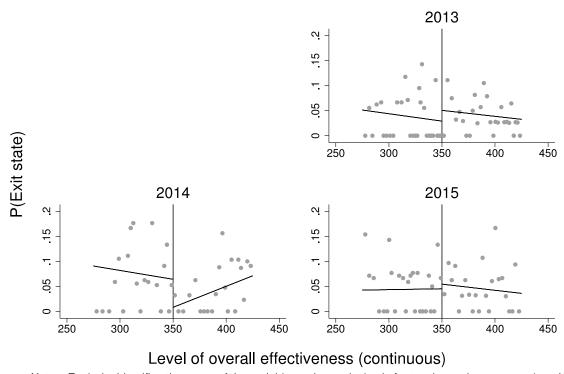


Figure A.8. Tenure Eligibility Effects on Exiting State, 5th Year Probation Teacher Sample, Previously Rated "Above Expectation"



with a vertical dashed line indicating the 350 LOE cutoff for tenure eligibility for each of the three categories of teacher turnover: transferred schools within the district, transferred districts within the state, and exited the state at the following year. Similarly, Figures A.6, A.7, and A.8 plot this same relationship but for teachers during their 5th year of probation. Each of the figures shows negligible or small and directionally inconsistent discontinuities at the 350 threshold, suggesting an absence or unclear effect of tenure eligibility on teacher turnover and attrition for teachers near the eligibility threshold.

Table A.2 presents the main RD results examining the effects of tenure eligibility on teacher transfer and attrition. The baseline specification—columns (1a), (2a), and (3a)—controls for the standard indicators included in an RD model (i.e., a binary indicator for whether a teacher received an LOE score above 350), the underlying continuous LOE score, and a linear spline of the assignment variable. The subsequent columns introduce controls for observable teacher and school characteristics. These modified specifications yield qualitatively similar results and, whether estimated among a sample of teachers pooled across years or among year-specific teacher samples, consistently indicate no statistical difference in turnover among teachers receiving scores making them eligible for tenure. As a placebo check, I estimate the RD models in years where cohorts of 4th and 5th year probation teachers were unaffected by tenure reform (the 2011–12 school year for 4th year probation teachers and 2012–13 for 5th year probation teachers). The RD estimates from these years also indicate statistically negligible differences between teachers across the tenure eligibility thresholds. Furthermore, the point estimates associated with the tenure eligibility threshold remain statistically negligible when defining alternative bandwidths around the cutoff (Table A.3).

Table A.2. Main RD model estimates of the probability of teacher transfer and exit

	Transferred school Transferred district within district within state			Exited state publ schooling system			
Sample	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	
		4th year	probation teach	ers			
Pooled sample	0.013	0.010	-0.011	-0.011	0.009	0.010	
	(0.018)	(0.016)	(0.014)	(0.014)	(0.015)	(0.015)	
AY 2012-13	0.016	0.018	-0.013	-0.012	0.010	0.009	
	(0.027)	(0.027)	(0.043)	(0.042)	(0.037)	(0.037)	
AY 2013-14	-0.016	-0.018	-0.009	-0.004	0.003	0.002	
	(0.043)	(0.041)	(0.024)	(0.024)	(0.033)	(0.033)	
AY 2014-15	0.043	0.031	-0.017	-0.019	0.026	0.023	
	0.034	0.036	0.030	0.029	0.025	0.024	
Placebo: AY 2011-12	0.004	0.015	-0.002	-0.007	-0.024	-0.025	
	(0.042)	(0.041)	(0.021)	(0.021)	(0.036)	(0.036)	
4	oth year prol	oation teachers,	previously rate	d "above expec	tation"		
Pooled sample	0.012	0.013	-0.011	-0.012	0.009	0.010	
	(0.030)	(0.030)	(0.019)	(0.019)	(0.023)	(0.022)	
AY 2013-14	0.019	0.021	-0.001	0.000	-0.034	-0.038	
	(0.057)	(0.056)	(0.042)	(0.042)	(0.041)	(0.040)	
AY 2014-15	-0.004	-0.005	-0.037	-0.035	0.016	0.013	
	(0.071)	(0.071)	(0.041)	(0.041)	(0.055)	(0.052)	
Placebo: AY 2012-13	0.009	0.003	-0.005	-0.009	0.036	0.046	*
	(0.042)	(0.040)	(0.025)	(0.025)	(0.032)	(0.032)	
Teacher covariates		X		X		X	
School covariates		X		X		X	

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Robust standard errors in parentheses. All models condition on a linear spline of the assignment variable and are estimated by samples defined by a mean square error (MSE)-optimal bandwidth. Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

Table A.3. Main RD model estimates, by alternative bandwidths

		rred school n district		Transferred district within state		Exited state public schooling system	
Bandwidth sample	n	Estimate	\overline{n}	Estimate	\overline{n}	Estimate	
	4th	year probation	teachers (poo	oled sample)			
Optimal bandwidth							
(OBW)	6619	0.010	5422	-0.011	7763	0.010	
		(0.020)		(0.017)		(0.017)	
OBW*0.5	3284	0.015	2708	-0.005	3885	0.013	
		(0.030)		(0.024)		(0.024)	
OBW*1.5	9809	0.008	8084	-0.004	11786	0.010	
		(0.016)		(0.014)		(0.014)	
OBW*2.0	13028	0.007	10783	-0.002	14653	0.010	
		(0.014)		(0.012)		(0.013)	
OBW value	5	7.173	46	5.863	67	7.885	
5th year pr	5th year probation teachers, previously rated "above expectation" (pooled sample)					le)	
OBW	1911	0.013	2419	-0.012	2113	0.010	
		(0.037)		(0.020)		(0.026)	
OBW*0.5	942	-0.013	1158	-0.021	1040	-0.001	
		(0.054)		(0.020)		(0.034)	
OBW*1.5	2876	0.004	3573	-0.011	3159	-0.002	
		(0.030)		(0.018)		(0.022)	
OBW*2.0	3815	-0.001	4946	-0.010	4261	-0.006	
		(0.026)		(0.017)		(0.020)	
OBW value		0.448	50	0.305		4.661	

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Robust standard errors in parentheses. All models condition on a linear spline of the assignment variable and are estimated by samples defined by a mean square error (MSE)-optimal bandwidth. Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

Heterogeneity of Effects of Tenure Eligibility

The main RD estimates may obscure several forms of treatment heterogeneity that are worth noting and exploring. That is, the impact of remaining on track to receive tenure could theoretically vary across teachers teaching tested and untested subject-grades (especially since the method to calculate their LOE score varies across both groups of teachers) as well as teachers from hard-to-staff school contexts (i.e., schools exhibiting low academic performance schools as well as schools predominately serving low-income or minority students).

In Table A.4, I present evidence on this issue by showing the reduced-form estimates in samples defined by tested subject-grade teacher group and three measures of school context: (1) schools in the top quintile of schools in the state with respect to percent of students score basic and below basic on the state's TCAP or EOC standardized exams (i.e., "low performing school"), (2) schools in the top quintile within respect to share of FRPL-eligible students (i.e., "high poverty school"), and (3) schools in the top quintile with respect to share of black, Hispanic, and Native American students (i.e., "high minority school"). The point estimates show consistently null effects across all teacher subgroups. This suggests that there is no underlying effect of tenure eligibility on teacher turnover across these defined categories of teacher groups.

Table A.4. Heterogeneity of RD model estimates of tenure effect

-		ferred school nin district		ferred district thin state		Exited state public schooling system	
Sample	n	Estimate	n	Estimate	n	Estimate	
	•	ear probation tea					
Tested subject/grade	2262	-0.007	1942	-0.019	2932	-0.001	
		(0.024)		(0.022)		(0.021)	
Untested subject/grade	3140	0.030	4430	-0.008	4534	0.021	
		(0.025)		(0.016)		(0.021)	
Low performing school	1953	0.001	2001	-0.036 *	1841	-0.008	
		(0.033)		(0.023)		(0.026)	
Non-low performing school	2699	0.028	4166	0.008	4265	0.017	
		(0.022)		(0.015)		(0.020)	
High poverty school	1807	0.007	1872	-0.037 *	1490	0.025	
		(0.038)		(0.023)		(0.023)	
Non-high poverty school	3249	0.022	3324	0.002	3960	-0.001	
		(0.020)		(0.018)		(0.022)	
High minority school	2477	0.010	2252	-0.027	2140	0.001	
		(0.033)		(0.024)		(0.030)	
Non-high minority school	3412	0.015	3978	0.001	3630	0.012	
		(0.018)		(0.014)		(0.020)	
5th year prob	ation teach	ers, previously ra	ated "above o	expectation" (po	oled sample)		
Tested subject/grade	841	-0.001	996	-0.004	841	0.032	
		(0.043)		(0.026)		(0.037)	
Untested subject/grade	1062	0.020	1449	-0.017	1224	-0.013	
		(0.041)		(0.027)		(0.026)	
Low performing school	665	0.002	599	0.006	848	-0.008	
		(0.051)		(0.041)		(0.032)	
Non-low performing school	1495	0.019	1013	-0.027	1445	0.014	
		(0.033)		(0.022)		(0.028)	
High poverty school	834	-0.007	750	0.015	865	0.027	
		(0.051)		(0.034)		(0.033)	
Non-high poverty school	1392	0.019	1072	-0.022	1464	-0.006	
		(0.032)		(0.027)		(0.028)	
High minority school	822	0.005	884	-0.013	745	0.015	
		0.057		0.034		0.038	
Non-high minority school	1208	0.011	1403	-0.012	1241	0.002	
•		(0.030)		(0.023)		(0.027)	

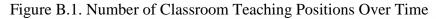
Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Robust standard errors in parentheses. All models condition on a linear spline of the assignment variable and are estimated by samples defined by a mean square error (MSE)-optimal bandwidth. Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

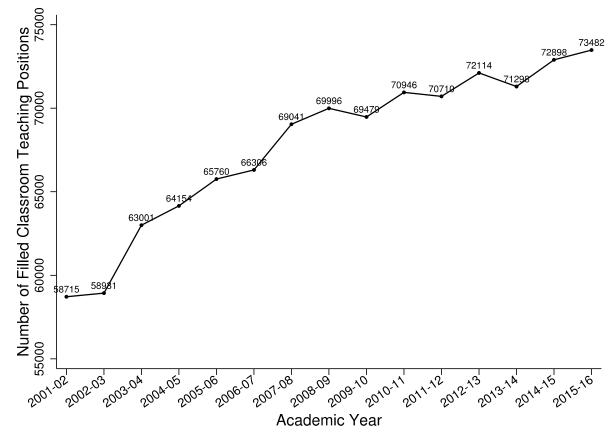
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Appendix B. Assessing Threats to Validity for DD Analysis

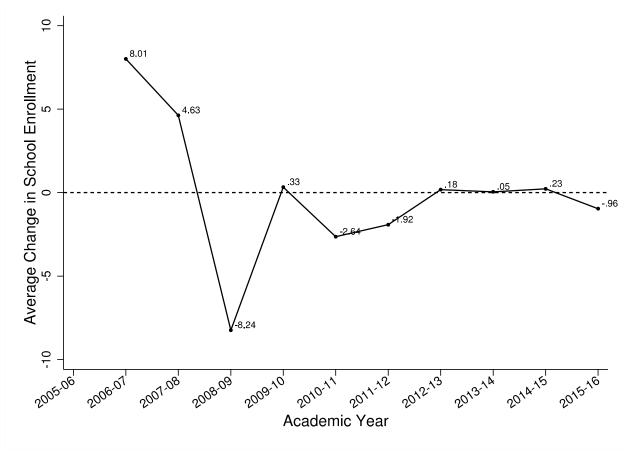
I conduct several checks exploring the extent to which alternate factors are credibly confounding the estimation of tenure reform effects under a difference-in-difference empirical framework. One potential concern is that there are dynamic differences in teacher labor market conditions that are unassociated with tenure reform and are occurring in years in which both groups of teachers (New Tenure and Grandfathered teachers) entered the teaching pool in Tennessee; in this regard, disparate labor market conditions when New Tenure and Grandfathered teachers entered the schooling system may be the true cause for differential declines in transfer and attrition rates across both teacher groups. I first explore whether the number of teaching positions was more restricted in years that *New Tenure* teachers entered the labor market, which could theoretically explain why transfer and exit rates declined differentially for this category of teachers in post-reform years. Figure B.1 displays the number of classroom teaching positions in the state of Tennessee in a given year. As shown, the number of teaching positions has gradually increased with time, suggesting that the labor market for New Tenure teachers was actually less restrictive, since they entered the teaching pool in later years compared to Grandfathered teachers. I next examine whether school enrollment changed differentially in years that *New Tenure* teachers had entered the teaching pool. Drastically increasing school enrollments during years in which New Tenure teachers entered the labor market could hypothetically increase the demand of classroom teachers and translate to lower rates of transfer and turnover during the post-reform period. Figure B.2 graphically demonstrates that average change in school enrollment remained relatively stable from year to year, ranging within an average absolute value change in approximately eight students per school in any given year. Finally, I assess the extent to which the number of possible temporary teaching positions—due to





temporary leave, for example—changed over time. The underlying concern in this regard could be that *New Tenure* teachers entered the labor market at a time when temporary teaching positions were substantially lower and were thus less likely to transfer schools or exit the profession for a permanent position. Figure B.3 displays the number of temporary exiting teachers in any given year (i.e., exiting teachers who re-entered the market in later years). While there is a slight decline in temporary exiting teachers from 1,511 in 2001–02 to 616 in 2013–14, this declining trend may be a byproduct of a shortened time frame to observe former teachers who re-enter the labor market in later years. Nevertheless, the trend in decline in temporary exiters remains virtually constant in the years immediately prior to tenure reform in 2011, which

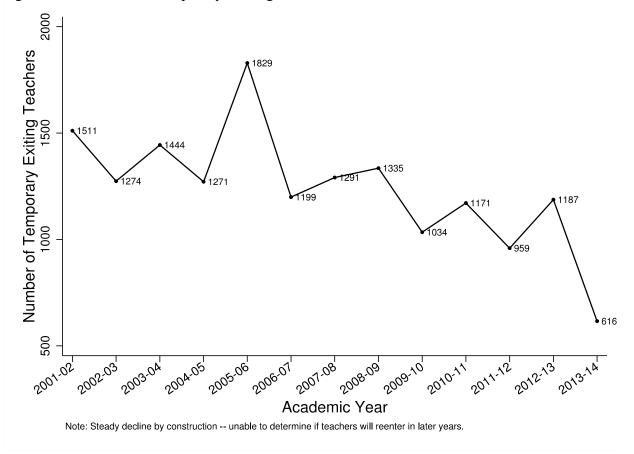
Figure B.2. Average School Enrollment Over Time



suggests there may be little difference in temporary teaching positions as *New Tenure* cohorts entered the labor market.

In addition to the above descriptive visual checks for changes in labor market conditions, I test whether observed tenure reform effects are confounded by concurrent policy reforms that may also have affected the teacher labor market. First, I explore whether impacts associated with tenure reform are also associated with districts most affected by the state's 2011 collective bargaining reform. In 2010, Tennessee hosted 136 traditional K–12 public-school districts, 91 of which collectively bargained, while 45 did not (Quinby, 2018). By leveraging within-state variation in bargaining status, I estimate model (1) separately among subsamples of teachers in districts that were and were not unionized prior to the 2011 collective bargaining law to test the

Figure B.3. Number of Temporary Exiting Teachers Over Time



heterogeneity of the impact of tenure reform across these two categories of districts. Table B.1 shows that declines in within-district transfer and school attrition for teachers in districts that were unionized prior to 2011—or districts most affected by collective bargaining reform—are statistically significant and similar and magnitude to main DD estimates presented in Table 3 (an additional 1.3 percentage point decline in within-district transfer and 1.6 percentage points decline in state attrition for *New Tenure* teachers in the post-reform period). While the corresponding coefficients are of similar magnitude among teachers in non-unionized districts, they lose statistical significance, suggesting tenure reform effects are measured imprecisely for the subgroup of teachers in non-unionized districts.

Table B.1. Heterogeneity by district unionization pre-collective bargaining reform

Tuble B.T. Heterogeneity by this	•	Transfer Transfer			
	school within	district within	Exit state		
	district	state	2		
	(1)	(2)	(3)		
Districts with teacher		to 2011 collective barga	` '		
Intercept	0.010				
•	(0.173)	(0.113)	(0.208)		
New Tenure cohort	0.021 ***	0.012 ***	0.055 ***		
	(0.005)	(0.004)	(0.007)		
Post Reform	-0.014 ***	0.001	-0.020 ***		
	(0.004)	(0.002)	(0.005)		
New Tenure x Post Reform	-0.013 **	-0.004	-0.016 **		
	(0.005)	(0.003)	(0.007)		
Teacher covariates	X	X	X		
School covariates	X	X	X		
District fixed effects	X	X	X		
N (Teacher-year)	78,944	78,944	78,944		
Districts without teacher	er unionization prior	r to 2011 collective barg	gaining reform		
Intercept	2.642	-6.249	5.489		
	(6.812)	(12.066)	(8.081)		
New Tenure cohort	0.020 *	0.007	0.039 ***		
	(0.011)	(0.007)	(0.013)		
Post Reform	-0.014	0.003	-0.015 *		
	(0.009)	(0.009)	(0.008)		
New Tenure x Post Reform	-0.011	0.100	-0.016		
	(0.014)	(0.008)	(0.011)		
Teacher covariates	X	X	X		
School covariates	X	X	X		
District fixed effects	X	X	X		
N (Teacher-year)	13,871	13,871	13,871		

Notes: *** p<0.01; ** p<0.05; * p<0.10. Standard errors shown in parentheses are clustered by district and year. Each column within a panel is a separate regression. Observations for teachers during the 2012–2015 school years are coded as "Post Reform." Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

Table B.2. Heterogeneity by district alternative salary initiatives

	Transfer	Transfer									
	school within	district within	Exit state								
	district	state									
	(1)	(2)	(3)								
Districts with alternative salary initiatives Intercept 0.237 0.147 *** 0.470											
Intercept	0.237	0.147 ***	0.470								
	(0.222)	(0.045)	(0.397)								
New Tenure cohort	0.025 ***	0.021 ***	0.056 ***								
	(0.007)	(0.005)	(0.008)								
Post Reform	-0.006	0.001	-0.013 *								
	(0.007)	(0.005)	(0.007)								
New Tenure x Post Reform	-0.016 *	-0.012 **	-0.011								
	(0.009)	(0.005)	(0.008)								
Teacher covariates	X	X	X								
School covariates	X	X	X								
District fixed effects	X	X	X								
N (Teacher-year)	27,202	27,202	27,202								
Distri	cts without alternativ	e salary initiatives									
Intercept	-0.065	-0.016	0.186								
	(0.216)	(0.155)	(0.241)								
New Tenure cohort	0.020 ***	0.007 **	0.050 ***								
	(0.005)	(0.003)	(0.008)								
Post Reform	-0.017 ***	0.001	0.022 ***								
	(0.004)	(0.003)	(0.005)								
New Tenure x Post Reform	-0.011 *	0.003	-0.017 **								
	(0.006)	(0.003)	(0.009)								
Teacher covariates	X	X	X								
School covariates	X	X	X								
District fixed effects	X	X	X								
N (Teacher-year)	65,613	65,613	65,613								

Notes: *** p<0.01; ** p<0.05; * p<0.10. Standard errors shown in parentheses are clustered by district and year. Each column within a panel is a separate regression. Observations for teachers during the 2012–2015 school years are coded as "Post Reform." Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

I similarly explore whether observed tenure reform effects are concentrated among districts with alternative compensation initiatives (i.e., CSF, IAF, or TN TIF). The implemented compensation plans varied across the 14 districts, but generally provided performance bonuses to highly effective teachers as well as extra pay for professional development and/or leadership activities (Ballou et al., 2016). To test the heterogeneity of the impact of tenure reform across districts with and without alternative compensation initiatives, I estimate model (1) separately among subsamples of teachers in districts that were and were not supported by CSF, IAF, and TN TIF. Table B.2 shows that declines in within-district transfer and state attrition are of similar magnitude to main DD estimates presented in Table 3, regardless of the presence of district-wide alternative salary initiatives. With the exception of declines in attrition among teachers in districts without alternative compensation programs, the remaining coefficients are at most marginally significant at the 0.10 level, which again suggests that tenure reform effects are measured imprecisely when estimated separately for subgroups of teachers in districts that did and did not implement alternative modes of teacher compensation.

Collectively, results from these checks suggest labor market conditions were not dissimilar in years that *New Tenure* cohorts entered the teaching pool. Further, I find that the magnitude of the observed decline in within-district transfer and state attrition associated with tenure reform is fairly consistent regardless of the presence of alternative district-wide reforms affecting the teacher labor market; however, the level of statistical significance does appear to dissipate when the analytic sample is decomposed into subsamples of districts with and without concurrent policy reforms.

CHAPTER 3

IN THE WAKE OF REFORM: EFFECT OF TENURE POLICY CHANGES ON TEACHER PERFORMANCE IN TENNESSEE

Introduction

Education policymakers have enacted a number of reforms in recent years in an attempt to improve the quality of the K–12 teacher workforce. Many of these reforms have revolved around changes to educator personnel policies, including compensation and evaluation. While the bulk of research in these areas has found limited or null effects of such policy reforms on teacher performance (e.g., Springer, Ballou, Hamilton, Le, Lockwood, McCaffrey, Pepper, & Stecher, 2010; Springer, Pane, Le, McCaffrey, Burns, Hamilton, & Stecher, 2012), studies have found that well-designed and implemented pay-for-performance programs and evaluation reforms, sometimes involving high-stakes compensation or dismissal incentives, can improve teacher performance (e.g., Dee & Wyckoff, 2015; Taylor & Tyler, 2012). However, less attention has been paid to examining whether and how recent reforms designed to alter the teacher tenure process similarly translate to improvements in teacher quality.

Spurred largely by state efforts to bid in the federal Race to the Top grant competition, a number of states have legislated a variety of changes to their teacher tenure policies, thus altering job protections available to K–12 public school teachers. The aspects of reforms have varied from state to state. Some states simply lengthened the pre-tenure probation period while others incorporated more drastic reforms, including requiring teachers to demonstrate a certain level of performance to become eligible for tenure, revoking tenure status from teachers who demonstrated low performance, or dismantling tenure protections for K–12 teachers entirely.

Education policy researchers are starting to explore the effects of reforms to the teacher tenure process throughout the U.S. The extant research has primarily sought to quantify the effect of recent tenure reforms on the supply and turnover patterns within the teacher labor market. For example, findings from a study examining the effect of linking tenure eligibility to teacher performance affecting all public school teachers in Louisiana indicate that tenure reform was associated with increased rates of exit of teachers from the workforce, particularly among teachers nearing retirement and teachers teaching in low-performing school settings (Strunk, Barret, & Lincove, 2017). A more recent study examines the influence of various teacher accountability policies on the statewide supply of new teachers using state-by-year panel data and finds that the effective elimination of tenure for new teachers across six states is associated with a sharp but temporary decline in the new teacher labor supply (Kraft, Brunner, Dougherty, & Schwegman, 2018). Few researchers have attempted move beyond an examination of the effects of tenure reform on teacher entrance and mobility patterns to explore whether and how reform has impacted teacher performance and gains in student achievement (Barret, Lincove, & Strunk, 2016; Goldhaber, Hansen, & Walch, 2016; Waite, Miller, Loeb, & Wyckoff, 2016); unfortunately, results across these early efforts have been generally null or inconclusive.

A growing body of research has coalesced to support the concept that teacher performance is a critical component of student development and achievement (Aaronson, Barrow, & Sander, 2007; Chetty, Friedman, & Rockoff, 2014a; Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004; Sanders & Rivers, 1996) and more long-term life outcomes (Chetty, Friedman, & Rockoff, 2014b). In addition, two theoretical paradigms, incentive theory and human capital theory, suggest that human resource policies designed to incentivize teacher—behavior may enhance motivation and induce professional development activities that are

capable of generating improvements in job-related performance (Becker, 1975; Hartog & Masseen, 2007; Laffont & Martimort, 2002; Lazear, 2000, 2003; Neal, 2011; Prendergast, 1999). In this regard, particular changes to teacher tenure policies designed to align performance with any form of job-related protection may hypothetically translate into increases in future performance. Although researchers have attempted to explore this line of inquiry with regard to recent tenure reforms in certain state settings, what remains to be seen is whether specific sets of moderate tenure reforms are associated with changes in teacher performance.

In April 2011, the Tennessee legislature formally redefined the tenure process for primary and secondary public school teachers across the state by (1) extending the pre-tenure probation period from three to five years; (2) requiring teachers to receive high evaluation ratings in the final two years of probation in order to become eligible for tenure; and (3) revoking tenure status from tenured teachers who receive low evaluation ratings for two consecutive years (Tenn. Code. Ann. § 49-5-501–515). Teachers who already received tenure prior to the passage of the legislated changes in 2011 were grandfathered under the previous tenure system and remained unaffected. This study helps to fill this knowledge gap by investigating whether the introduction of the comprehensive set of tenure reforms impacted teacher performance in Tennessee. More formally, I address the following research questions:

- 1. What is the impact of the comprehensive set of tenure reforms in Tennessee on teacher performance?
- 2. Is the effect of tenure reform persistent among teachers beyond the pre-tenure probationary phase?
- 3. To what degree is the impact of tenure reform on teacher performance heterogeneous across varying school contexts?

To answer these questions, I measure teacher performance by utilizing two value-added models, or VAMs, to estimate a teacher's impact on student achievement—that is, the value he or she adds—apart from other factors that affect achievement, such as individual ability, family environment, past schooling, and the influence of peers. I then estimate the impact of the tenure reform on teacher performance using a difference-in-difference (DD) empirical framework in which I compare changes in teacher performance before and after the implementation of the tenure reform law across grandfathered and newly tenured teacher groups.

Results from this study are among the first to contribute to the emerging evidence base on the effects of K–12 teacher tenure policy reform by approximating the causal effect of tenure reforms in Tennessee on teacher performance. I find evidence that the introduction of tenure reforms in Tennessee is associated with improved performance of teachers who remained in the workforce by 0.18 of a teacher-level standard deviation in math and 0.14 of a teacher-level standard deviation in English Language Arts (ELA). However, these effects are not robust across alternate measures of teacher performance. To explore the heterogeneity of tenure reform effects by salient school characteristics, I specifically examine whether any observed effects on teacher performance are moderated by whether teachers taught in hard-to-staff schools (i.e., schools with a relatively high share of low-income or minority students). I also find evidence that any observed increases in math or ELA teacher performance are concentrated among teachers in districts that are most affected by concurrent changes to collective bargaining laws and district-wide compensation initiatives, which implies that any effects are either confounded or synergistically produced by the presence of other salient teacher policy reforms.

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⁹ As an extension, I consider whether the specific set of reforms that linked teacher evaluation ratings to tenure decisions affected the performance of teachers who face the prospect of receiving tenure. This auxiliary analysis leverages a regression discontinuity (RD) design to exploit the arguably exogenous variation in concentrations of

Background on Tenure Reform in Tennessee

Tennessee has passed a number of education reforms in recent years. Amid ongoing national and local debate surrounding the need for reforms to incorporate a culture of accountability in schooling and the teaching profession, government administrators and advocates for education reform in Tennessee chose to simultaneously revamp the teacher tenure process and teacher evaluation system under the auspice of the federal Race to the Top grant. Upon reforming both K–12 teacher tenure and evaluation policies, both systems became inextricably linked throughout the state.

Tennessee state law stipulates that tenure status guarantees stricter due process (Tenn. Code. Ann. § 49-5-512–513) and protects tenured teacher contracts from non-renewal, with the exception of staff layoffs due to budget cuts and low school enrollment (Tenn. Code. Ann. § 49-5-502(a)). In April 2011, Governor Bill Haslam signed tenure reform bill SB 1528/HB 2012 into law, which reformed the system by which K–12 public school teachers could earn tenure status and its associated job protections. Prior to that point, a teacher could become eligible to receive tenure upon teaching in a single school district for three consecutive years. The tenure reform bill, later codified under Tenn. Code. Ann. § 49-5-501–515, exclusively affected teachers who did not obtain tenure prior to its passage; that is, the law included a strict grandfather clause allowing teachers who received tenure under the previous system to remain unaffected by any legislated changes to the tenure process. Under the reformed tenure system, probation teachers were required to teach five years within a district and demonstrate a certain level of performance in order to become eligible for tenure status. In addition, teachers who received tenure after 2011 could lose tenure status upon receiving two consecutive years of ineffective evaluation ratings.

teachers on either side of sharp performance cutoffs that determine tenure status and is discussed and presented in Appendix A.

Not long after the passage of the tenure reform bill, Tennessee implemented a new comprehensive statewide educator evaluation system—this reformed evaluation system now serves as the basis through which teacher performance is assessed throughout the reformed tenure eligibility process. Prior to 2011, the typical teacher evaluation process was similar to many other state settings that relied on subjective classroom observation checklists to assess teacher practice (Webb, 2009). A common criticism of such an evaluation was that summative evaluation ratings assigned to teachers often failed to meaningfully differentiate teacher performance (Kane, Taylor, Tyler, & Wooten 2011; Weisberg, Sexton, Mulhern, & Keeling, 2009). To address this concern, in July 2011 the Tennessee Department of Education (TDOE) implemented the Tennessee Educator Acceleration model (TEAM) as the reformed default evaluation model across the state and approved four alternate teacher evaluation models for districts that demonstrated satisfactory performance: Project Coach (COACH), Teacher Effectiveness Measure (TEM), and Teacher Instructional Growth for Effectiveness and Results (TIGER) and the Achievement Framework for Excellent Teaching (AFET).

All of the approved evaluation models incorporate similar features, including the use of a distinct composite measure to monitor teacher performance called the Level of Overall Effectiveness (LOE). The LOE is a weighted combination of qualitative data (i.e., classroom observations, student surveys, portfolios), student growth data, and student achievement data approved by the state and selected through mutual agreement a priori by the educator and evaluator. These components are combined to create a LOE scale score that ranges between 100 and 500 and is then categorized into five discrete performance levels ranging from Level 1 ("Significantly Below Expectation") to Level 5 ("Significantly Above Expectation").

The 2011 tenure reform bill stipulates that teachers without tenure prior to the passage of the law are required to receive a LOE scale score that places them in one of two highest performance categories under reformed evaluation system ("Above Expectation" or "Significantly Above Expectation") during the final two years of an extended five-year probation period in order to become eligible for tenure. Teachers who did not receive tenure status at the end of their five-year probation period are either rehired under a year-to-year contract or dismissed. Tennessee's reformed tenure law also effectively makes tenure status non-permanent for newly tenured teachers. Teachers that receive tenure under the reformed tenure system can later lose tenure and return to probation status if they receive one of the lowest performance ratings ("Below Expectations" or "Significantly Below Expectations") for two consecutive years.

In addition to reforms to the teacher tenure and evaluation system, Tennessee also concurrently implemented other reform initiatives intentionally designed to affect the educator labor market, including changes to collective bargaining and various alternative compensation and bonus initiatives. ¹⁰ First, the Professional Educators' Collaborative Conferencing Act, or PECCA, also passed in 2011, replaced traditional collective bargaining rules across the state, particularly in unionized districts. As part of this bill, teacher collective bargaining procedures have been replaced with a "meet and confer" process, in which school-district administrators are the sole arbiters of labor disputes (Quinby, 2018). The passage of PECCA has largely been considered an effort to de-unionize the teaching profession. Under the reformed system, teachers are still permitted to confer with administrators through an elected representative body, but are

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The concurrent implementation of other reform initiatives serves as a plausibly confounding factor when estimating the impact of tenure reform on teacher performance; I explore the extent to which this is the case with regard to the 2011 collective bargaining reform and alternative salary initiatives in the "Threats to Validity" section, below.

only allowed to discuss salaries and benefits, not school staffing or payroll deduction of union dues.

Second, beginning in the 2011–12 school year, three separate initiatives were launched to support the implementation of strategic teacher compensation plans in the Tennessee public schooling system: the Competitive Supplemental Fund (CSF), the Innovation Acceleration Fund (IAF), and the Tennessee Teacher Incentive Fund (TN TIF). All three initiatives were designed to support district efforts to implement alternative means to compensate teachers that differed from the standard statewide Minimum Salary Schedule, which pays teachers based on highest degree earned and teaching experience. CSF, IAF, and TN TIF targeted about \$30 million of funding provided by the U.S. Department of Education's Teacher Incentive Fund, the federal Race to the Top grant, as well as several private foundations to 14 districts serving almost 200 schools across the state over the duration of five years (Ballou, Canon, Elhert, Wu, Doan, Taylor, & Springer, 2016). The implemented compensation plans varied across the 14 districts, but generally provided performance bonuses to highly effective teachers as well as extra pay for professional development and leadership activities.

Finally, in the spring of 2013 the TDOE piloted a pair of bonus programs designed to attract and retained high performing teachers in low performing school settings. In that year, teachers receiving the highest LOE rating (Level 5 status) were eligible to receive a \$7,000 signing bonus if they voluntarily transferred to teach in a Priority School, the state's official designation for the bottom 5 percent of lowest performing schools based on a composite proficiency rate (success rate) for all students in a school. Similarly, Level 5 teachers already teaching in a Priority School were eligible to receive a \$5,000 retention bonus if they chose to remain teaching in a Priority School for an additional school year. While evidence has been

mixed as to whether compensation can alter teacher performance and retention, a series of studies have found that the retention bonus program in Tennessee, despite its one-year piloted nature, boosted retention of teachers of tested subject-grades in Priority Schools by roughly 20 percent (Springer, Swain, & Rodriguez, 2016) and generated improvements in student reading and math scores by approximately 0.07 to 0.10 of a standard deviations in schools that offered a retention bonus in the years following the bonus distribution (Swain, Springer, & Rodriguez, 2018).

Framework

The effect of legislated changes to the tenure process on teacher performance can best be understood through the lenses of incentive theory and human capital theory. Incentive theory stipulates that organizations are capable of stimulating employee behavior that will boost performance through reinforcement or incentives (Laffont & Martimort, 2002; Prendergast, 1999). Two motivating assumptions behind incentive theory are that, first, members of an organization may have different and sometimes conflicting objectives and that, second, incentives are a useful mechanism to align an individual's objective with that of the broader organization. The essential paradigm behind incentives posits that a reward or reinforcement serves as a form of extrinsic motivation to increase effort toward completing a particular objective. In addition, incentives may also involve selection effects in which higher performing candidates are successfully drawn to or retained within the workforce (Prendergast, 1999).

Scholars often utilize incentive theory as a framework to examine how increased pay serves as a useful and effective incentive to improve teacher quality (Lazear, 2000, 2003; Neal, 2011). However, incentive theories can also be readily applied to the context of reformed tenure policies. Stated simply, tenure status affords teachers with an incentive presented in the form of

job protection (i.e., a guaranteed job position within the district and due process in the event of termination). Evidence suggests that teachers are risk-averse and place a higher premium on job security than professionals from other fields (Bowen, Buck, Deck, Mills, and Shuls, 2014). Thus, the forms of job protection associated with tenure can theoretically serve as a valid incentive capable of either motivating enhanced performance or retaining high performing risk-averse teachers.

Recent reforms to the tenure process effectively strengthened the incentive mechanism inherent in tenure status and its associated job protections. Prior to reform, teachers that attained tenure status by teaching the required number of years benefited from available job protections indefinitely. However, under the reformed tenure regime, tenure is now exclusively assigned to teachers demonstrating high performance according to the evaluation system. In effect, denial of tenure status based on low evaluation ratings may motivate probation teachers to improve their performance in order to avert termination and potentially gain tenure in future periods or, alternatively, depart from the profession, thereby improving the quality of the outstanding teaching pool. In addition to restricting tenure status to teachers with high evaluation ratings, tenure reform also revokes tenure status from tenured teachers who consecutively receive low evaluation ratings. In this regard, loss aversion provides a natural extension of incentive theory to imply that negative forms of reinforcement (i.e., the removal of tenure status) also motivate individual behavior even after they complete their initial probation period to avoid losing the available incentive (i.e., job protection) (Laffont & Martimort, 2002).

While incentive theories imply that tenure functions as an incentive to improve performance by directly boosting individual motivation or inducing a selection effect within the teaching pool, human capital theory highlights how changes to professional development

activities may also mediate the effect of tenure on teacher performance. A central premise of human capital theory is that worker performance is a function of several components, including individual ability, quality of education and experience; relatedly, workers can increase their productivity by learning new skills and perfecting old ones through training and professional development (Becker, 1975; Hartog & Maassen, 2007).

A long tradition of researchers and practitioners has utilized human capital theory to verify the benefits of professional development for teachers. In general, the evidence base finds that "high quality" professional development that is—among other factors—content-focused, aligned with the curriculum, and of adequate duration is capable of improving teacher performance and student learning gains (Scher & O'Reilly, 2009). Research also demonstrates the key role that school administrators serve in human capital management of teachers. How administrators evaluate and provide growth opportunities to teachers likely has major ramifications for teacher performance (Donaldson, 2013; Kennedy, 2010; Kraft & Gilmour, 2016). Thus, as probation teachers are denied tenure (or tenured teachers face the risk of losing tenure status) under the reformed tenure system, they may not only exhibit increased performance due to enhanced motivation per se, but may also channel that motivation to incorporate training from professional development or evaluation feedback in such a way that translates to improvements to their job performance.

Specific school contextual factors may moderate the theoretical responses and behaviors described in this section. For example, teachers and administrators in hard-to-staff schools may be more concerned with the job protections associated with tenure and accordingly would exhibit differential changes in motivation or assigned professional development activities. Thus, an empirical examination of policies designed to incentivize teacher behavior or enhance teacher

performance naturally warrants consideration of the role and influence of varying school contexts.

Data, Sample, and Method

To estimate the effects of tenure reform on teacher performance, this study makes use of administrative data from the 2001–02 through 2014–15 school years for the state of Tennessee, where I define the 2010-11 school year as the start of the "post-reform" period. The data provide information on school placement for teachers in a given year, which I use to determine whether teachers received tenure under the previous system (if they had been teaching in the same district at least three consecutive years prior to 2010–11) or under the reformed system (if they had entered the Tennessee public school system in the post-reform period or had not received tenure prior to 2010–11). Below I describe the key constructs used in my analysis for the remainder of this study.

Measures of Teacher Performance

Critical to this analysis is the estimation of teacher performance, which serves as the main dependent latent construct. I use teacher performance measures derived from two alternate value-added models (VAMs) of teacher effectiveness. First, I use the single-year Tennessee Value Added-Assessment System (TVAAS) estimates of teacher effectiveness produced using a proprietary method developed by the SAS Institute that are made available back to the 2009–10 school year. The calculation of teacher effectiveness in TVAAS estimates the average student performance gains on the Tennessee Comprehensive Assessment Program (TCAP) across all subjects and grades that a teacher teaches within a given year relative to the district-level performance. I restrict my analysis to teachers in grades 3 through 8 who have been assigned

TVAAS scores in math or ELA and then normalize TVAAS scores by subject and year for the purpose of my analysis.

As an alternative to TVAAS, I also estimate value-added using multivariate modeling approach with teacher fixed effects as outlined by McCaffrey, Lockwood, Koretz, & Hamilton, 2003. I use student-teacher linkage files that connect students in grades 3 through 8 to classrooms and teachers from 2005–06 to 2015–16. Starting from the raw dataset, I make a series of restrictions that align with prior studies. First, I restrict the sample to students in grades 4 through 8, where prior test scores in mathematics/ELA are available. Second, I exclude 32.53 percent of records representing students that are not claimed by a subject teacher or claimed by more than one subject teacher in a given year. Third, I drop classrooms with less than 10 students or more than 200 students in a single grade, since these records are likely erroneously linked to classroom teachers (0.13 percent of observations). The final sample used to estimate teacher value-added includes 3.3 million student-year-subject records.

I estimate a teacher's impact on student test scores using a teacher fixed effect multivariate model approach through two main steps. First, I regress student test scores separately for each subject (math and ELA), grade (4th through 8th), and year on observable characteristics across students taught by the same teacher using an ordinary least squares (OLS) regression of the form:

$$A_{it}^* = \alpha_j + X_{it}\beta + \varepsilon_{ijt}, \tag{1}$$

where A_{it}^* represents student i's test score in year t (standardized to have a mean of zero and standard deviation of one in every grade and year). X_{it} represents a vector of control variables that include students' race/ethnicity, gender, age, special education status, English proficiency, FRPL eligibility, and prior retention in current grade as well as prior test scores using a cubic

polynomial in prior-year scores in math and ELA. Importantly, α_j is the fixed effect for teacher j.

Second, for each subject, grade, and year I calculate the residual student test scores after removing the effect of students' observable characteristics:

$$A_{it} = A_{it}^* - X_{it}\beta. (2)$$

I then generate the mean residual test score for each teacher j in year t, \bar{A}_{jt} . The mean teacher-level residuals for a given year, \bar{A}_{jt} , serve as an alternate value-added estimate for this study. Henceforth, I refer to this value-added estimate as "VAM-TFE," since they are generated using a basic value-added model incorporating teacher fixed effects.

Teacher and School Characteristics

The available data provide a range of teacher-level information, including years of prior teaching experience, race/ethnicity, gender, age, and highest degree held. Student-level background information are also available, which I aggregate to yield measures on school-level student characteristics, including student enrollment, the gender and racial/ethnic composition of student populations with a school, share of students that are eligible for the federal free- and reduced-price lunch (FRPL) program, share of students receiving special education services, and share of non-native English speaking students within a school.

Analytic Sample

To estimate the comprehensive effect of tenure reform on turnover patterns within the general teacher workforce, I focus on a sample of four cohorts of teachers, all of whom began teaching in the state prior to the passage of the law, but the first two entering cohorts were not affected by tenure reform while the latter two entering cohorts were. First, the analytic sample includes the last two entering cohorts who were capable of receiving tenure under the older

Table 1. Summary statistics for DD analytic sample by teacher group, pre-tenure reform (2009–10 through 2010–11)

	Overall	Subject to New Tenure Policy	Grandfathered Under Old Tenure Policy	Mean Difference	
	(1)	(2)	(3)	(4): (2) - (3)	_
Teacher Characteristics					
Race/ethnicity					
Black	0.11	0.11	0.11	< 0.01	
Other minority	0.01	0.01	0.01	< 0.01	
Education level					
Masters	0.29	0.25	0.32	-0.07	***
More than masters	0.03	0.02	0.04	-0.02	***
Female	0.85	0.83	0.86	-0.03	***
Age	32.84	31.06	34.08	-3.02	***
Years of experience	3.00	1.81	3.83	-2.02	***
School Characteristics					
Pct. black	0.26	0.28	0.25	0.04	***
Pct. other minority	0.09	0.09	0.09	< 0.01	
Pct. female	0.48	0.48	0.48	< 0.01	**
Pct. special education	0.16	0.16	0.16	< 0.01	
Pct. non-native English speaker	0.09	0.09	0.09	< 0.01	
Pct. FRPL-eligible	0.57	0.58	0.56	0.02	**
Student enrollment	654.34	655.36	653.62	1.74	
Number of observations	6034	2483	3551		

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Statistical significance tested using t test and chi-square to compare across teacher groups. Sample restricted to teachers entering between academic years 2007–08 through 2010–11 with a non-missing value-added measure.

tenure process (i.e., teachers who began teaching in the state in the 2007–08 and 2008–09 school years and could thus complete the three year probation period prior to tenure reform in April 2011, hereafter called the "*Grandfathered*" teacher group). Additionally, the sample includes the first two entering cohorts of teachers who were affected by tenure reform (i.e., teachers who began teaching in the state in 2009–10 and 2010–11 and could not complete the standard three-year probation period before tenure reform, hereafter called the "*New Tenure*" teacher group).

Table 1 provides pre-reform means of observable teacher and school characteristics for the full analytic sample of teachers with a non-missing value-added estimate. I report summary statistics for the overall sample as well as by teacher group (i.e., *New Tenure* or *Grandfathered*).

A number of observable characteristic differences appear across both groups. Unsurprisingly, the *New Tenure* teacher group had, on average, two fewer years of teaching experience and are approximately three years younger in age than the *Grandfathered* teacher group that entered the workforce in earlier years. In addition, a lower proportion of *New Tenure* teachers are female and hold more than a bachelor's degree compared to *Grandfathered* teachers. In addition to background differences of teachers across both groups, a number of key characteristics differ among the schools in which teachers across both groups teach. More specifically, *New Tenure* teachers tend to work in schools serving a higher proportion of black and FRPL-eligible students. While these differences across both groups are small in magnitude they are generally statistically significant beyond the 0.05 level.

Empirical Framework

To more rigorously identify the comprehensive impact of tenure reform on teacher performance, I utilize a difference-in-differences (DD) framework comparing the cohorts of teachers subjected to the reformed tenure legislation to the cohorts of teachers who were grandfathered under the old tenure process. Specifically, I estimate the following OLS linear probability model:

$$\begin{aligned} Y_{jskt} &= \beta_0 + \beta_1 NewTenure_j + \delta_0 PostReform_t + \delta_1 NewTenure_j \times PostReform_t \\ &+ X_{jskt}\Theta + S_{skt}\Psi + \gamma_k + \varepsilon_{jskt}. \end{aligned} \tag{3}$$

The Y_{jskt} term represents a series of subject-specific performance indicators (i.e., TVAAS or VAM-TFE) for teacher j in school s in district k at time t. The $NewTenure_j$ term represents a dummy variable equal to one for whether teacher j entered the public school system such that they could not complete three years of teaching in their district prior to the passage of tenure reform and was thus subjected to new tenure reforms. The $PostReform_t$ represents an indicator

equal to one for years 2011 and later in which tenure reform legislation from was passed and implemented. The vector X_{jskt} contains observable individual teacher characteristics, such as a teacher's race or ethnicity as well as an indicator for the year a teacher entered the TN public school system to control for fixed characteristics associated with cohorts of teachers that entered the state public school system within the same year. I also include a vector S_{skt} of school controls, such as student racial composition, percentage of FRPL-eligible students, and school size, as well as district fixed affects in the model, captured by γ_k , to account for time invariant district characteristics. Finally, I cluster standard errors at the district-year level to account for correlations among teachers associated with school openings and closures in the same district in the same year.

Coefficient β_1 captures permanent differences between *New Tenure* teachers and *Grandfathered* teachers while coefficient δ_0 captures the difference in the outcome Y_{jskt} before and after the introduction of tenure reform. The primary coefficient of interest for this analysis is δ_1 , which isolates the differential change in periods before and after the introduction of tenure reform across cohorts of teachers that were and were not affected by tenure reform. Although tenure reform was passed simultaneously with reforms to the teacher evaluation system, both *New Tenure* teachers and Grandfather teachers were evaluated similarly and subject to the same set of incentives with the exception of tenure eligibility; consequently, coefficient δ_1 does not estimate a differential effect of the 2011 educator evaluation reforms across both groups of teachers, but instead provides a plausibly exogenous estimate of the impact of Tennessee's tenure reform law on teacher performance.

Under a DD framework, the comparison groups are not required to be equivalent at

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I also estimate alternative models with standard errors clustered at the district and teacher level. The level of statistical significance remains consistent across all model results regardless of the chosen clustering method.

baseline. Instead, the key identifying assumptions for the difference-in-difference estimator are that differences across groups are fixed and time invariant and the treatment is the only factor altering these differences over time. If the groups of teachers have different trends or trajectories pre-reform period, it would violate these identifying assumptions and indicate a biased estimation of the impact of tenure reform. I test the parallel trends assumption in two ways, both using graphical evidence and time-disaggregated or event time models to assess pre-reform deviations across analytic teacher groups (*New Tenure* and *Grandfathered* teachers). Results from these tests are presented and discussed in full detail in the "Results" section below (Figure 1 and Tables 2 and 3), and show no visual or statistically significant differences between teacher groups in the pre-reform years.

In addition to estimating the average effect of tenure reform on teacher performance, I examine whether the observed effects are concentrated in a particular cohort of the *New Tenure* teacher group (i.e., teachers that entered in the 2009–10 school year versus those that entered in 2010–11). I do so by estimating a model similar to model (1), with the *NewTenure* and *PostReform* indicators and their associated interactions disaggregated by each teacher cohort and school year, respectively. By disaggregating effects across cohorts and years, I am able to assess whether they fade or become more pronounced for teachers in years they are capable of reaching the post-probation phase (the *New Teacher* cohort entering in the 2009–10 school year would be able to complete the typical five-year probation period for the first time in 2014–15).

Finally, I also investigate the possibility that tenure reform has a heterogeneous effect based on school context characteristics. More specifically, I investigate whether the introduction of tenure reform affects teacher performance equitably with regard to whether they teach in

schools with a high composition of minority (black, Hispanic, or Native American) students or high poverty schools (defined as schools with a high composition of FRPL-eligible students). To do so, I estimate difference-in-difference (DDD), or triple difference models by interacting the treatment and post-reform indicators with an indicator for whether a teacher's school was in the upper quintile of school-level percentage of minority or FRPL-eligible students in the state during a given year.¹²

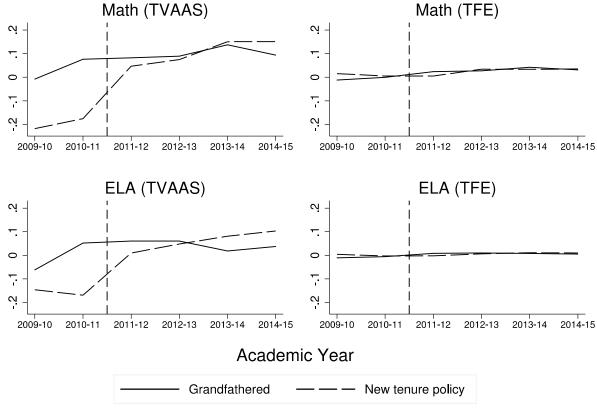
Results

Prior to presenting regression estimates, as a graphical presentation of naïve model estimates, I first present visual trends in teacher performance across New Tenure and Grandfathered teacher groups. Figure 1 shows changes in teacher performance across all main measures of teacher performance, stratified into the two groups of teachers affected by the new tenure policy and grandfathered under the previous tenure system. In all cases, the pre-reform trends do not appear to differ meaningfully by teacher group. I therefore view the pre-treatment trends as providing preliminary support for the use of teacher value-added as sources of identification in my econometric models. Increases in math and ELA TVAAS scores are observed among teachers subject to the new tenure policy are evident starting in the 2011–12 school year (the first year post-reform); however, no changes appear in value-added estimates generated using the VAM-TFE approach.

In the sections that follow, I present results from the main DD models—model (3) estimating the impact of tenure reform on math or ELA teacher performance. I next present results estimating the heterogeneous impact of tenure reform by teacher cohort and school

Out of all teachers within the analytic sample, at least 15.73 percent are located in a school with a high composition of minority students in a given year; at least 16.52 percent are in a high poverty school in a given year.

Figure 1. Average Teacher Performance by Teacher Group, 2009–10 Through 2014–15



Note: 95% CI displayed. Vertical dashed line marks beginning of tenure reform passed in April 2011.

context. Lastly, I discuss a number of validity checks to demonstrate the robustness of my findings.

Main Findings on Tenure Reform Effects on Teacher Performance

Tables 2 and 3 provide the main DD model estimates separately for math and ELA teacher performance, which reflect the trends shown in Figure 2. As shown in Table 2 column (1a), math TVAAS scores increase by 0.18 SD for teachers subject to new tenure policy reforms in the post-reform period, a statistically significant increase beyond the 0.01 level even after controlling for observable teacher and school characteristics and district fixed effects. However, this effect is not robust across performance measures as there is no statistically significant difference in math performance as measured by the value-added measure generated using the

Table 2. DD model estimates of mathematics teacher performance

		Math (T	VAAS)		Math (TFE)				
	(1a)		(1b)		(2a)		(2b)		
Intercept	-24.426	**	-22.469	**	-2.174		-1.728		
	(11.726)		(11.303)		(2.333)		(2.280)		
New Tenure	-0.225	***	-0.272	***	-0.001		-0.014		
	(0.069)		(0.069)		(0.012)		(0.013)		
Post Reform	0.068				0.038	***			
	(0.046)				(0.005)				
2010			-0.073				-0.015	*	
			(0.071)				(0.008)		
2012			0.018				0.026	***	
			(0.056)				(0.007)		
2013			0.043				0.033	***	
			(0.063)				(0.007)		
2014			0.103				0.051	***	
			(0.069)				(0.010)		
2015			0.104				0.046	***	
			(0.086)				(0.010)		
New Tenure x Post Reform	0.184	***			-0.01				
	(0.066)				(0.011)				
New Tenure x 2010			-0.029				-0.015		
			(0.075)				(0.015)		
New Tenure x 2012			0.191	**			-0.014		
			(0.078)				(0.014)		
New Tenure x 2013			0.188	**			0.007		
			(0.080)				(0.014)		
New Tenure x 2014			0.202	**			-0.013		
			(0.086)				(0.015)		
New Tenure x 2015			0.196	**			-0.007		
			(0.092)				(0.016)		
Teacher covariates	X		X		X		X		
School covariates	X		X		X		X		
District fixed effects	X		X		X		X		
N (Teacher-year)	10511		1051	1	8649)	8649)	

Notes: *** p<0.01; ** p<0.05; * p<0.10. Each column within a panel is a separate regression. Standard errors shown in parentheses are clustered by district and year. Observations for teachers during the 2012–2015 school years are coded as "Post-reform." Teacher controls not shown include race/ethnicity, education level, gender, age, and years of experience. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

Table 3. DD model estimates of ELA teacher performance

	EL	(AAS)	ELA (TFE)					
	(1a)		(1b)		(2a)		(2b)	<u> </u>
Intercept	-9.930		-8.918		-1.751	**	-1.698	**
	(8.954)		(9.059)		(0.822)		(0.814)	
New Tenure	-0.149	***	-0.215	***	0.003		0.000	
	(0.056)		(0.052)		(0.006)		(0.007)	
Post Reform	0.046				0.016	***		
	(0.045)				(0.003)			
2010			-0.086				-0.003	
			(0.072)				(0.005)	
2012			0.009				0.014	***
			(0.057)				(0.005)	
2013			0.024				0.018	***
			(0.065)				(0.005)	
2014			0.007				0.018	***
			(0.098)				(0.006)	
2015			0.031				0.017	***
			(0.076)				(0.006)	
New Tenure x Post Reform	0.135	***			-0.002			
	(0.049)				(0.006)			
New Tenure x 2010			0.128	*			-0.002	
			(0.066)				(0.007)	
New Tenure x 2012			0.157	***			-0.005	
			(0.059)				(0.008)	
New Tenure x 2013			0.179	***			-0.002	
			(0.061)				(0.008)	
New Tenure x 2014			0.220	***			0.001	
			(0.069)				(0.008)	
New Tenure x 2015			0.217	***			0.001	
			(0.068)				(0.008)	
Teacher covariates	X		X		X		X	
School covariates	X		X		X		X	
District fixed effects	X		X		X		X	
N (Teacher-year)	11765		11765		7769)	7769)

Notes: *** p<0.01; ** p<0.05; * p<0.10. Each column within a panel is a separate regression. Standard errors shown in parentheses are clustered by district and year. Observations for teachers during the 2012–2015 school years are coded as "Post-reform." Teacher controls not shown include race/ethnicity, education level, gender, age, and years of experience. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

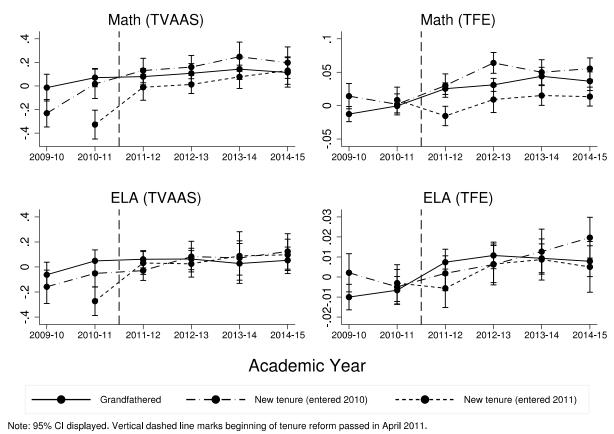
VAM-TFE approach, shown in column (2a). Coefficient estimates in Table 3 suggest a similar pattern for ELA; column (1a) suggests tenure reform was associated with an increase in ELA TVAAS scores by approximately 0.14 SD but no change in the alternate ELA VAM-TFE measure.

For each value-added measure in Tables 2 and 3, I also report disaggregated estimates by years in columns (1b) and (2b). The pre-trend deviations in math or ELA teacher performance across teacher groups (i.e., the coefficients on the interactions between treatment indicator and the 2010 indicator, which are estimated relative to the holdout year 2011) are small and not statistically significant at the 0.05 level, which supports the underlying DD assumption of parallel trends across analytic groups. In addition, disaggregated model estimates test whether the effect of tenure changes over time. Results indicate the magnitude of the observed increases in math and ELA TVAAS scores are intransigent and statistically significant across all post-reform years; however, differences as measured by VAM-TFE remain insignificant across all years.

Heterogeneity of Comprehensive Effects of Tenure Reform by Teacher Cohort

Figure 2 displays adjusted linear predictions generated from DD model estimates, but disaggregated for *New Tenure* teacher cohorts and holding covariates at their mean sample value. As shown, the estimated increases in TVAAS scores are confined to the later-entering *New Tenure* cohort, which calls into question whether the estimated tenure effect is confounded by a cohort-specific unobservable. In this regard, these results are unable to reveal whether the observed increases in TVAAS scores are persistent once this cohort of teachers is first able to enter the post-probation phase, since the timing of that transition is currently beyond the scope of the available years of data.

Figure 2. DD Effect by Cohort



Heterogeneity of Comprehensive Effects of Tenure Reform by School Context

Table 4 shows heterogeneity of the effect of tenure reform by whether a teacher's school contained a high proportion of minority students (i.e., upper quintile of schools within the state) using a triple differences framework. Results suggest that impacts do not differ across school settings with a high proportion of minority students, as the triple interaction is not statistically significant at conventional levels. That is to say, the estimated increase in math and ELA TVAAS scores associated with the implementation of tenure reform is not observably different among teachers in schools with a greater proportion of minority students. As before, there is no statistically significant overall or differential change in math or ELA value-added scores estimated using the VAM-TFE approach.

Table 4. Heterogeneity of DD model estimates of tenure effect, by school composition of minority students

	Math		Mat	h	ELA	1	ELA	1
	(TVAA	S)	(TFI	Ξ)	(TVA	AS)	(TFE	E)
	(1)		(2)	1	(3)		(4)	
Intercept	-26.141	**	-2.601		-12.28		-2.219	***
	(11.412)		(2.270)		(8.906)		(0.793)	
New Tenure	-0.243	***	-0.01		-0.147	***	0.001	
	(0.072)		(0.011)		(0.052)		(0.006)	
Post Reform	0.043		0.036	***	0.001		0.016	***
	(0.050)		(0.006)		(0.046)		(0.004)	
School w/ High Minority Composition	-0.231	***	-0.030	*	-0.255	***	-0.023	***
	(0.071)		(0.015)		(0.087)		(0.007)	
New Tenure x Post Reform	0.177	***	-0.003		0.130	***	-0.002	
	(0.068)		(0.011)		(0.049)		(0.006)	
New Tenure x School w/ High Minority Composition	0.078		0.038	**	0.037		0.016	***
	(0.107)		(0.018)		(0.078)		(0.006)	
Post Reform x School w/ High Minority Composition	0.119		0.014		0.294	***	0.007	
	(0.088)		(0.016)		(0.090)		(0.007)	
New Tenure x Post Reform	0.021		-0.036		-0.004		-0.001	
x School w/ High Minority Composition	(0.136)		(0.024)		(0.097)		(0.008)	
Teacher covariates	X		X		X		X	
School covariates	X		X		X		X	
District fixed effects	X		X		X		X	
N (Teacher-year)	10511		864	9	1176	55	7769)

Notes: *** p<0.01; ** p<0.05; * p<0.10. Each column within a panel is a separate regression. Standard errors shown in parentheses are clustered by district and year. Observations for teachers during the 2012–2015 school years are coded as "Post-reform." Teacher controls not shown include race/ethnicity, education level, gender, age, and years of experience. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

Table 5. Heterogeneity of DD model estimates of tenure effect, by school poverty status

		Math (TVAAS)		h E)	ELA (TVAA		ELA (TFE	
	(1)		(2)		(3)		(4)	
Intercept	-24.763	**	-2.199		-11.65		-1.956	**
	(11.799)		(2.359)		(8.898)		(0.849)	
New Tenure	-0.253	***	-0.01		-0.149	***	-0.002	
	(0.071)		(0.011)		(0.051)		(0.006)	
Post Reform	0.052		0.034	***	-0.007		0.012	***
	(0.048)		(0.006)		(0.046)		(0.004)	
High-Poverty School	-0.091		-0.017		-0.214	***	-0.024	***
	(0.064)		(0.012)		(0.062)		(0.006)	
New Tenure x Post Reform	0.188	***	-0.003		0.145	***	0	
	(0.070)		(0.011)		(0.048)		(0.006)	
New Tenure x High-Poverty School	0.134		0.043	**	0.007		0.019	***
	(0.089)		(0.020)		(0.102)		(0.007)	
Post Reform x High-Poverty School	0.058		0.017		0.22	***	0.015	**
	(0.078)		(0.015)		(0.067)		(0.007)	
New Tenure x Post Reform	-0.012		-0.033		-0.051		-0.013	
x High-Poverty School	(0.108)		(0.025)		(0.116)		(0.010)	
Teacher covariates	X		X		X		X	
School covariates	X		X		X		X	
District fixed effects	X		X		X		X	
N (Teacher-year)	10511		8649)	1176	5	7769)

Notes: *** p<0.01; ** p<0.05; * p<0.10. Each column within a panel is a separate regression. Standard errors shown in parentheses are clustered by district and year. Observations for teachers during the 2012–2015 school years are coded as "Post-reform." Teacher controls not shown include race/ethnicity, education level, gender, age, and years of experience. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

Table 5 similarly shows the heterogeneity of the effect of tenure reform by school poverty status. Recall, I use the percentage of FRPL-eligible students as the measure for student poverty and define high poverty to include schools in the upper quintile of school percentage of students who are FRPL-eligible. Similar to before, the positive impact of tenure reform on TVAAS scores is not statistically different between teachers teaching in high poverty and more affluent school settings.

Threats to Validity

I identify several potential threats to the validity of my findings and provide additional evidence to rule out each threat as an unlikely source of bias. First, I re-estimate model (3) among "placebo" samples of teachers fully comprised of Grandfathered cohorts of teachers that are wholly unaffected by the state's legislated reforms to the tenure process. I focus on two samples of unaffected cohorts: (1) the last four entering cohorts grandfathered under the old tenure process (i.e., teachers entering the state public school system between the school years 2006–07 through 2008–09) and (2) the first four entering cohorts observed in the available data (i.e., teachers entering between 2002–03 through 2005–06). If the impacts observed among TVAAS scores in the main DD results (Tables 2 and 3) are valid, the results from these robustness checks should not be statistically significant among cross-cohort comparisons of teachers with no practical significance. As expected, Table 6 provides evidence that any observed impact does not appear in placebo samples of untreated teachers. I also simulate the timing of the onset of tenure reform to four years after the first entering cohort appearing in the placebo sample to address concerns that estimated impacts are due to natural deviations in teacher performance occurring early in teachers' careers. I find no indication that this is the case.

Table 6. Placebo test: DD model estimates among untreated cohorts

	Math (TVAAS)	Math (TFE)	ELA (TVAAS)	ELA (TFE)
	(1)	(2)	(3)	(4)
Placebo: Sample restricted	d to last 4 entering cohort	s before reform (2006	5 to 2009); Post reform st	arting 2012
New Tenure x Post Reform	-0.010	0.009	0.001	0.004
	(0.043)	(0.008)	(0.037)	(0.004)
	N = 12718	N = 11481	N = 15453	N = 10989
Placebo: Sample restricted	d to last 4 entering cohort	s before reform (2006	5 to 2009); Post reform st	arting 2010
New Tenure x Post Reform	-0.005	0.011	0.011	-0.003
	(0.048)	(0.008)	(0.042)	(0.004)
	N = 12718	N = 11481	N = 15453	N = 10989
Placebo: Sample restricted to	o first 4 entering cohorts	observed in panel (20	03 to 2006); Post reform	starting 2012
New Tenure x Post Reform	-0.030	-0.007	0.033	-0.001
	(0.043)	(0.008)	(0.040)	(0.006)
	N = 10406	N = 11114	N = 13057	N = 10625
Placebo: Sample restricted to	o first 4 entering cohorts	observed in panel (20	03 to 2006); Post reform	starting 2007
New Tenure x Post Reform ^a	N/A	-0.003	N/A	0.007
		(0.011)		(0.005)
		N = 11114		N = 10625

Notes: *** p<0.01; ** p<0.05; * p<0.10. Each column within a panel is a separate regression. Standard errors shown in parentheses are clustered by district and year. Teacher controls not shown include race/ethnicity, education level, gender, age, and years of experience. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

a. TVAAS data are not available prior to the 2009–10 school, which prevents a placebo check simulating a post-reform period defined to begin in the 2006–07 school year.

I next examine whether observed tenure reform effects are concentrated in districts that underwent concurrent policy reforms that may have affected the teacher labor market. First, I explore whether impacts associated with tenure reform are also associated with districts most affected by the state's 2011 collective bargaining reform. In 2010, Tennessee hosted 136 traditional K-12 public school districts, 91 of which collectively bargained, while 45 did not (Quinby, 2018). By leveraging within-state variation in bargaining status, I estimate model (3) separately among subsamples of teachers in districts that were and were not unionized prior to the 2011 collective bargaining law to test the heterogeneity of the impact of tenure reform across these two categories of districts. Table 7 shows that the positive impacts of tenure reform on teacher performance—0.21 SD and 0.14 SD increases in math and ELA TVAAS scores, respectively—are concentrated among teachers in unionized districts, or districts most affected by collective bargaining reform. These increases are not statistically significant among teachers in non-unionized districts, or districts least affected by collective bargaining reform. Changes in the alternative math and ELA value-added measures are also not significant across both subsets of districts.

I similarly explore whether observed tenure reform effects are concentrated among districts with alternative compensation initiatives (i.e., CSF, IAF, or TN TIF). The implemented compensation plans varied across the 14 districts, but generally provided performance bonuses to highly effective teachers as well as extra pay for professional development and/or leadership activities (Ballou et al., 2016). To test the heterogeneity of the impact of tenure reform across districts with and without alternative compensation initiatives, I estimate model (3) separately among subsamples of teachers in districts that were and were not supported by CSF, IAF, and TN TIF. Table 8 shows that the increases in TVAAS scores are concentrated among teachers in

Table 7. Heterogeneity by district unionization pre-collective bargaining reform

	MATH (TVAAS) (1)		MAT (TFE		ELA (TVAA	S)	ELA (TFE	
			(2)		(3)		(4)	
Districts wit	h teacher un	ionizati	on prior to 20	11 colle	ctive bargainii	ng refor	m	
Intercept	-31.034	**	-1.039		-5.693		-1.346	***
	(15.158)		(2.999)		(11.310)		(1.165)	
New Tenure cohort	-0.251	***	-0.004		-0.148	**	0.002	
	(0.078)		(0.013)		(0.064)		(0.007)	
Post Reform	0.068		0.038	***	0.008		0.019	***
	(0.052)		(0.006)		(0.048)		(0.004)	
New Tenure x Post Reform	0.205	***	-0.008		0.139	**	-0.004	
	(0.074)		(0.012)		(0.054)		(0.006)	
Teacher covariates	X		X		X		X	
School covariates	X		X		X		X	
District fixed effects	X		X		X		X	
N (Teacher-year)	8898		7291		10023		6614	ļ
Districts with	out teacher u	ınioniza	tion prior to 2	2011 col	lective bargain	ning refo	orm	
Intercept	-9.104		-2.604	**	-113.588		-1.537	***
	(5.889)		(1.176)		(82.265)		(0.525)	
New Tenure cohort	-0.101		0.010		-0.142		0.007	
	(0.140)		(0.026)		(0.103)		(0.013)	
Post Reform	0.075		0.031	***	0.243	**	0.001	
	(0.088)		(0.011)		(0.095)		(0.008)	
New Tenure x Post Reform	0.074		0.026		0.141		0.010	
	(0.130)		(0.024)		(0.102)		(0.014)	
Teacher covariates	X		X		X		X	
School covariates	X		X		X		X	
District fixed effects	X		X		X		X	
N (Teacher-year)	1613		1358	3	1742		1155	5

Notes: *** p<0.01; ** p<0.05; * p<0.10. Standard errors shown in parentheses are clustered by district and year. Each column within a panel is a separate regression. Observations for teachers during the 2012–2015 school years are coded as "Post Reform." Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

Table 8. Heterogeneity by district alternative salary initiatives

	MATH (TVAAS)		MAT (TFE		ELA (TVAAS	S)	ELA (TFE		
	(1)		(2)		(3)		(4)		
	Districts	with al	ternative sala	ary initia	tives				
Intercept	12.984		1.094		-44.744		-2.537		
	(12.706)		(2.869)		(47.220)		(6.700)		
New Tenure cohort	-0.260	***	0.011		-0.130		0.026	**	
	(0.086)		(0.022)		(0.086)		(0.010)		
Post Reform	-0.066		0.029	***	0.020		0.004		
	(0.082)		(0.008)		(0.083)		(0.006)		
New Tenure x Post Reform	0.317	***	-0.005		0.180	**	-0.013		
	(0.082)		(0.019)		(0.076)		(0.009)		
Teacher covariates	X		X		X		X		
School covariates	X		X		X		X		
District fixed effects	X		X		X		X		
N (Teacher-year)	3234		2659	2659 3586			2577		
	Districts v	vithout	alternative sa	alary init	iatives				
Intercept	-35.815	***	-3.590		-10.655		-2.207	**	
	(13.862)		(2.656)		(9.331)		(0.871)		
New Tenure cohort	-0.206	**	-0.004		-0.152	**	-0.009		
	(0.091)		(0.012)		(0.072)		(0.006)		
Post Reform	0.121	**	0.040	***	0.043		0.023	***	
	(0.055)		(0.007)		(0.053)		(0.004)		
New Tenure x Post Reform	0.130		-0.013		0.117	*	0.001		
	(0.086)		(0.012)		(0.060)		(0.006)		
Teacher covariates	X		X		X		X		
School covariates	X		X		X		X		
District fixed effects	X		X	X		X		X	
N (Teacher-year)	7277		5990)	8179		5192		

Notes: *** p<0.01; ** p<0.05; * p<0.10. Standard errors shown in parentheses are clustered by district and year. Each column within a panel is a separate regression. Observations for teachers during the 2012–2015 school years are coded as "Post Reform." Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

districts implementing alternative compensation initiatives and larger in magnitude than the average effects presented in main DD models—0.32 SD and 0.18 SD increases in math and ELA TVAAS scores, respectively. Model results reveal no observable effect among teachers in districts without alternative compensation initiatives and, as before, no discernable change in the alternative math and ELA value-added measures associated with tenure reform.

Collectively, results from these checks suggest the effect of tenure reform is primarily observable among TVAAS scores and concentrated among teachers in district contexts that were affected by other salient policy reforms banning collective bargaining and implementing differentiated salary schemes for teachers. While robustness checks conducted among placebo samples partially affirm the validity of a tenure reform effect on teacher performance—at least measured through TVAAS—the presented checks nevertheless call into question whether observed tenure effects are confounded by other existing reforms affecting the teacher labor market and whether tenure reform is capable of altering teacher performance in the absence of such additional reforms.

Discussion

In this study, I investigate the impact of tenure reform on the performance of teachers within the K–12 workforce in Tennessee. Beginning in 2011, tenure reforms passed in the state systematically weakened permanent forms of job protections for teachers, which in effect reinforced performance mechanisms embedded within the educator evaluation system. To date, no other study has successfully attempted to quantify the effects of recent tenure reforms on teacher quality in Tennessee or other state settings. I find evidence of increased performance in both math and ELA among teachers most affected by the changes to the tenure eligibility process, however, my findings are sensitive to the method of estimation of teacher performance.

In addition, observed increases in performance are associated with concurrent teacher policies that took place throughout Tennessee, such as collective bargaining and district-wide alternative compensation initiatives. Considering the lack of robustness of the presented findings, the positive effect of tenure reform on teacher performance remains inconclusive. Future work should be conducted to reveal whether enhanced teacher performance associated with tenure reform is robust across other methods for measuring teacher effectiveness.

The analyses that I present demonstrate several challenges with attempting to isolate performance gains among teachers in response to instituted tenure reforms. First, I restrict my analysis to teachers of tested subjects and grades (math and ELA teachers in grade 3 through 8) in order to model teacher performance using existing VAM approaches. This, in fact, limits the generalizability of my findings to other categories of teachers that may be affected by the linkage of evaluation ratings to tenure eligibility decisions. For example, teachers of untested subjects and grades for whom the underlying measure that determines tenure eligibility, LOE, is calculated based off of school-wide student performance and growth may be most adversely affected by tenure reforms linking evaluation results to tenure. Further, previous studies have found teacher effects on test scores are weakly correlated with teacher effects on student behavioral outcomes (Gershenson, 2016; Jackson, 2012). In this regard, there may be changes in teacher performance that are difficult to isolate via student performance on standardized tests and more directly tied to teacher effects on student behavioral outcomes (e.g., absences, suspensions, course grades, on-time grade progression and graduation). Future work should explore the potential effects of tenure reforms on teacher performance in these dimensions.

Nevertheless, some implications can be drawn from this current study and the broader work examining of tenure reform in Tennessee. A well-established body of research posits that a

key component of the effectiveness of policy reform is the successful communication and implementation of policy directives at the school level (e.g., Berman, 1978; Spillane, Reiser, & Reimer, 2002). With regard to tenure reform, the state department of education has not set out to craft explicit policy for how to communicate changes to the tenure process to school-level administrators and teachers. In effect, minimal guidance from state-level administrators may have created a school environment in which teachers are largely unaware of the current tenure process. One concern that arises from ambiguous policy directives surrounding tenure reform is that the lack of knowledge among teachers may nullify or attenuate the performance mechanisms inherent in the design of tenure policy reforms in the Tennessee context. If teachers are unaware whether tenure exists as a valid form of job protection or do not understand the way in which they can become eligible for such protections, then they may not be exhibiting the behaviors that can translate into improvements in performance. In fact, in Chapter 4 I present evidence to suggest that teachers are largely unaware of tenure reform along numerous dimensions. A consideration in this regard is that enhanced knowledge of teachers about tenure reform may better facilitate improvements in teacher performance—that is, if teachers were more aware of the reformed tenure process then they more readily respond to available tenure incentives directly embedded in the current evaluation system.

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Appendix A. Estimating the Direct Effect of Tenure Eligibility on Teacher Performance

I leverage a regression discontinuity (RD) design to estimate the impact of remaining ontrack to receive tenure on teacher performance. The RD analytic design aims to isolate the causal effect on teacher performance by exploiting a discontinuity in the probability of remaining ontrack to receive tenure conditional on a teacher's LOE score, which serves as the measure that determines tenure eligibility under the reformed tenure system and running, or forcing variable in the RD analysis. Because a teacher's eligibility for tenure is determined by a score on a continuous variable with a strict cutoff (i.e., new teachers with $LOE \ge 350$ in their final two years of probation are on-track to receive tenure), teachers immediately on the other side of the threshold serve as a control to estimate an unbiased "local average treatment effect" (LATE) of eligibility to gain tenure within specified bandwidths. Further, the longitudinal nature of the data permits an estimation of RD effects across several cohorts of teachers before and after the implementation of the tenure reform law to assess whether effects are concentrated during particular post-reform years.

The following sub-sections describe the analytic samples of interest, proposed model specifications, and assumptions and limitations of the RD analysis in more depth followed by a discussion of results.

Method

Given that Tennessee's reformed evaluation system was first implemented during the 2011–12 school year, evaluation data for the continuous LOE composite measure (i.e., the running variable in the current analysis) is first available for 2012. This analysis will therefore use available state administrative data from 2011–12 and onward to identify distinct samples comprised of repeated cross-sections of teachers who are in distinct stages of the typical

probation and tenure phase. I focus on two samples of teachers. First, I estimate the effect of remaining on-track to receive tenure in the fourth year of probation by using a pooled sample of repeated cross-sections of teachers who taught in a district for four consecutive years, which I henceforth refer to as the sample of "4th year probation teachers." Second, I examine the effect of remaining on-track to receive tenure through the fifth year of probation. To do so, I use a second sample of teachers who taught in a district for five years and who received an effective score in the previous year, which for the sake of simplicity I refer to as the sample of "5th year probation teachers"; these are the subset of teachers who would remain on-track to receive tenure if they receive a consecutive score above the tenure eligibility threshold (LOE \geq 350).

Based on a RD specification, I estimate the impact of tenure eligibility separately among 4th year probation teachers and 5th year probation teachers using the following equation separately for data pooled across years and for each year individually:

$$Y_{js} = \alpha I \left(LOE_j \ge 350 \right) + f(LOE) + X_{js}\Theta + S_s\Psi + \varepsilon_{js}, \tag{A.1}$$

where Y_{js} denotes teacher performance in math or ELA the following year —as measured by TVAAS or estimated value-added—for teacher j in school s. LOE denotes a teacher's evaluation composite score, and $I(LOE_j \ge 350)$ is a binary indicator taking on the value of 1 when teacher j scored above the required tenure eligibility cutoff and remained on-track to receive tenure in a given year. The model also includes a vector of observable teacher and school characteristics, represented by X_{js} and S_s , and allows the slope of the regression to differ on either side of the cutoff; that is, the model incorporates a piecewise linear spline with a kink at the cutoff point, which I assume to be a local linear relationship. The α coefficient provides an estimate of the (local) average causal effect of tenure eligibility on the sub-sample of teachers above the cutoff. In other words, α identifies the "discontinuity" or "jump" in performance for teachers with

ratings that satisfy the reformed tenure eligibility requirements. To address whether tenure eligibility impacts teacher performance, estimates from model (A.1) will test the hypothesis that remaining on-track to receive tenure impacts teacher performance in math or ELA among a sample of teachers nearing the end of the five-year pre-tenure probation period ($\alpha \neq 0$). Assumptions and Limitations of the RD Identification Strategy

The key theory for causal inference within the RD framework is that teachers with similar underlying LOE scores are similar in other respects, and thus—conditional on the underlying score—the discontinuous rating assignments can be viewed as effectively random (Imbens & Lemieux, 2008; Lee & Lemieux, 2010). The RD design remains a credible approach for identifying the causal effects of tenure eligibility, particularly in the absence of covariate baseline imbalances and manipulation of the running variable around the cutoff determining treatment (i.e., being on-track to gain tenure).

I perform two tests that are commonly used to detect potential violations of these RD assumptions. The first test examines whether there are baseline imbalances between teachers on either side of the performance thresholds determining tenure eligibility. If other variables were discontinuous at the main thresholds, it would suggest that teachers with similar forcing-variable values near the cutoff are not otherwise similar. To determine whether other discontinuities in the data are present and align with the main discontinuities in teachers' evaluation scores, I estimate a series of reduced-form models similar to model (A.1) with each teacher covariate as the dependent variable among year-specific samples of teachers. As described by Lee and Lemieux (2010) and others, the concern is whether the observed baseline covariates are "locally" balanced on either side of the cutoff of interest, which should be the case if the treatment indicator is not statistically significant.

Table A.1. Auxiliary RD model estimates, covariate balance in the probation teacher samples

	4	4th year probation to	5th year probation teachers, previously rated "above expectation"				
Teacher covariate	AY 2012–13	AY 2013–14	4 AY 2014–	-15	AY 2013–1	4	AY 2014–15
Teacher characteristics							
Tested subject/grade	-0.010 (0.010)	0.063 (0.101)	-0.052 (0.064)		0.167 (0.127)		0.000 (0.004)
Minority/non-white	0.061 (0.107)	-0.054 (0.175)	-0.034 (0.176)		0.109 (0.091)		0.107 (0.222)
Masters or more	0.001 (0.078)	-0.081 (0.123)	-0.019 (0.076)		0.130 (0.175)		-0.003 (0.053)
Female	-0.052 (0.064)	-0.061 (0.204)	-0.173 (0.135)		-0.176 (0.175)		0.331 (0.523)
Age	5.960 (3.721)	-3.844 (4.426)	2.793 (3.912)		5.539 (7.598)		-1.005 (8.788)
Years of experience	3.143 ** (1.498)	-0.996 (1.859)	1.350 (1.450)		8.291 (5.960)		-1.446 (2.085)
School Characteristics							
Pct. Minority/non-white	0.027 (0.057)	0.000 (0.050)	0.014 (0.037)		-0.054 (0.034)	**	-0.148 (0.120)
Pct. female	-0.008 (0.013)	0.004 (0.015)	-0.003 (0.011)		0.012 (0.021)		0.013 (0.014)
Pct. special education	-0.005 (0.027)	0.050 · (0.025)	** 0.041 (0.021)	**	-0.029 (0.048)		0.031 (0.059)
Pct. non-native English speaker	0.003 (0.074)	0.013 (0.044)	-0.003 (0.038)		-0.045 (0.031)	*	-0.142 (0.134)
Pct. FRPL-eligible	0.063 (0.101)	-0.040 (0.080)	0.167 (0.127)		0.019 (0.153)		-0.213 (0.273)
Student enrollment	-101.964 (115.480)	-154.152 (134.379)	-28.185 (148.026)		-225.066 (152.698)		43.025 (259.482)

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Robust standard errors in parentheses. All models condition on a linear spline of the assignment variable and are estimated by samples defined by a mean square error (MSE)-optimal bandwidth.

The auxiliary regression results in Table A.1 provide evidence that observed teacher traits are generally similar on both sides of these thresholds. That is, for the majority of teacher characteristics and year-specific subsamples, I could not reject the null hypothesis of covariate balance at the 0.05 level, implying the absence of support for credible internal validity threat.

Density tests are also commonly used to validate RD designs. These tests look for evidence of "bunching" of the running variable around the discontinuity and can be useful for detecting manipulating behavior. In instances where the running variable is not smoothly distributed around the discontinuity point, the concern is that the lack of smoothness could reflect unobserved differences between individuals near the threshold (i.e., the manipulation may be non-random). Since a large proportion of the LOE scores are generated (and aggregated) based on student achievement data, it is likely that such manipulation did not occur. To test for manipulating behavior around the tenure eligibility thresholds, I also present statistical evidence that speaks to these concerns.

In each of the analytical samples (i.e., 4th year probation teachers in the 2011–12 through 2014–15 school years and 5th year probation teachers previously rated effective in 2012–13 through 2014–15), density tests (Cattaneo, Jansson, & Ma, 2017a; 2017b) fail to reject the null hypothesis that the distribution of observations is smoothly distributed around each threshold. The absolute values of the test statistics are not larger than 1.44. Figures A.1 and A.2 graphically illustrate that teacher observations do not appear to cluster on one side of a threshold (which would have suggested manipulation).

Figure A.1. Density of the LOE Assignment Variable, 4th Year Probation Teacher Sample

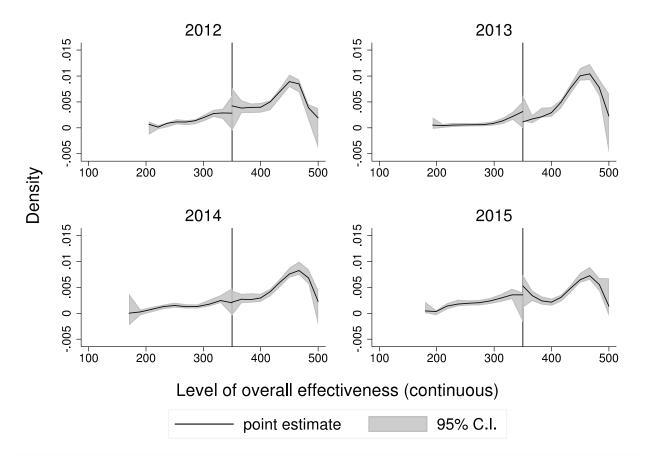
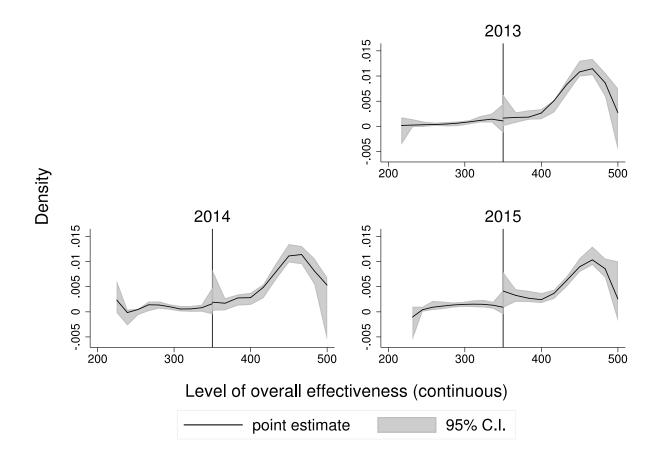


Figure A.2. Density of the LOE Assignment Variable, 5th Year Probation Teacher Sample Previously Rated "Above Expectation"



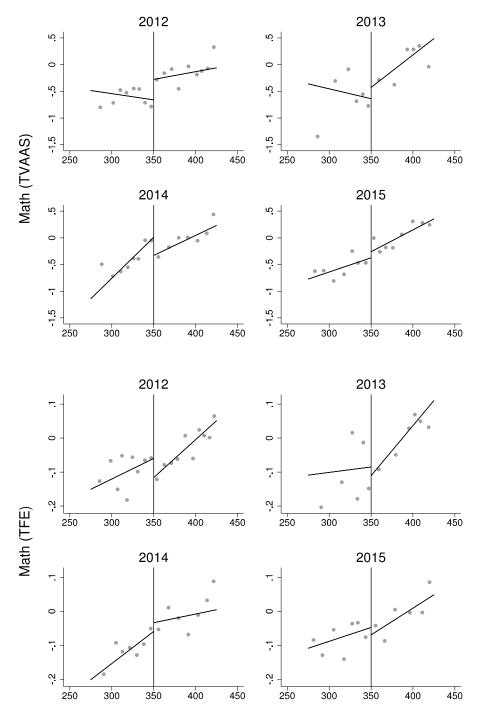
Main Findings on Tenure Eligibility Effects on Teacher Transfer and Attrition

Figures A.3 through A.6 provide graphical illustrations of the RD results. Figures A.3 and A.4 plot, during each year, teachers' LOE scores during their 4th year of probation, with a vertical dashed line indicating the 350 LOE cutoff for tenure eligibility for each of the measures of teacher performance in math and ELA, respectively. As shown for each measure of subject-specific performance, the direction of change across the eligibility threshold is negligible or directionally inconsistent across years, suggesting an absence or unclear effect of tenure eligibility on teacher performance for teachers near the tenure eligibility threshold.

Figures A.5 through A.6 plot a similar same relationship but for teachers during their 5th year of probation. While Figure A.6 shows negligible or small and directionally inconsistent discontinuities in teacher ELA performance at the 350 threshold, Figure A.5 generally shows a negative discontinuity in teacher math performance, suggesting that eligibility for tenure results in a *decline* in teacher performance in math.

While the graphical results are appealing in that they provide a visual face validity check without modeling assumptions, they do not explicitly estimate the effect of tenure eligibility on teacher performance in such a way that quantifies statistical uncertainty or allows flexible testing for robustness. Table A.2 presents the main RD results that allow for such extensions. The baseline specification—columns (1), (3), (5), and (7)—controls for the standard indicators included in an RD model (i.e., a binary indicator for whether a teacher received an LOE score above 350), the underlying continuous LOE score, and a linear spline of the assignment variable. The subsequent columns introduce controls for observable teacher and school characteristics. The "naïve" model estimates, whether generated among a sample of teachers pooled across years or among year-specific teacher samples, consistently indicate no statistical difference in teacher

Figure A.3. Tenure Eligibility Effects on Teacher Performance in Math, 4th Year Probation Teacher Sample



Level of overall effectiveness (continuous)

Figure A.4. Tenure Eligibility Effects on Teacher Performance in ELA, 4th Year Probation Teacher Sample

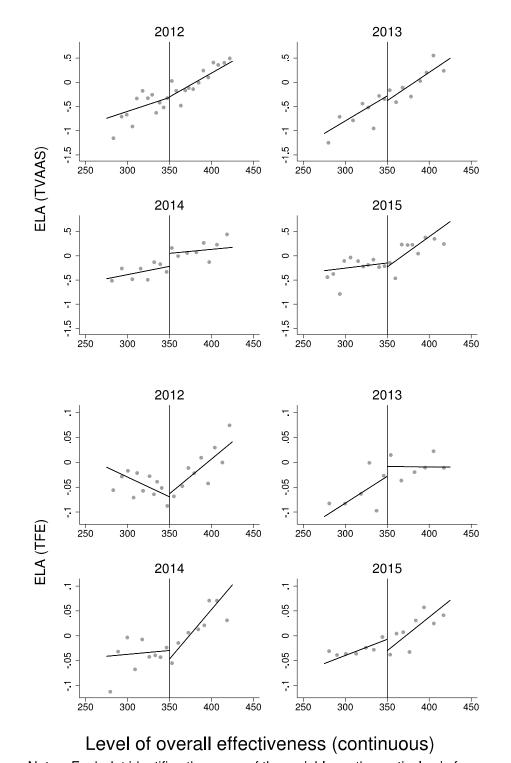


Figure A.5. Tenure Eligibility Effects on Teacher Performance in Math, 5th Year Probation Teacher Sample Previously Rated "Above Expectation"

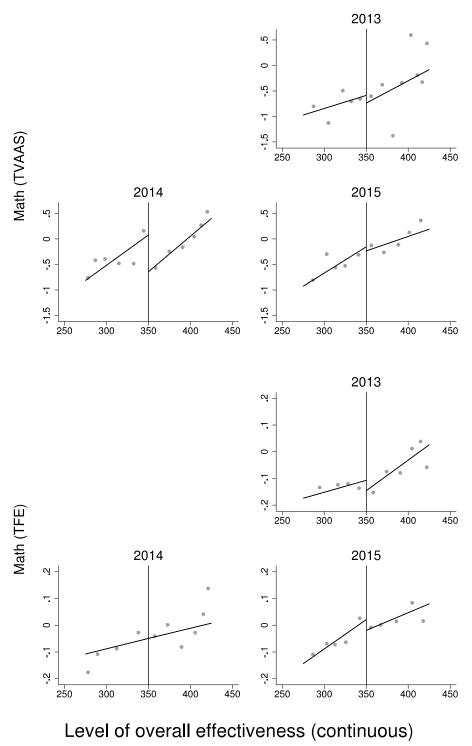
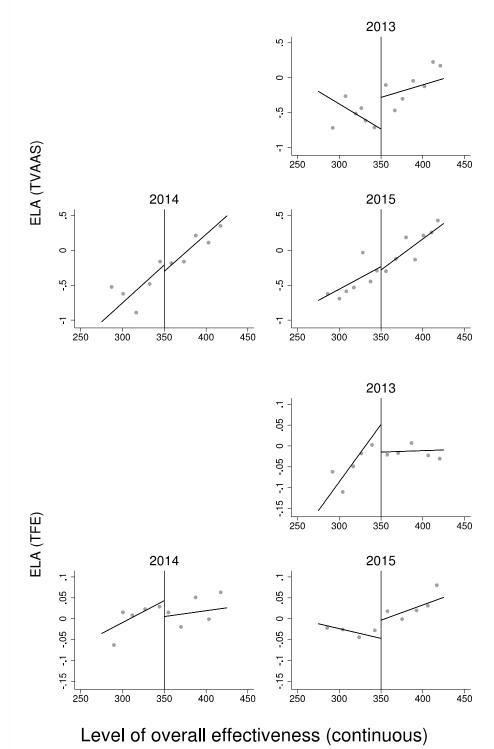


Figure A.6. Tenure Eligibility Effects on Teacher Performance in ELA, 5th Year Probation Teacher Sample, Previously Rated "Above Expectation"



performance in math or ELA. However, once statistical controls are introduced into the model, the magnitude of estimates generated among the pooled sample of 5th year probation teachers become increasingly negative and statistically significant for teacher performance in math, whether measured through TVAAS or value-added produced VAM-TFE approach.

As a placebo check, I estimate the RD models in years where cohorts of 4th and 5th year probation teachers were unaffected by tenure reform (the 2011–12 school year for 4th year probation teachers and 2012–13 for 5th year probation teachers). The RD estimates from these years generally indicate statistically negligible differences between teachers across the tenure eligibility thresholds; however, the RD estimate for the 5th year probation teacher sample in the placebo year suggests a statistically significant decrease in math TVAAS scores, calling into question the validity of the actual RD estimate associated with math TVAAS scores for this sample. One possible interpretation of the statistically significant placebo RD estimate may be that negative RD model estimates may actually be an indicator of regression to the mean of teacher performance in math rather than the actual effect of tenure eligibility.

Furthermore, the point estimates associated with the tenure eligibility threshold remain generally statistically negligible when defining alternative bandwidths around the cutoff (Table A.3). The detected changes in math teacher performance in the pooled 5th year probation sample are robust for smaller bandwidths, but are smaller in magnitude and not statistically significant for larger bandwidths.

Table A.2. Main RD model estimates of tenure effect on teacher performance

	Dependent variable								
	Math	(TVAAS)	M	ath (TFE)		ELA (TVAAS)	ELA V	/A (TFE)
Sample	(1)	(2)	(3)	(4)		(5)	(6)	(7)	(8)
			4th year	probation te	achers				
Pooled sample	0.252	0.256	-0.026	-0.035		0.144	0.176	-0.002	0.004
	(0.173)	(0.177)	(0.032)	(0.037)		(0.137)	(0.133)	(0.015)	(0.015)
AY 2012-13	0.247	0.373	0.018	-0.004		-0.080	-0.016	0.030	0.050
	(0.405)	(0.483)	(0.084)	(0.103)		(0.236)	(0.227)	(0.032)	(0.034)
AY 2013-14	-0.427	-0.445	-0.009	-0.054		0.288	0.322	-0.030	-0.013
	(0.302)	(0.251)	(0.054)	(0.049)		(0.230)	(0.219)	(0.028)	(0.025)
AY 2014-15	0.171	0.090	-0.014	-0.011		-0.058	-0.001	-0.030	0.005
	(0.271)	(0.240)	(0.062)	(0.060)		(0.370)	(0.350)	(0.035)	(0.027)
Placebo: AY 2011–12	0.533	0.473	-0.071	-0.092		0.255	0.244	0.006	-0.005
	(0.305)	(0.261)	(0.075)	(0.086)		(0.220)	(0.214)	(0.034)	(0.033)
		5th year prob	ation teachers,	previously	rated "al	ove expectat	ion"		
Pooled sample	-0.191	-0.576 **	-0.026	-0.074	**	0.294	0.165	-0.012	-0.033
	(0.302)	(0.269)	(0.043)	(0.041)		(0.297)	(0.246)	(0.039)	(0.038)
AY 2013-14	-0.897	-0.098	-0.040	-0.051		-0.098	0.276	-0.051	-0.012
	(0.644)	(0.364)	(0.079)	(0.050)		(0.531)	(0.438)	(0.067)	(0.046)
AY 2014–15	-0.143	-0.208	-0.036	-0.164	***	0.169	0.377	0.029	-0.015
	(0.438)	(0.140)	(0.050)	(0.040)		(0.364)	(0.354)	(0.046)	(0.038)
Placebo: AY 2012–13	0.276	-0.812 **	-0.051	-0.012		0.723	0.703	-0.026	-0.036
	(0.486)	(0.340)	(0.142)	(0.043)		(0.492)	(0.602)	(0.079)	(0.039)
School controls		X		X			X		X
Teacher controls		X		X			X		X

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Robust standard errors in parentheses. All models condition on a linear spline of the assignment variable and are estimated by samples defined by a mean square error (MSE)-optimal bandwidth. Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

Table A.3. Main RD model estimates, by alternative bandwidths

	Dependent variable									
	Math (TVAAS)		Math (TFE)		ELA (TVAAS)		ELA VA (TFE)			
Bandwidth sample	n	Estimate	e	n	Estima	ite	n	Estimate	n	Estimate
		4th	year pro	bation tea	chers (pool	ed sam	ple)			
Optimal bandwidth (OBW)	384	0.256		369	-0.035		632	0.176	598	0.004
		(0.177)			(0.037)			(0.133)		(0.015)
OBW*0.5	199	0.235		192	-0.027		339	0.277	315	0.010
		(0.319)			(0.069)			(0.199)		(0.026)
OBW*1.5	546	0.175		550	-0.032		909	0.088	848	0.003
		(0.183)			(0.038)			(0.136)		(0.016)
OBW*2.0	713	0.125		761	-0.032		1122	0.034	1147	0.004
		(0.158)			(0.033)			(0.123)		(0.014)
OBW value	36.230			44.292		37.416		57.594		
5	th year p	robation teac	hers, pro	eviously ra	ited "above	expect	tation" (poo	led sample)		
OBW	94	-0.576	**	114	-0.074	**	243	0.165	113	-0.033
		(0.269)			(0.041)			(0.246)		(0.038)
OBW*0.5	49	-0.687	**	60	-0.156	**	119	0.212	58	-0.056
		(0.317)			(0.050)			0.360		0.079
OBW*1.5	145	-0.259	*	185	-0.036	*	354	0.063	162	-0.016
		(0.292)			(0.042)			(0.248)		(0.043)
OBW*2.0	195	-0.195		303	-0.028		465	0.038	218	-0.017
		(0.274)			(0.037)			(0.223)		(0.038)
OBW value		28.195			44.972		4	1.718	3	31.110

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Robust standard errors in parentheses. All models condition on a linear spline of the assignment variable and are estimated by samples defined by a mean square error (MSE)-optimal bandwidth. Teacher controls not shown include race/ethnicity, education level, gender, age, years of experience, and year of entry in state public school system. School controls not shown include student enrollment, racial/ethnic background, gender, special education status, language background, and eligibility for free and reduced price lunch program.

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CHAPTER 4

UNDERSTANDING TENURE REFORM: AN EXAMINATION OF POLICY FRAMING AND SENSE-MAKING AMONG SCHOOL ADMINISTRATORS AND TEACHERS

Introduction

Over the past decade, several reforms have coalesced to modify teacher tenure policies within the K–12 public education system. As of 2015, 23 states issued a variety of reforms to the teacher tenure process (Doherty & Jacobs, 2015). These states departed from the traditional tenure system in which a teacher who worked in a district or state setting for a pre-specified time (usually three to five years) would automatically receive some form of job protection, which often involves an extensive and costly form of due process to terminate that teacher. Many of the reforms—largely passed in conjunction with state efforts to bid for the federal Race to the Top grant competition—make it more difficult for teachers to receive tenure, either by extending the required pre-tenure probation period and even requiring some form of evidence of teacher performance, with the explicit aim of removing ineffective teachers from the workforce (U.S. Department of Education, 2009).

While a substantial amount of attention has focused on discussing and investigating the effect of tenure reforms across state settings on teacher performance and retention (Goldhaber, Hansen, & Walch, 2016; Strunk, Barret, & Lincove, 2017; Waite, Miller, Loeb, & Wyckoff, 2016), there is little research on the ways in which states and districts have implemented tenure reform as well as how educators have made sense of these reforms. A well established body of research posits that implementation activities affect the individual sense-making process and thereby contribute to a shared understanding and consistent change of action (Ellis, 2016; Spillane, Reiser, & Reimer, 2002). However, the only known study that attempts to investigate

the implementation of tenure reform is a publicly available unpublished dissertation by Lomascolo (2016), which used interview and survey methods to examine principal perceptions of linking evaluation scores to tenure decisions in Tennessee. Lomascolo's findings revealed that principals generally felt that tenure is no longer a valuable construct and holds little influence over their ability to evaluate, retain, or dismiss teachers. However, Lomascolo did not consider whether administrators fully understood each provision of Tennessee's revised tenure law. Moreover, Lomascolo (2016) did not measure the perceptions of the most important unit of instruction—teachers.

In order to assess the implications of the post-reform tenure process, it is essential to investigate how school administrators and teachers perceive and accurately understand those changes in such a way that will lead to desired outcomes of tenure policy reform, such as improvements in the quality of the teaching profession. Alternatively, circumstances in which school-based staff have a poor perception or comprehension of tenure reform can potentially reveal areas of unintended responses that diverge from the reform's intended goals, which are equally worth exploring. The current study intends to fill the evidence gap by more fully probing administrator and teacher knowledge and perceptions on tenure reform. More specifically, I answer the following research questions:

- 1. To what extent do administrators and teachers understand Tennessee tenure policies, and what are sources of understandings and misunderstandings?
- 2. What sources of information do administrators and teachers rely on to construct their understanding of tenure reform?
- 3. How do administrators and teachers frame the purpose of the reformed tenure process?

4. Do administrators and teachers perceive that tenure reform facilitates desirable outcomes within the context of their work?

This research serves as one component within the broader body of work evaluating the effect of tenure reform in Tennessee. In this work, I attempt to explore areas for improved communication and support for school-based staff in the wake of large-scale tenure policy change with the ultimate aim of providing guidance on how to better communicate changes to tenure policy to better support teachers throughout the tenure eligibility process. My intention is not to undertake a comprehensive review of the implementation process of tenure reform in Tennessee, but rather to explore in depth one key, though regularly overlooked, facet of the implementation process: implementers' sense-making with regard to policy reform initiatives.

I draw on qualitative interviews from 10 school administrators and 30 pre-tenure classroom teachers from a large, urban district in Tennessee—Metro Nashville Public Schools (MNPS)—to illustrate the nature of their understanding and perceptions of the reformed tenure process affecting all public school teachers throughout the state of Tennessee. A number of findings arose across the full set of interviews with administrators and teachers. First, school-based administrators and teachers have a limited understanding of the benefits associated with tenure and particular changes to the teacher tenure process. However, both administrators and teachers tend to rely on a diverse set of sources in an attempt to support their understanding of the teacher tenure process. Second, some administrators distinguish between teachers who received tenure under the reformed process in favor of teachers whose tenure status was grandfathered under the previous system, and in select circumstances this preference was associated with reports of selective retention of non-tenured and newly tenured teachers. Finally, teachers generally supported the reforms to the tenure process as a way to promote accountability

within the teaching workforce, but nevertheless describe aspects of the tenure process that they perceive as unfair or inconsistent with the expectations established under the state's educator evaluation system.

Tenure Reform in Tennessee

There are over 60 thousand classroom teachers in the Tennessee Public School (TNPS) system in any given year. ¹³ An important consideration is the extent to which human resource policies exist to support the sizeable workforce of teachers as they deliver instruction within the classroom. One such human resource policy is tenure and its associated job protections afforded to teachers. While tenure was originally enacted into Tennessee state law in 1951 as a form of protection for teachers against racial and gender discrimination, the codified form of tenure policy has undergone continual modification in previous decades to include vocational teachers and redefine the way in which teachers can attain tenure status (Offices of Research and Education Accountability, 2012).

In Tennessee, maintaining tenure status guarantees stricter due process for tenured teachers during dismissal procedures (Tenn. Code. Ann. § 49-5-513) and protects tenured teacher contracts from non-renewal within the district, with the exception of staff layoffs due to budget cuts and low school enrollment (Tenn. Code. Ann. § 49-5-502(a)). Traditionally, public school teachers in Tennessee typically became eligible for tenure after having completed a pre-tenure probationary period based on the first three years spent teaching in the same district. Recent reforms, however, have altered how teachers become eligible for tenure.

In 2011, the Tennessee General Assembly voted to implement a number of reforms to the teacher tenure process (Tenn. Code. Ann. § 49-5-501–515). According to these legislated

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¹³ Calculated from state department of education administrative data.

reforms, new teachers must now complete an extended five-year probation period within their district and can only become eligible for tenure if they receive the highest two categories on the state's five-category effectiveness rating ("Above Expectation" or "Significantly Above Expectation") during the final two years of a five-year probationary period. Furthermore, new regulations make it possible for teachers to lose tenure upon receiving two consecutive years of low effectiveness ratings ("Below Expectation" or "Significantly Below Expectation"). However, the reformed tenure process only affected teachers who had not received tenure prior to that point and grandfathered tenure status for teachers who already received tenure prior to the law change; the group of grandfathered teachers is not required to demonstrate high performance under the evaluation system in order to maintain their tenure status.

In a series of private meetings, Tennessee Department of Education (TDOE) and MNPS staff described that the state and district departments of education have not set out to craft explicit policy for how to communicate the implications of tenure reform to school-level administrators and teachers. In effect, decisions for how to explain and orient teachers to changes to the tenure process are largely left to the devices of school-based staff. Therefore, minimal guidance from state-level administrators on statewide-legislated changes to the tenure process may create misunderstandings about the implications of tenure reform on job security and job-related expectations for teachers.

Policy Implementation and the "Sense-Making" Process

A pivotal component of the policy process is the implementation stage. Once policymakers craft and adopt policy reform, such as legislated reforms to the K–12 teacher tenure process, high-level administrators typically face the challenge of communicating expectations of the reform to local "implementers," or locally-based administrators and

practitioners, in order to enact the policy as intended to achieve a desired outcome. As a consequence, the implementation process is one that is complex and multi-faceted, often involving the delivery of policy directives through a loosely coupled structure beginning from the macro-level in which the policy was crafted (e.g., a federal or state legislature) and through the micro-level in which the policy is actually implemented (e.g., a school or classroom) (Berman, 1978).

A variety of factors may affect the implementation process as a policy passes from the initial reform decision through the adoption stage and into practice at the local level. Some factors affecting the implementation process identified by implementation and public administration scholars include the degree to which policymakers and high-level administrators clearly formulate and articulate policy goals and outcomes as well as the extent to which they supervise the implementation process (Mazmanian & Sabatier, 1981; Pressman & Wildavsky, 1974; Van Meter & Van Horn, 1975; Weatherly & Lipsky, 1977). Scholars also emphasize that the relationship structure between high-level administrators and local policy implementers plays an essential role in successful policy implementation (Cohen & Spillane, 1992; Porter, Floden, Freeman, Schmidt, & Schwille, 1988; Pressman & Wildavsky, 1974; Weatherly & Lipsky, 1977). Moreover, the degree to which local implementers—also known as "street-level bureaucrats"— operate with autonomy and actualize their unwillingness or incapacity to enact policy directives is a crucial element capable of obstructing the implementation stage in such a way that leads to undesired outcomes (Berman, 1978; Hjern, 1982; Lipsky, 1978; McLaughlin, 1987). In fact, several scholars emphasize the importance of street-level bureaucrats and local actors to the implementation process and posit that they often utilize discretion to execute a

policy to achieve or avert its goals, with or without the necessary resources or well-defined guidance from policymakers and high-level administrators (Berman, 1978; Lipsky, 1980).

Yet, prior to actually implementing newly introduced policy directives, the implementation process demands that implementation agents first engage in a sense-making process in which they decode those new directives. Sense-making is constituted in the interaction of the implementation agent's individual cognition (their knowledge, beliefs, and attitudes) with their social context (Ellis, 2016; Spillane et al., 2002). Implementers as an individual sense-maker interpret, frame, and construct meaning from new directives, or stimuli and cues, in order to encode into new knowledge structures, or schemas (Spillane, et al., 2002). Only then can implementers translate newly constructed schemas into individual actionable steps aimed at producing change (Ellis, 2016).

Central to an implementer's developing cognition and sense-making process is the implementer's existing funds of prior knowledge. Implementing agents may often times rely on their prior knowledge, beliefs, and experiences in order to develop new schemas and formulate their interpretations of a new policy (Spillane, et al., 2002). Those tasked with policy implementation may seek to extract from previous experiences with other known policies or programs to better understand novel institutional policies or practices (Ellis, 2016; Spillane, et al., 2002).

Although prior knowledge is a vital component of an individual's sense-making, the cognitive elements underlying the sense-making process are nevertheless situated within a social context. Social interactions with and among policymakers, administrative supervisors, and other peer implementers are capable of developing a shared understanding of new policy directives that enact and transform those directives into practice (Berger & Luckmann, 1996; Spillane, et

al., 2002; Weick, 1995). In this sense, a number of organizational elements can be highly influential to the social component of the sense-making process: staff cohesion and collaboration, trust in organizational leadership, institutional climate, and the availability of both formal and informal professional communities to sustain ongoing interactions among staff.

Prior studies have sought to examine the sense-making process of education administrators and practitioners as they frame and make sense of a wide array of large-scale education policy reforms (e.g., Coburn, 2001, 2004, 2006; Woulfin, Donaldson, & Gonzales, 2016). I similarly utilize sense-making embedded within the policy implementation stage as a suitable paradigm to investigate the ways in which local implementers at the micro-level, such as school-based administrators and teachers, have come to understand and perceive comprehensive tenure reform. While the linkage between administrative staff and the implementation process for tenure reform is more straightforward, since school-based administrators are responsible for carrying out the observation, evaluation, and feedback processes for teachers throughout their pre-tenure probation period, I also consider teachers implementers in the sense that they are tasked with implementing classroom instruction within the context of a reformed human resources process that can hypothetically affect their sense of security in their workplace environment. The replacement of the previous tenure system may pose several challenges to the implementation and sense-making processes for both school-based administrators and teachers undergoing the pre-tenure probation process, as they may be over-reliant on rules under the former system to understand the reformed system, particularly in the absence of continuous and deliberate policy directives from macro-level policymakers and administrators at the state and district.

Methodology

This study sought to answer a series of overarching questions: To what extent do administrative and teaching staff understand tenure reform? From what sources of information and interactions do administrators and teachers extract in order to understand the reformed tenure process? Further, how do school-based staff frame the purpose of tenure in the post-reform era? And finally, do administrators and teachers perceive that the reformed tenure system translates into a change in outcomes—intended and unintended—within the context of their work?

Sample of Participants

To answer these questions, the study recruited a sample spanning across 10 schools that included 10 school administrators (one per school) and 30 teachers nearing the end of the five-year pre-tenure probation period (about two to four teachers per school). Using statewide administrative data provided by the TDOE for the 2015–16 school year (i.e., the most recently available year of administrative data prior to the start of the study), I identified and randomly sampled a subset of 30 schools within the MNPS district, which served as the sampling frame for this study. With the assistance from staff at the Tennessee Education Research Alliance (TERA) at Vanderbilt University and MNPS, this study identified 10 school sites across the district from the sampling frame to be included in this study. Table 1 compares descriptive characteristics of the qualitative sample of schools with those of the 30 schools included in the initial sampling frame, all schools in MNPS, and all schools in TNPS.

The qualitative sample of schools is similar to the universe of schools at the district level in terms of student demographics, however, the average school enrollment as well as the

Table 1. Descriptive statistics for qualitative sample, sampling frame, Metro Nashville Public Schools (MNPS), and all Tennessee Public Schools (TNPS)

Qualitative sample	Sampling frame	All MNPS schools	All TNPS schools
0.01	0.02	0.09	1.00
0.40	0.29	0.58	0.68
0.40	0.46	0.27	0.16
0.20	0.25	0.15	0.16
0.70	0.79	0.65	0.47
0.80	0.86	0.68	0.47
807.50	815.82	543.43	579.66
0.62	0.64	0.67	0.32
0.53	0.53	0.54	0.59
10	30	167	1802
	0.01 0.40 0.40 0.20 0.70 0.80 807.50 0.62 0.53	sample frame 0.01 0.02 0.40 0.29 0.40 0.46 0.20 0.25 0.70 0.79 0.80 0.86 807.50 815.82 0.62 0.64 0.53 0.53	sample frame schools 0.01 0.02 0.09 0.40 0.29 0.58 0.40 0.46 0.27 0.20 0.25 0.15 0.70 0.79 0.65 0.80 0.86 0.68 807.50 815.82 543.43 0.62 0.64 0.67 0.53 0.53 0.54

Source: Tennessee Department of Education administrative data for the 2016–17 school year.

proportion of middle schools was higher compared to the district. The qualitative sample has a slightly higher proportion of schools that are below median achievement compared to MNPS; the sample included seven schools that are under the median TNPS school-level achievement in English Language Arts (ELA) and eight that are below the median achievement in math.

Within each school, I identified one *school administrator* to be included in this study. School administrators recruited to this study were directly involved with communicating school, district, and state education policy to teachers (i.e., a current Executive Principal or Assistant Principal). Table 2 shows background characteristics for all 10 administrators within the final qualitative sample. As the table indicates, seven administrators held Executive Principal positions within their school while the remaining three were Assistant Principals; the average years of experience working within their assigned school was approximately 4.8 years (though several principals reported having served the district for several more years as administrators and teachers).

Once the school administrator agreed to have their school site participate in the study, I then relied on a snowball sampling method (Biernacki & Waldorf, 1981) to recruit teachers. Relying on referrals from each participating school administrator, I identified and recruited approximately two to four *classroom teachers* within each school administrator's school. Ultimately, I interviewed a total of 30 teachers across all 10 school sites. All classroom teachers recruited to this study were non-tenured teachers nearing the end of the five-year pre-tenure probation period, and had on average years 4.66 years of total teaching experience. Teachers in the sample held a variety of teaching positions; about 7 percent certified ESL inclusion specialists, 10 percent taught exclusively in special education classrooms, and 17 percent taught

Table 2. Background characteristics for qualitative sample

	Qualitative
	sample
Administrator background characteristics	
Proportion female	0.80
Proportion male	0.20
Position	
Proportion Executive Principal	0.70
Proportion Assistant Principal	0.30
Average years of experience in school	4.80
Number of administrator observations	10
Teacher background characteristics	
Proportion female	0.73
Proportion male	0.2.7
Position	
Proportion ESL inclusion specialist	0.07
Proportion special education teacher	0.10
Proportion self-contained classroom teacher	0.17
Proportion subject-specific classroom teacher	
Mathematics	0.17
English Language Arts	0.27
Other subject	0.30
Average years of experience in school	3.10
Average years of experience (total)	4.66
Number of teacher observations	30

Source: Background information reported by interview participants.

in self-contained classrooms. The remaining teachers taught across a variety of other subject, with the majority specifically teaching either mathematics or ELA.

Data Collection and Interview Procedures

This study utilizes qualitative data collected through semi-structured in-person interviews with school administrators and teachers working at MNPS to examine how school administrators

and teachers frame, understand, perceive, and react to the current tenure process. A total of 40 interviews were completed (10 with school administrators and 30 with teachers) across 10 school sites. Each interview lasted approximately 20 minutes.

Appendix A provides the school administrator protocol interview questions for this study, which was designed to collect information on how administrators frame the tenure process for teachers in their school. School administrators were asked to describe 1) their understanding of tenure reform; 2) how tenure granting procedures and expectations are communicated to educators within their school; 3) whether tenure influences the ways in which they staff their schools; 4) whether tenure influences the teacher evaluation or professional development process within their school; and 5) their general impression of the tenure process.

Appendix B similarly provides the teacher protocol interview questions for this study, which is designed to collect information on teachers' sense-making process with regard to how they come to understand and perceive the reformed tenure procedures. Teachers were asked to describe 1) their understanding of tenure reform; 2) the ways in which they learned about tenure granting procedures; 3) expectations within their school related to tenure; 4) whether tenure influences how they incorporate professional development and evaluation feedback into their instruction; and 5) their general impression of the tenure process.

All interviews were recorded using audio equipment as well as field notes made during and immediately after each interview. Prior to data analysis, all interview notes and recordings were thoroughly reviewed and all audio recordings were fully transcribed and compiled using *NVivo 10* software.

Analytic Strategy

To analyze interview data collected from school administrators and teachers, I employed methods situated within the realm of qualitative and naturalistic inquiry with the goal of understanding how study subjects construct their own reality within their social context (Lincoln & Guba, 1985). Interviews were transcribed and initially analyzed in two phases; out of the 40 total transcripts, 18 were initially coded using an open coding approach to identify broad categories and themes grounded in the data (Strauss & Corbin, 1990). Upon identifying the major themes from the first phase of transcripts, I then proceeded to conduct open coding with the remaining 22 transcripts using the identified categories and themes, while simultaneously adjusting the description of the defined codes and applying new codes across all transcripts to identify newly emergent themes. Table 3 provides the relevant coding scheme used for this study.

Once I completed open coding across all interviews, I then employed a constant comparative focused analytic approach to identify more detailed themes and discrepancies that emerged across cases (Glaser & Strauss, 1967; Strauss & Corbin, 1990). For example, as I read through interview transcripts, I coded any portion of the interview with administrators about the extent to which they understood various aspects of the tenure process under the headings "Knowledge of Benefits Associated with Tenure Status" and "Knowledge of Reforms to Tenure Eligibility Process." Once I had read through all cases and coded all extracts under this theme, I read through the entire coded text for the domain to code for various aspects about the benefits associated with tenure or the tenure eligibility process that the respondent understood. For Table 3. Relevant coding architecture

Reported Knowledge of Reforms to Tenure Eligibility Process

- *Non-permanent tenure status*. Respondent described how teachers receiving low evaluation ratings are at risk of losing tenure status under reformed tenure process.
- *Tenure eligibility requirements*. Respondent described how teachers receiving high evaluation ratings are eligible for tenure under reformed tenure process.
- Extended probation period. Respondent described how pre-tenure probation period extended from three to five years under reformed tenure process.

Each sub-category coded as "Fully Aware," "Somewhat Aware," or "Unaware or Did Not Mention."

Reported Knowledge of Benefits Associated with Tenure Status

- Position guaranteed by district. Respondent described how tenured teachers are guaranteed a position within the district during following year.
- *Due process*. Respondent described how tenured teachers guaranteed due process upon termination from their position.

Each sub-category coded as "Fully Aware," "Somewhat Aware," or "Unaware or Did Not Mention."

Reported Sources of Knowledge About the Tenure Process

- Communication with other administrators. Respondent relied on communication with administrators in their school to understand tenure process.
- *Communication with other teachers*. Respondent relied on communication with other teachers in their school to understand tenure process.
- *Personal experience, research, or learning.* Respondent relied on previous work/school experience or personal research to understand tenure process.
- *The district.* Respondent relied on district-level supports (e.g., trainings, online materials, communication with district officials) to understand tenure process.
- *The state*. Respondent relied on state-level supports (e.g., trainings, online materials, communication with state officials) to understand tenure process.

Suggested Forms of Support to Better Understand the Tenure Process

- District website. Respondent identified additional materials on district website as potential form of support.
- Other online resources. Respondent identified other online resources as potential form of support.
- Additional training or workshop session. Respondent identified additional trainings or workshops as potential form of support.
- *Incorporation into teacher evaluation process.* Respondent indicated integration of formal conversations about tenure into post-observation feedback sessions as potential form of support.
- *Timed notification or newsletter*. Respondent identified automated notifications delivered to teachers as they neared the end of probation as potential form of support.

Perceptions of Tenure System

- Accountability within the workforce. Teacher described how tenure process served as a form of professional accountability for teachers.
- Inconsistent ratings. Teacher described misalignment of evaluation ratings expected of the "average" teacher and tenure eligibility.

Teacher Development and Staffing

• Strategic staffing tool. Administrator described how tenure process influenced staffing decisions within their school.

example, I coded whether administrators fully explained that the probation period was extended from three to five years or whether they understood that tenure was no longer permanent if a teacher was rated ineffective under the evaluation system. Once this final stage of coding was complete, I read within the sub-codes to summarize and synthesize the main categories and themes that emerged across interviewed subjects while highlighting notable discrepancies in the data

Results

In the sections below, I report my findings on teacher and administrator knowledge and perceptions of the reformed tenure process in Tennessee. I generally find that administrators and teachers have a limited understanding of the specific aspects of the reformed tenure process; however, administrators and teachers tend to rely on different stimuli in their sense-making process. Administrators indicate they utilize directives from the macro-level—district or state administrators or resources—as well as their previous experiences with tenure, as former teachers for example. Teachers tend to rely on social interactions with peer teaching staff to generate a sense of the reformed tenure process as well as their previous experience learning about tenure as students or as teachers in other states. Despite a limited sense of the specific aspects of tenure reform, administrators and teachers expressed distinct perceptions about the tenure process. Most importantly, administrators perceived the reformed process to be a tool that facilitates their ability to more flexibly staff their schools. Teachers framed reforms to the tenure process as a sensible form of accountability within the teaching profession, but articulated specific concerns about perceived flaws with the subjectivity and clarity of the process.

I begin by providing an overview of how well administrators understand particular aspects of the teacher tenure process, the sources of information they have relied on to

understand the process, as well as their recommendations for potential supports to improve their understanding; I then explore similar areas of understanding from the teacher perspective. Figure 1 provides frequency counts of how many administrators and teachers indicated they correctly understood the benefits associated with tenure status throughout the course of their interview. Figure 2 reports the number of sample administrators and teachers who understood the main components of the reformed tenure eligibility process. Finally, Figure 3 displays results related to the sources that sampled administrators and teachers relied on to understand the teacher tenure process while Figure 4 presents administrator and teacher recommendations for additional supports to improve their understanding.

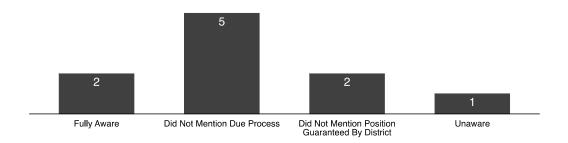
In addition to the above frequency counts, I provide detailed summaries of responses in order to increase the confirmability of my analyses and to provide readers with the points that support the descriptions that follow. I use tallies accompanied with quotes—accompanied by pseudonyms for names of individuals and their schools—to show direct evidence of patterns in administrator and teacher responses. This practice is meant to demonstrate the objectivity of my analysis of the data but also to provide information for researchers who conduct similar studies to examine the extent to which their findings replicate or challenge the results reported below.

Administrator Knowledge of the Teacher Tenure Process

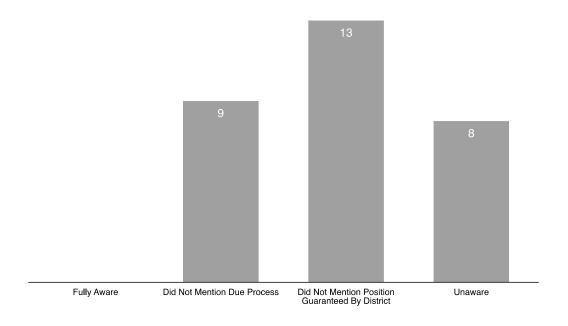
An ideal byproduct of the sense-making process within the context of the policy implementation stage is an accurate understanding of policy directives. Overall, administrators that I interviewed generally exhibited limited knowledge of the teacher tenure process. First, few sampled administrators were fully aware of the two main benefits that tenure status guaranteed a teacher: 1) due process upon threat of termination and 2) a position within the district in following year. As shown in Figure 1, only 2 of the 10 interviewed administrators articulated a

Figure 1. Reported Knowledge of Benefits Associated with Tenure Status

Administrators



Teachers



Notes: Frequency counts represent number of interviewed administrators and teachers.

clear understanding of these two main benefits associated with tenure. For example, Shannon, Executive Principal at Booker Middle School referenced how tenured teachers were guaranteed a position in the district: "If you were not tenured, I could just tell you that you were not rehired which also means you don't have to be rehired by the district. If you were tenured, you have more protection with that." Shannon further alludes to the benefit of due process by stating: "to release [a tenured teacher], I would have to go through documentation to fire [them]." Only one administrator indicated they were completely unaware of any benefit associated with tenure. The remaining seven administrators solely referenced one of the two main tenure benefits in their response, such as a guaranteed position in the district:

In the old days, we used to say tenure meant you had property rights to your job. If for some reason I am not performing as an administrator and I'm not dismissed from the district, then I am owed a teaching position within the district. (Sherley, Interim Executive Principal, Rockville Elementary School)

or the benefit of due process:

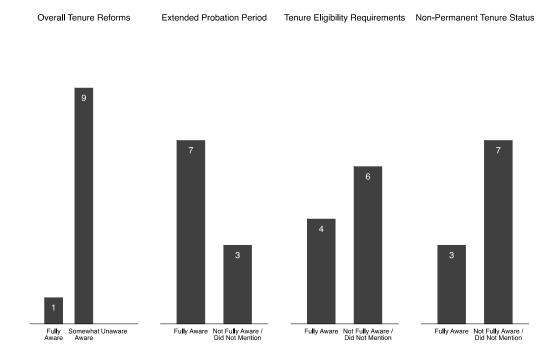
You're only getting the benefit of due process. (Trish, Executive Principal, Great Falls High School)

Collectively, two administrators only associated due process as a benefit throughout the course of their interview while five administrators identified that tenure status only guaranteed teachers a position within their district.

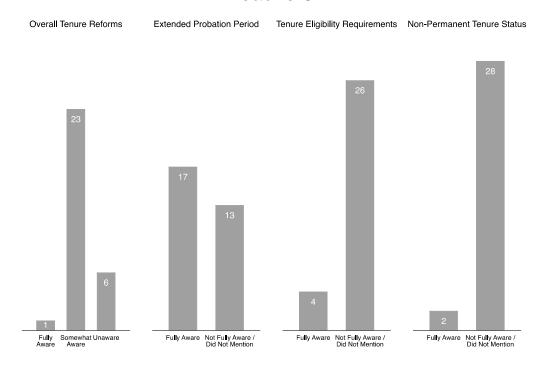
Similarly, the majority of administrators were only somewhat aware of the legislated changes to the teacher tenure eligibility process. As Figure 2 shows, only one administrator correctly articulated the three main changes to the tenure eligibility process, which include 1) the extension of the pre-tenure probation phase from three to five years; 2) the linkage of teacher evaluation ratings to tenure eligibility; and 3) the removal of tenure status for teachers who are

Figure 2. Reported Knowledge of Reforms to Tenure Eligibility Process

Administrators



Teachers



Notes: Frequency counts represent number of interviewed administrators and teachers.

rated ineffective under the educator evaluation system. While this administrator, Kathy, correctly references all the three main components of tenure reform, she does so with a lack of confidence:

In that fifth year, I think, we need scores of 4 or 5. And then at that point in time, if teachers have a score 4 and 5, then they are eligible. And I can't recall if it's two years in a row—I think it's two years in a row—and then they are eligible for tenure. However, if over time, they are not maintaining that 3, 4, and 5—I think—then they kind of go off tenure, so to speak and back into probationary until those scores go up. Or if they're in probation for so many years then, well, they just sit in probation—they don't have full tenure. I don't—yeah, so specifics beyond that I have no idea. (Kathy, Executive Principal from Wood Holly High School)

The majority of the remaining administrators were aware of the extension of the pre-tenure probation period, while only few correctly indicated that tenure eligibility was non-permanent and contingent on teacher evaluation ratings.

Despite an overall limited understanding of tenure reform, administrators reported that they used several sources of information to learn about the benefits associated with tenure and changes to the tenure eligibility process. As shown in Figure 3, a majority of sampled administrators relied on directives from high-level administrators in the form of district resources (e.g., district-led training sessions or contacts) to get a better sense of tenure reforms; a few indicated they relied on similar resources available at the state level. However, some administrators indicated that many state- and district-led trainings and information sessions about the reformed tenure process occurred soon after tenure reform was first passed in 2011:

When [tenure reform] rolled out, the big change in the state, when that whole policy and process rolled out new there were trainings at that point in time, and so really I'm just relying on what we talked about back then. (Kathy, Executive Principal, Wood Holly High School)

They sent out the new procedures from when it changed however long ago. The most we get [now] is an update every year about the teachers we have that are up for tenure via email. (Susan, Assistant Principal, Lincoln Middle School)

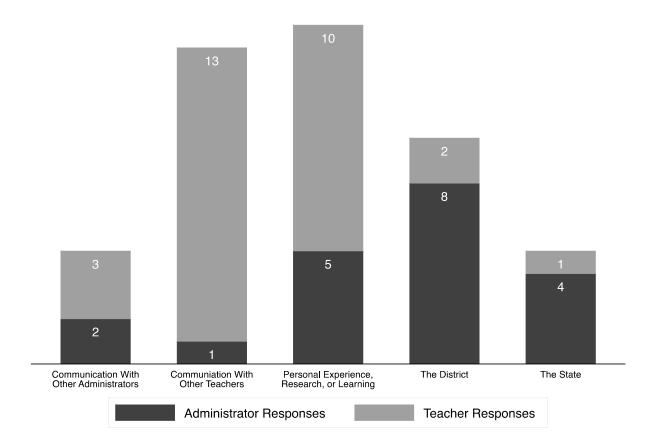


Figure 3. Reported Sources of Knowledge About the Tenure Process

Notes: Frequency counts represent number of instances interviewed administrator or teacher referenced a particular response category.

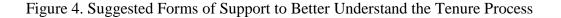
Aside from relying on high-level policy directives about tenure reform, some administrators stated they relied on their personal experience previously navigating the tenure process as a former teacher, learning about the tenure system in their postsecondary and graduate degree programs, or personal research/reading of news articles and other publicly available media to learn more about changes to the tenure process. For example:

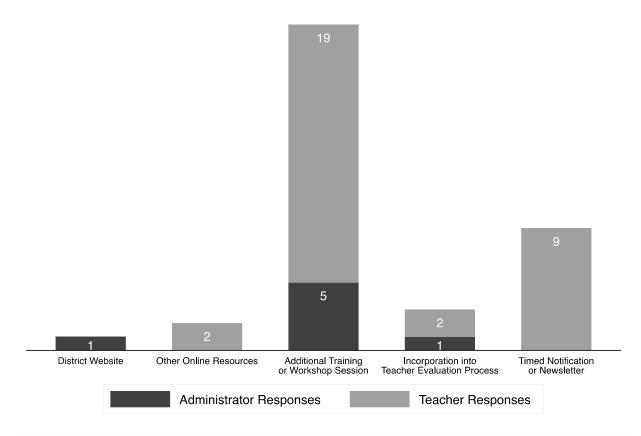
[I learned about tenure] through things I have read. Some are from the state some are through the district. But in general I learned about it back when I was in school to be a Tennessee state administrator. (Trish, Executive Principal, Great Falls High)

[My knowledge is] based on my tenure process as a teacher and how I learned about tenure in school. (Sherley, Interim Executive Principal, Rockville Elementary)

Only few administrators indicated that they learned about the tenure process by speaking with staff within their school or neighboring schools, with one principal—Erika, Executive Principal from Bridgeside Middle School—indicating they learned about tenure primarily through "word of mouth with other principals [and] with teachers."

Upon being asked for recommendations for additional sources of support to better understand the teacher tenure process, administrators made a number of suggestions, as shown in Figure 4. Several administrators identified additional trainings or information sessions as potential areas for additional support; one administrator called for more detailed information provided on the district's website while another administrator suggested that the annual recertification process for the teacher evaluation system serves as a sensible platform to incorporate additional information about the tenure process.





Notes: Frequency counts represent number of instances interviewed administrator or teacher referenced a particular response category.

Teacher Knowledge of the Teacher Tenure Process

Similar to administrators, teachers' sense-making resulted in a narrow knowledge base of tenure reform and often relied on funds of prior knowledge of tenure that they developed as students in degree programs or as teachers in other states. However, unlike administrators, teachers generally relied more on social interaction with peer teachers in their school or neighboring schools and less on directives from macro-level (i.e., district or state) administration to develop a sense of the tenure process.

Nearly all teachers had an inadequate understanding of the teacher tenure process. As shown in Figure 1, 8 out of the 30 sampled teachers reported no knowledge of the benefits

associated with tenure status at all, while several others did not fully articulate how tenure guaranteed a teacher due process or a position within their district at the following year. For example, Patty, a teacher at Wood Holly High School, states: "I don't know the benefits actually. I mean I know there are some. And I think some of them have to do with the process in terms of appealing any type of reprimands and things of that sort. But other than that, I'm not sure." In fact, some teachers stated they believed tenure did not exist at all in the state public schooling system or incorrectly explained that an increase in base salary was a main benefit to receiving tenure in their district.

Few teachers fully understood the specific changes to the tenure eligibility process.

Figure 2 shows that only one teacher correctly identified the three main changes to the tenure process, while 23 others correctly identified only some aspects of the reformed tenure process.

I was told I have to get 5's on my evaluation. That's pretty much it. (Leo, Teacher, Xavier Elementary)

The thing I know about it is you have to be here for at least five years. (Leonel, Teacher, Great Falls High School)

As with administrators, a majority of teachers were aware of the extended probation period, but relatively few teachers understood how their evaluation ratings served as the main measure determining whether they would become eligible to receive and maintain tenure moving forward.

Teachers also reported relying on different sources of information to understand the tenure process compared to administrators. As Figure 3 shows, few teachers indicated they received any form of training or support from the district or state, which is to be expected since many state- and district-led supports were organized at the time tenure reform was first implemented in 2011 well before the teachers in my sample began teaching in the state public

school system. The majority of teachers stated they relied on other teachers to understand the current tenure process.

[I learned about tenure through] word of mouth with coworkers and other teachers. Most of them have been teaching for 5 to 10 years. (Margorie, Teacher, Rockville Elementary School)

Just conversations with some of the more experienced teachers in the building. There's a couple that took me under their wing that have tenure and have talked about it. Most of them have got tenure under the old administration. As a faculty, there are still a lot of questions on what you have to do to get it. (Teddy, Teacher, Great Falls High School)

I've had to ask around actually. I have a friend who we both graduated together and teaches at a different school. So I've asked her. Now of course she got in right before they changed it from three years to five years. (April, Teacher, Lincoln Middle School)

While these teachers certainly highlight the vital role that social interaction with peer teaching staff functions throughout their sense-making process, they nevertheless indicated that most teachers with whom they spoke were veteran teachers who received tenure under the previous tenure system and, therefore, also had a limited sense of the current reformed tenure system.

Several teachers indicated they relied on their prior experiences to understand tenure, usually as students in undergraduate or graduate degree programs or as teachers in other state settings. As one teacher, Misty from Bridgeside Middle School, put it, she learned about tenure "pretty much all in college." Other teachers indicated similar sentiments:

[Tenure] isn't a conversation I've had with people here. The way I have learned about tenure is through my Master's. That's how I heard about it. Obviously, I was never near applying for tenure [...] just from colleagues that were there that were official professors, they were the people that would mention things about it. (Elva, Teacher, Great Falls High School)

Pretty much all I know about tenure comes from my Master's program. And I completed that two years ago. Since then, I've paid a little bit attention to it. [...]

But by in large, just through my education. (Frank, Teacher, Wood Holly High School)

I do not remember ever having a formal meeting either with MNPS or in [previous district] in which I was given any sort of formal discussion about what the tenure process is. But from time to time, there is a moderately similar procedure in [previous state], in which after "X" number of years [one could receive tenure]. (Marcus, Teacher, Wood Holly High School)

In addition, teachers reported having conducted personal research using online resources (e.g., news articles) to better understand the tenure process. With the exception of two teachers, most respondents claimed they never discussed the tenure process with administrators within their school.

Given that most teachers indicated they did not participate in any form of professional development or information session related to changes to the tenure process, it is unsurprising that a majority of teacher respondents requested additional trainings or workshops to better understand the current tenure system (Figure 4). In addition, some teachers requested an e-mail notification or newsletter to inform them of requirements to become eligible for tenure, preferably arranged so that a teacher received such information near the end of the probation period. A number of teachers also requested incorporation of information on the tenure process into online resources (e.g., websites such as the "Teacher Portal") or in post-observation feedback sessions with their evaluators, which are mandatory under the state's educator evaluation system.

Administrator Perceptions of Tenure Reform as a Strategic Staffing Tool

Administrators conveyed a limited sense of the details of the reformed tenure system, however the question remains: did they nevertheless perceive the tenure process served as a useful tool to achieve desirable outcomes within their school, such as promoting and facilitating

professional growth for their teachers or staffing and retaining high quality staff within their school? Administrators expressed that they generally deferred most of the details of the reformed tenure process to the state or district. For example, Shannon, Executive Principal at Booker Middle School stated plainly: "We really leave it up to the district [...] We really leave it up to HR to communicate about the tenure." However, this sentiment was not widely shared among administrators, as they sometimes viewed themselves as having a specific role within the reformed tenure process, whether confined as an "evaluator" of performance or "communicator" of policy to assist teachers sense-making.

We do play a role because we are the evaluator. (Sherley, Interim Executive Principal, Rockville Elementary School)

I would say communicated. I might have a role in how it's communicated, but the process, no. (Susan, Assistant Principal, Lincoln Middle School)

Yet some administrators acknowledged that their ability to effectively support their teachers throughout the tenure process was a function of the supports provided by the macro-level. For example:

I'm only as good as what my district gives me. If my district doesn't give me really accessible materials in one location with reminders [...] what ends up happening is we have this huge disconnect between those who forward the knowledge and those that share the knowledge. (William, Executive Principal, Pinetree Elementary School)

Notwithstanding having constructed a limited sense of the comprehensive details of the reformed tenure system, administrators nevertheless leveraged a general understanding of tenure reform (or specific components of tenure reform) to affirm their perception of the tenure process as a useful staffing tool. Some administrators indicated that linking teacher evaluation results to tenure eligibility has provided opportunities to more effectively engage with teachers on ways to pursue instructional growth. As previously mentioned, the reformed tenure process grandfathered

teachers who already received tenure under the previous system prior to the law change in 2011; this group of teachers were not required to demonstrate high performance under the evaluation system in order to maintain their tenure status. Some administrators distinguished between the grandfathered tenure system and reformed tenure system, claiming that the previous process made it challenging to remove ineffective teachers from the public schooling system.

[Tenure] is a little harder to get because we used to have cruddy teachers jumping schools. Go to School A and not do a good job. Transfer to School B and not do a good job. Transfer to School 3 and get tenure simply because they taught for 3 years. (Charles, Executive Principal, Red Tree Elementary School)

Before, I thought that once teachers achieved tenure they were able to breathe a lot easier which made them happier. But the bad thing about it is sometimes teachers kind of used that as a weapon, like "you can't get rid of me." The process for dismissing teachers was a lot more difficult than what it is now. (William, Executive Principal, Pine Tree Elementary School)

Other administrators directly contrasted the previous tenure system with the reformed process to highlight how the new system provided an incentive for teachers to improve their performance to maintain job protections associated with tenure status.

You've heard of lemon cars? Cars that are lemons? There are teachers that are lemons. Unfortunately, there are some people that have decided to become teachers because they get to be off during the summer. Now, the tenure process does help in that area because you are evaluated on an annual basis and the administrator can determine, based on evidence, that teaching is not a good fit for you. (Heidi, Assistant Principal, Xavier Elementary School)

Within any system, there are some issues. But overall, within the [teacher evaluation] process there are stronger requirements to gain tenure. [...] There seem to be some pieces put into place to make [gaining tenure] something you have to aspire to—something esteemed, but also something that you don't own forever. There is a responsibility as an educator that you have to perform in order to maintain [tenure]. (Sherley, Interim Executive Principal, Rockville Elementary School)

In fact, another administrator directly indicated that they observed superior performance among newly tenured teachers compared to teachers who received tenure under the previous system.

You know, some of my non-tenured and newly teachers are actually demonstrating stronger student achievement results or growth results than my [grandfathered] tenured people. (Kathy, Executive Principal, Wood Holly High School)

While several administrators described their preference for the reformed tenure system, they rarely indicated whether the new tenure process affected how they staffed their schools. Only one administrator described efforts to "counsel-out" grandfathered teachers from their school, as they preferred to retain untenured and newly tenured teachers since grandfathered teachers were nevertheless guaranteed a position within the district despite their evaluation ratings. The respondent, Sherley, was serving as Interim Executive Principal at Rockville Elementary at the time of her interview. She states:

It was a huge issue for me in prioritizing [which teachers to dismiss] when downsizing a school. As a leader, my stance is I am not comfortable until all of my teachers are placed, and there was not a lot of assistance placing them. I was prioritizing who I would let go early based on who I knew could get a job. If a good teacher had tenure, especially under the old system, it was guaranteed that they would be hired at [the district]. I would push them to go ahead and get their job now, and I'd release them.

Here, Sherley illustrates how she normally counseled out tenured teachers from her school, particularly if they received tenure "under the old system." I requested that she clarify her logic, by asking whether her intent was to release this category of teachers early so they could pursue a job as soon as possible. Sherley then replied:

No. It was so they could move into a job because there were schools within the district that were already hiring over the course of the year. I knew that if those teachers got to the end of the year, then there was no guarantee there would be an open position—[the teacher] would have to wait [for a position to open]. I'd rather have those teachers get another job in the district now rather have to

dismiss an untenured good teacher later who had less assurance that they would have a position at all. (Sherley, Interim Executive Principal, Rockville Elementary School)

Here, Sherley describes how the bifurcation of the tenure process influenced her decision to staff tenured teachers differently, since she perceived those grandfathered under the old system (i.e., teachers with permanent tenure status) were best positioned to receive a vacant position within the district. Sherley's response is indicative of strategic staffing behavior, however one that isn't guided by the intent of the policy—to retain high performing teachers—but one guided by a human element and, as she described earlier in her response, a discomfort with not having teachers secure alternate positions within the district. While Sherley represents but one administrator out of the 10 interviewed administrator respondents who directly indicated how they strategically staffed their school according to tenure status and timing of when teachers received tenure, it is important to emphasize that she was an Interim Executive Principal who was reassigned by the district to three separate schools that underwent closure or downsizing due to low student enrollment over the previous three school years. Out of all the interviewed administrators, Sherley reported having amassed substantial experience dismissing teaching staff across the schools she served and demonstrates but one possibility for how tenure can interplay in administrator's staffing decision-making process.

Teacher Perceptions of Tenure Reform as a Form of Accountability Within the Workforce

Considering teachers' limited sense of tenure reform, they typically expressed difficultly articulating any perception of the tenure process throughout their interview. I, therefore, became interested in how teachers would frame the purpose of tenure reform once they were provided additional background on the policy. Near the end of each teacher interview, if a teacher

respondent exhibited limited knowledge of reforms to the teacher tenure process (which was almost all cases), I clarified the main benefits associated with tenure as well as the individual changes to the tenure eligibility process as legislated by the 2011 reforms. I then devoted the remainder of the interview to discussing teachers' reactions and perceptions of the reformed tenure process after having described it to them.

One major theme that emerged across the final portion of interviews with teachers revolved around perceived accountability within the teaching workforce. Several teachers stated that they favored the reformed tenure process, claiming the overall system supports necessary accountability within the workforce. Some teachers pointed out that they perceive job security, which is reserved for teachers who meet specified performance eligibility requirements, serves as an incentive for teachers to "give it their all" and draw for teachers with "passion," "drive," and "who are performing" to enter and remain within the teaching profession.

[Tenure provides] job security. That's a huge thing to know that next year I have absolutely no worries. To me, that would be huge. So I think that people who are generally meeting expectations and just going right to that bar, well ok you are just doing what you have to. But to have job security, I want to give it to someone that is giving their all. (Donnetta, Teacher, Rockville Elementary School)

It's great to have job security. In my situation where I'm having to go to a different school...I mean I've had really good scores, and they have the option to choose other people but they do this system because they think it's fair where the last hires are the first out. I don't agree with that. That's not how I would run it. You want people who have a passion, who have a drive, who are performing [...] (Tracy, Teacher, Red Tree Elementary School)

One teacher emphasized out how they believed the non-permanent aspect of tenure serves as an impetus for increased accountability within the workforce, which might better align the perceived professionalism of teachers with other high-status professions.

I do like the fact that it's not permanent. That if you—depending on the situation—if you score a 1 or 2 for two consecutive years, I feel like that might

motivate teachers to be more consistent in their teaching. That's kind of my idea. I know that when my mom received her tenure it was pretty much like oh you've been teaching for 3 years, and now you get it. Which is nice, but there needs to be some sort of accountability, especially when teachers want to be paid more and viewed as professionals. You know lawyers and doctors and people like that with the high stakes jobs. The insurance is high on that because there are a lot of things at stake. I feel like teachers are the same too at that level of professionalism and that if we expect to be treated that way and for people to take the profession seriously then maybe we should have more work if you want to get paid more being compensated for the work I do. That's a step in that direction. I'd be all for it. (Solia, Teacher, Run Mill Middle School)

During their interview, another teacher pointed to the role that the extended pre-tenure probation period served in increasing teacher accountability.

[...] I like the fact that it takes five years now and that you have to have certain evaluation scores. It holds teachers accountable that you can't just come here for five years and then slack off. You have to work hard to get to your tenure and maintain that. So holding teachers accountable for doing well is good. (Leonel, Teacher, Great Falls High School)

Finally, several teachers pointed to the high performance threshold (i.e., an evaluation rating of Level 4 or higher) that determines tenure eligibility under the educator evaluation system as a motivation for teachers to improve their performance.

[...] I can see why they would want it to be a 4. You want it to be a 4 because you want people striving to be more or better. (Misty, Teacher, Bridgeside Middle School)

You can get a 3 if you at least come in everyday and try to teach a lesson. To be an actual benefit to the school, you can replace a 3 pretty easily. You can find someone who is going to come in, and I think of a 3 as cause no harm. You did your job. You did as much as we thought you would. You didn't hurt anybody. You kind of helped them. You made one year of growth [...] whereas a 4 and a 5 are definitely at a different level. I think that threshold makes sense. If we are expecting teachers to be 3s, that should be the average person I recruit for this job. That shouldn't be someone I am actively trying to retain. They are giving me a benefit, but not anything more than normal. They are not causing any harm. Moving where my middle teacher is. I want to keep more 4s and 5s because they

are going to move me higher. Maybe I can get my average teacher to be a 4 instead of a 3. (Lee, Teacher, Booker Middle School)

[I]t seems like it is something you should strive for to receive tenure. You should be working toward a 4 or 5. It makes common sense. (Ellen, Teacher, Red Tree Elementary School)

However, not all teachers agreed that Level 4 served as an appropriate threshold to determine tenure eligibility, especially since a Level 3 is considered "At Expectation" under the evaluation system. In fact, several teachers pointed to the inconsistent expectations established by labels used under the evaluation system and the required evaluation ratings to receive tenure and described such inconsistencies as unfair to teachers.

[I]f you are going to have someone at expectation how are you going to tell them that they cannot receive the benefits of the job or the evaluation if they have to be above the expectation. [...] You're "at expectation." You're where you are supposed to be but you have to be above. We're not always going to be above. (Margorie, Teacher, Rockville Elementary School)

[...] I've asked various administrators and they've let me know that [Level 3] is an average teacher. It's hard to reach that, and if you are at average you are doing well for a successful career. [...] That's why I think they should change it to a level 3. (Desire, Teacher, Bridgeside Middle School)

[A Level] 3 is considered "at expectation." I would say a teacher that is consistently earning all scores in all categories a 3 or better...if they are "at expectation," then I think [the tenure system] would need to have some more consideration than having [teachers] be "above expectation." I certainly believe it's better to be "above expectation," but if you're saying, "this is where you need to be" and I'm there, then what's the problem? (Frank, Teacher, Wood Hilly High School)

[W]e are calling a 3 "at expectation" and teachers are meeting that expectation. [...] If you have a teacher who is doing the job and growing kids, they should be included as well. I think [Level] 2 and 1 definitely not. But otherwise, it's kind of like we want you here to be where you should be, but we're not going to consider you an equal unless you are above average. I think that's not really fair. (Lucille, Teacher, Booker Middle School)

While teachers generally expressed a need and desire for some accountability within the teaching workforce, they found the defined tenure eligibility requirements under the reformed system as unnecessarily high and unfair to teachers who are otherwise considered "average" and meeting performance expectations.

Discussion and Conclusion

I draw on sense-making theory within the context of policy reform implementation to better understand administrator and teacher knowledge and perceptions of the reformed tenure process. Previous studies have empirically explored the sense-making of administrators and teachers with regard to other large-scale education policy reforms (Coburn, 2001, 2004, 2006; Woulfin, Donaldson, & Gonzales, 2016). This current study contributes to this extant literature by revealing the ways in which local administrators and practitioners make sense of policy reform under limited directives from the macro-level. My findings affirm vital theoretical elements of the sense-making process in which local administrators and practitioners tend to rely on other stimuli aside from largely absent high-level policy directives, such as previous experience with and knowledge of similar policies as well as social interaction with peer staff.

While administrators interviewed for this study did report that they tend to rely on macro-level directives provided by high-level administrators at the district and state, they expressed how these resources were largely made available immediately after the passage of tenure reform in 2011. The majority of interviewed teachers most affected by the reformed tenure process—who entered the profession more recently and were not teaching in the state's public schooling system when those macro-level directives were available—reported no knowledge of current trainings about the tenure process. With the exception of a four-page FAQ provided by the TDOE (Tennessee Department of Education, 2014), little other supports are currently made

available to staff to clarify the reformed tenure process. Instead, teachers reported having relied on information from other, usually more veteran, teachers.

Both local administrators and practitioners appear to have developed a limited comprehension of policy reform in the absence of macro-level policy directives, which emphasizes the challenge of sense-making without some form of explicit guidance from high-level administrators. This phenomenon suggests the possibility of a number of potentially adverse consequences. For example, lack of knowledge about policy reform on behalf of local administrators may inhibit their ability to communicate with and support their teaching staff as they engage in their own sense-making process of policy reform. Moreover, lack of knowledge on behalf of both local administrators and teachers may rouse stress, poor performance, and malcontent among staff that is associated with an ambiguous policy environment.

Despite the constrained set of macro-level directives, administrators and teachers nevertheless derived some sense of the purpose and utility of reform that is generally aligned with its original intent. While not explicitly stated in the legislation itself, the prevailing consensus among policymakers, researchers, and major news outlets reporting on the developments of tenure reform legislation across multiple state settings made clear that the underlying aim of tenure reform was to make staffing of schools more flexible for staff and reserve tenure protections to high performing teachers as a form of accountability. My analysis reveals that administrators and teachers perceived that the reformed tenure process could serve as a tool to achieve this goal. Administrators tend to distinguish between two categories of teachers: teachers that received tenure contingent on their performance under the reformed process, who they hold in favor of teachers that received permanent tenure status—regardless of their performance—under the previous system. However, out of the 10 interviewed administrators,

only one directly indicted that this distinction directly affected how they enact staffing decisions in their school, though it is possible that other respondents did not wish to directly disclose similar information during their interviews. In addition, interviews with teachers consistently illustrated, if given ample background and information, they tend to frame tenure reform as a necessary and sensible form of accountability within the profession. However, some teachers identified key areas in which the process could be improved or clarified, including provision of extra forms of support and communication to learn more about the tenure eligibility rules as well as consistent communication about satisfactory level of performance under the evaluation system.

It is important to note that this study is not without limitations. Results from this study are derived from interviews with staff within one large, urban district. My findings may not exactly translate across or outside the particular context I examined, yet they nevertheless provide a useful glimpse into how school-based educators understand, perceive, and respond to a large-scale education reform. In addition, these results are based on administrator and teacher self-reports. While respondents generally seemed comfortable and open while talking about their current understanding of the reformed tenure process, it is possible that both administrators and teachers were less forthcoming about specific forms of information, including their perceptions of particular aspects of the tenure process and how they translate to changes in staffing and instructional decisions within their school and classroom environments. This concern is a challenge relevant to all studies relying on self-reported data; however, the interview protocols were designed to mitigate this concern by reminding all participants that their identities would remain confidential.

This research has several implications for policy specific to the Tennessee context and broader policy landscape surrounding recent tenure reform. Across all interviews, it is clear there is an unfulfilled demand for macro-level policy directives from the state and district to better understand the reformed tenure process. A number of administrators and teachers directly indicated that additional trainings would be useful to better understand current tenure policy and job-related protections and benefits. Further, several respondents indicated there have been no centralized trainings provided by the state or district to acclimate staff to the tenure process, at least since it had been reformed in 2011. This is particularly problematic for newly entering teachers, who have reported that they largely rely on more veteran teachers to understand the tenure process, many of whom did not necessarily undergo the eligibility rules at the time they received tenure.

My findings also reveal that despite a limited understanding of tenure reform, teachers generally nevertheless identified one particular aspect they perceived as unclear or unfair to teachers—the inability of teachers receiving an "At Expectation" evaluation rating (i.e., Level 3) to become eligible for tenure. This perceived inconsistency has further inhibited teachers from constructing a clear sense of the purpose and function of tenure reform, particularly if it challenges directives from the evaluation process that indicate receiving "At Expectation" is satisfactory to remain within the teaching profession. At first glance, policymakers have two alternatives to remedy this inconsistency. First, they can revise the language of eligibility labels such that they do not indicate that a performance rating below the tenure eligibility threshold is the "average" or expected level of performance (e.g., changing "At Expectation" to "Developing" similar to the IMPACT evaluation system used in DC Public Schools) (District of Columbia Public Schools, n.d.). Second, policymakers can explicitly orient local administrators

and teachers, preferably through trainings or reference guides, to clarify why tenure eligibility is defined at the "Above Expectations" level and emphasize that non-tenured teachers can nevertheless remain teaching but become tenure-eligible once they demonstrate higher performance under the evaluation system.

These results also point to the broader need for policymakers to clearly communicate expectations of tenure reform to school-based staff in order to more effectively achieve desired outcomes, such as selective retention of high performing teachers or increased performance within the workforce. Teachers' lack of understanding of the performance requirements and benefits associated with tenure may inhibit innovative and transformative teaching practices and nullify the performance mechanisms embedded within the teacher tenure and evaluation systems altogether. Further, administrators' lack of understanding may likewise inhibit their efforts to staff and coach teachers in such a way that retains and motivates teachers eligible to achieve tenure-related protections. Macro-level framing of tenure reform in such a way that highlights the benefits of tenure may help achieve these intended policy goals. Such framing may assist administrators and teachers to understand that, despite the non-permanency of tenure in the post-reform era, tenure nevertheless exists as a valuable incentive for high performing teachers as a valid form of job protection within their district, a form of protection that is especially beneficial for teachers working in schools that may be downsizing or closing in the future.

Finally, this study illustrates the need for further research designed to unveil the sense-making process of education policy implementers and practitioners. If reform is coupled with ambiguous policy design and directives, the sense-making process of local administrators and practitioners may be particularly affected in such a way that prevents or mitigates the intended policy outcome. Administrators and teachers may nevertheless make an attempt to develop some

understanding of reform by over-relying on their experience with previous, yet outdated policies or seeking out non-centralized cues and interactions within their local contexts, even if those sources of information do not lead to an accurate and informed understanding of specific policy changes. Researchers should continue to consider and explore the ways in which local implementers make sense of particular policy reforms and whether and how their sense-making process facilitates or inhibits desirable policy objectives. More generally, this line of inquiry is highly contextual and should be considered regardless of the setting or policy under examination.

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Appendix A. School Administrator Interview Protocol

Intro	oduction Script
to tal of the whice period	ny name is, and I'm doctoral student at Vanderbilt University. I'd like k to you about how your school has communicated tenure policies to teachers. The purpose is study is to learn more about the challenges related to the tenure process as well as ways in h administrative staff support teachers as they near the end of the pre-tenure probationary d. Thank you for taking the time to talk to me. Your perspective as a school administrator is apportant piece of this research study.
will in thi	nt to emphasize that this is a confidential interview. Your name and the name of your school not be revealed to anyone, and I will never link your name or school to anything that is said is interview. At the end of this project, I'll give a summary report of what we heard from viewed staff without naming anyone or any school. The only exception is if I have reason to ve that a student is being harmed or will be harmed, in which case I am obligated to take in.
	ald like to record this interview to keep track of information accurately. Is that okay? Also, can ask to turn off the recorder at any time.
Do y	ou have any questions for me before we begin?
[STA	ART RECORDING NOW.]
This begin	is ID # You've indicated that it's okay for me to tape this interview. May we
Back	ground
I war	nt to begin by learning a little bit about what you do and your school.
1)	What is your current occupation title?
2)	How long have you been working for Tennessee Public Schools (TNPS)?
3)	How long have you been at [your current school]?
4)	Were you or are you currently a teacher? a) How many years of teaching experience?
5)	About how many teachers are there in your school? a) About how many of these teachers are in the probation or pre-tenure phase?

Knowledge and Communication

I'm interested in what school administrators know the about the tenure process as legislated under current law (TN Code Title 49-Chapter 5-Part 5), as well as how they are communicating the details of the law to teachers.

- Tell me about the parts of the tenure eligibility process that you are familiar with. How can new teachers become eligible for tenure?
 - **Probe knowledge on how long teacher must teach in current district**
 - **Probe knowledge on how evaluation ratings influence tenure eligibility**
 - **Probe knowledge of the role that Director of Schools and School Board have in granting tenure to eligible teachers**
- 7) Tell me about the benefits guaranteed by tenure status that you are familiar with.
 - **Probe knowledge on due process rights afforded to tenured teachers**
 - **Probe knowledge on contract renewal**
- 8) In general, how have you been learning about the tenure eligibility process and benefits associated with tenure status?
- 9) Can you think of any other forms of training or support to learn more about the tenure eligibility process or tenure benefits that would be useful?
 - **If so, probe suggested forms of training and support**
- 10) How has your school communicated the tenure eligibility process to teachers?
- Is tenure something that is highlighted as an important factor for teachers in your school?

 a) Why or why not?
- What has your school communicated to teachers would happen if they don't receive tenure?
- 13) Do you receive any notifications when teachers receive tenure?

Teacher Development and Staffing

I'm interested in learning whether probation status or tenure status influence how school administrators train and evaluate teachers or staff their schools.

- Has tenure played a factor as you recommend possible forms of professional development to teachers?
 - a) Why or why not?
- 15) Does tenure play a role in how you evaluate teachers during classroom observations?
 - a) Why or why not?

16) Have you ever had to terminate a teacher before?

General Impressions and Perceptions

I'd like to talk to you about your general impressions and perceptions related to the tenure eligibility process and general tenure policies.

- 17) What has been difficult about the current tenure eligibly process?
- 18) What do you find useful about the current tenure system?
 - a) Do you find that the system stimulates teachers to work harder?
 - b) Do you find that the system affects how your school can identify and retain good teachers and dismiss ineffective ones?
- 19) Research has suggested that administrators play a critical role in the framing and implementation of education policy reform. Would you say that this applies to recent changes in tenure policy?
 - a) Why or why not?
- 20) Do you think that Level 4 and 5 are appropriate levels to require for tenure eligibility?
- 21) What types of changes, if any, would you make to the current teacher tenure process?
 - a) If you said no changes, why would you choose to make no changes?

Closing

- 22) Do you have anything else you would like to add?
- 23) Is there anything you would like to ask me about the study?

Thank you for your comments and your time. I've gone through all of my questions.

[TURN OFF TAPE RECORDER NOW]

^{**}If so, probe the circumstance of the situation**

^{**}If so, probe whether teacher tenure status/timing of tenure eligibility (pre/post-reform) influenced decision**

Appendix B. Teacher Interview Protocol

Introduction Script	
Hi, my name is, and I'm doctoral student at Vanderbilt University. I'd like to talk to you about your experiences as a teacher nearing the end of their pre-tenure probationary period. The purpose of this study is to learn more about the challenges related to the tenure process as well as ways in which administrative staff support teachers as they near the end of their probationary period. Thank you for taking the time to talk to me. Your perspective as a teacher is an important piece of this research study.	
I want to emphasize that this is a confidential interview. Your name and the name of your school will not be revealed to anyone, and I will never link your name or school to anything that is said in this interview. At the end of this project, I'll give a summary report of what we heard from interviewed staff without naming anyone or any school. The only exception is if I have reason to believe that a student is being harmed or will be harmed, in which case I am obligated to take action.	
I would like to record this interview to keep track of information accurately. Is that okay? Also, you can ask to turn off the recorder at any time.	
Do you have any questions for me before we begin?	
[START RECORDING NOW.]	
This is ID #You've indicated that it's okay for me to tape this interview. May we begin?	
Background	
I want to begin by learning a little bit about what you do.	
24) How long have you been a teacher in Tennessee?	
25) How long have you been at [your current school]?	
What subjects do you teach?	
What grades do you teach?	
Knowledge and Communication	

I'm interested in what teachers know the about the process as legislated under current law (TN Code Title 49-Chapter 5-Part 5), as well as how they are learning about it.

28) Tell me about the parts of the tenure eligibility process that you are familiar with. How can new teachers become eligible for tenure?

- **Probe knowledge on how long teacher must teach in current district**
- **Probe knowledge on how evaluation ratings influence tenure eligibility**
- **Probe knowledge of the role that Director of Schools and School Board have in granting tenure to eligible teachers**
- 29) Tell me about the benefits guaranteed by tenure status that you are familiar with.
 - **Probe knowledge on due process rights afforded to tenured teachers**
 - **Probe knowledge on contract renewal**
- 30) In general, how have you been learning about the tenure eligibility process and benefits associated with tenure status?
- Can you think of any other forms of training or support to learn more about the tenure eligibility process or tenure benefits that would be useful?
 - **If so, probe suggested forms of training and support**
- 32) Is tenure something that administrators in your school highlight as an important factor?
 - a) Why or why not?

Teacher Development

I'm interested in learning whether probation status or tenure status influence how teachers pursue professional development and incorporate evaluation feedback.

- Has tenure played a factor as you considered possible forms of professional development in the past?
 - **If so, probe teacher to clarify how tenure played a role.
- Has your classroom evaluator mentioned tenure at any point when giving you feedback from classroom observations?
 - **If so, probe teacher to clarify what the evaluator said and whether it affected how they incorporated that specific form of feedback.

General Impressions and Perceptions

I'd like to talk to you about your general impressions and perceptions related to the tenure eligibility process and tenure policy overall.

- 35) What has been difficult about the current tenure eligibly process?
- 36) What do you like about the process?

- 37) Is tenure status an influential factor for you with regard to the effort you put into teaching?
 - a) Why or why not?
- 38) Do you know of other teachers in your school for whom tenure status influenced how much effort they put into teaching?
- 39) Is tenure status an influential factor for you with regard to whether to continue teaching long-term in your current school, district, or Tennessee Public Schools? a) Why or why not?
- 40) Do you know of other teachers in your school for whom tenure status influences whether they continued teaching in the school, district, or the Tennessee Public School system?
- 41) Are you concerned about whether you'll receive tenure?
- 42) The new law is intended to detect ineffective teachers and attract more effective teachers to the profession. Do you agree with this statement?
 - a) Why or why not?
- 43) Do you think that Level 4 and 5 are appropriate levels to require for tenure eligibility?
- What types of changes, if any, would you make to the current teacher tenure process? 44) a) If you said no changes, why would you choose to make no changes?

Closing

- 45) Do you have anything else you would like to add?
- Is there anything you would like to ask me about the study? 46)

Thank you for your comments and your time. I've gone through all of my questions.

[TURN OFF TAPE RECORDER NOW]