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ABSTRACT

In most states, K-12 teachers receive tenure after serving a probationary period of several years. Teachers with tenure, or a continuing contract, are guaranteed due process before they can be dismissed from their job. I use a restricted use version of the 2007 Schools and Staffing Survey (SASS) to estimate the effect of tenure on teacher behavior and time allocation at school and outside of school. Estimates are obtained by exploiting the cross-state variation in the probationary period length of novice teachers within a difference-in-difference framework. I find that in the year that teachers are evaluated for tenure, they spend significantly more of their own money on classroom materials. Relative to the tenure evaluation year, once teachers receive tenure, they communicate less with students and parents outside of class and participate less in school and district committees. In those districts where at least one probationary teacher is fired, I find that teachers reallocate their teaching time. Immediately after receiving tenure, they spend less time teaching math and more time teaching English.

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1 Introduction

In most public school districts, teacher tenure is a time-honored element of teacher employment contracts. However, several states have recently introduced legislation to modify or eliminate teacher tenure. In 2011, the state of Florida passed a bill that any new teacher hired would receive a year-to-year contract, effectively eliminating tenure. In 2009, Ohio extended the probationary period before a teacher is eligible for tenure from three years to seven years. Proponents of tenure argue that once teachers demonstrate competency during a probationary time period, they should be protected from arbitrary dismissal. Opponents of tenure argue that the process of firing poor performing teachers is too time-consuming and expensive. Once a teacher receives tenure, school districts must follow a detailed and costly sequence of steps to fire a poor performing tenured teacher. As a consequence, few tenured teachers are fired for poor performance in the United States. For example, from 2004 – 2008 Chicago Public Schools only formally dismissed 9 tenured teachers, or 0.01 percent of its workforce. Prior to receiving tenure, school districts can fire, or fail to renew the contract, of a probationary teacher for almost any reason – with the exception of discriminatory or other illegal reasons. Because tenure status increases a teacher's job security by reducing the likelihood of being fired, I investigate how teachers anticipate and respond to receiving tenure.

In particular, I look at how teacher work hours and specific-subject teaching hours vary once a teacher is granted tenure. I also look at the change in a teacher's spending on classroom materials and explore whether teachers change their time allocation in activities outside of the classroom (e.g. club sponsorship, coaching, serving on school committees, etc.). Finally, I consider how teachers respond in districts where at least one probationary teacher's contract was not renewed in the previous year. That is, I examine if a differential response exists in districts

where tenure evaluation standards may be more stringent or more strongly enforced. To answer these questions, I use data from the 2007-2008 restricted use version of the Schools and Staffing Survey (SASS) and exploit the cross-state variation in the probationary period length of novice teachers. The majority of states require that teachers serve for three years in a district before tenure is granted. However, several states have shorter probationary periods of two years while others have longer periods of four or even five years. I use a difference-in-difference methodology to investigate the changes in teacher behavior in the year immediately following receipt of tenure.

Teacher tenure is a specific application of employment protection legislation (EPL) which consists of the laws and regulations that govern the hiring and firing of workers. Once a teacher is granted tenure, dismissal or firing costs increase considerably. There is a sizable economics literature on the effects of EPL on various outcomes of interest. Autor et al. (2007) found that the adoption of wrongful discharge protection laws in the United States altered firms' production choices, causing employers to retain unproductive workers and subsequently reduced technical efficiency. Blanchard and Portugal (2001) found that the strict employment protection in Portugal profoundly affected the labor market relative to the United States and led to an increased duration of unemployment. Heckman and Pagés (2000) showed that job security legislation in Latin America reduced employment and increased wage inequality across workers. Several other papers also found that EPL affects worker employment (Martins, 2009; Kugler and Saint-Paul, 2004; Miles, 2000; Lazear, 1990).

There are also papers that investigate the impact of EPL on individual worker behavior. Ichino and Riphahn (2005) used data from a large Italian bank and found that employee absenteeism increased significantly once employees were no longer under a probationary period.

Scoppa (2010) used the 1990 EPL reform act in Italy to investigate the effect on worker absenteeism in that country. Using a difference-in-difference approach, the author exploited the fact that the law drastically increased the firing costs for small firms, and found that shirking increased once employees were granted firing protection. Despite this extensive literature, there is little research that looks at EPL in the context of K-12 education. Jacob (2011) used the 2004 new collective bargaining agreement in Chicago Public Schools (CPS) that gave principals the flexibility to dismiss probationary teachers for any reason, and found that annual teacher absences were reduced by roughly 10 percent. Goldhaber and Hansen (2010) examine the implications of using value-added models as a criterion for granting tenure to teachers. The Widget Effect, published by The New Teacher Project, documents the relationship between tenure and the number of teachers who are fired. While not specifically addressing teacher tenure, Hansen (2009) used North Carolina administrative data and found that teacher absences increased dramatically in the year prior to teacher retirement or departure.

I find that in the year that teachers are evaluated for tenure, they spend significantly more of their own money on classroom materials. Relative to the tenure evaluation year, once teachers receive tenure, they communicate less with students and parents outside of class and participate less in school and district committees. In those districts where at least one probationary teacher is fired, I find that teachers reallocate their teaching time. Immediately after receiving tenure, they spend less time teaching math and more time teaching English.

2 State Variation in Teacher Tenure

The history of teacher tenure in the United States began in 1909 when New Jersey was the first state to pass comprehensive tenure legislation for K-12 teachers. By the 1940s, seventy

percent of teachers were covered by tenure protection; and today, nearly every state has passed legislation granting some form of tenure. In order to receive tenure, new teachers in a school district must serve for a probationary period – typically for three years. In some states, tenure status is also called a continuing contract or permanent employment status. Regardless of its name, tenure is a series of steps or due process that must be followed in order to dismiss a tenured teacher. Under certain circumstances, it can take several years and hundreds of thousands of dollars before a teacher can be fired. A spokeswoman for the New York City Department of Education claimed that the cost to fire one incompetent teacher in its jurisdiction is $250,000.

Proponents of tenure claim that it is necessary to protect teachers from unfair and/or discriminatory firing. Opponents argue that tenure protects ineffective or even incompetent teachers. According to data from the 2007-2008 SASS, only two percent of teachers in the United States were dismissed or failed to have their contract renewed. Table 1 shows the wide variation in dismissal rates across states. South Dakota removed almost 12 percent of its teachers for poor performance while Arkansas removed only 0.2 percent.[1] In some school districts, that number is even lower. In The Widget Effect, the researchers found that from 2005 – 2008, Denver Public Schools did not fire any school teachers for poor performance.

[1] I tested whether the variation in firing percentages across states generated heterogeneity in teacher response. However, I could find no significant difference between states which fire a relatively higher percentage of teachers relative to those which fire a relatively lower percentage of teachers. This lack of heterogeneity could be due to the fact that outside of South Dakota and Alaska, every state fired less than four percent of teachers for poor performance. The sample size in these two states is not large enough to make any definitive conclusions.

Table 2 shows the probationary period that each teacher was required to serve before receiving tenure in 2008. While the state passes legislation to provide the scope or limitations of the tenure application process, the details are often left to individual school districts. For example, with over one million students, New York City is the largest, and arguably, the highest-profile school system in the United States. Over the last several years, considerable attention has been devoted to the consequences of the tenure system in New York, and so I will provide a brief overview of tenure in New York.

New York state law requires that teachers be granted tenure after a majority vote of the board of cooperative educational services upon the recommendation of the district superintendent. The district superintendent must write a report to the board of cooperative educational services indicating that the teacher is "competent, efficient and satisfactory." The law further states that teachers shall not be removed except for any of the following causes, after a hearing: "(a) Insubordination, immoral character or conduct unbecoming a teacher; (b) Inefficiency, incompetency, physical or mental disability or neglect of duty; or (c) Failure to maintain certification as required by this chapter and by the regulations of the commissioner."

The state of New York requires that the district superintendent write a recommendation in order for a teacher to receive tenure. There is no rubric or requirement that teachers meet student achievement benchmarks or undergo a certain number of observations from a principal or third-party observer. In the 2010-2011 school year however, New York City introduced more stringent requirements in order for teachers to achieve tenure. Teachers are now rated under a four-point scale that must incorporate student test scores, classroom observations, and parental feedback (the previous rating system only measured two levels – unsatisfactory and satisfactory).

The number of teachers who were denied tenure outright increased from 1 percent in 2006 to 3 percent in 2011.

Incorporating student performance in the tenure decision is rare at the state level. During the 2007-2008 school year, only two states, Iowa and New Mexico, required that student academic performance be considered in awarding teacher tenure. Even in those states, student performance is not the predominant criterion for awarding tenure. Because states leave tenure decisions to the discretion of the local school district, I also investigate to what extent student performance, specifically student growth, is discussed in school district contracts as a requirement for teacher tenure. Out of the 50 largest school districts in the United States, only three districts specifically require teachers to demonstrate student growth prior to being awarded tenure.

From this evidence, it appears that few teachers on probation are denied tenure. In The Widget Effect, the researchers find that in five of the six school districts they studied, less than one percent of probationary teachers were denied tenure. Included among these five districts was Chicago Public Schools which refused tenure to only 0.1 percent of probationary teachers. While this dismissal rate is a ten-fold increase from the 0.01 percent dismissal rate of tenured teachers, it is still a low number.

3 Data

Details on state tenure laws come from the 2007 National Council on Teacher Quality (NCTQ) State Teacher Policy Yearbook. In the yearbook, NCTQ publishes each state's probationary period before a teacher may be granted tenure, as well as a citation for the relevant state law. In addition, prior to publication of the yearbook, the organization provides state

officials with a draft copy of its findings in order to check the accuracy of its claims. Because some laws were written to permit school district administrators to have authority over teacher tenure under special circumstances, at times, discretion must be used to code a state's probationary period into a numerical value. For example, the state of Maryland has a probationary period of two years, but it may be extended to three years on an individual basis. NCTQ decided to code Maryland as having a two-year probationary period. In the four states where NCTQ notes that there are potentially different interpretations, I follow NCTQ's coding scheme.

I match the 2007 NCTQ data to teacher response data from the restricted-use version of the 2007-2008 Schools and Staffing Survey (SASS), conducted by the National Center for Education Statistics. Begun in 1987, the SASS is fielded every three to four years and surveys a stratified random sample of public schools, private schools, and schools funded by the Bureau of Indian Education (BIE). The SASS collects data on teacher, administrator, and school characteristics, as well as school programs and general conditions in schools. In addition to restricting the sample to public school teachers only, teachers who indicated that they received no salary or did not work full time were dropped from the analysis. Teachers from career or vocational schools, alternative schools, and special education schools were also removed from the sample. Because I am only interested in looking at teacher behavior around tenure, I remove teachers who have been teaching for 8 or more years. Table 3 provides summary statistics for the 2007 SASS.

Because the empirical results rely on a difference-in-difference methodology, I divide the dataset into states with two, three, and four year probationary periods. The combined sample contains 27,260 observations. There are slight differences in teacher characteristics across the

different probationary period states. The states with a two year probationary period have teachers that are slightly older and less likely to be white. These same states have higher student-teacher ratios and a higher percentage of teachers covered under a collective bargaining agreement. Teachers in these states also spend larger amounts of their own money on classroom materials. These differences are likely driven by the geographic nature of the two year probationary period states. These states include: California, Maine, Maryland, Nevada, South Carolina, Vermont, and Washington. Most of these states are located on the coast and have higher costs of living. Because of these differences across states, I run a robustness check which restricts the data to particular probationary period states.

The last column in Table 3 describes overall characteristics of the teaching labor force in the 2007 SASS. Teaching is a female-dominated profession with more than three-quarters of all teachers being female. Approximately three-fifths of teachers work in a district with a collective-bargaining agreement. Teachers are asked to provide the total amount of hours spent on all teaching and school-related activities during a typical full week and the average for this variable is 53 hours per week. This self-reported number of work hours is higher than what is found in other well-known datasets like the CPS; however, the SASS prompts the teacher to include hours spent during the school day, before and after school, and on the weekends. The SASS also asks elementary teachers how many hours a week they spend teaching the following four subjects: English, math, social science, and science. Elementary teachers only spend about 21 hours on average, or 40% of their work week actually teaching the material for these subjects.

Teachers indicate that they spend about $425 of their own money on average on classroom supplies. The fact that teachers spend their own money in the classroom is so common that the IRS allows a tax deduction for these purchases called the Educator Expense

Deduction. Teachers can deduct up to $250 of any unreimbursed expenses incurred for books, supplies, computer equipment, and other supplementary materials. In addition, I look at teacher participation in school extra-curricular activities as a measure of teacher devotion. Approximately fifteen percent of teachers coach a sport at the school they teach; and one-third of teachers sponsor a school club. Over one-half of teachers indicate that they serve on a school or district wide committee, while only ten percent serve as a curriculum specialist.

In order for tenure to alter behavior, teachers must have flexibility to make changes around school and extracurricular activities. In the SASS teachers are asked, "How many hours are you required to work to receive base pay during a typical full week at this school?" On average, school districts require teachers to work 38 hours a week. Since teachers indicate that they spend 53 hours on all teaching-related activities, there is still considerable flexibility for teachers to reduce participation rates in extracurricular activities. Likewise, if teachers are required to participate in professional development activities, teacher tenure could not affect any changes in professional development participation rates. While states do require teachers to participate in some form of professional development to maintain their certification, there is often a time window in which to complete these activities. For example, the state of Ohio requires a teacher to complete 18 continuing education units over a 5 year time period in order to maintain certification. Because a teacher has flexibility around scheduling these units, the possibility of strategic behavior in response to teacher tenure exists.

4 Empirical Methodology

To estimate the effects of teacher tenure on effort, I use a difference-in-difference model to exploit the cross-state variation in the time required for a teacher to earn tenure. I exclude

Washington DC from the data since there is no required probationary period specified in the employment contract. I also exclude Hawaii, Mississippi, and North Dakota, three states that have a one year probationary period, because I cannot disentangle whether the changes in teacher outcomes are from tenure or from the unique challenges of first year teaching. Within the remaining forty-seven states, I use the observations in the first year after a teacher receives tenure as the treatment group in the model. The control group consists of teachers who are in the same year of teaching as the treatment group but have not yet received tenure because of the state's longer probationary period. I use this estimation method because simply comparing the differences in outcomes before and after tenure may be confounded by other factors that drive these differences. For example, teachers with one more year of experience may not need as much time to teach the material effectively. There could also be changes in expectations around school service activities for more experienced teachers. For these and other reasons, using states with a longer probationary period controls for the differences in teacher behavior that are not related to teacher tenure.

Table 4 illustrates the identification strategy by looking at the change in classroom expenditures across different years of teaching and different probationary period states. The first and second columns of Table 4 report expenditures in the third and fourth year of teaching, respectively. The first row of Table 4 reports classroom expenditures for states with a 3 year probationary period. The second row of Table 4 reports classroom expenditures for states with either a 4 or 5 year probationary period. In longer probationary period states, a teacher's personal spending on classroom materials does not noticeably change between the third and fourth year of teaching. However, in the states with a 3 year probationary period, there is a decline of over $80 in the fourth year of teaching (i.e. the first year that a teacher receives

tenure). The basic difference-in-difference estimate shows a statistically significant decline of $110 in classroom expenditures.

Figure 1 provides a visual description of the identification strategy by plotting the amount of unreimbursed money that teachers spend on classroom materials by the length of a state's probationary period. For the states with either a two or three year probationary period, Figure 1 clearly shows a "spike" in classroom expenditures in the year that a teacher is being evaluated for tenure. Teachers in two year probationary period states spend more than $100 of their own money in that year relative to the previous year or following year. This sharp increase in expenditures in the year of tenure evaluation motivates the following empirical specification.

For the empirical analysis, I estimate the following equation –

$$Y_{idst} = \beta_0 + BeforeTenureEval_{idst}\beta_1 + 1YrTenure_{idst}\beta_2 + 2PlusYrTenure_{idst}\beta_3 + X_{idst}\beta_4 + \mu_s + \upsilon_t + \varepsilon_{idst} \qquad (1)$$

where Y_{idst} is the outcome of interest for teacher *i*, in school district *d*, in state *s,* in teaching year, *t*. *BeforeTenureEval* is a dummy variable indicating if the teacher is in a year prior to the tenure evaluation year. *1YrTenure* is a dummy variable indicating if a teacher is in the first year of teaching with tenure, *2PlusYrsTenure* is a dummy variable indicating if a teacher has two or more years of teaching with tenure, X_{idst} is a vector of individual and district characteristics, μ_s are state effects, υ_t are teaching year effects, and ε_{ids} is an idiosyncratic error term.[2] Coefficients on the three tenure dummy variables are interpreted relative to the tenure evaluation year.

[2] Individual and school district controls include: teacher age, teacher race, teacher sex, the student-teacher ratio, district expenditures per student, and whether or not the district has a collective bargaining agreement.

Section 2 described how the details of teacher tenure can vary widely by state. Teachers may respond differently during the tenure evaluation year in a state where the process of firing a teacher is more time consuming and costly in one state relative to another state. For this empirical specification however, I do not distinguish between different aspects of tenure. Future research could look at how differences in due process affect teacher behavior. The requirements of achieving tenure are relatively similar across the states. During the 2007-2008 school year, only two states, Iowa and New Mexico, officially incorporated student test scores into the tenure decision. As a robustness check, I calculate the estimates after these two states are dropped from the data.

Another potential concern is how to address the tenure status of veteran teachers who transfer school districts. There are a few examples where states have made it easier for veteran teachers to acquire tenure after transferring school districts. For example, in 2011 Illinois passed SB7 which allows previously tenured teachers who earned either a "Proficient" or "Excellent" rating to be eligible for tenure in 2 years if they earned an "Excellent" rating in each of the first two years in the new district. A new teacher in Illinois would be on probation for four years, rather than two. With the limitations of the data, I cannot calculate whether or not this type of condition would be applicable for a teacher in the dataset. Therefore, I treat all teachers as under the same tenure laws as specified in the NCTQ dataset. Including potentially tenured teachers in my estimation strategy would bias my results towards zero.

5 Results

5.1 Key Findings

The difference-in-difference estimate of the effect of teacher tenure on classroom expenditures is reported in column 1 of Table 5. Relative to the tenure evaluation year, teachers spend approximately $70 less on classroom materials in the years leading up to the evaluation. Likewise, they also spend approximately $70 less in the first year of receiving tenure. This amount reflects a 17 percent decline from the average of $425 spent on classroom materials. The coefficient of $71 on the Tenure Evaluation Year dummy in Column 2 of Table 5 clearly shows the spike in expenditures in the tenure evaluation year. Column 3 of Table 5 shows the results using a simplified difference-in-difference specification with only using dummy variables for the first year of tenure as well as for two or more years with tenure. Relative to teachers without tenure, teachers in the first year of tenure spend $72 less on classroom expenditures. However, even though the coefficient on the "Two or More Years with Tenure" dummy is negative, it is statistically insignificant, suggesting that the immediate drop in classroom expenditures may be temporary. Teachers may feel that they need to "take a break" after the tenure evaluation year, but behavior reverts back to trend after a one year pause. Column 4 of Table 5, which presents the baseline specification without any teacher or district controls, shows that the decline in classroom expenditures is not driven by changes in teacher or district characteristics. Regardless of whether teachers spend their own money as an investment in their students' academic performance or as a signal of commitment, teachers appear to perceive the return on their money to decline immediately after tenure.

Table 6 shows the effect of teacher tenure on other measures of teacher effort. While there is no decline in overall work hours, I find that immediately after receiving tenure, teachers

are 1 percentage point less likely to pursue any form of professional development. Since 99 percent of teachers are already participating in some form of professional development, the magnitude on this estimate is not particularly large. Teachers are also asked if they communicate with students or parents outside of the classroom using any of the following: email, online bulletin board, course or teacher web page, blog, or instant messaging. In column 3 of Table 6, I find that teachers are significantly less likely to communicate outside of the classroom in the first year of receiving tenure compared to the tenure evaluation year. In column 4 of Table 6, I find that tenured teachers feel they have more job security relative to the tenure evaluation year. Immediately after receiving tenure, teachers are ten percent less likely to agree or strongly agree with the statement "I worry about the security of my job because of the performance of my students on state and/or local tests." With two or more years of tenure, teachers are fifteen percent less likely to agree with this statement relative to teachers in their tenure evaluation year.

Table 7 shows the effect of tenure on extra-curricular activities outside of the classroom. Column 1 shows that teachers are seven percentage points less likely to serve on a school or district-wide committee immediately after receiving tenure. Columns 2 and 3 of Table 7 show a participation rate spike in coaching a sport and serving as a curriculum specialist. Teachers who temporarily coach a sport (or serve as an assistant coach) for one year may not be ideal for student development. In contrast to these declines, once teachers receive tenure, they are six percentage points more likely to sponsor a student organization, group, or club in the year following tenure. Teachers who would like to sponsor a club may feel that their time is better spent on more visible and/or more rewarded activities during the tenure evaluation year. Tenure may allow these teachers to pursue other student development activities. This reallocation of

time between different extra-curricular activities may explain why tenure does not change the overall level of teacher work hours.

In Table 8, I restrict the dataset to only include districts where no tenured teacher was fired in the previous year, but at least one teacher on probation failed to have their contract renewed. This information comes from the SASS survey completed by district officials. District officials reported the number of probationary and tenured teachers that were fired in the previous academic year. For those districts where at least one probationary teacher was fired, one might expect that teacher behavior around tenure would change the most (i.e. in these districts, the tenure process appears to be more stringent). In these districts, I find a spike of $100 in personal money spent on the classroom during the tenure evaluation year – an even higher amount relative to the baseline estimate. I also find that there is a reallocation of how elementary teachers spend their time teaching core subjects. Because middle and high school teachers are usually restricted to teaching only certain subjects in which they are certificated, columns 2 – 4 in Table 8 is restricted to elementary teachers. I find that immediately after receiving tenure, teachers spend one hour less per week teaching math, but an additional two and a half hours per week teaching English. This reallocation of time may reflect a district superintendent's consideration of student math scores in granting tenure. Finally, I find that the stricter tenure process in these districts is reflected in teacher perceptions. Teachers are ten percentage points less likely to agree or strongly agree with the following statement "If I could get a higher paying job I'd leave teaching as soon as possible."

Thirty-three states use a probationary period of three years before granting tenure, but seven states use a two year period and another seven states use four or five year probationary periods. In Table 9, I restrict the dataset to look at each of these period lengths separately.

For example, in column 2 of Table 9, where I restrict to the data to just states with two or three year probationary periods, I consider the two year probationary period states as the treatment group and three year probationary period states as the control group. I perform this same check with three and four year probationary period states. With this data restriction, I am checking to see if the results are robust across different probationary period lengths.

For brevity, I provide results for work hours, classroom expenditures, committee participation, and coaching participation. In two year probationary period states, there is an even higher decline in the amount of money spent on classroom materials once tenure is received. The magnitude of the result is similar to the baseline estimate when the analysis is restricted to the treatment group of three year probationary period states. However, states with a four year probationary period length do not show a decline in personal money spent on classroom materials. Results for the other outcomes of interest are similar to the baseline estimates.

5.2 Threats to Identification

The validity of the difference-in-difference estimation strategy relies on the assumption that trends in the treatment group would have been identical to trends in the control group in the absence of tenure. There should not be changes in the schooling environment unrelated to tenure that modify teacher behavior in this transition time period. That is, a trend in teacher behavior (measured by work hours, participation in extracurricular activities, communication levels, etc.) does not change trajectory as a teacher advances from the tenure evaluation year to receiving tenure next year. I will present three tests to provide evidence that the trends in the treatment and control groups would not have changed in an environment without tenure.

The previous finding in column 4 of Table 3, which presents the baseline specification without any teacher or district controls, showed that the decline in classroom expenditures is not driven by changes in teacher or district characteristics. This finding suggests that trends in teacher and district characteristics at the time of tenure evaluation are not experiencing a break. Including these characteristics in the estimating equation is done to improve efficiency, and not to control for confounding factors. If the key findings only exist once these covariates are included, one might speculate that there are additional factors, outside of tenure, driving the results.

Next, if the difference-in-difference identification strategy for teacher tenure is working properly, I would not expect to see any changes in teacher behavior after the transition period from probation to tenure. Columns 1 - 3 in Table 10 show that there is no statistically significant difference in work hours, classroom expenditures, and committee participation (the same variables as in table 9) between the second and three years after receiving tenure. This again suggests that the trends between the treatment and control groups would not have otherwise changed. Note that the difference-in-difference strategy may still causally identify the effect of teacher tenure even if there is a change in behavior moving from year 2 to year 3. For example, particularly forward-looking teachers may start to increase their teaching hours in advance of the tenure application process.

In the third test for the validity of the difference-in-difference methodology, I carry out a placebo test where I investigate if outcomes, which should be unaffected by tenure, change as a result of the identification strategy. Teachers are asked if any of the following are serious or moderate problems: poverty, students being unprepared, or students dropping out. We would not expect the coefficients of these variables in the estimating equation to be statistically different

from zero as a result of tenure evaluation. Table 11 provides confirmation of this intuition. The coefficients on the dummies for Period Before Tenure Evaluation, First Year with Tenure, and Two or More Years with Tenure, are all statistically insignificant.

6 Conclusion

In the year that teachers are evaluated for tenure, they spend significantly more of their own money on classroom materials. Relative to the tenure evaluation year, once teachers receive tenure, they communicate less with students and parents outside of class and participate less in school and district committees. In those districts where at least one probationary teacher is fired, I find that teachers reallocate their teaching time. Immediately after receiving tenure, they spend less time teaching math and more time teaching English.

This paper describes the lumpy investment behavior of teachers around the tenure evaluation year. It does not make the larger and more ambitious claims about the welfare implications of this behavior. While certain activities are unlikely to benefit from a spike in activity around the tenure evaluation year (e.g. coaching a sport likely requires several years to master); tenure may also grant teachers the freedom to pursue club sponsorship and other activities that may not have been pursued under an annual evaluation. I also find evidence that the immediate drop in classroom expenditures in the first year of tenure is temporary. Teachers may feel that they need to "take a break" after the tenure evaluation year, but then behavior reverts back to trend after a one year pause. Those states which have eliminated tenure should not see swings in teacher behavior around tenure evaluation. This consequence may make planning and staffing decisions easier for school district officials in these states.

The findings in this paper lead to interesting avenues of future research. If teachers behave strategically, the next step should be to investigate the impact of tenure on student achievement. If teachers spend fewer hours teaching math and invest less money in the classroom, does student achievement noticeably decline in a teacher's classroom in the year following the receipt of tenure? Since total works hours remain unchanged after tenure, a teacher's reallocation of time towards certain extracurricular activities may also provide insight into the link between teacher activities and student achievement.

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Figure 1: Personal Money Spent on Classroom Materials, SASS Data

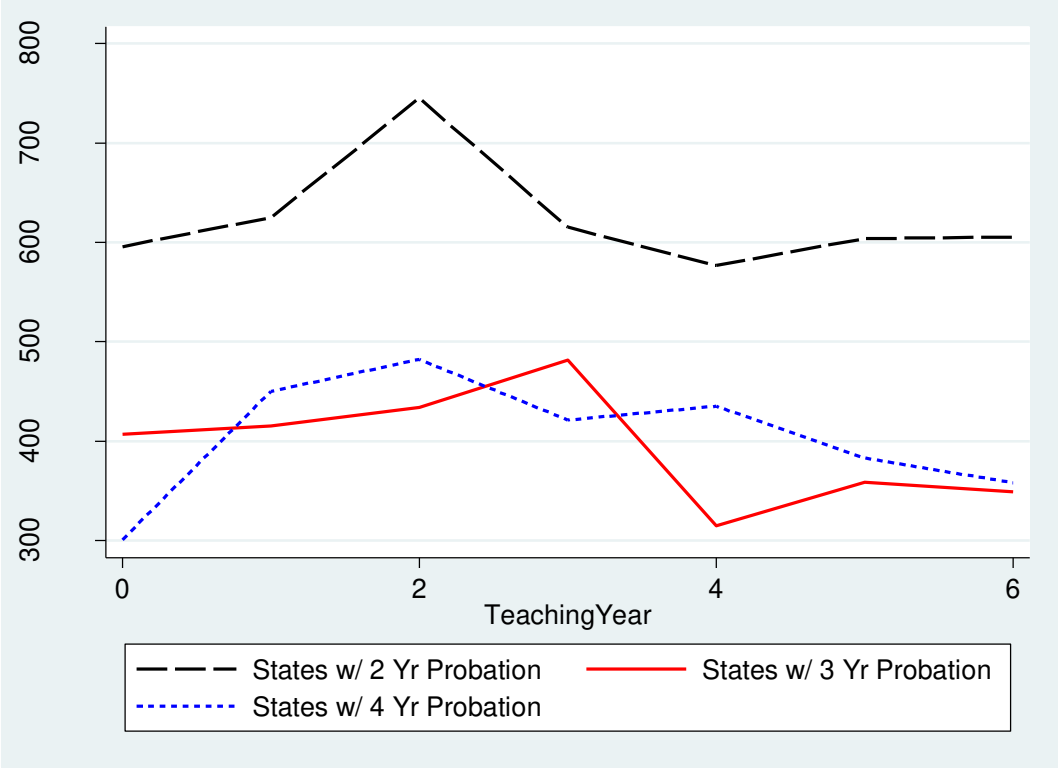

Table 1: Teacher Dismissal Rates in the 2006-2007 Year, 2007-2008 SASS Data

	Average number of teachers per district	Number of teachers who were dismissed or did not have their contracts renewed	Percentage of teachers who were dismissed or did not have their contracts renewed
United States	211.4	4.4	2.1%
Highest 5 States			
South Dakota	59.8	7.1	11.9%
Alaska	166.1	9.6	5.8%
Minnesota	128.8	4.8	3.7%
Alabama	384.7	14.1	3.7%
Oklahoma	75.7	2.7	3.6%
Lowest 5 States			
Nevada	1,527.4	8.6	0.6%
Delaware	227.5	1.2	0.5%
Pennsylvania	180.9	0.9	0.5%
North Dakota	46.2	0.2	0.4%
Arkansas	123.0	0.3	0.2%

Note: Of the ~3,780 districts, 38% did not renew the contract of a teacher on probation. Only 18% of districts fired a tenured teacher for poor performance.

Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS), "Public School District Data File," 2007–08.

Table 2: Number of Years Before a Teacher Earns Tenure, By State, 2008

No Policy (1)	1 Year (3)	2 Years (7)	3 Years (33)		4 Years (5)	5 Years (2)
DC	Hawaii	California	Alabama	New Jersey	Connecticut	Indiana
	Mississippi	Maine	Alaska	New Mexico	Illinois	Missouri
	N. Dakota	Maryland	Arizona	New York	Kentucky	
		Nevada	Arkansas	Ohio	Michigan	
		S. Carolina	Colorado	Oklahoma	N. Carolina	
		Vermont	Delaware	Oregon		
		Washington	Florida	Pennsylvania		
			Georgia	Rhode Island		
			Idaho	S. Dakota		
			Iowa	Tennessee		
			Kansas	Texas		
			Louisiana	Utah		
			Massachusetts	Virginia		
			Minnesota	West Virginia		
			Montana	Wisconsin		
			Nebraska	Wyoming		
			N. Hampshire			

Source: NCTQ State Teacher Policy Yearbook 2008

Table 3: Summary Statistics, Data from 2007 SASS

	2 Year Probationary Period States	3 Year Probationary Period States	4 Year Probationary Period States	2,3, 4 Year Probationary Period States
Teacher Demographics				
Age*	42.90	42.13	41.05	42.12
White*	0.88	0.91	0.92	0.91
Male	0.25	0.24	0.23	0.24
Teaching Year	8.27	8.46	8.75	8.47
School / District Characteristics				
Student-Teacher Ratio*	18.00	13.76	14.70	14.56
Expenditures per Student*	$11,666	$12,327	$11,075	$12,055
Collective Bargaining Agreement*	0.77	0.52	0.57	0.57
Outcomes of Interest				
Work Hours	52.79	52.98	53.08	52.96
Own Money Spent*	$569.85	$391.43	$429.40	$424.85
Professional Development	0.98	0.99	0.99	0.99
Communication*[1]	0.80	0.83	0.85	0.83
Would Leave for High Paying Job[2]	0.26	0.26	0.24	0.26
Job Security[3]	0.31	0.30	0.32	0.29
Teaching Hours	20.99	20.94	21.46	21.02
Math Hours	5.50	5.34	5.35	5.36
English Hours	11.64	11.14	11.44	11.27
Coach a School Sport	0.14	0.16	0.17	0.16
Serve as a Curriculum Specialist*	0.13	0.10	0.10	0.10
Serve on a School or District Committee*	0.57	0.51	0.59	0.53
Sponsor a School Club	0.36	0.37	0.36	0.36
Total Observations	3870	20600	2790	27260

Note: Sample sizes rounded to nearest 10 for NCES confidentiality purposes.

-Variables with an '*' are significantly different across states with different probationary periods.

1) Dummy variable is defined as 1 if a teacher uses any of the following to communicate with parents or students outside of the regular school day: e-mail to send out group updates, e-mail to address individual questions or concerns, online bulletin board, course or teacher web page, course or teacher blog, instant messaging (IM)

2) Teachers are asked if they agree or strongly agree with the following statement "If I could get a higher paying job I'd leave teaching as soon as possible."

3) Teachers are asked if they agree or strongly agree with the following statement "I worry about the security of my job because of the performance of my students on state and/or local tests.

Table 4: Personal Money Spent on Classroom Materials, SASS Data

	Third Year of Teaching	Fourth Year of Teaching	Teaching Year Difference
States with 3 Year Probation	427.32	346.65	-80.67**
	(25.30)	(21.35)	(34.15)
States with 4 or 5 Year Probation	372.91	402.86	29.95
	(30.88)	(36.88)	(46.66)
Probationary Period Difference	-54.41	56.21	-110.62**
	(39.85)	(37.94)	(54.93)

Table 5: Effect of Teaching Tenure on Own Money Spent, SASS Data

Sample Restrictions	(1) Baseline	(2) Tenure Evaluation Year Dummy	(3) Exclude "Before Tenure Evaluation" Dummy	(4) No Individual Teacher or District Controls
Before Tenure Evaluation	-71.259**			-70.514**
	(32.295)			(31.892)
Tenure Evaluation Year		71.259**		
		(32.295)		
First Year With Tenure	-74.078**	-2.818	-72.862*	-61.361**
	(36.687)	(49.538)	(38.765)	(29.800)
Two Or More Years With Tenure	-35.053	36.207	-48.146	-29.647
	(47.706)	(68.561)	(47.756)	(44.707)
Black	-65.126***	-65.126***	-66.243***	
	(21.235)	(21.235)	(21.336)	
Hispanic	49.703*	49.703*	50.040*	
	(26.938)	(26.938)	(26.400)	
Other Race	-71.556**	-71.556**	-71.282**	
	(34.419)	(34.419)	(34.413)	
Male	-99.378***	-99.378***	-99.076***	
	(14.678)	(14.678)	(14.628)	
Age	3.785***	3.785***	3.784***	
	(1.016)	(1.016)	(1.016)	
Student-Teacher Ratio	-3.560**	-3.560**	-3.550**	
	(1.595)	(1.595)	(1.585)	
Expenditures Per Student	-1.604	-1.604	-1.715	
	(1.493)	(1.493)	(1.487)	
Collective Bargaining	20.447	20.447	19.575	
	(20.512)	(20.512)	(20.671)	
R-squared	0.049	0.049	0.049	0.035
Observations	14280	14280	14280	14770

Standard errors in parentheses, clustered by state

State effects and teaching year effects are included in the above regressions

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note 1: Sample sizes rounded to nearest 10 for NCES confidentiality purposes

Note 2: An additional robustness check was performed by dropping IA and NM from the regression. The results are nearly identical in magnitude and significance.

Note 3: I cannot reject the hypothesis that "First Year With Tenure" is equal to "Two Or More Years With Tenure" for any of the outcomes

Table 6: Estimates of Teacher Tenure on Effort Outcomes, SASS Data

Dependent Variable	(1) Work Hours	(2) Professional Development	(3) Communication	(4) Job Security
Before Tenure Evaluation	0.369	-0.006	-0.029	0.021
	(0.593)	(0.005)	(0.024)	(0.031)
First Year With Tenure	0.590	-0.010*	-0.040**	-0.032*
	(0.455)	(0.006)	(0.018)	(0.019)
Two Or More Years With Tenure	0.153	-0.005	-0.042	-0.047**
	(0.981)	(0.006)	(0.033)	(0.022)
Black	-0.660	-0.001	-0.124***	0.031
	(0.558)	(0.004)	(0.032)	(0.041)
Hispanic	-0.100	0.004	-0.100***	0.113***
	(0.259)	(0.006)	(0.027)	(0.012)
Other Race	-0.854	0.000	-0.088***	0.022
	(0.518)	(0.005)	(0.027)	(0.041)
Male	0.841*	-0.017***	0.030***	-0.020
	(0.436)	(0.003)	(0.009)	(0.014)
Age	-0.004	0.000**	-0.002***	0.003***
	(0.022)	(0.000)	(0.000)	(0.001)
Student-Teacher Ratio	0.048	-0.001*	0.009***	-0.002
	(0.036)	(0.000)	(0.003)	(0.001)
Expenditures Per Student	0.036	0.000	-0.005	0.001
	(0.032)	(0.000)	(0.003)	(0.002)
Collective Bargaining	-0.091	-0.000	-0.027	-0.002
	(0.354)	(0.003)	(0.027)	(0.019)
R-squared	0.027	0.016	0.069	0.024
Observations	14280	14280	14280	14280

Standard errors in parentheses, clustered by state

State effects and teaching year effects are included in the above regressions

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note 1: Sample sizes rounded to nearest 10 for NCES confidentiality purposes

Note 2: I cannot reject the hypothesis that "First Year With Tenure" is equal to "Two Or More Years With Tenure" for any of the outcomes

Table 7: Estimates of Teacher Tenure on Extracurricular Activities, SASS Data

Dependent Variable	(1) Committee	(2) Curriculum	(3) Coach	(4) Sponsor
Before Tenure Evaluation	-0.004	-0.039***	-0.039***	-0.030
	(0.025)	(0.011)	(0.012)	(0.023)
First Year With Tenure	-0.066**	-0.029*	-0.029*	0.059**
	(0.033)	(0.015)	(0.016)	(0.028)
Two Or More Years With Tenure	-0.080*	-0.013	-0.004	0.049
	(0.046)	(0.017)	(0.024)	(0.031)
Black	-0.050	-0.015	0.016	0.073***
	(0.030)	(0.015)	(0.019)	(0.027)
Hispanic	-0.154***	-0.011	-0.019	-0.087***
	(0.046)	(0.008)	(0.013)	(0.019)
Other Race	-0.145***	0.053**	-0.044*	-0.000
	(0.046)	(0.021)	(0.025)	(0.032)
Male	-0.088***	0.001	0.343***	0.128***
	(0.013)	(0.007)	(0.016)	(0.015)
Age	-0.000	0.002***	-0.006***	-0.003***
	(0.001)	(0.000)	(0.000)	(0.001)
Student-Teacher Ratio	-0.009***	-0.001	0.003**	0.007***
	(0.002)	(0.001)	(0.001)	(0.002)
Expenditures Per Student	-0.003*	0.004***	-0.000	0.000
	(0.001)	(0.001)	(0.002)	(0.001)
Collective Bargaining	-0.001	0.006	-0.030**	-0.022
	(0.021)	(0.012)	(0.014)	(0.016)
R-squared	0.054	0.031	0.182	0.039
Observations	14280	14280	14280	14280

Standard errors in parentheses, clustered by state

State effects and teaching year effects are included in the above regressions

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note 1: Sample sizes rounded to nearest 10 for NCES confidentiality purposes

Note 2: I cannot reject the hypothesis that "First Year With Tenure" is equal to "Two Or More Years With Tenure" for any of the outcomes

Table 8: Estimates of Teacher Tenure in Districts which Fire Probationary Teachers, SASS Data

Dependent Variable	(1) Own Money Spent	(2) Math Hours	(3) English Hours	(4) Leave for High Paying Job
Before Tenure Evaluation	-99.258*	-0.042	-0.244	0.005
	(52.860)	(0.291)	(0.912)	(0.046)
First Year With Tenure	-105.051	-1.007*	2.580**	-0.095**
	(64.565)	(0.579)	(1.062)	(0.037)
Two Or More Years With Tenure	-60.769	-0.931	3.977**	-0.091
	(125.963)	(0.836)	(1.650)	(0.061)
Black	-57.906*	0.366	-0.825	0.107**
	(31.125)	(0.461)	(0.550)	(0.047)
Hispanic	113.051*	0.318	1.218**	0.095
	(57.036)	(0.207)	(0.533)	(0.088)
Other Race	-40.729	-0.611	-1.361	0.066
	(61.958)	(0.501)	(0.906)	(0.083)
Male	-128.006***	0.064	-0.457	0.094***
	(20.785)	(0.274)	(0.540)	(0.022)
Age	2.778***	-0.011	0.016	0.001
	(0.789)	(0.014)	(0.024)	(0.001)
Student-Teacher Ratio	-4.526*	0.060	-0.058	-0.002
	(2.269)	(0.050)	(0.044)	(0.003)
Expenditures Per Student	-5.465	-0.016	0.159**	-0.002
	(5.554)	(0.042)	(0.075)	(0.004)
Collective Bargaining	19.206	0.223	-0.249	-0.029
	(33.913)	(0.257)	(0.574)	(0.040)
R-squared	0.062	0.050	0.073	0.042
Observations	4620	1530	1530	4620

Standard errors in parentheses, clustered by state

State effects and teaching year effects are included in the above regressions

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note 1: Sample sizes rounded to nearest 10 for NCES confidentiality purposes

Note 2: I cannot reject the hypothesis that "First Year With Tenure" is equal to "Two Or More Years With Tenure" for any of the outcomes

Table 9: Estimates of Teacher Tenure by Probationary Period, SASS Data, Robustness Check

Sample Restrictions	(1) Baseline	(2) 2 or 3 Year Probationary Period States	(3) 3 or 4 Year Probationary Period States	(4) 4 or 5 Year Probationary Period States
Effect on Work Hours				
Before Tenure Evaluation	0.369	0.565	0.788	1.867
	(0.593)	(0.671)	(1.142)	(1.629)
First Year With Tenure	0.590	-0.428	1.988**	-0.451
	(0.455)	(0.636)	(0.829)	(1.197)
Two Or More Years With Tenure	0.153	-2.605**	2.978*	1.782
	(0.981)	(1.288)	(1.671)	(1.777)
Effect on Own Money Spent				
Before Tenure Evaluation	-71.259**	-56.626	-79.773	-96.186
	(32.295)	(44.509)	(57.464)	(71.627)
First Year With Tenure	-74.078**	-127.090**	-63.561	76.740
	(36.687)	(50.844)	(54.605)	(63.402)
Two Or More Years With Tenure	-35.053	-80.430	-66.394	82.356
	(47.706)	(77.656)	(90.197)	(126.779)
Effect on Committee Participation				
Before Tenure Evaluation	-0.004	-0.032	0.047	-0.141**
	(0.025)	(0.036)	(0.045)	(0.048)
First Year With Tenure	-0.066**	0.022	-0.137***	-0.167
	(0.033)	(0.045)	(0.038)	(0.098)
Two Or More Years With Tenure	-0.080*	0.102**	-0.187***	-0.223
	(0.046)	(0.039)	(0.061)	(0.212)
Effect on Coaching Participation				
Before Tenure Evaluation	-0.039***	-0.042*	-0.035***	0.012
	(0.012)	(0.023)	(0.013)	(0.045)
First Year With Tenure	-0.029*	-0.035	-0.004	-0.060***
	(0.016)	(0.022)	(0.040)	(0.015)
Two Or More Years With Tenure	-0.004	0.019	-0.028	-0.001
	(0.024)	(0.038)	(0.059)	(0.056)
All covariates in eq. 1 are also included				
R-squared	0.049	0.053	0.039	0.065
Observations	14280	9970	10720	2160

Standard errors in parentheses, clustered by state.

Because of the small number of states, clustering by state may generate high Type 1 error rates.

State effects and teaching year effects are included in the above regressions

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Sample sizes rounded to nearest 10 for NCES confidentiality purposes

Table 10: Falsification Test, Change in Dependent Variable Between 2 and 3 Years After Tenure, SASS Data

Dependent Variable	(1) Work Hours	(2) Own Money Spent	(3) Committee	(4) Coach
3 Years After Tenure	0.566	48.200	-0.006	0.012
	(1.219)	(73.804)	(0.025)	(0.025)
Black	1.221	-32.193	-0.094	0.012
	(2.261)	(41.695)	(0.058)	(0.039)
Hispanic	-0.322	37.109	-0.197**	-0.049
	(0.485)	(51.394)	(0.076)	(0.029)
Other Race	-1.012	1.514	0.003	-0.131**
	(0.672)	(50.860)	(0.117)	(0.054)
Male	0.940*	-48.047**	-0.105***	0.367***
	(0.496)	(20.772)	(0.022)	(0.029)
Age	0.071**	4.928***	-0.000	-0.007***
	(0.030)	(1.730)	(0.001)	(0.001)
Student-Teacher Ratio	0.173**	-2.281	-0.004	0.002
	(0.067)	(1.797)	(0.006)	(0.002)
Expenditures Per Student	-0.040	-2.133	-0.009	-0.002
	(0.032)	(3.219)	(0.008)	(0.002)
Collective Bargaining	-1.384*	-2.505	-0.127***	-0.010
	(0.781)	(29.281)	(0.037)	(0.033)
R-squared	0.058	0.048	0.085	0.228
Observations	3810	3810	2770	2770

Standard errors in parentheses, clustered by state

State effects and teaching year effects are included in the above regressions

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Sample sizes rounded to nearest 10 for NCES confidentiality purposes

Table 11: Falsification Test, Effect of Teacher Tenure on Perceptions of Students, SASS Data

Dependent Variable[1]	(1) Poverty	(2) Students Unprepared	(3) Students Dropping Out
Before Tenure Evaluation	0.012	0.015	0.028
	(0.021)	(0.016)	(0.028)
First Year With Tenure	0.005	-0.003	0.006
	(0.011)	(0.019)	(0.021)
Two Or More Years With Tenure	-0.000	-0.002	-0.024
	(0.027)	(0.025)	(0.026)
Black	-0.050**	-0.040**	-0.043**
	(0.019)	(0.019)	(0.018)
Hispanic	-0.078**	-0.067***	-0.069***
	(0.030)	(0.021)	(0.021)
Other Race	-0.046	0.014	-0.085***
	(0.029)	(0.034)	(0.026)
Male	-0.013	-0.025***	-0.196***
	(0.014)	(0.009)	(0.014)
Age	-0.001	-0.001*	-0.001***
	(0.000)	(0.000)	(0.000)
Student-Teacher Ratio	0.005**	-0.002	-0.017***
	(0.002)	(0.002)	(0.004)
Expenditures Per Student	0.005*	0.001	-0.003*
	(0.003)	(0.003)	(0.002)
Collective Bargaining	-0.004	-0.006	-0.005
	(0.022)	(0.016)	(0.027)
R-squared	0.043	0.025	0.063
Observations	14280	14280	14280

Standard errors in parentheses, clustered by state

State effects and teaching year effects are included in the above regressions

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1) Teachers are asked if any of the following are serious or moderate problems.

Note: Sample sizes rounded to nearest 10 for NCES confidentiality purposes

Appendix – Data Sources

NCTQ

Details on state tenure laws come from the 2008 National Council on Teacher Quality (NCTQ) State Teacher Policy Yearbook. In the yearbook, NCTQ publishes each state's probationary period before a teacher may be granted tenure, as well as a citation for the relevant state law.

SASS

Data on teacher behavior and time allocation comes from the restricted-use version of the 2007-2008 Schools and Staffing Survey (SASS), conducted by the National Center for Education Statistics. The sample is restricted to public school teachers only. Teachers from career or vocational schools, alternative schools, and special education schools were also removed from the sample.