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Pension-Spiking, Free-Riding, and the Effects of Pension Reform on Teachers' Earnings*

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Abstract

In many states, local school districts are responsible for setting the earnings that determines the size of pensions, but are not required to make contributions to cover the resulting state pension fund liabilities. In this paper, I document evidence that this intergovernmental incentive inherent in public sector defined benefit pension systems distorts the amount and timing of income for public school teachers. I use the introduction of a policy that required experience-rating on earnings increases above a certain limit in a differences-in-differences framework to identify whether districts are willing to pay the full costs of their earnings promises. Because of the design of the policy, overall earnings of teachers near retirement did not change. Instead, districts that previously provided one-time pay increases shifted to smaller increments spread out over several years. In addition, some districts that did not practice pension-spiking prior to the reform appear to begin providing payments up to the new, lower limit, perhaps due to increased salience of the fiscal incentive. Therefore, the policy was ineffective at decreasing pension costs.

Keywords

Intergovernmental Incentives; Teacher Compensation; Teacher Retirement

Introduction

In recent years, much attention has been paid to the relatively large fractions of their lifetime income that public sector employees receive in the form of deferred compensation, like back-loaded earnings increases and retirement benefits. This is particularly true of teachers, whose earnings increase quite significantly at the end of their careers, despite a lack of agreement amongst researchers about whether quality also increases over this period (Papay

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and Kraft 2015; Wiswall, 2013; Clotfelter et al. 2006; Rivkin, Hanushek and Kain, 2005; and Rockoff, 2004). Also drawing attention to teacher pensions is the fact that some teacher pension benefits provide retirees with income replacement rates over 85 percent, making retirement benefits much more generous than, for example, the median Social Security benefit (Wu et al. 2013).

Despite the growing interest, relatively little is known about why these deferred compensation mechanisms are used so heavily in the public sector. Both pensions and end-of-career earnings increases have a discontinuous nature. Because productivity is unlikely to change discontinuously at high levels of experience, it is doubtful that the increases in earnings are driven by increases in employee productivity. One oft-cited theory motivating the use of such deferred compensation in the private sector is that high end-of career earnings encourage effort by giving employers leverage to discontinue the contract before the high payoff occurs (Lazear 1979). That is unlikely to be the case in public school systems today where teachers are protected by tenure after just a few years on the job. Another theory is that this compensation structure attracts the best teachers, but recent work has shown that teacher preferences cannot be used to motivate generous end-of-career earnings and pensions (Fitzpatrick 2014). This suggests a shift of focus to other theories, most of which involve the political nature of public employee wage determination. In the current paper, I focus on one such potential explanation: intergovernmental incentives distort the true costs to school districts of back-loading earnings for their teachers.

In this setting, distortion of the behavior of local government results from the structure of public employees' compensation streams. In all states, the earnings of teachers are determined at a local level by the district.¹ In all but one state in the U.S. (Alaska) teachers participate in some form of defined benefit pension system. In these defined benefit pension systems, pension benefits paid to employees are based on the teachers' final average earnings, which, as mentioned, are determined by the district. Given this structure of these defined benefit pensions, there is a large return to the teacher of an extra dollar of earnings at the end of her career relative to just a bit earlier in her career because she will receive an increased annual retirement benefit (which she receives at least from the time she retires to the end of her life).

Typically, in these defined benefit pension systems for teachers, employees and employers make annual contributions to the fund and the state is responsible for paying for any remaining difference between these contributions and the liabilities of the promised pensions. Employee contributions are a set fraction of annual earnings. In 22 states, the required employer contributions to the pension fund are established by statute and changed only infrequently (Loeb and Miller 2007).² In the other 28 states, the employer contribution rates are set annually (or on some other regular schedule) and adjusted to cover the short-term projected liabilities of the pension fund. However, because in all states these contribution rates are the same across districts and apply to the earnings of teachers

¹About half of the states (27) require some minimum scheduled salary for teachers, but in almost all states (46) there are no restrictions on how much districts can pay above the state mandated minimum salary (Loeb, Miller and Strunk 2007).

²These states include many of the largest and many of those with the most underfunded pension liabilities: CA, CO, FL, GA, ID, IL, IA, KY, MA, NE, NM, ND, OH, OK, SC, SD, TX, UT, VT, WV, WI and WY.

throughout their careers, in no state are the employee and employer contribution rates fully experience-rated to take into account the full costs of pension benefits resulting from differences across districts in actual final average earnings paid.³

Why might distortion in the price to districts of lifetime compensation for teachers lead to a distortion in teacher earnings? Earnings of teachers while employed are the result of a two-sided bargaining process. In collective bargaining states, contract negotiations are between the teachers union and the school board (or school district administrators).⁴ If the objective function of union leadership, which is often composed of the most senior members of a district, includes seeking rents for senior membership, it may put pressure on districts to disproportionately place earnings at the end of teachers' careers, when there is a large return for teachers (Farber 1986; Freeman 1986; Moe 2006). On the other side of the negotiating table, if the school board's objective function focuses solely on maximizing student achievement, then the state subsidy of end-of-career earnings may encourage the district to offer a bonus to teachers at the end of their careers as a way to incentivize productivity.⁵ Moreover, if the preferences of the union directly enter into the school board's objective function, perhaps because the teachers' union wields significant political influence over who gets elected to the school board, then the district will be more inclined to accept the earnings structure preferred by the union and backload pay. The same would be true if the union is relatively strong for other reasons.

The practice of local governments paying teachers more at the end of their careers is known as pension-spiking. Its prevalence has been noted frequently in the popular press (e.g., Chon 2010, Tumulty 2010, Lifsher 2014; for a summary, see Mannino and Cooperman 2013) and several states have tried limiting the behavior. However, to date, this phenomenon has gone largely unnoticed in the economic literature.⁶ In this study, I first document the prevalence of increases in end-of-career earnings for teachers and present evidence that these increases are directly related to incentives inherent in the pension system. To do this, I use administrative data on all teachers in the Illinois Public School (IPS) system from the 2003 and 2004 school-years.⁷

Of additional interest is determining whether districts would continue to engage in the practice of pension-spiking if forced to pay its full costs.⁸ To see whether this is the case, I make use of a natural experiment that shifted the intergovernmental incentives between the

³The lack of full experience-rating in this setting parallels that in unemployment insurance where firms are not fully experience-rated in the claims that result from their layoffs. For more on experience-rating in the unemployment insurance context, see Topel (1983, 1984) and Anderson and Meyer (1993).

⁴In states without collective bargaining, earnings are determined by school boards with input from teacher membership organizations. Because membership organizations can wield pressure in much the same way unions do, the theory underlying public school teacher earnings determination in collective bargaining states and other states is likely similar, as evident in the fact that similar compensation structures are used for teachers in both types of states. To simplify the discussion, I focus on the situation where teachers are represented by a union.

⁵In this variant of the Lazear (1979) model, the threat of the district renegeing on the bonus, rather than the threat of being fired *per se*, is what increases productivity of less experienced workers.

⁶The exception is a 2013 working paper by Mannino and Cooperman. In it, the authors document evidence on pension-spiking from news reports, a survey of pension managers, and two administrative datasets on public employees.

⁷I use the year of the spring semester as short-hand when referring to school-years.

⁸Understanding how local governments respond to state policy decisions has been of longstanding interest in the economics literature, particularly with respect to state policies that change the tax-price of local spending (e.g., Welch 1981, Reilly 1982, Anderson 2006, Rockoff 2010, and Anderson 2011).

state of Illinois and its public school districts. Specifically, in 2005, the state legislature passed a law requiring districts to pay the full cost of end-of-career earnings increases above six percent that served to increase the retirement benefits of public school teachers. The legislature applied this pension reform policy only to earnings covered in contracts or collective bargaining agreements put into place after the law's passage in June 2005. Because contract negotiation timing is arranged at the time of the previous contract and staggered across districts over time, there is exogenous variation in implementation of the policy across districts over time. This allows me to use difference-in-difference methods to estimate the effects of the state's pension reform policy on teachers' earnings.

To estimate the effects of the pension reform policy, I combine data on individual teacher earnings, other forms of compensation, and contract negotiation timing from the Illinois State Board of Education (ISBE) from 2003 to 2012. I exploit the fact that the earnings of teachers within the window for retirement benefit calculation (i.e., within the years that are most likely to be used to calculate their final average earnings) are those most likely to have been affected by the pension reform policy. A teacher reaches eligibility for retirement, and therefore the window for retirement benefit calculation, at specific combinations of age and experience (e.g. a teacher who is aged 59 with 15 years of experience is not eligible to retire, but one who is 60 with 15 years of experience is). Therefore, I can separately control for any age or experience related differences in earnings. I also utilize the variation in treatment over time and across districts as the policy was implemented, making this a difference-in-difference-in-difference framework.

Identification therefore stems from comparison of earnings for similarly aged and similarly experienced teachers within a district, some of whom are closer to retirement than others, before and after the pension reform policy takes effect. The identifying assumption with this strategy is that differential trends in teacher earnings of those more or less likely to be within the retirement benefit calculation window in districts that are subject to the pension reform policy in later years are appropriate counterfactuals for the differential trends in the earnings of similar teachers in districts that are subject to the pension reform policy in earlier years. I present event-study-style evidence consistent with this assumption.

The results show that the earnings of teachers who are most likely to be within the retirement benefit calculation window are much more likely to increase by exactly six percent after the pension reform policy is in effect. Despite this shift, on average, the earnings of teachers in the retirement benefit calculation window do not change because of the policy. Descriptive evidence suggests that this pattern of results occurs for two reasons. First, districts that previously offered large retirement bonuses to all teachers for one or two years just before retirement now spread the retirement bonuses over more years to prevent any one-year increase in earnings from triggering a fee. Second, some districts that did not practice pension-spiking prior to the reform appear to begin providing payments up to the new, lower limit, perhaps due to increased salience of the fiscal incentive. This pattern of effects means there is no change in the total costs of teacher pensions.

In what follows, in Section II, I begin by describing the general structure of the pension system in IPS, incentives that encourage the heavy use of end-of-career earnings, and the

change to those incentives with the introduction of the pension reform policy. In Section III, I provide information on the data used. Then, in Section IV, I detail my empirical strategy for identifying the effects of the pension reform policy. Also, I document the back loading of teacher earnings, its close connection to the incentives inherent in the pension system, and how it shifts with the pension reform policy. I then conclude in Section V.

II. Teacher Retirement Benefits in Illinois

As described, teachers of IPS are participants in a defined benefit pension plan. Before 2005, in each year of employment, teachers contributed 9 percent of their annual earnings to the retirement system, but employers were not required to make contributions on annual teacher earnings. Since 1967, annual benefits have been available to members of the Teachers Retirement System (TRS) when they terminate active service with IPS and meet the following age and service requirements: age 55 with 35 years of service, age 60 with 10 years of service, or age 62 with 5 years of service. Retiring teachers can count up to two years of sick leave as creditable service, meaning 55 year olds can reach eligibility and the maximum retirement benefit with 33 years of service.⁹ In addition, one can retire between ages 55 and 60 with at least 20 years of creditable service and receive an annuity that is discounted by 6 percent for each year between the retiree's age and 60.¹⁰

A teacher's annual benefit upon retirement is calculated using a predetermined formula, which is a function of the accrued service at retirement and average end-of-career earnings. Each year of service a teacher accrues contributes 2.2 percent of her end-of-career earnings to her annual retirement benefit, up to a maximum benefit equal to 75 percent of one's end-of-career earnings.¹¹ The measure of end-of-career earnings used in the calculation of the teacher's retirement benefit is the average of her four highest consecutive annual earnings in the last ten years of creditable service. For most teachers, this is the average across her earnings in each of her last four years of employment. Any earnings above 120 percent of the previous year's earnings are not included in the end-of-career earnings for the purposes of retirement benefit calculation.

This structure of the pension system provides teachers a large return of a dollar of earnings in the last four years of employment relative to just a bit earlier. This is because any dollar received during a year that counts for pension benefit calculation increases both her current earnings and the size of her pension. However, ignoring inflation, there is no difference in the cost to districts of paying a teacher an extra dollar in her fifth last year of teaching relative to one of her last four years of teaching. This is because, before 2005, districts in

⁹Teachers can also purchase additional service credit for other types of leaves of absence and service with other employers, e.g., private schools or out-of-state schools.

¹⁰To avoid the actuarial discounting, the employee can choose the Early Retirement Option (ERO), which involves both the retiree and her employer paying a one-time fee that is proportional to the employee's distance in age and experience from full retirement eligibility.

¹¹The "2.2 formula" was introduced in 1998. For service accrued prior to 1998, the formula for calculating the annual retirement benefit is nonlinear and depends on the accumulation of creditable service in the system. The contribution proportions are 1.67, 1.9, and 2.1 percent of end-of-career earnings per year for the first, second and third decades of service, respectively, and 2.3 percent per year for any service beyond 30 years. Employees with service in 1998 that had accrued pension benefits at the old rate could be updated to the new higher rate for a one-time fee (Fitzpatrick 2014).

Illinois were not required to make contributions to the pension fund based on the earnings of their teachers.

The costs to the districts that provide teachers who are just inside or outside of the retirement benefit calculation window with a dollar of lifetime income can be best illustrated with budget constraints. Consider a district with two teachers who have the same amounts of experience and salary, but one is a year younger than the other and therefore is just outside the retirement benefit calculation window. In other words, the older teacher is within 4 years of retirement benefit eligibility and the younger teacher is 5 years from retirement benefit eligibility. The district is considering raising current pay and has enough money to raise the pay of one teacher by Y percent.

Figure 1 illustrates the district's budget constraints in this scenario under policies with different pension incentives. Along the vertical axis is the increase in lifetime income of the younger teacher (who is outside the retirement benefit calculation window) and the horizontal axis measures the increase in lifetime income of the older teacher (who is within the retirement benefit calculation window). The setting without any pension incentives at all is illustrated by the solid grey line, which has a slope of negative one and hits both axes at Y percent of pay.

The district's budget constraint in the period before 2005 is illustrated by the dashed black line in Figure 1. Before teachers reach the period four years before retirement, each dollar of lifetime income for the teacher costs the district one dollar. However, a dollar of lifetime income for a teacher cost the district just $1/\alpha$ ($\alpha > 1$) if it was paid to the teacher in one of her last four years of employment.¹² Therefore, the slope of the dashed black line is $-1/\alpha$ for ranges of the older worker's current pay increases between 0 and 20 percent, which correspond to an increase in lifetime income of between 0 and 20α percent (of current earnings). If a teacher's current earnings increase hits the 20 percent earnings cap for benefit calculation, the cost to the district of an additional dollar of lifetime income is one dollar even if the earnings are accrued in the last four years of employment. Therefore, the slope of the line is negative one for ranges of increases in the older worker's lifetime pay above 20α percent (of current earnings).

The figure illustrates that in Illinois before 2005 it is relatively low-cost for the district to increase teachers' lifetime income at the end of their careers. As such, we might expect districts to pay teachers more at the end of their careers relative to earlier in their careers. At the same time, end-of-career earnings increases above 20 percent do not enjoy the same privileged low-cost status in terms of lifetime compensation that earnings increases below 20 percent do. Therefore, as would be expected given the kink in the budget constraint at 20α

¹² $\alpha > 1$ represents the change in lifetime income with an increase of \$1 of current income in the retirement window. The TRS estimates that each dollar of final average earnings costs the pension system between 14 and 16 dollars in present value terms. This estimate is based on TRS actuarial assumptions for life expectancy and 8.5 percent interest earnings. (<http://trs.illinois.gov/employers/calculators/excesssalincrcalculator.aspx>) As such, \$1 in one of the four years used to calculate retirement benefits leads to between \$3.50 and \$4.00 of lifetime income for the employee and α is between 3.5 and 4. Therefore, under the TRS assumptions, one dollar in lifetime income costs the district between \$0.25 and \$0.29. As documented by Novy-Marx and Rauh (2009), the approximately 8 percent discount rates used by state retirement systems to calculate the present value of their liabilities are much too high to account for the risk-free nature of the debt. Because of this, the TRS estimates of the present value of lifetime costs of final average earnings payments are likely too low. Therefore, I use the more general α to depict the budget constraints.

percent of lifetime income, if earnings increases can be precisely determined by districts, before 2005 there should be bunching of lifetime earnings increases for teachers within the retirement window at 20a percent (which corresponds to a 20 percent increase in one year).

With pension funds facing increased scrutiny for their funding levels after the recession of the early 2000s, lawmakers and newspapers began paying more attention to the practice of pension-spiking (e.g., Goze 2004, Caisley 2004). A few particularly egregious examples of teachers and district administrators receiving extremely large pay increases at the end of their careers, and the resulting relatively large pensions, helped motivate support for legislative restrictions on the practice of pension-spiking.

In 2005, Illinois legislators instituted new laws requiring public school districts to pay the costs of pension benefits ensuing from creditable earnings increases over six percent.¹³ Specifically, if a district gives a teacher an earnings increase over six percent and that increases the teacher's retirement benefit (because it is used in the calculation of end-of-career earnings) the district is required to pay a fee to the TRS. The cap on earnings increases at 20 percent for pension benefit calculation remains in place. The new rule therefore requires that any earnings increases between 6 and 20 percent carry not only their current cost to a school district, but also a lump-sum payment to TRS at the time of the teacher's retirement. The size of the lump-sum payment is the TRS-estimated actuarial value of the increase in lifetime retirement benefits owed to the teacher because of the earnings increase.¹⁴ At the time, the executive director of the retirement system stated that the new legislation introducing the pension reform policy was designed to "align the responsibility with awarding the raises with the responsibility for paying them (Dey 2005)."

To give a sense of the magnitude of the policy, consider a teacher with \$80,000 in creditable earnings in the 35th year of her career, which will be her last.¹⁵ A six percent earnings increase is \$4,800, while a seven percent earnings increase is \$5,600. Before the policy shift, it would therefore have cost the district \$800 to give a seven percent earnings increase rather than a six percent one. However, because she is eligible for the maximum pension benefit and assuming this last year will count as one of her four highest earning years, her retirement benefit will increase by \$150.¹⁶ The TRS calculates the present discounted value of this annual increase to be approximately \$2,100, and charges the district this fee.¹⁷ The \$800 earnings increase now costs the district over three and a half times as much.

¹³In 2005, the state legislature also changed the rules governing the ERO. The new rules increased annual employee contributions to the retirement system, setting aside these funds specifically for use of the ERO and allowing the funds to be refunded to employees who do not retire under the ERO. Additionally, the ERO fees to the employee and employer were increased and employers were allowed to limit the ERO retirements in each year to just 10 percent of eligible employees. (The previous limit had been 30 percent.) Employees eligible for retirement under the ERO system existing before 2005 were given until June 1st of 2005 to declare their ERO retirement; otherwise they would face the new higher fees and lower limits.

¹⁴Again, this is probably an underestimate of the increase in lifetime retirement benefits (see footnote 9).

¹⁵This is around the average total earnings for employees close to retirement, i.e. those with 30 to 33 years of experience in IPS.

¹⁶This is based on the fact that a one-year \$800 increase in earnings in her four highest-earning years increases the average end-of-career earnings by \$200. Since she has 35 years of service, she has reached the maximum benefit amount of 75 percent of her end-of-career earnings.

¹⁷Actual costs are calculated by TRS and vary based on the age of the employee. An online calculator is provided by TRS to help employers estimate the costs. I used this calculator to estimate the costs for the described earnings increase in the 35th year of employment for an employee aged 55 to 59 at the time of retirement and obtained estimates ranging between \$2,282 and \$2,157 for employees between the ages of 55 and 60 at the time of retirement. <http://trs.illinois.gov/employers/calculators/excesssalincrcalculator.aspx>

It is useful to use the budget constraint framework outlined earlier to illustrate the dramatic pension reform policy-induced change in the cost of a dollar of lifetime compensation (in present value terms) for increases in current earnings above 6 percent. In Figure 1, the solid black line traces out the budget constraint for the hypothetical scenario described earlier in which a district is choosing pay amounts for two teachers, one outside the retirement benefit calculation window and the other inside of it. The figure shows that the pension reform policy causes a clear increase in the cost to the district of giving lifetime earnings increases above 6 percent (which corresponds to current increases above 6 percent) to teachers within the retirement benefit calculation window (since the budget constraint lies inward on the horizontal axis relative to the dashed line). After the policy, since the cost to the district of a dollar of lifetime compensation increases dramatically at increases over 6 percent, it is likely that there is bunching of earnings in the post-policy period of exactly 6 percent. Notably, the kink in the budget constraint at 20 percent increases in lifetime income for the older worker is no longer present on the solid black line. This indicates that after the pension reform policy we should expect to see less bunching at pay increases of 20 percent for teachers within the retirement benefit calculation window.

After describing the data, I show that the hypothesized patterns of bunching of earnings increases before and after the policy's introduction hold.

III. Data Description

To conduct the analysis, I use four sources of data: the Teacher Service Record (TSR), data on employees' age from the Teacher Retirement System, contract timing from the Teacher Salary Study (TSS) and other data on compensation collected from school district contracts.

The TSR contains data on employees of IPS and is collected by the Illinois State Board of Education (ISBE). Because the data are from administrative records of all employed service in IPS, I can completely characterize the employment and earnings experiences of every employee of IPS. In the summer of 2002, the state began requiring summer earnings to be included as part of the recorded earnings of teachers.¹⁸ This makes earnings difficult to compare before and after 2003, so I begin the analyses in 2003.¹⁹

Each observation in the TSR is an employee-school record for a given school year. The TSR includes the following information about employees in IPS: the school and district in which the employee works, total earnings (as reported to the relevant retirement system), number of months employed at the position, full-time equivalent percentage of the position and the percent of time that is administrative. The data also contain information on the number of years of school experience (within the district, within Illinois and out-of-state), the position and the highest degree held by the employee.

The reported earnings includes scheduled salary, extra-duty pay (summer, coaching, clubs, etc.), vacation and sick day buyouts, bonuses, and other earnings that the Teachers Retirement System (TRS) includes in total creditable earnings.²⁰ Unfortunately, the

¹⁸I use the year corresponding to the spring of a school year to index school years.

¹⁹The results are unchanged if the pre-period is extended. Results are available from the author upon request.

available data does not indicate what fraction of total earnings is from each of these different categories, which is why, as I describe later, I supplement this data with information from the district contracts. However, importantly for the current work, the earnings measure recorded in the TSR is a precise measure of total creditable earnings toward the retirement system and therefore the earnings that are used to calculate pension benefits. Because the state policymakers levied fees on increases in nominal earnings, nominal earnings is likely the measure most affected by the policy. Therefore, in what follows, earnings measures are reported in nominal terms.

Age is an important factor determining retirement eligibility. Information on age or date of birth is missing from the TSR, so I use data on age from the Teacher Retirement System. These data are administrative data collected for the purposes of determining retirement benefits for IPS employees. The TRS data and TSR data do not share a common identifier, so I use fuzzy matching techniques to merge the two data sources based on employees' names, experience and employers. 98 percent of teachers in the TSR have a unique match in the TRS data.

The school district contract data comes from the collective bargaining agreements between school district administrators and teachers' unions. Some information from these contracts is gathered by the ISBE in the form of the Teacher Salary Study (TSS). The TSS reports summary information about compensation governed by the contracts. Importantly for this project, it includes information about the timing of contract renegotiation. To understand the structure of compensation more fully, I surveyed the 910 districts in the IPS school system in 2012 requesting copies of their collective bargaining agreements from 2003 to 2011. The response rate of my survey was 64 percent.²¹ When I use this data in analyses, I limit the sample to the 528 districts that responded and have pre-treatment data.

The first panel of the Table 1 includes summary statistics of measures of the teacher characteristics that I use as controls. After making sample selections described in the Data Appendix, the sample includes full-time teachers with at least 5 years of experience in Illinois, but not Chicago, who worked in districts with negotiated contracts between 2002 and 2011. There are a total of 119,621 unique teachers in the sample and 651,369 teacher-year observations. Across all the years of data, the average experience of teachers is 16 years and the average age is 45. Seventeen percent are non-white and 23 percent are male. Most teachers have either a Bachelor's degree (38 percent) or a Master's degree (61 percent). The second panel of the table reports information about treatment and teacher earnings. Finally, average nominal earnings are \$61,291. The average annual increase in earnings is around \$3,400. The average percentage change in earnings from year-to-year is a 5.6 percent.²²

²⁰This measure of compensation does not include the cost of employer-paid health insurance or other benefits provided by the school-board to the employee.

²¹Of the 910 districts, 33 (4 percent) were districts that did not exist in their current form in 2006 (some districts have consolidated since 2006; others that exist today are new schools, e.g. charter schools, most of which do not have collective bargaining agreements), 10 (1 percent) are districts without teachers' unions, and 46 (5 percent) responded but could not locate contracts from before 2005. Another 302 districts did not respond to the survey at all. The response rate of districts, and the resulting sample selection in the analyses using this data, is not associated with the propensity of a district to offer its employees earnings increases above 6 or 20 percent in the pre-pension reform policy period. That said, smaller districts, which are also those with lower earnings and fewer teachers with MA degrees, were slightly less likely to respond to the survey. See Appendix Table 1. This may affect the generalizability of the results using the district contract information to very small schools.

IV. Identifying the Effect of the Pension Reform Policy on Teacher Earnings

In what follows, I present difference-in-difference models estimating the effect of the pension reform policy on earnings. The identification strategy hinges on the fact that the policy only applied to earnings paid under collective bargaining agreements entered into after the policy's passage in the summer of 2005. Generally, collective bargaining between district leadership and the teachers' unions in Illinois takes place at pre-determined intervals ranging from every year to every 7 years.²³ This pattern means that each year some of the districts in the state renegotiate their contracts with their teachers. As time passes, therefore, the new policy applies to more districts and to the earnings of more teachers.

To illustrate the variation in contract renegotiation timing, Figure 2 presents the fraction of schools in the 2005 school-year that have contracts set to expire in each successive year. Contracts expiring in 2005 are those that expire after the 2005 school-year and where a new contract would apply to the 2006 school-year, i.e. those expired between June of 2005 and August of 2005. As can be seen in the figure, 37 percent of districts in Illinois had contracts that expired in 2005. Another 27 and 28 percent of contracts were renegotiated after 2006 and 2007, respectively. Most of the remaining eight percent of districts renegotiated their contracts in 2008.

This variation across districts in pre-determined contract renegotiation timing creates exogenous variation across districts in when they were bound by the earnings pension reform policy. Note that the contract expiration year used in the figure and for identification was recorded in the fall of the 2004–2005 school-year, before the policy was introduced. Using the contract expiration date from before the policy was instituted ensures no post-policy contract renegotiation confounds my estimates of the effects of the policy on teacher earnings.²⁴

Figure 2 also presents the percent of teachers in the sample who can be considered treated after the school-year reported on the horizontal axis. For example, 35 percent of teachers in the sample were employed in districts that renegotiated their collective bargaining agreements between 2005 and 2006 and therefore would be subject to the pension reform policy in the 2006 school year. By 2008, nearly all teachers are covered by the policy.

Contracts between districts and teachers often delineate specific salary schedules for each school-year of the contract. This makes it difficult to adjust scheduled salaries, bonuses or other forms of earnings covered by the contract in response to any unanticipated economic shock. Thus, if a shock occurs during the middle of a contract period, earnings are unlikely

²²I have top-coded percent changes in earnings at 20 percent because no increases in nominal earnings above 20 percent are included in the calculation of retirement benefit levels. To be symmetric, I have also bottom-coded decreases of 20 percent.

²³A collective bargaining agreement can be signed between the two parties that lasts for any amount of time agreed upon by both parties. However, in the data is rare to see agreements that take more than 7 years to expire.

²⁴The exemption for only those employees under contracts and collectively bargained agreements that were entered into before June 1, 2005 was strictly upheld by the TRS. It required annual affidavits verifying the timing and nature of contract negotiations from any district claiming to be exempt from the fee on raises above six percent. Also, one might be concerned that teacher earnings responded to the policy's announcement in 2005 before contracts were adjusted. However, it is difficult for any form of compensation covered by contracts to be altered mid-contract without a full renegotiation, which would have made the policy binding. In results not reported, I have investigated whether there were any changes in earnings in the interim period between the policy's announcement and the first post-2005 contract renegotiation and found none.

to adjust until the next planned negotiation. To illustrate, consider how contracts would adjust if there were a negative economic shock in the fall of 2004. Earnings in districts negotiating their contracts in the summer after the 2005 school-year would adjust by the 2006 school-year, but those not negotiated until the summer after the 2006 school-year would not. If I were only to rely on the timing of contract negotiation for identifying variation, such a shock would bias estimates of the pension reform policy because the coefficient would capture the effect of both the policy and the shock.

It is therefore important to disentangle the effects of the pension reform policy and any concurrent budgetary or economic shock. To do this, I make use of the fact that the earnings of some teachers are more likely to be affected than the earnings of others. Which teachers' earnings are most likely affected by the policy? The policy introduced an extra cost to districts giving their workers earnings increases of over six percent when those earnings increases would serve to increase the teachers' retirement benefits. The earnings that go into the calculation of the retirement benefit are the four highest consecutive earnings in the last ten years of a teachers' career. Nominal earnings most likely increase over time because inflation adjustments are built into contracts and teachers move up the career-salary-ladders (if they have not already reached the maximum salary step). Therefore, the policy is most likely to affect the earnings of teachers in their last four years of employment.

Ideally, I would compare the earnings of teachers in the last four years of their careers to that of similar teachers earlier in their careers before and after they were subject to the pension reform policy. Unfortunately, censoring of the data make it difficult to know which teachers are at the end of their careers. Even without censoring, retirement behavior could respond to the pension reform policy. To circumvent these problems, I create measures of treatment using pension eligibility rules to determine which teachers are likely to have been in their last four years of employment in the absence of the policy change.²⁵

In Illinois, teachers can retire at any point, subject to the age and experience criteria already described. However, as other authors have documented, nonlinearities in the retirement benefit accumulation formulas of defined benefit systems like TRS make the incentives to retire at certain points in one's career quite large (Costrell and Podgursky, 2009; Costrell and Podgursky, 2010; Brown, 2013). I therefore define a variable, *Treated*, to be equal to one if the teacher is aged 51 or older with at least 29 years of experience or age 56 or older with at least 11 years of experience, and zero otherwise.²⁶ This definition does not map exactly to eligibility rules mentioned earlier because some teachers in the untreated group may be eligible for retirement (e.g., those above age 65 with between 5 and 10 years of experience). However, I use this classification because it leaves me with enough variation within age and experience to control for district differences and economic shocks specific to similarly aged

²⁵Results are similar with other definitions of treatment intensity. For example, the results are similar with other age and experience combinations to define who is likely to be in the retirement eligibility window. Results are available from the author upon request.

²⁶Those aged 51 with 29 years of experience are within 4 years of the eligibility threshold at age 55 with 35 years of experience if they count 2 years of sick leave as creditable experience. I allow for the sick leave accumulation in my definition of treatment since many very experienced teachers use accumulated sick leave to qualify for retirement. Those aged 56 are within the eligibility threshold at age 60 with 12 years of experience.

and experience teachers. The use of this imprecise definition of treatment is likely to attenuate estimates of the policy's effect.

Graphical Evidence on the Effects of the Pension Reform Policy

To illustrate further the variation underlying my identification strategy, in Figure 3, I present histograms of the percent change in earnings from one year to the next. In Panel A, I use data on teachers in the 2003 and 2004 school years. The shaded bars represent the distribution of earnings increases for teachers in the untreated group. The darkly outlined bars represent the distribution of the earnings increases among teachers in the treated group. For the most part, the distribution of earnings increases for those in the eligibility window falls below that of those who are not yet in the window. This is likely because similarly sized annual increases in earnings represent smaller increases in relative terms for the more experienced group of treated teachers. However, as predicted, the teachers in the treated group are more likely than the untreated to receive earnings increases that are at least 20 percent.

In Panel B, I present histograms of the year to year earnings increases for the same two groups of teachers, but for the first year after the new pension reform policy becomes binding in a teacher's district of employment. Although there is relatively little change in the distribution of earnings changes for employees not within the retirement benefit calculation window, there are two dramatic changes in the distribution for teachers nearing retirement eligibility. First, they are about half as likely to be receiving large earnings increases of at least 20 percent. Second, they are much more likely to be receiving earnings increases of exactly 6 percent. A third, more subtle, change is that, relative to the teachers outside of the retirement benefit calculation window, the teachers within the retirement benefit calculation window are also slightly less likely to be receiving earnings increases just below 6 percent, a point I return to in the discussion of regression estimates.

Estimation Evidence on Pension Spiking and the Effects of the Pension Reform Policy

To isolate only the variation in post-2005 earnings that is driven by the pension reform policy, I estimate the following equation allowing the policy's introduction to have different effects on earnings depending on whether a teacher is within the retirement benefit calculation window:

$$y_{idt} = \alpha + \pi \text{Treated}_{it} + \gamma \text{Treated}_{it} \times \text{Policy}_{dt} + X_{it}\beta + \delta_{jdt} + \rho_{adt} + \varepsilon_{idt}. \quad (1)$$

In equation (1), y_{idt} is the outcome for teacher i in district d in year t . The variable *Policy* is a dummy variable equal to one if the year of the observation is between 2005 and 2011 and district d 's contract had been renegotiated since the policy was introduced. X_{it} are teacher characteristics, such as fixed effects for educational attainment, race and gender. I use ordinary least squares methods; since many outcomes of interest are binary, these are therefore linear probability models. Standard errors are clustered at the district level.

I also include year-by-district-by-experience fixed effects (δ_{jdt}) and year-by-district-by-age fixed effects (ρ_{adt}) to capture any shocks to earnings among similarly aged and experienced

teachers in a district.²⁷ These fixed effects also control for any employer-specific variation in the outcomes, e.g. if certain districts are more likely to offer high wages or have higher turnover rates. Note that because of the set of fixed effects included, the effect of the policy is identified using only districts that have multiple teachers of the same age or experience in a given year. With this rich set of fixed effects, the policy effect is identified off differences in outcomes for people in the same district with the same level of experience (age) whose likelihood of being in the retirement benefit calculation window differs because they are of different ages (levels of experience) from one another.

Evidence of Pre-treatment Trends in Outcomes?

An assumption underlying my use of the differences-in-differences identification strategy in this setting is that there were no other changes in policy or environmental factors that differentially altered the trajectory of earnings for teachers more or less likely to be within four years of retirement and occurred systematically at the time of the first post-2005 contract negotiation other than the pension reform policy that I study. In order to provide support for this assumption, in Figure 4, I present event style estimates of the changes in earnings in each year relative to when the policy takes effect in a teacher's district. More precisely, the solid line traces coefficient estimates of γ from estimation of equation (1) replacing the binary treatment variable, *Policy*, with distributed leads and lags measuring the number of years before or after the policy's enactment in the district that an observation occurs.

Two observations from these graphs are worth mention. First, there is little evidence of pre-treatment trends when the dependent variable is the probability of earnings increases of 6 percent or total earnings in the following year. When the outcome is the probability that earnings increased by exactly six percent, the coefficient estimates on the variables representing pre-treatment periods hover around zero. When the outcome is a teacher's total earnings in the following year, the pre-treatment estimates hover around \$400. This is consistent with the previously presented evidence showing that, before the policy's implementation, teachers nearing retirement receive increased earnings. Generally, for these two outcomes, these pre-treatment estimates are not statistically different from one another.²⁸ This evidence supports the assumption that underlies the differences-in-differences estimation strategy, i.e. there were no pre-treatment trends in teacher earnings. However, in Panel C, there is suggestive evidence of a decline in the probability of the change in earnings being at least 20 percent before the policy's introduction. This should be kept in mind when interpreting the estimated effects of the policy on this outcome.

Second, once the policy becomes effective in a district, there is a marked increase in the probability that a teacher's increase in earnings from year-to-year is exactly equal to 6 percent. It is more difficult to distinguish any change in earnings due to the policy. Estimates of the difference in earnings in year $t+1$ for those in the retirement benefit calculation window relative to similarly aged and experienced teachers who are not in the retirement

²⁷An important example of such a shock is the 2005 change in the ERO described in Footnotes 10 and 13, which led to a large number of exits from the data.

²⁸The exception is the estimate, γ , five years before the policy's introduction on earnings in Panel B.

benefit calculation window in the post-policy period hover around \$200. By the second year the pension reform policy in a district is binding, teachers in the retirement benefit calculation window are 5 percentage points more likely than their similarly aged and experienced counterparts to receive an earnings increase of exactly 6 percent.

Difference-in-Difference Estimates of the Pension Reform Policy by Teacher Eligibility Status

I now turn to estimation of equation (1), replacing the event-style model with a single variable measuring whether the pension reform policy has been implemented in the district of employment at the time of the observation. The results of this estimation framework are in Table 2. In the table, there are six dependent variables: whether an earnings increase is less than 6 percent, equal to six percent, more than 6 percent and less than 20 percent, or at least 20 percent, as well as the percent change in earnings and the total earnings in year $t+1$.²⁹

The first thing worth noting about the results in Table 2 is that, in the pre-policy period, as teachers enter the retirement benefit calculation window, they receive larger increases in earnings between one year and the next (row 1) and therefore higher earnings in the following year (row 3). For example, as teachers reach the retirement benefit calculation window, earnings increases were 0.54 percentage points higher, on average. As a result, earnings in the next year were about \$350 higher. These estimates are statistically significant at the one percent level. This is also confirmed by the evidence in rows 5 and 9, which shows that those teachers who are within the retirement benefit calculation window are less likely to receive earnings increases less than six percent and more likely to receive earnings increases greater than six percent, respectively. Teachers within the retirement benefit calculation window before the policy is introduced are also, on average, 2 percentage points (33 percent) more likely than their counterparts to receive earnings increases from year to year that are 20 percent or more (row 11).

Second, the evidence in the table suggests that the pension reform policy had an effect on the distribution of wage changes among teachers who were within the retirement benefit calculation window. The policy increased the likelihood that teachers in the retirement benefit calculation window received a raise of exactly six percent by 7 percentage points (row 8). Given that just five percent of these teachers are receiving a six percent raise in the pre-period, this is an extremely large increase. And, because there were no other systematic policy changes to earnings that directly targeted earnings increases of six percent, we can attribute this entire effect to the pension reform policy itself. Note that the increase in the probability of receiving an earnings increase of six percent is driven by both a 3 percentage point decrease in the probability of earnings increases above six percent (rows 10 and 12, though the estimate in row 10 is not statistically significant) and a 4 percentage point decrease in the probability of an earnings increase below six percent (row 6).³⁰ Most of the decrease in raises above 6 percent comes from a decrease in the probability of treated teachers receiving an earnings increase of at least 20 percent (row 12). After the pension

²⁹Other possible outcomes of interest include exit from IPS and job-switching. In results not presented, I find that the pension reform policy had no effect on either of these outcomes.

reform policy, teachers in the retirement benefit calculation window are no more likely than those not in the retirement benefit calculation window to receive these large increases.

It is useful to explore the changes in earnings in more detail. In Figure 5, I plot coefficient estimates and confidence intervals for the difference-in-difference-in-difference effects of the policy on the likelihood of receiving an earnings increase between 0 and at least 20 percent. The most striking part of the figure is the large increase in the probability of earnings increases of exactly six percent after the pension reform. This echoes the result in Table 2. The information in Figure 5 also shows that there are statistically significant decreases in the probability of earnings increases being 1, 2, 16, 17, 19 and at least 20 percent. The coefficient estimates are also negative for increases of 0, 3, 4, 8, 9, 10 and 15 percent, though these estimates are not statistically significant at the 5 percent level. In other words, there is shift of earnings increases towards six percent from both above and below six percent.

Importantly, these shifts in the distribution of raises in percent terms do not translate into changes in earnings in level terms. The coefficient estimate in row 4 of Table 2 shows that the policy had almost zero effect on the amount of earnings in year $t+1$. In row 2, we also see that the policy had little effect on the average percent change in earnings. This means that, after the policy, teachers within the retirement benefit calculation window are still receiving higher earnings than their counterparts who are not in the window. Therefore, the pension reform policy did not save the retirement system any money. Using the coefficients in Table 2, I estimate that the observed pre-policy pension-spiking cost state taxpayers about \$116 million per year.³¹ The pension reform policy did not save the pension fund from these costs.

One possibility for why the policy did not have more of an effect on earnings is that earnings may have been redistributed across the years over which earnings count towards benefit calculation so as to avoid the penalty that comes with a one-year increase above six percent. For example, a district offering a 20 percent earnings increase in the final year may move to four consecutive years of six percent earnings increases for retiring teachers. I now turn to analyses of the information in district contracts to provide additional evidence on how earnings responded to the pension reform policy.

What Components of Earnings Shifted?

Thus far, I have shown that the pension reform policy shifted the distribution of teacher earnings used in the calculation of pension benefits. Recall that this measure is the sum of multiple forms of earnings, including scheduled salary, longevity pay, bonuses, extra-duty

³⁰The group receiving a raise of less than 6 percent includes those with raises between 0 and 6 percent as well as those whose pay decreases. The 4 percentage point decrease in the probability of being in this category shown in row 6 of Table 2 can be separated into a 1 percentage point decrease in the probability of receiving a pay decrease and a 3 percentage point decrease in the probability of receiving a pay increase of between 0 and 6 percent.

³¹Between 2003 and 2005, there are about 22,000 teachers per year that are in the retirement benefit calculation window. If each of these teachers is paid an extra \$350 in each year of being within the window, that totals \$7.722 million per year. Since the TRS uses a factor of between 15 and 16 to calculate the pension costs resulting from end-of-career earnings, this translates to a cost to the pension fund of nearly \$116 million per year. As described, the TRS estimates of pension costs are likely too low; therefore, the true cost to the pension fund is likely quite a bit higher.

pay, and other earnings that the TRS includes in total creditable earnings. In thinking about the effects of the policy, it is useful to consider what mechanisms districts had for pension-spiking in the first place. All teachers with the same experience are paid according to the same salary schedule. However, while the pension spiking is identified for teachers with the same amount of experience (due to the experience fixed effects), so scheduled salaries cannot be responsible for the identified pension-spiking. Similarly, longevity payments are available to all teachers that meet a given level of experience. Therefore, longevity payments would not increase earnings as teachers entered the retirement benefit calculation window (relative to earnings of others with the same experience who are not within the window).

Teachers' earnings might spike from movement along the salary schedule by obtaining a MA degree. Alternatively, salary schedules are different across different districts, so another way for teachers to increase their earnings in the retirement benefit calculation window would be to change employers. Likewise, teachers could move into higher paying positions (e.g., school administration) within a school or district in order to increase earnings when they reach the retirement benefit calculation window. However, descriptive evidence suggests these types of changes are not the main driver of pension-spiking in IPS. For example, combined, only five percent of the teachers in the retirement benefit calculation window in the pre-pension reform period who receive earnings increases of at least 20 percent are teachers who have obtained a MA degree, switched employers or switched positions in the year of the 20 percent earnings increase. Therefore, other forms of earnings increases are most responsible for pension-spiking.

Bonuses are another component of observed total earnings. Bonuses may be offered by districts for many reasons, but the type of bonus most likely to play a role in pension-spiking is what is often termed a retirement bonus. In coding the information from the survey of district contracts, I define a retirement bonus to be a bonus described in a district's contract that is available to teachers who promise to retire, regardless of the timing of retirement.³² Once a teacher notifies her district of her intent to retire on a particular date, the bonuses are paid either via lump sum at the end of the school year or via increases in the amount of regular paychecks. If the teacher does not retire as promised, she must return the bonus payment to the district. These retirement bonuses are available for all teachers regardless of quality, though oftentimes districts only offer the bonuses to teachers who have been employed with the district for some minimum number of years.³³ The size of these bonuses varies across districts, as does the number of years over which the bonus is offered and whether there is a limit to the total amount of the retirement bonus.³⁴

To get a better sense for the prevalence and size of retirement bonuses in IPS, I compiled information from the survey of district contracts I conducted. For each year of each contract

³²Instead of a bonus that is available to all employees at any point they retire, some districts offer a bonus only if teachers retire in the first year they are eligible. Since this is directly meant to incentivize retirement as early as possible, I call this an early retirement incentive. Just five districts mention early retirement incentives in their contracts.

³³Of districts that offered retirement bonuses in 2003 and 2004, 25, 25 and 20 percent required 10, 15 and 20 years of experience with the district. Another 20 percent had no experience requirement and the remaining district's required level of experience for retirement bonus eligibility are spread between 5 and 30 years.

³⁴Sometimes, the contract language specifies the retirement bonus in terms of a percentage increase. Others, it specifies the retirement bonus in dollar terms.

in the sample, information on the size, type and availability of retirement bonuses was coded. I combine information on the size of the retirement bonus with information on the maximum scheduled salary for MA degree teachers in the district that year to obtain a measure of the dollar value of and relative size of retirement bonuses across districts.

In Panel A of Figure 6, I present information on retirement bonuses reported by districts. The shaded bars plot the distribution of retirement bonuses in the years before the pension reform policy. (Observations are at the district-year level.) 46 percent of district contracts in pre-policy period specifically mention a retirement bonus. In Column 1 of Table 3, I present additional information about these retirement bonuses offered in the pre-policy period. 59 percent of retirement bonuses were one-year bonuses, 34 percent were two-year retirement bonuses and the remaining were paid over the course of 3 to 5 years. Of those that mention a retirement bonus, 20 percent retirement bonuses are the most common (at 38 percent of bonuses). Of the retirement bonuses that were exactly 20 percent, 59 percent were paid only in the last year of employment. Another 35 percent offered 20 percent retirement bonuses in each of the last two years of employment and the remaining were paid over the course of 3 to 5 years. In other words, before the pension reform policy, specifically offering a 20 percent retirement bonus in the year of retirement was the most common form of retirement bonus found specified in the contracts (23 percent of retirement bonuses), followed by a two-year 20 percent retirement bonus (13 percent of retirement bonuses).

As might be expected, districts that specified a 20 percent retirement bonus in their contracts are much more likely to have teachers whose earnings increases from year to year are 20 percent. In Panel A of Figure 7, I present the distribution of earnings increases from t to $t+1$ for teachers in districts where the contract in the pre-pension reform policy period specifically mentions a 20 percent retirement bonus. Shaded bars plot the distribution of earnings increases for teachers not in the pension benefit calculation window and the dark outlined bars present the distribution for those teachers in the pension benefit window. The distributions plotted in Panel B of Figure 7 are analogous, except that they represent distributions of earnings increases for teachers in districts that did not offer 20 percent retirement bonuses in their contracts. As is clear from the figure, teachers in the retirement benefit calculation window are much more likely to receive earnings increases of or around 20 percent if they are employed in a district whose contract specifies a 20 percent retirement bonus.

This descriptive evidence in column 1 of Table 3 from the contract language makes clear that retirement bonuses play a significant role in pension-spiking in IPS. Of interest is how the size and timing of these bonuses changed after the pension reform policy was put in place. The bars in Panel A of Figure 6 outlined in black and information in Column 2 of Table 3 report information about the retirement bonuses in contracts after the pension policy reform is implemented. After the pension reform policy the fraction of district-year observations in which the contract mentions a bonus is 57 percent, an increase of 22 percent from the pre-policy period. As can be seen in the figure, there is a clear shift in the distribution of retirement bonuses. Retirement bonuses of 6 percent comprise 73 percent of all bonuses in the post-pension reform policy period. Some of the increased probability of offering a six percent retirement bonus stems from decreases in the use of large bonuses (10, 15 and 20

percent). Some of it also comes from decreases in the probability of not offering a retirement bonus at all. As such, though there is a shift in the distribution of total retirement bonuses (paid over all years) there is little change in the average total retirement bonus (see Figure 6, Panel C).

The information in Column 2 of Table 3 sheds more light on how retirement bonuses were redistributed in the post-policy years. Namely, the timing of retirement bonuses shifts from mostly being paid over one (59 percent) and two (34 percent) years before retirement towards a setting where the most common number of years of payment is 4 (47 percent). This is driven mostly by an increase in the use of six percent increases paid over the four year period. 44 percent of all retirement bonuses in the post-policy period involve a 6 percent earnings increase in each of the final four years of employment.

There are a couple of other dimensions along which a district's offer of a retirement bonus may have changed with the pension reform policy. The first is that districts may have become generally more restrictive about who is eligible to receive a retirement bonus, perhaps placing caps on the number of teachers eligible. However, this does not seem to be the case since in none of the contracts after the policy was implemented were caps placed on the number of teachers who would qualify. The second is that there may have been a shift in the requirements placed on the amount of experience within the district required to be eligible. In Panel B of Figure 6, I plot histograms of the distributions of the years of service required to be eligible for a retirement bonus in pre-policy (shaded bars) and post-policy periods (bars with dark outlines). There is little change to this requirement.

The information in panels C and D of Figure 7 indicates that having a 6 percent retirement bonus written into the district contract is highly correlated with the prevalence of 6 percent earnings increases for teachers in the retirement benefit calculation window. These panels present distributions similar to those in Panels A and B of Figure 7, but use information on teachers in the post-pension reform policy period and present distributions separately for teachers in districts that specify 6 percent retirement bonuses versus those that do not. In districts that specify 6 percent retirement bonuses, there is a clear bunching of earnings increases at 6 percent for teachers in the retirement benefit calculation window. The evidence in Figure 7 therefore suggests that retirement bonuses play a major role in the pension-spiking behavior of districts.

The other mechanism through which total earnings may have decreased post-pension reform policy is through a change to the pay for or assignment of extracurricular activities. These duties involve teachers spending extra time at school and might include activities like summer school, detention, coaching, yearbook, etc. As with any form of earnings that counts for the pension, the value to the teacher of the pay for extracurricular duty assignments increases if she is in a year of employment where her earnings will count for pension benefit calculation. Because of this, teachers with more experience may use their seniority to obtain extracurricular activity assignments. Once the pension reform policy is implemented, and districts have to pay the full costs of earnings increases above six percent, they may not be willing to assign these tasks in the same manner as previously.³⁵ Unfortunately, to my

knowledge, information on the assignment of these activities does not exist for IPS, making it difficult for me to determine how big a role they play in pension-spiking.

Which Districts Were Most Likely to Be Pension-Spiking Teacher Earnings?

Different types of districts may find it more or less advantageous to engage in pension-spiking. Understanding which districts engage in pension-spiking as described here is important because taxpayers in districts that give their teachers large earnings in the face of this intergovernmental incentive are free-riding off of taxpayers in districts that do not.³⁶ For example, wealthier districts may have an easier time offering their teachers end-of-career bonuses because they have more resources than poorer districts. On the other hand, low-income districts may use the end-of-career bonus increases to reward teachers who may have accepted lower pay while working in a relatively poor district. Evaluation of the welfare effects of the intergovernmental incentive depends in part on which districts are free-riding off of other districts.

In Table 4, I report the results of an exercise to determine which districts engage in free-riding. Specifically, I regress earnings outcomes of interest on individual worker characteristics and school district characteristics using data from 2003. To see if certain types of districts are engaging in free-riding by increasing earnings among those close to retirement, I interact the district characteristics with a measure of whether a teacher is within the retirement benefit calculation window. Because I also control for age and experience fixed effects, the results are able to tell us whether certain types of districts are more likely to give end-of-career earnings increases to teachers nearing retirement than they are to similarly aged and experienced teachers who are less likely to be near retirement.

I use three dummy variable outcome measures of earnings back-loading: (i) the teacher's earnings increases by more than 20 percent, (ii) the percent change in teacher's earnings from t to $t+1$, and (iii) the teacher's earnings in $t+1$. The estimates in the first row of Table 4 show that teachers in the retirement benefit calculation window are 2 percentage points more likely to get earnings increases of at least 20 percent, and have earnings increases that are around 0.6 percent and about 450 dollars higher than their counterparts who are not in the window for retirement benefit calculation.

Low-income districts give lower raises to their teachers and are less likely to give teachers earnings increases of at least 20 percent (row 2). Also, districts with more low-income students are less likely than their counterparts with fewer low-income students to give bonuses to teachers in the retirement benefit calculation window. For example, a one standard deviation increase in the percent of students who are low-income is associated with a 0.3 percentage point decrease in the probability of a teacher who is in the retirement

³⁵A close read of the contracts suggests that, after the pension reform policy, districts were increasingly careful about allowing the use of extracurricular assignments to increase end-of-career earnings such that they were forced to pay fees to the pension fund.

³⁶Rather than the tax-payers free-riding, it may be the district administrators who are free-riding off the state. For example, if district administrators see pension-spiking as a relatively low-cost way to appease a politically active teachers' union and district funding decisions are not salient to taxpayers, then it would be the district administrators free-riding off of the state pension fund, rather than the district taxpayers.

benefit calculation window receiving a 20 percent earnings increase. This suggests that, on average, high-income districts are free-riding off of low-income districts in this setting.

Teachers who are in the retirement benefit calculation window may put pressure on a district to offer end-of-career bonuses. Districts with more teachers in the retirement eligibility window are less likely to give teachers who are not in the retirement eligibility window 20 percent earnings increases and the earnings increases they do give are smaller than in districts with fewer such experienced teachers (row 3). However, districts with more teachers in the retirement eligibility window are also less likely to engage in pension-spiking than districts with less experienced staff (row 6). Perhaps the increased costs of paying for pension-spiking when a district has a lot of eligible teachers outweighs the efforts of the senior teachers to place pressure on the district to pension-spike.

Finally, Illinois is one of the few states where teachers in different districts are represented by each of the two main national teachers' union organizations, the American Federation of Teachers and the National Educators Association. If the unions, or their members, have different stances on pension-spiking and the back loading of pay, then it might be the case that the districts represented by different unions will be differentially likely to engage in pension-spiking. I explore this possibility in Table 4. Teachers in districts whose members are represented by the AFT are more likely than those whose members are represented by the NEA to receive higher earnings and earnings increases in the years of their careers before they reach the retirement benefit calculation window (row 4). However, teachers in districts represented by the two unions are equally likely to receive earnings increases of 20 percent and have similar earnings in the retirement benefit calculation window (row 7).

In Appendix Table 2, I present results using the same regressions on data from 2009–2012 to determine which types of districts are pension-spiking in the era after the pension reform. The results in Appendix Table 2 display a similar pattern as those in Table 4, with two exceptions. First, teachers in the retirement eligibility window are no longer any more likely to receive pay increases of 20 percent or more than those outside the retirement eligibility window. This is consistent with the budget constraint illustration and the difference-in-difference results presented earlier. Second, the differences across teachers represented by the two unions are more muted than they were before pension reform. Notably, the pattern of results suggests that teachers in the poorer districts are getting lower end-of-career salary increases than those in wealthier districts. This pattern also holds if the dependent variable is the probability of teachers receiving an earnings increase of 6 percent.³⁷ Therefore, the pattern of free-riding has not changed much – it is still the wealthier districts free-riding off of the low-income districts.

V. Conclusion

In this paper, I have shown that the intergovernmental incentives embedded in the structure of earnings decisions lead to large end-of-career increases in earnings that are unlikely to be related to worker productivity. This behavior, known as pension-spiking, is costly. I use the

³⁷These results are not in the table, but are available from the author upon request.

estimates of earnings for near-retirement teachers before the policy was in effect (Table 2) and counts of the number of teachers in each eligibility category in the data in 2004 and find that pension-spiking costs the Illinois TRS pension fund \$115 million per year.

A state-level pension reform policy aimed at limiting the use of large end-of-career earnings increases for public school teachers in Illinois served to change the distribution of earnings over teachers' careers without changing total compensation. The policy was ineffective at lowering those costs because districts were able to shift the timing of earnings increases in such a way that teachers continued to receive the same overall amount spread over more years, which prevented the districts from having to pay any extra to the pension fund. To be effective, future efforts aimed at limiting costs to the pension fund resulting from end-of-career increases will have to more carefully consider the design of policy around the intergovernmental incentive structure inherent in the public sector pension setting. One possibility might be to limit districts' ability to offer bonuses tied explicitly to the promise of retirement, or to remove these bonuses from the definition of earnings that is used in calculating the pension benefit. Another might be to place limits on the increases in pay over the entire retirement benefit calculation window rather than just using annual limits. A final, more straightforward possibility, might be to base pensions on total salary paid throughout one's career, as opposed to using final average salary. Since, in many states, employees and districts make contributions to the pension fund based on annual earnings, this would more closely align the contributions to and payouts from the pension fund.

This work contributes to our knowledge by being among the first to clearly document pension-spiking using administrative data on public school teachers. Further, it is the first work to examine the effectiveness of a policy designed to limit the use of pension-spiking and, by providing evidence that the policy was not effective, offers important insight for policymakers whose goal is to lower pension costs. However, the current study is limited in what it contributes to our understanding by the limited nature of the data. Our knowledge of pension-spiking and the driving factors behind pension costs would benefit from more detailed information about teacher earnings, including more specific information about earnings from different sources (bonuses, extracurricular pay, etc.). With such data, future work might be able to provide better evidence about the trade-offs between alternative sources of teacher compensation and thereby allow for more efficient, productivity-enhancing pay structures for teachers than are currently in place.

Data Appendix

In Section III, I describe the data collected and used in the analyses. Here, I describe the sample selection choices in more detail. Although I have information on all employees of IPS, the collective bargaining process may be different for administrators and staff who may have their separate unions or may not even be unionized, so I limit the sample to teachers. Because teacher earnings in the first few years of employment are much more variable than that in later years, I only include teachers with at least five years of experience. Chicago Public Schools (CPS) participates in a separate pension system, so I exclude teachers of CPS from the analysis.³⁸ I also omit the 1.8 percent of teachers from employers without negotiated contracts (e.g. preschools, regional boards of education, prisons, etc.). Some of

the outcome variables measure teacher earnings changes between one school year and the next, so, even though the data are available through 2012, I include only those teachers between 2003 and 2011 in the analysis sample.³⁹ Part-time teachers will have more variable earnings from one year to the next, so I do not include the 3 percent of teachers who are part-time. I also omit the 0.3 percent of teachers whose earnings in year t+1 are recorded as zero, since this is likely a data recording error.

Appendix Table 1

District Characteristics in 2005, by Survey Response

	(1)	(2)	(3)
Survey Response	Yes	No	P-value of Difference
Fraction of Teachers within 4 years of Full Retirement Eligibility	0.39	0.36	0.191
Fraction of Teachers that Receive 6% Earnings Increase	0.06	0.06	0.861
Fraction of Teachers that Receive 20% Earnings Increase	0.32	0.34	0.517
Fraction of Teachers within 4 years of Full Retirement Eligibility who Receive 6% Earnings Increases	0.10	0.09	0.229
Fraction of Teachers within 4 years of Full Retirement Eligibility who Receive 20% Earnings Increases	0.02	0.02	0.834
Fraction Male	0.31	0.28	0.809
Fraction Non-white	0.07	0.06	0.563
Average Total Earnings (\$1,000)	56.26	54.03	0.029**
Average Teacher Experience	17.59	17.73	0.838
Fraction with an MA	0.54	0.48	0.000***
Fraction in Leadership Positions	0.06	0.07	0.318
Percent of Students who are Low-Income (standardized)	23.59	28.99	0.097*
Total Enrollment of Students	2331	1412	0.000***
Number of Districts	302	574	

Note: Average district characteristics based for districts based on whether they provided contracts for any year between 2003 and 2011. Column 3 presents the p-value of the t-statistic from a regression of a dummy variable indicating response on the characteristic indicated in the row header.

Appendix Table 2

Relationship between District Characteristics and End-of-Career Earnings Increases, by Whether an Teacher is Near Retirement, Post-Policy

Dependent Variable:	Change from t to t+1 >= 20%			% Change in Earnings, t to +1			Total Earnings t+1		
Within in Retirement Benefit Calculation Window	0.003 (0.002)	0.004* (0.002)	0.003 (0.002)	0.431*** (0.078)	0.464*** (0.077)	0.462*** (0.079)	346.980*** (73.762)	381.001*** (72.543)	378.590*** (74.483)

³⁸The fact that Chicago is responsible for setting both the size of employees' earnings and the costs of the resulting pensions means there is no intergovernmental distortion and the pension reform policy is unlikely to have any direct effect. Additionally, the data on age provided by the Chicago Teachers Pension Fund was unreliable, making it difficult to conduct analyses similar to the ones for teachers in TRS.

³⁹One might worry that the inclusion of the years covering the Great Recession would significantly bias the estimates. To be sure the Great Recession is not driving the estimated effects of the pension reform policy, I have estimated its effects using only the years prior to 2008. The conclusions are qualitatively similar to those presented and results are available upon request.

Dependent Variable:	Change from t to t+1 >= 20%	% Change in Earnings, t to +1	Total Earnings t+1
% of the Students that are Low-Income	-0.006*** (0.000)	-0.339*** (0.016)	-291.098*** (14.770)
% of Teachers in Retirement Benefit Calculation Window	-0.005*** (0.000)	-0.073*** (0.017)	-122.567*** (15.589)
Teachers are Members of AFT (rather than NEA)	0.002* (0.001)	0.054 (0.035)	85.337*** (32.955)
<u>Interaction Between Being within 4 Years of Retirement Eligibility and:</u>			
% of the Students that are Low-Income	-0.004*** (0.001)	-0.175*** (0.031)	-241.949*** (28.817)
% of Teachers in Retirement Benefit Calculation Window	-0.003*** (0.001)	-0.154*** (0.031)	-155.559*** (28.740)
Teachers are Members of AFT (rather than NEA)	0.001 (0.002)	-0.068 (0.073)	-98.242 (68.280)

Note: Based on the author's calculations using the TSR, TRS, TSS and Illinois State Report Card Data from 2009 and 2004. Each column presents results from a regression of the outcome indicated by the column header on individual teacher characteristics including position, educational attainment, gender, race, earnings and experience and age fixed effects, as well as the other measures indicated in the table. The variables measuring the percent of students in a district who are low-income and the percent of teachers in retirement benefit calculation window have been standardized to have mean zero and standard deviation of one. The dummy variable measuring a teacher's being within the retirement benefit calculation window measures whether a teacher's age and years of service are such that she is within four years of eligibility for retirement with an undiscounted annuity. Standard errors are in parentheses. ***, **, and * represent coefficient estimates that are statistically significant at the one, five and ten percent levels, respectively.

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Pension-Spiking, Free-Riding, and the Effects of Pension Reform on Teachers' Earnings

- The intergovernmental funding structure of local public school teacher pension systems leads there to be a disconnect between the cost of local employee earnings to the district and the total cost of those earnings to the pension fund.
- This intergovernmental incentive encourages pension-spiking.
- Pension-spiking of teacher earnings in public schools is a costly practice, resulting in \$115 million in annual costs to the pension fund in Illinois.
- A policy aimed at saving the pension fund money by ending the practice of pension-spiking for public school teachers was ineffective due to poor policy design.

Figure 1. Budget Constraint of Hypothetical District Choosing between Pay Increases for Teachers within and outside of the Retirement Benefit Calculation Window

Note: The figure depicts budget constraints of a district with two teachers who have the same amounts of experience and salary, but one is a year younger than the other and therefore is just outside the retirement benefit calculation window. The district is considering raising current pay and has enough money to raise the pay of one teacher by ΔY percent. Along the vertical axis is the increase in lifetime income of the younger teacher (who is outside the retirement benefit calculation window) and the horizontal axis measures the increase in lifetime income of the older teacher (who is within the retirement benefit calculation window). The setting without any pension incentives at all is illustrated by the solid grey line. The district's budget constraint in the period before 2005 is illustrated by the dashed black line. The solid black line traces out the budget constraint under the pension reform policy. $\alpha > 1$ represents the change in lifetime income with an increase of \$1 of current income in the retirement window.

Figure 2. Schedule of Contract Negotiation Timing as of the 2004–2005 School-Year

Notes: Based on the author's calculations using the Illinois Teacher Service Record in 2005–2010 in conjunction with the Teacher Salary Study from 2005. Contract negotiation timing is as reported by districts in the fall of the 2004–2005 school-year, i.e. the school-year before the pension reform policy was introduced. Contracts scheduled to be negotiated between June 1 and August 30 of 2005 are assumed to take effect for earnings beginning in the 2005–2006 school year. Contracts scheduled to be negotiated between September 1 and August 30 of later school-years are assumed to take effect in the subsequent school-year. The bars in the graph present the fraction of districts in 2005 that report expected contract renegotiation in the school year on the horizontal axis. The cumulative percent of teachers bound by the policy is the percent of teacher observations in an indicated school-year that work in a district that was scheduled to have renegotiated its contract in time for the pension reform policy to be applicable.

Panel A.

Panel B.

Figure 3. Distribution of Earnings Increases for Teachers by Whether Teachers are Within the Window for Retirement Benefit Calculation

Panel A. 2003 and 2004 School Years

Panel B. First Post-Policy Treated School Year

Note: Based on the author's calculations using the Illinois Teacher Service Record, 2003 to 2008. Histograms are of percentage changes in earnings for teachers in the indicated group in the given time period. Earnings changes have been top- and bottom-coded at 20 and -20, respectively

Panel A.

Panel B.

Panel C.

Figure 4. Event-Study-Style Estimates of Pension Reform Policy's Effects on Earnings Panel A. Probability Change in Earnings from t to $t+1$ is Equal to Six PercentPanel B. Total Earnings in $t+1$ Panel C. Probability Change in Earnings from t to $t+1$ is at Least Twenty Percent

Note: Based on the author's calculations using the Teacher Service Record for teachers between 2003 and 2011. Solid lines trace out coefficient estimates of equation (1) with distributed leads and lags in time relative to treatment rather than a single dichotomous variable for policy implementation. Teacher characteristics, school-year-by-district-by-experience and school-year-by-district-by-age fixed effects are also included.

Figure 5. Estimated Effects of the Pension Reform Policy across the Distribution of Earnings Increases

Note: Based on author's calculations using the Illinois Teacher Service Record from 2003 to 2011. Each point presents difference-in-difference estimates of equation (1) for the policy's effect on the probability of receiving an earnings increase equal to the percent indicated on the horizontal axis. Teacher characteristics, school-year-by-district-by-experience and school-year-by-district-by-age fixed effects are also included. Standard errors are clustered at the district level and the dotted lines trace the 95 percent confidence intervals.

Panel A.

Panel B.

Panel C.

Figure 6. Characteristics of Retirement Bonuses before and After the Pension Reform Policy

Panel A. Distribution of Retirement Bonus Size (in one year)

Panel B. Distribution of Years of Service Required to be Eligible for a Retirement Bonus

Panel C. Distribution of Total Retirement Bonus Size (over all years of bonus)

Note: Based on the authors' survey of school district contracts as described in the text.

Panel A.

Panel B.

Panel C.

Panel D.

Figure 7. Distribution of Earnings Increases for Teachers, by Whether Teachers are Within the Window for Retirement Benefit Calculation and the Size of the Retirement Bonus Offered by District

Panel A. Retirement Bonus in District is Exactly Equal to 20 Percent Earnings Increase, Pre-Pension Reform Period

Panel B. Retirement Bonus in District is Not Exactly Equal to 20 Percent Earnings Increase, Pre-Pension Reform Period

Panel C. Retirement Bonus in District is Exactly Equal to 6 Percent Earnings Increase, Post-Pension Reform Period

Panel D. Retirement Bonus in District is Not Exactly Equal to 6 Percent Earnings Increase, Post-Pension Reform Period

Note: Based on the authors' survey of school district contracts as described in the text and the TSR from 2003–2011.

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Table 1

Characteristics of Teachers in Illinois Public Schools, 2003–2011

	Mean	Standard Deviation	10th Percentile	90th Percentile
Panel A.				
Experience in IPS	15.72	8.53	6.00	29.00
Age	45.30	10.33	31.00	58.00
Non-white	0.17	0.37	0.00	1.00
Male	0.23	0.42	0.00	1.00
BA degree holders	0.38	0.49	0.00	1.00
MA degree holders	0.61	0.49	0.00	1.00
Panel B.				
Fraction in Retirement Benefit Calculation Window	0.23	0.42	0.00	1.00
Total Earnings	61,291	19,246	40,347	87,883
Change in total earnings from current year to next	3,442	5,572	27	7,856
Percent change in total earnings from current year to next	5.60	6.40	0.04	13.37
Number of observations	651,369			

Note: Based on author's calculations using the Illinois Teacher Service Record from 2003 to 2011.

Table 2

Difference-in-Difference Estimates of the Pension Reform Policy on Earnings Outcomes

Outcome		(1)
% Change in Earnings, t to +1	Treatment	0.54*** (0.14)
	Post X Treat	-0.13 (0.15)
Total Earnings t+1	Treatment	351.51*** (125.26)
	Post X Treat	-1.69 (142.13)
Change from t to t+1 < 6%	Treatment	-0.03*** (0.01)
	Post X Treat	-0.04*** (0.01)
Change from t to t+1 = 6%	Treatment	-0.00 (0.00)
	Post X Treat	0.07*** (0.01)
Change from t to t+1 > 6% and <20%	Treatment	0.01 (0.01)
	Post X Treat	-0.02 (0.01)
Change from t to t+1 >= 20%	Treatment	0.02*** (0.01)
	Post X Treat	-0.02** (0.01)
Number of Observations		651,369

Note: Based on author's calculations using the Illinois Teacher Service Record from 2003 to 2011. Each row and column set presents difference-in-difference estimates for the teachers in the years indicated when the dependent variable is as indicated by the row header. Teacher characteristics, school-year-by-district-by-experience and district-by-school-year-by-age fixed effects are also included. Standard errors are clustered at the district level and ***, **, and * indicate estimates statistically significant at the 1, 5, and 10 percent levels, respectively.

Table 3

Characteristics of Retirement Bonuses in Illinois Public Schools

	Pre-Policy	Post-Policy
Percent of Districts Offering Retirement Bonus	46.37	56.85
<u>Percent of Retirement Bonuses that Cover:</u>		
1 Year	59.36	17.66
2 Years	33.74	14.54
3 Years	4.87	15.38
4 Years	1.42	47.27
5 or more Years	0.61	5.15
Percent of Offered Retirement Bonuses that Are 20 Percent	38.11	7.97
<u>Percent of 20 Percent Retirement Bonuses that Cover:</u>		
1 Year	59.26	58.74
2 Years	34.61	34.62
3 Years	3.12	3.15
4 Years	1.51	1.75
5 or more Years	1.51	1.75
Percent of Offered Retirement Bonuses that Are 6 Percent	0.65	72.81
<u>Percent of 6 Percent Retirement Bonuses that Cover:</u>		
1 Year	0	5.2
2 Years	0	9.22
3 Years	35.29	18.02
4 Years	64.71	60.98
5 or more Years	0	6.58

Note: Based on the authors' survey of school district contracts as described in the text.

Table 4
Relationship between District Characteristics and End-of-Career Earnings Increases, by Whether an Teacher is Near Retirement

Dependent Variable:	Change from t to t+1 >= 20%		% Change in Earnings, t to +1		Total Earnings t+1
Within in Retirement Benefit Calculation Window	0.018*** (0.004)	0.019*** (0.004)	0.627*** (0.103)	0.646*** (0.105)	462.670*** (85.946)
% of the Students that are Low-Income	-0.003*** (0.001)	-0.003*** (0.001)	-0.208*** (0.022)	-0.208*** (0.022)	-154.703*** (18.289)
% of Teachers in Retirement Benefit Calculation Window		-0.003*** (0.001)	-0.123*** (0.021)		-64.197*** (17.510)
Teachers are Members of AFT (rather than NEA)		0.016*** (0.002)		0.395*** (0.049)	193.475*** (41.411)
<u>Interaction Between Being within 4 Years of Retirement Eligibility and:</u>					
% of the Students that are Low-Income	-0.003** (0.002)		-0.067* (0.040)		-90.043*** (33.538)
% of Teachers in Retirement Benefit Calculation Window		-0.004** (0.002)	-0.147*** (0.039)		-167.671*** (32.697)
Teachers are Members of AFT (rather than NEA)		-0.014*** (0.004)		-0.141 (0.095)	-211.561*** (79.840)

Note: Based on the author's calculations using the TSR, TRS, TSS and Illinois State Report Card Data from 2003 and 2004. Each column presents results from a regression of the outcome indicated by the column header on individual teacher characteristics including position, educational attainment, gender, race, earnings and experience and age fixed effects, as well as the other measures indicated in the table. The variables measuring the percent of students in a district who are low-income and the percent of teachers in retirement benefit calculation window have been standardized to have mean zero and standard deviation of one. The dummy variable measuring a teacher's being within the retirement benefit calculation window measures whether a teacher's age and years of service are such that she is within four years of eligibility for retirement with an undiscounted annuity. Standard errors are in parentheses. ***, **, and * represent coefficient estimates that are statistically significant at the one, five and ten percent levels, respectively.