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Abstract

This study examines whether pension cuts affecting current public employees encourage mid-career teachers and civil servants to separate from their employers. The analysis takes advantage of a 2005 reform to the Employees' Retirement System of Rhode Island (ERSRI) that dramatically reduced the generosity of benefits for current workers. Importantly, the cuts applied only to ERSRI members who had not vested by June 30, 2005. Vested ERSRI members and municipal government employees in Rhode Island were unaffected. This sharp difference in benefit generosity permits a triple-differences research design in which non-vested ERSRI members are compared, before and after the reform, to vested members and to all members of the Municipal Employees' Retirement System of Rhode Island. The results show that the pension cut caused a 2.4-percentage-point increase in the rate of separation, implying an elasticity of labor supply with respect to pension benefits of around 0.25. Rhode Island teachers were significantly less responsive to the benefit cut than other occupations, in line with an existing literature on teacher labor supply, suggesting that the results from that literature may not generalize to the broader workforce.

Introduction

One-third of state and local defined benefit pensions are so financially troubled that government sponsors may soon need to reduce the benefits promised to current employees (Aubry, Crawford, and Wandrei 2018). Until recently, public pension reforms rarely affected current workers, since state constitutions and statutes traditionally entitle future retirees to the pension formula in place on their date of hire (Monahan 2010; and Munnell and Quinby 2012). Cuts for current workers became more common after the 2008 financial crisis, when courts around the country judged that pensions were crowding out vital government services like K-12 education and police protection (Cloud 2011; and Monahan 2017).[1] Since then, 17 states have reduced the post-retirement cost-of-living adjustments (COLA) earned by current workers, and cuts to promised annuity payments have been successfully legislated in two states and are under discussion in two more (Munnell et al. 2016).[2] Will these pension cuts for current state and local government employees encourage mid-career workers to leave for the private sector?

This project takes advantage of a 2005 reform to the Employees' Retirement System of Rhode Island (ERSRI) that extended the normal retirement age (NRA), reduced the annual pension benefit, and limited post-retirement COLAs for current public school teachers and state government employees. Most teachers and state employees also lost access to subsidized retiree health insurance before age 65. Importantly, the cuts applied only to ERSRI members who had not vested by June 30, 2005 (had fewer than 10 years of government service on that date). Vested ERSRI members and municipal government employees in Rhode Island were unaffected. This sharp difference in the generosity of benefits, based on tenure at a specific date, permits a triple-differences research design in which non-vested members of ERSRI are compared, before and after the reform, to vested members and to all members of the Municipal Employees' Retirement System (MERS).

Although Rhode Island is a small state, it is an excellent setting for the analysis. The state government was the first to enact major pension cuts for current workers, and the depth and breadth of its pension reforms created multiple natural experiments, where otherwise similar

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[1] Over the course of several court cases, a consensus view has also emerged that COLAs are less protected by state statutes than the core benefits described by plan documents when the employee was hired (Reinke 2011).
[2] Rhode Island cut core benefits for current workers in 2005, 2009, and 2011; Ohio followed suit in 2012. Similar reforms are being discussed in Kentucky and Colorado. Several municipalities are also considering similar measures or have already enacted them (most famously Detroit following its 2013 bankruptcy).

workers suddenly received different retirement benefits. Practically, ERSRI provided the personnel records of all members of ERSRI and MERS (except police officers and firefighters) between 2003 and 2017. Moreover, its public workforce is representative of state and local governments across the country, so that lessons learned in Rhode Island might translate to future pension reforms in other settings.[3]

The results show that the pension cut caused an immediate 2.4-percentage-point increase in the rate of separation, corresponding to a 12-percent increase in the baseline separation rate. Consistent with expectations and past literature (Koedel and Xiang 2017), teachers in Rhode Island were less responsive to the benefit cut than other occupations. Whereas general state employees were 4 percentage points more likely to separate due to the pension cut (a 19-percent increase in the baseline rate), teachers were only 1.7 percentage points more likely to separate (a 9-percent increase), and the difference between teachers and general state employees is statistically significant. This finding suggests that teachers' labor responses to benefit cuts may not generalize to other state and local occupations, although it could also reflect differences in treatment intensity across occupations.[4]

Nevertheless, the labor supply of public employees in Rhode Island is inelastic relative to the magnitude of the pension cuts. In 2005, Rhode Island's actuaries predicted that the reform would reduce the present value of future pension benefits for active members by $243 million (ERSRI Actuarial Valuation Report 2004). For a typical non-vested member of ERSRI, this change decreased pension wealth by 48 percent. Hence, the results imply an elasticity of labor supply with regard to pension wealth of around 0.25, which is consistent with a large literature on the wage elasticity of labor supply, but is somewhat higher than the elasticity found by a growing literature on teacher pensions.[5] The 2005 reform of ERSRI caused a large increase in separation, despite this small elasticity, because the benefit cut was also considerable. This increase in separation likely reflects a combination of income and substitution effects, as well as new information about Rhode Island's capacity to pay promised pensions, and feelings of spite.

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[3] This point will be discussed further in the background section.

[4] In particular, the loss of subsidized retiree health insurance disproportionately affected state government employees relative to teachers, although the present discounted value of the lost health benefit lost was small relative to the lost pension benefits.

[5] Chetty et al. (2011) and Peterman (2016) survey the literature on wage elasticities and place most estimates around 0.3. Fitzpatrick (2015) and Koedel and Xiang (2017) suggest that teachers are much less responsive to their pensions than to wages. The next section will review the teacher studies in detail.

Although the analysis does not find evidence in favor of large income effects, the complexity of these mechanisms – and potential interplays between them – make it difficult to draw firm conclusions.

Overall, this research suggests that sponsors of financially troubled pension systems must weigh the budgetary gains of benefit cuts against the costs of increased separation. Conceptually, workers who leave their jobs impose two types of costs on employers (Ronfeldt, Loeb, and Wyckoff 2013). First, employers must directly expend financial resources to recruit, hire, and train replacements. Although attempts to quantify these direct costs produce widely differing estimates depending on the employer studied and the research methodology, estimates in the state and local sectors generally fall between $4,000 and $18,000 per employee.[6] Assuming that government employers in Rhode Island expended a similar amount for each separated employee, the 2005 pension cut caused a one-time increase in direct turnover costs of between $1.8 million and $8.1 million – small in magnitude relative to the pension savings. Second, separation may hurt the quality of public services if new hires are less skilled than those who leave. In Rhode Island, where government salaries do not appear to have increased to compensate for lost pension benefits, the concern is that highly skilled employees – such as teachers, nurses, and lawyers – may have selected out of public service and chosen careers in the local private sector or the public sectors in neighboring states.[7] This concern is particularly relevant given the magnitude of Rhode Island's pension cut. While the impact of the loss of more skilled workers is difficult to measure, it may be the larger cost associated with pension cuts.

The remainder of this paper proceeds as follows. The next section provides an overview of related literature. The third section describes Rhode Island's history of pension reforms and

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[6] Two studies of K-12 education place the direct costs between $4,000 and $18,000 per separating teacher, with large urban districts experiencing higher costs (Barnes, Crowe, and Schaefer 2007; and Watlington et al. 2010). Graef and Hill (2000) estimate the cost of replacing a child protective services worker at $10,000. Meanwhile, four studies of registered nurses estimate costs ranging from $24,000 to $67,000 per nurse (Jones 2005; Nursing Solutions Inc. 2016; The Lewin Group, Inc. 2009; and Waldman et al. 2004).

[7] See, for example, Bacolod (2007); Corcoran, Evans, and Schwab (2004); Figlio (1997); and Nagler, Piopiunik, and West (2015). Separation could also reduce staff cohesion and community, with adverse effects on agency performance (Bryk and Schneider 2003; and Johnson, Harrison, and Donaldson 2005). A large body of literature in the public and private sectors finds that organizations with high turnover also have lower productivity (see Hausknecht and Trevor 2011; and Park and Shaw 2012 for a review of this literature). However, one should be cautious when assigning a causal interpretation to the negative correlation because of reverse causality: unproductive organizations could suffer from systemic human resource problems that cause the high turnover.

details the natural experiment that occurred in 2005. The fourth section introduces the data and empirical methodology. The fifth section presents empirical results. The final section concludes that governments contemplating pension cuts should be prepared for disruptions to their workforce.

Literature Review

Despite the increasing likelihood of pension reforms for current public sector workers, how benefit cuts affect employment decisions has so far been unanswered. Most studies of the public sector labor market focus on older workers' decisions to retire, with a particular emphasis on K-12 teachers. These studies rely either on structural models relating the probability of retirement to the pension accrual formula (Costrell and Podgursky 2009; Koedel et al. 2013; Kong et al. 2018; Ni and Podgursky 2017) or on natural experiments when benefits were suddenly enhanced during the 1990s (Brown 2013; and Fitzpatrick and Lovenheim 2014). Like similar literatures on private sector pensions and Social Security, these analyses find that retirement spikes around the ages that teachers become eligible for normal and early retirement.[8]

Yet, 60 percent of state and local government employees were under age 50 in 2017, and therefore excluded from this growing literature on retirement (U.S. Census Bureau 2017a). Pension cuts should make working for the government a less attractive option relative to other employment, encouraging some mid-career employees to leave for the private sector. The magnitude of this outflow is not obvious, since workers may heavily discount future benefits and thus not be very responsive to cuts that will affect them far in the future (as implied by Fitzpatrick 2015).

To date, the most consistent predictions about how mid-career workers will likely respond to benefit cuts come from structural models that simulate behavior and suggest that mid-career teachers would respond modestly to changes in retirement ages, benefit multipliers, and COLAs (Costrell and McGee 2010; and Knapp et al. 2016). But it is difficult to determine whether these estimates would play out in reality without exploiting a natural experiment and, to our knowledge, no one has taken this route. Koedel and Xiang (2017) examine a benefit

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[8] For example, see Behaghel and Blau (2012); Coile and Gruber (2007); and Stock and Wise (1990). Some evidence also suggests that older teachers may be more responsive to the normal and early retirement ages in their defined benefit pensions than to other plan parameters with similar effects on lifetime wealth. See, for example, Brown (2013) and Ni and Podgursky (2017).

enhancement for teachers in the 1990s and are unable to detect a change in retention for mid-career employees. Two considerations, however, suggest caution when extrapolating from this study to benefit cuts for public sector workers more broadly. First, loss-averse public employees may have a stronger reaction to cuts than to enhancements, particularly if they view pension reform as a harbinger of future compensation reductions. Second, the labor supply of K-12 teachers – who comprise only 30 percent of the state and local workforce nationwide – is likely to be less elastic than that of other public sector occupations because teachers have fewer private sector options and must often leave the state in order to switch pensions while remaining in education.[9] Looking beyond K-12 education, Goda, Jones, and Manchester (2017) explore how mid-career faculty and staff at a public university respond to a new defined contribution plan, but argue that this reform could have been viewed as a benefit enhancement, rather than a cut, because the new plan is portable across employers.[10]

Meanwhile, studies of private sector firms have long found a large negative correlation between the presence of fringe benefits and employee separations (see, for example, (Alan, Clark, and McDermed 1993; Dale-Olsen 2006; Frazis and Lowenstein 2013; Gustman and Steinmeier 1993; Madrian 1994; Mitchell 1982 and 1983; and Rabe 2007). However, much of this literature cannot fully account for the potential of workers with high quit propensities to sort into firms with fewer benefits. Looking beyond employer pensions, Gelber, Isen, and Song (2016) evaluate how older workers reacted to the Social Security "notch" – a similar reform to the Rhode Island pension cut, but in a very different national setting – and find an elasticity of labor force participation of 0.7.[11]

Background: A Natural Experiment in Rhode Island

Despite being a small state, Rhode Island hosts 41 defined benefit plans for public employees. K-12 teachers (who are employed by local school districts), general state government employees, nurses in state hospitals, and corrections officers each have their own

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[9] U.S. Census Bureau (2017b). Most teachers participate in large state-administered pensions that set benefit levels equally across all school districts (*Public Plans Database* 2017). A few large districts administer their own pensions, such as the Teachers' Pension and Retirement Fund of Chicago and the Teachers' Retirement System of the City of New York.

[10] A related strand of literature estimates how retention changes after governments implement a defined contribution plan for new hires only (Clark et al. 2016; and Quinby 2018).

[11] How the generosity of Social Security benefits affects labor supply has historically proven hard to pin down. See Feldstein and Liebman (2002) and Krueger and Meyer (2002) for detailed reviews of this literature.

plans within the Employees' Retirement System (ERSRI). Additionally, state police officers have their own system, and 117 local government units voluntarily participate in the state-administered Municipal Employees' Retirement System (MERS).[12] Rhode Island's larger cities and towns administer the remaining 34 plans (U.S. Census Bureau 2017c).[13] This study focuses on the two largest state-administered systems, ERSRI and MERS.[14] The members of these two retirement systems resemble their counterparts across the country. A simple comparison of the state and local sectors in Rhode Island with those in other states, based on the 2017 *Current Population Survey*, reveals similar demographic characteristics, although teachers make up a larger share, and minorities a smaller share, of the state and local government workforce in Rhode Island than in other states (see Table 1).[15]

Due to the chronic underfunding of ERSRI, Rhode Island has an unusual history of benefit reductions, even for current employees. The first set of cuts occurred in 2005 (Article 7 Sub. A), when ERSRI and MERS were 59 percent and 93 percent funded, respectively (*Public Plans Database* 2004). This legislation targeted ERSRI members who had not yet vested in the pension and did not yet have a claim to future benefits by extending the NRA, reducing the annual benefit, and cutting the COLA. The second set of cuts for current employees took place in 2009 (Article 7 Sub. B), extending the NRA and reducing the annual benefit of ERSRI members who had been unaffected by the prior reform in 2005, but who were not yet eligible to retire in 2009. Finally, in 2011, the Rhode Island Retirement Security Act (RIRSA) fundamentally altered the structure of benefits for all ERSRI and MERS members by dramatically cutting the defined benefit pension and adding a defined contribution component.

The remainder of this study focuses on the 2005 reform (Article 7 Sub. A). The Rhode Island state legislature passed this benefit cut in conjunction with the annual appropriations bill, which was signed by Governor Donald Carcieri on June 30, 2005.[16] Public employees learned about the reform during fiscal year 2005; the reform went into effect at the beginning of fiscal

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[12] Municipal Employees' Retirement System (2017).

[13] The local pensions often cover just police officers and firefighters, with other municipal employees participating in MERS.

[14] Within ERSRI, the study further focuses on teachers and general state employees because nurses and corrections officers comprise a small fraction of plan membership but receive slightly different pension benefits.

[15] Rhode Island's small land mass also sets it apart from other states and forces it to compete with Connecticut and Massachusetts. It is interesting to note, however, that many large public employers on the East Coast have pension funding difficulties as great as Rhode Island, including the states of Connecticut, Massachusetts, and New Jersey, as well as the cities of New York and Philadelphia (*Public Plans Database* 2017).

[16] The last day of fiscal year 2005.

year 2006. Hence, the proposed reform could have altered labor supply as early as 2005, with the full effects observed in 2006 after the reform passed and was fully communicated to ERSRI members.

The specifics of Article 7 Sub. A. (henceforth, the 2005 reform) are as follows: increased the NRA from 60 to 65; decreased the benefit multiplier; and reduced the COLA from 3 percent compounded to the CPI or less, commencing on the third anniversary of retirement.[17] Importantly, the benefit cuts applied only to teachers and state employees who were not yet vested in the pension system on June 30, 2005, meaning that they had fewer than 10 years of government tenure in Rhode Island. Vested teachers and state employees were unaffected by the reform, as were all members of the well-funded MERS.[18] These changes significantly reduced the present value of future benefits for the affected workers. In 2004, Rhode Island's actuaries reproduced their 2003 valuation report using the new benefit rules in order to recalculate the state government's contribution requirements in 2005.[19] The actuaries estimated a $251 million decrease in the present value of future retirement benefits for active members of ERSRI, but an $8 million increase in the present value of disability benefits, for a total savings of $243 million.[20]

To quantify the value of the lost pension from the employee's perspective, a simple projection can calculate the present discounted value of future benefits for a hypothetical non-vested member of ERSRI in 2005 under both pension regimes. Consistent with actual data from ERSRI, this hypothetical worker is assumed to have joined the government in 2001, at age 34, and will experience 5 percent nominal wage growth annually. If he stays in the government, the worker would work until age 60 and claim his benefits at the NRA (60 before the reform and 65 after).[21] The present discounted value of lifetime benefits is the sum of the stream of future

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[17] Appendix Table A1 details the benefit provisions of both ERSRI and MERS. Recall that defined benefit pensions calculate annual benefits as *Final Average Salary * Benefit Multiplier * Years of Tenure*.

[18] MERS members were always allowed to retire earlier than ERSRI members– at age 58 versus 60 – but received a lower stipend and were not guaranteed an equally generous COLA in retirement. See Appendix Table A1 for details.

[19] See ERSRI Actuarial Valuation Report (2004). Government sponsors contribute annually to the pension system in order to prefund future benefits. State contributions to Rhode Island's system are set two years in advance to facilitate budgeting.

[20] Before the reform, the unfunded liability in ERSRI was approximately $3.1 billion.

[21] An alternative scenario would allow the worker to continue earning a salary until his NRA. Although this assumption would attenuate the loss of retirement wealth due to the reform, it also forces the worker to forgo leisure or alternate employment that he could have previously enjoyed between ages 60 and 65.

payments, beginning at the claiming age, with upward adjustments for the COLA and downward adjustments for mortality and the discount rate.[22] Under these assumptions, the 2005 reform reduced the present value of future benefits by 48 percent. Assuming instead that the worker anticipates only a 10-year career in government, the 2005 reforms reduced his pension wealth by 44 percent. Either scenario reveals a substantial loss of benefits.

Although the 2005 reform did not make any changes to the state's retiree health insurance plan, eligibility for subsidized insurance was tied to the pension's NRA. Specifically, in 2005, Rhode Island maintained two retiree health programs for ERSRI members (State of RI Retiree Health Care Benefits Plan 2005). The first allowed retirees under age 65 and their spouses to access the state's health plan for active workers.[23] Although teachers were eligible to participate in this program, most received retiree health insurance directly from their school districts. The second program subsidized the insurance premiums of state government employees (not teachers) for the duration of retirement, with the amount of the subsidy dependent on current age and years of tenure in the government. Vested employees who separated without immediately receiving pension benefits had to wait until their NRA to access either of the state's retiree health insurance programs.[24] Hence, some employees affected by the pension reform also lost five years of subsidized insurance. Teachers fared better, on average, than their colleagues in state government and may display a smaller response to the pension reform.[25] However, even for state employees, the present discounted value (PDV) of five years of retiree health insurance, while substantial, is only 15 percent of the PDV of the pension cut. [26]

It is important to note that, besides the pension reform, workforce and compensation policies do not appear to have changed suddenly in 2005. In particular, one might be worried that general budgetary stress led the state government to reduce wages and benefits in a way that

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[22] Future benefits are discounted to 2005. The worker assumes that future inflation will follow the long-run assumption of the 2005 Social Security Trustees Report (2.8 percent), and discounts benefits by a nominal 5.8 percent (equal to the interest rate on the Social Security Trust Fund).

[23] The program's cut-off is age 65, when retirees were expected to go on Medicare. A minority of employees without Medicare coverage (mostly teachers) remained in the state health plan after age 65.

[24] A 2008 reform of the retiree health insurance program dramatically reduced the generosity of benefits.

[25] For example, the authors used school district websites, negotiated contracts, and actuarial valuation reports to investigate the 2018 eligibility criteria for retiree health insurance in Rhode Island's five largest school districts. Two districts link eligibility to the ERSRI NRA – one links it to the earlier of the ERSRI early and normal retirement ages, one does not link it to ERSRI, and one does not publish the information online.

[26] Based on the authors' calculations, the PDV of the pension cut (not including the implicit cut to health insurance) was around $153,000 for a worker with 25 years of tenure, while the PDV of the associated health insurance cut was around $24,000.

particularly hurt short-tenure employees, confounding the empirical analysis despite the presence of control groups. Indeed, the growth of total revenue slowed in the years leading up to pension reform, from 6.7 percent in fiscal year 2003 to 6.2 percent in 2004 and 4.9 percent in 2005. Nevertheless, neither wages nor workforce size show discontinuous changes around the time of the reform.[27] It seems more likely that the reform was a targeted attempt to reign in ERSRI's large unfunded liabilities. The next section describes the data and quasi-experimental strategy used to estimate the effect of these benefit cuts.

Data and Methodology

As mentioned previously, the 2005 pension reform reduced the benefits only for employees who had not yet vested on June 30, 2005. The empirical analysis exploits this sharp discontinuity in benefit levels, based on years of service, to compare the separation of affected employees to that of their unaffected but otherwise similar colleagues. ERSRI facilitated access to a detailed dataset of employment records for all ERSRI and MERS members between 2003 and 2017.[28] For each employee in each year, the records document: first and last name, employment status (active, inactive vested, or retired), employment status last year, date of hire, date of separation, date of benefit claiming (if applicable), pension plan name (ERSRI or MERS), employer, years of service, gender, birth year, broad occupation category, annual salary, and annual salary last year.[29]

The empirical analysis ultimately follows four cohorts of workers who were on the government payroll in 2003 and who choose each year after that whether to remain in their job. The treated group consists of ERSRI members whose tenure in 2003 disqualified them from vesting before 2005 – i.e. those with fewer than eight years of tenure in 2003.[30] The analysis compares these treated employees to three different control groups unaffected by the reforms: 1)

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[27] Specifically, median annual wage growth hovered around 5 percent from 2003 until the 2008 financial crisis. Wage growth is calculated from personnel records provided by ERSRI. It excludes individuals who have zero earnings in either the prior or the current year. The authors also looked for discontinuous changes at the 25th, 50th, and 75th percentiles of the annual distribution of wage growth and across those with low levels of tenure.
[28] ERSRI does not maintain personnel data prior to 2003.
[29] Unfortunately, the employment records made available do not contain an employee-specific numerical identifier that remains constant over time. Hence, the first task in this study was to construct the required identifier based on time-invariant demographic characteristics. A detailed description of the matching procedure is described in Appendix B.
[30] Assigning treated status based on tenure in 2003 ensures that workers do not endogenously sort into the control group or out of the sample in response to the reform.

members of ERSRI who could potentially vest by 2005 (those with at least eight years of tenure in 2003); 2) members of MERS who will not vest by 2005; and 3) members of MERS who could potentially vest by 2005.

The empirical strategy relies on a dynamic triple-differences research design. Intuitively, the design first performs a difference-in-differences (DID) analysis of separation behavior in ERSRI, comparing the treated and control groups before and after the 2005 benefit cut. Since the strong private sector labor market at the time of the benefit cut could have disproportionately encouraged less-attached government workers to seek outside opportunities, the design also conducts a DID analysis of separation from MERS, which did not cut benefits for any of its workers. The DID results for MERS estimate how macroeconomic changes during the analysis period differentially affected employees with different tenures, allowing these differential trends to be netted out of the DID for ERSRI. The difference between the DID results for ERSRI and those for MERS reflects the effect of the benefit cut on separation.[31] This triple-differences design also has the advantage that it performs an implicit placebo test on a group that was legally unaffected by the reform. Thus, the DID analysis of separation from MERS should display no substantial change immediately before and after 2005.

Specifically, the analysis runs the following Ordinary Least Squares regression on a balanced panel of employment records:

$$Separate_{i,t} = \alpha + \boldsymbol{\beta_0 Year_t} + \beta_1(Non\ Vested_i) + \boldsymbol{\beta_2}(Non\ Vested_i * \boldsymbol{Year_t}) +$$
$$\beta_3 ERSRI_i + \boldsymbol{\beta_4}(ERSRI_i * \boldsymbol{Year_t}) + \beta_5(ERSRI_i * Non\ Vested_i) + \boldsymbol{\beta_6}(ERSRI_i *$$
$$Non\ Vested_i * \boldsymbol{Year_t}) + \boldsymbol{X_i} + \varepsilon_{i,t} \qquad (1)$$

where $Separate_{i,t}$ is a binary variable equal to one if employee i separates on or before fiscal year t.[32] $\boldsymbol{Year_t}$ represents a vector of year fixed effects, $Non\ Vested_i$ is a binary variable equal to one if the employee did not have eight years of tenure in 2003, and $ERSRI_i$ is another binary variable equal to one if the employee was a member of ERSRI in 2003. The first three terms on

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[31] An alternate approach would perform the DID analysis only on non-vested ERSRI and MERS employees. Unfortunately, this approach still shows evidence of pre-trends, likely due to the different occupational mix of the two pensions.
[32] Separation is defined as ceasing to receive tenure credit toward future pension benefits. Separation is an absorbing state, so that workers who return to their 2003 pension system are treated the same as employees who leave permanently.

the right-hand side of this equation (ignoring the constant) perform a DID analysis on MERS members only. The next two terms check whether vested ERSRI members separate at a different rate than vested MERS members, and the vector of coefficients $\boldsymbol{\beta_6}$ are the triple-differences estimates, which this study interprets as the effect of the benefit cut on separation in each year following the reform, and as tests of the parallel pre-trend assumption in the years prior to the reform. The vector $\boldsymbol{X_i}$ improves statistical precision by controlling for employees' demographic characteristics in 2003.[33] The analysis tracks workers through 2008 in order to avoid Rhode Island's subsequent pension reform in 2009. Standard errors are clustered at the individual employee level.

Estimating occupational differences in labor supply requires a slight modification to equation (1). Namely, the triple-differences regression includes a binary variable equal to one if the employee is a teacher in 2003, and interacts this teacher dummy with the other key variables (recall that teachers are all members of ERSRI):

$$Separate_{i,t} = \alpha + \boldsymbol{\beta_0 Year_t} + \beta_1(Non\ Vested_i) + \boldsymbol{\beta_2}(Non\ Vested_i * \boldsymbol{Year_t}) + \beta_3 ERSRI_i + \boldsymbol{\beta_4}(ERSRI_i * \boldsymbol{Year_t}) + \beta_5(ERSRI_i * Non\ Vested_i) + \boldsymbol{\beta_6}(ERSRI_i * Non\ Vested_i * \boldsymbol{Year_t}) + \beta_7 Teacher_i + \boldsymbol{\beta_8}(Teacher_i * \boldsymbol{Year_t}) + \boldsymbol{\beta_9}(Teacher_i * Non\ Vested_i) + \boldsymbol{\beta_{10}}(Teacher_i * Non\ Vested_i * \boldsymbol{Year_t}) + \boldsymbol{X_i} + \varepsilon_{i,t} \qquad (2)$$

In equation (2), the vector of triple-differences coefficients $\boldsymbol{\beta_6}$ reflects the effect of the benefit cut on state government employees, while the vector of coefficients $\boldsymbol{\beta_{10}}$ estimates the difference in effect size between state workers and teachers. Hence, the linear combination of $\boldsymbol{\beta_6}$ and $\boldsymbol{\beta_{10}}$ measures the effect of the benefit cut on teacher separation. Once again, elements of vectors $\boldsymbol{\beta_6}$ and $\boldsymbol{\beta_{10}}$ from the years prior to the reform serve as tests of the parallel pre-trend assumption for state workers and for the difference in trends between state workers and teachers.

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[33] These controls include age and service fixed effects, as well as the employee's salary, gender, and occupation (teacher, general state government, corrections officer, or nurse). The results are also robust to the inclusion of individual fixed effects. The results with individual fixed effects are not reported, but available from the authors upon request, since it is difficult to interpret individual fixed effects when the outcome is an absorbing state.

Results

　　The analysis follows 23,676 employees between 2003 and 2008. Table 2 summarizes their demographic characteristics in 2003, with the aim of highlighting differences between the four cohorts. In keeping with the emphasis on mid-career separation, the sample drops employees who are younger than 16 and older than 60 in 2003 because those who work past age 60 (the pre-reform NRA in ERSRI) are likely quite different from those who choose to retire on time.[34] Similarly, the analysis excludes employees with 20 or more years of tenure, so that no one in the sample is already working past their first eligibility for early retirement in 2003.[35] As expected, the non-vested ERSRI and MERS members are younger, on average, than the vested members, although the difference is more pronounced in ERSRI than in MERS. The average tenure in the non-vested and vested groups appears similar in both pension plans. Conversely, teachers and state government employees earn substantially higher salaries than do municipal employees.

　　Figure 1 presents the triple-differences research design graphically to add some intuition to the regression. The first set of bars in the figure, labeled DID ERSRI, focuses on teachers and state employees, subtracting the mean of $Separate_{i,t}$ in the vested group from that in the non-vested group each year between 2003 and 2008. Separation in the non-vested group rises over time relative to the vested group. Although the trend jumps in 2005, it is already apparent in 2004, before the pension reform. Changing labor market conditions in Rhode Island over this period may cause this pre-trend, and motivate the use of MERS as additional control groups. Hence, the second set of bars in Figure 1, labeled DID MERS, replicates the procedure used for ERSRI. The slight trend in 2004 is also apparent in MERS, but the jump in 2005 is smaller and does not persist. The third set of bars, labeled Triple Difference, subtracts the difference for MERS from the difference for ERSRI. Reassuringly, the trend in 2004 disappears, highlighting a 2- to 3-percentage-point increase in separation from ERSRI that begins in 2005 and persists through 2008.

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[34] Only 12 percent of active workers in 2003 are over age 60.

[35] The sample also excludes employees with zero years of tenure in 2003, since 25 percent of these observations are purportedly born in 1900 and an additional 10 percent earn zero wages despite being coded as "active" employees. Together, these tenure-based sample restrictions eliminate 25 percent of observations under age 60. A robustness check will further limit the sample to employees younger than age 53 and with fewer than 15 years of tenure in 2003 so that no one becomes retirement eligible during the analysis period.

Equation (1) formalizes Figure 1 by checking for statistical significance and controlling for the pre-reform characteristics of employees. Figure 2 plots the vector of triple-differences coefficients by year (β_6) as well as the 95-percent confidence interval on each.[36] The regression confirms a 1.7 to 3.2-percentage-point increase in cumulative separation that has stabilized at 2.1 percentage points by the end of 2006. The triple-differences estimates are almost all statistically significant at the 5-percent level or better, with the notable exception of 2003, which is a precisely estimated zero (see Table 3 for detailed regression results). Furthermore, in line with expectations for the low-tenure MERS employees who are, in fact, untreated by the reform, this group displays no change in separation rates in the years immediately post reform. Instead, they show a significant decline in separations in 2008, likely reflecting the Great Recession, and further justifying use of this group as a control for ERSRI. A two-period triple-differences regression estimates the average effect across all the years to be 2.4 percentage points, statistically significant at the one-percent level.[37]

Given that much of the existing literature on public sector labor supply focuses on K-12 education, the next question is whether teachers respond less to benefit cuts than do state government employees. Figure 3 presents triple-differences estimates for each occupation by calculating the sum of β_6 and β_{10} from equation (2). The effect on teachers is about half as large as the effect on state employees – slightly under 2 percentage points compared to 4 percentage points – and is not always statistically different from zero.[38] Detailed regression results in Table 4 reveal that these occupational differences are statistically significant. However, given that the dynamic effects are imprecisely estimated for teachers (due to the smaller sample size), Table 5 replicates the analysis using a two-period triple-differences regression with 2005 as the first year post reform. This model again shows that the size of the effect is statistically different between the two occupations, and that the overall estimate for teachers is 1.7 percentage points, but that the estimate for teachers is only marginally statistically significant at the 10-percent level (a p-value of 0.065).

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[36] The regression normalizes all of the coefficients relative to the difference between the treated and control groups in the year before the reform.
[37] This regression is presented in the next section as a robustness test.
[38] The overall effect is calculated from Table 4 as the effect on state government employees plus the additional effect on teachers.

Interpreting the Magnitude of the Change in Labor Supply

How should one interpret the magnitude of the labor supply response generally, and why did the pension reform have a relatively small effect on teachers? Teachers may respond less to the pension cut because they enjoy their jobs more than state employees do, because they lack competitive outside options, or because the cut itself was less severe for them. To assess this last possibility, the PDV of future pension benefits is recalculated under the pre- and post-reform provisions for a hypothetical teacher and state employee. The teacher is three years younger than the state employee in 2005, has one fewer year of tenure, earns a higher salary, and receives half a percentage point more salary growth annually.[39] Teachers are also more likely to be female, which improves their longevity.[40] Despite having different demographic profiles, teachers and state employees experienced a pension cut of similar magnitude: a 50 percent and 47 percent reduction in benefits, respectively. The dollar value of the cut was substantially greater for teachers – $199,931 versus $98,492 – because teachers receive higher salaries. Therefore, it is unlikely that teachers are half as responsive because they kept more of their old pension wealth. Similarly, retiree health insurance is unlikely to fully account for the occupational differences in labor supply because the PDV of lost health benefits was only around 15 percent of the PDV of lost pension benefits, and some school districts (including Providence, the capital) also link insurance eligibility to the teacher's NRA, paralleling state workers' eligibility criteria.

Although teachers and state employees seem to face different labor market conditions, it is unclear whether either group experienced an economically meaningful change in separation. One possible reference point is the overall probability of separation, which makes the effect of pension reform appear moderately large. Among the non-vested ERSRI members employed in 2003, 22 percent had separated from active service by 2008. Hence, a 2.4-percentage-point increase in the separation rate corresponds to a 12-percent increase in the baseline (no reform) rate. By occupation, the benefit cut caused a 19-percent increase in the baseline separation rate for general state employees and a 9-percent increase in the baseline rate for teachers.

However, another possible reference point is the percentage reduction in lifetime benefits. As discussed previously, the 2005 reform caused a 48-percent reduction in the pension

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[39] As before, the modeling assumptions come from the personnel records, the 2005 ERSRI Actuarial Valuation Report, and the 2005 Social Security Trustees Report.

[40] The analysis takes a weighted average of male and female mortality rates from 2017 cohort life tables provided by the Social Security Office of the Chief Actuary.

wealth of a typical non-vested ERSRI member, implying that the elasticity of labor supply with regard to pension wealth is around 0.25.[41] By the same logic, the elasticity of labor supply is around 0.18 for teachers and 0.40 for state employees. In summary, the pension reform caused a noticeable disruption to Rhode Island's public sector workforce because the benefit cut was substantial.

The retroactive nature of the pension cut implies a mixture of income and substitution effects that varied across individuals. The cut to accrued benefits is a pure wealth shock that primarily hit medium-tenured workers who had not yet vested, but who anticipated vesting with substantial accruals within the next few years. Reductions in future accruals created both income and substitution incentives for all employees; the income effect could have spurred employees to try to recover the lost wealth by seeking outside jobs with higher pay (perhaps in exchange for fewer amenities); while the substitution effect made outside options appear more attractive than they used to. In addition to the standard income and substitution effects, benefit cuts are an information shock, which could change employee beliefs about the likelihood of future cuts.[42] Finally, cuts for current employees – even more than ex nunc reductions – might inspire feelings of spite, particularly among employees who have nearly vested.

Although these theoretical mechanisms suggest that medium-tenure employees may respond differently to the cut than their short-tenure colleagues, the analysis uncovers no evidence of differential effects by tenure.[43] On its face, this finding is consistent with negligible income effects. However, the complex interaction of income, substitution, information, and spite channels, along with the inherent statistical imprecision of heterogeneity analysis on small subsamples, renders firm conclusions about mechanisms challenging in the current context.

Robustness Tests

Any empirical analysis must make design choices that could influence the results. This section conducts several robustness checks to confirm that the main results are not overly sensitive to model specification or the sample selection criteria. As a first robustness check, Column (1) of Table 6 demonstrates that the main triple-differences coefficients do not depend

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[41] It is likely somewhat smaller because the reform also restricted access to five years of subsidized retiree health insurance, although this represents only a relatively small increase in the PDV of the cuts due to the reform.
[42] Indeed, public employees in Rhode Island would have been correct to assume that future cuts were coming.
[43] Results not shown, but available from the authors upon request.

on the demographic control variables. Column (2) of Table 6 limits the sample to employees ages 53 and younger with no more than 15 years of tenure, so that no one becomes eligible for normal or early retirement during the analysis period. Similarly, column (3) drops employees with fewer than two years of tenure in 2003, due to concerns about data quality (see the discussion in Appendix B), while column (4) drops corrections officers and nurses with occupation-specific benefit provisions. The main conclusion remains unchanged, even though shrinking the sample attenuates the coefficients slightly and reduces statistical power.

A final robustness check trades the OLS model in equation (1) for a logistic regression.[44] Because the estimated coefficients from a logistic model are difficult to interpret, this analysis uses the model to calculate the predicted probability of having separated for the four cohorts of employees, with all control variables held constant at their means. It then takes a linear combination of these predicted probabilities to produce DID and triple-differences estimates. Table 7 compares the DID and triple-differences estimates from the logistic regression with their OLS counterparts. To simplify the exposition, Table 7 shows results for the two-period research design rather than the dynamic triple-differences design. The two sets of estimates are nearly identical.

Conclusion

In 2017, one-third of the large state and local pension systems in the United States were so poorly funded that sponsors may soon attempt to scale back the benefits promised to current employees. This study demonstrates that pension cuts for current workers encourage mid-career civil servants and teachers to leave their government jobs. Specifically, the study evaluates a 2005 reform of Rhode Island's ERSRI that dramatically reduced benefits for K-12 teachers and state employees. The benefit cut caused a 2.4-percentage-point increase in the cumulative probability of separating before 2008, or a 12-percent increase in the pre-reform separation rate. Since the reform reduced lifetime pension wealth by 48 percent for a typical non-vested member of ERSRI, the results imply an elasticity of labor supply of around 0.25.

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[44] Although a Cox proportional hazard model might seem appealing in this setting, the model relies on a restrictive assumption of constant proportional treatment effects at all points in time. Rather than support this assumption, the OLS estimates suggest that Rhode Island's benefit cut caused a sudden outflow of employees that subsided a couple years after the reform.

Teachers – an important group of government employees – were less responsive to cuts than were state government employees, with the two groups being 1.7-percentage-points and 4-percentage-points more likely to separate, respectively, following the reform. It is possible that state employees (such as lawyers, accountants, clerks, and maintenance workers) have alternative employment opportunities in the private sector that K-12 teachers lack. This interpretation suggests that policymakers should be cautious when extrapolating from studies of teacher labor markets to the broad state and local government workforce, of which teachers only comprise 30 percent (U.S. Census Bureau 2017b).

Since Rhode Island is a small state integrated into a larger New England labor market, the elasticity of labor supply estimated here might be larger than that in more isolated states. Nevertheless, it seems generalizable to the other Northeastern governments that are in financial difficulty, as well as to municipal governments with troubled pensions nationwide. Lessons learned from Rhode Island could soon apply in Connecticut, Illinois, New Jersey, Philadelphia, Kentucky, Massachusetts, and New York City, among other jurisdictions where one or more pension systems for teachers or civil servants were less than 60 percent funded in 2017. In short, pension cuts for current workers may be considered to shore up troubled systems, but sponsors might want to prepare for their likely and real effects on the government workforce.

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Table 1. *Characteristics of State and Local Government Workers in 2017*

Mean characteristic (Percent)	Rhode Island	All other states
Teachers	37.4%	22.9%
Protective service workers	10.2	9.0
State employees	39.7	40.5
Female	58.0	59.6
Black	3.1	14.0
White	84.6	78.2
Hispanic origin	9.2	12.3
Age (years)	43.4	44.3

Note: Racial and ethnic categories do not sum to one because employees of Hispanic origin may also classify as "white."
Source: Authors' calculations from the U.S. Census Bureau, *Current Population Survey* (2017).

Table 2. *Demographic Characteristics of Public Sector Employees in Rhode Island, 2003*

Variable	N	Mean	SD	Min	Max
ERSRI: Non-vested					
Age	8839	38	9	18	59
Tenure	8839	4	2	1	8
Teacher	8839	1	0	0	1
Salary	8839	$40,969	$13,656	$7	$158,064
Female	8839	1	0	0	1
ERSRI: Vested					
Age	9774	46	7	20	59
Tenure	9774	13	3	8	20
Teacher	9774	1	0	0	1
Salary	9774	$52,657	$15,457	$7	$153,885
Female	9774	1	0	0	1
RI MERS: Non-vested					
Age	2890	44	8	20	59
Tenure	2890	4	2	1	8
Teacher	2890	0	0	0	0
Salary	2890	$24,441	$11,896	$57	$10,1961
Female	2890	1	0	0	1
RI MERS: Vested					
Age	2173	48	7	28	59
Tenure	2173	13	3	8	20
Teacher	2173	0	0	0	0
Salary	2173	$29,852	$11,875	$194	$110,675
Female	2173	1	0	0	1

Note: ERSRI is the Employees' Retirement System of Rhode Island, which covers state government employees and public school teachers. MERS is the Municipal Employees' Retirement System of Rhode Island, which covers the employees in 117 local government units.
Source: Authors' calculations from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017).

Table 3. *Difference-in-Differences and Triple Differences Estimates of the Effect of Benefit Cuts on the Cumulative Probability of Separation*

	DID MERS	DID ERSRI	Triple Diff
	(1)	(2)	(3)
Variables	Separated	Separated	Separated
Effect of low tenure 2003	-0.0106*	-0.0123***	
	(0.0059)	(0.0026)	
Effect of low tenure 2005	0.0026	0.0193***	
	(0.0066)	(0.0029)	
Effect of low tenure 2006	-0.0112	0.0209***	
	(0.0083)	(0.0036)	
Effect of low tenure 2007	-0.0030	0.0180***	
	(0.0095)	(0.0043)	
Effect of low tenure 2008	-0.0271**	-0.0053	
	(0.0107)	(0.0049)	
Effect of cut 2003			-0.0017
			(0.0065)
Effect of cut 2005			0.0167**
			(0.0071)
Effect of cut 2006			0.0321***
			(0.0091)
Effect of cut 2007			0.0210**
			(0.0105)
Effect of cut 2008			0.0218*
			(0.0118)
Constant	1.7965***	1.5519***	1.6908***
	(0.2680)	(0.1023)	(0.2439)
Observations	30,378	111,666	142,044
R-squared	0.096	0.084	0.087
Year FE	Yes	Yes	Yes
Service in 2003 FE	Yes	Yes	Yes
Age bracket in 2003 FE	Yes	Yes	Yes
Teacher in 2003 dummy	Yes	Yes	Yes
Corrections in 2003 dummy	Yes	Yes	Yes
Nurse in 2003 dummy	Yes	Yes	Yes
Log salary	Yes	Yes	Yes
Female dummy	Yes	Yes	Yes
ERS dummy			Yes
ERS * year FE			Yes

Notes: Standard errors in parentheses are clustered at the employee level. *** p<0.01, ** p<0.05, * p<0.1. Column (1) presents a dynamic difference-in-differences analysis of the Municipal Employees' Retirement System. Column (2) shows a similar analysis of the Employees' Retirement System of Rhode Island. Column (3) displays the triple-differences results.
Source: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017).

Table 4. *Dynamic Triple Differences Estimates of the Effect of Benefit Cuts on the Cumulative Probability of Separation by Occupational Group*

Variables	(1) Separated
Effect of cut 2003	-0.0023
	(0.0074)
Effect of cut 2005	0.0293***
	(0.0083)
Effect of cut 2006	0.0477***
	(0.0103)
Effect of cut 2007	0.0424***
	(0.0119)
Effect of cut 2008	0.0381***
	(0.0134)
Differential effect on teachers 2003	-0.0007
	(0.0054)
Differential effect on teachers 2005	-0.0178***
	(0.0061)
Differential effect on teachers 2006	-0.0236***
	(0.0076)
Differential effect on teachers 2007	-0.0324***
	(0.0090)
Differential effect on teachers 2008	-0.0201**
	(0.0102)
Constant	1.7069***
	(0.2444)
Observations	142,044
R-squared	0.088
Year FE	Yes
ERS dummy	Yes
ERS * year FE	Yes
Teacher in 2003 dummy	Yes
Teacher * year FE	Yes
Service in 2003 FE	Yes
Age bracket in 2003 FE	Yes
Corrections in 2003 dummy	Yes
Nurse in 2003 dummy	Yes
Log salary	Yes
Female dummy	Yes

Notes: Standard errors in parentheses are clustered at the individual employee level. *** $p<0.01$, ** $p<0.05$.
Source: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017).

Table 5. *Two-Period Triple Differences Estimates of the Effect of Benefit Cuts on the Cumulative Probability of Separation by Occupational Group*

Variables	(1) Separated
Effect of cut	0.0405***
	(0.0102)
Differential effect on teachers	-0.0233***
	(0.0077)
Constant	1.6688***
	(0.2444)
Observations	142,044
R-squared	0.088
Year FE	Yes
ERS dummy	Yes
Post dummy	Yes
ERS * Post	Yes
Teacher in 2003 dummy	Yes
Teacher * post	Yes
Service in 2003 FE	Yes
Age bracket in 2003 FE	Yes
Corrections in 2003 dummy	Yes
Nurse in 2003 dummy	Yes
Log salary	Yes
Female dummy	Yes

Notes: Standard errors in parentheses are clustered at the individual employee level. *** p<0.01.
Source: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017).

Table 6. *Robustness Checks on Triple Differences Estimates of the Effect of Benefit Cuts on the Cumulative Probability of Separation*

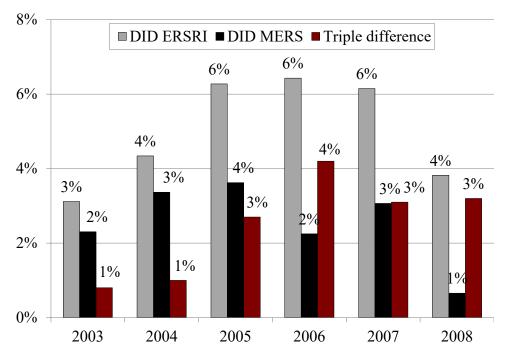| Variables	(1) Separated	(2) Separated	(3) Separated	(4) Separated
Effect of cut 2003	-0.0017	0.0033	-0.0022	-0.0016
	(0.0065)	(0.0071)	(0.0066)	(0.0065)
Effect of cut 2005	0.0167**	0.0145*	0.0152**	0.0158**
	(0.0072)	(0.0083)	(0.0074)	(0.0072)
Effect of cut 2006	0.0320***	0.0210**	0.0278***	0.0310***
	(0.0091)	(0.0099)	(0.0095)	(0.0091)
Effect of cut 2007	0.0211**	0.0118	0.0173	0.0197*
	(0.0105)	(0.0111)	(0.0109)	(0.0105)
Effect of cut 2008	0.0219*	0.0214*	0.0198	0.0202*
	(0.0118)	(0.0124)	(0.0123)	(0.0118)
Constant	0.0805***	1.6918***	1.6515***	1.7027***
	(0.0058)	(0.2502)	(0.2478)	(0.2444)
Observations	142,056	107,748	131,070	136,218
R-squared	0.039	0.082	0.081	0.087
Year FE	Yes	Yes	Yes	Yes
ERS dummy	Yes	Yes	Yes	Yes
ERS * year FE	Yes	Yes	Yes	Yes
Service in 2003 FE		Yes	Yes	Yes
Age bracket in 2003 FE		Yes	Yes	Yes
Teacher in 2003 dummy		Yes	Yes	Yes
Corrections in 2003 dummy		Yes	Yes	
Nurse in 2003 dummy		Yes	Yes	
Log salary		Yes	Yes	Yes
Female dummy		Yes	Yes	Yes

Notes: Standard errors in parentheses are clustered at the individual employee level. *** p<0.01, ** p<0.05, * p<0.1. Column (2) drops workers older than 53 in 2003 and those with more than 15 years of tenure. Column (3) drops workers with fewer than 2 years of tenure in 2003.
Source: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017).

Table 7. *Predicted Probability of Separation by Pension Plan and Time Period*

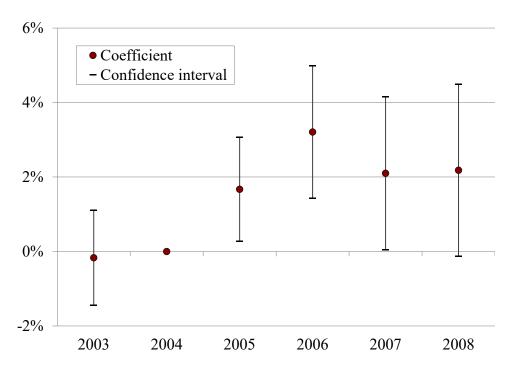| Treated mean - control mean	Logistic regression	OLS regression
ERSRI pre-reform	0.0322***	0.0372***
	(0.0028)	(0.0030)
MERS pre-reform	0.0229***	0.0284***
	(0.0058)	(0.0065)
ERSRI post-reform	0.0541***	0.0566***
	(0.0048)	(0.0048)
MERS post-reform	0.0246**	0.0240**
	(0.0105)	(0.0103)
Triple differences	0.0233***	0.0237***
	(0.0090)	(0.0089)

Notes: The table depicts predicted probabilities from the regression with control variables held constant at their means (see Table 2 for a list of the control variables). Standard errors in parentheses are clustered at the individual employee level. *** $p<0.01$, ** $p<0.05$.
Source: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017).

Figure 1. *Development of the Triple Differences Estimates without Control Variables, 2003-2008*
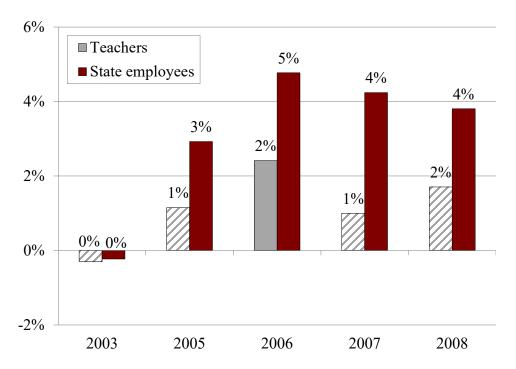

Notes: The figure follows members of ERSRI and MERS who were actively employed in 2003. The bars labeled DID ERSRI subtract the separation rate in the control group from the separation rate in the treated group. The bars labeled DID MERS subtract the separation rate in the placebo control group from the separation rate in the placebo treated group. The bars labeled Triple Difference subtract the bars labeled DID MERS" from those labeled DID ERSRI.
Source: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017).

Figure 2. *Effect of Pension Cuts for Current Workers on the Cumulative Probability of Separation, 2003-2008*

Notes: Dots represent the regression coefficients and whisker lines depict the 95-percent confidence interval. The regression analysis treats 2004 as the omitted reference year; hence the estimated effect in 2004 lacks a confidence interval by design.
Source: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017).

Figure 3. *Effect of Pension Cuts for Current Workers on the Cumulative Probability of Separation, by Occupation, 2003-2008*

Notes: Solid bars are statistically significant at the 5-percent level or better. Despite being employed by local school districts, teachers participate in the same pension plan as state government employees.
Source: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017).

Appendix A: Benefit Provisions of the Employees' Retirement System of Rhode Island and the Municipal Employees' Retirement System

Table A1. *Benefit Provisions Pre-Reform (2003-2004) and Post-Reform (2005-2008)*

Provision	ERSRI pre reform	ERSRI post reform	MERS
Vesting period	10 years of tenure	10 years of tenure	10 years of tenure
Normal retirement age	• Age 60 • Or any age with 28 years of tenure	*If non-vested on 6/30/05:* • Age 65 • Or age 59 with 29 years of tenure *If vested on 6/30/05:* • No change	• Age 58 with 10 years of tenure • Or any age with 30 years of tenure
Early retirement age	Age 55 with 20 years of tenure	No change	Age 50 with 20 years of tenure
Benefit multiplier	Tenure 1-10: 1.7% Tenure 11-20: 1.9% Tenure 21-34: 3% Tenure 35+ : 2%	Tenure 1-10: 1.6% Tenure 11-20: 1.8% Tenure 21-25: 2% Tenure 26-30: 2.25% Tenure 31-37: 2.5% Tenure 38+: 2.25%	Tenure 1-20: 2% Tenure 20+: • 2% or 2.5% depending on the locality
Final average salary period	3 years	3 years	3 years
Benefit cap	80% of FAS	75% of FAS	75% of FAS
Cost-of-living adjustment	3% compounded annually	CPI capped at 3% compounded annually, commencing on the third anniversary of retirement.	Participating localities voluntarily choose between several COLA options, including no COLA.

Note: The provisions for ERSRI only reflect general state employees and teachers, who comprise the majority of members.
Source: Various Actuarial Valuation Reports and Plan Documents (2003-2008).

Appendix B: Methodology for Linking Personnel Records over Time

The personnel records provided by the Employees' Retirement System of Rhode Island did not include a unique numerical identifier that tracks individuals over time. This appendix provides a description of the matching procedure used create the missing identification number. The procedure employs three steps, described below.

Step 1: Match on Employee Name and Year of Birth

The majority of person-year observations receive an identification number based on a "naive" match of first name, last name, and year of birth. Names are cleaned to standardize inconsistencies across time by removing all spaces and punctuation, and changing Arabic numerals to Roman numerals (i.e. John Smith 111 became John Smith III). Because Rhode Island is a small state, less than one percent of observations in any given year have duplicate names and years of birth. Because they are so uncommon, the analysis drops these duplicate observations.

Step 2: Match Full-Time Employees Based on Prior-Year Wages and Tenure

Names occasionally change over time due to marriage or administrative misspellings, leading Step 1 to mis-identify a single employee as two separate people. This step attempts to rectify the problem by taking advantage of a variable in the dataset that records prior year wages. The dataset is cut to keep only the first and last observation of each identification number created in Step 1, as well as any observations surrounding a temporal discontinuity within the identification number (ie. an ID is observed in years 2004 and 2006, but not 2005). The remaining observations are then matched to each other if the following information aligns: 1) current and prior fiscal year; 2) current and prior-year wages; 3) current and prior-year tenure, where prior-year tenure is calculated as current tenure minus one; 4) sex; and 5) year of birth. Fortunately, these matching criteria are sufficiently detailed (and the Rhode Island public workforce is sufficiently small) that only three temporal discontinuities could potentially match to more than one other. In these rare cases, the algorithm does not attempt to assign a match.
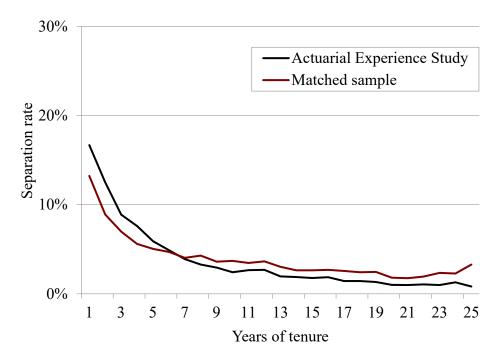
Steps 3: Match Part-Time Employees Based on Prior-Year Wages and Active Status

Step 2 only matches employees who earn a full year of service credit and ignores part-time employees. To rectify this omission, Step 3 replicates the procedure in Step 2 for any remaining temporal discontinuities, but only requires that tenure in the prior year be no greater than tenure in the current year. In order to limit the number of potential matches, Step 3 also requires that prior-year status (active, inactive, retired, etc.) be consistent with a current-year variable that records status in the prior year. As before, the matching criteria are sufficiently detailed that only four temporal discontinuities matched with multiple others; the algorithm does not assign a match when it detects duplicates.
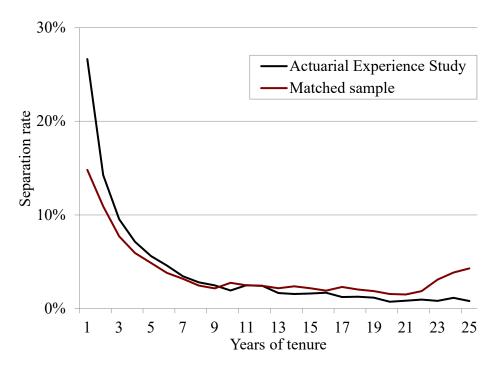
Verify Accuracy

Ultimately, 91 percent of employees in the final dataset have identification numbers created by Step 1 only. An additional six percent receive identification numbers created by a combination of Steps 1 and 2, while the remaining three percent are assigned identification numbers based on a combination of all three steps. To check that the identification numbers are accurate, Figures B1-B3 display separation probabilities for member of ERSRI and MERS by occupation and years of accrued tenure. The figures contrast these probabilities with published termination rates from Rhode Island's most recent actuarial experience study (Employees' Retirement System of Rhode Island 2017). The two sources should produce the same rates because the official experience study is based on the same employment records employed in this analysis. However, the actuaries receive restricted data that contain employees' Social Security Numbers and so know exactly when an employee separates. In general, the rates calculated for this analysis are consistent those published by the actuaries, although this study tends to find less difference between short and long-tenured workers than the actuaries calculate. Importantly, deviations from the official rates are consistent across ERSRI and MERS.

Figure B1. *Separation Rates for State Government Employees by Accrued Tenure, 2007-2016*
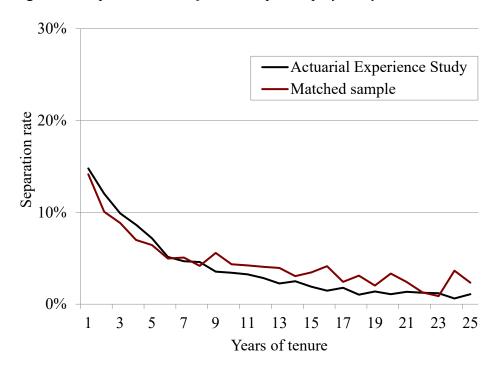

Sources: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017); and published rates in Employees' Retirement System of Rhode Island (2017).

Figure B2. *Separation Rates for Teachers by Accrued Tenure, 2007-2016*

Sources: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017); and published rates in Employees' Retirement System of Rhode Island (2017).

Figure B3. *Separation Rates for Municipal Employees by Accrued Tenure, 2007-2016*

Sources: Authors' estimates from employment records provided by the Employees' Retirement System of Rhode Island (2003-2017); and published rates in Employees' Retirement System of Rhode Island (2017).

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