Interstate Differences in Pension Vesting Rules and K-12 Teacher Experience

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Abstract

Public sector pensions have gained wide attention recently due to concerns about financial sustainability and state fiscal health. Several states have enacted reforms in an effort to reduce their future pension obligations but 98 percent of teachers continue to be covered by defined benefit plans. While these plans' strong retirement incentives have been the focus of much research, we focus on important interstate differences in teacher pension opportunities across states in the early years of a teacher's career. Unique among public sector workers, a state's K-12 teacher workforce age and experience may have implications for the educational attainment of a state's workforce. We illustrate state differences in the actuarial present value of a teacher's pension wealth with different experience levels and salary. Second, we examine the correlation between state vesting rules with the age and experience distribution of a state's teacher population. Using cross section aggregate data, we find that pension characteristics relevant to the early years of a teacher's career influence the fraction of younger teachers in a state.

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I. Introduction

The funding of public pension systems has become a source of significant stress on state financial systems. Actuarial valuations from state financial reports estimate a total of approximately $325 billion in unfunded liabilities, which the literature considers to be an underestimate due to unrealistic actuarial assumptions (Doherty et al. 2012; Novy-Marx and Rauh 2011). Minor reforms to teacher pension systems have attempted to alleviate some fiscal stress by increasing vesting requirements and raising teacher and employer contributions.[1] These parameter changes have implications not only for state budgets but for the age and experience distribution of K-12 teachers in a state.

While the private sector has moved to defined contribution plans, and pension reform has made some inroads in public plans for general government workers, 98 percent of K-12 teachers continue to be covered by defined benefit plans with influential pension accrual patterns and limits to portability. Unique among public sector workers, a state's K-12 teacher workforce age and experience may have implications for the educational attainment of a state's workforce. The accrual pattern in pension wealth may affect a district's ability to attract younger, more mobile teachers or individuals from the private sector changing jobs mid-career.

In this paper we focus on vesting rules, portability through service credits, and pension wealth differences across states for teachers in the early years of their career. Pension vesting rules have received little attention in the literature, yet they may have unintended effects on new teacher retention or teacher preferences for shorter-term employment. For example, recently the New York State Teachers' Retirement System changed the vesting requirement from five years to 10 years for new teachers. Additionally, they now require the teacher to contribute to his or her pension for the length of active membership, as opposed to only the first ten years of

employment. Similar reforms to pension parameters were made in Florida, Illinois, Michigan, and Texas. These changes reduce the incentive for new teachers to stay in teaching for several years. Restrictions across state borders on purchasing credits may also reduce young teacher mobility. Yet these early years of teaching are critical for teacher effectiveness. Several recent studies have found that new teachers are less effective than those with some experience.[2]

We illustrate the magnitude of these differences across four states with different vesting rules. We construct the actuarial present value of pension liability (or, wealth from the teacher's perspective) that is commonly used in valuing pensions for legal matters, such as Qualified Domestic Relations Orders following divorce.[3] This termination liability, or accrued benefit obligation, is a measure of the pension liability owed at different points through a teacher's career should she separate from service.[4]

The next section briefly reviews the literature on mobility and retirement effects of defined benefit plans with an emphasis on teacher pensions. In section III we discuss our calculations of individual teacher pension wealth and compare wealth for teachers at different levels of experience across four states as an illustration. Section IV provides preliminary evidence that these interstate differences in pension vesting rules may affect the distribution of teacher experience across states. There is a brief conclusion.

II. Related Literature

Previous studies of mobility and pension wealth focus on retirement incentives at the end of the career for public sector workers. Friedberg (2011) reviews retirement and mobility implications of defined benefit plans and the related literature for public employees and teachers in particular. She finds that defined benefit pension incentives play a significant role in the

timing of one's retirement from the labor market. However, she notes that empirical evidence regarding the predicted reduced mobility of younger workers with defined benefit plans is suggestive, but not definitive. Using the Survey of Consumer Finances (SCF) data from 1983, Friedberg and Owyang (2002) find that private sector workers with a defined benefit pension have total expected tenure that is 5-7 years longer on average than workers without any pensions, but that workers with defined contribution plans also have longer tenure than workers without pensions. Using the CPS and Public Plans Database, Munnell et al (2012) find that the probability of remaining with a single plan until earliest normal retirement eligibility is reduced if the employee also has a defined contribution plan and is covered by Social Security.

Prior work that has focused specifically on teacher retirement incentives associated with defined benefit plans includes Friedberg and Turner (2010), Friedberg and Turner (2011), Furgeson, Strauss, and Vogt (2005), and Costrell and Podgursky (2009). This literature describes the incentives created by the defined benefit programs and provides state-specific and national studies of teacher response to these incentives. For example, there was a large increase in teacher retirement in Pennsylvania from 1997-1998 to 1998-1999 in response to more generous retirement benefits (Furgeson, Strauss, and Vogt, 2005).

A related literature on the retirement incentives imbedded in Social Security benefits examines the effect of the peak value of benefits on retirement. The peak value concept subtracts current pension wealth from the peak of pension wealth that is available in the future.[5] Work on teacher retirement typically compares pension wealth peaks and job exit. Costrell and McGee (2010) use administrative data from particular states to describe pension wealth differences. Friedberg and Turner (2011) use the Teacher Follow-Up Survey of the Schools and Staffing Survey in 2000 and 2004 (SASS). Using a peak value approach along with data on

teacher satisfaction, they find that teachers who are dissatisfied with their jobs respond more strongly to pension retirement incentives. Teachers who express job satisfaction still respond to retirement incentives, but with a much smaller magnitude.

A subset of the teacher retirement literature focuses specifically on cross-state variation in teacher pension wealth and provides simulation evidence of peak wealth. These calculations, like ours, use the characteristics of state pension programs to calculate the present discounted value of a teacher's pension benefits under a number of different assumptions about teacher age, experience, and salary growth. Costrell and Podgursky (2009) focus on six states in their simulation, and show the cross-state variation in spikes in pension wealth. Toutkoushian et al. (2011) calculate a simulation for one identical career teacher in all 50 states, providing a ranking for the most generous pension plans.[6] Rather than focusing on the generosity of plans at the normal retirement age, our simulations provide some insight into the present discounted value of pension wealth for younger workers. We compare the magnitude of this pension wealth upon vesting across states. In addition, we improve upon earlier assumptions by using actual state starting salaries and salary caps so that teacher salaries do not grow to unrealistic values.

III. Vesting Rules and Teacher Pension Wealth

To illustrate the large differences across states in early-career teacher pension wealth, we selected four states with pension plans that have different vesting rules – some as a result of recent changes – as well as other differences. We compare the present discounted value of pension wealth for similarly-experienced teachers in California, Florida, Michigan, and Wisconsin. Michigan requires ten years of service before a teacher is vested, while Florida only requires six years. California requires five years for vesting, but teachers do not contribute to

Social Security and are no longer allowed to retire prior to the traditional retirement age with full lifetime benefits (Doherty et al, 2012). Prior to 2011, teachers were immediately vested in Wisconsin. Now Wisconsin has a vesting rule of five years. There are differences in teacher contribution rates and the age for retirement with full benefits as well. Table 1 summarizes these differences.

Based on these pension plan parameter values and a number of assumptions detailed below, we calculate the present discounted value of pension wealth at any point in time for a hypothetical teacher. This calculation involves determining the annual pension benefit, which is calculated as follows:

$$\text{Benefit} = \text{Final Average Salary} \times \text{Factor} \times \text{Years of Service}$$

Final average salary and the multiplicative factor are also plan specific parameters that we obtain from each state's pension plan brochures. We multiply this value by the probability of survival at each age, assuming the individual will live until age 100. Lastly, we calculate the present discounted value of pension wealth using a discount rate r as follows:

$$PDV = \sum_{t=0}^{t=100-C} \frac{A}{(1+r)^t}$$

where A is the actuarial value of annual benefits, t indicates the year at which the calculation is done, and C is the teacher's age at the time of the calculation.

We also make a number of assumptions. First, the teacher's starting salary is the state's average salary for the teacher's level of education from the 2008 Schools and Staffing Survey (SASS). Salaries grow at three percent per year until they reach the top step reported by the SASS. Once the salary reaches the top step for the state, the salary remains constant. While teachers typically begin contributing to the pension as soon as they begin working, if the teacher leaves before vesting, these contributions are refunded (sometimes with interest). Our reported

present value deducts contributions, but we omit the possible interest payments. We assume a three percent discount rate in our calculations, and use the 2008 female combined-race life tables to estimate the probability of survival to the next year (Arias, 2012). In footnote seven we illustrate variations due to racial differences in mortality.

Our calculations do not include cost of living adjustments (COLAs). In some states, such as Michigan, cost of living adjustments are a predetermined percent of initial benefit. In other states, the legislature votes annually on the possibility of a COLA that year. In other plans, COLAs are linked to an inflation index with a cap. Because our focus is on the front end of a teacher's career, and because inserting a COLA would require arbitrary and different assumptions across states, we do not include COLAs in our empirical work. For illustration, in Table 2 we compare pension wealth estimates for Michigan teachers with and without the COLA – three percent per year (not compounded) starting in October after one full year of retirement. Clearly, cost of living adjustments can have significant effects on present discounted values for retirees who work as teachers throughout their careers (depending on actual levels of inflation). However, they make a much smaller difference early in the teacher's career, our demographic of interest.

Figure 1 shows our calculation of the present discounted value of pension wealth net of contributions over a typical teacher's lifetime career for our illustrative states. We assume this teacher started working at age 25 with a Bachelor's degree and no prior experience. The ages on the x-axis are the ages when the teacher stops teaching and stops accruing pension benefits. The values on the y-axis are the present discounted values of pension wealth assuming a three percent discount rate and taking into account the probability of survival and salary growth as discussed above. The shape of Figure 1 is commonly found in analyses of defined benefit pension plans.

The accrual pattern of these plans creates significant jumps in pension wealth at particular ages and strong incentives to retire when wealth reaches a maximum at the plan's normal retirement age.

Our focus is on the front end of the career trajectory. In Figure 2, we zoom in on the early years of the teacher's career. Note the jump in pension wealth when the teacher becomes vested – at different levels of experience in the four states. While the pension formulas differ with respect to salary and pension multiplier, the cross-state variation in vesting requirements alone accounts for timing differences in any pension wealth. Recently several states have increased the years required before vesting, reducing their future pension obligation but possibly without regard to retaining young teachers to maximize their experience and value-added to students.

There are other factors driving the cross-state variation in Figures 1 and 2. Apart from vesting rules, contribution rates, salary calculations, and benefit formulas also contribute to these differences. For example, consider the calculation of the final average salary used in the defined benefit formula. In Michigan and Wisconsin this number is the average of the highest three years of compensation, in California it is the highest consecutive twelve months, and in Florida it is the average of the highest eight years. The significantly lower present value for Wisconsin in Figure 1 occurs because of a relatively high contribution rate coupled with a significantly lower salary. The average starting salary of $30,700 for a Wisconsin teacher with no prior experience and a Bachelor's degree is substantially lower than an identical teacher in the other states. Furthermore, the peak salary of $57,100 is the lowest among the four states. Wisconsin's pension plan includes a relatively high contribution rate of 6.65 percent of salary as well.

In Table 3, we calculate pension wealth for various early stages in a teacher's career. For a teacher who started teaching at 25 years old with a Master's degree, we compare the present discounted value of her pension if she quits after two years, five years, and 10 years and also at typical retirement ages. Column (1) highlights interstate differences in the peak value of her pension along with the age at which the peak will occur. The remaining columns include the difference from the peak value in parentheses. This difference is one measure of the opportunity cost of quitting or moving across state (district) boundaries in terms of pension wealth.[7] If the teacher chooses to relocate across state lines she could face a similar penalty, as many teachers do.

The simulated values of pension wealth in Table 3 indicate that young teachers with a defined benefit pension earn virtually nothing toward their pension wealth before they are vested. In contrast, in the bottom row of Table 3 we also simulate the value of a young teacher's pension if she were contributing to a defined contribution plan, using the Michigan teacher defined contribution plan offered to new hires as of September 2012 as an example. We assume that a teacher contributes six percent of her salary to the account with a 50 percent match rate (up to three percent) by the employer. We further assume that this account grows at three percent per year. Table 3 shows how defined contribution pension wealth steadily grows for this worker, even in the early years. If a teacher quits after two or five years she still earns a sizable amount of pension wealth if she participates fully in this defined contribution plan.[8]

IV. Pension plan characteristics and the distribution of teacher experience

In this section, we analyze the relationship between two key pension plan characteristics that affect a teacher's early career and the distribution of teacher experience across 50 states. In addition to pension plan characteristic data from the 59 largest teacher plans for the 50 states, we add data from the

2008 SASS on starting salary and the experience distribution across states. The SASS provides the following experience categories: fewer than four years of experience, between four and nine years, 10 to 14 years, and 15 plus. Table 4 provides summary statistics that highlight the cross-state variation in the experience distribution of teachers, vesting requirements, the ability to purchase service credits, and starting salary. These statistics show that almost 19 percent of teachers in the sample have less than four years of experience and almost 27 percent have between four and nine years.

The sizable number of low-experience teachers is evident in national data as well. In Figure 3 we use the tenure of teachers in the National Longitudinal Survey of Youth of 1997 (NLSY97) to illustrate this point.[9] We plot the current tenure (in years) of 560 individuals identified as teachers. We can see that the great majority of these young teachers have not reached the threshold of five (or ten) years of service required to vest in most state pension plans. If these individuals choose to change careers or move to a different state, they will receive no pension for their early years of work. In future work, we will focus on the behavioral response of these young teachers to cross-state variation in pension vesting rules.

A second pension plan characteristic affects portability of benefits once vested. Defined benefits may not be fully portable across states or sometimes even within the same state. That is, when a teacher changes school systems, he or she may be able to accrue continued service in the same plan. If not, some plans allow for the purchase of service credits that reflect previous public sector employment. Arrangements vary across plans, however, in the types and amounts of creditable service allowed, and the cost and payment options. For our empirical work, we code the reported provisions into a dummy variable indicating typical purchase of credits allowed versus none or limited purchase of prior service credit. This is certainly an oversimplification of these rules, but we save the refinement for future work.

Table 5 reports results from a regression of the state-level experience categories on pension characteristics to see if pension characteristics that affect the early career are related to the distribution of new teachers. We focus on years until vesting and the ability to purchase credits in a new district/state. We also include as controls the average age among teachers in the state and the natural logarithm of the starting salary for a teacher with no prior experience. In the first panel – percentage of teachers with less than four years of full time teaching experience – the vesting coefficient of -.455 (p-value .062) suggests that for each additional year of waiting time required until any pension wealth is owned, a state will have almost half a percent fewer new teachers. A vesting period of 5 years is common – 37 of these 59 largest public plans require five years. Those states will have two percentage points fewer teachers in early career stages. Eleven states require 10 years – they are predicted to have 4.6 percentage points fewer newer teachers – more than one standard deviation in the mean of this variable. Vesting rules do not have a statistically significant effect on the percentage of teachers with four to nine years of experience – many of these are already vested and the rest are close.[10] Years to vesting is positively related to the percentage of teachers with 10 to 14 years experience – since these percentages sum to 100 the vesting coefficients must be of opposite sign at some point, and vesting cannot have any influence at this point in their career. This cohort is vested near mid-career.

Credit purchasing does not appear to affect the distribution of teacher experience. In regressions not reported here, it did not affect the distribution of teacher tenure either. It may be also that there is not sufficient variation in this variable to get an accurate estimate with only 59 observations – 90 percent of plans in this sample allow for credit purchases. Also note that higher starting salaries do appear to increase the percentage of younger teachers (by 4.8 and 13 percentage points for the two youngest categories).

V. Conclusion

This paper adds to the literature on the incentives created by teacher pension benefits by focusing on the early career, specifically the incentives created by vesting requirements. Our simulations of pension wealth at various points throughout a teacher's career show the variation across four states in the initial jump in pension wealth that occurs upon vesting. Furthermore, we provide cross-sectional evidence that the incentives created by vesting requirements are having impacts on the distribution of the teaching labor force. Future work will focus on individual teachers' behavioral responses to these incentives. Specifically, do young teachers adjust entry and exit decisions in the teaching profession in response to changes in pension wealth? Given the vital role that teachers have in educating the future workforce, we can also try to understand if these labor market responses are affecting the educational outcomes of students.

Endnotes

[1] See the National Conference on State Legislatures' annual review of pension and retirement plan enactments.
[2] For an overview, see Rice (2010), and for individual studies see Kane, Rockoff, and Staiger (2006), Ladd (2008), Sass (2007).
[3] Papke thanks Robert Raasche for providing detailed information about these arrangements.
[4] This is similar to the accrued benefit obligations emphasized in Rauh (2010).
[5] Coile and Gruber (2007) use peak value to measure Social Security incentives and Friedberg and Webb (2005) use data from the Health and Retirement Survey for individuals aged 50 and over.
[6] Because of the large scope of this simulation, they only present results for one type of teacher who spent their entire career in the teaching profession with no salary cap. In addition, they assume one starting salary across all states and a salary growth rate of 3 percent with no cap. These assumptions result in six figure final salaries for lifetime teachers.
[7] We can incorporate race into our calculations. If the teacher is white, the highest value of her pension (from Table 3) in California, Florida, Michigan, and Wisconsin, respectively, would be $693,921, $684,392, $666,664, and $372,561. If she is black these values would be $638,249, $634,157, $614,999, and $342,051.
[8] Some states allow teachers to purchase credits from their new district if they have previous experience as a teacher. We account for this in our regression analysis.
[9] The NLSY97 is a longitudinal survey of individuals age 12 to 16 that began in 1997. In Figure 3 we use the 2008 wave of the survey, when most respondents are between 23 and 27 years old. We identify teachers by using the industry and occupation variables that describe current employment.
[10] Papke (2004) finds that quit rates in public employment drop off steeply right before vesting.

Table 1. State Teacher Pension Parameters.

State	Retirement Rule	Factor	Salary (Bachelor's, Experience=0)	Salary (Top Step)	Contribution Rate	Covered by Social Security?
California	60/5 Vesting = 5 FAS = highest year salary	1.4% to 2.4%, depending on age at retirement	$40,100	$75,400	8%	No
Florida	62/6, A/30 Vesting = 6 FAS = average of highest 8 years	1.6%	$33,300	$60,800	3%	Yes
Michigan	60/10, 46/30 Vesting = 10 FAS = average of highest 3 years	1.5%	$34,200	$66,700	$510 + 6.4% of any income over $15,000	Yes
Wisconsin	65/5, 57/30 Vesting = 5 FAS = average of highest 3 years	1.6%	$30,700	$57,100	6.65%	Yes

Source: SASS and state-specific handbooks detailed below.

California: CALSTRS 2013 Member Handbook (available at http://www.calstrs.com/sites/main/files/file-attachments/memberhandbook2013_web_v4.pdf)

Florida: Florida Retirement System Pension Plan Summary Plan Description (available at https://www.rol.frs.state.fl.us/forms/spd-pp.pdf)

Michigan: Michigan Public School Employees Retirement System Member Handbook (available at http://www.michigan.gov/documents/MPSERS1_92795_7.pdf)

Wisconsin: Wisconsin Retirement System Benefit Handbook (available at http://etf.wi.gov/publications/et2119.pdf)

Note: Retirement rule provides the minimum age and minimum years of service required for full retirement benefits. This is written as a fraction: minimum age/minimum years of service. "A" implies full retirement benefits at any age (provided the teacher has the minimum years of service). FAS stands for Final Average Salary.

Table 2 Cost of Living Adjustments

State	Peak Value	Quit After 10 Years	Retire at 55	Retire at 60	Retire at 65
Michigan No COLA	$457,101 Age 55	48,963 (-408,138)	457,101 (0)	443,489 (-13,612)	399,078 (-58,023)
Michigan With COLA	$663,788 Age 55	$65,909 (-597,879)	$663,788 (0)	$632,911 (-30,877)	$561,805 (-101,983)

Note: This table compares the present discounted value of pension wealth for a simulated teacher in Michigan both with and without Cost of Living Adjustments (COLA). The assumed formula for Cost of Living Adjustments is three percent of annual benefit each year (not compounded) starting the October after one full year of retirement.

Table 3 Started teaching at age 25 with Master's Degree

State	Peak Value	Quit after 2 years	Quit after 5 Years	Quit After 10 Years	Retire at 55	Retire at 60	Retire at 65
California	$691,288 Age 60	$0 (-691,288)	$27,069 (-664,219)	$56,223 (-635,065)	$487,271 (-204,017)	$691,288 (0)	$612,237 (-79,051)
Florida	$681,595 Age 55	0 (-681,595)	0 (-681,595)	49,971 (-631,624)	681,595 (0)	667,366 (-14,229)	616,536 (-65,059)
Michigan	$663,788 Age 55	0 (-663,788)	0 (-663,788)	65,909 (-597,879)	663,788 (0)	632,911 (-30,877)	561,805 (-101,983)
Wisconsin	$370,893 Age 57	0 (-370,893)	11,279 (-359,614)	19,237 (-351,656)	322,055 (-48,838)	354,977 (-15,916)	304,814 (-66,079)
Michigan (Defined Contribution Plan)	---------	6,341	17,322	40,161	664,480	802,186	927,981

Note: Difference from peak value appears in parentheses below the present discounted value.

Source: Authors' calculations.

Table 4 Summary Statistics

	Mean	Standard deviation	Minimum	Maximum
Years of exp. < 4	18.656%	3.261	11.9	28.3
4 <years <= 9	26.83%	3.697	18.6	35.6
10 <years <= 14	16.202%	2.415	10.2	22.9
15+ years	38.315%	5.256	29.5	50.3
Years until vested	5.729	2.377	0	10
Purchase credits?	.898	.305	0	1
Starting salary	$33,503	4,146	24,800	42,700

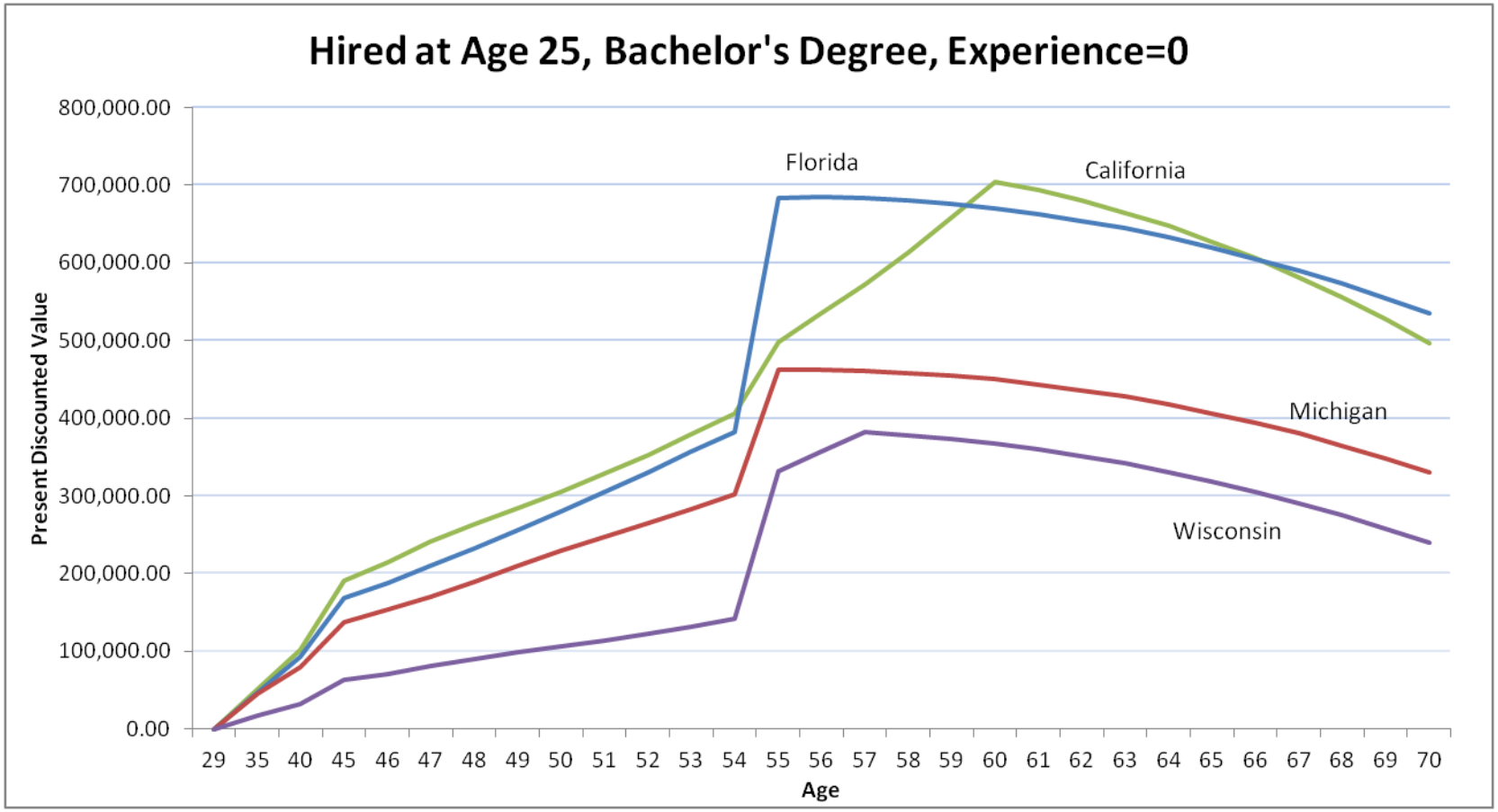
Table 5 Regression results. Dependent variables: Distribution of teacher experience

	Percent with fewer than 4 years exper		Percent with 4 to 9 years exper		Percent with 10 to 14 years exper	
Years until vested	-.368	-.455	.396	.176	.332	.332
	(.217)	(.239)	(.166)	(.169)	(.122)	(.132)
Purchase credits?		1.182		.751		-.882
		(1.094)		(.943)		(.765)
Average age		-.548		-1.059		.052
		(.255)		(.378)		(.250)
Log(starting salary)		4.848		13.492		.562
		(3.461)		(3.312)		(2.616)
Constant	20.766	-6.899	24.567	-70.102	14.297	7.001
	(1.445)	(41.155)	(1.109)	(42.628)	(.712)	(31.731)
Obs.	59	59	59	59	59	59
R^2	.0721	.1700	.0647	.4560	.1071	.1210

Notes: Pension data are from the Public Pension Database. 2001-2010. Center for Retirement Research at Boston College and Center for State and Local Government Excellence.

Robust standard errors are in parentheses.

Figure 1 Pension Wealth Over the Teaching Career



Source: Authors' calculations from 2013 CAFRs.

Figure 2 Pension Wealth Early in the Teaching Career

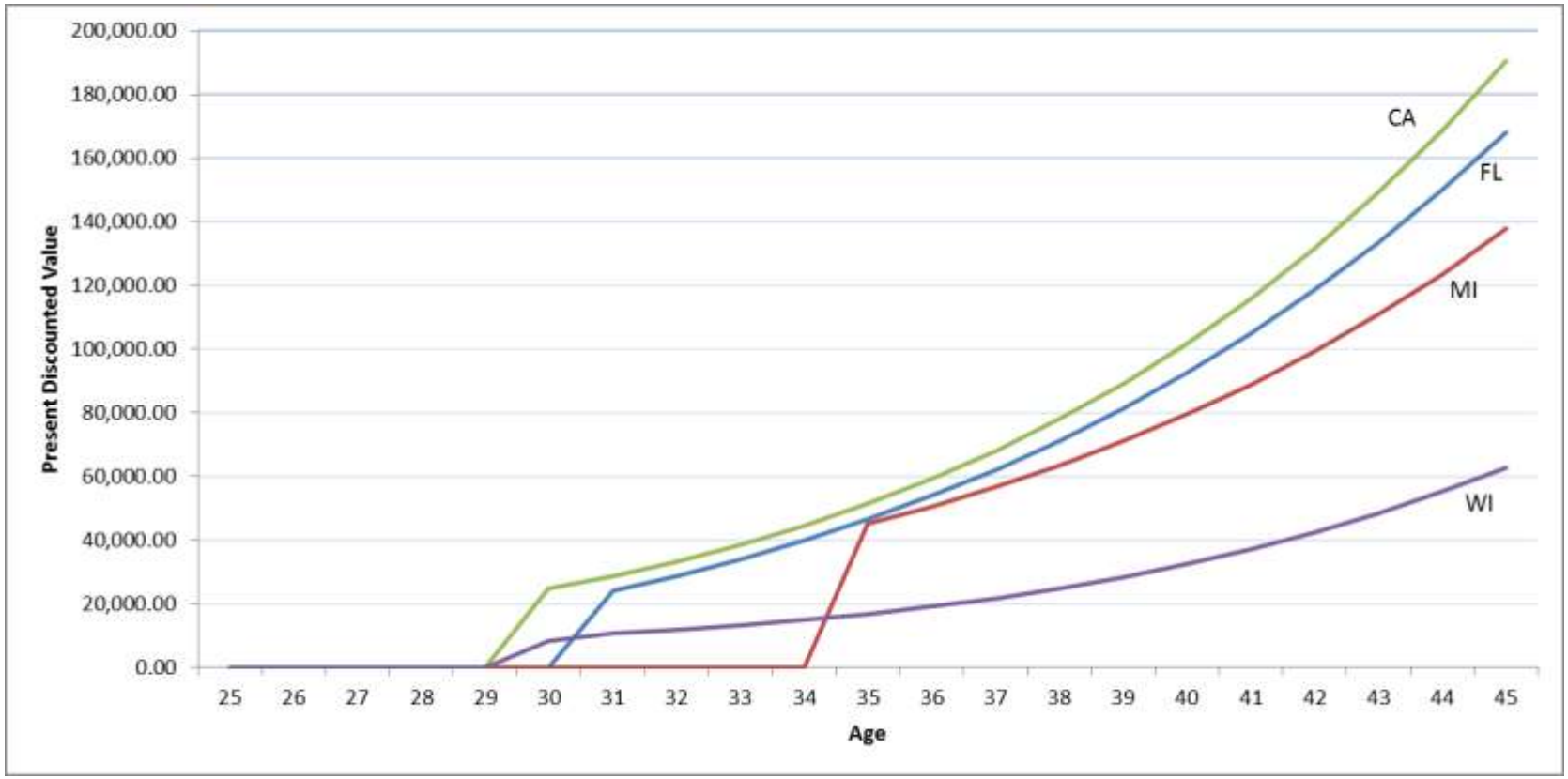
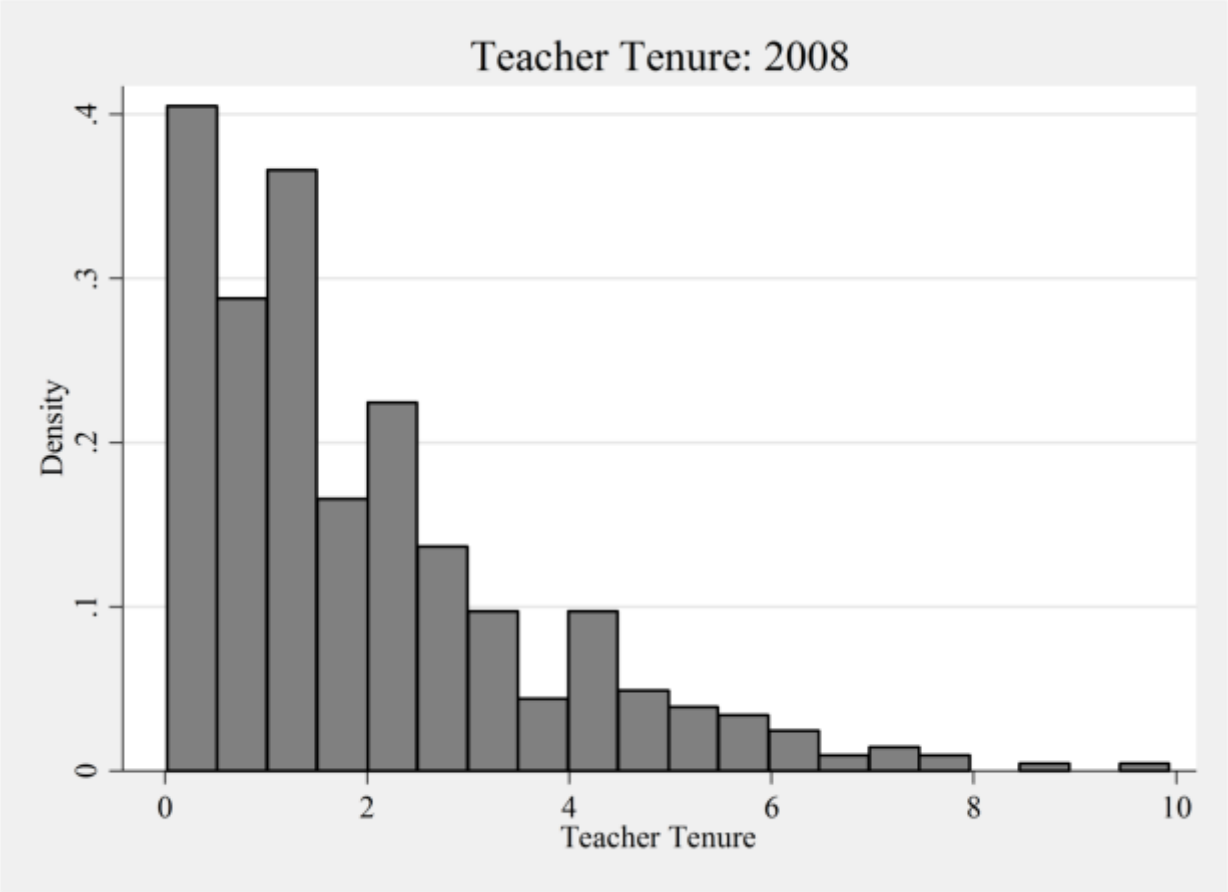


Figure 3



Source: National Longitudinal Survey of Youth of 1997, 2008 Wave

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