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PENSION UNDERFUNDING AND LIBERAL RETIREMENT BENEFITS AMONG STATE AND LOCAL GOVERNMENT WORKERS

RICHARD W. JOHNSON *

Abstract - *This paper finds evidence that the relative generosity of pensions among state and local government workers is related to the ability to underfund public employee retirement plans. Since underfunding can reduce tax burdens for residents who expect to leave the community before retirement benefits are paid, governments have an incentive to offer employees generous, poorly funded pensions. Combining individual-level data from the Current Population Survey (CPS) with state-level pension plan provisions, a recursive system of equations characterizing pension underfunding levels and pension benefits is estimated. The results indicate a strong, positive relationship among underfunding levels, individual pension wealth, and taxpayer mobility.*

*Institute for Health, Health Care Policy, and Aging Research, Rutgers University, New Brunswick, NJ 08903.

INTRODUCTION

Relative to workers in the private sector, government employees receive a large portion of their pay in the form of pension benefits deferred until retirement. A number of studies, for example, have found that the ratio of pension benefits to preretirement earnings is about twice as high in the public sector as in the private sector (Munnell and Connolly, 1979; Kotlikoff and Smith, 1983; Lovejoy, 1988; Phillips, 1992). Many other factors, in addition to the pension replacement rate, affect pension wealth, defined as the present discounted value of employer-financed retirement income. Since many of these factors, which include age and service eligibility requirements for retirement benefits, the level of employee contributions to pension funds, the level of employer contributions to Social Security, and future cost-of-living adjustments (COLAs) in benefit payments, vary by sector, simple comparisons of replacement rates in the public and private sectors may be misleading. On one hand, Wiatrowski (1994) notes that government workers are more likely

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than private workers to contribute to their own pension plans and less likely to be covered by Social Security; on the other hand, retirement packages in the public sector are more likely to include COLA provisions. However, controlling for these factors does not change the basic conclusion that public employees receive relatively generous pension benefits. Among covered workers in the Retirement History Survey, for example, pension wealth is 80 percent higher for state employees than private workers and 30 percent higher for local employees (Quinn, 1982).

This paper develops and tests a model to explain the relative generosity of pensions among state and local government workers. Despite the magnitude of these public-private differentials, the determinants of pension benefits among government workers have not been carefully studied.[1] The analysis of government pensions in the public finance literature has focused on the level of pension funding and the trade-offs among wages, pension benefits, and pension funding in the public sector, treating the level of pension benefits as exogenous (Ehrenberg, 1980; Smith, 1981; Ehrenberg and Smith, 1981; Inman, 1981, 1982; Grosskopf, Hayes, and Sivan, 1983; Grosskopf, Hayes, and Kennedy, 1985; Grosskopf, Hayes, and Porter-Hudak, 1988; Mitchell and Smith, 1994), whereas previous work on the role of pensions in the labor market has emphasized the private sector (e.g., Dorsey, 1982, 1987; Taubman, 1985; Hutchens, 1987; Gustman and Steinmeier, 1989; Woods, 1989).

Although economists have proposed a number of different models to study the role of pensions in the labor market, none of these models offers a convincing explanation of the public-private differences in pension wealth. For example, employers may offer pensions in order to provide workers with future retirement income (Bodie, 1990), but this model does not necessarily predict that pensions in the public sector would be more generous than pensions in the private sector. Although government workers appear to differ systematically from private workers, in that workers in the public sector tend to be better educated, more experienced, and more averse to risk, and are less likely to be male or white (Blank, 1985; Bellante and Link, 1981), it is not clear how these differences would affect the demand for retirement income. Other models, which maintain that preferential tax treatment may motivate pension coverage (Munnell, 1982; Woodbury, 1983; Reagan and Turner, 1994), predict that pension wealth will increase with income; these models do not, however, explain why pension wealth is greater for public workers at a given level of earnings. A final set of models justifies pension coverage by emphasizing productivity effects. By reducing turnover and shirking (Lazear, 1979, 1983, 1985; Hutchens, 1987, 1989), by inducing older, less productive workers to retire (Mitchell and Fields, 1982; Kotlikoff and Wise, 1989), or by eliciting cooperative behavior from labor unions (Ippolito, 1985), pension coverage can make workers more productive. However, since these models suggest that pensions are more valuable to profit-maximizing firms, they seem to predict—contrary to the evidence—that pension coverage would be more prevalent in the private sector than among governmental organizations, which lack profit motives.

The model developed below focuses on the capacity to underfund pensions in the public sector as a potential explanation for the generosity of defined

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benefit pension plans among state and local government employees.[2] In addition to current earnings, workers in jobs with pension coverage also earn each year rights to future pension benefits. A retirement plan is considered to be fully funded when employers set aside financial reserves equal to these future liabilities as they accrue, under assumed rates of real interest, turnover, mortality, and real wage growth. By underfunding, i.e., putting aside less money than necessary to pay future benefits, taxpayers reduce the current labor cost of public services while raising their future tax liability. If they subsequently move out of the government's jurisdiction before the underfunded benefits are paid out, taxpayers can forever avoid a portion of the labor bill as long as underfunded pension obligations are not fully capitalized into land values.[3] The capacity to underfund, and thus to pass on a larger fraction of the current labor bill to future taxpayers, increases as pensions comprise a larger portion of the total compensation of public servants. In the private sector, where the ability to underfund retirement plans is limited, employers do not have this incentive to offer compensation packages that are heavily weighted toward pension benefits. Thus, as long as government workers are confident that their retirement benefits will be paid, the underfunding hypothesis predicts that state and local government workers will receive generous pensions relative to their current wages and that pension benefits will be positively correlated with the level of underfunding, which in turn will increase with the mobility of taxpayers.[4]

The underfunding model is tested by estimating a recursive system of equations characterizing pension underfunding levels and pension benefits. The data consist of individual-level information from the Current Population Survey (CPS), state-level pension plan provisions collected from state statutes, and other state-level variables available from published government sources. The results support the underfunding model. The analysis reveals a strong, positive relationship between the level of underfunding among state-administered pension plans and the fraction of the population leaving the state over a five-year period. In addition, predicted plan underfunding levels significantly increase annual increments to individual pension wealth and the ratio of these increments to current earnings.

THEORETICAL MODEL

Employee compensation can be divided into two categories: wages and benefits that are received by the worker during the same period in which services are performed, and pension and other benefits that are not received by the worker until retirement in some future period. Because they are deferred, pension benefits do not require employer financing in the current period and can instead be funded by future revenue. Strict ERISA regulations and the efficiency of the stock market limit underfunding of pension obligations in the private sector. In the public sector, however, underfunding can allow current residents to pass the cost of government worker pensions on to future residents if there is incomplete capitalization of unfunded obligations into land values and if government workers are confident that their pensions will be paid (Inman, 1981, 1982). As pensions comprise an increasing fraction of total public employee compensation, current taxpayers can avoid a larger fraction of the labor costs of government services. Thus, current taxpayers have an

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incentive to offer government workers compensation packages that are heavily weighted in favor of deferred pension benefits.

In the model below, public sector wages, pension promises, and pension funding are elements of an optimal contract between current public sector workers and current taxpayers. The contract maximizes the level of utility achieved by public workers while maintaining taxpayer utility at a fixed level.

Taxpayer preferences are defined by the utility function $U = u(Y) + x(G)$, where Y is per capita after-tax income and G is the level of government services. For simplicity, both u and x are assumed to be linear, with strictly positive first derivatives. All taxpayers are identical. If I = per capita before-tax income, T = the total amount paid by current residents for government services, and n = the number of current residents, then $Y = I - (1/n)T$, where I is assumed to be exogenous.

Output in the public sector is determined by the production function $G = f(L) = L$, where L is the number of government employees. Government employees work during the first period and are retired during the second. They are paid in the form of current wages (w) and the promise of future pension payments (π) in the next period. In each period, the government sets aside tax revenue p to finance the pension obligations that must be paid in the next period. Let ρ denote the amount of money that must be set aside to fund fully the pension obligations, such that no tax revenue would be required next period to pay current employees their pensions. Then, $\rho = \Delta\pi$, where $0 \leq \Delta \leq 1$. Δ is an actuarial constant that reflects expected interest rates and turnover, retirement, and mortality probabilities.[5]

If all taxpayers expect to remain in the community for both periods, there would be little incentive to underfund pension obligations, i.e., set aside $p < \rho$, since funds invested in pension plans accrue interest at before-tax rates, whereas funds invested elsewhere generally earn lower, after-tax rates of return.[6] However, there might be an incentive to underfund for those who expect to leave the community at the end of the first period and wish to pass the pension obligations on to new residents. This incentive is mitigated if unfunded pension obligations are capitalized into land values. Underfunded pension obligations imply higher future taxes. Given two pieces of land that are identical in every respect except that one is in a community with relatively poorly funded pension obligations, a fully informed individual would not be willing to pay as much for the property in the underfunded community. In fact, with complete capitalization, the fall in purchase price would exactly equal the present value of future unfunded pension obligations per taxpayer.

Define δ as the degree of capitalization, where $0 \leq \delta \leq 1$, and define T^* as the total cost (including both current and deferred compensation) of government services. If all taxpayers are certain to leave the community at the end of the first period, then the total cost of local government services to current residents can be expressed as $T = L[w + p + \delta(\Delta\pi - p)]$. With full capitalization ($\delta = 1$), $T = L(w + \Delta\pi) = T^*$, and current taxpayers bear the entire cost of government employment. Now assume that residents expect to leave the community with some probability $q < 1$. Then we have $T = L[w + p + (1 - q)(\Delta\pi - p) + q\delta(\Delta\pi - p)]$. If $\delta = 1$, or if $q = 0$, this again reduces to $T = T^*$. However, $T < T^*$ if $q > 0$ and $\delta < 1$.[7]

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Government employee preferences are defined by the time-separable utility function, $V = v(w - t) + \beta v[H(p, \pi)\pi + s]$, where s = Social Security benefits paid by the federal government; t = Social Security tax, assumed here to be assessed on a lump-sum basis; and $H(p, \pi)$ = the subjective probability each individual worker places on his actually receiving the promised level of pension benefits, with $0 \leq H \leq 1$. For simplicity, v is assumed to be linear, with strictly positive first partial derivatives. Workers, who do not have access to capital markets, discount second-period utility by the factor β. Government workers are assumed to pay no local taxes and to derive no utility from the consumption of government services.

The value of H and its partial derivatives are related to the funding status of the pension plan. In particular, $\partial H/\partial p > 0$, since workers gain confidence in their pensions as funding increases, and $\partial H/\partial \pi < 0$, since workers lose confidence as the promised pension becomes more generous, holding the level of funding constant. A one-dollar increase in promised pension benefits increases underfunding by $\Delta < 1$ dollar, whereas a one-dollar increase in pension funding reduces underfunding by one dollar. If H merely reflected the degree of underfunding, then $\Delta \partial H/\partial p$ would equal the absolute value of $\partial H/\partial \pi$. However, the impact of a marginal increase in pension funding on employees' confidence in their retirement benefits goes beyond the reduction in the level of underfunding; it is also likely to convey a future commitment by the community to provide those pension benefits. As a result, an increase in pension funding is likely to raise employee confidence more than an actuarially equivalent reduction in pension promises. Thus, $\Delta \partial H/\partial p$ is assumed to exceed $\partial H/\partial \pi$ in absolute value. In addition, H is assumed to be a linear function with zero cross-partial derivatives.

The contract (w, π, p) is the solution to the following constrained maximization problem:

1

$$\max v(w - t) + \beta v[H(p, \pi)\pi + s]$$

$$\text{s.t. } u\{1 - (L/n)[w + p + (1 - q + q\delta)$$

$$(\Delta\pi - p)]\} + x(L) \geq Z$$

$$p \geq 0$$

where the first constraint specifies a minimum level Z of utility for taxpayers, and the second constraint rules out negative pension funding. Assuming the first constraint is binding and the second constraint is not binding, the first-order conditions are as follows:

2

$$v'(w - t) = \lambda \frac{L}{n} u'(\cdot)$$

3

$$v'(H\pi + s) = \lambda \frac{L}{n} u'(\cdot)\, \Delta(1 - q + q\delta) \left[\beta\left(H + \pi \frac{\partial H}{\partial \pi}\right)\right]^{-1}$$

4

$$v'(H\pi + s) = \lambda \frac{L}{n} u'(\cdot)\, q(1 - \delta)\left(\beta\pi \frac{\partial H}{\partial p}\right)^{-1}$$

where λ is the non-negative Lagrange multiplier on the first constraint. To examine the comparative statics,

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equations 2–4 and the binding constraint are totally differentiated. Defining D as the determinant of the bordered Hessian, it then follows that

5

$$D = \left[\frac{L}{n}\, u'(\cdot)\beta v'(H\pi + s)\,\frac{\partial H}{\partial p}\right]^2 > 0.$$

By Cramer's Rule, the following derivatives can be obtained to measure, respectively, the impact of tax capitalization on the level of pension benefits and the impact of taxpayer mobility on both pension benefits and the extent to which pensions are underfunded:

6

$$\frac{d\pi}{d\delta} = -D^{-1}\left[\frac{L}{n}u'(\cdot)\right]^2 \beta v'(H\pi + s)$$

$$v'(w - t)q\,\frac{\partial H}{\partial p} - < 0$$

7

$$\frac{d\pi}{dq} = D^{-1}\left[\frac{L}{n}\, u'(\cdot)\right]^2 \beta v'(H\pi + s)\, v'(w - t)$$

$$(1 - \delta)\frac{\partial H}{\partial p} > 0$$

8

$$\frac{d(\Delta\pi - p)}{dq} = 2D^{-1}\left[\frac{L}{n}\, u'(\cdot)\right]^2 \beta v'(H\pi + s)$$

$$v'(w - t)(1 - \delta)\left\{\Delta\frac{\partial H}{\partial P} + \frac{\partial H}{\partial \pi}\right\}.$$

Promised pension benefits increase as the degree of capitalization decreases and as taxpayer mobility increases. In addition, given the assumptions here concerning the relative magnitudes of $\partial H/\partial p$ and $\partial H/\partial p$, the last term in braces in equation 8 is positive, so that the entire derivative expressed by equation 8 is greater than zero. Thus, pension underfunding is positively related to taxpayer mobility.

In summary, generous pensions for public sector workers may result from efforts by current residents to shift the costs of local public goods to future residents. Since private employers are less able to avoid labor costs by offering workers underfunded pension plans, they are less likely to provide workers with pension plans as generous as those available in the public sector. This explanation requires first that the local population expects with some nonzero probability to leave the community in the future, which seems plausible given the degree of household mobility in the United States.[8] Second, the model assumes that future pension liabilities are not completely capitalized into local property values. Given the lack of perfect information regarding pension obligations and search costs in the housing market, complete capitalization seems quite unlikely. In fact, a recent study finds that less than 25 percent of the difference in current local property taxes is capitalized into property values, after controlling for housing and neighborhood variables (Yinger et al., 1988). The model predicts that communities with relatively mobile taxpayers will offer their government workers generous, but poorly funded, pension plans.

The underfunding explanation can be extended to account for the generosity of pensions among federal government employees by adding an intergenerational element to the model. Taxpayers cannot escape the costs of deferred

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compensation to federal workers by moving to another state. However, they do avoid the cost of underfunded federal pension benefits when they die, leaving the bill for the next generation of taxpayers. By offering generous but poorly funded pensions to federal workers, a relatively large fraction of total labor costs can be passed to future generations. In this context, the motivation to underfund is limited not by the capitalization of future tax liabilities into land values, but by concern about the welfare of future generations (Barro, 1974).

DATA

In order to test the underfunding model, individual-level data from the CPS are combined with information about workers' pensions collected from state statutes, estimates of pension funding calculated from an algorithm developed by Inman (1986), and state-level variables available from government publications. Unlike pension plans in the private sector, the provisions of government employee retirement plans are part of the public record. The details of state-administered pension plans are codified in state law, making available information on retirement ages, vesting, rates at which employees contribute to the pension fund, COLAs, and the formulas by which pension benefits are calculated. In addition to covering all state government employees, most state pension plans also include local government employees.[9]

Information was collected from state statutes on pension plans administered by 47 states in the continental United States.[10] The data are generally restricted to current plan provisions, although historical data were also collected whenever they were available. Most states administer more than one retirement system. For example, a typical state might have one general plan for most state government workers and maintain separate plans for specific occupations, such as teachers, state and/or local police, firefighters, and general local employees. Information was collected for as many different plans as possible. Selected provisions of general and teacher-only state plans, by far the two most common types, are presented in Appendix Tables 1 and 2, respectively. This pension information is matched to corresponding state and local government workers in the May 1983 and May 1988 CPS pension supplements, by occupation and state of residence.[11] In addition to providing information on current retirement plans, the pension supplement also includes information on the number of years spent with the current employer and whether the worker receives or expects to receive pension benefits from any previous employer. The sample is restricted to state and local government workers between the ages of 25 and 65 who claim that their employers offer pension plans, resulting in a sample of 5,211 individuals in 102 different state-administered retirement plans.

Calculation of pension wealth

With information on pension provisions, earnings, job tenure, and demographics, pension wealth for the public workers in the sample can be estimated. Pension wealth, *PW*, net of employee contributions, is calculated by equation 9:

9

$$PW = [FT \times FW \times \lambda - \varphi](1 + i)^{-(R-a)}$$

$$A(R) - C$$

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where *FT* is expected total years of job tenure, *FW* is the expected final wage base, λ is the plan-specific percentage factor, φ is the reduction in pension benefits due to Social Security integration, *i* is the nominal interest rate, *R* is the normal retirement age, *a* is the current age of the worker, $A(R)$ is a function converting a one-dollar lifetime annuity into its present value as of the normal retirement age, and *C* is the present value of employee contributions to the pension plan.

The bracketed expression in equation 9 represents the value of nominal pension benefits that workers can expect to receive during the first year of retirement. Workers are assumed to remain with the employer until becoming fully vested in the pension plan and until reaching the plan's normal retirement age.[12] The final wage base is a function of expected final tenure, wage growth, and the number of years used in calculating average final wage, as specified by the particular plan. Assumed real wage growth is based on an age-earnings profile estimated from a cross section of state and local government workers in the May 1988 CPS. An individual's real earnings history is assumed to follow that profile and grow at an additional annual compound rate of 0.6 percent to reflect economy-wide productivity increases.[13] According to these computations, real wages for individuals beginning work in the public sector at age 35, for example, will increase at a 15 percent compound annual rate during their first five years of tenure, but this growth declines to less than four percent a year over the next five years and to one percent annually during years 15–20.

Retirement plans that are integrated with Social Security generally reduce pension benefits by the amount of Social Security benefits received. Thus, for workers in the sample covered by integrated plans, φ is equal to the expected final wage base times the Social Security replacement rate. Based on data from the U.S. Social Security Administration (1990), the Social Security replacement rate is assumed to be 0.6 for workers earning less than $15,000, 0.41 for workers earning at least $15,000 but less than $50,000, and 0.27 for those earning more than $50,000.

The nominal benefits calculated for the first year of retirement are received annually for the remainder of the retiree's life, although the size of the payment may be subject to COLAs. The annual retirement benefit, discounted to the current age, is converted into its annuity value by the function $A(R)$, shown in equation 10:

10

$$A(R) = \sum_{t=R}^{85} \left(\frac{1 + k_t}{1 + i} \right)^{t-R} s_{R,t}$$

where k_t is the COLA at age *t*, $s_{R,t}$ is the probability of surviving from the normal retirement age to age *t*, and *i* is again the nominal interest rate. Survival probabilities are taken from standard life tables. The value of k_t depends upon the inflationary environment and the COLA provisions of the specific pension plan. Many plans cap COLAs, so that they cannot exceed a given percentage increase in any particular year. When retiree benefits are adjusted on an irregular, *ad hoc* basis by either the state pension board or state legislature, which is quite common, they are assumed to increase annually at a rate equal to one-half the increase in the CPI.[14] Following Arnold (1983) for consistency with the

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underfunding calculations discussed below, a real interest rate of three percent and inflation rate of five percent are assumed.

Finally, pension wealth is reduced by the expected present value of employee contributions to the pension plan. These contributions are calculated as the product of the current contribution rate and annual earnings for each year the worker is employed.

Descriptive statistics for the pension variables, as well as other selected variables, are presented in Table 1. On average, state and local government workers are required to contribute five percent of their earnings to retirement plans, and they become fully vested after seven years of service. The mean normal retirement age is 61.5 years, and the mean percentage factor used to calculate annual retirement benefits is 1.8 percent of the product of final average salary and years of service. Workers in the sample have spent almost ten years with their current employer and will remain with the employer for a total of 30 years, on average, under the assumption that they do not leave the current employer until reaching normal retirement age. The mean annual earnings in the sample is approximately $21,000. About one-quarter of the workers are teachers, and an additional 27 percent are employed in other professional or managerial occupations. These workers are well-educated, averaging 14.5 years of schooling, and heavily unionized, with about one-half covered by collective bargaining agreements.

Mean pension wealth in the sample is $51,778.[15] This figure would be substantially higher in the absence (all else equal) of mandatory employee contributions to the retirement plan, which are subtracted from future retirement benefits in the calculation of pension wealth and which amount to about $31,000 per worker in present value terms over the worker's entire tenure with the employer. The mean ratio of pension to wage wealth in the sample is 0.09.[16] By comparison, Gustman and Steinmeier (1989) estimated the mean ratio of pension to wage wealth to be 0.143 for private sector workers in the 1983 Survey of Consumer Finance. However, their estimates are based on a different set of assumptions than those used here. When pension wealth in this sample is re-estimated under the same set of assumptions as Gustman and Steinmeier employ, the mean ratio of pension to wage wealth for state and local government workers is 0.216, consistent with earlier findings that pension benefits are a larger fraction of total compensation in the public sector than in the private sector.[17]

In order to estimate annual increments in pension wealth, final pension wealth must be allocated to individual years of employment. The approach taken here, which is consistent with the implicit contract view of pensions that employers and employees expect their employment relationship to continue into the future, is that pension wealth accrues evenly each year.[18] Thus, annual pension accrual is calculated here as total pension wealth divided by total expected years on the job. As reported in Table 1, the annual increment in pension wealth is $1,821, and the ratio of annual pension accrual to current earnings is 0.091.

Estimates of pension funding levels

Since consistent, detailed information on funding levels for a broad cross section of public pension plans over

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TABLE 1
DESCRIPTIVE STATISTICS[a]

	Mean	Standard Deviation
Current annual earnings ($1987)	20,830	11,999
Completed years with current employer	9.7	7.6
Total expected years with employer[b]	29.7	9.1
Years of schooling	14.5	2.8
Age	41.7	10.4
Male[c]	0.454	0.50
Nonwhite[c]	0.110	0.31
Expect other pension benefits[c]	0.068	0.25
Part-time work[c]	0.099	0.30
Collective bargaining[c]	0.493	0.50
Teacher[c]	0.246	0.43
Other professional or manager[c]	0.272	0.45
Police officer or firefighter[c]	0.059	0.24
Characteristics of pension plan:		
Plan percentage factor	0.018	0.003
Employee contribution rate	0.050	0.02
Normal retirement age	61.5	2.57
Years to vest	7.0	2.74
Level of plan underfunding per member ($1987)[d]	32,014	41,029
Pension wealth:		
Total net pension wealth ($1987)	51,778	42,745
Present value of employee contributions ($1987)	31,367	24,790
Ratio of pension wealth to wage wealth	0.090	0.049
Annual increment in pension wealth ($1987)	1,821	1,518
Ratio of pension accrual to current earnings	0.091	0.05

[a] Sample is restricted to state and local government workers, between the ages of 25 and 65, who report that their employer offers a retirement plan (n = 5211). Data are pooled from the 1983 and 1988 May CPS's. Assumes 5 percent inflation and 3 percent real interest.
[b] Assumes worker remains with current employer until reaching normal retirement age.
[c] Dummy variable that equals one if the characteristic is present.
[d] Mean level over the period 1980–89, calculated using Inman's (1986) algorithm.

time does not exist, pension underfunding is estimated for state-administered plans using the methodology developed by Inman (1986).[19] Inman demonstrates theoretically that underfunding can be described by readily observable financial statistics and plan provisions. In particular, he specifies plan underfunding in any given year as a function of the plan's accumulated assets, the total amount of benefits paid to retirees that year, growth in plan membership, and a number of different plan attributes—the percentage factor applied to the product of earnings and job tenure to calculate annual pension benefits, the employee contribution rate, the retirement age, COLAs, and Social Security integration.

Inman (1986) estimates his underfunding equation based on data and calculations from Arnold (1983), who made actuarial computations of underfunding levels for the year 1978–79 with detailed information from his survey of plan administrators. The results of Inman's preferred specification are reported in equation 11:

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11

$$1 + \frac{U}{A} = 211{,}300\,\frac{m}{a} + 39.61\,\frac{B_0}{A} + 1417.50\,\frac{c}{b}\,\frac{B_0}{A}\,k - 61.28\,\frac{c}{b}\,\frac{B_0}{A}(R-54) + 5.98\,\frac{c}{b}\,\frac{B_0}{A}\,(R-54)^2$$

where U is the level of underfunding, A is accumulated assets, B_0 is benefits paid to retirees during the year, b is the replacement rate, c is the employee contribution rate, m is the growth rate of plan membership over a ten-year period, k is the COLA, and R is the plan's normal retirement age. To compute the replacement rate, defined here as tenure times the plan percentage factor minus any reduction for Social Security integration, Inman assumes that final tenure is equal to the retirement age minus 30 (the presumed age at which employees are hired) and that Social Security reduces the replacement rate by 27 percent.

Equation 11 is applied to the plan attributes of workers in the sample to calculate levels of underfunding for each year from 1980 to 1989. The asset, benefit, and membership data are available annually from government publications (U.S. Bureau of the Census, 1981–1991a).[20] Estimates of the mean level of underfunding per plan member for general and teacher plans over the period are reported, in constant 1987 dollars, in Appendix Tables 1 and 2, respectively. Among all government workers in the sample, the mean level of plan underfunding over the period is $32,014, as reported in Table 1.

Taxpayer mobility

The mobility of local taxpayers, which is the key exogenous variable in the test of the underfunding model, is measured by the fraction of the state's population that moves out of the state over the five-year period between 1985 and 1990. The 1990 U.S. Census of Population and Housing reports the fraction of each state's population that resided in a different state in 1985, so that the number of movers into each state can be estimated. The fraction of the population moving *out* of each state from 1985 to 1990 is calculated as the number of in-movers plus the number of births minus the change in total population minus the number of deaths in each state over the period, divided by the mean population over the period. Taxpayer mobility in each state is reported in Appendix Table 3. The mean value of the mobility measure, weighted by state population in 1990, is 0.085. Residents were least likely to leave California, where only 1.2 percent of the population moved out of state between 1985 and 1990, and were most likely to leave Wyoming, where 29 percent of the population left. Residents in North Dakota, Idaho, Colorado, and Montana were also relatively mobile during the last half of the 1980s.

EMPIRICAL SPECIFICATION

The predictions of the underfunding model are tested by estimating the relationships among pension wealth, levels of pension underfunding, and taxpayer mobility.[21] Taxpayer mobility is expected to raise the level of pension wealth among state and local government workers by creating an incentive to underfund pensions, which in turn leads to more generous retirement benefits, both in absolute terms and

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relative to current earnings, as current taxpayers shoulder a diminishing portion of the total pension cost. The following recursive system of equations is specified:

12

$$u_{jkt} = m_k \beta_1 + z_{kt} \gamma_1 + c_t \xi_1 + \phi_k + \varepsilon_{jkt}$$

13

$$P_{ijk} = x_{ijk} \beta_2 + y_k \gamma_2 + \left(\frac{1}{T_{jk}} \sum_{t=1}^{T_{jk}} \hat{u}_{jkt} \right) \delta_2 + d_{ijk} \xi_2 + \varphi_k + \eta_{ijk}$$

where u_{jkt} is the level of plan underfunding per member for plan j in state k at time t (t = 1, 2, ..., 10); $\hat{u}_{jkt}$ is the predicted value of plan underfunding per member; T_{jk} is the number of underfunding observations between 1980 and 1989 for each plan; P_{ijk} is the annual increment to pension wealth (measured alternatively as the absolute level and relative to current wage earnings) for individual i in plan j in state k; m_k is the fraction of the population leaving state k between 1985 and 1990; $\mathbf{x}_{ijk}$ is a vector of individual-level characteristics that are expected to affect pension wealth; $\mathbf{z}_{kt}$ is a vector of state-level variables at time t that are expected to affect underfunding; $\mathbf{y}_k$ is a vector of state-level variables, averaged over the decade of the 1980s, that are expected to affect pension wealth; $\mathbf{c}_t$ and $\mathbf{d}_{ijk}$ are vectors of year dummies; ϕ_k and φ_k are randomly distributed unobserved state-specific effects, which are constant over time and over plans or individuals within a state; ε_{jkt} and η_{ijk} are idiosyncratic error terms; and β_1, β_2, γ_1, γ_2, δ_2, ξ_1, and ξ_2 are parameters to be estimated.

Equation 12 is estimated for a panel of retirement plans, since underfunding levels have been calculated annually between 1980 and 1989, whereas equation 13 is estimated for a cross section of workers, pooled for the years 1983 and 1988. Thus, $\mathbf{c}_t$ is a vector of nine year dummies, whereas $\mathbf{d}_{ijk}$ is a single dummy for 1988. Because the level of underfunding varies a great deal from year to year while pension benefits are relatively stable, the mean level of underfunding from 1980 to 1989 enters pension equation 13. All state-level variables enter equation 12 as annual values and enter equation 13 as mean values over the period, unless otherwise noted.

The estimation is conducted under the assumption that $E(\phi_k) = E(\varphi_k) = E(\varepsilon_{jkt}) = E(\eta_{ijk}) = E(\varepsilon_{jkt}\eta_{ijk}) = 0$, for all i, j, k, and t. However, since state-specific unobservables that affect the level of underfunding may also affect the level of pension benefits, no restriction is placed on $E(\phi_k\varphi_k)$. The presence of unobservables that are potentially correlated with each other requires that the estimation be carried out in two stages. In the first stage, equation 12 is estimated, generating predicted values of $\mathbf{u}_{jkt}$. These predicted values are used in the second stage to estimate equation 13. Generalized least squares is used in the estimation of both equations, to account for state-specific random effects.

State-level variables[22]

The components of $\mathbf{z}_{kt}$ in equation 12 include state-level variables, which reflect differences across states in the ability or willingness of taxpayers to fully fund government pension plans, differences in preferences for fully funded plans, and differences in the

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effective price to taxpayers of fully funded plans. Differences in the ability to pay are proxied by per capita income, unemployment rates, and the amount of revenue received by state and local governments from the federal government. The level of per capita income in the state indicates the potential ability of the government to generate tax revenue and fund public pension plans; levels of plan underfunding are expected to be negatively correlated with per capita personal income and with annual deviations in per capita income from the ten-year average during the 1980s. Since economic recessions generally strain state budgets, general government revenues may be diverted from the funding of state pension plans during periods of high unemployment. To capture this possibility, both the rate of unemployment and deviations from the ten-year average unemployment rate enter the underfunding equation. Finally, taxpayers may be better able to devote resources to public employee pension plans as they receive more revenue from the federal government. To control for this effect, $\mathbf{z}_{kt}$ includes the value of grants to states and local governments from the federal government, exclusive of Medicaid payments, divided by total state and local government revenue.

Variation across states in the effective price of plan funding and preferences for fully funded plans may also affect underfunding levels. The effective price to taxpayers can be proxied by the fraction of the total value of real estate in the state that is commercial or industrial. Local residential taxpayers share the cost of government obligations, including pension funding, with outside business interests, which do not participate in the political process but which pay taxes on property owned within the locality. As a result, the marginal cost of government services to local, voting taxpayers decreases as the fraction of commercial and industrial real estate increases. The level of underfunding is thus expected to be negatively related to the ratio of the value of commercial and industrial real estate to total real estate in the state. States may also differ in underlying preferences for pension funding. If political parties reflect these preferences, then the fraction of state legislative seats held by Democrats may affect underfunding. Both of these variables enter equation 12 through $\mathbf{z}_{kt}$.

State and local tax and debt burdens may be important determinants of pension funding, either because they measure the ability of states to devote resources to pension funds or because they reflect the preferences of taxpayers. If taxes are imposed to reduce unfunded state liabilities, then pension plans in states with relatively high tax burdens are likely to be well-funded. On the other hand, if high tax burdens reflect strong underlying preferences for government services on the part of taxpayers, then relatively little revenue may be available to fund pension plans in high-tax states, resulting in high levels of underfunding. Similarly, high levels of outstanding debt may indicate less conservative fiscal policies, which are likely to be associated with higher levels of plan underfunding, or they may suggest that governments are, in effect, funding pension plans with revenue raised in bond markets. To control for these potential effects, both the fraction of personal income paid in state and local taxes and the ratio of outstanding state and local debt to personal income are included in $\mathbf{z}_{kt}$.

Two final state-level variables enter equation 12. The percent change in population over the period from 1980

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to 1990 is included in $\mathbf{z}_{kt}$ to interpret properly the taxpayer mobility variable. Controlling for the change in total population, an increase in the fraction of the state population that leaves the state indicates higher turnover in the state's population, as the theory requires, and not simply an overall decline in population. The fraction of state and local government employees that are covered by collective bargaining agreements is included to measure the impact of unionization on underfunding.[23]

Many of the state-level variables that are expected to influence underfunding are also likely to affect annual increments in pension wealth, by affecting the level of total compensation offered to public employees. For example, per capita personal income and the state unemployment rate may influence promised pension benefits by affecting the ability of state and local governments to generate revenue and compensate government workers. The fraction of income paid in state and local taxes and the ratio of outstanding state and local debt to income may affect pension benefits in either direction, depending upon whether they measure past tendencies to devote local resources to the public sector or they measure budgetary pressures. Pension wealth may rise with the fraction of commercial and industrial real estate, which reduces the effective price to taxpayers of government expenditures, whereas the political affiliation of state legislators may have an impact if the two major political parties differ in their approach to public employee compensation. A number of other variables, including the fraction of the population under 18, the fraction African American, and the fraction living in urban areas, potentially measure state differences in the demand for government services, which may affect the levels of compensation paid to public employees. Finally, mean annual wages paid to private-sector workers in the state provide a measure of the opportunity cost of working in the public sector; total compensation, including pension benefits, in the public sector is likely to increase with wages in the private sector. Each of these variables enters equation 13 as a component of $\mathbf{y}_k$.

Individual-level variables

A number of individual-level variables, which measure differences in human capital, demographics, job characteristics, and preferences for pension plans, may affect pension wealth and are components of $\mathbf{x}_{ijk}$ in equation 13. The level of human capital is measured by education (which enters the specification through a series of dummy variables indicating fewer than nine years of education, some high school education but fewer than four years, some college but fewer than four years, exactly four years of college, and more than four years of college), expected final years of service with the current employer and its square, current age and its square, and veteran status. By raising potential productivity, prior military service and additional years of schooling and experience are likely to increase the level of pension wealth, although their predicted impact on the ratio of pension accrual to current earnings is less obvious. Basic demographic variables include dummies for male, nonwhite, current marital status, and residence in a metropolitan area. Job characteristics include occupational dummies (indicating teacher, other white-collar occupation, and police officer or firefighter) and dummies indicating part-time status (fewer than 35 hours per week) and whether the individual's job is covered by a collective bargaining agreement. Finally, $\mathbf{x}_{ijk}$ includes a dummy variable

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indicating whether workers are receiving or expect to receive retirement benefits from any previous employer. If pension wealth on a previous job reduces demand for retirement benefits on the current job, and if workers can sort themselves into jobs on the basis of the mix of current and deferred compensation, then access to other retirement benefits may be negatively related to pension wealth on the current job. On the other hand, previous pension wealth may indicate strong preferences for retirement income and, thus, may be positively related to pension wealth on the current job.

RESULTS

Plan underfunding per member

Table 2 presents estimates of equation 12, for a sample of 1,013 observations on 102 different plans in 47 states over a period of up to ten years. Column (1) of the table reports the basic specification, without year dummies, estimated by ordinary least squares (OLS); column (2) adds year dummies, and column (3) adds additional controls to test the robustness of the results. Because of collinearity problems, which arise from missing data patterns in the sample, variables measuring tax and debt burdens and federal grants are dropped from the specifications reported in columns (2) and (3). Columns (1′), (2′), and (3′) re-estimate the models in the first three columns, using random- effects models instead of OLS. Each of the OLS specifications is rejected by the Lagrange multiplier (LM) test in favor of the corresponding random-effects model, with *p*-values of less than 0.0001.

The findings in Table 2 are consistent with the underfunding model. The fraction of the population leaving the state has a significant, positive effect on the level of plan underfunding per member. The estimated elasticity of underfunding with respect to resident mobility is 1.33 in column (1) and 1.17 when year dummies are included in column (2). The impact of mobility in these two specifications is somewhat smaller in the random-effects models, where the estimated elasticity drops just below unity. Nonetheless, the effect of taxpayer mobility remains significantly positive and, in fact, is the only significant determinant of pension underfunding in the random effects models, with the exception of the debt and federal grant variables, which are marginally significant. Additional controls are added to the specification in columns (3) and (3′) to test whether the mobility results are driven by outmigration from heavily industrialized and unionized states with large, underfunded public pension plans.[24] These state-level variables are the fraction of the work force employed in the manufacturing sector in 1989, the percent change in that fraction between 1980 and 1989, and the fraction of manufacturing employees unionized in 1989. The effect of mobility on underfunding is robust to the inclusion of these additional controls; in fact, the size of the mobility coefficient is larger in columns (3) and (3′) than in columns (2) and (2′), respectively, although the coefficient is only marginally significant in (3′). Both the fraction of workers in manufacturing and the fraction of manufacturing workers unionized significantly increase plan underfunding levels in the OLS equations but are insignificant in the random-effects equations.[25]

The effect on underfunding levels of variables designed to measure the ability of local taxpayers to fund pension plans is mixed, as reported in Table 2. As expected, public pension plans are more fully funded in states in which a large

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TABLE 2
IMPACT OF TAXPAYER MOBILITY ON PENSION UNDERFUNDING[a]

	OLS			Random Effects		
	(1)	(2)	(3)	(1')	(2')	(3')
	790***	696***	1060***	583**	580**	*
	(126)	(113)	(170)	(243)	(289)	(448)
	−0.994**	−0.410	1.05*	−1.03	−0.713	0.191
	(0.445)	(0.425)	(0.599)	(0.807)	(0.991)	(1.53)
	−3.17	0.050	−4.65	−0.452	2.14	−2.89
	(3.18)	(2.84)	(3.29)	(6.47)	(7.88)	(9.88)
	−5.37	−7.46	−3.54	−7.89	−10.2	−5.29
	(6.02)	(6.52)	(6.64)	(7.93)	(9.19)	(10.8)
	−705***	−516**	−950***	−489	−322	−827
	(253)	(253)	(348)	(566)	(719)	(1051)
	923**	756*	1211**	549	593	1102
	(388)	(448)	(511)	(623)	(779)	(1095)
	−553**	—	—	−97.9	—	—
	(236)			(284)		
	153**	—	—	135*	—	—
	(62.2)			(77.7)		
	−124*	−164*	−263***	−95.7	−113	−125
	(70.1)	(88.8)	(93.1)	(75.4)	(102)	(99.9)
	−469***	—	—	−321*	—	—
	(144)			(183)		
	68.2***	66.8***	79.1***	47.8	51.3	56.1
	(23.0)	(23.4)	(27.2)	(44.0)	(50.0)	(53.4)
	117***	99.3***	102***	67.9	67.1	56.7
	(30.7)	(28.2)	(28.7)	(57.4)	(69.5)	(74.4)

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TABLE 2 (Continued)

	OLS			Random Effects		
	(1)	(2)	(3)	(1')	(2')	(3')
Fraction of employment in manufacturing, 1989	—	—	162^{*} (87.3)	—	—	48.6 (260)
Percent change in fraction of employment in manufacturing, 1980–89	—	—	–96.3 (59.8)	—	—	–60.6 (164)
Fraction of manufacturing employees unionized, 1989	—	—	162^{***} (61.5)	—	—	154 (190)
Year dummies	no	yes	yes	no	yes	yes
R–squared	0.132	0.119	0.131	0.111	0.096	0.107
p–value, LM test (versus OLS)	—	—	—	0.0000	0.0000	0.0000

Significant at 0.05 level.
* Significant at 0.10 level.

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fraction of total state and local government revenue comes from the federal government, but contrary to expectations, funding levels are also higher in states with high unemployment rates. On the other hand, positive deviations in the unemployment rate from the ten-year average, which is probably a better measure of short-term budgetary pressures, increase the level of plan underfunding, as expected.[26] Per capita income does not significantly affect pension funding in this sample.[27] Underfunding levels fall as tax burdens increase, suggesting that at least part of the additional tax revenue in these states funds pension plans. The state and local debt burdens increase underfunding levels. Of these variables, only those relating to debt burdens and federal grants are (marginally) significant in the random-effects models.

The remaining determinants of pension underfunding levels exhibit the expected effects in the OLS estimation. Underfunding levels are lower in states in which commercial and industrial real estate account for a relatively large portion of total real estate value. Underfunding levels rise as Democrats control more seats in state legislatures, consistent with the notion that they pursue less conservative budgetary practices. Underfunding levels are also higher in states where government employees are more unionized; Mitchell and Smith (1994), who also report this result, speculate that union officials, under pressure from their members to produce tangible results, trade pension funding for more salient wage increases. None of these variables is significant in the random-effects models.

Individual pension wealth

Table 3 reports estimates of individual pension wealth, as specified by equation 13. The dependent variable is defined as the annual increment in individual pension wealth in columns (1) and (2) and as the ratio of annual increments in pension wealth to annual current earnings in columns (3) and (4). OLS estimates are reported in columns (1) and (3), and generalized least squares estimates, to account for state-specific random effects, are reported in columns (2) and (4). Both of the OLS specifications are rejected by the LM test in favor of the corresponding random-effects model, with *p*-values of less than 0.0001.

The results in Table 3 provide additional support for the underfunding model. The mean predicted value of the pension plan's unfunded liabilities per member, over the period 1980–89, significantly increases annual increments to pension wealth.[28] The estimated elasticity of annual pension accrual with respect to underfunding levels per member is 0.50 in the OLS model. The effect is smaller, but still significant, in the random-effects model, as reported in column (2), with an estimated elasticity of 0.33.

The ratio of pension wealth increments to current earnings also increases with the level of predicted pension underfunding per plan member, as reported in columns (3) and (4). These results represent perhaps the strongest evidence in favor of the underfunding model. The positive relationship between plan underfunding and increments to pension wealth reported in columns (1) and (2) may merely represent compensating differentials, as workers demand higher levels of total compensation, including pensions, in order to accept the risky promise of future benefits that are not well-funded. However, columns (3) and (4) indicate that relatively high underfunding levels lead to public sector pay packages in

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TABLE 3
DETERMINANTS OF PENSION WEALTH[a]

	Annual Increment to Pension Wealth[b]		Ratio of Annual Pension Accruals to Current Earnings[c]	
	OLS (1)	Random Effects (2)	OLS (3)	Random Effects (4)
Predicted mean underfunding per member, 1980–89 ($000)	18.3*** (0.708)	12.2*** (4.14)	0.001*** (0.0002)	0.0006*** (0.0002)
Education:				
No high school[d]	–342*** (103)	–375*** (89.0)	0.004 (0.003)	0.002 (0.002)
Some high school only[d]	–19.0 (81.8)	–55.8 (70.8)	0.004* (0.002)	0.003* (0.002)
(Reference: high school grad)	—	—	—	—
Less than 4 years of college[d]	195*** (51.2)	180*** (44.3)	–0.001 (0.002)	–0.003*** (0.001)
Four years of college[d]	361*** (59.8)	375*** (51.7)	–0.003* (0.002)	–0.003** (0.001)
More than 4 years of college[d]	724*** (58.8)	784*** (50.8)	–0.005*** (0.002)	–0.003** (0.001)
Experience:				
Expected total years on job	37.5*** (10.8)	32.2*** (9.41)	–0.0002 (0.0003)	0.0004* (0.0002)
Expected years squared/100	–93.8*** (19.1)	–71.9*** (16.8)	–0.004*** (0.001)	–0.003*** (0.0004)
Age	63.3*** (14.6)	60.2*** (12.7)	–0.0004 (0.0004)	–0.001*** (0.0003)
Age squared/100	–41.3** (16.7)	–34.0** (14.4)	0.00004 (0.0005)	0.0006* (0.0003)
Veteran[d]	191*** (51.9)	214*** (44.8)	–0.0004 (0.002)	0.0002 (0.001)
Occupation:				
Teacher[d]	125** (59.4)	65.9 (51.4)	0.003 (0.002)	0.0003 (0.001)
Other white–collar worker[d]	442*** (50.9)	398*** (44.0)	0.003* (0.002)	0.001 (0.001)
Police officer or firefighter[d]	608*** (75.3)	655*** (65.2)	0.012*** (0.002)	0.014*** (0.002)
(Reference: blue-collar worker)	—	—	—	—

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TABLE 3 (Continued)

	Annual Increment to Pension Wealth[b]		Ratio of Annual Pension Accruals to Current Earnings[c]	
	OLS (1)	Random Effects (2)	OLS (3)	Random Effects (4)
Other job characteristics:				
Collective bargaining[d]	–20.9 (37.2)	–48.4 (33.1)	–0.002* (0.001)	–0.003*** (0.001)
Part–time[d]	–908*** (58.1)	–840*** (50.5)	–0.001 (0.002)	0.003** (0.001)
Demographic characteristics:				
Male[d]	145*** (41.5)	104*** (35.9)	–0.013*** (0.001)	–0.015*** (0.001)
Nonwhite[d]	–143*** (54.1)	–142*** (46.9)	–0.002 (0.002)	–0.001 (0.001)
Married[d]	–50.1 (37.8)	–16.4 (32.7)	–0.003*** (0.001)	–0.002** (0.001)
Metropolitan residence[d]	231*** (41.7)	230*** (36.9)	0.003** (0.001)	0.002*** (0.001)
Expect retirement benefits from previous job[d]	41.3 (67.1)	32.9 (58.1)	0.0003 (0.002)	–0.0003 (0.001)
Year 1988[d]	201*** (32.9)	181*** (28.7)	0.003*** (0.001)	0.002*** (0.001)
State-level variables:				
Mean private–sector salary	0.342*** (0.029)	0.141 (0.145)	0.00002*** (0.000001)	0.00001 (0.00001)
Fraction of population under 18	–7293*** (1262)	–2182 (7018)	–0.330*** (0.038)	–0.072 (0.290)
Fraction of population African American	–426 (282)	–407 (1471)	–0.046*** (0.008)	–0.049 (0.061)
Fraction of population urban	1330*** (230)	875 (979)	0.050*** (0.007)	0.028 (0.040)
Per–capita personal income	–0.343*** (0.038)	–0.106 (0.189)	–0.00002*** (0.000001)	–0.00001 (0.00001)
Unemployment rate	–3248 (2085)	4779 (10560)	–0.292*** (0.062)	0.076 (0.436)
Fraction of income paid in state and local taxes	–3723** (1481)	561 (7788)	–0.422*** (0.044)	–0.227 (0.321)
Ratio of state and local debt to income	–1573*** (388)	–969 (1829)	–0.071*** (0.012)	–0.046 (0.075)

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TABLE 3 (Continued)

	Annual Increment to Pension Wealth[b]		Ratio of Annual Pension Accruals to Current Earnings[c]	
	OLS (1)	Random Effects (2)	OLS (3)	Random Effects (4)
Fraction of real estate commercial or industrial	1459*** (476)	3182 (2115)	0.022 (0.014)	0.101 (0.087)
Fraction of legislature Democratic	1940*** (165)	1707* (906)	0.109*** (0.005)	0.097*** (0.037)
R–squared	0.413	0.394	0.565	0.528
p–value, LM test (versus OLS)	—	0.0000	—	0.0000

[a] Restricted to state and local government workers, between the ages of 25 and 65, who report that their employer offers a retirement plan (n = 5211). Data are pooled from the 1983 and 1988 May CPS's. Monetary values are expressed in constant 1987 dollars. All regressions also include an intercept term and four dummy variables that equal one if data are missing on collective bargaining, part–time work status, metropolitan residence, and the availability of retirement benefits from previous jobs. Standard errors are in parentheses.
[b] The dependent variable is the average annual increment to pension wealth over the entire length of the employment relation, assuming inflation rate of 5 percent and real interest rate of 3 percent.
[c] The dependent variable is the ratio of the average annual increment in pension wealth to annual current earnings, assuming inflation rate of 5 percent and real interest rate of 3 percent.
[d] Dummy variable which equals one if the characteristic is present.
*** Significant at 0.01 level.
** Significant at 0.05 level.
* Significant at 0.10 level.

which the mix of total compensation is tilted toward deferred retirement benefits, which enables mobile taxpayers to pass the costs of government services to future taxpayers, as the underfunding model predicts. The estimated elasticities are similar to the corresponding elasticities for columns (1) and (2).[29]

The measures of human capital included in the estimating equation generally increase pension wealth, as most earlier studies of the private sector have found (e.g., Taubman, 1985; Gustman and Steinmeier, 1989; Johnson, 1996). Annual increments in pension wealth increase with the worker's educational level, expected total years of tenure with the current employer, age, and prior military service. However, these variables appear to have greater effects on current earnings than on pension wealth, since the ratio of pension accruals to earnings declines with education, experience, and age.[30]

A number of other individual-level variables have significant effects on annual increments to pension wealth. White-collar workers (other than teachers), police officers, and firefighters earn significantly higher pension accruals than blue-collar workers in state and local government, controlling for differences in human capital and other variables. There is no evidence that collective bargaining increases pension benefits among state and local government employees; in fact, workers covered by collective bargaining agreements earn smaller pension accruals relative to current earnings than nonunionized workers. Annual increments to pension wealth are smaller among part-time and nonwhite workers than among full-time and white workers, but they are not significantly

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smaller relative to earnings. Men earn significantly higher levels of pension accruals than women, but lower accruals relative to earnings. Government workers with accumulated pension wealth from a previous job do not earn significantly different pension accruals than workers who do not expect to receive other pension benefits.

Although virtually all of the state-level variables are significant in the OLS models, only the party composition of the state legislature affects pension benefits in the random-effects models. Pension accruals are significantly higher in states where members of the Democratic Party are relatively well-represented in the state legislature. No other state-level variables in Table 3 are significant in the random-effects models. In the OLS estimation, mean salaries in the private sector have a significant positive effect on pension accruals, suggesting that the public sector competes with private firms for workers, in part, by offering generous pension benefits. Individual pension wealth increases as commercial and industrial real estate comprise a larger fraction of total real estate value, suggesting that public employees may be relatively well-compensated when voters pay a relatively small share of local taxes. Pension accruals are lower in states where children under 18 represent a relatively large fraction of the total population; this result is somewhat surprising, since the demand for teachers might have been expected to increase the total level of compensation, including pension wealth, received by local government employees. Increments to pension wealth are also negatively related to per capita income, again contrary to expectations.

Conclusions

This paper develops and tests a model to explain the generosity of pensions among state and local government workers, relative to workers in the private sector. The model is based on the incentive for mobile taxpayers to delay payments for government services. When taxpayers believe they may move out of the community sometime in the future, they can reduce their tax burden by underfunding public pension plans, as long as unfunded pension obligations are not fully capitalized into land values. The incentive to underfund thus increases with the underlying mobility of residents. Moreover, as the level of underfunding increases, taxpayers can avoid a greater portion of government labor costs by increasing the fraction of total public employee compensation that is deferred until retirement. Thus, the underfunding model predicts that funding levels for public employee pension plans will be low in states where residents are relatively mobile, and that pension plans will be more generous when plans are poorly funded.

The underfunding model is tested by estimating a recursive system of equations characterizing plan underfunding and annual increments to pension wealth. The results strongly support the model. Funding levels among state-administered pension plans in the 1980s were significantly lower in states from which relatively large fractions of the population emigrated between 1985 and 1990. This finding is robust to the introduction of state-specific random effects to the estimating equation. In addition, state and local government workers in the CPS who participate in poorly funded pension plans receive relatively large annual pension accruals, both in terms of actual

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levels and relative to current annual earnings. Again, these results remain significant when random-effects models are estimated.

Although the model is tested by exploiting variations in pension wealth among state and local government workers, the underfunding model provides an explanation of the disparity in pension wealth between workers in the public and private sectors. Federal regulations and the efficiency of the stock market limit the extent to which private employers can underfund employee pension plans. As a result, the overall net gain of offering deferred compensation to workers may be smaller in the private sector, which would lead to relatively high levels of pension wealth in the public sector.

Finally, the underfunding model implies that the mix between current and deferred compensation received by state and local government workers is socially inefficient. By underfunding pensions, current taxpayers force future residents to subsidize the provision of retirement income; as a result, the worker's marginal rate of substitution of wages for pensions exceeds the social marginal rate of transformation. The overprovision of pensions in the public sector could be reduced, and social welfare enhanced, if the federal government were to limit levels of local underfunding.

ENDNOTES

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[1] Gustman and Segal (1977) and Woodbury (1983) investigate the determinants of teacher pension benefits, but they lack individual-level data. Fogelson (1984) and Taylor (1986) provide thorough verbal descriptions of police and fire pension plans and teacher retirement systems, respectively.

[2] This paper focuses exclusively on defined benefit pensions, i.e., plans in which future benefits are specified as a function of tenure, some measure of final earnings, and a fixed percentage factor. Defined contribution pensions, which function basically as a forced savings plan that pays the beneficiary the balance that has accumulated in the account at the time of retirement, are not analyzed. Since more than 90 percent of government workers participate in defined benefit pensions plans (Lovejoy, 1988), this restriction is unlikely to distort the results.

[3] Of course, moving may not lower one's tax burden if all local governments underfund public pensions, since movers would have to pay part of last period's labor bill in the new community. However, the failure to underfund pensions in the former community would make movers worse-off, since they would then be paying for current services twice. The incentive to underfund remains as long as taxpayers believe there is some chance that they will leave the community before the pension benefits are paid.

[4] This argument can be extended to explain the generosity of pension benefits received by federal government employees. Although federal taxpayers cannot avoid future taxes by relocating within the United States, they can avoid paying for future obligations that are unfunded at the time of their death.

[5] In this very simple model, workers do not quit, the probability of retirement is unity, and the probability of death is zero during the second period.

[6] Epple and Schipper (1981) argue that pension underfunding may be advantageous as a way to reduce the excess burden of taxation when current local taxes are particularly high. However, even when taxpayers can save at the before-tax rate of return, this argument would be valid only if taxpayers expect future local tax rates to decrease in the future, which seems unlikely given the steady increase in local property taxes against value over the past 30 years (Inman, 1982).

[7] This analysis assumes that n, the total size of the community, remains constant over the two periods; emigrants are immediately replaced by

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immigrants. It also assumes that all taxpayers are homeowners.

[8] Individuals in this model do not move in response to high taxes. Instead, the probability *q* that an individual will leave the community in this model is exogenous and known from the beginning.

[9] Eighty-six percent of all local government employees are currently members of state pension plans (U.S. Bureau of the Census, 1991a). The exceptions are generally municipal employees in large cities, whose pension plans are sometimes administered independently of state employee plans.

[10] Nebraska was not included in the analysis because of data limitations.

[11] Several potential sources of error arise in the process of matching pension and individual data. First, the pension provisions were collected in June 1992 and then matched with individual-level data from May 1983 and May 1988. If pension provisions change frequently, which seems unlikely, then the discrepancy in dates might pose a serious problem. Second, the CPS includes information on state of residence, which in some cases may not be the state where one is employed and earns future pension benefits. However, the prevalence of residence requirements for state and local workers is likely to reduce the severity of this problem. Finally, some local government workers, particularly in large cities, may be covered by pensions that are locally controlled; since these individuals cannot be identified in the data, however, all workers are assumed to participate in state-administered plans.

[12] This turnover assumption is necessary for the estimates of pension wealth to be consistent with the underfunding calculations by Inman (1986), described below, which assume that government workers remain with their employers until reaching the normal retirement age.

[13] This rate of productivity growth equals the increase in real hourly wages over the 30-year period from 1957 to 1987.

[14] Crown and Mutschler (1993) find that benefits from state pension plans do not generally keep pace with inflation; retirees in 72 percent of all general employee and teacher plans experienced a reduction in the purchasing power of their pension benefits from 1982 to 1987.

[15] Estimates of pension wealth are quite sensitive to assumptions on employee turnover. If workers are assumed to leave the employer at the time of the survey, then mean estimated pension wealth falls to $5,394. (This scenario conforms to Bulow's (1982) legal concept of pension wealth, by which pension liabilities at a point in time are computed as if the plan were to be terminated at that moment.) If pension wealth is calculated on the basis of age- and gender-specific turnover probabilities, as estimated by Ureta (1992) from CPS data, then mean pension wealth in the sample is $14,941.

[16] Wage wealth is defined as the present value, discounted to the time of the survey, of the stream of annual earnings over the worker's entire tenure with the current employer, given the real wage growth and interest rate assumptions noted earlier.

[17] Gustman and Steinmeier reduce their estimate of wage wealth by the present value of employee contributions to the retirement plan, whereas in this study, the estimate of pension wealth is reduced by the value of employee contributions. Gustman and Steinmeier also utilize a real interest rate of 0.8 percent, eliminate part-time workers, and eliminate workers with zero pension wealth; the last restriction excludes about 5.7 percent of their sample.

[18] Legal rights to pension wealth accrue very unevenly, however. Accrual profiles of pension wealth to which individuals are legally entitled exhibit sharp, upward spikes at the time of vesting and typically rise sharply at the age of early retirement before declining after the normal retirement age (Kotlikoff and Wise, 1989). Other studies that have estimated pension accruals following the implicit contract approach include Ippolito (1985), Freeman (1985), Lazear and Moore (1988), and Kotlikoff and Wise (1989).

[19] Funding data for public pension plans are available for 1989 from the Government Finance Officers Association, covering 137 state-level plans in 42 states, plus 134 local plans (Zorn, 1991); these data have been analyzed by Mitchell and Smith (1994). Also, public pension funding levels are available for local plans in Pennsylvania and Illinois (Smith, 1981; Grosskopf, Hayes, and Sivan, 1983; Grosskopf, Hayes, and Kennedy, 1985; Grosskopf, Hayes, and Porter-Hudak, 1988).

[20] These data are included in the Census of Governments for years when the census is conducted.

[21] Because there is no reliable indicator of the extent to which unfunded future pension liabilities are capitalized into property values, the model's predictions concerning capitalization cannot be tested.

[22] State-level variables are from the U.S. Bureau of the Census (1982b, 1986b, 1991b, 1981–1993c). Mean values from 1980 to 1989 of selected variables, by state, are reported in Appendix Table 3.

[23] Because of data limitations, the percent of state and local government employees covered by collective bargaining in 1980 is used for each year of the analysis.

[24] As noted earlier, however, mobility is greatest among residents of the Rocky Mountain states, not the industrialized Northeast and Midwest.

[25] The estimated effect of taxpayer mobility on pension underfunding is not driven by outliers in

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the data. When the models in columns (1)–(3) are re-estimated after eliminating from the sample studentized residuals greater than two in absolute value, the coefficient on the fraction of the population leaving the state remains large and statistically significant. In the model in column (1), for example, the coefficient on taxpayer mobility is estimated as 518, with a standard error of 63.5, after 58 observations with large residuals are eliminated.

[26] This set of findings is consistent with earlier studies. Inman (1982) finds that police pension plans are more fully funded in cities with relatively high unemployment rates. Mitchell and Smith (1994) find that funding levels fall for state-administered pension plans when the state unemployment rate exceeds its five-year average.

[27] Both Inman (1982) and Grosskopf, Hayes, and Porter-Hudak (1988), however, find that local income levels increase pension funding among locally administered police pension plans.

[28] Underfunding levels per member are predicted using the specification reported in column (3′) of Table 2.

[29] These results are not unduly influenced by the presence of outliers. When the models are re-estimated after eliminating observations with studentized residuals greater than two in absolute value, the effect of predicted pension underfunding on pension wealth remains strong and significant.

[30] When pension wealth is estimated under alternative turnover scenarios, which do not assume that workers remain with the current employer until reaching the normal retirement age, the ratio of pension to wage wealth significantly increases with education and experience.

REFERENCES

Arnold, Frank S. "State and Local Employee Pension Funding: Theory, Evidence, and Implications." Ph.D. diss., Harvard University, 1983.

Barro, Robert J. "Are Government Bonds Net Wealth?" *Journal of Political Economy* 82 No. 6 (November–December, 1974): 1095–117.

Bellante, Don, and Albert N. Link. "Are Public Sector Workers More Risk Averse Than Private Sector Workers?" *Industrial and Labor Relations Review* 34 No. 3 (April, 1981): 408–12.

Blank, Rebecca M. "An Analysis of Workers' Choice Between Employment in the Public and Private Sectors." *Industrial and Labor Relations Review* 38 No. 2 (January, 1985): 211–24.

Bodie, Zvi. "Pensions as Retirement Income Insurance." *Journal of Economic Literature* 28 No. 1 (March, 1990): 28–49.

Bulow, Jeremy I. "What Are Corporate Pension Liabilities?" *Quarterly Journal of Economics* 97 No. 3 (August, 1982): 435–52.

Crown, William H., and Phyllis H. Mutschler. "Pension Benefits for State, Local, and Teacher Retirees: Coping with Inflation, 1982–1987." *Research on Aging* 15 No. 1 (March, 1993): 33–49.

Dorsey, Stuart. "A Model and Empirical Estimates of Worker Pension Coverage in the U.S." *Southern Economic Journal* 49 No. 2 (October, 1982): 506–20.

Dorsey, Stuart. "The Economic Functions of Private Pensions: An Empirical Analysis." *Journal of Labor Economics* 5 No. 4, pt. 2 (October, 1987): S171–89.

Ehrenberg, Ronald G. "Retirement System Characteristics and Compensating Wage Differentials in the Public Sector." *Industrial and Labor Relations Review* 33 No. 4 (July, 1980): 470–83.

Ehrenberg, Ronald G., and Robert S. Smith. "A Framework for Evaluating State and Local Government Pension Reform." In *Public Sector Labor Markets*, edited by Peter Mieszkowski and George E. Peterson. Washington, D.C.: Urban Institute, 1981.

Epple, Dennis, and Katherine Schipper. "Municipal Pension Funding: A Theory and Some Evidence." *Public Choice* 37 No. 1 (1981): 141–78.

Fogelson, Robert M. *Pensions: The Hidden Costs of Public Safety*. New York: Columbia University Press, 1984.

Freeman, Richard B. "Unions, Pension, and Union Pension Funds." In *Pensions, Labor and Individual Choice*, edited by David A. Wise. Chicago: University of Chicago Press, 1985.

Grosskopf, Shawna, Kathy Hayes, and Thomas Kennedy. "Supply and Demand Effects of Underfunding of Pensions on Public Employee Wages." *Southern Economic Journal* 51 No. 3 (January, 1985): 745–53.

Grosskopf, Shawna, Kathy Hayes, and Susan Porter-Hudak. "Pension Funding and Local Labor Costs: A Dynamic Analysis of Illinois Police Pension Funds." *Southern Economic Journal* 53 No. 3 (January, 1988): 572–82.

Grosskopf, Shawna, Kathy Hayes, and David Sivan. "Municipal Pensions, Funding and Wage Capitalization." *National Tax Journal* 36 No. 1 (March, 1983): 115–21.

Gustman, Alan L., and Martin Segal. "Interstate Variations in Teachers' Pensions." *Industrial Relations* 16 No. 3 (October, 1977): 335–44.

National Tax Journal
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Gustman, Alan L., and Thomas L. Steinmeier. "An Analysis of Pension Benefit Formulas, Pension Wealth, and Incentives from Pensions." In *Research in Labor Economics*, Vol. 10, edited by Ronald G. Ehrenberg. Greenwich, CT: JAI Press, 1989.

Hutchens, Robert M. "A Test of Lazear's Theory of Delayed Payment Contracts." *Journal of Labor Economics* 5 No. 4, pt. 2 (October, 1987): S153–70.

Hutchens, Robert M. "Seniority, Wages, and Productivity: A Turbulent Decade." *Journal of Economic Perspectives* 3 No. 4 (Fall, 1989): 49–64.

Inman, Robert, P. "Wages, Pensions, and Employment in the Local Public Sector." In *Public Sector Labor Markets*, edited by Peter Mieszkowski and George E. Peterson. Washington, D.C.: Urban Institute, 1981.

Inman, Robert P. "Public Employee Pensions and the Local Labor Budget." *Journal of Public Economics* 19 No. 1 (October, 1982): 49–71.

Inman, Robert P. "Appraising the Funding Status of Teacher Pensions: An Econometric Approach." *National Tax Journal* 39 No. 1 (March, 1986): 21–33.

Ippolito, Richard A. "The Labor Contract and True Economic Pension Liabilities." *American Economic Review* 75 No. 5 (December, 1985): 1031–43.

Johnson, Richard W. "The Impact of Human Capital Investments on Pension Benefits." *Journal of Labor Economics* 14 No. 3 (July, 1996): 520–54.

Kotlikoff, Laurence J., and Daniel E. Smith. *Pensions in the American Economy*. Chicago: University of Chicago Press, 1983.

Kotlikoff, Laurence J., and David A. Wise. *The Wage Carrot and the Pension Stick: Retirement Benefits and Labor Force Participation*. Kalamazoo, MI: W. E. Upjohn Institute for Employment Research, 1989.

Lazear, Edward P. "Why Is There Mandatory Retirement?" *Journal of Political Economy* 87 No. 6 (December, 1979): 1261–84.

Lazear, Edward P. "Pensions as Severance Pay." In *Financial Aspects of the United States Pension System,* edited by Zvi Bodie and John B. Shoven. Chicago: University of Chicago Press, 1983.

Lazear, Edward P. "Incentive Effects of Pensions." In *Pensions, Labor and Individual Choice*, edited by David A. Wise. Chicago: University of Chicago Press, 1985.

Lazear, Edward P., and Robert L. Moore. "Pensions and Turnover." In *Pensions in the U.S. Economy*, edited by Zvi Bodie, John B. Shoven, and David A. Wise. Chicago: University of Chicago Press, 1988.

Lovejoy, Lora Mills. "The Comparative Value of Pensions in the Public and Private Sectors." *Monthly Labor Review* 111 No. 12 (December, 1988): 18–26.

Mitchell, Olivia S., and Gary S. Fields. "The Effects of Pensions and Earnings on Retirement: A Review Essay." In *Research in Labor Economics*, Vol. 5, edited by Ronald G. Ehrenberg. Greenwich, CT: JAI Press, 1982.

Mitchell, Olivia S., and Robert S. Smith. "Pension Funding in the Public Sector." *Review of Economics and Statistics* 76 No. 2 (May, 1994): 278–90.

Munnell, Alicia H. *The Economics of Private Pensions*. Washington, D.C.: The Brookings Institution, 1982.

Munnell, Alicia H., and Ann M. Connolly. "Comparability of Public and Private Compensation: The Issue of Fringe Benefits." *New England Economic Review* (July–August, 1979): 27–45.

Phillips, Kristen. "State and Local Government Pension Benefits." In *Trends in Pensions 1992*, edited by John A. Turner and Daniel J. Beller. Washington, D.C.: U.S. Department of Labor, 1992.

Quinn, Joseph F. "Pension Wealth of Government and Private Sector Workers." *American Economic Review Papers and Proceedings* 72 No. 2 (May, 1982): 283–87.

Reagan, Patricia B., and John A. Turner. "Youth, Taxes, and Pension Coverage." Paper presented at the Center for Pension and Retirement Research Conference, Miami University, Oxford, OH, 1994.

Smith, Robert S. "Compensating Differentials for Pensions and Underfunding in the Public Sector." *Review of Economics and Statistics* 63 No. 3 (August, 1981): 463–8.

Taubman, Paul. "Determinants of Pension Benefits." In *Pensions, Labor and Individual Choice*, edited by David A. Wise. Chicago: University of Chicago Press, 1985.

Taylor, Suzanne Saunders. *Public Employee Retirement Systems: The Structure and Politics of Teacher Pensions*. Ithaca, NY: ILR Press, 1986.

U.S. Bureau of the Census. *Finances of Employee-Retirement Systems of State and Local Governments*. Washington, D.C.: Government Printing Office, 1981–1991a.

National Tax Journal
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U.S. Bureau of the Census. *State and Metropolitan Area Data Book*. Washington, D.C.: Government Printing Office, 1982b, 1986b, 1991b.

U.S. Bureau of the Census. *Statistical Abstract of the United States*. Washington, D.C.: Government Printing Office, 1981–1993c.

U.S. Social Security Administration. *Social Security Bulletin, Annual Statistical Supplement*. Washington, D.C.: Government Printing Office, 1990.

Ureta, Manuelita. "The Importance of Lifetime Jobs in the U.S. Economy, Revisited." *American Economic Review* 82 No. 1 (March, 1992): 322–35.

Wiatrowski, William J. "On the Disparity Between Private and Public Pensions." *Monthly Labor Review* 117 No. 4 (April, 1994): 3–9.

Woodbury, Stephen A. "Substitution Between Wage and Nonwage Benefits." *American Economic Review* 73 No. 1 (March, 1983): 166–82.

Woods, John R. "Pension Coverage Among Private Wage and Salary Workers: Preliminary Findings from the 1988 Survey of Employee Benefits." *Social Security Bulletin* 52 No. 10 (October, 1989): 2–19.

Yinger, John, Howard S. Bloom, Axel Borsch-Supan, and Helen F. Ladd. *Property Taxes and House Values: The Theory and Estimation of Intrajurisdictional Property Tax Capitalization*. San Diego: Academic Press, 1988.

Zorn, Paul. *Survey of State and Local Government Employee Retirement Systems*. Chicago: Government Finance Officers Association, 1991.

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APPENDIX TABLE 1
CHARACTERISTICS OF STATE GENERAL PENSION PLANS[a]

State	Percentage Factor[b]	Normal Retirement Age	Contribution Rate	Underfunding per Member[c]
Alabama	0.0201	60	0.05	16,646
Arizona	0.02	62	0.04	13,218
Arkansas	0.018	60	0.06	(4,355)
California	0.02	60	0.05	3,307
Colorado	0.025	65	0.08	58,984
Connecticut	0.01	65	0.02	145,579
Delaware	0.0167	60	0.03	24,086
Florida	0.016	60	0.0	20,399
Georgia	0.0164	60	0.0125	24,997
Idaho	0.0167	65	0.045	43,945
Illinois	0.011	60	0.04	19,140
Indiana	0.011	65	0.03	17,007
Iowa	0.0157	65	0.037	20,554
Kansas	0.0125	65	0.04	31,973
Kentucky	0.0185	65	0.05	25,368
Louisiana	0.025	60	0.075	41,895
Maine	0.02	60	0.065	41,717
Maryland	0.018	60	0.05	95,779
Massachusetts	0.025	65	0.06	84,236
Michigan	0.015	60	0.035	50,776
Minnesota	0.0125	65	0.0415	28,234
Mississippi	0.0175	60	0.055	10,204
Missouri	0.015	60	0.0	16,066
Montana	0.0179	60	0.06	14,878
Nevada	0.025	60	0.08	6,516
New Hampshire	0.0167	60	0.05	10,212
New Jersey	0.0167	60	0.03	16,583
New Mexico	0.025	60	0.0618	20,108
New York	0.02	62	0.03	27,262
North Carolina	0.0155	65	0.06	45,063
North Dakota	0.0169	65	0.04	19,105
Ohio	0.021	60	0.08	21,279
Oklahoma	0.02	62	0.02	31,688
Oregon	0.0167	58	0.06	10,548
Pennsylvania	0.02	60	0.0625	55,618
Rhode Island	0.02	60	0.075	32,767
South Carolina	0.0145	65	0.05	26,984
South Dakota	0.02	65	0.05	26,809
Tennessee	0.015	60	0.05	(16,069)
Texas	0.02	60	0.06	10,080
Utah	0.01625	65	0.06	32,214
Vermont	0.0156	62	0.05	37,944
Virginia	0.015	65	0.05	33,367
Washington	0.02	62	0.06	25,145
West Virginia	0.02	60	0.04	11,420
Wisconsin	0.013	65	0.05	25,034
Wyoming	0.02	60	0.0557	2,768

[a] Pension plan provisions were tabulated from state statutes as of June 1992. Nebraska is excluded because of data limitations. Information on vesting, Social Security integration, and number of years used to compute final average salary were also collected from state statutes.
[b] Denoted by λ in equation 9.
[c] Mean level over the period 1981–89, expressed in 1987 dollars. Underfunding is calculated using the algorithm developed in Inman (1986).

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APPENDIX TABLE 2
CHARACTERISTICS OF STATE TEACHER PENSION PLANS[a]

State	Percentage Factor[b]	Normal Retirement Age	Contribution Rate	Underfunding per Member[c]
Alabama	0.0201	60	0.05	16,161
Arkansas	0.018	60	0.06	19,086
California	0.02	60	0.08	22,813
Connecticut	0.02	60	0.06	43,962
Georgia	0.02	60	0.06	12,458
Illinois	0.01785	60	0.06	38,200
Indiana	0.011	65	0.03	67,611
Kentucky	0.02	60	0.096	13,198
Louisiana	0.02	60	0.08	55,430
Maryland	0.018	60	0.07	111,618
Massachusetts	0.025	65	0.06	115,776
Michigan	0.015	60	0.06	33,993
Minnesota	0.015	65	0.085	33,985
Missouri	0.0125	65	0.04	52,022
Montana	0.0167	60	0.07	27,200
New Jersey	0.0167	60	0.03	33,136
New Mexico	0.0215	60	0.076	9,758
New York	0.02	55	0.05	42,285
North Dakota	0.0139	65	0.0675	48,955
Ohio	0.021	60	0.08	34,429
Oklahoma	0.02	62	0.05	65,520
Pennsylvania	0.02	62	0.0625	58,709
Texas	0.02	60	0.063	10,337
Vermont	0.0094	60	0.0	63,393
Washington	0.02	60	0.05	44,598
West Virginia	0.02	60	0.06	55,614

[a] Pension plan provisions were tabulated from state statutes as of June 1992. Nebraska is excluded because of data limitations. Teachers in states not included in the table are members of the general state employee pension plan. Information on vesting, Social Security integration, and number of years used to compute final average salary were also collected from state statutes.
[b] Denoted by λ in equation 9.
[c] Mean level over the period 1980–89, expressed in 1987 dollars. Underfunding is calculated using the algorithm developed in Inman (1986).

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APPENDIX TABLE 3
SELECTED STATE-LEVEL VARIABLES

State	Fraction of Population Leaving State, 1985–90	Personal Income, Per Capita ($1987)[a]	Unemployment Rate[a]	Fraction of Democrats in Legislature[a]	Fraction of Employment in Manufacturing, 1989
Alabama	0.0985	11,261	0.0994	0.8547	0.2417
Arizona	0.1192	13,184	0.0679	0.3648	0.1290
Arkansas	0.1230	10,859	0.0859	0.8739	0.2578
California	0.0121	16,410	0.0717	0.5407	0.1724
Colorado	0.1799	15,124	0.0645	0.3633	0.1311
Connecticut	0.0981	18,861	0.0483	0.5477	0.2144
Delaware	0.1172	15,273	0.0579	0.5457	0.2117
Florida	0.0773	14,338	0.0634	0.6229	0.1026
Georgia	0.0987	12,930	0.0633	0.7921	0.1929
Idaho	0.1819	11,489	0.0778	0.2647	0.1651
Illinois	0.0954	15,476	0.0859	0.5085	0.1895
Indiana	0.0983	13,120	0.0823	0.4192	0.2603
Iowa	0.1139	13,420	0.0656	0.5222	0.1950
Kansas	0.1345	14,509	0.0504	0.4121	0.1728
Kentucky	0.1064	11,422	0.0897	0.6917	0.1980
Louisiana	0.1457	11,834	0.1026	0.8431	0.1148
Maine	0.0890	12,460	0.0617	0.5683	0.1954
Maryland	0.0832	16,391	0.056	0.7986	0.0973
Massachusetts	0.0824	16,811	0.0498	0.7803	0.1808
Michigan	0.0655	14,403	0.1072	0.5265	0.2478
Minnesota	0.0735	14,651	0.0587	0.5490	0.1909
Mississippi	0.1203	9,835	0.0986	0.8592	0.2643
Missouri	0.0976	13,574	0.0712	0.6404	0.1902
Montana	0.1741	11,864	0.0737	0.4756	0.0756
Nevada	0.1388	15,391	0.0715	0.5760	0.0436
New Hampshire	0.1295	15,545	0.0419	0.3348	0.2161
New Jersey	0.0857	17,936	0.0601	0.5132	0.1761
New Mexico	0.1487	11,497	0.083	0.5595	0.0750
New York	0.0602	16,274	0.0665	0.5400	0.1443
North Carolina	0.0964	12,168	0.0599	0.6935	0.2829
North Dakota	0.1880	12,880	0.0531	0.3937	0.0631
Ohio	0.0803	13,759	0.0876	0.5537	0.2331
Oklahoma	0.1636	12,842	0.0651	0.6525	0.1412
Oregon	0.1089	13,232	0.0849	0.5481	0.1800
Pennsylvania	0.0706	14,139	0.0781	0.4782	0.2052
Rhode Island	0.0997	14,366	0.0585	0.7528	0.2354
South Carolina	0.1098	11,232	0.071	0.7478	0.2601
South Dakota	0.1423	11,844	0.0473	0.2635	0.1153
Tennessee	0.1037	11,850	0.0818	0.5992	0.2432
Texas	0.0893	13,766	0.0696	0.6753	0.1424
Utah	0.1494	11,024	0.0643	0.2772	0.1485
Vermont	0.1154	12,755	0.0507	0.4791	0.1847
Virginia	0.1136	14,971	0.0525	0.6483	0.1495
Washington	0.0845	14,763	0.0865	0.5113	0.1767
West Virginia	0.1399	10,839	0.1211	0.7687	0.1429
Wisconsin	0.0703	13,795	0.0724	0.5870	0.2494
Wyoming	0.2907	13,843	0.0659	0.3333	0.0454

[a] Mean levels over the period 1980–89.
Source: U.S. Bureau of the Census (1982b, 1986b, 1991b, 1981c–1993c).