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AIR

Benefit or Burden? On the Intergenerational Inequality of Teacher Pension Plans

Ben Backes
Dan Goldhaber
Cyrus Grout
Cory Koedel
Shawn Ni
Michael Podgursky
P. Brett Xiang
Zeyu Xu

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Ben Backes
American Institutes for Research

Dan Goldhaber
American Institutes for Research and University of Washington

Cyrus Grout
University of Washington

Cory Koedel
University of Missouri

Shawn Ni
University of Missouri

Michael Podgursky
University of Missouri

P. Brett Xiang
University of Missouri

Zeyu Xu
American Institutes of Research

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Abstract

Most teachers are enrolled in defined benefit (DB) pension plans, which facilitate various types of resource transfers between workers. Using administrative micro data from four states, combined with national pension funding data, we examine a specific type of resource transfer permitted by educator pension plans: intergenerational transfers. We show that for new cohorts of teachers, DB pension plans are driving a transfer of compensation to previous cohorts of teachers. Across state plans in the United States, current teachers pay an average of approximately 10 percent of their earnings to cover previously-accrued pension liabilities. This amounts to a significant reduction in real operating spending per student. If current teachers were not required to cover these liabilities, their salaries could be increased substantially without increasing the total budget for teacher compensation.

Introduction

Defined benefit (DB) pension plans have been in decline in the private sector for decades but remain the prevailing type of pension plan for the vast majority of public school teachers (Hansen, 2010; Wiatrowski, 2012). By design, benefit payments in DB plans are not directly tied to contributions at the individual level; rather, they are defined by a formula that depends on the employee's years of covered service and salary. The lack of a direct link between contributions and benefits at the individual level in DB plans facilitates cross-teacher resource transfers. In this study we use administrative micro data from four states—Missouri, North Carolina, Tennessee, and Washington—supplemented with national pension funding data, to examine the extent to which educator pension plans reallocate resources across generations of teachers. We document significant resource reallocations in most states that favor previous generations of teachers at the expense of current teachers.

The potential for DB pension plans to reallocate resources across generations is not a new idea. In fact, theoretically, this feature of the plans could improve welfare by allowing for increased risk-sharing across generations (Cui, de Jong, & Ponds, 2011; Gollier, 2008). However, the potential benefits associated with risk-sharing across generations have been derived within the context of economic models that assume well-informed and benevolent policy making. These models do not account for how politics influence the structure and funding of public DB pension plans. Models that account for the influence of political factors suggest that DB plans could be suboptimal. Glaeser and Ponzetto (2014), for instance, develop a model in which pension costs are poorly understood by taxpayers and where politicians can curry favor from key constituents by making pension plans more generous. The result is that deferred compensation constitutes an inefficiently large share of total compensation for public

workers.[1] Koedel, Ni, and Podgursky (2013, 2014) argue that individuals who are in a position to benefit disproportionately from DB pension benefit increases (i.e., senior teachers and administrators) are also the most politically influential. As such, benefit increases tend to favor those individuals, with the liabilities associated with the benefit increases often falling on later cohorts of teachers.

In theory, DB plans can shift resources backward or forward across generations. Funds can transfer resources from current generations to future generations by maintaining an asset-to-liability ratio in excess of 100 percent, which would mean that future generations of teachers need to save less for the same benefits. In practice, this virtually never happens. In fact, the only time period in recent history in which a non-negligible number of funds were above or close to the 100-percent-funded benchmark was in the late 1990s after an extended, extraordinarily positive run in the stock market. The stock market run greatly inflated asset valuations, albeit temporarily, and legislatures reacted by retroactively improving benefit formulas for covered workers, raising liabilities and bringing funding ratios back down.[2]

More common is for pension funds to transfer resources from young teachers to older teachers. This type of transfer occurs when a pension system's accrual of liabilities outpaces its accrual of assets. As we show below, this second type of transfer is ubiquitous in educator pension plans across the United States today. Officially, it appears in pension accounting documents as payments by working

[1] Note that some level of deferred compensation might be useful for improving workforce quality by, for instance, encouraging employee retention (Gustman, Mitchell, & Steinmeier, 1994). However, several studies provide evidence consistent with the Glaeser and Ponzetto (2013) result that deferred compensation is too high. For example, Fitzpatrick (2015) shows that teachers do not value marginal pension dollars at nearly the cost of providing them, and Chingos and West (2015) and Goldhaber and Grout (forthcoming) find that a substantial fraction of teachers are willing to transfer retirement compensation from the backloaded DB structure to the more mobile defined contribution structure. DeArmond and Goldhaber (2010) provide survey evidence that is also consistent with teachers preferring that marginal retirement compensation be delivered in the form of a more mobile benefit.

[2] For example, according to the Delaware Office of Pensions, :The legislation (in Delaware in 2001 to improve the pension formula) was developed to reduce the overfunded position in the State Employees' Pension Plan by granting benefit improvements to active and retired members…" (National Conference of State Legislators, 2001).

teachers to cover the "Unfunded Actuarial Accrued Liability," or UAAL. UAAL payments reflect the fact that a pension fund has accrued debt, and the burden is being borne by active plan members.

To illustrate, take the case of Missouri, which is one of the four states we investigate in detail below. The required contribution rate to the pension fund for Missouri teachers as reported in the 2013 actuarial valuation report was 29.2 percent of earnings (by state statute, teachers and school districts in Missouri evenly split this contribution). However, the actuarially estimated "normal cost" for the plan, which is the estimated percent of salaries required to fund the retirement benefits accrued by currently working teachers, was only 19.1 percent. The 10.1 percent differential represents what is required to pay down the UAAL, which is owing to previous plan operations.[3] The large gap between normal cost and the required contribution rate represents a "pension tax" on working teachers. Below we show that as a consequence, newly entering teachers in Missouri can expect to contribute more to the plan over the course of their careers than they will receive in pension benefits.

Our investigation of pension finances nationally reveals that the vast majority of DB pension plans that cover public educators are in a situation similar to that of Missouri. In fact, we show that there has been a recent increase in the cost of UAAL payments in almost every state plan in the nation. The growth of UAAL costs can be attributed to a number of factors including retroactively implemented formula enhancements in the past, unmet actuarial assumptions that have resulted in perpetual funding shortfalls, and government agencies failing to make required contributions on teachers' behalf. Munnell, Aubry, and Cafarelli (2015) find that the key driver of the accelerated UAAL payments between 2001 and 2013 in public plans nationally is that actual investment returns consistently underperformed actuarially assumed returns. This underperformance is not surprising; for instance, Biggs (2011) shows that pension

[3] The numbers for this specific example can be found in the 2013 comprehensive annual financial report of the Missouri Public School Retirement System (PSRS). See page 92 of the report, which can be obtained at the following URL where the pension fund maintains a report archive: https://www.psrs-peers.org/Investments/Past-Issues-CAFR.html.

funding ratios decline markedly if a standard options pricing method is used in place of the actuarial accounting framework to calculate pension liabilities, and Novy-Marx and Rauh (2009) describe the rates that state pension plans use to discount liabilities as "unreasonably high" (p. 192; also see Novy-Marx & Rauh, 2011, 2014). In short, actuarial assumptions have led to an understatement of how much past generations of teachers needed to contribute to fund their benefits, which has resulted in the persistent accumulation of pension debt in most plans over time.

Regardless of how to apportion blame among various actors in the past for current pension funding shortfalls, the fundamental takeaway from our study is that a substantial burden is being levied on the current teaching workforce by their own pension plans. Yet, the existence of this burden is not readily evident. Although information about UAAL payments is available in the detailed financial reports of most pension plans, individual members do not receive a clear accounting of how their contributions, and contributions on their behalf by their employers, are being used. The naïve assumption is that all of the contributions made on behalf of current employees are being used to fund their own retirement benefits, but this is not accurate for the vast majority of teachers in the United States.[4]

From a legal standpoint pension promises must be fulfilled; the question is how this should occur. The opacity of pension funding mechanisms makes it politically easy to place the burden of UAALs on new and prospective entrants into a particular pension plan. However, it is important to recognize that this imposes real compensation tradeoffs between generations of teachers. If the UAAL burden of educator pension plans were lifted from the current teaching workforce and the resources currently

[4] Evidence from Chan and Stevens (2008), who show that pensioners commonly misunderstand how their plans work, supports the contention that pensioners may not understand this aspect of how contributions are spent, although we are not aware of any direct evidence. Indirectly, the lack of any public discourse on this point is also consistent with pensioners being unaware of what is happening—with the large give-back that is being required of current workers, if it were common knowledge one would expect at least some expression of dissatisfaction.

devoted to paying down the UAAL could instead be used to raise teacher salaries, substantial wage increases would be possible in most states holding the total compensation budget fixed.[5]

In a concluding section we discuss policy prescriptions to end or reduce intergenerational resource transfers via DB pension plans in education. The most straightforward solution would be to move teachers from DB to defined contribution (DC) pension coverage. The key feature of DC pension plans that prevents cross-teacher resource transfers is that each teacher's benefits are tied to her own contributions and investment returns, which by construction prevents transfers. There are also other options within the general DB framework that would limit the scope for intergenerational resource transfers moving forward.

Background

Pension Benefits

The overwhelming majority of public school teachers in the United States have access to a DB pension plan, and most receive their retirement benefits exclusively from a DB plan.[6] With a handful of exceptions, these plans are administered at the state level.[7] The following general formula is used to determine the annual benefit for teachers at retirement:

$$B = F * YOS * FAS \quad (1)$$

[5] The budget-neutral wage increase in each state would be similar in magnitude but a little smaller than the percentage of salary currently devoted to cover UAAL costs. The reason for the gap is that higher salaries would generate larger pension obligations, meaning that the salary increase would need to be lower than the UAAL payments to maintain budget neutrality. We also note that it is not obvious that any freed-up resources associated with relieving current teachers of the UAAL payments would go to fund salary increases—this point gets back to the Glaeser and Ponzetto (2014) argument that pension benefits are "shrouded" to the public.

[6] Throughout this paper we refer to "teacher" pension plans. In fact, the plans apply to all professional educators, including teachers, school administrators, and counselors.

[7] A few municipalities still operate their own pension plans. Examples of municipalities with their own plans include Chicago, Duluth, Kansas City, St. Louis, and St. Paul.

In (1), *B* represents the annual benefit, *F* is the formula factor, *YOS* indicates years of service in the system, and *FAS* is the teacher's final average salary, commonly calculated as the average of the final few years of earnings. Future benefits may or may not be adjusted for inflation.

It typically takes 5–10 years for teachers to become vested in a pension plan (National Council on Teacher Quality, 2012); once vested, a teacher can collect her pension upon becoming collection eligible. The "normal retirement age," which varies from 60 to 67 across state plans, is one way that collection eligibility is determined. There are also provisions in most systems that allow individuals to retire and begin collecting benefits prior to normal retirement. These provisions depend on either (1) work experience alone or (2) a combination of age and work experience. An example of a work-experience provision is the 30-year service requirement in Tennessee, which allows a teacher to retire and begin collecting full benefits without penalty, regardless of age, upon attaining 30 years of in-system service. An example of a combination rule is Missouri's Rule-of-80. The Rule-of-80 allows for full benefit collection once a teacher's combination of age and experience sums to 80.

Table 1 documents the main features of the educator retirement plans in the four states we study in detail: Missouri, North Carolina, Tennessee, and Washington. We use administrative micro data from these states to construct pension wealth accrual and contribution cost curves in each state for a representative entrant into teaching (see below). We supplement the in-depth analysis of the pension plans in these four states with a broader analysis of pension plans nationally, for which we use the plans' actuarial valuation reports and comprehensive annual financial reports, along with data from the Public Plans Database maintained by the Center for Retirement Research at Boston College.

One complicating feature arises in the case of Tennessee and Washington, which now incorporate DC components into their pension systems. Tennessee recently initiated a hybrid plan that covers all new hires as of 2014, and Washington allows teachers to choose between a pure DB and

hybrid plans. In Table 1, we document the rules for the pure DB plan as well as for the DB component of the hybrid plan for these states. The basic details of the DC components to the hybrid plans are also provided in the table, but they are not the focus of our study because, by construction, cross-teacher resource transfers, whether inter- or intragenerational, are not permitted via the DC portion of the plans. The presence of the DC component is only notable for our analysis of resource transfers in that it signifies that a smaller share of retirement benefits is conveyed via the DB structure relative to a pure DB plan.

Nationally, roughly two-thirds of teachers covered by state pension plans are dually enrolled in Social Security, as is the case for teachers in three of the four states we study: North Carolina, Tennessee, and Washington. Although the Social Security system facilitates resource transfers across generations at the national level, the mechanisms and funding structure are quite different, and for this reason we abstract from issues related to Social Security here.

Pension Contributions

Actuaries calculate the contributions necessary (as a percentage of salary) to fund the benefits accrued by the members of each pension system and to pay down previously accrued liabilities. The assumptions behind the contribution calculations, which vary from state to state, incorporate expectations about investment returns, teacher turnover and mortality, and retirement timing. The contributions are paid by currently employed teachers, their employers (i.e., school districts), and state governments. There can be discrepancies between the contributions *necessary* to fully fund a pension system and what is *actually* contributed to that system. Several factors contribute to these contribution gaps. Perhaps the highest profile factor—although it is not very common—is that states can simply skip payments (as has occurred in the past in states such as California and Illinois). Gaps may also arise if actuarially estimated funding ratios change sharply from one year to the next because some state

statutes limit the magnitude of year-to-year changes in contribution rates, which results in short-term gaps between necessary and actual contributions (as happened in Missouri between 2005 and 2012). It is also important to recognize that consistently making the actuarially necessary contribution does not ensure that funding shortfalls will be avoided—if the actuarial assumptions are wrong, then pension plans can end up over- or underfunded. In practice, actuarial assumptions have tended to overstate returns, meaning that even plans that collect full contribution payments often amass pension debt.

Guidelines from the Government Accounting Standards Board (GASB) require that actuaries set a target funding ratio (i.e., the ratio of assets to liabilities) of 100 percent (American Academy of Actuaries, 2012). When the funding ratio falls below target it can trigger contribution increases. In the bottom panel of Table 1 we draw on the 2007 and 2013 actuarial valuation reports for the four featured state plans to document the gaps between each plan's normal cost and the necessary contribution rate. Recall that normal cost is the percent of salary needed to fund retirement benefits accrued by teachers in the workforce. The gaps have widened substantially between 2007 and 2013 in the four states we study in detail, which is consistent with the national trend.

Accrual of Contributions and Pension Wealth Across Plans

Figure 1 shows stylized examples of pension wealth accrual and contribution accrual curves over the career cycle for a representative entrant in 2013 in each of the six pension plans that we study across our four focus states (we allow the 2013 entrant to hypothetically enter the hybrid plan in Tennessee for the sake of comparability despite the fact that the hybrid plan was not officially opened until 2014). The graphs plot total contributions, which include teachers' own contributions along with contributions on their behalf by states and school districts. These total contributions reflect the resources devoted to fund pension benefits for individual teachers in these states.

The representative teacher profile in each state is constructed using the administrative data in three steps: (1) identify the modal entry age into teaching in each state, (2) obtain the average salary for new entrants at the modal age, and (3) project out wages over the career cycle. Table 2 documents the entering age and wage for the representative teacher in each state. The wage projection over the course of the career is made using fitted values from a regression of wages on a cubic in teaching experience (following Koedel, Ni, & Podgursky, 2014). The cubic wage function is estimated separately for each state, which allows for differences in lifetime salary profiles across states to influence contribution and pension wealth accruals, using data from the years 2004–2007.[8]

With an entry age and salary profile in hand for each state, we apply the pension contribution and benefit rules as of 2013 to the wage profiles to produce the graphs. The pension wealth accrual profiles show accumulated benefits at each point in the career cycle as a scalar that we refer to as "pension wealth," which is the present value of the stream of pension payments earned up to that point. The value of accrued pension benefits at any point in the career, *s*, with collection starting at time *j*, where $j \geq s$, discounted to the point of entry, can be written as:

$$PW_{a|s} = \sum_{t=j}^{T} Y_{t|s} * P_{t|s} * d^{t-a} \qquad (2)$$

[8] Note that the North Carolina data do not include age directly but do have information on the year when teachers completed their undergraduate degrees. We impute age for North Carolina teachers as follows: age = {(year+24) – year_ug}, where year_ug is the year in which the teacher completed her undergraduate degree. Also note that in Missouri, the wage profile we estimate and use for Figure 1 is flatter than what has been estimated in past work using the same method but a longer data panel (e.g., as in Koedel, Ni, & Podgursky, 2014). For consistency in reporting across states we use data from the same years for all four focus states (2004–2007). A steeper wage profile in Missouri would raise the pension wealth accrual curve at the back end relative to the contribution accrual curve because of the disproportionate role of late-career salary in determining the pension benefit. Still, using a steeper wage profile in Missouri (or any other focus state) does not change the qualitative implication of Figure 1 that it is difficult for new teachers entering these plans to meaningfully benefit.

In (2), $PW_{a|s}$ is pension wealth discounted to the entry age, *a*, conditional on separation at point *s*. $Y_{t|s}$ is the annual pension payment in period *t*, $P_{t|s}$ is the probability that the individual is alive in period *t* conditional on being alive in period *s*, *d* is a discount factor, and T is set to 101.

All dollar values in Figure 1, and throughout the manuscript, are reported in 2013 dollars. In the figure, at each possible point in the career cycle we assume that if the teacher decides to exit, she will collect pension benefits in a way that maximizes her pension wealth subject to her work history. For example, when the Tennessee teacher reaches 26 years of experience she can retire under Tennessee's 25-and-out option with a penalty that depends on her age, wait until age 55 to collect with a smaller penalty, or wait until age 60 to collect full benefits without a penalty (see Table 1); we determine which option generates the largest expected pension wealth as calculated in equation (2) and assign her that choice. Additional details about our pension wealth calculations and wage profile calculations are provide in Appendix A.[9]

The contribution accrual curves in Figure 1 reflect the present discounted value of cumulative contributions at each stage in the representative teacher's career. The contribution rates that we use are as reported in the actuarial valuation reports from the state plans in 2013. These contribution rates are a reasonable characterization of expectations for new entrants, but two issues are worth mentioning. The first is that teachers have the option to forego their pensions and withdraw their own contributions from a pension plan, with interest, at any time.[10] If a teacher withdraws, she loses all contributions on her behalf by the employer. It is optimal in most cases for a teacher who exits and is not vested to withdraw (an exception could be a teacher who is uncertain about returning), and in fact,

[9] The most important parameter that we specify in our calculations, at least in terms of affecting the pension wealth values that we report throughout, is the discount rate. We use a real rate of 4 percent, which is in between the rate used in other recent studies (Coile & Gruber, 2007; Costrell & Podgursky, 2009). The pension wealth values that we report below are sensitive to the discount rate, but our findings are qualitatively similar if we choose a different (reasonable) rate.

[10] The interest rates vary by state but are substantially below the assumed return rates of the pension funds.

it can be optimal to withdraw for some vested teachers who separate early in their careers as well. Individuals who withdraw are not incorporated into the illustrative graphs in Figure 1. The second issue worthy of mention is that contribution rates are subject to change due to a variety of factors, including changes to the actuarial assumptions and changes to plan finances. With regard to UAAL payments in particular, GASB standards require pension systems to adopt a plan for paying down the UAAL over a time interval not to exceed 30 years. Most plans adopt the maximum window and choose a level percent of funding pay-down scheme (Governmental Accounting Standards Board, 1994). Thus, while future UAAL costs are subject to change, new entrants into teaching today may reasonably expect current UAAL costs to persist for an extended period. Moreover, even if current UAAL costs are paid down, this in no way ensures that future liabilities will not emerge, and empirically, UAAL payments have been consistently rising in public pension plans across the United States since at least the turn of the century (Munnell, 2012). This is true even in plans where educators and employers have ultimately made all actuarially required contributions (e.g., Missouri).

In summary, the graphs in Figure 1 are designed to illustrate reasonably expected benefits and costs for a newly entering teacher into each of the pension plans in the four focus states, which we argue are best reflected by benefit and cost conditions upon entry. If anything, a well-informed new entrant might expect career contribution rates to be higher than what is required upon entry given the recent trend of rapidly rising pension costs in the overwhelming majority of public plans (see below; also Munnell, 2012), and because many plans are currently underfunded (Biggs, 2011; Novy-Marx & Rauh, 2009, 2011, 2014).

Before delving into the issue of intergenerational transfers in the next section, we first describe other key aspects of the graphs in Figure 1. First, all six pictures contrast the relatively steady accrual of contributions against the backloaded accrual of defined benefits. Backloaded pension wealth accrual is a

common feature of public DB plans and has been studied extensively in previous research (e.g., Aldeman, 2015; Costrell & Podgursky, 2009; Even & Macpherson, 1996; Fitzpatrick, 2015; Ippolito, 2002; McGee & Winters, 2013). Under each plan, teachers receive no plan benefits until they are vested (which occurs either in years 5 or 10 in the focus plans) so the wealth accrual line is flat for an initial period. The significant differences across plans in the height of pension wealth accrual at the "peak" are driven primarily by two plan features: (1) the formula factor and (2) how fast full retirement eligibility is attained. Missouri, the only non-Social Security state in the figure, has the largest formula factor, and the rule-of-80 enables retirement at relatively young ages. These factors result in larger benefits, which also come with higher contribution rates. Similarly, the pure DB plans in Washington and Tennessee offer more pension wealth with higher contribution costs relative to the DB portion of the hybrid plans.

Also note that in each graph, peak pension wealth is attained upon first eligibility for unreduced retirement benefits (e.g., rule-of-80 in Missouri, 30 years of service in Tennessee) and declines thereafter. The reason for the decline in pension wealth after gaining eligibility for unreduced benefits is that beyond this point, each year of continued work results in a year of forgone pension payments. Put differently, the opportunity cost of continued work spikes upon becoming eligible for unreduced benefits. This is a typical feature of DB pension plans. Ni and Podgursky (forthcoming) show that the attainment of collection eligibility is a strong predictor of retirement from the system.[11,12]

[11] To maximize earnings, a teacher who reaches the peak but wishes to continue working would be best off by retiring from the pension plan and finding outside employment (e.g., as a private school teacher). That way, she could collect a full salary and her pension payments at the same time.

[12] There are other interesting features of the graphs that reflect differences in plan rules and labor market conditions across states that we do not explore in detail here. For example, total contributions to the Washington DB plan are higher than in Missouri despite the Washington plan having a lower contribution rate as a percentage of salaries—this reflects higher salaries for Washington teachers in our data (also see Snyder & Dillow, 2015, Table 211.60, for a comparison of average teacher wages across the four focus states). Also note the lower pension wealth accrual in North Carolina relative to the other pure DB plans—this is driven by a variety of factors, but a subtle one is that there was no formal cost-of-living adjustment (COLA) in the North Carolina plan as of 2013 (as noted in Table 1, a formal COLA was implemented in 2014 in North Carolina), which affects the long-term value of the stream of pension payments.

As is clear from the figure, the total contributions (made by teachers and on their behalf) for teachers who work less than a full career far exceed the pension benefits for which they are eligible based on the DB formula. For instance, the difference between contributions and benefits for a teacher who works 15 years covered by the Tennessee hybrid plan, the plan in Figure 1 with the smallest midcareer spread, is roughly $35,000. For a worker covered by the pure DB plan in Washington, the plan with the largest midcareer spread, the difference after 15 years of covered employment is $130,000.

Intergenerational Resource Transfers

The most striking feature of the graphs in Figure 1 is that the contribution profiles dominate the pension wealth accrual profiles throughout the entire career cycle for all of our representative entrant teachers. The interpretation of these graphs is that under the assumed 4 percent real discount rate, a new entrant into teaching would always be a net loser in the pension system (i.e., the value of cumulative contributions exceeds the value of cumulative benefits)—the only question is whether by more (for an early or very late exiter) or less (for a teacher who retires near the peak).[13]

There are several factors that contribute to this surprising result, but a key factor is that a substantial share of the contributions to these plans is not being used to fund retirement benefits for current teachers.[14] As indicated in the bottom rows of Table 1, working teachers in these states contribute between 3.5 and 10.1 percent of their earnings to cover past pension debts. Again we use

[13] The pension wealth of a very late exiter is diminished by the fact that they have fewer years of life over which to collect a pension. We use life expectancy data provided by the Social Security Administration to incorporate this feature of pension wealth accrual into the calculations in equation 2 (which we use to produce the graphs in Figure 1). See Appendix A for details.

[14] Other contributing factors reflect *intra*generational transfers that are facilitated by these systems. As one example, the age of entry can affect individual-specific normal cost and result in resource transfers across teachers within generations. Administrative fees can also create a small wedge between contributions and benefits, but these fees are low in DB plans (e.g., they typically range from 0.1 to 0.3 percent of earnings) and in many cases are included as part of normal cost. We abstract from all types of *intra*generational transfers facilitated by the pension plans, and administrative fees, in order to focus on the intergenerational issue. Ignoring the small role of administrative fees, the gap between total required contributions and normal costs captures the intergenerational transfer in the sense that the contribution costs above normal cost are taken off the top before any *intra*generational transfers are made.

Missouri as a specific example, where over one-third of the total retirement contribution made by working teachers and on their behalf is being diverted. Such a large amortization levy on current teachers keeps them "underwater" for all or most of their careers. To put this another way, if any individual saving for retirement was forced to give over one-third of the total amount that she set aside for retirement to someone else, it would be unreasonable to expect her to overcome this loss and end up with a retirement account balance in excess of what was contributed in the first place.

The large gaps between contribution rates and normal costs in the pension plans that we have studied thus far, driven primarily by UAAL payments, provide clear evidence of intergenerational resource transfers via the pension plans. Depending on the root cause of the UAALs in each state, current teachers can be characterized as transferring resources to some combination of past teachers, past school operations, and/or past state governments. Identifying the key beneficiaries in each state would require a careful state-by-state analysis and even then would be difficult. For example, consider a state that failed to pay into the pension fund as necessary in some previous year. This state could have used some of the resources that it saved by skipping the pension payment to support public schools, including increasing teacher salaries by more than what would have otherwise been possible. But it is important to keep in mind that, irrespective of who specifically benefited from the accrual of liabilities during the stewardship of previous generations over the pension plans in these states, the current condition of these plans and the consequences for current teachers are unchanged. A newly entering teacher in all four states that we study will contribute substantial resources to her pension plan that will be used to pay off past pension liabilities without any direct gain in her own retirement benefits.

Next we examine the extent to which our findings from the four focus states translate nationally. Although we do not have access to detailed administrative micro data from all states to construct contribution and wealth accrual profiles for a comparable representative entrant, we do have

access to the financial reports from the state pension plans that we obtained with assistance from the Center for Retirement Research at Boston College. These reports are sufficient to document the gaps between contribution rates and normal costs across state plans, which is what we show in Table 3 for 2007 and 2013.[15]

When possible, we report gaps in Table 3 that are relevant for new entrants in that year. As an example, for states that have implemented new "tiers" in their pension plans with less generous benefits for new members (such as Illinois), Table 3 reports the gap based on the tier for current enrollees as of 2007 and 2013. However, some pension plans do not report separate normal costs for different tiers, in which case we must use aggregate data. This data limitation will lead to an understatement of the true gaps faced by new entrants in each year in the table. The reason is that in cases where we use aggregate data, the gaps from the older tier(s) and newer tiers are combined, but the older tiers have more favorable gaps (typically owing to better benefits at the same or similar contribution costs) and are not available to new entrants (Kan & Aldeman, 2015).[16]

We report gaps separately for plans that cover only teachers and consolidated plans in which teachers are covered along with other public workers (although note that even in consolidated plans, teachers typically have their own benefit and contribution structures). We also separate plans based on whether teachers are covered by Social Security. Plans in which teachers are not covered by Social

[15] Minor differences in accounting practices across plans, like whether to include administrative fees as part of normal cost or as a separate cost item, generate small discrepancies between UAAL payment costs and normal cost/contribution gaps. These discrepancies, however, are so small relative to overall UAAL costs as to be ignorable: On average across the 34 states in 2013 that explicitly report UAAL payments as a percentage of salaries, we calculate that 99 percent of the gap between normal cost and total contributions is attributable to UAAL costs.

[16] We elaborate on our 2013 calculations briefly in this note for illustration. In 2013, the following states enrolled new entrants into a sub-plan/tier that was less generous (gross and net) than the plan in which some other more experienced teachers were enrolled: AL, AZ, DE, IL, IN, KS, KY, MS, NJ, NM, NY, ND, OR, SC, PA, UT, VT, WA, WI, and WY. Of these states, the financial reports provided by the pension fund were sufficient to calculate contribution-to-normal cost gaps for the sub-plan/tier relevant to new entrants for AL, IL, IN, and KY. For the other states—AZ, DE, KS, MS, NJ, NM, NY, ND, OR, SC, PA, UT, VT, WA, WI, and WY—we calculated the gaps using aggregated data from all sub-plans/tiers, including more generous sub-plans/tiers that were closed to new members as of 2013.

Security tend to have more generous benefit formulas and higher costs (as we see in the case for Missouri relative to the plans in the other three focus states).

The 2013 gaps are more directly relevant for teachers working today. The gaps in 2007 provide a pre-financial crisis benchmark for comparison with the 2013 gaps. Because 2007 predates the 2008 financial crisis, and in fact marks the end of an extended period of economic growth, it would be hard to attribute any gaps as of 2007 to issues related to an unfavorable economy. In fact, if a motivation for public DB plans is to smooth out economic fluctuations across generations, it would be difficult to find a time in recent history in which we should be more likely to see pension surpluses (or negative gaps) than in 2007. The reason is that the extended boom in the stock market was such that pension plans' investment portfolios had done extraordinarily well over the previous 10–15 years (despite the small dip during the early 2000s), which should have resulted in exceptionally high asset-to-liability ratios. At such a point in time, if DB pension plans are indeed designed to smooth returns across generations, one would expect to see evidence of accumulated assets that could be used to offset lower investment returns during less prosperous times in the future.

However, as Table 3 clearly shows, in 2007 there was a shortfall: The average gap between the required contribution rate and normal cost across state plans was non-negligible and positive. On average, it was over 5 percent of earnings. Two-thirds of the plans in 2007 had gaps between contribution rates and normal costs in excess of 3 percent of earnings. Thus, there is strong evidence that even in 2007, working teachers were already subsidizing previous generations of teachers via their pension contributions. This strongly suggests that these plans are not performing the idealized function of smoothing risk across generations. Instead, increases in benefits (often applied retroactively) that were common in the late 1990s and early 2000s, when returns were high, appear to be a form of economic rent capture, consistent with arguments that the pension benefits are determined more by

political economy features than as a purposeful way to attract and retain high-quality teachers (Glaeser & Ponzetto, 2013; Koedel, Ni, & Podgursky, 2014).

By 2013, the average gap across states had grown substantially.[17] For example, the share of states where the gap is more than three percentage points of teacher salaries increased from two-thirds to 90 percent from 2007 to 2013. While it is possible that the gaps will decline in coming years, absent a major stock market boom there is no reason to expect that they will. Reductions of current pension shortfalls via the UAAL payments do not guarantee that future shortfalls will not occur, and debts are commonly re-amortized each year. A number of prominent studies have argued that perpetual shortfalls are all but assured in public DB plans given common actuarial assumptions (Biggs, 2011; Costrell & Lueken, 2011; Munnell, 2012; Novy-Marx & Rauh, 2009, 2011, 2014).

Policy Implications and Solutions

We have shown that teachers working today are being asked to carry the burden of liabilities accrued by previous generations in state pension plans. In many plans, the burden is substantial. An obvious question is whether it makes sense to require today's teachers to bear the sole responsibility of shouldering this burden. A concern is that such a large drag on total teacher compensation may contribute to the degradation of the profession. For instance, there is evidence showing that teachers do not greatly value their DB pension benefits (Fitzpatrick, 2015) and that entry-level salaries may not be sufficient to make teaching a desirable profession (Auguste, Kihn, & Miller, 2010). If state governments were to absorb the UAAL costs in educator pension plans and relieve current teachers of this burden, large salary increases would be possible while holding the total budget for teacher compensation fixed.

[17] The National Council on Teacher Quality (2015) reports related numbers indicating the share of total employer contributions in each state diverted to pay down the UAAL.

The salary increases that could be afforded while maintaining cost neutrality would be nearly as large in percentage terms as the current UAAL payments themselves.[18]

It is natural to think about what sort of policy reforms could prevent continued pension funding shortfalls that result in UAAL payments. A simple but substantial reform that would ensure this objective would be to shift teachers from DB to DC pension plans. The key feature of DC pension plans preventing cross-teacher resource transfers is that each teacher's benefits are tied to her own contributions and investment returns, which by construction prevents transfers. Although shifting teachers into DC plans is not a necessary condition for preventing intergenerational resource transfers, it is a sufficient condition.

While DC plans have the desirable feature of preventing cross-teacher resource transfers, they have other features that some view as inferior to their DB counterparts. One concern, for example, is that DC plans can require individuals to manage their own accounts, which transfers investment risk from the plan to the individual. However, there are options to reduce individual risk. In Washington State, for instance, individuals can choose to invest contributions made to the DC component of the hybrid plan in the same portfolio that the state manages for the DB accounts. This does not eliminate risk (or change who bears the risk), but it does mean that the level of investment risk is the same as that adopted by the state's professional fund managers. Another concern with DC plans is that individual contribution rates can be discretionary, in which case individuals may under-save for retirement, although this problem can be addressed by mandating contribution rates. There is also the worry that individuals poorly manage their savings accounts post-retirement, which can lead to retirement income insecurity.[19]

[18] As previously noted, the salary increases would need to be slightly lower than the UAAL payments because higher salaries also trigger higher pension costs, which would need to be accounted for in a cost-neutral calculation.
[19] For elaboration on these and other concerns about DC plans, see Munnell (2012). Despite these issues, it is notable that some teachers clearly prefer DC plans. For example, Chingos and West (2015) show that a large fraction of Florida teachers (roughly 30 percent) choose a DC plan when given choice between a DB and DC plan despite the default option in Florida being enrollment in the DB plan. Goldhaber and Grout (forthcoming) similarly

There are also retirement plan alternatives in which benefits and contributions are directly linked at the individual level—a key feature that can help to reduce intergenerational transfers—but do not have any of the features of DC plans that some view as undesirable. An example is a cash balance plan, which can have required contributions, be professionally managed with a guaranteed rate of return, and provide benefits that are automatically annuitized so that pensioners (and their spouses) do not outlive their benefits. The U.S. Department of Labor describes a cash balance plan as "a defined benefit plan that defines the benefit in terms that are more characteristic of a defined contribution plan."[20] Cash balance plans do not structurally prevent intergenerational resource transfers, even with the feature that teachers have individual retirement accounts, because the guaranteed rate of return on the professionally managed portfolio may be too high or too low for a particular cohort of teachers. However, as noted by Munnell, Aubry, and Cafarelli (2014), cash balance plans that have been implemented in practice use assumptions that permit more responsible long-term funding, perhaps because of their increased transparency.

Incremental changes within the DB framework could also reduce the accumulation of large unfunded pension liabilities moving forward. An example of such a change would be to tie required pension contributions more closely to pension funding levels. Reducing the GASB-recommended maximum time interval over which pension debt can be amortized would also limit the extent to which intergenerational transfers can occur. Another alternative would be to tie DB benefits to pension funding. For example, if states adopted policies that require benefit cuts to near-retirees if pension liabilities reach certain levels or persist over an extended period of time, it would create a strong political constituency for preventing underfunding.

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show that in the choice environment in Washington State, the majority of teachers opt for the hybrid plan with the DC component over the pure DB plan.

[20] This quotation was retrieved by the authors on August 20, 2015, from http://www.dol.gov/ebsa/faqs/faq_consumer_cashbalanceplans.html. Currently, all state and local employees in Nebraska (except teachers) are in a cash balance plan, as are new teachers in Kansas and part-time teachers in California. A description of cash balance plans in various states may be found in The Pew Charitable Trusts (2014).

Conclusion

We have shown that large intergenerational resource transfers are occurring in public DB pension plans that cover most public school teachers. The direction of the resource transfers is decidedly one-sided—current generations of teachers are being asked to bear the burden of past pension liabilities by devoting considerable resources to pay down previously accrued pension debt. If current teachers were not required to pay down previously accrued pension debt and instead these resources could be redirected to raise salaries, substantial salary increases would be possible without raising total compensation costs in the public education sector.

It is notable that the extended period of strong economic growth—from the mid-1990s and generally through 2007—was not marked by asset-to-liability ratios in educator pension plans in excess of 100 percent. The implication is that while teachers today are being asked to pay back pension liabilities from the past, teachers in the past were not transferring the prosperity afforded by good economic times forward. The fact that the one-way intergenerational transfers were occurring even after an unusually long period of sustained high financial returns suggests that this is a structural problem, not a momentary aberration. Thus, it is difficult to argue that teacher pension plans are performing the idealized function of intergenerational risk sharing as in Cui, de Jong, and Ponds (2011) and Gollier (2008). Instead, the evolution of the pension landscape over the last 20 years is consistent with what economists term "rent seeking" (e.g., see Glaeser & Ponzetto, 2013; Koedel, Ni, & Podgursky, 2013, 2014).

A key feature of DB plans that facilitates intergenerational resource transfers (again, in one direction) is that they do not directly link teachers' contributions to their benefits at the individual level. Instead, pension plans balance assets and liabilities across the workforce and can enact benefit changes and contribution rate changes intertemporally to achieve this objective. A simple but substantial policy

shift that would ensure that the current situation is not prolonged, and not repeated in the future, is to move teachers into DC pension plans. Evidence from Chingos and West (2014) and Goldhaber and Grout (forthcoming) suggests that a large fraction of the teaching workforce would prefer such a change. This would structurally prevent all cross-teacher resource transfers, including intergenerational transfers. Other solutions to the problem include (a) moving teachers into cash balance plans, which have the desirable feature of more transparent, individual-level retirement accounts but can still facilitate intergenerational transfers to some degree, and (b) tightening the link between DB funding and benefit formulas, which would give policy makers less political freedom to underfund pension systems.

A simultaneous policy of alleviating current teachers of the pension burdens of past generations, for which young teachers today seem no more responsible than any other taxpayer, and reforming teacher retirement plans to prevent the current situation from re-emerging in the future, can help to improve the professional outlook for educators across the nation and help put states on a path toward long-term fiscal sustainability for K–12 finances.

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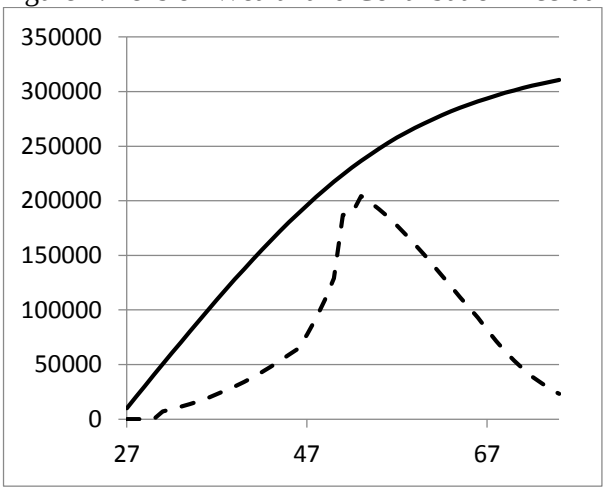
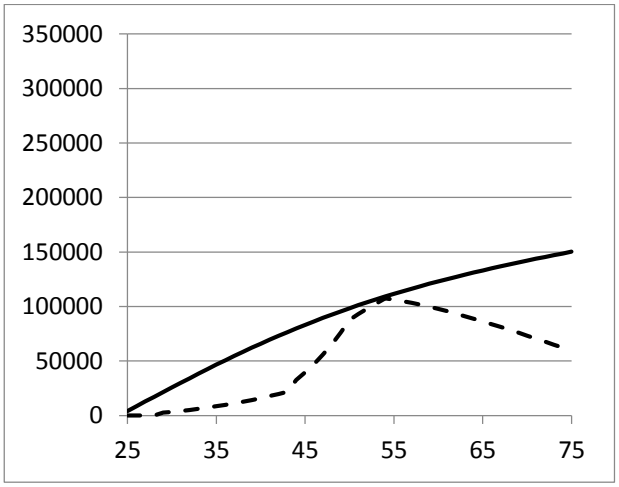
Figures

Figure 1. Pension Wealth and Contribution Accrual Curves for a New Entrant in Each Focus Plan



Missouri



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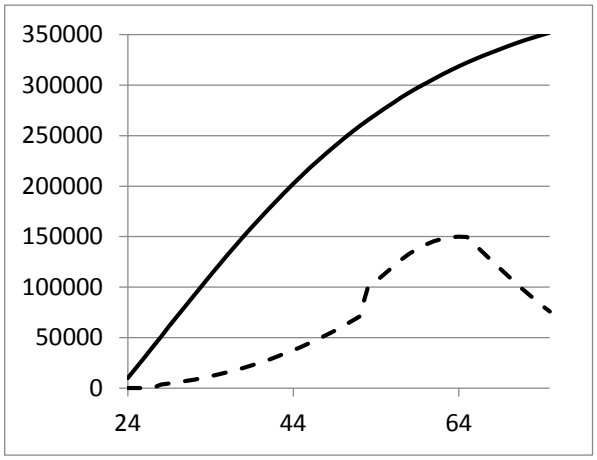
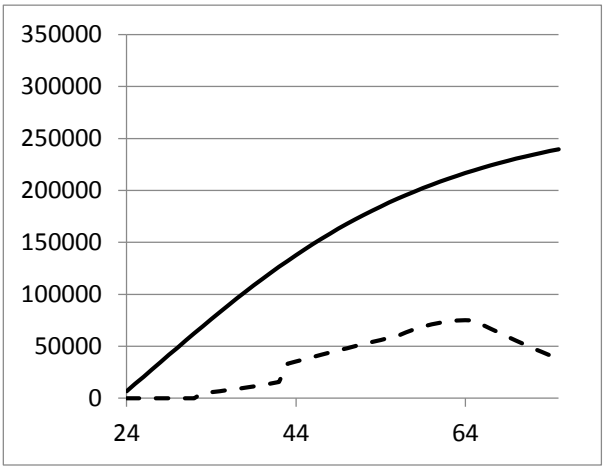
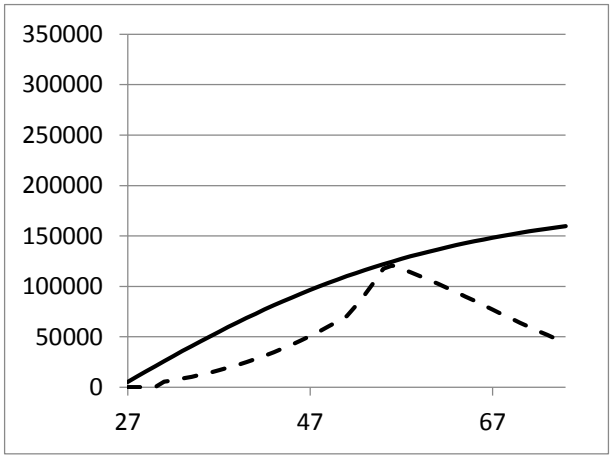


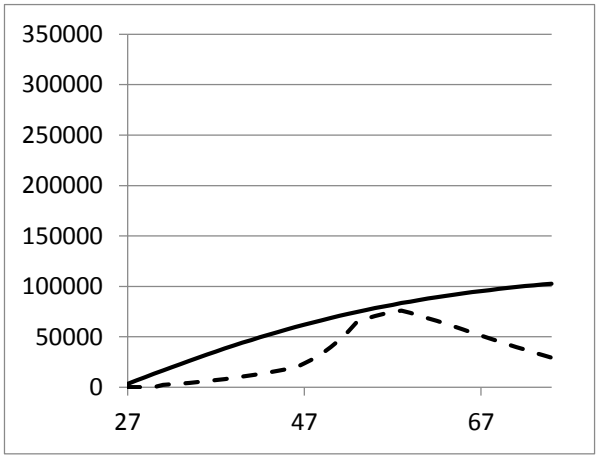
Washington Pure DB



Washington Hybrid (DB Component)



Tennessee Pure DB



Tennessee Hybrid (DB Component)

Notes: In each graph, the solid line indicates the accrual of contributions and the dashed line is pension wealth accrual. For the hybrid plans in Tennessee and Washington State, wealth accrual and contributions are for the DB component only. Values are reported in 2013 dollars throughout and discounted to the point of entry.

Tables

Table 1. Key Pension Plan Details for the Pure DB plans, or the DB Components of the Hybrid Plans, for the Four Focus States as of 2013

	Missouri	North Carolina	Tennessee		Washington	
Plan Type	Pure DB	Pure DB	Pure DB	Hybrid[1]	Pure DB	Hybrid
Formula Factor	0.025	0.0182	0.015	0.010	0.020	0.010
Final Average Salary Calculation	Highest 3	Highest 4	Highest 5	Highest 5	Highest 5	Highest 5
Normal Retirement Age	60	65	60	65	65	65
Full Retirement Before Normal Retirement Age	Rule-of-80; 30 yrs of service	60/25; 30 yrs of service	30 yrs of service	Rule-of-90	N/A	N/A
Early Retirement with Reductions	55/5; 25 yrs experience	60/5; 50/20	55/5; 25 yrs of service	60/5; Rule-of-80	55/20; 55/30	55/10; 55/30; 20-year inflation protection
Cost of Living Adjustment (COLA) by Statute	Yes	No[2]	Yes	Yes	Yes	Yes
Social Security	No	Yes	Yes	Yes	Yes	Yes
DC Component	No	No	No	Yes	No	Yes
DC Details				State 401(k), 2% from employees, 5% from employers		5% (minimum) from employees, 0% from employers
Financial Information (for DB or DB Component)						
2007 Total Normal Cost[3]	21.6	12.3	11.0	N/A	10.6	5.7
2007 Required Contribution Rate (Total)	28.2	9.4	11.4		15.7	10.8
Direct by Teachers	14.1	6.0	5.0		4.9	0
By Employers (School Districts)	14.1	3.4	6.4		10.8	10.8
2013 Total Normal Cost[3]	19.1	11.2	10.2	N/A	14.4	7.6
2013 Required Contribution Rate (Total)	29.2	14.7	14.0		21.3	14.5
Direct by Teachers	14.6	6.0	5.0		6.8	0
By Employers (School Districts)	14.6	8.7	9.0		14.5	14.5

[1] Details for the DB Component of the TN hybrid plan are included in the table for completeness even though this plan was not open until 2014.

[2] A 1 percent COLA was implemented in North Carolina beginning in 2014.

[3] Years indicate the year of the actuarial valuation report.

Table 2. Entering Age and Salary for Representative Entrant Into Teaching in Each State

	Age	Salary (2013 dollars)
Missouri	27	34,740
North Carolina	25	31,202
Tennessee	27	37,157
Washington	24	44,066

Table 3. Average Contribution Rate Minus Normal Cost Across States and Over Time for New Entrants Based on Funding Data From 48 State Educator Pension Plans, Defined Benefit Only

	2007	2013
Contribution Rate Minus Normal Cost (All 48 plans)	5.36%	10.66%
In Educator-Only Plans (26 plans)	5.87	12.82
In Consolidated Plans (22 plans)	4.77	8.11
In Plans With Dual Social Security Coverage (35 plans)	4.35	8.81
In Plans Without Dual Social Security Coverage (13 plans)	8.40	16.22
Share of Plans Where the Total Contribution Rate Is More Than Three Percentage Points Above Normal Cost	0.67 (32/48)	0.90 (43/48)
Number of Plans	48	48

Notes: This table was constructed primarily using data from actuarial valuation reports and comprehensive annual financial reports published by state plans in 2007 and 2013, supplemented for several plans with data from the Public Plans Database maintained by the Center for Retirement Research at Boston College. The table reports numbers for the plans into which new entrants were enrolled in 2007 and 2013 whenever possible. In some instances where states offer multiple plans and do not separately report financial information, the contribution rate and normal cost numbers are combined (as an example, Washington State reports total contribution costs and normal costs for the pure DB and DB component of the hybrid plan together, which results in a weighted average across plan types). Financial reporting data for Connecticut and Nevada are not available for 2007, and therefore, we use data from 2006 and 2012 for these states in the table, although excluding them from the calculations entirely has no qualitative impact on the findings. Alaska and West Virginia are excluded from the table because their DB plans were closed as of 2013.

Appendix A

Details for Pension Wealth Calculations

We determine the representative teacher's survival probabilities over the life cycle for use in equation (2) in the text using the Cohort Life Tables provided by the Social Security Administration. Our accrual profiles are based on survival probabilities for women. As noted in the text, we project out future wages over the career using a growth function that depends on teaching experience. The parameters of the growth function come from a regression of real teacher wages on a cubic of experience, estimated separately (but using the same analytic structure) for each state using administrative data from 2004–2007. The function captures real wage growth, and wages are also adjusted for inflation.

The present discounted value (PDV) calculations require that we specify a real discount rate. We use a real discount rate of 4 percent, which allows for a positive real interest rate and some time preference in earnings. Our choice of a 4-percent real discount rate falls somewhere in between what others have used in the literature. For example, Coile and Gruber (2007) use 6 percent and Costrell and Podgursky (2009) use 2.5 percent. With a 4 percent real rate, and inflation parameterized at 3 percent, the nominal interest rate is 7 percent. This is lower than the assumed rate of 8 percent for most public DB pension plans, including educator plans, but as others have pointed out in the literature, the 8 percent rate is likely too high (Biggs, 2011; Novy-Marx & Rauh, 2009, 2011, 2014). Moreover, using a higher rate would only exacerbate the gaps in the four focus states shown in Figure 1. The reason is that a higher rate would lower pension wealth values relative to contributions (because pension payments are not collected until far into the future while contributions are required throughout the career).