

# Benefit or Burden? On the Intergenerational Inequity of Teacher Pension Plans

Ben Backes<sup>1</sup>, Dan Goldhaber<sup>1,2</sup>, Cyrus Grout<sup>2</sup>, Cory Koedel<sup>3</sup>, Shawn Ni<sup>3</sup>, Michael Podgursky<sup>3</sup>, P. Brett Xiang<sup>3</sup>, and Zeyu Xu<sup>1</sup>

Most public school teachers in the United States are enrolled in defined benefit (DB) pension plans. Using administrative microdata from four states, combined with national pension funding data, we show these plans have accumulated substantial unfunded liabilities—effectively debt—owing to previous plan operations. On average across 49 state plans, an amount that exceeds 10% of current teachers' earnings is being set aside to pay for previously accrued pension liabilities. To the extent that the costs of the unfunded liabilities drag on teacher compensation, they may exacerbate problems of teacher recruitment and retention. We briefly discuss three policy changes that could end or reduce the accumulation of unfunded liabilities in educator pension plans: (1) transition teachers to defined-contribution retirement plans, (2) transition teachers to cash-balance retirement plans, and (3) tighten the link between funding and benefit formulas within the current defined-benefit structure.

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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). An important feature of DB plans is that benefit payments are not tied directly 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 in DB plans facilitates resource transfers between teachers within a plan, which can occur contemporaneously or across generations. In this study, we use administrative microdata 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 intergenerationally.

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). But the potential risk-sharing benefits have been derived within the context of economic models that assume well-informed and benevolent policymaking. These

theoretical models do not account for how politics influences the structure and funding of public DB 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 pensions more generous. The result is that deferred compensation constitutes an inefficiently large share of total compensation for public workers (for more on related political economy issues, see Koedel, Ni, & Podgursky, 2013, 2014).<sup>1</sup>

In theory, DB plans can shift resources backward or forward across generations. Resources can be transferred forward from current generations to future generations by maintaining an asset-to-liability ratio in excess of 100%, which would mean that future generations would need to save less for the same benefits. In practice, this virtually never happens. Funds can transfer

<sup>1</sup>American Institutes for Research, Washington, DC

<sup>2</sup>University of Washington, Seattle, WA

<sup>3</sup>University of Missouri, Columbia, MO

resources backward from current and future generations to older generations by accruing liabilities at a rate that outpaces the accrual of assets. As we show in the following, this second type of transfer is ubiquitous in educator pension plans across the United States today. The magnitude of the transfer is quite large and likely not well understood given that it is reported only in arcane pension documents. The transfer appears in these documents in the form of payments to cover the “Unfunded Actuarial Accrued Liability,” or UAAL. Plans typically collect revenue from employers to pay down UAALs as a percentage of earnings for active plan members.

We use the case of Missouri as an illustrative example. The required contribution rate to the pension fund for Missouri teachers as reported in the 2013 actuarial valuation report was 29.2% of earnings (by state statute, teachers and school districts in Missouri evenly split the total contribution). However, the actuarially estimated “normal cost” for the plan, which is the percentage of salaries required to fund retirement benefits accrued by currently working teachers, was only 19.1%. The 10.1 percentage-point difference represents what is required to pay down the UAAL. In the following, we show that as a consequence of this “pension tax,” contributions to the pension plan by a new Missouri teacher and on her behalf by her school district will exceed the value of the pension benefits she ultimately receives regardless of when she retires.

Our national analysis reveals that most 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 size 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 underpaying—or not paying at all—required contributions on teachers’ behalf. Munnell, Aubry, and Cafarelli (2015) find that the key driver of the growth in UAAL payments between 2001 and 2013 in public plans nationally is that actual investment returns consistently underperformed actuarially assumed returns. In short, actuarial assumptions have led to an understatement of how much past generations needed to contribute to fund promised benefits, which has resulted in the persistent accumulation of debt in most plans over time.

The end result is that a substantial financial burden is being levied on the current generation by teacher pension plans. Yet the existence of this burden is not readily evident. Individual plan 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.<sup>2</sup>

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. The extent to which UAAL costs are passed directly onto working teachers across the nation—namely, the economic incidence of these costs—is unknown and merits further study. For example, government

agencies, taxpayers, and/or school districts may shield current teachers from UAAL payments by absorbing some of these costs. That said, in the following, we give examples of plans where incidence on young teachers is quite clear. The fundamental takeaway from our study is that UAAL costs in educator pension plans are large and growing. These costs require the current generation to make tradeoffs somewhere in the system, whether in the form of lower salaries and benefits for current teachers, less resources to support other educational or government expenditures, and/or higher taxes. As UAAL costs continue to rise, these tradeoffs will become more pronounced.

## Background

### *Pension Benefits*

Most public school teachers in the United States have access to a DB pension plan, and many receive their retirement benefits exclusively from a DB plan. With a handful of exceptions, these plans are administered at the state level. They use the following general formula to determine the annual benefit at retirement:

$$B = F \times YOS \times FAS. \quad (1)$$

In Equation 1,  $B$  represents the annual benefit,  $F$  is a formula factor,  $YOS$  indicates years of service in the system, and  $FAS$  is the teacher’s final average salary, which for most teachers is the average of the final few years of earnings. Future benefits may or may not be adjusted for inflation.

It typically takes 5 to 10 years for a teacher to become vested in a pension plan (National Council on Teacher Quality, 2012); once vested, she can collect her pension upon becoming collection eligible. The “normal retirement age” varies from 60 to 67 across state plans and is one way that collection eligibility is determined. There are also provisions in most plans that allow individuals to retire and begin collecting benefits prior to the normal retirement age. 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 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, which allows for full benefit collection once a teacher’s age and experience sum to 80.

Table 1 documents the features of the pension plans in the four states we study in detail: Missouri, North Carolina, Tennessee, and Washington. We use administrative microdata to construct pension wealth accrual and contribution cost curves in each state for a representative entrant into teaching (see the following). Tennessee and Washington incorporate defined contribution (DC) components into their pension systems. Tennessee recently initiated a DB/DC hybrid plan that covers all new hires as of 2014, and Washington allows teachers to choose between a DB-only and DB/DC hybrid plan. In Table 1, we document the rules for the DB-only plan as well as for the DB component of the hybrid plans for these states. The basic details of the DC components to the hybrid plans are also provided. However, they are not the focus of our study because cross-teacher resource

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

Plan Type	Missouri	North Carolina	Tennessee		Washington	
	DB	DB	DB	Hybrid <sup>a</sup>	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 years of service	60/25; 30 years of service	30 years of service	Rule-of-90	N/A	N/A
Early retirement with reductions	55/5; 25 years of experience	60/5; 50/20	55/5; 25 years of service	60/5; rule-of-80	55/20; 55/30	55/10; 55/30
Cost of living adjustment (COLA) by statute	Yes	No <sup>b</sup>	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 investment return assumption, %	8	7.25	7.5		8	8
2007 total normal cost <sup>c</sup>	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	14.1	3.4	6.4		10.8	10.8
2007 contribution minus normal cost	6.6	-2.9	0.4		5.1	5.1
2013 investment return assumption, %	8	7.25	7.5		7.8	7.8
2013 total normal cost <sup>c</sup>	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	14.6	8.7	9.0		14.5	14.5
2013 contribution minus normal cost	10.1	3.5	3.8		6.9	6.9
Gap increase from 2007 to 2013	3.5	6.4	3.4		1.8	1.8

*Note.* DB = defined benefit; DC = defined contribution.

<sup>a</sup>Details for the DB component of the Tennessee hybrid plan are included in the table for completeness even though this plan was not open until 2014.

<sup>b</sup>A 1% COLA was implemented in North Carolina beginning in 2014.

<sup>c</sup>Years indicate the year of the actuarial valuation report.

transfers do not occur under the DC portion of the plans. This is by construction—in a DC plan, a teacher’s retirement benefits are directly linked to contributions made on her behalf (her own contributions and contributions from her employer) and her own investment returns, leaving no room for transfers of any kind. The presence of the DC component is only notable because it signifies that a smaller share of retirement benefits is conveyed via the DB structure.

Nationally, roughly two-thirds of teachers are dually enrolled in Social Security, as is the case 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.<sup>3</sup>

#### *Pension Contributions*

Actuaries calculate the contributions (as a percentage of salary) necessary to fund benefits accrued by members and pay down

unfunded liabilities. 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 discrepancies. Perhaps the highest profile factor—although it is not very common—is that states can skip pension payments entirely. States can also pay some but not all of the necessary contribution, which happens more frequently (The Pew Charitable Trusts, 2015). 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 (Georgia and Maine are examples of states that have made full actuarial payments but are underfunded).

Guidelines from the Government Accounting Standards Board (GASB) recommend that actuaries set a target funding ratio (i.e., the ratio of assets to liabilities) of 100% (American Academy of Actuaries, 2012), although GASB does not have enforcement authority. When the funding ratio falls below the target level for a plan, it can trigger contribution increases. In the bottom panel of Table 1, we draw on 2007 and 2013 actuarial valuation reports for the four featured state plans to document the gaps between normal cost and the necessary contribution rate. Recall that normal cost is the percentage of salary (as calculated by actuaries) needed to fund retirement benefits accrued by teachers currently in the workforce. The gaps have widened substantially between 2007 and 2013 in the focus states, growing by between 1.8% and 6.4% of teacher salaries.

### Accrual of Contributions and Pension Wealth Across Plans

Figure 1 shows pension wealth accrual and contribution accrual curves over the career cycle for a representative entrant into teaching 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 opened until 2014). These states represent a convenience sample for which our authorship has access to administrative microdata. The graphs plot total contributions, which include teachers' own contributions along with contributions made on their behalf by states and school districts. These total contributions reflect the resources devoted to fund pension benefits 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, (2) obtain the average salary for new entrants at the modal age, and (3) project out wages over the career cycle.<sup>4</sup> 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 et al., 2014). The cubic wage function is estimated separately for each state using data from 2004 to 2007; this allows for differences in lifetime salary profiles across states to influence contribution and pension wealth accrual.<sup>5</sup>

With an entry age and salary profile in hand for each state, we apply the pension contribution and benefit rules as of 2013 to produce the graphs. The pension accrual profiles show accumulated benefits at each point in the career 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. Pension wealth 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:

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

In Equation 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. 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 pension wealth subject to her work history and the pension rules. All dollar values in Figure 1 and throughout the article are reported in 2013 dollars. Additional details about our pension wealth calculations and wage profile calculations are provided in the Appendix.<sup>6</sup>

The contribution curves in Figure 1 reflect the present discounted value of cumulative contributions at each stage in the representative teacher's career, using the same discount factor that we use for the benefit curves per the Appendix. The contribution rates are as reported in the actuarial valuation reports from the state plans in 2013 and are a reasonable characterization of expectations for new entrants, but two issues are worth mentioning. The first is that a teacher who quits can forego her pension and withdraw her own contributions from a pension plan, with interest, at any time.<sup>7</sup> If she withdraws, she loses all contributions made 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, 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 is that contribution rates are subject to change due to a variety of factors, including changes to actuarial assumptions and changes to plan finances. With regard to UAAL payments in particular, GASB (1994) has previously recommended that pension systems pay down the UAAL over a time interval not to exceed 30 years, and most plans adopt roughly a 30-year amortization window. Moreover, many plans reset the amortization timeframe each year (termed *open amortization*).<sup>8</sup> 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 does not ensure that future liabilities will not emerge, and empirically, UAAL costs 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.

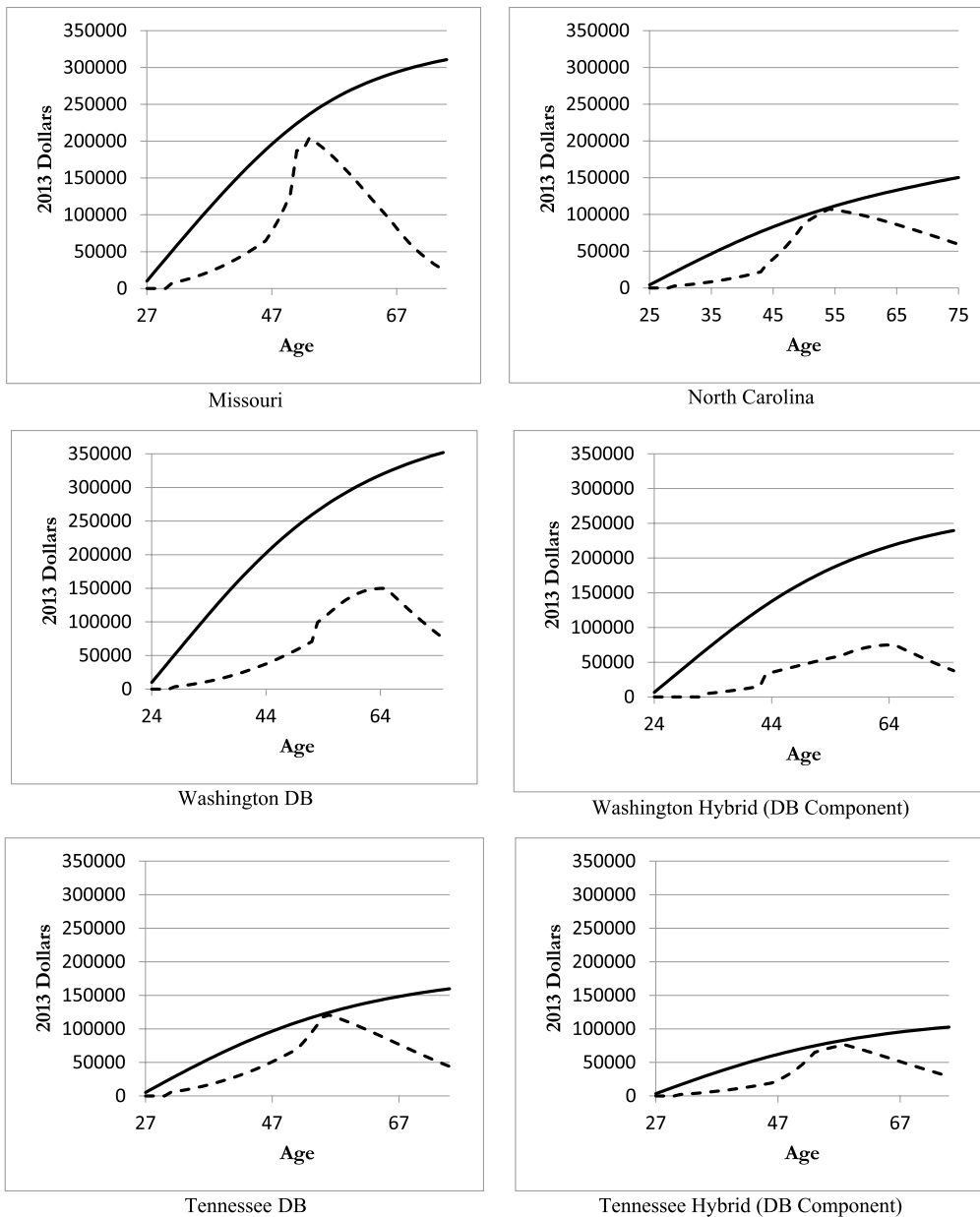


FIGURE 1. *Pension wealth and contribution accrual curves for a new entrant in each focus plan*

In each graph, the solid line indicates the accrual of total 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 defined benefit component only. Values are reported in 2013 dollars throughout and discounted to the point of entry using the same discount rate for benefits and contributions.

In summary, the graphs in Figure 1 are designed to illustrate reasonably expected benefits and total contribution 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 total contribution rates to be higher than what is required upon entry given the recent trend of rapidly rising pension costs in most public plans (see the following; also Munnell, 2012) and because the extent of underfunding is often understated in plan reports (Biggs, 2011; Novy-Marx & Rauh, 2009, 2011, 2014).

Before delving into the issue of intergenerational resource transfers in the next section, we first briefly describe other key

aspects of the graphs in Figure 1. All six pictures contrast the relatively steady accrual of contributions against the backloaded accrual of benefits. Backloading 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). Differences across plans in the height of the pension wealth “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 plan features result in larger benefits (which also come with higher contribution rates).

**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

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 is that after teachers attain full collection eligibility, 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. Ni and Podgursky (in press) show that the attainment of collection eligibility is a strong predictor of retirement from the system (also see Costrell & McGee, 2010).<sup>9</sup>

As is clear from the figure, the total contributions 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 DB-only plan in Washington, the plan with the largest midcareer spread, the difference after 15 years 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 career for all of our representative entrants. The interpretation is that under the assumed 4% real discount rate (which corresponds to a 7% nominal rate in our calculations; see the Appendix), and accounting for the total contributions to the plan made by the teacher and employer, 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 retiring near the peak).<sup>10</sup>

Several factors contribute to this surprising result, but a key factor is that a substantial share of contributions is not being used to fund retirement benefits for current teachers.<sup>11</sup> As indicated in the bottom rows of Table 1, between 3.5% and 10.1% of teacher earnings are being used to cover past pension debts. Again we use Missouri as an example, where over one-third of the total retirement contribution made by working teachers and their employers (on their behalf) is being diverted. Such a large amortization levy keeps teachers “underwater” throughout their careers. To put this another way, if any individual saving for retirement was forced to give over one-third of the total amount set aside for her retirement to someone else, it would be unreasonable to expect her to overcome this loss (e.g., with high

investment returns) and end up with a retirement account balance in excess of what was contributed in the first place.

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 microdata from all states, we do have access to the plans’ actuarial valuation reports and comprehensive annual financial reports. These reports, supplemented with data from the Public Plans Database (2001–2013) maintained by the Center for Retirement Research at Boston College, are sufficient to document the gaps between contribution rates and normal costs. We show these gaps in Table 3 for 2007 and 2013.<sup>12</sup>

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 (e.g., 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 separately for different tiers, in which case we use aggregate data. This data limitation will lead to an understatement of the true gaps faced by new entrants 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).<sup>13</sup>

We report gaps separately for plans that cover only teachers and consolidated plans in which teachers are covered along with other public workers (although even in consolidated plans, teachers typically have their own benefit and contribution structures and can even have their own amortization structure). We also separate plans based on whether teachers are covered by Social Security. Plans in which teachers are not covered by Social Security tend to have more generous benefits and higher costs (as is the case for Missouri relative to the other plans previously mentioned).

The 2013 gaps are most relevant for teachers working today. The 2007 gaps provide a pre-financial crisis benchmark for comparison. Because 2007 predates the 2008 financial crisis and marks the end of an extended period of economic growth, it would be hard to attribute any gaps in 2007 to issues related to an unfavorable economy. In fact, if a motivation for public DB plans is to smooth out financial risk 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). 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 to 15 years (despite the small dip during the early 2000s), which should have resulted in high asset-to-liability ratios.

However, as Table 3 clearly shows, in 2007 there was a shortfall: The average gap between the required contribution rate and normal cost rate across state plans was, on average, over 5 percentage points. Two-thirds of plans in 2007 had gaps in excess of 3 percentage points. Thus, there is strong evidence that even in 2007, the current generation was already subsidizing previous generations. This suggests that these plans are not performing the idealized function of intergenerational smoothing.<sup>14</sup>

By 2013, the average gap had grown substantially to over 10% of teacher salaries, and the share of states where the gap is

**Table 3**  
**Average Contribution Rate Minus Normal Cost Across States and Over Time for New Entrants Based on Funding Data From 49 State Educator Pension Plans, Defined Benefit Only**

	2007	2013
Contribution rate minus normal cost (all 49 plans), %	5.60	10.89
In educator-only plans (27 plans)	6.28	13.18
In consolidated plans (22 plans)	4.77	8.11
In plans with dual Social Security coverage (37 plans)	4.69	9.17
In plans without dual Social Security coverage (12 plans)	8.40	16.22
Share of plans where the total contribution rate is more than 3 percentage points above normal cost	0.67 (33/49)	0.90 (44/49)
Number of plans	49	49

*Note.* This table was constructed primarily using data from actuarial valuation reports and comprehensive annual financial reports published by state plans in 2007 and 2013 and supplemented for several plans with data from the Public Plans Database maintained by the Center for Retirement Research at Boston College. The table reports on 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 defined benefit-only and defined benefit 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 (excluding them from the calculations entirely has no qualitative impact on the findings). Alaska is excluded because their defined benefit plan was closed as of 2013.

more than 3 percentage points of salaries increased to 90%.<sup>15</sup> 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.<sup>16</sup> Reductions of current pension shortfalls via UAAL payments do not guarantee that future shortfalls will not occur, and debts are commonly reamortized each year. A number of prominent studies have argued that perpetual shortfalls are all but assured in public DB plans given common actuarial assumptions and practices (Biggs, 2011; Costrell, 2016; Munnell, 2012; Novy-Marx & Rauh, 2009, 2011, 2014).

As noted previously, the economic incidence of UAAL contribution costs is not clear. While from a pure accounting standpoint, it is employers who make UAAL payments on a per-teacher basis as a percentage of salary, how much of these costs are passed onto currently working teachers in the form of lower wages and/or reduced benefits is unknown. The extent to which the UAAL payments are crowding out other educational and non-educational government expenditures and/or taxpayers have absorbed them is also not clear. Nonetheless, in some cases, it is more apparent than in others that young teachers are bearing disproportionate costs associated with rising UAAL payments. An example is New Mexico, where senior teachers are enrolled in “Tier 1” of the pension plan and their more junior counterparts are enrolled in Tiers 2 and 3 (New Mexico teachers who started between June 30, 2010 and June 30, 2013 are enrolled in Tier 2 of the plan; those starting later are enrolled in Tier 3). Tier 1 offers more generous benefits than Tiers 2 and 3, but despite the gap in benefit generosity across plan tiers, contribution requirements for teachers and employers are the same. Within districts, Tier 1, Tier 2, and Tier 3 employees share the same salary schedules. There are many similar examples.<sup>17</sup>

### Policy Implications

We have shown thus far that a substantial debt burden has accrued in educator pension plans owing to previous generations’ stewardship over these plans. While economic incidence is

not clear and requires further study, to the extent that these UAAL costs drag on teacher compensation, they may exacerbate problems of teacher recruitment and retention. For instance, there is evidence 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). An interesting thought experiment involves the state government absorbing the UAAL burden in teacher plans entirely and shifting the resources currently devoted to this expenditure toward higher teacher salaries. In such a scenario, substantial wage increases would be possible in most states holding total compensation budgets fixed at current levels.<sup>18</sup> Operationally, there are a number of ways that a state might absorb the UAAL burden, but the key aspect of any such action is that the liability would be removed from the books of the pension system and added to a different part of the state’s balance sheet (note that some states already pay the employer cost, e.g., Illinois).

It is natural to think about what sort of policy reforms could prevent future pension funding shortfalls that result in UAAL payments. Such reforms would likely be a required component of any proposal in which state governments “rescue” plans from their currently accrued debts. A straightforward but substantial reform would be to shift teachers from DB to DC pension plans. The key feature of DC plans preventing intergenerational resource transfers is that each teacher’s benefits are tied to her own contributions, contributions from her employer, and her investment returns, which by construction prevents transfers. Although shifting to a DC structure is not a necessary condition for preventing intergenerational resource transfers, it is a sufficient condition. The most feasible shift to a DC plan—both practically and legally—would apply only to new teachers, preserving the current retirement benefit structure for incumbents. Incumbents could also be given the option to switch to a DC plan if they choose, in which case they would either retain already accrued DB benefits or receive equivalent DC compensation as determined by actuaries. Already accrued UAALs in

DB plans would be treated as a sunk cost in this scenario, with the benefit that future UAALs would be avoided.

While DC plans have the desirable feature of structurally preventing intergenerational resource transfers, they have other features that some view as inferior to their DB counterparts (see Munnell, 2012).<sup>19</sup> But it is important to recognize that retirement plan alternatives exist in which benefits and contributions are directly linked at the individual level—a key feature that can help to reduce intergenerational transfers—and 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.”<sup>20</sup> 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, Munnell et al. (2014) show that cash balance plans that have been implemented in practice use assumptions that permit more responsible long-term funding and are thus less likely to produce intergenerational transfers.<sup>21</sup>

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 contributions more closely to pension funding levels. Another alternative would be to tie DB benefits to pension funding, which would create a strong political constituency to prevent underfunding. The Society of Actuaries (2014) calls for much greater transparency in pension reporting—particularly pertaining to investment risk—as a way of reducing underfunding and improving intergenerational equity, although the report stops short of calling to directly align the benefits of current plan members with funding benchmarks.

## Conclusion

We have shown that large intergenerational resource transfers are occurring via the DB pension plans that cover most public school teachers. The direction of the resource transfers is decidedly one-sided—current generations are being asked to bear the burden of past pension liabilities. On average across state plans, UAAL costs are more than 10% of current teachers’ earnings. It is notable that at the end of an extended period of strong economic growth—from the mid-1990s and generally through 2007—asset-to-liability ratios in most educator pension plans were still well below 100%, which suggests that this is a structural problem, not a temporary aberration. Thus, it is difficult to argue that teacher pension plans are performing the idealized function of facilitating intergenerational risk sharing as in Cui et al. (2011) and Gollier (2008).

A straightforward but substantial policy shift that would end the accumulation of UAAL costs in educator pension plans is to

move teachers into DC pension plans. Evidence from Chingos and West (2015) and Goldhaber and Grout (2016) suggests that a significant fraction of the teaching workforce might prefer such a change. This would structurally prevent intergenerational transfers via teacher retirement plans such as those highlighted in this study. Other solutions 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 policymakers less political freedom to underfund pension systems.

A simultaneous policy of states absorbing the pension burdens of past generations and explicitly reserving at least some of the resources freed up by this transfer of debt for salary increases for current workers, combined with reforming teacher retirement plans to prevent the current situation from reemerging in the future, can help to improve the professional outlook for educators across the nation and put states on a path toward long-term fiscal sustainability for K–12 finances.

## NOTES

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<sup>1</sup>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 (2014) result that deferred compensation is too high, including Fitzpatrick (2015), Chingos and West (2015), and Goldhaber and Grout (2016).

<sup>2</sup>Evidence from Chan and Stevens (2008) shows that pensioners commonly misunderstand how their plans work, which supports the contention that they may not understand this aspect of contribution spending.

<sup>3</sup>Table 3 shows that teachers covered by 37 of the 49 defined benefit (DB) plans we examine nationally are covered by Social Security. At the individual teacher level, the share covered by Social Security is smaller than the simple average across state plans because teachers in several large states are not covered—for example, California, Illinois, and most districts in Texas.

<sup>4</sup>Our calculations are similar in spirit to the calculations made by actuaries for the pension funds. However, relative to what is shown in most actuarial valuation reports, our calculations are more flexible. The administrative data also allow us to standardize our approach to performing the calculations across the focus states. This improves inference by removing the role of state-to-state variation in actuarial assumptions.

<sup>5</sup>The North Carolina data do not include age directly but do have information on the year when teachers completed their undergraduate



degrees. We use this information to impute age for North Carolina teachers. Also note that the Missouri wage profile we 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., see Koedel, Ni, & Podgursky, 2014). For consistency in reporting across states, we use data from the same years for all focus states (2004–2007). A steeper wage profile in Missouri would raise the pension wealth accrual curve because of the disproportionate role of late-career salary in determining the pension benefit. Still, using a steeper wage profile would not change the qualitative implication of Figure 1.

<sup>6</sup>The most important parameter that we specify in our calculations is the discount rate. We use a real rate of 4%, which is in between the rates used in other recent studies (Coile & Gruber, 2007; Costrell & Podgursky, 2009). The pension wealth values are sensitive to the discount rate, but our findings are qualitatively similar if we choose a different (reasonable) rate.

<sup>7</sup>The interest rates vary by state but are substantially below the assumed return rates of the pension funds.

<sup>8</sup>Although the Government Accounting Standards Board (GASB) has recently changed its recommendations regarding amortization (see GASB Statement 68 issued in June of 2012; [http://www.gasb.org/jsp/GASB/Pronouncement\\_C/GASBSummaryPage&cid=1176160219492](http://www.gasb.org/jsp/GASB/Pronouncement_C/GASBSummaryPage&cid=1176160219492)), the new recommendations are not yet reflected in many plans.

<sup>9</sup>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).

<sup>10</sup>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.

<sup>11</sup>Other contributing factors reflect *intragenerational* 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. We abstract from all types of *intragenerational* transfers facilitated by the pension plans in order to focus on the intergenerational issue.

<sup>12</sup>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 Unfunded Actuarial Accrued Liability (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, 99% of the gap between normal cost and total contributions is attributable to UAAL costs.

<sup>13</sup>We elaborate on our 2013 calculations briefly 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: Alabama, Arizona, Delaware, Illinois, Indiana, Kansas, Kentucky, Mississippi, New Jersey, New Mexico, New York, North Dakota, Oregon, South Carolina, Pennsylvania, Utah, Vermont, Washington, Wisconsin, and Wyoming. Of these states, the financial reports provided by the pension fund were sufficient to calculate cost gaps for the sub-plan/tier relevant to new entrants in Alabama, Illinois, Indiana, and Kentucky. For the other states we calculated the gaps using aggregated data from all sub-plans/tiers, including more generous sub-plans/tiers closed to new members as of 2013.

<sup>14</sup>As recently as the turn of the century, many public pension plans had favorable asset-to-liability ratios—some above 100% (Munnell, 2012)—and this was true for educator plans as well (Koedel et al., 2014;

Munnell, Aubry, & Cafarelli, 2015). One reason is that within the general economic boom period spanning the early 1990s to 2007, the mid-to late-1990s were particularly strong, with the Dow Jones Industrial Average generating a 200% cumulative return between 1995 and 1999 alone (Koedel et al., 2014). However, the time span over which educator plans had asset-to-liability ratios above 100% was short-lived for several reasons, including the stock market correction in the early 2000s and the practice in most plans of retroactively improving benefit formulas in the late 1990s and early 2000s for active plan members and retirees, which effectively increased long-term liabilities in response to a transitory increase in asset values (Koedel et al., 2014).

<sup>15</sup>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.

<sup>16</sup>Even then, we note that the stock market has had strong returns since 2009, but many pension plans continue to struggle.

<sup>17</sup>See Note 13 for a list of teacher plans that provide differential benefits to teachers via different pension plan tiers. In some plans, like New York, newer tiers come with both lower benefits and higher direct contribution costs for new teachers.

<sup>18</sup>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 is that higher salaries would generate larger pension obligations, meaning that the salary increase would need to be smaller than the UAAL payments to maintain budget neutrality. We also note that per the preceding discussion, absent a targeted policy, it is not obvious that any freed up resources associated with states absorbing UAAL payments would go to fund teacher salary increases—this point gets back to the Glaeser and Ponzetto (2014) argument that pension benefits are “shrouded” to the public and similar-sized expenditures that are more transparent may not be politically feasible.

<sup>19</sup>Despite the issues discussed by Munnell (2012), there is evidence showing that many teachers prefer defined contribution plans (Chingos & West, 2015; Goldhaber & Grout, 2016).

<sup>20</sup>[http://www.dol.gov/ebsa/faqs/faq\\_consumer\\_cashbalanceplans.html](http://www.dol.gov/ebsa/faqs/faq_consumer_cashbalanceplans.html).

<sup>21</sup>A description of cash balance plans in various states may be found in The Pew Charitable Trusts (2014).

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## AUTHORS

**BEN BACKES**, PhD, is a researcher at the American Institutes for Research, 1000 Thomas Jefferson St, Washington, DC 20007; [bbackes@air.org](mailto:bbackes@air.org). His research interests include teacher preparation, teacher quality, and the sorting of students to colleges.

**DAN GOLDBERGER**, PhD, is a vice president at the American Institutes for Research, 1000 Thomas Jefferson Street, NW, Washington, DC 20007; [dgoldhaber@air.org](mailto:dgoldhaber@air.org). His research focuses on teacher quality and teacher labor markets.

**CYRUS GROUT**, PhD, is a consulting researcher at the Center for Education Data & Research at the University of Washington, Bothell, 3876 Bridge Way N, Ste 201, Seattle, WA 98103; [cyrusgrout@gmail.com](mailto:cyrusgrout@gmail.com). His research focuses on teacher labor market policy, particularly issues related to pensions and the teacher hiring process.

**CORY KOEDEL**, PhD, is an associate professor of economics and public policy at the University of Missouri-Columbia, 118 Professional Building, Columbia, MO 65211; [koedelc@missouri.edu](mailto:koedelc@missouri.edu). His research focuses on teacher quality and compensation and schooling efficacy in K–12 and higher education.

**SHAWN NI**, PhD, is a professor of economics at the University of Missouri-Columbia, 118 Professional Building, Columbia, MO 65211; [ni@missouri.edu](mailto:ni@missouri.edu). His research applies life cycle models to study household consumption and teachers’ career choices.

**MICHAEL PODGURSKY**, PhD, is a professor of economics at the University of Missouri-Columbia, 118 Professional Building, Columbia, MO 65211; [podgurskym@missouri.edu](mailto:podgurskym@missouri.edu). His research focuses on teacher quality and compensation.

P. BRETT XIANG is a PhD candidate at the University of Missouri-Columbia, 118 Professional Building, Columbia, MO 65211; *pxiang@missouri.edu*. His research focuses on teacher pensions and teacher quality.

ZEYU XU, PhD, is a managing researcher at the American Institutes for Research; *zxu@air.org*. His research focuses on teacher labor market and student college readiness policies.

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## APPENDIX

### Details for Pension Wealth Calculations

We determine the representative teacher's survival probabilities over the life cycle for use in Equation 2 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 to 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%, which allows for a positive real interest rate and some time preference in earnings. As noted in the text, we use the same rate to discount benefits and contributions. Our choice of a 4% real discount rate falls in between what others have used in the literature. For example, Coile and Gruber (2007) use 6%, and Costrell and Podgursky (2009) use 2.5%. With a 4% real rate and inflation parameterized at 3%, the nominal interest rate is 7%. This is lower than the assumed rate of 8% for most public defined benefit pension plans, including educator plans, but as others have pointed out in the literature, the 8% 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.