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Abstract

How much do teachers value compensation deferred for retirement (CDR)? This question is important because the vast majority of public school teachers are covered by defined benefit (DB) pension plans that "backload" a large share of compensation to retirement relative to the compensation structure in the private sector, and there is scant evidence about whether pension structures are consistent with teacher preferences for current compensation versus CDR. This study examines a unique setting in Washington State, where teachers are enrolled in a hybrid pension system that has both DB and defined contribution (DC) components. We exploit the fact that teachers have choices over their DC contribution rate to infer their revealed preferences for current versus CDR. We find that teachers on average contribute 7.23 percent of salary income toward retirement; 62 percent in fact elect to contribute more than the minimally required contribution of 5 percent. This suggests that teachers value CDR far more than suggested by prior evidence.

1. Introduction

How much do teachers value dollars that are set aside for retirement (which we refer to as compensation deferred for retirement or CDR)? The answer to this question is of fundamental import to designing a teacher compensation structure that makes teaching a desirable profession. Understanding teacher preferences for different compensation structures is important but also challenging since, in most states, the amount that teachers defer for retirement is determined through a political process where policymakers, as opposed to individual teachers, make decisions.

The vast majority of public school teachers are served by defined benefit (DB) pension plans (National Education Association, 2010) that "backload" a disproportionate share of compensation to retirement (relative to the compensation structure in the private sector).[1] There are good theoretical arguments for why a backloaded teacher compensation structure might be optimal for student achievement. Ippolito (2002), for instance, suggests that backloaded compensation may be desirable to higher-quality employees, who tend to prefer higher rates of saving for retirement. It is also possible that a backloaded compensation lowers attrition and shirking behavior of employees (Costrell and Podgursky, 2009; Gustman et al., 1995; Lazear, 1979; Lazear and Moore, 1984).[2] [3]

[1] Public school teachers typically earn over 10 percent of their total compensation through retirement benefits (not including employee retirement contributions), which is nearly twice the rate of the average private sector employee (Aldeman, 2016).

[2] There is evidence that the churn of teachers is itself harmful for student achievement (for example, see Ronfeldt, Loeb, and Wyckoff, 2013), which means that a backloaded compensation structure could be a net positive for student achievement even if the structure of compensation is not optimized to make teaching as desirable as possible for new entrants. For this to be the case, the benefits of reduced churn associated with backloading would need to offset any reduction in the quality of new teacher entrants associated with backloading.

[3] Aside from workforce quality/student achievement effects, there are other arguments favoring backloaded compensation and DB pensions in particular. One is that teachers, left to their own devices, would save too little for retirement as they may not fully understand the features of their retirement plans and/or are not generally sophisticated about retirement planning (Laibson, 1998; Laibson, Repetto, Tobacman, Hall, Gale, and Akerlof,

An alternative, however, is that compensation backloading reflects rent capture and not efficiency. One theory, proposed by Glaeser and Ponzetto (2014), suggests that DB pensions could shroud benefits from public notice so that policymakers can increase total teacher compensation by more than would be possible if benefits were transparent. It is also possible that compensation is backloaded due to the greater influence of experienced teachers relative to novices. For example, Monk and Jacobson (1985) suggest that the increased backloading of salary schedules during the 1970's could be due to effective bargaining by teachers' unions on behalf of more experienced teachers. Similarly, Lankford and Wyckoff (1997) find that the majority of districts have allocated disproportionally large shares of salary increases to veteran teachers that appear to have little impact on retention.

Much of the literature on teacher pensions is focused on the fiscal sustainability of state systems (e.g. Novy-Marx & Rauh, 2011; Biggs, 2015). This is certainly warranted given that a number of states' pension systems are judged to be inadequately funded in the sense that the current liabilities in the system far exceed the current assets (e.g. Pew, 2019). There is also concern about the degree to which the funding of pension promises is eating into current schooling expenditures; the share of per pupil expenditures going to pensions has, for instance, risen from about $500 in 2004 to over $1,500 in 2020 and accounts for 11.1 percent of total per-pupil expenditures (Costrell, 2020).

1998; Brown & Weisbenner, 2014; Chan & Stevens, 2008). In addition to potentially correcting under-saving, one frequently referenced benefit of DB pensions is that they protect teachers from investment risk, and that DB pension plans may have better investment returns relative to DC plans (NEA, 2016). That said, these issues are contentiously debated; many researchers find that many teachers exit the profession prior to the accumulation of meaningful retirement benefits (for example, see Costrell and McGee, 2010; Koedel, Podgursky, and Shi, 2013; Johnson, Butrica, Haaga, and Southgate, 2014).

Far less research has focused on the extent to which teacher pension structures are consistent with *teacher preferences* for CDR.[4] Some precision with language is necessary for this discussion: when we say "compensation deferred for retirement (CDR)" we are referring specifically to funds set aside for retirement that cannot be accessed prior to reaching retirement and drawing a pension.[5] By "current compensation" we are referring to money that individuals receive in the form of salary or wages, which may be used for consumption or savings (though not savings that receive special tax deferred benefits).

Two recent studies attempt to shed some light on teacher preferences for CDR relative to current compensation; both find that teachers under a DB pension system tend not to value dollars set aside for pension upgrades anywhere close to the cost of providing them (Fitzpatrick, 2015; Johnston 2020).[6] But, there may be reason to question these results because the studies are based on complex methods that require a number of assumptions (Fitzpatrick, 2015), or rely on stated preferences (in surveys) rather than revealed preferences (Johnston, 2020).

In this article, we contribute to the body of evidence on this topic by considering an alternative to estimating demand or asking teachers to consider alternatives. Instead, we exploit the fact that a significant share of teachers in Washington state are enrolled in a hybrid pension plan that has both DB and defined contribution (DC) components, and teachers have to choose a contribution rate under the DC component. This allows us to infer how much teachers value

[4] Related issues are the degree to which DB pensions affect attrition (Goldhaber et al., 2017; Koedel & Xiang, 2017), retirement timing (Costrell & Podgursky, 2010; Costrell & McGee, 2010; Brown, 2013; Ni & Podgursky, 2016) or teacher quality (Koedel et al., 2013).

[5] Or more generally, the funds cannot be accessed without incurring significant financial penalties, such as those associated with withdrawing funds from a 403B account prior to reaching retirement age.

[6] Johnston (2020) considers a large set of employment characteristics in addition to the value teachers place on CDR, though the inclusion of costs of pension upgrades allow us to compare these estimates to other studies. Closely related work by Fuchsman et al. (2020) uses a similar stated preferences experiment and focuses primarily on the tradeoffs of different types of pension systems, finding that teachers slightly prefer DB pension plans and these preferences differ depending on age which informs our estimation as described below.

current compensation versus CDR by using a simple approach that does not require any complex estimation (as in Fitzpatrick), and is motivated by revealed preferences (as opposed to stated preferences as studied by Johnston, 2020).

As a specific example of our assumption about teacher preferences, we infer that those teachers who choose to set aside 7 percent of their current consumption for retirement, rather than the default 5 percent, reveal that they prefer setting aside these dollars towards additional retirement income more than the forgone current consumption.[7] Thus, the key to our analysis is the fact that the teachers enrolled in Washington's hybrid DB-DC pension system can choose to contribute between 5 percent and 15 percent of their current compensation into the DC portion of the system and earn market rates of return (more on the limits of their choices below in Section 2). Washington is one of a small number of states where a teacher's primary pension plan provides a DC component, and it is one of only two states that grant teachers discretion over contribution rates.

We find that about 62 percent of teachers in Washington actively choose to set aside more than the minimum required compensation towards their retirement; on average they set aside 7.2 percent from each paycheck. This average contribution rate figure is roughly consistent with research on average contribution rates in private sector DC plans, where research finds that employee contribution rates average between 5 percent and 7 percent (Holden and VanDerhei ,2001; Munnell et al., 2002; Huberman et al., 2007).[8]

[7] In particular, we do not need to model pension wealth or identify exogenous variation in prices in order to obtain estimates of teacher preferences for current compensation versus CDR.

[8] In the private sector employees individuals have more flexibility to choose rates that fall below federally mandated maximums that are age dependent (in the Washington hybrid system, describe in more detail below, teachers must choose amongst specific plans with defined rates and there is more limited flexibility to adjust between plans over time).

Importantly, the average contribution rate masks the considerable heterogeneity across teachers. About 10 and 13 percent of teachers actively choose high contribution rates of 10 or 15 percent, which greatly exceed the average, and about 38 percent of teachers choose to contribute the minimum amount of 5 percent. This heterogeneity in preferences for CDR suggests one virtue of DC pension plans: teachers can choose contribution rates that are more tailored to their own preferences. This contrasts with DB plans, where members contribute the same amount to retirement, and conditional on age, years of service and salary, receive the same expected retirement compensation.

But just because Washington teachers contribute an average of 7.2 percent does not mean that they *value* these dollars at the same rate because of minimum required contributions. Yet even under very conservative assumptions about how much teachers value those contributions, such as assuming that those in the minimally required 5 percent contribution plan would rather not contribute salary toward retirement, we find teachers are willing to trade current compensation for CDR. This finding stands in sharp contrast to Fitzpatrick (2015) who suggests that teachers only value money set aside for their retirement at a faction of the cost of the providing retirement benefits. We conclude by discussing possible explanations for this difference and policy implications.

2. Contribution Rate Choices and Teacher Preferences in Washington State

We argue that contribution rate choices allow us to directly observe teacher preferences for current compensation versus compensation deferred for retirement (CDR). Teachers with strong preferences for current compensation will choose to contribute little of their salary to their DC account, and teachers with strong preferences for CDR will contribute more of their current salary. We illustrate this idea in **Figure 1** by presenting a simple theoretical model of teacher

preferences for current versus deferred compensation.[9] As mentioned above, "CDR" refers specifically to funds set aside for retirement that cannot be accessed for consumption spending prior to retirement, and "current compensation" refers to money that individuals receive in the form of salary or wages, which may be used for consumption or savings (that does not receive special tax benefits).

In **Figure 1**, individuals choose contribution rates that are best suited to their preferences. Increasing a contribution rate, for example, from the state required minimum of 5 percent (represented by the vertical line) to 8 percent, represents a tradeoff between current compensation and CDR.[10] Individuals will choose the rate that maximizes their utility by choosing a contribution rate that balances increases in retirement compensation with decreases in current compensation. This balance is depicted by the net marginal benefit curves, which represent individuals' preferences for current compensation versus CDR. The values on the vertical axis show the utility measured in dollars associated with different retirement contribution rates. The curves for individuals A, B, and C show the net marginal benefit– i.e., the marginal benefit of current compensation, MB_C, less the marginal benefit of CDR, MB_R.

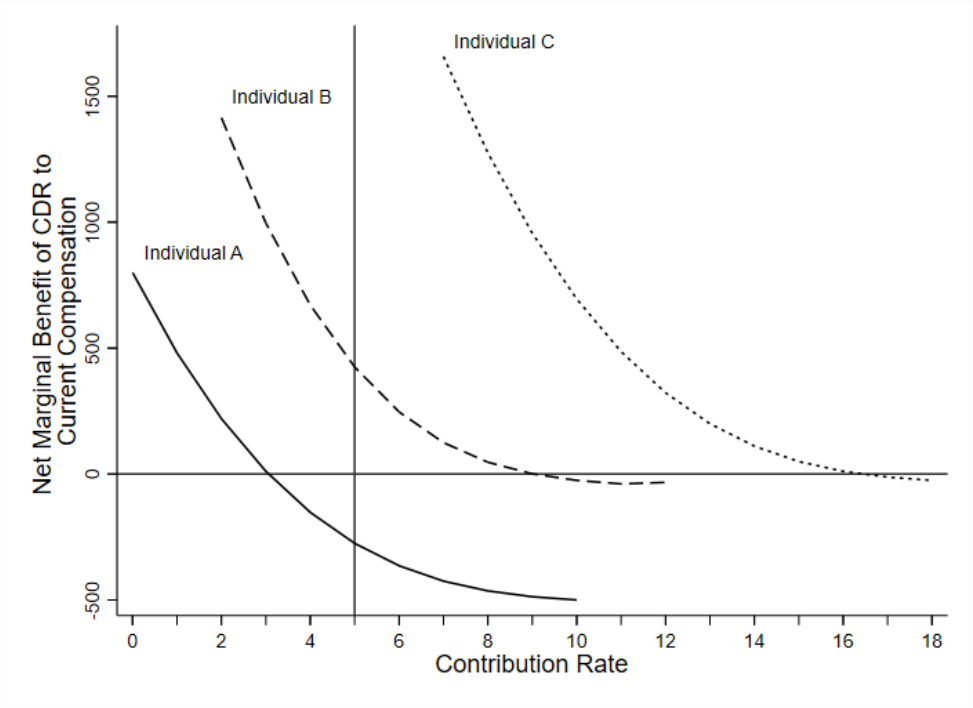
Now consider the three individuals A, B, and C, who are deciding whether or not to contribute more or less than 5 percent of their current compensation toward retirement. At a 5 percent contribution rate, the net marginal benefit is negative for Individual A, i.e. $MB_C > MB_R$; A can improve her utility by decreasing savings and increasing current compensation, so would

[9] This figure can be derived from the traditional two product constrained utility maximization problem where the products depict the tradeoff between current compensation and CDR and the budget constraint is determined by the rate of return on investments and marginal tax rates.

[10] Not illustrated explicitly, this model is built on the fact that the interest rate received for retirement contributions determines the amount of retirement income. Moreover, in practice, the decision to set aside current compensation for retirement is moderated by national and state tax laws that provide incentives to save by reducing taxable income and deferring tax payments on retirement contributions until retirement. Lastly, individuals could decide to set aside current compensation into other forms of savings for future consumption.

opt to contribute less than 5 percent. But Individuals B and C have positive net marginal benefits, i.e. $MB_C < MB_R$ at a 5 percent contribution rate; they will opt to save more. Each individual optimizes savings where $MB_C = MB_R$, which is a contribution rate of 3 percent for A, a contribution rate of 9 percent for B, and a contribution rate of 16.5 percent for C.

Figure 1. The Net Marginal Benefit of CDR Relative to
the Marginal Benefit of Current Compensation



This model illustrates how contribution rates are directly related to an individual's preferences for current compensation and CDR. If teachers place a low value on retirement compensation, they will have net marginal benefit curves similar to Individual A and will choose to contribute low levels of current compensation. Alternatively, teachers could resemble

Individuals B or C and would wish to contribute higher levels of current compensation. The bottom line is that contribution rate choices reveal teacher preferences for CDR.

The simple model is also useful for illustrating three censoring issues due to the discrete nature of contribution rate plans in Washington State.[11] Teachers choose one of 6 contribution rate plans, where four plans have fixed contribution rates: 5, 7, 10, and 15 percent. The other two plans allow for increasing contribution rates according to age: 5 percent to 7.5 percent and 6 percent to 8.5 percent with increasing age. Teachers may have preferences to save less than 5 percent (which we call left censoring), preferences to save more than 15 percent (right censoring), or preferences to save in between the percent values offered by Washington State (interval censoring). Individual A in Figure 1 would prefer to contribute less than 5 percent, but must contribute at least 5 percent—their contribution rate choice is left censored, and a naïve examination of their contribution rate decision will overstate their true preferences for CDR as they would have chosen a contribution rate of 3 percent. Individual B is interval censored, because they must choose between contributing 7 percent or 10 percent, while they would in fact prefer to contribute 9 percent. Finally, Individual C is right censored as they would prefer to contribute 16.5 percent but must choose the maximum rate of 15 percent.

We address the censoring issues described above, providing lower-bound estimates of what contribution rates imply for teacher preferences for CDR. We deal with the three types of censoring issues as follows. In the case of teachers selecting the 5 percent contribution plan, we make the very cautious assumption that teachers, like Individual A, who contribute the

[11] Another type of censoring is related to when we observe individuals in the sample. For example, we do not observe the final contribution rate decisions of teachers hired in 2010—only their initial election. That said, we are not particularly concerned about this because most teachers do not change their rate choice (Goldhaber and Grout, 2016b) and in fact, a 2013 IRS rule change described below greatly limited teacher's ability to change rate plans (aside from changing jobs).

minimally required 5 percent would prefer to contribute zero. This clearly provides a lower bound on the valuation for retirement contributions for those in the 5 percent plan since there would be some individuals who prefer to contribute some value between zero and 5 percent. For teachers like Individual B, whose contribution rate preferences fall between 7 percent and 10 percent, we assume that they would prefer to contribute at one rate plan below what they actually chose. For instance, suppose that individual B chooses to contribute 10 percent, which we know exceeds their preferred choice of 9 percent. We can infer that choosing 10 percent indicates they would prefer to contribute *at least at a rate of 7 percent.* Finally, for teachers, like Individual C, who would prefer to contribute more than 15 percent and are right censored, we simply note that these choices will understate their preference for CDR as they would choose to set aside a higher amount given the option (e.g. 16.5 percent, as mentioned above).

3. Evidence from Washington State Contribution Rate Decisions

In 1995 the Washington legislature passed legislation that created Teacher Retirement System 3 (TRS3), a hybrid retirement plan with a DB component funded by employers and a DC component funded by employee contributions. We examine teacher preferences for compensation deferred for retirement (CDR) by using data on each teacher's pension plan, membership dates, and contribution rate choices, recorded by the Washington Department of Retirement Services. These administrative data contain 157,515 teacher-level records between 1997 and 2010.

We focus on the contribution decisions of TRS3 teachers who may choose one of six different contribution rate plans described in Table 1. A teacher who does not indicate a preference within 90 days is defaulted into the lowest contribution rate plan, Plan A, at 5 percent

of earnings.[12] Prior research suggests that default options can greatly influence the pension choices of individuals (Goda and Manchester, 2013).[13] This suggests that, in our setting, some of the 38 percent of individuals enrolled in Plan A would likely have chosen a different option if they had more information about their retirement options. This will tend to understate the value that teachers place on retirement benefits relative to a fully informed population of teachers.

One important consideration when examining contribution rates is whether teachers actively chose to enroll in TRS3. Enrollment into TRS3 consists of three types of members—(1) employees already employed in the state as of July 1996, who had been enrolled in a traditional DB system (known as TRS2) and transferred to TRS3 when the plan was created; (2) employees who were hired between July 1996 and July 2007 and were mandated into TRS3, and (3) employees who were hired after July 2007 who opted into TRS3 rather than TRS2 when given the choice as a new employee—we refer to these groups as Transferred, Mandated, and Choice, respectively.[14]

We present results for all teachers in TRS3, but also for each group individually. Exploring differences between the Transferred and Choice groups relative to the Mandated group provides evidence on how self-selection into TRS3 may be related to preferences for CDR.[15]

[12] Initially, TRS3 members could change contribution rate plans only if changing employers. However, in 2000 the Department of Retirement Services (DRS) submitted TRS3 to the IRS for qualification and added a provision allowing members to change rate plans during an adjustment period occurring in January of each year. TRS3 was qualified by the IRS in 2002, and in 2003 state statutes were amended to include rate flexibility (Chapter 156, Laws of 2003). The first January adjustment period occurred in 2004. TRS3 members were informed of the opportunity to change contribution rates in a memo prepared by the DRS in December 2003. In 2013, rate flexibility was removed as part of an IRS requirement for the requalification of TRS3.

[13] See Aldeman (2020) for a discussion of default rules in pension plan choice (e.g. choosing between DB and DC plans) for Ohio teachers.

[14] For more detail about the choice by teachers between TRS2 and TRS3, see Goldhaber and Grout, 2016a.

[15] They do, of course, self-select into and out of the Washington public school teacher workforce so it is possible that they could differ from teachers who would have entered or exited the workforce under an alternative pension structure.

The first column of **Table 1** shows the percent of TRS3 teachers choosing each contribution rate plan for all teachers in TRS3, and as described above, the next three columns present results for Transferred, Mandated, and Choice teachers. The first column indicates that, overall, about 38 percent of teachers contribute at the lowest rate of 5 percent,[16] and about 62 percent of teachers choose to contribute more than 5 percent. About 27 percent of teachers choose contribution rates that increase with employee's age (e.g. 5-7 percent and 6-8.5 percent plans), and about 23 percent of teachers are willing to contribute very high levels of compensation, at 10 or 15 percent.

Not surprisingly, and consistent with prior research (Goldhaber and Grout, 2016b), the older and more experienced Transferred teachers have the lowest enrollment in Plans A and B (5 percent contribution & 5 to 7.5 percent contribution by age) relative to the Mandated and Choice groups. Put another way, Panel B shows that the teachers who self-selected into the hybrid plan mid-career tend to save significantly more for retirement *on average*, 7.9 percent, than either those teacher mandated into the hybrid pension system at 6.9 percent, or those who select in at the beginning of their careers at 6.8 percent.

[16] Note that this is the default rate plan so, for this rate choice, we cannot determine that employees are actively choosing 5 percent as the most optimal plan. Our data includes a default flag, but we cannot rule out that individuals are aware of the default rule and prefer the minimum 5% contribution rate, and choose not to actively select the default plan.

Table 1. Contribution Rate Choices, Average Rates, and Lower Bound Estimates for Teacher's Preferred Choices

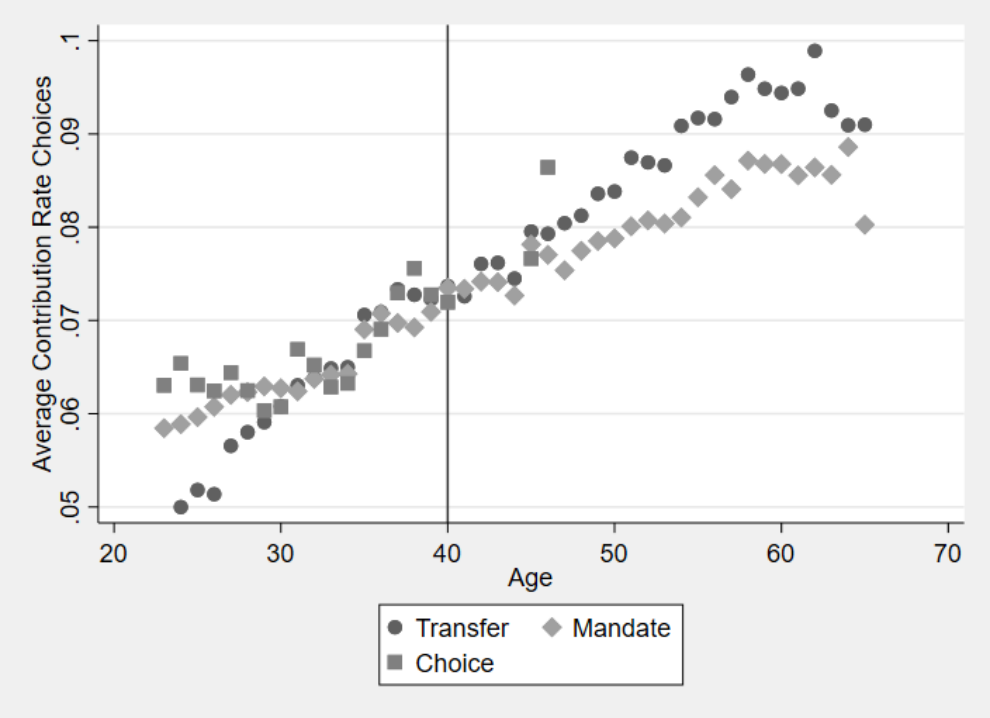
	All TRS3 teachers	TRS3 Transferred	TRS3 Mandated	TRS3 Choice
Panel A: Percent of Teachers Choosing Contribution Rate Plan Choices				
Plan A, 5%	37.8	28.3	43.7	39.1
Plan B, age adjusted 5-7.5%	12.6	8.4	14.8	18.8
Plan C, age adjusted 6-8.5%	14.3	15.7	13.5	14.3
Plan D, 7%	12.8	20.5	8.2	8.2
Plan E, 10%	12.8	15.2	11.4	11.9
Plan F, 15%	9.7	11.9	8.6	7.7
Choosing To Defer More Compensation Than the Minimum Requirement	62.2	71.7	56.4	60.9
Panel B: Average Age, Average Contribution Rate, Predicted Contribution Rate, & Lower Bound				
Average age	39.5	45.0	36.4	33.1
Average Contribution Rate	7.2	7.9	6.9	6.8
Predicted Contribution Rate at Age 40	7.2	7.4	7.2	7.2
Lower Bound Estimate on Desire to Contribute at Age 40	4.3	5.0	3.8	4.1
Observations	76,643	28,203	45,500	2,929

Notes: Calculations are based on the most recent observation of teachers in each category to capture changes in contribution rates in the flexibility period or due to changes in employer. Average contribution rates are calculated using the fixed values of 5, 7, 10, and 15 percent for teachers who choose plans A, D, E, and F, respectively. We use data on teacher age for contribution rate plans that vary by age to determine the level of contribution. Lower-bound contribution rates set Plan A 5 percent contribution rates to zero, and adjust all other contribution plans down one level—see discussion in Section 2. Proportion choosing to defer more compensation than the minimum requirement is calculated as the proportion of teachers choosing plans other than Plan A. Predicted contribution rates control for age and group interactions, and are evaluated for teachers at age 40. All predictions are statistically significantly different from zero, and jointly different from each other, at the 0.001 level.

The above evidence suggests that selection into TRS3 is related to preferences for CDR. But these different groups of TRS3 teachers also vary along other important dimensions. In particular, because enrollment in TRS3 by group depends on date-of-hire, the average age of the teachers across the three groups differ. To account for this, we explore contribution rates by age graphically and then estimate a simple model at the individual teacher level in which contribution rate is a function of age.

Consistent with the evidence mentioned above, we show in **Figure 2** that average contribution rates tend to rise for teachers with age, where the vertical line represents the mean age of teachers (about 40). There is also evidence that there are somewhat different retirement savings patterns by teacher group (Transferred, Mandated, and Choice). In particular, between ages 30 and 45, contribution rates are fairly comparable. For instance, Transferred teachers who are age 40 tend to contribute an average of 7.4 percent, which is quite similar to 40 year old Mandated and Choice teachers who contribute about 7.3 and 7.2 percent, respectively. There are some small differences—for example, older Transferred teachers and Mandated teachers have less than a one percentage point difference in average contribution rates. This could reflect the fact that Transferred teachers tend to have more experience than Mandated teachers. Interestingly, there is a somewhat larger difference in contribution rates for young teachers—Mandated teachers have contribution rates that are about 1 percentage point higher than Transferred teachers.

Figure 2. Variation in Contribution Rate Decisions by Age and TRS3 Group



Given the apparent differences shown in **Figure 2**, we report predicted contribution rates in **Table 1 Panel B** that control for a quadratic in age interacted with group indicators (Transferred, Mandated, Choice) to account for nonlinearities in contribution rates by age and group.[17] These predictions are estimated for teachers who are age 40 (corresponding to the vertical line in **Figure 2**, which is the mean age for all teachers). These results suggest that controlling for age leads to very similar rates across groups—7.4 percent, 7.2 percent, and 7.2 percent for Transferred, Mandated, and Choice groups, respectively. This is consistent with the notion that, conditional on age, teachers are willing to contribute a large share of their current

[17] Formally, we estimate the following regression models: $rate_i = \alpha_0 + \alpha_1 age_i + \alpha_1 age_i^2 + \sum_{j=0}^{2} \beta_j age_i^j * 1(Mandated = 1) + \sum_{j=0}^{2} \delta_j age_i^j * 1(Choice = 1) + \varepsilon_i$ where $rate_i$ is the observed rate chosen by teacher i, and the omitted group is Transferred teachers. We have also estimated linear models with age and group interactions and find very similar results.

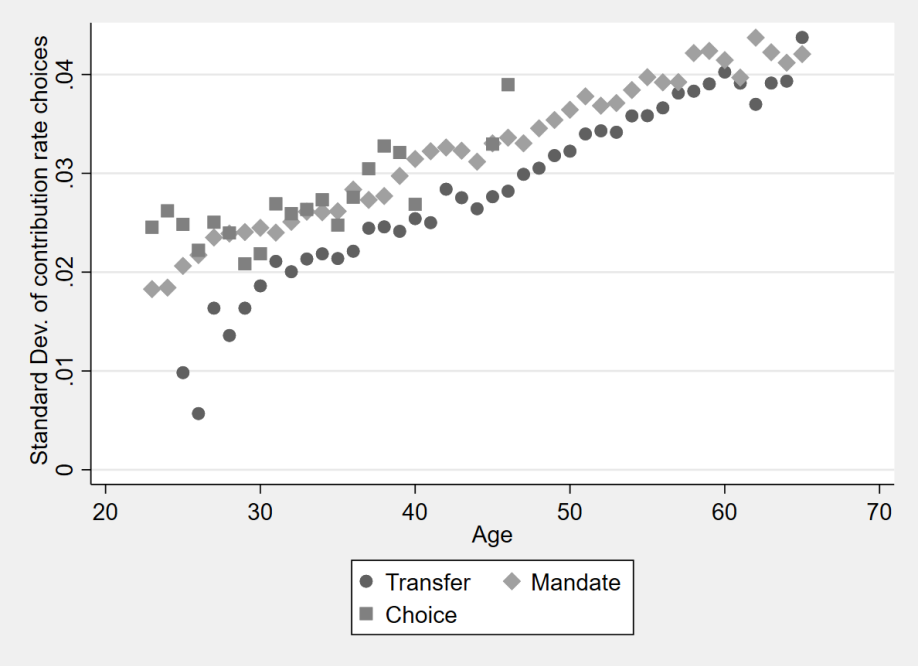
compensation towards retirement, and the consistency across groups suggests that self-selection into TRS3 does not greatly affect our estimates of contribution rates.[18]

As described above, contribution rate plans in Washington State do not allow for contributions less than 5 percent, or for individuals to freely choose any rate; they must choose one of the six rate plans specified in Table 1. Thus, we report lower bound estimates of the valuation of CDR (according to the assumptions described at the end of Section 1). These calculations are shown in **Table 1 Panel B**. The lower-bound valuation of CDR is 4.3 percent. Finally, we do see small, but statistically significant differences in valuation across the different teacher groups; consistent with the findings reported in Panel A of the table, the Transfer Group values CDR more than the Mandated or Choice Groups (whose valuation is similar).[19]

[18] We note that all predictions are statistically significant from zero, and that the predicted contribution rate for Transferred teachers is statistically significantly different from that for Mandated teachers (F-Test of equality, P-value < 0.001). Though, this appears to have little practical difference in the magnitude (e.g. 0.2 percentage points), and the difference between Mandated and Choice teachers is not statistically significant (F-Test of equality, P-value = 0.534).

[19] Left censoring is much more of a concern for Mandated and Choice teachers because, as reported above, they are far more likely to be enrolled in Plan A and therefore have their 5% contribution (conservatively) adjusted to a valuation of zero.

Figure 3. Standard Deviation of Contribution Rates by Age and Group



Lastly, we present results on the heterogeneity of preferences for TRS3 teachers. As previously shown in **Table 1, Panel A**, there is a great deal of variation in the rate plans chosen in Washington State. For instance, while nearly 40 percent of teachers choose to contribute as little as possible, over 20 percent choose very high contribution rate plans of 10 or 15 percent. Why do teachers differ so much in their choices? One source of heterogeneity is clearly teacher age, because as previously shown in **Figure 2**, contribution rate choices are positively correlated with age; but our models suggest that age explains only about 10 percent of the variation in contribution rates. So, to what degree is there heterogeneity among similarly aged teachers? **Figure 3** explores this issue by presenting the standard deviation of contribution rate choices by age and group (Transferred, Mandated, Choice). Variation in contribution rates shows a clear correlation with age; young teachers appear to choose very similar contribution rates while older

teachers have a greater spread.[20] That said, the larger point is that there is considerable heterogeneity in contribution rate choices even controlling for age. This means a retirement plan that forces teachers into a single rate of CDR will poorly reflect the heterogeneity of preferences.

4. Comparing Washington to Prior Research

We are aware of only three papers that estimate teacher preferences for current salary versus compensation deferred for retirement (CDR). In a well-cited and influential paper, Fitzpatrick (2015) considers a unique setting in Illinois where teachers were offered the option to purchase an upgrade to their DB pensions, providing the opportunity to evaluate the extent to which teachers trade off current salary against greater retirement benefits. Based on her analysis, Fitzpatrick reaches the provocative conclusion that "employees are willing to trade just 20 cents of current compensation for each expected dollar of future compensation" (p. 179) and that "teachers' valuation of the increased pension benefits was much less than their cost" (p. 185).

Two new working papers explore preferences for current compensation versus CDR using discrete choice experiments that ask people to choose between hypothetical jobs with randomly selected attributes (e.g., salary, retirement plan generosity, DB versus DC). Johnston (2020), analyzes survey responses from teachers in a large school district in Texas and finds that "Teachers value an additional ten-point replacement rate in pension equivalent to a $1,730 salary increase, somewhat less than its cost of $2,870 per year" (p. 16).[21] Johnson notes that his findings are consistent with Fitzpatrick, but we believe while consistent in the sense that teachers value increased CDR at less than the cost of providing them, the magnitude of the difference

[20] This could be because circumstances change as individuals age in ways that are likely to affect retirement savings—e.g. marriage, children (Knoll et al., 2012; Munnell et al., 2017). While outside the scope of this paper, we believe this issue merits more investigation.

[21] A replacement rate is the percent of salary that a teacher will receive in retirement (e.g., a DB plan with a 50 percent replacement rate will provide half of a teacher's final average salary in retirement each year).

with Fitzpatrick is quite large. In particular, the ratio between valuation of benefits and cost of provision is much larger than what Fitzpatrick estimates. Johnston's results imply a ratio of about 0.60 ($1,730 divided by $2,870)—which is much higher than Fitzpatrick's estimates of 0.20.

Fuchsman et al., (2020), another new working paper, like Johnston, uses a discrete choice stated preferences experiment as part of a nationally representative survey of teachers to estimate willingness to pay for many different retirement plan characteristics. They find that, "a one percentage point replacement rate increase in retirement is equivalent to a 1.6 percent salary increase." (p. 22). With an average salary of about $63,000, this implies a willingness to pay of about $1,015 for an increase in the replacement rate that is one-tenth as large as the one specified in Johnston (2020). That said, it is challenging to compare these estimates to the above studies because Fuchsman et al. do not provide an estimate of the cost of providing the one percentage point increase in replacement rates.[22]

As we describe in more detail below, our findings in Washington appear most at odds with Fitzpatrick's Illinois-based analysis, given the low valuation she finds teachers place on monies set aside for retirement compensation. So how does the magnitude of the findings in Washington State compare to those in Illinois? Putting the findings on the same metric is challenging because both the cost (to the state) and the benefits are known (given assumptions about retirement ages and life expectancy) in the Illinois context, whereas in Washington the benefits of setting aside funds for retirement compensation depend on rates of return on those set

[22] Fuchsman et al. and Johnston could have estimates that are consistent with each other if there is strong diminishing marginal utility; in other words, each additional percentage point increase sharply decreases a teacher's willingness to pay. In this case, Fuchsman et al. measure the increases with the highest valuation while Johnston measures the value for the total increase.

aside funds. Recall, however, that the advantage of examining teacher choices in Washington is that no sophisticated estimation is required to assess the value teachers place on CDR. A teacher clearly values the tradeoff of current compensation today for *contributions toward* future retirement compensation if they choose to make a contribution that is above the mandated 5%.

In Washington we can put a lower bound on the value teachers place on getting a dollar toward deferred compensation by examining the tax implications of setting aside a dollar toward retirement. The cost of deferring a dollar of compensation for retirement is less than a dollar given that teachers would have paid tax if they had received the compensation in the form of salary, but do not if they set it aside toward retirement. For the sample period of our data, the highest federal marginal tax rate faced by most teachers is 28 percent, so that each dollar set aside only reduces current compensation by 72 cents.[23] Given that we observe 62 percent of Washington teachers setting aside at least some compensation above what is minimally required, it suggests that these teachers value the dollars set aside for retirement compensation at a rate of at least 72 cents on the dollar.[24] We know that at least 62% of Washington teachers opt for this current compensation versus CDR trade off (see Table 1 and accompanying discussion). Even if the remaining 38% of teachers do not place any value on their required contribution, we can infer an average value of at least 45 cents on the dollar that is set aside for retirement (i.e.,

[23] There is no state income tax for Washington, so we only need to be concerned about the implications of federal taxes. We use reported federal tax brackets in 2010, and pick a conservative bracket that represents the highest marginal tax rate faced by most teachers at 28 percent: single filers making between $82,401 and $171,850. Using data from the Department of Retirement services, we calculate that more than 98 percent of teachers make less than $171,850 in 2010. Of course, different filing status or family income levels could push teachers to higher marginal tax rates, such as 28, 33, or 35 percent. Moreover, CDR is taxed when it is withdrawn in retirement; rather than model this, we use a more conservative figure by ignoring taxable income in retirement.

[24] Note that we would not expect a rational teacher to value a dollar set aside for employer-sponsored retirement plans at a dollar (or more) given that the dollar set aside is constrained in the sense that they cannot easily use it without incurring financial penalties. Put another way, if setting aside a dollar of current income did not cost less than a dollar, we would expect individuals to simply take the dollar in current compensation and make their own unconstrained savings decisions—in fact, tax deferral is one method to encourage retirement savings by providing a more favorable vehicle (Bernheim, 2002; Yoo & Serres, 2004).

0.62*$0.72+0.38*$0 = $0.45), or more than twice the 20 cents on the dollar suggested by Fitzpatrick (2015).

From one perspective, our findings do not appear to be that different from what Fitzpatrick reports about teachers purchasing the upgrade in Illinois. Specifically, the pension upgrade Fitzpatrick examines is quite generous: an income stream that is likely worth about $97,000 in current compensation has a price of about $15,000 (Fitzpatrick, 2015 p. 177), and as such, it may not be surprising that 70 to 78 percent of teachers purchase the upgrade.[25] Nevertheless, her analysis leads her to the conclusion that teachers only value these additional dollars set aside for retirement at about 20 cents, which is less than half of what we report above.

What might explain the contrast between the findings in Washington and Fitzpatrick's in Illinois? We discuss a number of possible explanations. First, even if one knows the exact benefits and prices that teachers face, there are reasons to think that Fitzpatrick's estimates may be biased. In particular, demand is challenging to estimate in the Illinois context Fitzpatrick examines given that both the benefits and the cost of purchasing those benefits (the pension upgrade offered to teachers) are functions of a teacher's salary. As such, income effects are likely to influence the estimates of demand, and call into question the validity of these estimates. In Appendix A, we illustrate the econometric challenges of estimating teacher demand for the pension upgrade (and hence valuation of the upgrade) using a simple model and discuss their implications in more detail.[26] Moreover, recent work by Ni et al. (2020) suggests that

[25] Recent work by Ni et al. (2020) reexamines the upgrade decisions of the same cohort of Illinois teachers using recent data and finds that, by 2019, almost all of them have purchased the upgrade (87 percent).

[26] There are other potential challenges in estimating demand in this context. As noted by Fitzpatrick, the Illinois setting requires out-of-sample estimates for high-valuation individuals and thus, strong assumptions about the slope of the demand curve. And DB pensions require assumptions about expected benefits via retirement dates, survival probabilities, and end-of-career salary, and these may differ systematically across teachers who choose to purchase or not purchase the upgrade.

Fitzpatrick's approach of using historical retirement patterns to calculate these benefits and prices are problematic because of unobserved heterogeneity in teacher preferences for work versus retirement (many teachers who did not purchase the upgrade worked long enough to reach the Illinois pension cap anyway), and because the policy itself changed retirement patterns. The bottom line is there are good reasons to be skeptical that the 20 cents on the dollar is an accurate estimate of the value teachers place on the investment in their pensions.

But let us assume that Fitzpatrick's 20 cents on the dollar estimate is correct. A second explanation for the divergent findings is that teachers across the two contexts could have very different perspectives about the returns they will see from those set aside dollars. If, for instance, teachers in Washington have very high expectations for the investment returns on their DC contributions, we would expect them to value dollars set aside more than teachers in the Illinois context, where the benefit stream of the set aside is known because it is based on a DB formula. But how high would these expectations need to be to make the DC account more appealing than the DB benefit upgrade in Illinois? As mentioned above, the Illinois upgrade is quite generous with a ratio of price to present value of benefits at 6.37, or 637 percent (Fitzpatrick, 2015; p. 177). Washington teachers would need to expect an *even greater* rate of investment returns to explain the behavior we see in Washington State. While individuals might have unreasonably optimistic assumptions about the returns they might see, it is hard to believe that Washington teachers hold such widely optimistic assumptions about the rates of return for this to explain the dichotomy between the Washington and Illinois findings.

Third, differences in valuations could be due to differences in overall retirement wealth between Illinois and Washington teachers. Economic theory suggests that the marginal utility of retirement wealth is decreasing—said simply, if teachers in Illinois start with higher retirement

wealth, they will be less willing to pay for increases relative to Washington teachers. Evaluating and comparing total retirement wealth is quite challenging because Washington teachers are contributing towards one of their primary investment vehicles whereas Illinois teachers are choosing whether to purchase a supplement. While the pension upgrade in Illinois is clearly a marginal contribution, to some extent, DC contributions to TRS3 are also marginal in the sense that it funds only half of the plan—DB benefits are not impacted by these contribution rate decisions. Moreover, deciding to contribute 5 percent or 7 percent has relatively little impact on the total annual allocation toward the Washington teacher's pension, changing the total annual contribution by about 10 percent.[27] By comparison, Illinois teachers who decide to purchase the upgrade tend to pay slightly less, about 6 to 7 percent.[28] The bottom line is that these figures are somewhat different so it is possible that teachers are making decisions on different margins—but it seems unlikely that it is large enough to explain the difference in valuation that we see in Washington relative to Illinois.[29]

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[27] For instance, based on the average salary of about $70,000 for teachers in 2010, a change in the contribution rate from the 5% plan to the 7% plan represents only about a 10 percent increase percent of the total annual allocation toward a Washington teacher's pension ($1,400 additional contribution / ($10,000 employer contributions + $3,500 employee contributions under the 5 percent plan).

[28] In Illinois teachers purchasing the upgrade contribute a one-time payment of 20 percent of their salary for the upgrade (about $15,000 of $75,000 salary), and spread over the 8 to 10 years between the purchase and retirement for Fitzpatrick's sample of teachers, this works out to about $1,500 to $1,875 per year. This value should be compared to total contributions in Illinois—state actuaries calculate that employer and state contributions should be about 25 percent of payroll (much of this is intended to offset the massive amount of unfunded liabilities from years of underfunding) and about a 9 percent employee contribution rate (see https://www.trsil.org/sites/default/files/documents/2010ValuationRept.pdf). Thus, purchasing the upgrade is about a 6 to 7 percent increase in total annual allocations towards the Illinois DB pension ($1,500 for upgrade over 10 years / ($18,750 in employer/state contributions + $6,750 employee contributions without the upgrade).

[29] It also seems plausible that teachers are at different margins in terms of their retirement investments, due to age. Fitzpatrick focuses on an older sample of teachers (e.g. age 61) while we consider a younger sample of teachers in Washington (e.g. age 40). Given that age is likely to be closely related to retirement savings choices, one might expect this to explain some of the differences in contribution rate decisions. To explore this possibility, we consider teachers who are on a similar margin of retirement savings—those who are near the end of their career and choosing how much more to contribute to their retirement. Specifically, we use models discussed above that control for age and group interactions (Transferred, Mandated, Choice), to predict the contribution rate of teachers at age 61 (the average from Fitzpatrick's sample) —consistent with Figure 2, we actually find that average contribution rates are higher for this age, at about 9 percent, relative to the average Washington teacher. Thus, age does not appear to explain the differences in findings across contexts.

Related to the above point, a fourth potential difference could be the influence of retirement wealth from other sources which would also affect relative marginal willingness to set aside funds for retirement. In fact, one important contextual feature is that teachers in Illinois do not participate in social security but Washington do; if plan generosity is comparable between these states, theory would suggest that Illinois teachers should be willing to contribute more, not less (as is suggested by Fitzpatrick's results).[30] Thus, it also appears that the differences across the two states in terms of pension plan setting are unlikely to explain the differences in findings.[31]

Finally, teachers may simply have different preferences for DB versus DC retirement plans. Brown and Weisbenner (2014) find that individual's preferences for risk, financial literacy, and expectations of returns are important factors when individuals choose between DB and DC pension structures. DC pension plans can provide teachers with greater control over their investments, both in terms of the quantity of compensation to set aside and how those funds are invested, and individuals may derive utility from managing and following their investments (Wärneryd, 1996; Keller & Siegrist, 2006). It is also possible that there are different views about

[30] Of course the relative generosity of the pension plans also matters. It may be that Illinois pension plans are designed around the fact that teachers do not participate, and tend to provide larger benefits to compensate. At best, one can roughly calculate that the TRS3 DB annuity plus social security benefits, which suggests that the Washington setting is slightly more generous than the Illinois DB plan and would tend to cause Washington teachers to contribute less. For a teacher who does not purchase the upgrade in Illinois, the replacement rate at 30 years of service is 54%. The DB portion of TRS3 provides a replacement ratio of 30%, while Social Security contributes an additional 27.1% (see Clingman, Burkhalter, and Chaplian, 2017, for high earnings group who attain age 62 in 2013).

[31] Note that we cannot account for other unobserved factors could also play a role. For instance, if Washington teachers place virtually no value on the DB portion of their retirement wealth, or on their social security benefits, then total wealth looks much lower in Washington relative to Illinois. And it could also be the case that DC accounts and social security could affect private savings, either crowding out private savings or by encouraging it (Attanasio & Rohwedder, 2003; Lehmann-Hasemeyer & Streb, 2018). The bottom line is that we cannot know definitively that total wealth (or perceived total wealth) in both settings is comparable.

the extent to which pension assets can be bequeathed; it tends to be easier to provide for inheritance of pension assets under a DC plan (Poterba et al., 2007), though this is more complicated in the case of public pensions.[32]

Teachers in Washington were surveyed prior to the design of the hybrid pension plan (TRS3), and the survey responses suggested that teachers viewed the previous pension plan, which was a pure DB, as somewhat inflexible, and believed that they would not have a good return on their contributions if they left before the age of 65 (HB 1206, Laws of 1995). DC pensions are also more portable across employers and state lines (Goldhaber et al., 2015), and provide higher benefits for teachers who separate midcareer (Costrell and Podgursky, 2009). All of this may suggest that Washington State teachers could choose to contribute larger proportions of their current compensation for their hybrid-DC plan because they value these features of DC plan structure more than DB plans.

5. Conclusion

Our findings suggest that Washington teachers willingly set aside more of their current compensation than is required for CDR—and in some cases—quite a lot. This willingness to participate appears to contrast with prior research suggesting that teachers do not value these benefits anywhere near the cost of providing them. This is important since having compensation structures that reflect the preferences of teachers is crucial to the desirability of the teacher workforce. Our revealed preference findings in Washington are quite different from the prior published work in this area in that a large share of teachers in a hybrid pension system that includes a DC component elect to save more than is required by the system. As we discussed

[32] Many states like Washington give annuity options for DB plans to provide for survivors.

above, there are a number of potential explanations for the divergent findings, but the fact that they diverge, suggests the need to be cautious about interpretations of teachers' valuation of CDR. We believe more research is needed on this important topic, especially in light of the fact that the underfunding of pensions will likely put pressure on making structural changes to pension systems in the not too distant future.

We also find that Washington teachers vary greatly in how much compensation they choose to set aside. The heterogeneity in contribution rate choices reveals a potentially important advantage that DC pension systems have over DB systems: DB pension systems are not well suited to addressing such differences in retirement preferences as they provide the same retirement benefits to all individuals with a given level of experience, age, and final average salary. Consequently, they may lead to inefficiencies in terms of compensation packages that make teaching less desirable to individual teachers than would be possible if the same level of compensation were allocated differently.[33] Providing teachers choice about how much compensation to defer to retirement is a means of better aligning teacher compensation structures with teacher preferences. But while it is natural to think of DC plans as providing more flexibility, not all do. For example, Ohio teachers who participate in a DC plan are required to contribute 14 percent, regardless of their preferences (Aldeman, 2020). And, as with the case of the Illinois pension upgrade, DB systems could potentially offer teachers with choices about CDR.

[33] But, on the other hand, some argue that DB pension plans have higher administrative costs, and that participants in DC plans may earn lower investment returns and pay higher fees relative to individuals in DB plans (Boivie and Weller 2012; Fornia and Rhee 2014; Munnell et al. 2011). Thus, it does not immediately follow that DC plans would increase overall teacher welfare.

That many teachers are enrolled in the default rate plan of 5 percent raises questions about what the appropriate default is in a system that offers contribution rate choices. A growing body of work suggests that default choices could explain a great deal of behavior, from participation in 401(k) plans (Madrian and Shea, 2001) to decisions between DB and DC pension plans (Goda and Manchester, 2013). While we cannot determine how many Washington teachers are in the 5 percent rate plan due to default rules or because they prefer it, there is no obvious reason to favor the lowest contribution rate as the default. Given concerns about retirement security (Aldeman & Robson, 2017) and findings that individuals tend to save less than they would prefer (e.g., Laibson, 1998), there seems little downside to setting a higher default contribution rate but allowing teachers to select into plans with lower contributions.

Lastly, our findings clearly demonstrate a positive relationship between savings for retirement and age. While teachers in Washington could once adjust their contributions as they age, a 2013 change in IRS rules limited the ability to do this (except when teachers change jobs). While there may be good reasons to do this from a tax revenue perspective, the inability to adjust contributions is clearly out-of-step with the way DC systems in the private sector function and limits the extent to which public sector teachers can align their preferences for retirement compensation with actual contributions.

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Appendix A. Instrumental variables and demand estimation

In this appendix, we discuss the challenges in estimating demand for retirement benefits using instrumental variables. Estimating demand in any setting is a challenging empirical task, but it is particularly challenging when price is directly related to an individual's income. We illustrate this by presenting a stylized, single-variate model of demand:

$$D_i = \beta_0 + \beta_1 P_i + \varepsilon_i$$

where D is the quantity of upgrade demanded, P is the price, and ε_i represents the unexplained portion of demand. For β_1 to be unbiased, P must be unrelated with the unexplained variation in demand:

$$Cov(P_i, \varepsilon_i) = 0$$

For pension research, many benefits and costs are functions of salary. For instance, DB benefits themselves are usually calculated as a fraction of final average salary. As such, there are many cases in which P_i, the price offered to the individual, will be related to an individual's salary S_i:

$$P_i = f(S_i)$$

As noted by Fitzpatrick, in Illinois, P_i is determined by the state pension system as a function of salary S_i: $P_i = 0.20 * S_i$.

Basic economic theory suggests that changes in salary will affect demand through income effects. In this case, where individuals are choosing between current and deferred compensation, income effects suggest that as an individual's salary increases, they are willing to defer a part of

that additional compensation for the future. Suppose that unexplained demand depends on some fraction of salary, so that:

$$\varepsilon_i = \alpha_1 S_i + u_i$$

where α_1 represents the relationship between demand and total salary, and u_i is a random error term. In this case, as pointed out by Fitzpatrick, β_1 will not give an unbiased estimate of the effect of prices because P is correlated with unexplained variation in demand. As shown in our model when $P_i = 0.20 * S_i$,

$$Cov(P_i, \varepsilon_i) = Cov(P_i, \alpha_1 S_i + u_i) = Cov(P_i, \alpha_1 S_i) = Cov(.2S_i, \alpha_1 S_i) = .2\alpha_1 Var(S_i) > 0$$

For this simple, single variate model, we can sign this bias as well. Because price and salary are positively correlated, and supposing that income effects are likely positive for future consumption, this will cause an upward bias on the slope coefficient β_1. Economic theory suggests that demand is negatively related to price, so this will tend to bias results in a less steep demand curve, or even a positively-sloped demand curve.[34] Interestingly, Fitzpatrick does find an upward-sloping demand curve when estimating OLS models, and we agree with her conclusion that a different approach is required to address this bias.

One approach is to use an instrumental variables method with instruments constructed from the teacher's base salary schedule, S_b.[35] For convenience, we define S_b relative to total salary: $S_i = S_{ib} + S_{ia}$, where S_{ia} is any additional salary. For S_{ib} to be a valid (e.g., unbiased) instrument, two conditions must hold. First, the instrument must predict price: $Cov(S_{ib}, P_i) \neq 0$.

[34] In the multivariate case, omitted variable bias is more complicated to sign, and will depend on the correlation of price with other control variables. See Green (2013), pg. 336.

[35] Fitzpatrick uses several instruments from the base salary schedule, including a cross district measure (the beginning base salary paid to a teacher with a bachelor's degree), and a within-district measure (the salary paid to a teacher with a bachelor's degree for a given amount of experience, with a district fixed effect included in the model).

This is true in Illinois because the price is a function of salary ($P_i = 0.20 * S_i$).[36] Second, it must hold that the instrument uncorrelated with unexplained demand, $Cov(S_{ib}, \varepsilon_i) = 0$. This places strong assumptions about the form of income effects. For example, it seems plausible that affluent districts have higher base salary schedules than poor districts. This would require that other factors related to the level of wealth in the school district would not influence the decision to purchase the upgrade (i.e., family wealth, job security, etc.).

In our model, these conditions cannot both hold when income effects depend on S_i. In particular, excludability implies that,

$$Cov(S_{ib}, \varepsilon_i) = 0$$

$$Cov(S_{ib}, \alpha_1 S_i + u_i) = 0$$

$$Cov(S_{ib}, \alpha_1 S_i) = 0$$

When price is a linear function of salary, is in the case of Illinois, we can substitute S_i for a function of P_i:

$$Cov(S_{ib}, \alpha_1 * 5P_i) = 0$$

$$5\alpha_1 Cov(S_{ib}, P_i) = 0$$

By assumption, α_1 cannot be zero because it is the parameter on income effects (see above). Thus, $Cov(S_{ib}, P_i) = 0$ which contradicts the second condition for a valid instrument. In other words, if base salary is truly exogenous, then it does not predict price and cannot be used as an instrument. Conversely, if base salary does predict price, then it cannot be excluded.

[36] In fact, only variables that are correlated with salary could be used as instruments, otherwise, $Cov(Z_i, P_i) = 0$.

What if income effects do not depend on total salary S_i, but instead on additional salary S_{ia}? It is *possible* to have unbiased estimates, but in addition to the usual requirements for instruments, an additional condition must hold: base salary must be uncorrelated with additional salary S_{ia}. For example, consider the following model where income effects depend on S_{ia}:

$$\varepsilon_i = \alpha_1 S_{ia} + u_i$$

Using the condition that $Cov(S_{ib}, \varepsilon_i) = 0$, we see that:

$$Cov(S_{ib}, \varepsilon_i) = 0$$

$$Cov(S_{ib}, \alpha_1 S_{ia} + u_i) = 0$$

$$\alpha_1 Cov(S_{ib}, S_{ia}) = 0$$

Again, α_1 cannot be zero because it is the parameter on income effects, which implies that $Cov(S_{ib}, S_{ia}) = 0$. Is base salary likely to be uncorrelated with additional salary S_a in practice? We think the answer is no. It seems likely that districts that pay higher base salaries are likely to pay higher additional compensation as well; moreover, many types of pay are likely scaled by an individual's base salary. Empirically, we have found that base salary in Washington state has a 0.4 correlation with other salary. Second, there are good reasons to think that income effects likely influence the demand for goods, but it is not clear why only specific kinds of compensation would affect demand for pension benefits (i.e., additional compensation). Instead, it seems plausible that individuals do not respond differently to changes in base salary relative to changes in additional pay.