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How Much do Teachers Value Deferred Compensation? Evidence from Defined Contribution Rate Choices

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Contents

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Abstract

How much do teachers value compensation that is deferred until retirement? 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. There is little evidence, other than Fitzpatrick (2015), however, about whether DB pensions are consistent with teacher preferences for current and deferred compensation. This study examines a unique setting in Washington State, where teachers enroll in a hybrid, DB-Defined Contribution (DC) pension system, and have choices over their DC contribute rate. These choices reveal preferences about the value teachers place on current versus retirement compensation. We find that teachers choose to contribute an average of 8.18 percent, significantly more than the minimum required contribution of 5 percent. This suggests that teachers value retirement compensation significantly more than previously estimated by Fitzpatrick. Potential explanations for the difference in findings from prior evidence are discussed, including estimation strategies, differences in state settings, overall plan generosity, and the potential for teachers to view DB and DC pensions as different products.

1. Introduction

How much do teachers value compensation that is deferred until retirement? The answer to this question is of fundamental import to designing a teacher compensation structure that makes teaching a desirable profession. Understanding teacher preferences over compensation structure 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's also possible that a compensation structure that is more backloaded than teachers prefer would lower attrition and shirking behavior of employees (Lazear, 1979, 1984; Gustman and Steinmeier, 1995).[2] Similarly, research on teachers has also noted that DB pension plans provide powerful incentives for retention (e.g. Costrell and Podgursky, 2009).[3]

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[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 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

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 both current and retirement 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 more 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.

The literature on teacher pensions is overwhelmingly focused on the issues discussed above; estimating the impacts of DB pensions on retention, teacher quality, and solutions to looming, unfunded pension liabilities. There is little evidence, however, about whether teacher pensions are consistent with *teacher preferences* for backloaded compensation. A recent study provides some of the only empirical evidence on the degree to which teachers' value deferred compensation. Fitzpatrick (2015) considers a setting in Illinois where teachers were offered the option to purchase an upgrade to their DB pensions and estimates the amount teachers would be willing to pay for a dollar of retirement benefits. Fitzpatrick's results suggest that "the majority of IPS employees value pension benefits at the margin much less than the cost of providing

sophisticated about retirement planning (Laibson, 1998; Laibson, Repetto, Tobacman, Hall, Gale, and Akerlof, 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).

them. On average, these employees are willing to trade just 20 cents of current compensation for each expected dollar of future compensation."

Fitzpatrick's research in Illinois provides a crucial missing piece of the pension literature, and the policy implications that call for more frontloading of teacher compensation have been frequently cited. For instance, Nagler, Piopiunik, and West (2015) note: "Fitzpatrick (forthcoming) shows that the value teachers place on pension benefits is much lower than the cost to the government of providing them and would prefer higher salary levels" Goda, Rammath, Shoven, and Slavov (2015) state "Alternatively, individuals tend to undervalue annuities and may therefore not value the marginal increase in their Social Security annuity from deferring (Fitzpatrick forthcoming; Chai et al. 2013)". Fitzpatrick's work has also seen significant media coverage.[4] We too (Backs et al, 2016) have suggested the policy import of Fitzpatrick's findings: "For instance, there is evidence that teachers do not greatly value their DB pension benefits (Fitzpatrick, 2015)." But is it generally correct that teachers are only willing to pay 20 cents for an expected dollar of future compensation? Would we be better off frontloading (i.e. in current compensation) some (or perhaps much) of this retirement money given the evidence that teachers don't value it much?

While influential and provocative, it may be premature to jump to strong conclusions based on Fitzpatrick's findings. One issue is that it is difficult to estimate an individual's willingness to pay when the price they face depends on their level of income. For example, we

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[4] See articles in the Baltimore Sun (http://www.baltimoresun.com/news/opinion/oped/bs-ed-pensions-20110726-story.html, retrieved 2/16/2018), Forbes (https://www.forbes.com/sites/joshbarro/2012/02/08/charter-schools-pensions-and-golden-handcuffs/#4c20263352c0 , retrieved 2/16/2018), Education Week (http://blogs.edweek.org/edweek/inside-school-research/2014/10/study_suggests_why_teachers_mi.html, retrieved 2/16/2018), and the Boston Globe (https://www.bostonglobe.com/opinion/2012/07/12/public-pensions-mass-towns-have-too-much-power-but-not-power-they-need/Y1FgYPkjQvPw5kGZV8CQhL/story.html , retrieved 2/16/2018).

want to know an individual's sensitivity to price: when price increases, how much does the likelihood of purchasing decrease? But when price is determined by salary, as is the case in Illinois where those who face higher prices also have higher incomes, this can cause the effect of the price increase to be conflated with income effects, where we would expect people to purchase more retirement wealth with higher income.[5] Additionally, the benefit in Illinois is far more generous than the price that teachers pay, so that comparing individual's willingness to pay to the costs faced by the state is difficult.[6] We discuss these challenges, and others, in more detail in Section 2.

In this article, we seek to provide more evidence on this topic by considering an alternative to estimating demand by using a simple approach motivated by revealed preferences. We derive estimates of teacher preferences for current versus backloaded compensation based on observing the choices teachers make about contribution rates under a DC pension system operating in Washington State. We argue that this allows for a transparent assessment of teacher preferences given that when teachers choose to set aside current compensation current compensation in exchange for greater retirement benefits because they must value the additional expected retirement income more than the reduction in current compensation.[7] One important limitation of this approach is that we are not able to estimate the demand for deferred compensation, and can only speak to willingness to pay at the internal, subjective "prices" faced

[5] Fitzpatrick seeks to address concerns about price by instrumenting using the teacher salary schedule. This removes variation in price across teachers where highly motivated individuals seek additional responsibilities and earn higher salaries and who may have a higher willingness to pay for retirement income. That said, these instruments require strong assumptions about the form of income effects because individuals with higher or lower scheduled salary will likely have different levels of income. We discuss this issues in more detail in Section 2 and Appendix A.
[6] Specifically, this comparison requires out-of-sample predictions and assumptions about the shape of demand and costs outside the sample. Said differently, we can't directly observe the choices of individuals who are given an "actuarially fair" offer to buy the upgrade.
[7] In particular, as compared to the aforementioned Fitzpatrick work, we do not need to model pension wealth or identify exogenous variation in prices in order to obtain estimates of teacher preferences for current versus deferred (retirement) income.

by each teacher.[8] We also note several important differences in our setting that make it difficult to directly compare our results to Fitzpatrick's research, which we discuss in the conclusion.

Washington State is an ideal setting to study because a large share of the teacher workforce is enrolled in a hybrid DB-DC pension system. The key to our analysis is the fact that the teachers enrolled in the hybrid 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 teachers in Washington State are willing to set aside an average of 8.18 percent from each paycheck, which is substantially more than the state's minimum requirement of 5 percent and indicates that teachers prefer the expected increase in retirement benefits more than current consumption. Our findings in Washington State are roughly consistent with research on average contribution rates in the private sector DC, where individuals have more flexibility to choose their own contribution rates; several studies suggest that employee contribution rates average between 5 percent and 7 percent (Holden and VanDerhei ,2001; Munnell, Sunden, and Taylor, 2002; Huberman, Iyengar, and Jiang, 2007).

What explains these apparent differences between our findings and Fitzpatrick's? We discuss possible explanations in the conclusion, including differences in settings for Washington and Illinois, how overall plan generosity may affect demand for marginal increases in retirement wealth, and the potential for teachers to view DB and DC pensions as different products.

[8] As we discuss below, "price" for a 401(k) or DC-type pension plan is the tradeoff between income today and income in retirement, which will depend on returns to investment, taxes, and other factors.

2. Prior research: the value of deferred compensation in Illinois

Fitzpatrick considers a unique setting in Illinois where teachers were offered the option to purchase an upgrade to their DB pensions. This provides a rare opportunity to evaluate whether teachers would choose to have more retirement benefits for a given price in current compensation. In this section, we discuss the setting in Illinois, the inherent challenges, and our impression of several caveats when applying this research to policy questions.

Teachers who purchased the upgrade received an increased benefit factor for their DB pension, leading to higher annual payments upon retirement. Based on the present discounted value of these benefits, Fitzpatrick estimates that the average teacher would receive approximately $95,000 from purchasing this benefit. The price of the upgrade is a simple function that, conditional on an employee's experience, is a fixed proportion of salary. For the sample of employees that Fitzpatrick considers, price is 20 percent of an individual's salary at the time of purchase, and on average, this would cost the average employee about $15,000.

The pension upgrade option in Illinois might be considered quite generous: a one-time payment of around $15,000 leads to an increase in pension wealth (measured by its present discounted value) of around $95,000. In terms of returns on investment, purchasing this upgrade would be comparable to earning about a 30 percent rate of return on that $15,000, which is much higher than a pension system could feasibly pay over a long period of time.[9] Not surprisingly then, more than 70 percent of teachers decided to purchase it.

[9] We considered the same discount rate of 5.1%, as assumed by Fitzpatrick; the present value of $95,000 in retirement, which is roughly 10 years away for the average teacher in this sample, suggests a nominal value of $156,000. A 29.75% return on investment would be needed to increase $15,000 to $156,000 over 10 years.

Would teachers have still purchased the upgrade if it was less generous? And would Illinois teachers be willing to pay prices similar to the cost of providing the benefit? Fitzpatrick seeks to address this issue by estimating the demand for this upgrade while controlling for the cost of the benefit to the state pension system. She finds that "employees are willing to trade just 20 cents of current compensation for each expected dollar of future compensation" and that "teachers' valuation of the increased pension benefits was much less than their cost". This leads to the conclusion that "if the choice in the structure of teacher compensation is between higher pension benefits and equivalent increases in current salary, as is often assumed, employees would be better off with increases in current salary".

One concern is that estimating demand in any setting is a challenging empirical task that requires largely untestable assumptions: researchers must exploit variation in price that is uncorrelated with other determinates of demand. In the case of Fitzpatrick's study, estimating demand is particularly difficult because the price of the upgrade is directly determined as a function of salary. For example, suppose we want to know how much an individual's willingness to pay decreases when we increase the price of the upgrade by $1,000; however, a $1,000 increase in price only happens when salary is $5,000 higher (because price is set to be 20 percent of an individual's salary), so while the benefit is more expensive the individual has greater income to buy it. In fact, even if salary was randomly assigned to teachers, prices would still depend on whether individuals received a high or low assigned salary, and thus, if income effects exist, they will likely cause bias. In Appendix A, we illustrate these challenges with a simple model, and discuss their implications in more detail. This discussion suggests that Fitzpatrick's estimates are unbiased if: 1) there are no income effects (and thus no need to instrument), OR 2) income effects depend only on base salary AND base salary is *uncorrelated* with other pay, which is likely inconsistent with the structure of teacher pay.

Another concern is that Fitzpatrick's sample requires out of sample predictions to evaluate willingness to pay.[10] As noted on page 180, Fitzpatrick states

> "Since the demand curve traces the marginal willingness-to-pay a particular price and the marginal cost curve presents the cost of providing the upgrade to those who purchase at a particular price, the ratio between the vertical heights of these lines is the cost of providing the upgrade to IPS employees relative to the value the employees place on the benefits"

Importantly, there is no overlap between prices and costs. Consistent with our discussion of benefit generosity above, visual inspection of Fitzpatrick's estimates in Figure 2 (pg. 181) suggests that no employee in the Illinois sample faces a price that is as large as the cost faced by the state (i.e. the prices observed for estimated demand, represented by circles, do not overlap vertically with observed costs, represented by squares). This lack of support implies that only out of sample predictions can lead to intersecting demand and cost curves. This implies that we need assumptions about the shape of demand and cost (e.g. linear, or curvature that is well approximated at the lower tail) to infer behavior where the price of the upgrade is equal to its cost.

[10] Fitzpatrick notes part of this issue on page 182, saying "This makes it difficult to be certain what levels of valuation are among the employees with the highest willingness-to-pay because I am forced to go out-of-sample to make predictions". In this context, Fitzpatrick discusses a "highest marginal willingness-to-pay" and finds a value of just 21 cents on the dollar; strangely, a similar logic can be applied to the *lowest* marginal willingness-to-pay (which appears to be about $10,000 at a marginal cost of about $45,000) and find a seemingly paradoxical value of 33 cents on the dollar.

A final concern is that estimating demand for the pension upgrade also requires assumptions about the size of benefits teachers expect to receive when they retire if they purchase the upgrade. These benefits depend on retirement dates, survival probabilities, and end of career salary, and it seems reasonable to suppose that teachers who purchase the upgrade may have systematically more optimistic expectations for each of these factors relative to those who do not purchase. For example, teachers who purchase the upgrade could expect to live longer and collect greater benefits from the upgrade relative to teachers who do not purchase. Fitzpatrick also instruments for benefits using the maximum salaries paid to teachers with Master's degrees for a given district. That said, this income-based instrument is likely correlated with income effects because pension benefits are mechanically related to end-of-career salary, similar to the discussion of instruments for price mentioned above.

3. Contribution Rate Choices and Teacher Preferences in Washington State

The previous discussion highlights the difficult challenges of estimating demand in a setting where price is determined as a function of salary. We consider an alternative approach. We argue that contribution rate choices allow us to directly observe teacher preferences for current versus deferred compensation. 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 retirement compensation 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 consumption.[11]

[11] This figure can be derived from the traditional two product constrained utility maximization problem where the products depict the tradeoff between current and future (retirement) consumption.

In this figure, 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 and future consumption.[12] Individuals will choose the rate that maximizes their utility by choosing a contribution rate that balances increases in retirement consumption with decreases in current consumption. This balance is depicted by the net marginal benefit curves, which represent individuals' preferences for current consumption versus deferred consumption. The values on the vertical axis show the utility measured in dollars associated with different retirement contribution rates, i.e. curves for individuals A and B show the net marginal benefit– i.e. the marginal benefit of current consumption, MB_C, less the marginal benefit of retirement consumption, MB_R.

Consider two individuals who are deciding whether or not to contribute more or less than 5 percent of their current income toward retirement. At a 5 percent contribution rate the net marginal benefit is negative for Individual A, i.e. $MB_C > MB_R$ so A can improve her utility by decreasing savings and increasing consumption, so would opt to contribute less than 5 percent. But Individual B will has a positive net marginal benefit, i.e. $MB_C < MB_R$ at a 5 percent contribution rate so B will opt to save more. Each individual optimizes savings where $MB_C = MB_R$, which for A is a contribution rate of 3 percent and for B is a contribution rate of 9 percent.

[12] 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.

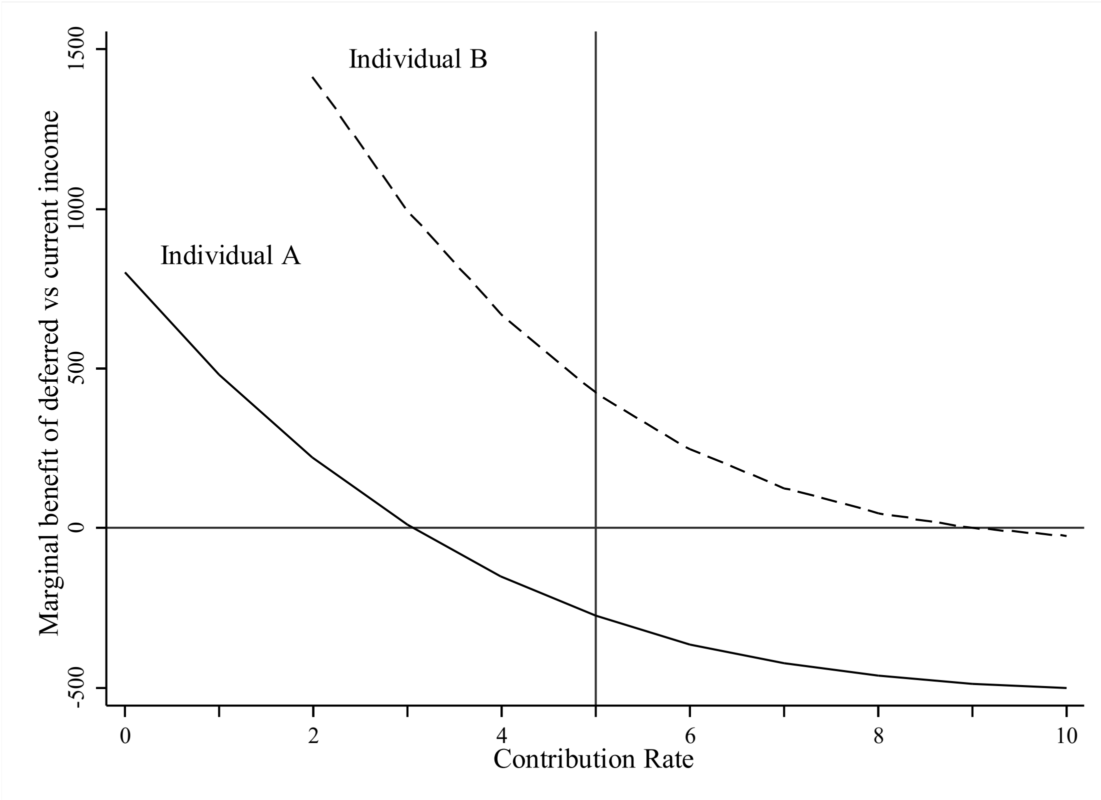

Figure 1. The Net Marginal Benefit of Retirement Contributions Relative to the Marginal Benefit of Current Consumption

The simple model is useful for illustrating three censoring issues due to the discrete nature of contribution rate plans in Washington State. 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: 5-7.5 and 6-8.5 percent. Teachers may have preferences to save less than 5 percent (which we call lower censoring), preferences to save more than 15 percent (upper censoring), or preferences to save in between the percent values offered by Washington State (discrete integer censoring). Individual A in Figure 1 must choose a minimum contribution rate of at least 5 percent, while they would prefer to contribute less and they are therefore lower censured and their contribution rate decision of 5 percent will overstate their preferences for deferred compensation. We address this by focusing on the proportion of teachers contributing more than 5 percent, and calculating a lower bound of the average contribution rate by assuming that teachers who contribute 5 percent would prefer to contribute zero. As in our example, this likely understates the true preferred contribution rate as there are likely individuals who prefer to contribute some value between zero and 5 percent. Similarly, there may be individuals, not shown in Figure 1, who would prefer to contribute more than 15 percent and are upper censured, and so our calculations will tend to understate the preferences of teachers who choose the highest contribution rates. We do not adjust our estimates, but note that our estimates will tend to understate savings due to this group. Lastly, individual B is integer censured, because they must choose between contributing 7 percent or 10 percent, while they would in fact prefer to contribute 9 percent. As such, we assume that contribution rate choices between 5 percent and 15 percent represent the average rate for teachers.

This model suggests that contribution rates are directly related to an individual's preferences for current and deferred compensation. If teachers place a low value on retirement compensation, they will have net marginal benefit curves similar individual A and will choose to contribute low levels of current compensation. Alternatively, teachers could resemble individual B and contribute high levels of current compensation. The bottom line is that contribution rate choices reveal teacher preferences for deferred compensation, and as such, we next consider what teacher contribution rate decisions in Washington State suggest about teacher preferences for deferred compensation.

4. Evidence from Washington State Contribution Rate Decisions

In 1995 the Washington legislature passed legislation that created Teacher Retirement System 3 (TRS3), a hybrid retirement system with a DB component funded by employers and a DC component funded by employee contributions. We examine teacher preferences for deferred (retirement) compensation 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 2007.

We focus on the contribution rate decisions of TRS3 teachers, who upon enrollment may choose one of six different contribution rate plans, described above, which determine the percentage of salary automatically diverted to a teacher's DC account each month. A teacher who does not indicate a preference within 90 days is defaulted into Plan A, which requires the minimum contribution of 5 percent of earnings.[13]

The first column of **Table 1** shows the percent of TRS3 teachers choosing each contribution rate plan for the DC portion of the TRS3 plan for all teachers in TRS3. About 38 percent of teachers contribute at the lowest rate of 5 percent,[14] and about 62 percent of teachers choose to contribute more than 5 percent. These include contribution rates that increase with employee's age (e.g. 5-7 percent and 6-8.5 percent plans), and fixed rates of 7, 10, and 15

[13] 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.

[14] 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.

percent. About 21 percent of teachers are willing to contribute very high levels of current compensation, at 10 or 15 percent.

Table 1. Percent of Teachers Choosing Contribution Rate Plans

		All TRS3 teachers	Experienced TRS3 teachers (YOS > 22)	Mandated TRS3 teachers
Plan A:	5%	37.84	23.51	32.44
Plan B:	5-7.5%	12.56	7.68	14.63
Plan C:	6-8.5%	14.33	13.14	18.59
Plan D:	7%	12.74	26.7	8.04
Plan E:	10%	12.83	16.18	15.09
Plan F:	15%	9.7	12.8	11.22
Observations		76643	6760	6085

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.

There are two ways that contribution rates are likely to vary across individuals, and both have important implications for the demand for retirement benefits depending on the chosen sample. First, prior research suggests that individuals tend to increase their contributions as they gain experience (for example, see Goldhaber and Grout, 2016). We explore this possibility in Figure 2, where we plot the average contribution rate by years of experience. This figure is consistent with our expectations that contribution rates increase with experience, and notably, contribution rates are roughly constant for individuals with more than 20 years of experience. Given this, in order to compare our findings more directly with Fitzpatrick's study, we define a sample of "retirement age teachers" who have more than 22 years of experience, and display their contribution rate choices in Column 2 of **Table 1**.[15] Consistent with our expectations, older teachers in TRS3 are willing to contribute more of their current compensation to retirement. This

[15] Fitzpatrick (2015) states "I limit the sample to employees with 22 to 28 years of experience in 1998" on page 176.

column shows that over 75 percent of teachers choose to contribute more than 5 percent, and over 28 percent choose to contribute more than 10 percent of their salary each year.

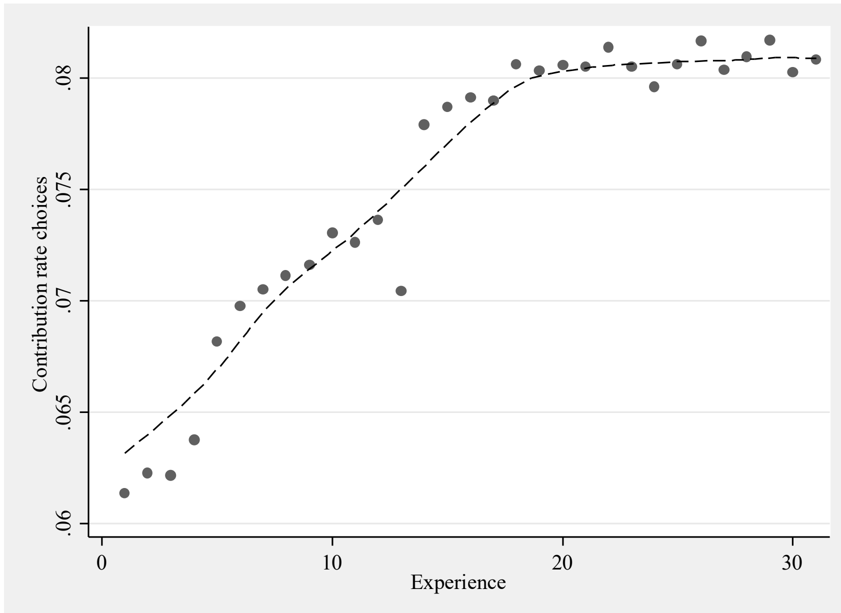

Figure 2. Variation in Contribution Rate Decisions by Experience

A second issue is that enrollment in TRS3 could be endogenous as to teacher preferences for DC plans. Enrollment in TRS3 was mandated for employees hired between July 1996 and July 2007. Those employees already employed in the state as of July 1996, and enrolled in a traditional DB system (known as TRS2) had the opportunity to transfer to TRS3. Teachers who decide to transfer into TRS3 may have stronger preferences for DC retirement compensation, and may also choose higher contribution rates relative to the average teacher. This is also complicated by the fact that TRS3 is a relatively new plan; the only TRS3 teachers with more than 20 years of experience had transferred into TRS3 from TRS2. We attempt to address this concern by also considering the contribution rate decisions of less experienced TRS3 teachers who were mandated into the TRS3. These individuals do not have endogenous enrollment, but are generally less experienced relative to teachers in Column 2; at best, we can restrict our focus to teachers with more than 10 YOS. As such, we expect them to contribute less than more experienced TRS3 teachers, but more than the average TRS3 teacher in Column 1. We show these results in Column 3 of **Table 1**. As expected, these individuals contribute more than the average TRS3 teacher, but less than transfer TRS3 teachers in column 2: about 68 percent of teachers choose contribution rates above the minimum 5 percent, and about 26 percent of teachers choose to contribute more than 10 percent of their salary each year.

Next, we describe the average contribution rate across our sample of TRS3 teachers, as well as bounds to address the censoring of teacher preferences. **Table 2** presents the average contribution rate for each sample discussed above. The average contribution rate across the sample is 6.53 percent. Consistent with findings that teachers tend to save more when they are closer to retirement, we see a higher average contribution rate of about 8 percent for experienced teachers who transferred into TRS3, and consistent with the notion that experience and self-selection may affect contribution rates, and teachers mandated into TRS3 with less experience has a somewhat lower average contribution rate of 7.48 percent.

Table 2. Average and Lower-Bound Contribution Rates, and Percent Choosing to Contribute More than Plan A

	All TRS3 teachers	Experienced TRS3 teachers (YOS > 22)	Mandated TRS3 teachers
Contribution rate using:			
Average	6.53	8.18	7.48
Lower bound	5.34	7.01	5.86
Proportion choosing to defer more compensation than the minimum requirement	62.16	76.49	67.56

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 average contribution rates set Plan A 5 percent contribution rates to zero. Proportion choosing to defer more compensation than the minimum requirement is calculated as the proportion of teachers choosing plans other than Plan A.

As described above, contribution rate plans in Washington State do not allow for contributions less than 5 percent, which could overstate the average that would be derived based solely on teacher preferences. We address this by also calculating a lower-bound of the average contribution rate by assuming that individuals who contribute 5 percent would prefer to contribute zero; this is clearly a lower-bound estimate as teachers required to contribute 5 percent would have, left to their own devices, contributed more than zero. We use the assumption of zero value for those in the 5 percent contribution plan in the second row. The lower-bound average contribution rate is 7.01 percent for experienced transfer TRS3 teachers, and 5.86 percent for less experienced, 5 percent mandated TRS3 teachers.

Lastly, we consider a simple metric that addresses concerns about censoring. The third row presents the percent of teachers who actively choose to contribute more than the state's minimum retirement plan. Individuals who choose to contribute above the minimum are willing to trade at least some amount of current compensation in exchange for retirement income. This suggests that without making assumptions about minimum preferred contribution rates, the majority of teachers in all samples are willing to forgo current compensation for additional retirement consumption.

5. How does the setting in Washington compare to Illinois?

The previous section suggests that Washington teachers tend to prefer setting aside more retirement compensation than the state's minimum requirements, and as shown in our theoretical model in Figure 1, that Washington teachers have preferences are more like Individual B than Individual A. The fact that we observe more than 76 percent of experienced teachers choosing to defer at least some current compensation suggests that they value deferred compensation more than Fitzpatrick's estimates seem to suggest. But our results from Washington are not directly comparable to Fitzpatrick's from Illinois, as we do not estimate willingness to pay; moreover, teachers face different pension structures, payment choices (contribution rates versus lump sum), and investment returns.

In this section, we attempt to place both settings into the same framework suggested by our theoretical model so that we can make comparisons between our estimates and Fitzpatrick's estimates. We proceed by describing the theoretical connection between rates of return on investments and the time preferences of teachers, and introduce the concept of a rate of return implied by an individual's time preferences. We then discuss the implications based on our findings in Washington and the implications based on Fitzpatrick's estimates.

First, it is worth noting that the decision to set aside funds for retirement depends crucially on the rate of return on investments and the time preferences of teachers. The rate of return on retirement contributions represents the rate at which current compensation can be exchanged for retirement compensation. Higher rates of return mean that more retirement compensation is received for the same quantity of retirement contributions. Similarly, as shown in Figure 1, individuals with stronger preferences for deferred compensation will tend to set aside more current compensation relative to individuals with weaker preferences for deferred compensation. These two concepts are connected: individuals with weak preferences for deferred compensation could be motivated to save for retirement if the rate of return is high enough. So, how high does the rate of return need to be to induce the average teacher to defer at least some current compensation? We define this as the Reservation Rate of Return.[16]

Second, what can we determine about Reservation Rate of Return in Washington state from our sample? Given the rates of return faced by teachers, we know that more than 50 percent chose to defer at least some current compensation. This means that the Reservation Rate of Return has to be smaller than the average rate that teachers actually face; but what is this rate? This is challenging because it depends of teacher's expectations of interest rates on retirement contributions, which are not known; as a stand-in, we consider the Washington State actuarial assumption of a 7.5 percent rate of return.[17] Alternatively, we can consider information provided by the Washington State Department of Retirement Services for what teachers should expect for investment returns via their retirement calculator, which do not exceed 6 percent.[18] This would suggest that the Reservation Rate of Return for Washington State teachers is likely smaller than 7.5 percent.

Third, what is the Reservation Rate of Return in Illinois? We calculate this by using Fitzpatrick's estimate that the average teacher is willing to pay 20 cents in current compensation for a dollar of expected retirement benefits. This estimate is closely related the concept of a Reservation Rate of Return: teacher preferences suggest that the average teacher would only set

[16] This is similar to the idea of a reservation wage in labor economics, which is the wage necessary to induce a worker to participate in the labor market.

[17] It could still be the case that teachers have irrationally high expectations of rates of return, which would suggest a higher Threshold Rate of Return, though this may be unlikely as experienced teachers would have a long period over which they observed investment returns.

[18] See http://www.drs.wa.gov/education/calculator/default.htm , retrieved 2/22/2018

aside current compensation if the rate of return on 20 cents of current compensation would return a dollar of expected retirement compensation; i.e., an increase of a factor of five. Another technical difference is that this estimate is in *expected value* vs actual benefits; we convert this estimate into the amount that would need to be provided at retirement. For example, an individual with a 5.2 percent discount rate, 7 years in the future would be willing to trade 20 cents of current compensation for about $1.43 in retirement.

Given these figures, we calculate a Reservation Rate using a simple compound interest formula:

$$T = P[(1 + r)^n]$$

where T is the value of the investment, P is the principal invested, n is the number of years over which the principal is invested, and r is the Reservation Rate of Return. Given Fitzpatrick's estimates, T/P is $1.43/$0.2, and the Reservation Rate of Return varies from about 22 percent to 92 percent depending on whether n varies from 3 to 10 years. To narrow this range somewhat, we calculate for Fitzpatrick's sample that the average teacher has 25.05 years of service in 1998 and retires with 32.6 years of service, which gives an n of 7.55 and a Reservation Rate of Return of 29.8 percent.

Our calculated Reservation Rates of Return differ greatly between Washington and Illinois: teachers in Washington State have Reservation Rates of Return that are likely less than 7.5 percent while Illinois teachers have Reservation Rates of Return around 30 percent. What are we to make of the seemingly large discrepancies between the Reservation Rates of Return in IL and WA, and is it plausible that teacher preferences could be this different between the two settings?

6. Discussion

Why do teachers in Washington State seem to prefer deferred income more than teachers in Illinois? In this section, we discuss three potential explanations for why results might differ between both settings: employees have large differences in total retirement wealth, and could have different levels of family savings; similarly, each state provides different tax incentives; there are also reasons to think that Fitzpatrick's estimates may understate demand for deferred compensation; and lastly, teachers could have different preferences for DB versus DC retirement plans. We generally rule out the first explanation, and then highlight the policy implications for the remaining two.

First, total retirement wealth may be different in Washington and Illinois, which could affect a teacher's willingness to pay for additional, marginal retirement compensation. For example, economic theory suggests that additional retirement wealth will likely decrease the marginal utility of retirement contributions. If teachers in Illinois start with higher retirement benefits, they will be less willing to pay for increases. There are several challenges to examining total retirement wealth for Washington and Illinois: Illinois teachers do not participate in social security while Washington teachers do; teacher salaries, which determine pension wealth, are higher in Illinois relative to Washington; and the Washington plan we study, TRS3, has both DB and DC components. As such, we consider a very rough back of the envelope calculation to compare retirement wealth in both settings. To keep things simple, we compare only the DB portion of TRS3 to teachers in Illinois. For a teacher who does not purchase the upgrade, 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). This suggests that TRS3 provides a higher replacement ratio, even without considering the DC account. Overall, this suggests that Illinois teachers should have a higher willingness to pay relative to Washington due to having lower total retirement wealth, while Fitzpatrick's estimates suggest this is not the case.

Teachers in Washington and Illinois could have different levels of overall family savings which influence willingness to pay for retirement via teacher pensions. For example, teachers in Illinois may choose to participate in supplemental savings plans.[19] As such, our estimated contribution rates will understate teacher preferences for deferred compensation if individuals set aside compensation in unobserved assets. Alternatively, one may expect that household savings could differ according to differences in family structure in Illinois and Washington. While this is not possible to test in our data, we consider this possibility by examining census data from the Current Population Survey in 2015, which roughly suggests that family structure is fairly similar for individuals in Illinois and Washington State. For example, in Illinois, 22% of individuals are never married and 72% never have children relative to 20% and 70% in Washington State. Rates of employment are 41% in Illinois and 39% in Washington. We think it is reasonable that these types of differences likely cannot explain the estimates we present in this paper.

Second, it could also be the case that we cannot get unbiased estimates of demand in the context of DB pensions. Demand is particularly challenging to estimate in the context of DB pensions because many factors are a function of salary (e.g. price of the upgrade, size of the benefit). As such, income effects are likely to influence the estimates of demand. Moreover, as noted by Fitzpatrick, the Illinois setting requires out-of-sample estimates for high-valuation

[19] For instance, Card and Random (2011) find that university faculty are willing to contribute 3.3 to 3.7 percent of their current compensation to supplemental plans in addition to their primary DC accounts.

individuals and thus, strong assumptions about the slope of the demand curve. Lastly, 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.

Alternatively, there are reasons to think that estimates in Washington and Illinois are not contradictory. One possibility is that the tax incentives for Washington State teachers are likely more favorable toward setting aside funds for retirement than those faced by Illinois teachers who purchase the upgrade. In Washington, additional contributions to retirement plans reduce taxable, federal income, and thus, provide an incentive for retirement savings.[20] Said differently, setting aside a dollar for retirement does not lead to a full dollar reduction in current consumption; instead, forgone current consumption is net of the tax rate faced by the individual.[21] However, the pension upgrade in Illinois is paid for using post-tax earnings.[22] Thus differences in the taxation environments in each state may indeed explain part of the difference in our estimates.

Another explanation, as noted by Fitzpatrick, is that teachers may view DB and DC pensions as distinct retirement products. DC plan structures have less backloading of compensation relative to DB plans, and provides smaller penalties for mobility and attrition (Lazear, 1979, 1984; Gustman and Steinmeier, 1995; Ippolito, 2002). Brown and Weisbenner (2014), for example, find that individual's preferences for risk, financial literacy, expectations of

[20] Washington has no state income tax, and thus, no state income tax incentive for retirement contributions.
[21] For example, an individual who faces a 25 percent tax rate chooses between a dollar allocated towards retirement compensation versus 75 cents of current compensation.
[22] If available, the upgrade can also be purchased using a rollover from a previous retirement account. Alternatively, teachers can pay "periodic payments in substantially equal amounts for up to 24 months through a reduction in (their) retirement benefit". See "How may I pay for the upgrade?" (https://www.trsil.org/sites/default/files/documents/BRO19.pdf, retrieved 2/16/2018).

returns are important factors when individuals choose between DB and DC pension structures. 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 DC plan structure more than DB plans.

Even considering the issues above, there are several important points for policy. Our observations of teacher choices clearly suggest that teachers in both states value the additional retirement benefits more than the cost they pay in forgone current consumption. Therefore, teachers would be worse off if policymakers did not provide the option for the Illinois pension upgrade, or if Washington State teachers were not given the option to contribute more than the state minimum. We also find that Washington State teachers have substantial heterogeneity in their preferences for contribution rates which highlights a substantial benefit of DC retirement plans to match teacher preferences. If policymakers were forced to choose a contribution rate for teachers, as is the case under a pure DB pension plan, and correctly predicted the that the most popular employee contribution rate would be (for example, 7% for our experienced sample) the majority of teachers would still prefer higher or lower contribution rates and be worse off without choice. As such, we view this study as highlighting the need for further research is needed in other states on teacher preferences for current or deferred compensation.

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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.[23] 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.[24] 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: $Cov(S_{ib}, P_i) \neq 0$.

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[23] 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.
[24] 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 ($P_i = 0.20 * S_i$).[25] 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,

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

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

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

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:

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

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

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.

[25] 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 find that base salary in Washington state has a 0.4 correlation with other salary.[26] 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.

[26] Using S275 data for 2017-18, and variables "basesal" and "othersal".