The Impact of Tax Incentive Structure On Taxpayers' Retirement Savings Decisions

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Abstract

Understanding the potential impact of tax incentives on individual retirement savings requires an understanding of how individuals incorporate tax incentives into their savings decisions. To that end, we examine taxpayers' relative preferences for defined contribution retirement plans with differentially structured tax incentives (i.e., front-loaded and back-loaded incentives). In three experiments, we find mixed evidence regarding whether individuals appropriately weight temporal tax rate changes, the primary factor driving the difference in after-tax returns between tax incentive structures, in their plan type choices. In contrast, we find consistent evidence that plan attributes related to taxpayers' non-economic attitudes and preferences influence plan choice. Finally, we find that taxpayers prefer back-loaded retirement plans even in situations in which a back-loaded plan is economically dominated by a front-loaded plan. The results have implications for policymakers and others considering how best to encourage retirement savings and interpret taxpayers' actual saving decisions.

Keywords: retirement savings; tax incentives; incentive structure; experience utility.

JEL classifications: D14; H31; K34.

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I. INTRODUCTION

With the declining use of employer-provided defined benefit retirement plans, rising life expectancies and healthcare costs, and increasing concerns over the long-run viability of Social Security funding, the importance of personal retirement savings continues to grow (e.g., Anderson 2013; U.S. Department of Labor 2016; Quinn and Cahill 2016). Many countries, including the U.S., try to encourage retirement savings by offering tax incentives to participants in various defined contribution plans. However, while some 60 percent of U.S. retirement assets now reside in tax-preferred plans at an annual cost of approximately $240 billion to the federal government (Holden and Schrass 2017b; Joint Committee on Taxation 2017), evidence regarding the effectiveness of these subsidies is mixed at best (e.g., Hubbard and Skinner 1996; Poterba, Venti and Wise 1998; Gale 1998).

Determining whether tax incentives are effective and efficient in promoting retirement savings requires an understanding of how taxpayers make savings decisions. This study examines whether taxpayers' general attitudes and preferences may interact with the structure of savings incentives to systematically impact their experience (dis)utility[1] and, therefore, the attractiveness of the incentive. Similar to the views expressed by Chetty (2015), we believe that explicitly taking such (dis)utility into account may allow for both better predictions about the outcomes of existing policy and a better understanding of alternative policies' welfare implications.

[1] We use experience (dis)utility throughout the paper to mean the net sum of all hedonic pleasure and pain experienced in connection with a choice including, but not limited to, that related to financial wealth or income (e.g., Chetty 2015).

The tax benefits for participating in tax-favored retirement plans in the U.S. have historically been front-loaded, providing a deduction or exclusion for contributions to a tax-favored plan but imposing tax on qualified withdrawals of both contributions and earnings. Relatively recently, and many think primarily as a budget gimmick (e.g., Blustein 1989; Steuerle 1997; Halperin 1998), the U.S. has adopted tax-favored plans with back-loaded incentives, which provide no immediate tax benefits when contributions are made to qualified plans but impose no tax on either contributions or the earnings they generate when withdrawn. Plans employing front- and back-loaded incentives in the U.S. are generally referred to as to "traditional" and "Roth" plans respectively. In some contexts, Roth plans are the only incentive structure available (e.g., for tax-favored college savings plans). In others, taxpayers may choose between traditional and Roth plans. However, statutory participation restrictions and/or employers' failure to offer both plan types may complicate and/or limit that choice (e.g., personal IRAs and employer-sponsored 401(k) plans). Further, where a choice currently exists, the U.S. Congress has seriously considered eliminating that choice and allowing only Roth options.[2] In contrast, while most OECD and EU countries offer tax incentives for retirement savings, the vast majority offer only front-loaded plans (OECD 2015).

Assuming participants have similar access to financial markets and investment options for each plan type, and absent any other restrictions that may be imposed differently across plan types, any differences in the after-tax returns derived from front- and back-loaded plans are primarily due to the relation between taxpayers' current tax rates and the rates they will face when they withdraw funds from the plan in retirement. However, the actual impact of incentive

[2] The President's Advisory Panel on Tax Reform (2005) recommended adopting a single retirement savings account with a single tax structure. More recently, lawmakers considered proposals to "Rothify" retirement savings by converting existing front-loaded holdings to Roth status and/or lowering caps on contributions to front-loaded plans (e.g., El-Sibaie 2017; Thornton 2017).

structure and temporal tax rate changes on savings decisions is unclear for several reasons. For example, the extent to which taxpayers understand the impact of temporal tax rate changes on relative after-tax returns is suspect. Even given such understanding, the relation between a taxpayer's current and future tax rates is a result of many environmental and personal factors that are likely unknown to the taxpayer when making savings decisions. Further, tax incentive structure may have impacts on the attractiveness of a plan independent of, or inconsistent with, its impact on after-tax returns. Whether taxpayers benefit from having a choice between alternatively-structured tax-preferred plans (i.e., whether providing such a choice systematically encourages savings and/or leads to utility-maximizing decisions) and, absent a choice, which incentive structure might lead to greater overall savings, are open questions. In this study, we explore the following questions: (1) do taxpayers understand and respond to the factors that determine the relative after-tax returns of back- and front-loaded plans; (2) does the structure of the tax incentive impact the attractiveness of a plan independent of its impact on after-tax returns; and (3) might the preferred structure differ across the contexts in which individuals make savings decisions?

Addressing these issues by examining archival data is problematic, largely because both plan types are not consistently available to all taxpayers. For example, differences in statutory limits on participation can affect one's access to front- and back-loaded plans based on factors such as family income and employment status.[3] In addition, front-loaded plans generally have existed longer than back-loaded plans, perhaps contributing to social norms or other forms of

[3] For example, the income thresholds limiting U.S. taxpayers' ability to contribute to back-loaded IRAs are generally higher than those limiting current deductions for contributions to front-loaded IRAs. However, limits on front-loaded IRA deductions may be reduced or eliminated for those who are self-employed or otherwise lack employer-sponsored retirement options. Further, back-loaded options may only be offered in employer-sponsored plans if a front-loaded option is also offered.

institutional entrenchment that prompt more investment in front-loaded plans regardless of taxpayer preferences.[4] This may be particularly challenging for individuals who primarily save for retirement through employer-sponsored plans, as employers generally have to amend or replace their existing retirement plans to implement new account offerings. Recent survey evidence suggests this process of discovery and "opting in" can be slow and cumbersome—though back-loaded employer-sponsored accounts have been available for over a decade, just over half of U.S. employers currently offer a Roth option (Collinson 2017). Further, while personal accounts may provide greater flexibility in shifting prior holdings in front-loaded plans to back-loaded plans when desired, such transactions are neither straightforward nor without consequence. For instance, conversions from traditional plans to Roth IRAs in the U.S. typically trigger immediate tax liabilities that, as of 2018, cannot be recharacterized if the taxpayer has a change of heart or economic circumstance.

Thus, since both plan types are not consistently available to all taxpayers, observing current contributions and account values may not accurately reflect individuals' preferences. Moreover, even when a choice is available and observable, interpreting taxpayers' preferences based on archival data may still be impossible if taxpayer's preferences are based on beliefs about their current and future tax rates as well as subjective attitudes and preferences unobservable in archival data. Given these limitations, we examine our questions experimentally. In three experiments with complementary strengths and limitations, taxpayer participants choose between tax-favored retirement plans that are identical in all respects except for the timing of the tax benefits. We examine the effect of tax rate changes, personal attitudes and preferences, and

[4] For example, the Employee Retirement Income Security Act of 1974 established front-loaded IRAs in the U.S. Back-loaded IRAs only became available after the Taxpayer Relief Act of 1997. Similarly, the Revenue Act of 1978 laid the foundation for modern front-loaded employer-sponsored plans in the U.S., but back-loaded versions were not available until 2006.

the context of the savings decision on plan choice.

We find mixed evidence supporting an effect of tax rate changes on plan choice. Participants responded to tax rate changes only in the presence of an experimental intervention; i.e., only (1) when we explicitly described in a controlled experiment the looming rate change and immediately paid participants based on the eventual economic consequence of their plan choices or (2) when asking participants to consider a plan choice they might make without immediate compensation, we explicitly explained the effect of any rate changes on the plans' relative returns. Expected tax rate changes did not affect plan choices when we neither prompted participants about the change nor explicitly educated them about the tax rate changes' impact on the plans' relative returns. These results suggest that individuals may not consistently or accurately consider tax rate changes when evaluating tax-favored retirement plans.

Although at least part of the failure to consider tax rate changes is likely attributable to ignorance, our results suggest that non-economic attitudes and preferences appear to influence taxpayers' plan choices as much or more than do the economic effects of changing tax rates. For example, we find that preferences for back-loaded plans are correlated with generally held preferences for prepaying for consumption as well as feelings of dread over looming liabilities. We further observe that preferences for back-loaded plans are stronger for those who more directly associate the immediate tax savings of a front-loaded plan with the eventual tax liability, as well as for those who perceive the tax benefits of a front-loaded plan as more uncertain than those of a back-loaded plan.

Even after controlling for the above attitudes and perceptions, we find that taxpayers strongly prefer back-loaded to front-loaded plans. This preference persists even when a back-loaded plan is economically dominated by a front-loaded plan and we explicitly and

unambiguously explain the relative economic benefits of the plans. Overall, our findings are in stark contrast to archival data showing that U.S. retirement wealth is more heavily concentrated in front-loaded plans (Holden and Schrass 2017a).[5] Although we do not claim to identify all factors underlying taxpayers' expressed preference for back-loaded plans, consistent with Chetty (2015), we believe that the pragmatic benefits of improving predictions regarding existing policy outweigh the potential inability to identify the precise mechanism underlying observed behavior.

This study increases our understanding of when and how the tax incentives used to encourage savings might be most effective. When considering the potential impact of savings incentives, our results can provide policymakers insight into (1) determinants of taxpayers' experience utility when making retirement savings decisions, (2) the expected benefits of educating taxpayers about those savings incentives, and (3) the benefits of allowing taxpayers a choice of incentive structures. Taken together, the results suggest a systematic preference for back-loaded plans even when economically dominated by front-loaded plans. As a result, when given a choice between incentive types, a significant number of taxpayers will systematically choose the one providing lower after-tax returns (though not necessarily lower utility). Though educating taxpayers about the relation of temporal tax rate changes and relative returns available from different plan types may reduce misunderstanding, it may nonetheless fail to change a significant number of economically "irrational" choices. Should policymakers prefer a single incentive type for whatever reason, back-loading tax incentives may be a more effective use of government resources to encourage savings. Our results also suggest that policymakers should take care not to evaluate the effectiveness of alternative savings incentives and taxpayers'

[5] Data from the Investment Company Institute (ICI) indicates more U.S. households hold front-loaded than back-loaded IRAs (28 vs. 20 percent) and the average wealth held in front-loaded plans is more than double that held in back-loaded plans (Holden and Schrass 2017a).

investment choices purely on their ex post financial efficacy.

II. HYPOTHESES DEVELOPMENT

The Economics of Tax-Favored Retirement Savings

Contributions to front-loaded plans are immediately deductible or excludable from taxable income, generating current tax savings for the contributor. However, all subsequent withdrawals of contributions and investment earnings are taxed as ordinary income. Conversely, contributions to back-loaded plans provide no deduction or exclusion, but all qualified withdrawals of contributions and earnings are tax-free. The after-tax returns available from front- and back-loaded plans are equal as long as the tax rates applicable to current deductions or exclusions and future withdrawals are equal (e.g., Burnam, Gale and Weiner [2001]; Hrung [2007]). Taxpayers with current tax rates that are lower (higher) than their retirement tax rates will earn higher after-tax returns by contributing to a back- (front-)loaded plan.[6] Of course, the relation of current and future rates will vary across taxpayers depending on the taxpayer's earnings and savings patterns as well as temporal changes in statutory tax rates. Although taxpayers know none of these factors when making retirement savings decisions, the financially rational strategy is to contribute to a back- (front-)loaded plan when tax rates during retirement are *expected* to be higher (lower) than current rates.[7] Stated formally:

[6] Equivalence also depends on the reinvestment of the initial savings from a front-loaded contribution at the same after-tax rate of return as that on contributed capital. Relative returns may also differ due to other restrictions that might be imposed differently across plans (e.g., penalties on early withdrawals, withdrawal requirements, etc.). Burman et al. (2001) provide a more detailed analysis of the choice between front-loaded and back-loaded plans, including the effect of interest rates and investment horizons when contribution limits are constrained to be equal across plans. We do not address any factors here that are not inherently different across incentive structures.

[7] Hewitt Associates (2006), examining choices between front- and back-loaded employer-sponsored plans, report greater participation in back-loaded plans by those in their twenties, and presumably facing a lower tax rate, than by those in their fifties. Similarly, they report higher participation by non-highly compensated employees in back-loaded plans than in front-loaded plans. Copeland (2014) also reports that participants in back-loaded plans are younger, on average, than those in front-loaded plans. While these results are consistent with taxpayers expecting their tax rates to be higher in retirement preferring back-loaded plans, it is unclear whether the relations are due to tax rate expectations or other factors that may be confounded with age and/or current tax rates (e.g., the stickiness of prior decisions, willingness to adopt a new innovation).

H1: *Ceteris paribus*, taxpayers expecting their tax rate in retirement to be higher (lower) than their current rate are more likely to prefer a back-loaded (front-loaded) retirement plan.

However, evidence on the sensitivity of personal savings to neo-classical economic incentives is mixed. For example, Hrung (2007) examines U.S. Statistics of Income data and finds that observable proxies for intertemporal changes in tax rates have an economically weak, albeit statistically significant, relation to taxpayers' choices between front- and back-loaded plans. Several factors could explain this. One is methodological—data limitations introduce significant noise in the proxy for intertemporal tax rate changes. Another factor is environmental—individuals may simply be unaware of, or misunderstand, the impact of tax rate changes on plans' relative after-tax returns.

Prior research suggests that ignorance may indeed impact taxpayers' use of intertemporal tax rate changes in their plan choices. For example, individuals have very low levels of financial sophistication generally (e.g., Lusardi and Mitchell 2011) and have trouble incorporating taxes into financial and investment decisions (e.g., Rupert and Wright 1998; Rupert, Single, and Wright 2003). Moreover, taxpayers seem to lack a basic understanding of tax-favored retirement plans. For example, research suggests that merely informing taxpayers of the economic incentives related to qualified retirement plans can increase participation (Goda et al 2014; Duflo and Saez 2003; Dolls et al. 2018). Beshears, Choi, Laibson, and Madrian (2017) studied eleven employer-sponsored plans that added a back-loaded option to an existing front-loaded plan and found that employees failed to adjust for the different tax treatment of the plans when determining the amount to contribute to the new back-loaded plan. In an attempt to explain these results, Beshears et al. conducted a separate survey and found that less than half of active participants in defined contribution plans understood the difference between front- and back-loaded plans.

Based on the above, we expect that the relation of intertemporal tax rate changes and plan choice will be mitigated, at least in part, by taxpayer ignorance. If so, the effects of economic incentives should be strengthened with improved information. We, therefore, posit the following:

H2: Educating taxpayers about the impact of intertemporal tax rate changes on the relative returns of back- and front-loaded retirement plans will increase the impact of expected tax rate changes on plan choice.

Notwithstanding the role of ignorance in taxpayers' potential failure to incorporate intertemporal tax rate changes in their plan choices, the behavioral economics and psychology literatures have identified several factors lacking direct economic implications that may nonetheless impact economic decision making. Chetty (2015) considers several such factors that are expected to impact the retirement savings decision independently of economic incentives (e.g., nudges like automatic opt-in [Madrian and Shea 2001]; enhanced saliency of the plan's benefits via information reporting [Dolls et al. 2018]). We note that behavioral factors may also interact with economic incentives such that the structure of tax incentives may also carry experience (dis)utility.[8] We propose that the structure of retirement savings incentives as front- or back-loaded will interact with taxpayers' general attitudes and preferences to impact the relative attractiveness of the incentive. Some of those attitudes and preferences are directly related to incentive structure while others pertain to the broader context in which taxpayers make retirement savings decisions.

[8] For example, Card and Ransom (2011) illustrate that framing required contributions to defined benefit plans as coming from the employer versus the employee can impact the amount of voluntary contribution made by employees to defined contribution plans.

Behavioral Factors Directly Related to the Structure of Savings Incentives

Prospective mental accounting

Prelec and Loewenstein (1998) proposed a "double-entry" mental accounting model in which people experience utility through two sets of mental accounting entries: one which records the discounted "net" utility derived from consumption and another that records the discounted "net" disutility from paying for that consumption. In this model, people are assumed to consider all benefits (costs) twice—once directly upon consumption (payment) and again when the consumption (payment) buffers the experience of the payment (consumption). Simply put, merely thinking about the cost of a purchase can undermine the pleasure derived from it, while thinking about the pleasure of consumption can blunt the pain of paying for it.

Prospective mental accounting further suggests that people heavily weight the consequences of future events but heavily discount prior events. This increases the overall utility of prepaying for consumption as the heavily-discounted prepayment has little effect on the net utility of subsequent consumption, while the lightly discounted pending consumption greatly reduces the net disutility of the prepayment.[9] In the context of retirement planning, taxpayers who perceive taxes on retirement savings as the cost of retirement consumption may anticipate greater net utility from their retirement consumption when prepaying the related tax, as in a back-loaded plan. At withdrawal, the previously-paid taxes should detract little from the utility of consumption. Conversely, with a front-loaded plan, taxpayers may anticipate the disutility they will experience from the tax triggered by each withdrawal. We expect, therefore, that

[9] The potential effects of prospective mental accounting are independent of any direct discounting suggested by traditional discounted expected utility models and any benefit of prepayment resulting from prospective mental accounting may be insufficient to overcome the discounting of a delayed benefit.

taxpayers' general preferences for prepaying for consumption will lead to a preference for back-loaded plans over front-loaded plans.

Framing and intertemporal reference points

Intertemporal options may be framed as choices to expedite or delay outcomes relative to an adopted temporal referent point, producing offsetting gains and losses (Loewenstein 1988; Loewenstein and Thaler 1989; Loewenstein and Prelec 1992; Shelley 1993).[10] Since losses loom larger than gains (Kahneman and Tversky 1979; Tversky and Kahneman 1981), any choice framed as a change in the timing of outcomes will generally result in a net reduction in experience utility. Further, the impact of temporal framing and loss aversion notwithstanding, psychological discounting of the deferred outcomes will also affect temporal choices. However, research suggests that positive outcomes face larger discount rates than do negative outcomes (e.g., Thaler 1981; Loewenstein 1988; Shelley 1993).

The above discussion suggests that, if taxpayers adapt to paying taxes currently on income (congruent with a "pay-as-you-go" withholding system), they might frame front-loaded savings as trading an immediate gain (current tax savings) for a future loss (a future tax liability). Loss aversion suggests that the loss would overshadow the related gain. Further, the relatively light discounting of the deferred tax would provide little consolation. Conversely, taxpayers may be less likely to frame the tax costs and savings from back-loaded contributions as competing temporal prospects. When considering a back-loaded plan, income is taxed currently regardless of participation. With no immediate loss to associate with the future tax savings, we would not

[10] For example, a person expecting to receive $100 today may have the opportunity to delay the receipt, trading an immediate loss (i.e., the forfeiture of an immediate $100) for a future gain (i.e., the $100 received in the future). Similarly, a person expecting to receive $100 in the future may have the opportunity to expedite the receipt to today, trading an immediate gain (i.e., the current $100) for a future loss (i.e., forfeiting $100 in the future).

expect negative intertemporal framing effects. Therefore, we expect a back-loaded plan to compare more favorably with the status quo than will a front-loaded plan.[11]

Dread

Research suggests there is disutility in the "dread" associated with anticipating future aversive events and utility in anticipating future pleasant events (Loewenstein 1987; Hardman 2009). Under certain circumstances, savoring (dread) can lead to a preference to delay (accelerate) desirable (undesirable) outcomes, inconsistent with traditional economic models of discounted utility. Negative discounting is more likely when the undesirable outcome can be vividly imagined (e.g., Loewenstein 1987). Research also suggests that taxpayers have largely negative views about paying taxes (e.g., Hardisty et al. 2010) and find the federal income tax filing and payment process unpleasant and complex (e.g., Moon 2009). If taxpayers focus on the benefits of tax-favored savings, the opportunity to savor the delayed benefits of a back-loaded plan may make those benefits more attractive than the equivalent, but immediate, benefits of a front-loaded plan. Similarly, if taxpayers focus on the taxes paid, they may prefer to avoid the dread of paying tax on future retirement consumption and "get it over with" by contributing to a back-loaded plan. In general, we expect the savoring (dread) of future financial benefits (liabilities) to increase preferences for back-loaded plans.

Predictability

Finally, people generally dislike uncertainty and act to avoid it (Kahneman and Tversky 1979; Einhorn and Hogarth 1985). With respect to retirement plan preferences, we posit that taxpayers may view a back-loaded plan as a relatively more certain or predictable prospect

[11]Though front-loaded plans may serve as referents for back-loaded plans, this is less likely given a taxpayer making a choice whether to save or not (versus a choice of changing from a front-loaded to a back-loaded plan). It is also unlikely that one plan will serve as the referent for another when only one plan is available as in nearly all OECD countries.

because the taxpayer knows both the taxes paid on current contributions and the tax due (none) on qualifying withdrawals. While "locking in" taxes on both contributed and accumulated wealth has no effect on the inherent uncertainty of one's future investment opportunities and needs for retirement consumption, and therefore does not make back-loaded plans an inherently "safer" alternative for retirement savings, back-loaded incentives do at least inoculate taxpayers' retirement savings against future tax rate changes and eliminate one key element of an already complex forecasting exercise. On the other hand, although a taxpayer *may* know the current tax savings generated by contributions to a front-loaded plan, they *cannot* know with certainty the taxes that will be due on withdrawals nor, therefore, the net benefits of participation. We expect, therefore, that taxpayers' general aversion to uncertainty will lead them to seek back-loaded tax incentives that may enhance the perceived predictability of retirement planning.

Though it has been argued that back-loaded plans without an immediate tax benefit will be relatively ineffective at encouraging savings (e.g., Thaler 1994), the factors discussed above all suggest otherwise. All else equal, we expect contributions to back-loaded plans to produce greater experience utility than contributions to front-loaded plans. Thus, we posit the following:

H3: *Ceteris paribus*, taxpayers prefer back-loaded plans to front-loaded plans.

Behavioral Factors Related to the Decision Context

Temporal distance

The decision context may also impact the relative experience utility of contributing to front- and back-loaded plans. For example, perhaps the strongest draw of a front-loaded plan is the immediacy of the tax benefit, appealing to taxpayers' general myopia (Thaler 1994). It follows that the temporal proximity of the tax benefits to the participation decision will increase

the perceived benefits of plan participation. This proximity, in turn, varies with the context in which taxpayers make tax-advantaged savings decisions.

Taxpayers may consider tax-advantaged retirement savings in at least two contexts: (1) when filing a return, when a decision to contribute will reduce the tax liability of the prior period (i.e., a retroactive contribution) and produce an immediate benefit, and (2) when choosing whether to commit to making future contributions to an employer-sponsored plan (i.e., prospective contributions), when the decision to contribute will result in a delayed benefit.[12] In either instance, the fact that back-loaded tax benefits are not realized until retirement implies the temporal distance between an initial contribution decision and its associated tax savings is strictly greater for a back-loaded plan compared to an otherwise equivalent front-loaded plan. However, even the benefits of a front-loaded plan are delayed when considering prospective contribution elections, reducing the relative attractiveness of a front-loaded plan. Therefore, we expect preferences for front-loaded plans to be greater when taxpayers consider retroactive contributions in the context of a tax filing—the immediacy of this context both minimizes the temporal distance between front-loaded contributions and their associated tax benefits and maximizes the temporal disadvantage of an otherwise equivalent back-loaded plan.

Tax return settlement position

Prior research suggests that taxpayers frame taxes due at filing as losses whereas they frame refunds as gains, and that this framing changes the aggressiveness of reporting decisions on the related return (e.g., Schepanski and Kelsey 1990; White et al. 1993; Jackson and Hatfield 2005) consistent with prospect theory (Kahneman and Tversky 1979). We posit that taxpayers

[12] In the U.S., taxpayers can make retroactive contributions to both front- and back-loaded individual retirement accounts (IRAs) through the annual filing deadline. In contrast, contributions to employer-sponsored plans (e.g., 401(k) plans) are generally made prospectively with elected changes in payroll withholdings.

will be similarly motivated by loss aversion to contribute to a front-loaded retirement plan when the immediate tax savings can reduce a tax payment (loss) due at filing.

However, from a mental accounting perspective, the potential for a given outcome to impact a decision maker's perceived gain or loss depends on the likelihood that the decision maker associates the two, or enters them in the same mental account (Thaler 1985, 1999; Thaler and Johnson 1990). This likelihood, in turn, depends on their categorical and temporal relation. For example, when considering a contribution in the context of a tax filing, the likelihood a taxpayer records the potential tax savings from retroactive contributions to a front-loaded plan in the same mental account as the tax due with the current filing is increased by both their categorical and temporal relation. The netting of the taxes saved with the payment due is consistent with the findings of Feenberg and Skinner (1989) and Frischmann, Gupta and Weber (1998) who report that, prior to the introduction of back-loaded plans, contributions to front-loaded IRAs were more likely when taxpayers had tax liabilities due.

When considering periodic contributions for the coming year, a taxpayer could similarly record the tax savings from a front-loaded plan in the same mental account as the taxes due with a future filing because of their categorical relation (i.e., taxes). However, the greater temporal distance between the contribution decision, the applicable tax filing, and the eventual tax savings will reduce that likelihood. Therefore, we predict that the impact of a taxpayer's settlement position will be greater when considering a retroactive contribution in the context of a tax filing than when considering contributions to be made in the coming year. Formally stated:

H4a: A shorter temporal distance between the contribution decision and related tax savings will reduce the relative attractiveness of a back-loaded plan.

H4b: A tax-due settlement position will reduce the relative attractiveness of a back-loaded plan.

H4c: The impact of a tax-due settlement position on plan preference will be greater as the temporal distance between the contribution decision and related tax savings decreases.

III. METHODS AND RESULTS

We use three online experiments to examine our hypotheses.[13] We begin this section by discussing two elements common to all three experiments—participant recruitment and measurement of the latent constructs underlying H3—before discussing the unique design features and results of each experiment.

Participants

We recruited all participants through Amazon's Mechanical Turk (MTurk) platform.[14] We limited participation to U.S. citizens between the ages of 19 and 59 (i.e., adults under the standard minimum age to take qualifying retirement distributions) who are currently employed or self-employed, participate in their household's financial decisions, and have previously filed an income tax return.

We received 1,068 complete responses to experiment one, 283 to experiment two, and 292 to experiment three. The final sample demographics are similar across experiments and resemble the general U.S. population and prior MTurk samples (e.g., Buchheit et al. 2018a; Stinson et al. 2018a). As shown in Table 1, participants have a mean age of 36 years. Fifty-four (46) percent are female (male) and 47 percent are married. The median participant has a bachelor's degree and household income of approximately $56,000. Participants estimate their average marginal tax rate to be 18 percent. Fifty-one (28) percent believed their tax rate in

[13] Prior to data collection, we obtained IRB approval for each experiment.

[14] MTurk provides access to a broader cross-section of the population than traditional convenience samples. Notably, prior studies show that the population of MTurk workers is more heterogeneous and more representative of the U.S. population as a whole than the population of university students, specifically with respect to age, education, income, and tax filing experience (Paolacci et al. 2010; Crump et al. 2013; Steelman et al. 2014; Farrell et al. 2016; Smith et al. 2016; Buchheit et al. 2018b). Further, although MTurk workers, like university students, are generally younger and more educated than the general U.S. population (e.g., Hitlin 2016), they are more diverse than other internet-based samples and provide data that meet the standards associated with published social science research (Buhrmester, Kwang, and Gosling 2011).

retirement will be higher (lower), reporting an average expected rate of 22 percent.

[Table 1]

Measurement of General Attitudes and Preferences

We hypothesize in H3 that several attitudes, preferences, and plan perceptions will jointly impact retirement plan choices. Although these attitudes, preferences and perceptions have been shown to be widely held, we use the varying degrees to which they are held across individuals to examine their influence on plan choice. Specifically, following our elicitation of the main dependent variables and manipulation checks in each experiment, we asked participants a series of questions (see Appendix for details) to capture traits we hypothesize will impact their plan choices. We then combine these responses across experiments to produce factor scores capturing individual preferences for prepayment (*PrepayPref*), perceptions of relative temporal framing (*RelTempFrame*), dread with respect to future tax payments (*Dread*), and beliefs in the relative predictability of front- and back-loaded plans (*BackPredict*).

In addition, while not related to the latent constructs behind H3, we asked participants to report their household income; formal education; the number of college-level finance, accounting, economics, and tax courses taken; and a self-assessment of their relative knowledge of personal finance and investing. These factors have been used previously to measure financial sophistication (*FinSoph*), which we use as an additional control in our analyses (e.g., Calvert, Campbell and Sodini 2009; Muller and Weber 2010; Smith, Finke and Huston 2011).

We present descriptive statistics for each of our attitudinal and demographic measures in Table 2, Panel A. As expected, participants, on average, prefer prepaying for consumption and associate tax costs with savings more for a front-loaded plan than for a back-loaded plan. They also positively discount future cash payments, and perceive the tax costs and savings of a front-

loaded plan as less predictable than those of a back-loaded plan. The factor analysis results in Table 2, Panel B confirm that five factors capture the elicited measures, explaining nearly 62 percent of the total variance in responses (all eigenvalues greater than one). Further, the varimax-rotated factor loadings suggest that the factors correspond to the constructs they were expected to capture. Each item loads highest on the expected factor with no factor loadings below an absolute value of 0.5, and no significant cross-loadings above an absolute value of 0.3.

[Table 2]

Experiment One

Experiment one draws on the experimental economics paradigm. However, as we are specifically interested in characteristics of the decision context, we use contextual terminology throughout the experiment. Participants assumed the role of a taxpayer and were compensated based on the after-tax income their decisions generated. Before the decision task, all participants were told it was important that they be familiar with two types of retirement plans that Congress had at one time or another considered. They then read descriptions of basic front- and back-loaded plans, including the tax treatment of contributions and withdrawals. We required all participants to correctly answer comprehension checks regarding each plan's tax treatment before they could proceed to the decision task and receive payment for completing the study.[15]

Decision Task

Participants were told to assume they had earned $50,000 in wages. Forty thousand dollars was required to pay essential living expenses and tax withholding, leaving $10,000 available to either consume immediately or save and invest for retirement. Participants could

[15] Participants incorrectly answering a comprehension check were expelled from the study. This design choice produced a high passage rate for post-task manipulation checks, and we eliminated very few participants with complete responses.

save through the two previously-described plans. Each plan allowed participants to invest contributions in the same two mutual funds. The funds varied in risk while maintaining positive expected returns and the potential for loss.[16] Conversely, immediate consumption precluded both investment returns and the risk of loss. Participants earned $2.00 for completing the task plus a bonus of $0.03 for every $1,000 of after-tax consumption and accumulated wealth at the end of the study – thus, participants received a riskless benefit from consumption but could potentially increase their earnings by saving in a retirement plan.

After reviewing the instructions, participants again saw the retirement plan descriptions introduced earlier. We explicitly described the plans as being different from those that might be currently available, and similar to each other in all respects except for the timing of the tax benefits (e.g., they had similar rules covering withdrawals, investment options, etc.).[17] Participants made two contribution decisions serving as our primary dependent variables. Participants first provided the total amount they would like to contribute to a retirement plan, and then further allocated their contributions across the available plans (*BackRatio*).[18] The percentage allocated to the back-loaded plan served as one dependent variable. Next, each participant indicated how much they would contribute, and which plan they would choose, if they could only contribute to one (*BackPref*). They responded to the latter question on a scale of 1 (definitely the front-loaded plan) to 6 (definitely the back-loaded plan), which we rescaled to

[16] Consistent with Falsetta, Rupert, and Wright (2013) and Stinson et al. (2018a), each participant was given a distribution of possible annual returns for two hypothetical mutual funds. Mutual Fund A offered a relatively conservative investment strategy producing an expected annual return of approximately 8 percent. Mutual Fund B was a relatively aggressive investment that produced an expected annual return of approximately 13 percent with greater potential for downside loss.

[17] Though the instrument explained the details of each plan on the same screen, it randomized the presentation order. To further reduce the chances of participants incorporating any information they might have brought with them to the study regarding existing plans, we avoided the use of terms like "Roth" and "traditional," and explicitly noted that the plans differed from currently available plans.

[18] Participants who initially indicated they would not make a contribution to either plan were asked to assume that they were required to contribute five percent of their income to retirement, which they then allocated across the two plans.

−2.5 to +2.5 to aid in interpretation.

After choosing their desired level of retirement savings relative to immediate consumption, participants allocated contributions between the two mutual funds offered within each plan. A fixed schedule of returns for each mutual fund determined participants' total investment income. Participants' income was thus based on the type of retirement plan(s) chosen and the relative savings allocated to each mutual fund. Taxes were assessed on all taxable income at the tax rates described below. The instrument concluded with a post-experimental questionnaire including manipulation checks.

Independent Variables

To test our hypotheses, we manipulated four variables across participants. All participants faced a "current" tax rate of 15 percent (applicable to income that was consumed or contributed to a back-loaded plan). To examine the impact of tax rate changes on plan choice predicted in H1, participants faced a tax rate in retirement (applicable to withdrawals from the front-loaded plan) of either 10 (decrease), 15 (constant), or 20 (increase) percent.[19]

To examine whether educating taxpayers strengthens the relationship between their plan preferences and tax rate changes as predicted in H2, we used a method similar to that used by Loewenstein and Sicherman (1991). Specifically, immediately after describing the plans but

[19] As explained in footnote 6, even when tax rates remain constant, the economic equivalency of front- and back-loaded plans is dependent on the ability to reinvest the tax savings of a front-loaded plan in a similar, tax-advantaged investment. Equivalency, therefore, requires greater nominal contributions to front-loaded plans. To simplify the experimental task, we limited the amount of income available to save, informing participants that any immediate tax benefits from contributions to a front-loaded plan would increase current consumption. Therefore, it was possible that participants facing constant tax rates and wishing to save relatively large amounts were unable to appropriately adjust their contributions to front-loaded plans for the tax savings, making Roth plans economically preferable despite the constant rates. Forty-four of 393 participants in the constant-rate condition made contributions to the back-loaded plan large enough to preclude a compensating increase for a contribution to a front-loaded plan. For these participants, the plans were not economically equivalent. Our results remain qualitatively and quantitatively unchanged when these participants are excluded from our analyses. In the decreasing rate condition, the rate decrease more than compensates for any limits on the contribution, making the front-loaded plan the economically dominant choice regardless of a participant's desired contribution level.

before introducing the decision task, we explained the impact of tax rate changes on the plans' relative after-tax returns to half of the participants. To ensure our "educated" participants understood this relation, a comprehension check required them to identify the plan producing the highest accumulated retirement savings in three different scenarios, one each in which a taxpayer expects increasing, decreasing, or constant tax rates. Participants could not continue to the decision task until they identified the correct plan in each scenario.[20] To minimize the possibility of demand effects, and to give participants "permission" to make a choice consistent with their non-economic preferences in the decision task, the education treatment ended with the following statement:

> *"Of course, predicting future tax rates may be difficult, and other factors might make one plan more personally appealing than the other regardless of the potential economic impact of tax rate changes. Therefore, there is no 'right' plan choice in any situation."*

We hypothesize in H4 that a contribution's temporal proximity to its tax benefits, a taxpayer's payment/refund position at filing, and their interaction, will impact plan preference. We examine the simple (H4a) and moderating (H4c) effects of temporal proximity by manipulating the contribution decision context (*FilingContext*). Half of our participants considered a retroactive contribution to an IRA in the context of filing a current-year tax return.[21] The other half considered prospective contributions in the context of enrolling for employment benefits for the upcoming year. To examine H4b, we manipulated settlement position at two

[20] To further test our treatment's effectiveness, we repeated the descriptions of both the front- and back-loaded plans for *all* participants post-experimentally and asked which would produce the greatest retirement savings under increasing, decreasing, or constant tax rates. Seventy-nine (33) percent of the participants receiving (not receiving) the education treatment correctly answered all three post-experiment questions (χ^2= 238.19; p<0.001).

[21] Participants in the temporally proximate (filing) condition were immediately informed of the impact their decisions had on their return settlement amount, similar to prompts included in popular tax preparation software. They could then modify their decisions if desired, and their final decisions constitute the *BackRatio* dependent variable.

levels by varying participants' hypothetical tax withholding levels (*TaxDue*). Participants were told that they had already paid either $8,000 or $7,000 of their tax liability through withholding, resulting in either a $500 tentative refund or payment due.[22]

Results

On average, participants completed the experiment in 32 minutes and earned $2.91, yielding an effective hourly wage of $5.55 (Table 1).[23] Preliminary analyses provide evidence that participants were randomly assigned across experimental conditions; participant age, education level, household income, financial sophistication, and actual settlement position on their most recent tax return did not differ across experimental conditions.[24] Average contributions in the tax filing (year-ahead) context were 64 (68) percent of disposable income. Forty-seven (50) percent of tax filing (year-ahead) contributors split their contributions between front- and back-loaded plans. Overall, participants allocated 64 (67) percent of tax filing (year-ahead) contributions to back-loaded plans.

Table 3, Panel A reports the experiment one results using two linear regressions with standard errors bootstrapped over 10,000 replications. The first examines participants' forced choice between the plans (*BackPref*) while the second examines the percentage of total

[22] As described above, each participant received information describing an annual salary of $50,000, of which $10,000 was unencumbered and could be used for immediate consumption or investment, net of any incremental year-end tax obligations. To maintain this salary breakdown and preserve mathematical equivalence across prepayment conditions, we adjusted the initial available cash balance for each participant by the amount of the assigned settlement position. For example, *TAXDUE* participants saw a $10,500 available cash balance (and a $39,500 budget for essential living expenses), but were immediately given enough information to determine that $500 was already "spoken for" in the form of taxes if they chose not to make front-loaded contributions.

[23] This amount is above the average effective wage reported in a number of prior studies using MTurk participants (e.g. Paolacci et al. 2010; Rennekamp 2012; Brandon et al. 2014; Brasel et al. 2016) and is considered reasonable for MTurk subjects (Farrell et al. 2016).

[24] Participants' predictions of their tax rate changes in retirement did differ significantly (p=0.007) across the education manipulation. However, we found in untabulated analyses that real-life predicted tax rate changes did not interact with the tax rate change manipulation, nor qualitatively nor quantitatively impact the predicted education by (manipulated) tax rate interaction.

retirement contributions allocated to the back-loaded plan (*BackRatio*).[25] For each dependent variable, we examine the impact of the economic factors of interest (*RateChange*, *Education*, and their interaction) as well as each participant's financial sophistication (*FinSoph*). We also include the four psychological constructs of interest (*PrepayPref*, *RelTempFrame*, *Dread*, and *BackPredict*) as well as the two contextual factors (*TaxDue* and *FilingContext*) and their interaction.

[Table 3]

Consistent with H1, the coefficients on *RateChange* are positive and significant in both models ($p<0.001$), indicating that preferences for back-loaded plans increase when participants expect tax rates to increase in retirement. The coefficients on *Education* are both negative at the 0.05 level, suggesting that the tutorial alone reduced preferences for the back-loaded plan. Further, consistent with H2, the coefficients for the *RateChange* × *Education* interaction are positive, suggesting the tutorial amplified the impact of rate changes. This effect is generally stronger for allocation decisions than for plan choices ($p=0.006$ vs. 0.069, one-tailed). Moreover, the interaction coefficients are roughly equal in absolute value to the single-order terms for *Education*. We interpret this result as a ceiling on education's effect given our participants' otherwise dominant back-loaded plan preferences, which we describe in more detail below—simply put, education could not move participants with increasing tax rates any further into the ("correct") back-loaded plan, while education could incrementally move those with decreasing tax rates toward the front-loaded plan.[26]

[25] Our *BackPref* dependent variable is ordinal in nature and positively skewed. To address these issues, we also ran our tests of *BackPref* using ordered logistic regression (untabulated) with the same model and bootstrapping procedures detailed in Table 3. Our statistical inferences remain qualitatively unchanged.

[26] To control for the level of financial sophistication our participants brought with them to the study and the impact that might have had on our education treatment, we tested interactions of *FinSoph* with *RateChange*, *Education*, and *RateChange* × *Education* in both models (untabulated). These additional interactions were insignificant at

The above results suggest that, consistent with H1, participants did incorporate tax rate changes into their plan choice. However, as predicted in H2, explicitly explaining the relation between tax rate changes and after-tax returns significantly increased the influence of tax rate changes on the decision. This finding suggests that ignorance or misunderstanding weakens taxpayers' ability to "correctly" incorporate tax rate changes into their plan choices. However, accounting solely for the potential misunderstanding of tax rates continued to leave a large part of participants' preferences unexplained. As illustrated in Panel B of Table 3, even among participants educated about the rate-change-return relation, 48 percent nonetheless contributed to a back-loaded plan when facing declining rates. Conversely, only 17 percent of participants facing increasing rates contributed to a front-loaded plan. Taken together, this pattern suggests a strong preference for back-loaded plans that was not attenuated by relative return incentives and education.

To learn more about these results, we next consider the impact of specific attitudes and preferences on participants' plan choices. We find that *PrepayPref*, *RelTempFrame*, *Dread*, and *BackPredict* all have significantly positive (all $p \leq 0.030$, one-tailed) effects on plan preferences. In addition, the intercepts in both models are positive and significant (both $p < 0.001$), indicating a baseline preference for the back-loaded plan that is incremental to any effects captured by our independent variables. The significantly negative coefficients on *FinSoph* (both $p \leq 0.003$) indicate financial sophistication reduces the baseline preference for back-loaded plans identified in the intercepts, implying that the effect of non-economic experience utility is offset somewhat by greater financial sophistication. Nonetheless, results suggest that taxpayers' general attitudes

conventional levels with the exception of *Education* × *FinSoph*, which produced a positive coefficient with a p-value of 0.021 only for our *BackRatio* dependent variable. Despite this lone significant interaction, our hypothesized effects and statistical inferences remain both qualitatively and quantitatively unchanged.

produce a preference for back-loaded plans as predicted by H3. On the other hand, we find no support for H4: *FilingContext, TaxDue* and their interaction are all insignificant in both models (all p>0.10, one-tailed).[27]

Experiment one provides a relatively strong test of the effects of temporal tax rate changes on plan preferences by randomly assigning participants to different tax-rate change conditions and compensating participants immediately after the experiment (together enhancing the salience of the economic incentives). However, because the explicit goal of the experimental task was to maximize income, and the consequences of participants' choices (i.e., returns earned and experience utility) were temporally confined to the experiment, experiment one provides a relatively weak test of the experience utility factors we expect to impact taxpayers' plan preferences. Nonetheless, we find that economic incentives fail to fully explain plan preferences and non-economic factors significantly influenced plan choices. We approach both design elements differently in experiments two and three.

Experiment Two

The purpose of experiment two is to examine plan preferences in a more natural and realistic setting. To do this, we asked participants to make hypothetical plan choices without artificially imposing any economic or contextual conditions on them. Nor did we prompt participants regarding tax rate changes as part of the judgment task. Rather, we elicited future tax rate expectations after the savings decision, eliminating the chances of artificially triggering their salience.

After agreeing to participate in the study, participants first provided their annual income,

[27] In untabulated analyses, we find that none of the non-economic factors moderate *RateChange* at traditional significance levels. Including the interactions leaves our primary inferences and results qualitatively and quantitatively unchanged.

pay frequency, the amount of payment owed or refund due on their last tax return, and estimates of their current marginal tax rate. We incorporated this information in each participant's decision task (described below), hopefully making the decision more personally meaningful, thereby enhancing construct and external validity. All participants were then introduced to the same basic front- and back-loaded plans used in experiment one and were required to answer comprehension checks regarding the tax treatment of each plan before they could move on to the decision task. Next, we explained the decision context and participants made the same plan choice and allocation decisions as in experiment one.

Independent Variables and Decision Task

To examine the impact of expected tax rate changes on plan choice, we elicited participants' expectations of whether their tax rate in retirement would be higher or lower than their current rate (*ExpRateChange;* -3 [3] = much lower [higher]). To avoid artificially enhancing their salience, we elicited tax rate expectations after the dependent variables.

To examine the extent to which potential non-reliance on tax rate changes was an error due to a lack of understanding, we randomly provided participants with the same tutorial on the relation of tax rates and relative plan returns employed in experiment one (*Education*). As in experiment one, participants receiving the tutorial could not proceed to the decision task until they correctly identified the plan that provided the highest returns in situations in which rates increase, decrease, or remain constant.[28]

To capture the temporal distance between (1) the savings decision and (2) the

[28] We again provided *all* participants descriptions of front- and back-loaded plans post-experimentally and asked which would produce the greatest retirement savings under increasing, decreasing, or constant tax rates. Similar to experiment one, 72 (35) percent of the participants receiving (not receiving) the tutorial correctly answered all three post-experiment questions (χ^2=42.34; p<0.001).

contribution and its tax consequences, we asked participants to make contribution decisions in two randomly ordered contexts.[29] As in the first experiment, one was in the context of choosing whether to make a contribution to an IRA while filing a tax return. In this context, participants were told that, in the process of completing their tax return, they discovered they were eligible to contribute to two new types of personal retirement accounts. In the other context, participants were asked to imagine that their employer was about to offer two new tax-favored retirement plans as replacements for any plans they may currently offer with contributions to be made through withholding from next year's paychecks. In both contexts, the previously-introduced plans were again described as alternatives and participants made their plan choice and allocation decisions.

Finally, as mentioned above, we elicited participants' payment/refund due on their most recent tax return. We randomly increased or decreased this amount by 10 percent, and explicitly incorporated it as the settlement position in each participant's personalized decision scenario. Participants also evaluated their settlement position on a scale of 1 (owed a lot) to 6 (received a large refund) to capture their perception of the dollar amount.

Results

Participants received a fixed fee of $2.25 and took an average of 27 minutes to complete the instrument, yielding an average hourly wage of approximately $5.00. Preliminary analyses suggest that participants were randomly assigned across experimental conditions—participant age, education level, household income, financial sophistication, and expected tax rate changes

[29] Unlike in experiment one, we manipulated decision context within participants. In addition to randomizing the order of our decision context manipulation, we informed participants before making either set of decisions that the two contexts were independent, inherently different, and should be considered separately from one another. This was reiterated after the first set of decisions when participants were explicitly told that, given that the situations differ, their second set of decisions may or may not be similar to their first.

did not differ across the education manipulation.[30] The average voluntary contribution in the retrospective (prospective) context was 1.3 (4.8) percent of self-reported household income. Thirty-seven (36) percent of participants split contributions across front- and back-loaded plans in the retrospective (prospective) context. Participants allocated 65 (64) percent of all retrospective (prospective) contributions to back-loaded plans.

Panel A of Table 4 reports results from experiment two using two restricted maximum likelihood models, with subject random effects to account for the within-subjects feature of our design (e.g., Everitt 1995; Stinson et al. 2018b). The first model examines participants' preferences given a forced choice between plans (*BackPref*) and the second examines the percentage of total retirement contributions allocated to the back-loaded plan (*BackRatio*).[31]

[Table 4]

Unlike experiment one, and inconsistent with H1, we observe no effect of *ExpRateChange* absent the *Education* treatment (p=0.330 and 0.396, one-tailed). However, consistent with experiment one and H2, the *ExpRateChange* × *Education* interactions are consistently positive and significant (both p≤0.006, one-tailed), suggesting that the failure to use expected tax rate changes in the plan choice was, at least in part, due to ignorance.[32] Nevertheless, the evidence also suggests many participants retained their preferences for back-loaded plans despite the education provided, just as in experiment one. As illustrated in Panel B

[30] Participants' actual tax return settlement positions did differ significantly (p=0.03) across the education manipulation. However, this is controlled by including it in all subsequent analyses.
[31] Similar to experiment one, we examined the ordinal *BackPref* dependent variable using ordered logistic regression with standard errors clustered by subject to account for a lack of independence for within-subject responses. In addition, we performed linear regression on *BackPref* and *BackRatio* using standard errors clustered by subject. The results of these untabulated analyses are consistent with those reported in Table 4.
[32] As in the analyses related to experiment one, the model initially included interactions of *FinSoph* with *ExpRateChange*, *Education*, and their interaction to control for participants' financial sophistication and any impact that might have on the education treatment (untabulated). None of the interactions are significant (all $p \geq 0.49$), and our primary inferences and results remain qualitatively and quantitatively unchanged.

of Table 4, even among those receiving the education treatment, 49 percent of participants expecting lower retirement tax rates nonetheless elected to contribute to a back-loaded plan. Conversely, only 18 (20) percent of participants expecting increasing tax rates chose to make retrospective (prospective) contributions to a front-loaded plan.

Similar to experiment one, non-economic attitudes and perceptions significantly impact plan preference in experiment two (consistent with H3), albeit not as strongly. Specifically, the relative perceived uncertainty of front-loaded plans, *BackPredict*, has a positive and significant impact on both plan choice and contribution allocations (both $p<0.001$). Participants' relative temporal framing of plan costs and benefits between front- and back-loaded plans, *RelTempFrame*, marginally affects plan allocations ($p=0.082$, one-tailed) but not plan preferences ($p=0.272$, one-tailed). The coefficients of all other non-economic factors are positive in both models, as expected, though not statistically significant. The intercepts for both models are positive and significant ($p<0.001$), again suggesting a baseline preference for the back-loaded plan not attributable to differences in expected returns across the plans. As in experiment one, the preference for back-loaded plans appears to be partially offset by *FinSoph* (both $p\leq0.001$).

Finally, we find evidence supporting the impact of contextual factors on the savings decision predicted in H4. Specifically, we observe a marginally negative simple effect of *FilingContext* on *BackRatio* ($p=0.065$, one-tailed). Similarly, we find a marginally negative effect of *ExpTaxDue* on *BackPref* ($p=0.100$, one-tailed), offering support for H4b. For both dependent variables, we find that the *ExpTaxDue* × *FilingContext* interaction amplifies these effects (one-tailed $p=0.056$ for *BackPref* and 0.002 for *BackRatio*) as predicted in H4c. Thus, while our participants still tended to prefer back-loaded plans in general, this preference decreased when front-loaded contributions could immediately reduce an expected tax payment.

Experiment Three

Experiment three isolates the impact of general attitudes and preferences on plan choice by eliminating any potential differences in economic returns between the plans. To do this, we employed a decision task similar to experiment two. However, we explicitly and unambiguously set the retirement tax rate equal to each participant's own estimated current tax rate, thereby making the plans economically equivalent. As it was important that all participants understood the plans' economic equivalence, *all* received the education treatment, and 72 (80) percent of participants correctly answered all (at least two of three) post-experiment questions testing this understanding. Experiment three is otherwise identical to experiment two.

Results

On average, participants took 27 minutes to complete the instrument for a fixed fee of $2.25, yielding an hourly wage of $5.07. Forty (42) percent of participants split their tax filing (year-ahead) contributions between front-and back-loaded plans. Overall, participants allocated 60 (65) percent of tax filing (year-ahead) contributions to back-loaded plans. Average tax filing (year-ahead) contributions were 2.2 (5.3) percent of self-reported household income.

Congruent with our analysis of experiment two results, we report experiment three results in Table 5 using restricted maximum likelihood models with subject random effects. However, since we restricted tax rate changes to zero and educated all participants, the models include only our experience utility factors and a control for financial sophistication (*FinSoph).*[33]

[Table 5]

Similar to experiments one and two, we find strong support for H3. All of the attitudinal

[33] As in experiment two, we examined our ordinal *BackPref* dependent variable using ordered logistic regression, with standard errors clustered by subject to account for a lack of independence for within-subject responses. In addition, we performed linear regression on *BackPref* and *BackRatio* using standard errors clustered by subject. The results of these untabulated analyses are consistent with those reported in Table 5.

factors yield significantly positive coefficients in both models (all $p<0.09$, one-tailed, for *PrepayPref*, *RelTempFrame*, *Dread*, and *BackPredict*). Moreover, consistent with both prior experiments, we observe positive intercepts (both $p<0.001$), suggesting a preference for back-loaded plans incremental to the attitudes we examine directly. Further, as in experiment two, we obtain negative coefficients for *FilingContext* (both $p\leq0.001$, one-tailed), *ExpTaxDue* (both $p<0.09$, one-tailed), and *ExpTaxDue* × *FilingContext* (both $p<0.05$, one-tailed) in both models, providing support for H4.[34]

IV. DISCUSSION AND CONCLUSIONS

Effectively stimulating retirement saving requires an understanding of how individuals make savings decisions, including how they respond to common tax incentives. While economically rational retirement plan choices should largely be driven by taxpayers' expectations about their current and future tax rates, research consistently suggests that individuals systematically violate economic axioms, incorporating non-economic factors into their investment decisions. However, neither individuals' expectations regarding future tax rates nor their non-economic attitudes and preferences are observable in archival data, limiting the inferences that can be made based on that data. Therefore, we examine taxpayers' choices between front- and back-loaded plans using three experiments.

We find mixed evidence regarding individuals' incorporation of expected tax rate changes when making such choices. Tax rate changes significantly impact plan choice when

[34] In untabulated analyses, we also examine the impact of participants' expected temporal tax rate changes (*ExpRateChange*). Although the front-loaded plan described to participants explicitly set retirement tax rates equal to current rates so that tax rate changes should have no impact on relative returns, participants' expected rate changes were nonetheless positively related ($p<0.01$) to both plan preference and allocation decisions. We suspect that tying future tax rates to uncertain current rates, and providing all participants the education treatment, may have made it difficult for participants to totally ignore their rate change expectations. However, including these expectations in our tests had no qualitative nor quantitative effects on our predicted coefficients and our inferences remain unchanged.

participants are (1) explicitly educated regarding their economic effects or (2) told the direction of the change they should expect in the experiment and immediately paid based on the economic outcomes of their decisions. However, expected tax rate changes had no impact on plan choices when participants were neither explicitly educated regarding the economic impact of tax rate changes nor experimentally prompted with information about the change (i.e., when left to their own devices). These results suggest that individuals may not fully consider or incorporate their beliefs about tax rates when making retirement savings decisions.

The moderating effect of our education treatment suggests that the tenuous relation between rates and plan choice is due, at least in part, to a lack of awareness or understanding of the differential impact of rate changes on returns across plans and that taxpayer education can increase the quality of retirement savings choices and overall taxpayer utility. However, even when this impact was explicitly and unambiguously explained, participants continued to exhibit a strong preference for back-loaded plans inconsistent with expected wealth maximization. This preference appears to be systematically related to participants' more general attitudes and preferences and the relation of these attitudes and preferences to the plans' tax incentive structure. Further, even after accounting for several attitudes rooted in theory from behavioral economics and psychology, our participants still exhibited a significant unexplained preference for back-loaded plans.

Though we employ multiple experimental methods and a broad-based participant pool to enhance construct and external validity, our study and its implications are nonetheless subject to limitations. For example, it is possible our payment incentives in experiment one did not achieve economic dominance. However, the impact of tax rates observed in experiment one suggests the tax rate manipulation was salient to participants. Furthermore, the study's goal is not to isolate

the economic impact of tax incentives, but rather to examine the impact of those incentives in the context of the judgment made by taxpayers. It is also possible that participants' responses may have been biased by their current plan participation. However, if participants relied on their current savings strategies, it would reduce our ability to detect any effects of our temporal tax rate manipulation in experiment one. Similarly, to the extent that current participation is impacted by restrictions on eligibility that are not imposed in our experiment, participants' reliance on their current participation would bias against findings in all three experiments.

Overall, our findings are relevant to policymakers interested in using the tax system to encourage savings. Taken together, the results suggest a systematic preference for back-loaded plans even when economically dominated by front-loaded plans. As a result, when given a choice between incentive types, a significant number of taxpayers will systematically choose the one providing lower after-tax returns (though not necessarily lower utility). Though educating taxpayers about the relation of temporal tax rate changes and relative returns available from different plan types may reduce misunderstanding, it may nonetheless fail to change a significant number of economically "irrational" choices. Should policymakers prefer a single incentive type, our results suggest that back-loading tax incentives may be a more effective use of government resources to encourage savings. In conjunction with Beshears et. al's (2017) findings that taxpayers may unwittingly accumulate more after-tax funds in back-loaded plans, our results suggest that back-loaded plans may be more effective at increasing retirement savings than more commonly used front-loaded plans.

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Appendix
Variable Definitions

Dependent Variables	
BackPref	Stated preference for a back- or front-loaded plan if only one plan could be selected (1[6] = definitely front-loaded [back-loaded], which we shifted downward to a −2.5[2.5] scale).
BackRatio	The amount of household income allocated to the back-loaded plan, divided by total elected retirement contributions.
Economic Factors	
RateChange	A categorical variable equal to 1, 0, or –1, when the retirement tax rate randomly assigned in experiment one equaled 20, 15, or 10 percent, respectively. All conditions featured a current tax rate of 15 percent.
ExpRateChange	A participant's predicted tax rate in retirement relative to current rates (–3 [3] = much lower [higher]).
Education	An indicator variable equal to 1 when participants received the education treatment before the primary experimental task.
Psychological Experience Utility Factors	
PrepayPref	Latent variable capturing participants' preference for prepayment over debt financing. Primary factor loadings come from *PrepayUE* and *PrepayV*.
RelTempFrame	Latent variable capturing differences in participants' temporal framing of front- and back-loaded retirement plans. Primary factor loadings come from *TempFrameBack* and *TempFrameFront*.
Dread	Latent variable capturing participants' dread with respect to future tax payments. Primary factor loadings come from *Dread10* and *Dread20*.
BackPredict	Latent variable capturing participants' beliefs in the predictability of back-loaded relative to front-loaded retirement plans. Primary factor loadings come from *RelRisk*, *PredTaxTotal*, *PredTaxSave*, and *PredRetFunds*.
Contextual Experience Utility Factors	
TaxDue	An indicator variable equal to 1(0) for conditions where current tax withholdings were less than (greater than) current tax liability, generating a payment (refund) due.
ExpTaxDue	A participant's self-described settlement position on his or her most recent tax return (1[6] = large refund [payment] due), shifted downward to a −2.5 [2.5] scale).
FilingContext	An indicator variable equal to 1 when participants made retroactive contribution decisions in the context of filing a return, and 0 for prospective contribution elections.
Control Variables	
FinSoph	Latent variable capturing participants' financial sophistication. Primary factor loadings come from *HHIncome*, *EdLevel*, *Courses*, and *InvestKnow*.

Elicited Variables Used in Factor Analysis

PrepayUE and *PrepayV*	A participant's choice of financing a month of future unemployment or a future vacation with savings or interest-free debt (7[1] = strongly prefer saving prior to [paying after] the event, shifted downward to a 3[−3] scale).
TempFrameBack and *TempFrameFront*	We asked participants which of the following statements best described their view of a back- (front-) loaded plan: "A: The potential tax savings on my withdrawals (contributions) *directly increased* the taxes I would otherwise have to pay currently (in retirement)." and "B: The potential tax savings on my withdrawals (contributions) had *no direct impact* on the taxes I would otherwise have to pay currently (in retirement)." Response scales ranged from 1 (entirely A) to 7 (entirely B), which we shifted downward to a −3 to +3 scale. Positive numbers represent greater temporal framing.
Dread10 and *Dread20*	We asked participants the most they would pay currently to avoid having to pay $5,000 of additional taxes at three points in the future: one year, ten years, and twenty years (adapted from Loewenstein 1987). We then subtracted the amount each participant would pay to avoid the payment if due in 10 and 20 years from what they would pay to avoid it if due in one year and divided the difference by the one-year amount. Larger numbers suggest higher discounting of future payments (less dread).
PredRetFunds, *PredTaxSave*, and *PredTaxTotal*	Difference between a participant's level of agreement (1 = strongly disagree to 7 = strongly agree) with statements that the total funds available in retirement, the tax savings derived, and the total taxes paid on retirement income are unpredictable for front- and back-loaded plans. Positive scores indicate back-loaded plans are more predictable.
RelRisk	Participants' perception of the "riskier" plan (−1 = back-loaded, 0 = equal, 1 = front-loaded).
Courses	Sum of a participant's self-reported number of college courses taken in accounting, economics, finance, or taxation (0 = none to 4 = more than three courses for each topic area).
EdLevel	A participant's self-reported highest level of education (0 = less than high school to 5 = terminal degree).
HHIncome	A participant's self-reported household income.
InvestKnow	A participant's self-assessed knowledge of personal finance and investing (3[–3] = far above [below] average).

Table 1
Sample Description

	Total Sample	Experiment One	Experiment Two	Experiment Three	General Population
No. Participants	1,643	1,068	283	292	
Average Age	36	36	36	35	38 [a]
Female	54%	55%	57%	46%	51% [b]
Med. Household Income[c]	$56,000	$59,300	$56,000	$54,500	$55,300 [b]
Married	47%	47%	47%	44%	48% [b]
Average Dependents	0.86	0.83	0.93	0.87	0.64 [d]
Highest Education Level Achieved					
High School	20%	18%	25%	25%	41% [b]
Some College	19%	18%	18%	20%	31% [b]
Bachelor's Degree	42%	43%	41%	42%	18% [b]
Graduate School	19%	21%	16%	12%	10% [b]
Households Currently Saving for Retirement	84%	86%	78%	83%	52% [e]
In Back-loaded Plans	33%	33%	30%	32%	
In Front-loaded Plans	53%	54%	51%	49%	
Received Refund in Most Recent Tax Filing	79%	79%	81%	79%	71% [f]
Average Estimated Current Tax Rate	18%	17%	20%	19%	
Average Estimated Retirement Tax Rate	22%	21%	23%	24%	
Expected Change in Tax Rates					
Expect Increase	51%	51%	46%	57%	
Expect to Stay the Same	21%	20%	19%	23%	
Expect to Decrease	28%	28%	34%	20%	
Mean Task Completion Time (minutes)	30	32	27	27	
Effective Wage/Hr.	$5.37	$5.55	$5.00	$5.07	

[a] Median age per the 2016 American Community Survey, Demographics and Housing Estimates.
[b] 2016 U.S. Census.
[c] Self-reported household income.
[d] Tax year 2015 IRS Statistics of Income, [(Number of Exemptions – Exemptions for Taxpayers)/Number of Returns].
[e] Federal Reserve Bulletin Vol. 103, No. 3 (September 2017).
[f] 2016 IRS e-file statistics.

Table 2
Elicited Psychological Variables

Panel A: Descriptive Statistics

Elicited Response	Mean	Std. Dev.	Min.	Max.	t	Std. Error	p-value
PrepayUE	1.618	1.807	−3	3	36.302	(0.045)	<0.001
PrepayV	1.634	1.896	−3	3	34.916	(0.047)	<0.001
Dread10	0.245	0.521	−1	1	19.060	(0.013)	<0.001
Dread20	0.376	0.615	−1	1	24.779	(0.015)	<0.001
TempFrameBack	−0.802	1.891	−3	3	−17.180	(0.047)	<0.001
TempFrameFront	1.017	1.774	−3	3	23.243	(0.044)	<0.001
RelRisk	−0.489	0.693	−1	1	−28.622	(0.017)	<0.001
PredTaxTotal	−1.985	2.720	−6	6	−29.590	(0.067)	<0.001
PredTaxSave	−0.778	2.500	−6	6	−12.623	(0.062)	<0.001
PredRetFunds	−1.296	2.227	−6	6	−23.581	(0.055)	<0.001
HHIncome[a]	6.795	4.798	0	75	57.402	(0.118)	<0.001
EdLevel	2.621	1.081	0	5	98.250	(0.027)	<0.001
Courses	2.927	3.459	0	16	34.297	(0.085)	<0.001
InvestKnow	−0.239	1.321	−3	3	−7.337	(0.033)	<0.001

Panel B: Factor Analysis

	Rotated Factor Pattern				
Elicited Response	*PrepayPref*	*Dread*	*RelTempFrame*	*BackPredict*	*FinSoph*
PrepayUE	0.849				
PrepayV	0.850				
Dread10		−0.975			
Dread20		−0.974			
TempFrameBack			−0.794		
TempFrameFront			0.737		
RelRisk				0.606	
PredTaxTotal				0.787	
PredTaxSave				0.715	
PredRetFunds				0.767	
HHIncome					0.579
EdLevel					0.675
Courses					0.690
InvestKnow					0.693
Factor Eigenvalue	1.510	1.980	1.170	2.350	1.620
Percent Explained	10.800	14.140	8.330	16.810	11.550
Mean	-0.001	0.000	0.006	0.016	0.001
Std. Dev.	1.000	1.000	1.001	1.004	1.003
Min.	−3.120	−1.440	−3.175	−3.314	−2.475
Max.	1.936	2.638	2.137	2.445	5.196

Notes: Panel A contains information regarding participants' responses to questions capturing underlying attitudes and perceptions. Panel B reports the results of a confirmatory factor analysis with a varimax rotation. Factor loadings below 0.3 have been suppressed for presentation purposes. See Appendix for variable definitions.

[a] Self-reported household income scaled by 10,000 for presentation purposes.

Table 3
Experiment One Results

Panel A: Regression Results

		BackPref			*BackRatio*		
Variable	**Pred. Sign**	**Estimate**	**Std. Error**	**p-value**	**Estimate**	**Std. Error**	**p-value**
Intercept		0.898	(0.100)	<0.001	0.666	(0.022)	<0.001
RateChange	+(H1)	0.365	(0.075)	<0.001	0.065	(0.016)	<0.001
Education		−0.181	(0.092)	0.049	−0.047	(0.020)	0.019
RateChange × *Education*	+(H2)	0.171	(0.115)	0.069	0.063	(0.025)	0.006
FinSoph		−0.186	(0.050)	<0.001	−0.032	(0.011)	0.003
PrepayPref	+ (H3)	0.281	(0.052)	<0.001	0.055	(0.011)	<0.001
RelTempFrame	+ (H3)	0.151	(0.049)	0.001	0.027	(0.010)	0.004
Dread	+ (H3)	0.083	(0.044)	0.030	0.020	(0.009)	0.016
BackPredict	+ (H3)	0.470	(0.050)	<0.001	0.080	(0.011)	<0.001
TaxDue	− (H4a)	−0.121	(0.130)	0.180	−0.032	(0.028)	0.131
FilingContext	− (H4b)	−0.017	(0.124)	0.446	0.024	(0.028)	0.200
TaxDue × *FilingContext*	− (H4c)	0.088	(0.183)	0.316	0.024	(0.040)	0.275
No. Participants		1,068			1,068		
F		21.74			17.58		
Pr > F		<0.0001			<0.0001		
Adj. R-squared		0.184			0.154		

Notes: Both models report OLS estimates of participants' relative preferences for back-loaded retirement plans. Standard errors are bootstrapped over 10,000 replications. See Appendix for variable definitions. All p-values relating to hypothesized (unhypothesized) effects are one-tailed (two-tailed).

Panel B: Plan Choices by Those Educated Regarding the Impact of Rate Changes on Relative Returns

	Tax Rate Change	
	Decreasing	**Increasing**
Participants Choosing		
Back-loaded Plan	48%	83%
Front-loaded Plan	52%	17%

Table 4
Experiment Two Results

Panel A: Maximum Likelihood Results

		BackPref			***BackRatio***		
Variable	**Pred. Sign**	**Estimate**	**Std. Error**	**p-value**	**Estimate**	**Std. Error**	**p-value**
Intercept		0.658	(0.155)	<0.001	0.651	(0.033)	<0.001
ExpRateChange	+(H1)	−0.036	(0.082)	0.330	0.005	(0.017)	0.396
Education		−0.246	(0.187)	0.189	−0.070	(0.040)	0.077
ExpRateChange × *Education*	+(H2)	0.339	(0.121)	0.003	0.064	(0.025)	0.006
FinSoph		−0.292	(0.088)	0.001	−0.069	(0.019)	<0.001
PrepayPref	+ (H3)	0.089	(0.089)	0.160	0.020	(0.019)	0.140
RelTempFrame	+ (H3)	0.054	(0.088)	0.272	0.026	(0.019)	0.082
Dread	+ (H3)	0.015	(0.106)	0.445	0.000	(0.022)	0.498
BackPredict	+ (H3)	0.627	(0.082)	<0.001	0.131	(0.017)	<0.001
ExpTaxDue	− (H4a)	−0.116	(0.091)	0.100	−0.010	(0.019)	0.307
FilingContext	− (H4b)	0.006	(0.082)	0.473	−0.028	(0.018)	0.065
ExpTaxDue × *FilingContext*	− (H4c)	−0.102	(0.155)	0.056	−0.041	(0.033)	0.002
No. Participants		283			283		
Chi-squared		97.110			109.900		
Pr > Chi-squared		<0.001			<0.001		
Log Likelihood		−974.000			−128.200		

Notes: Both models report restricted maximum likelihood (REML) estimates of participants' relative preferences for back-loaded retirement plans, with random effects applied by subject. See Appendix for variable definitions. All p-values relating to hypothesized (unhypothesized) effects are one-tailed (two-tailed).

Panel B: Plan Choices by Those Educated Regarding the Impact of Rate Changes on Relative Returns

	Reported Tax Rate Expectations			
	Decreasing		**Increasing**	
	Retrospective Contributions	Prospective Contributions	Retrospective Contributions	Prospective Contributions
Participants Choosing				
Back-loaded Plan	49%	49%	82%	80%
Front-loaded Plan	51%	51%	18%	20%

Table 5
Experiment Three Results

		BackPref			***BackRatio***		
Variable	**Pred. Sign**	**Estimate**	**Std. Error**	**p-value**	**Estimate**	**Std. Error**	**p-value**
Intercept		0.792	(0.117)	<0.001	0.664	(0.026)	<0.001
FinSoph		−0.213	(0.090)	0.018	−0.039	(0.019)	0.044
PrepayPref	+ (H3)	0.224	(0.085)	0.004	0.039	(0.018)	0.017
RelTempFrame	+ (H3)	0.383	(0.087)	<0.001	0.067	(0.019)	<0.001
Dread	+ (H3)	0.288	(0.110)	0.005	0.032	(0.024)	0.089
BackPredict	+ (H3)	0.561	(0.085)	<0.001	0.104	(0.018)	<0.001
ExpTaxDue	− (H4a)	−0.121	(0.090)	0.090	−0.030	(0.020)	0.068
FilingContext	− (H4b)	−0.279	(0.088)	0.001	−0.081	(0.022)	<0.001
ExpTaxDue × *FilingContext*	− (H4c)	−0.118	(0.117)	0.046	−0.043	(0.026)	0.008
No. Participants		292			292		
Chi-squared		91.940			77.210		
Pr > Chi-squared		<0.001			<0.001		
Log Likelihood		−1,020.500			−179.100		

Notes: Both models report restricted maximum likelihood (REML) estimates of participants' relative preferences for back-loaded retirement plans, with random effects applied by subject. See Appendix for variable definitions. All p-values relating to hypothesized (unhypothesized) effects are one-tailed (two-tailed).