Contribution location decisions and inertia in retirement plans: evidence from the non-profit sector

Brent J. Davis, TIAA Institute

David P. Richardson, TIAA Institute

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Abstract
Employers offering Defined Contribution (DC) plans have the option to provide a Roth account in addition to traditional tax-deferred accounts. Traditional accounts provide deferral of contributions and asset earnings, with distributions fully taxable. By comparison, Roth contributions are not deducted from current taxable income and withdrawals (including asset earnings) are tax-free. In this study, we analyze the characteristics of workers who are Roth contributors within a TIAA record-kept plan. In 2018, 42% of actively-contributing TIAA participants were in a plan with a Roth option. We find 12% of participants use a Roth option. Utilization of a Roth option depends on age, default status, plan contribution requirements, and whether a Roth option was available when joining the plan. We find evidence of contribution inertia, with participants who did not have a Roth option when joining the plan being less likely to have Roth contributions. Half of Roth contributors use Roth accounts exclusively. Roth-contributing participants save more on a tax-equivalent basis except when they have mandatory contributions. Our results provide insight into how plan design impacts household tax location decisions and provides insights into how retirement policy changes may affect household retirement security.

Keywords: Roth, retirement, asset location, tax diversification
JEL Codes: J26, G51, G11

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1 Introduction

For decades, workers contributed on a pre-tax basis when participating in an Individual Retirement Account (IRA) or defined contribution (DC) retirement plan. These accounts provided tax-deferral of contributions and asset earnings, with account distributions fully taxed at ordinary income tax rates. Roth treatment of retirement accounts were introduced as part of the Taxpayer Relief Act of 1997 for IRAs and for DC plans as part of the Economic Growth and Tax Relief Reconciliation Act of 2001 and became an active option in those accounts in 2006. By comparison to traditional tax treatment, Roth contributions are fully-taxable but asset earnings and distributions are tax-free. This latter policy change introduced a tax location choice for worker's DC retirement savings. Assuming households have the same income tax schedules at the time of contribution and withdrawal, the only difference between Roth and pre-tax accounts is the timing of the tax payment.

Households expecting higher (lower) tax rates in retirement can reduce expected lifetime tax liability by locating relatively more (less) contributions to Roth accounts. However, most households face substantial uncertainty about future tax rates. Brown, Cederburg, and O'Doherty (2017) find that households may be able to reduce expected their lifetime tax liability by mixing their contributions across both Roth and pre-tax accounts. While paying taxes at the time of contribution insures against future income tax increases, pre-tax contributions best manage current tax liability and insure against low account performance via the progressive income tax schedule. Their analysis finds that many households should split contributions between traditional and Roth accounts, and that the percent allocated to tax-deferral increases as tax uncertainty diminishes (as a household nears retirement age). Despite the benefits of incorporating Roth contributions into an overall tax location strategy, Roth accounts are used by a small minority of retirement savers, statistics from ICI (2023) show these accounting for only 9% of IRA assets in 2022. This may be due to the relatively recent adoption of Roth provisions or may be due to behavioral considerations.

In this paper, we analyze the tax location choice of employee contributions in DC plans using administrative data from plans record-kept by TIAA. We document the characteristics of Roth contributors and how they split their contribution dollars across traditional pre-tax and Roth accounts. Following our descriptive findings, we compare tax location decisions to the Brown et al. (2017) location benchmark. Finally, we use an event study to examine inertia in location

decisions by exploiting when a Roth account became available in the plan and when a participant joined the plan.

Our work adds several important aspects to the literature on retirement savings decisions and household finance. More broadly, our study connects various aspects of retirement plan design (Mitchell and Utkus, 2004; Bubb and Warren, 2020), including impact of default rules (Beshears et al. 2009). More specific to our study, we extend the limited empirical literature examining asset location decisions with Roth accounts (Beshears et al. 2014, 2017; Burman et al. 2001), as historically this literature examined the location choice between pre-tax accounts and taxable brokerage accounts (Poterba et al. 2004; Bergstresser and Poterba 2004; Dammon et al 2005). Our study complements and extends Beshears et al. (2014) with more recent data, which is important as individuals become more accustomed to Roth saving availability, using a larger sample in a different sector of the workforce.

In 2018, 42% of active participants were in a plan that allowed Roth contributions (Roth eligible). On the extensive margin, we find that 12.0% of Roth eligible participants contribute to a Roth account—complementing findings from the for-profit sector.[1] This percentage is higher for younger participants, males, and those who make active investment decisions. Because auto-enrollment defaults participants in a pre-tax savings account, our finding comports with research that passive investors are more likely to fully accept default provisions. Another tax margin is the ability to exceed the qualified deferral limit. Because the contribution limit is the same for both Traditional and Roth accounts, workers can effectively contribute more to a Roth account because it includes the tax payment.[2] We find participants contributing the maximum amount were significantly less likely to use Roth accounts compared to participants contributing below the qualified limit, suggesting this group is more focused on managing current tax liability than tax-schedule uncertainty. On the intensive margin, we find little evidence that workers follow the Brown et al. (2017) finding that the optimal contribution allocation is "age + 20%" to a traditional account. Half of Roth contributors in our sample use Roth accounts exclusively and 10% use a simple 50/50 location heuristic to split contributions between Roth and traditional pre-tax accounts.

[1] See Beshears et al. (2014) and PSCA (2018).
[2] The contribution limit in 2018 for 403(b) plans is $18,500. If the plan allows catch-up contributions the limit was $24,500 for participants aged 50 and older.

A common plan design feature among plans in the public and not-for-profit sectors is mandatory employee contributions to a primary retirement plan as a condition of employment. By contrast, voluntary employee contributions to a primary or supplemental retirement plan may be either Roth or tax-deferred. Mandatory contributions are always located in a pre-tax account and only those participants with voluntary contributions above the mandatory minimum have a location choice. We find that participants with both mandatory and voluntary contributions are 7% more likely to be Roth participants and use Roth accounts with greater intensity, compared to those with only voluntary contributions. This result adds to the few studies that examine impact that mandatory contributions have on savings decisions (Friedberg et al. 2021; Card and Ransom, 2011).

If participants focus on savings rates as the salient feature when contribution to retirement plans, then Roth contributors would pre-purchase more retirement consumption has they have already paid taxes on this amount. Consistent with previous literature (Beshears et al 2017), we find evidence that Roth contributors save more. Importantly, however, this finding does not extend to participants with mandatory contributions. This shows that the impact location choices have on saving amounts can be sensitive to plan design elements.

Conducting an event study, we examine location decisions by delineating between participants who join their plan before or after the introduction of a Roth option. Participants who joined plans before a Roth option was introduced were significantly less likely to use the Roth accounts, by a nearly 10 percentage point difference. This suggests that there is substantial inertia in participants' contribution location decisions. This finding follows inertia in other household finance and retirement decisions, such as contribution amounts and asset allocation (Agnew et al. 2003; Ameriks and Zeldes, 2004; Mitchell et al. 2006).

The remainder of the paper is structured as follows. The tradeoff between traditional and Roth contributions is discussed in Section 2. Section 3 describes our sample. Section 4 examines characteristics of Roth contributors. Section 5 overviews our optimal benchmarking analysis followed by our event-study in section 6. Section 7 offers concluding thoughts.

2. The Pre-tax versus Roth decision

Employees[3] are only eligible to put their own voluntary contributions in a Roth account if a Roth account is offered by the plan. If offered, employees then have a location choice to allocate their contribution dollars to a Roth or pre-tax account, or both. By comparison, employer contributions can only be made to a pre-tax account. Assuming an individual's marginal tax rate is the same at the time of contribution and retirement, then both locations provide equivalent tax liability and retirement consumption, and the only difference is the timing of the tax. However, there is considerable uncertainty around future marginal tax rates, and in particular for younger workers. Tax rates in retirement can differ if either taxable income or income-tax schedules change. If the tax rate in retirement is higher (lower), then the employee can lower lifetime tax liability and increase retirement consumption by using the Roth (pre-tax) account. By committing to paying (deferring) taxes at the time of contribution, the participant can "insure" against future tax rate increases (decreases).

When employee contributions are matched by an employer, the attractiveness of a pre-tax account is greater for liquidity-constrained individuals compared to a Roth account. This is because d dollars of employee pre-tax contributions are matched with d employer dollars, but only $(1-\tau_0)d$ Roth contributions are matched with d dollars, where $0 < \tau_0 < 1$ is the participant's current marginal tax rate. Assume a participant is liquidity constrained and only able to contribute a dollars, and $a < (1+\tau_0)d$. This participant would not be able to receive the full employer match as that would require Roth contribution dollars of $d_R = (1+\tau_0)d$. If they switch to a pre-tax account, then d contributions are match with d dollars, which provides a better outcome under reasonable future tax assumptions, since $d > d_R$.[4]

Many non-profit employers provide a primary employee non-contributory plan or a flat contribution to an employee contributory retirement plan.[5] If the employer provides a flat contribution without requiring any employee contributions, then the attractiveness of a worker contributing to a supplemental Roth account increases compared to the employer-matching case. This is because there is no contribution requirement on receiving employer contributions. Some employers require employee pre-tax contributions as a condition of participation in a primary plan,

[3] We use the term employee and participant synonymously throughout the paper.
[4] Beshears et al. (2024) provide further discussion on this point.
[5] See Card and Ransom (2011) for discussion on this taxonomy.

which is not uncommon in the public or not-for-profit sector. In this case, Roth contributions may be attractive to participants with desire to contribute beyond the mandatory minimum contribution amount. Provided a participant desires to make contributions beyond the mandatory amount, increasing the attractiveness of a Roth contribution increases compared to an employee who has no mandatory contribution requirement. This is because as the individual already has a pre-tax deferral on the pre-tax mandatory contribution amount.

DC plan participants have substantial flexibility in determining what percent of their salary to contribute to a workplace retirement plan. Intuitively, saving rates (what can I afford?) may be a more salient feature for participants than the tax-equivalent amount (what are my tax savings?) when considering how much to save. This could lead Roth investors to purchase more retirement consumption compared to pre-tax only savers. Beshears et al (2017) find some evidence for this. We also find evidence for this in our setting, but notably only for participants without mandatory contributions.

A natural question to ask is what is the optimal mix of contributions between Roth and pre-tax accounts? Optimal retirement saving location depends on one's current income tax schedule and their expected income tax schedule in retirement. Brown et al. (2017) use historical tax schedules and portfolio returns to derive an optimal location strategy. They derived a simple investment rule that closely matches the fully optimized model. This rule is to locate *(Age + 20)%* of retirement savings to a traditional account, and the remaining amount to a Roth account, unless one is in the lowest tax bracket, where the rule is to locate all savings in a Roth account. We examine participant location portfolios against this rule as a benchmark in section 5.

3. Data Description

We examine contribution location decisions for participants making voluntary employee contributions to a plan that allowed Roth contributions (Roth eligible). We use a cross-section of administrative data from plans where TIAA is the sole record keeper.[6] In 2023, TIAA served approximately 4.7 million individuals. For the year of our study – 2018 -- there were approximately 1.5 million participants at TIAA who were actively contributing to a workplace retirement plan. We then limit the sample to the 911,703 participants (1) who contributed throughout year, and (2)

[6] In the not-for-profit sector, many employers have multi-vendor recordkeepers where participants accumulations and contributions could be with one or multiple record-keepers. Restricting to sole record kept plans allows us to know all balances and contributions for a participant.

are in plans that are sole-record kept by TIAA. We include only participants were in a plan with a Roth account option (42.3%), leaving us with a sample of 385,315 participants in 2018.[7] We do not know Roth coverage for inactive (non-contributing) participants. For example, we do not have data on participants with an available supplemental plan but do not make supplemental contributions, and thus we do not know the overall Roth coverage for all participants. At the plan level, 19.2% of 403(b) plans that allow employee money have a Roth account option.

Table 1 provides summary statistics for our sample of contributing participants. The average participant is 47 years old, has a balance of $199,425, and has been in a TIAA record kept plan for 10.2 years. Six in ten of contributors are women. The average total contribution is $13,005, of which 56% are funded by the employee and 44% by the employe4. About 10% of participants have mandatory employee contributions. Over one-third of participants (36.1%) defaulted into the plan's default investment option and remained fully in the QDIA. Based on age and income, we estimate 6.6% of participants contributed to the qualified maximum deferral limit. We have salary information for 62.4% of the sample, which is almost $87,000 on average. Average total contribution rates were 14.8%.

A majority (55.3%) contributed only to a primary retirement plan, while 35.8% contributed to both a primary and supplemental plan. Less than one in ten (8.9%) contributed only to a supplemental plan. The latter group may have a defined benefit plan as the primary plan.

[7] If a participant did not make any voluntary contributions (they only had mandatory employee contributions), they are classified as not having a Roth option since none of their contributions could be located in a Roth account. That is, based on their plan participation, they were not Roth eligible.

Table 1. Summary statistics

Variable	Mean	St. Dev.
Age	46.6	12.8
Female (%)	60.1	
TIAA Tenure (yrs)	10.2	9.8
Asset Balance	199,425	371,942
Defaulter (%)	36.1	
Max Contributor (%)	6.6	
% with Employer Contributions	87.1	
% with Mandatory Contributions	10.2	
% with Roth Contributions	12.0	
Total Contributions ($)	13,004	12,325
Employee Contributions ($)	7,043	7,475
Vol Pre-tax Contributions ($)	6,144	6,993
Vol Roth Contributions ($)	461	2,106
Mandatory Contributions ($)	438	1,809
Employer Contributions ($)	5,960	6,256
Salary ($)	86,881	61,078
Total Employee Contribution Rate (%) ($)	14.8	9.4
Employee Contribution Rate (%)	8	7.2
Employer Contribution Rate (%)	6.7	4.3
Primary only (%)	55.3	
Supplemental only (%)	35.8	
Primary and Supplemental (%)	8.9	

Notes: We include salary data if salary is known and between $5,000 and $500,000. The number of observations is 385,315 except for salary which is 240,271. For calculating contribution rate, we include individuals with a tenure of contributing to TIAA of at least one to control for partial-year contributors.
Source: Authors' analysis of administrative records.

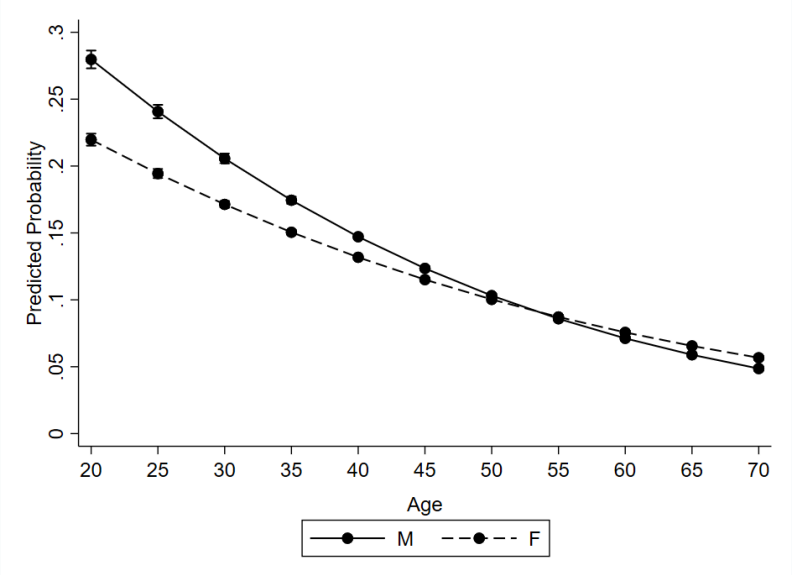
4. Characteristics of Roth contributors

4.1 The Extensive Margin: Who Makes a Roth Contribution

In 2018, 12.0% of participants in our sample contributed to a Roth account. Figure 1 shows the predicted probability of making a Roth contribution by age and sex using results from a logit regression model. Overall, 20.0% of participants under 30 contributed to a Roth account, which monotonically and significantly decreases to 7.9% for participants over 50 years old. The pattern is similar for males and females, but younger males have a significantly higher propensity to use Roth accounts. After age 50, women are slightly more likely to use a Roth account. These empirical findings match lifecycle expectations. Roth accounts may be more attractive to younger workers who expect greater income growth as they advance through their career and thus expect higher income in retirement than they have currently. Likewise, the immediate pre-tax deduction is not as impactful for younger workers as they on average lower salaries facing and face a lower

marginal income tax than older workers with higher salaries. And younger works have a longer time horizon and more uncertainty around income tax rates in retirement compared to older workers. Brown et al. (2017) demonstrate that a Roth option can be valuable to savers given historical variance in income tax rates, which depends on the length of the investors investment horizon. They model that participants with a 10-year investment horizon are willing to pay up to 0.5% in additional fees for access to a Roth account, which increases to up to 1.2% with a 30-year investment horizon.

Figure 1. Likelihood of making a Roth contribution by age and sex

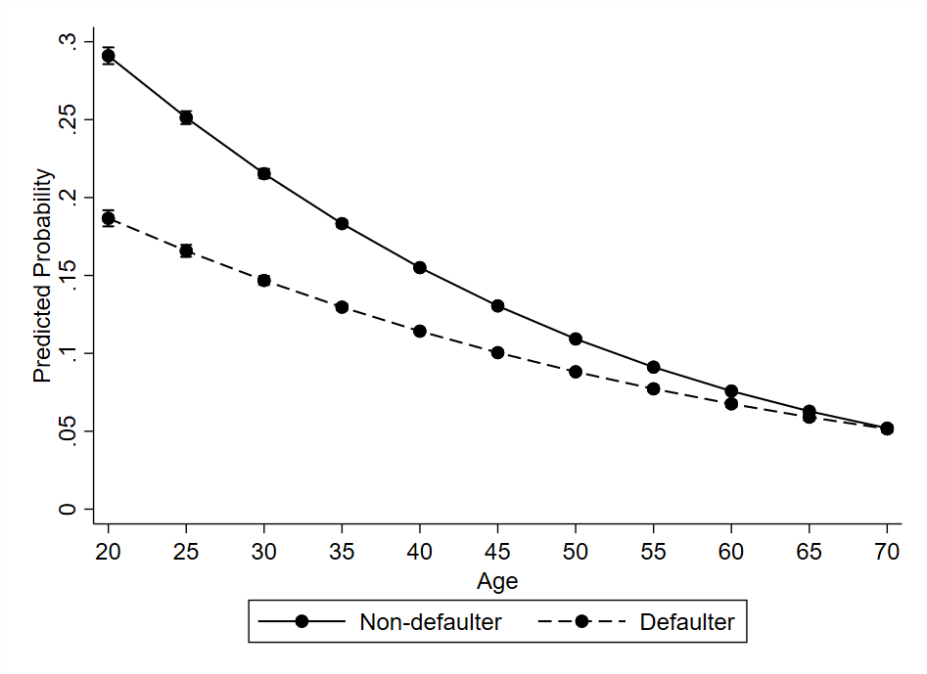


Source: Authors' analysis of administrative records.
Notes: Figure plots predicted probabilities from Logit estimates interacting sex and age. Sex and age are the only control. Whiskers denote 95 percent confidence intervals with robust standard errors.

DC plan design elements, such as defaults investment offerings (Choi et al. 2002; McDonald et al. 2019, 2021), auto-enrollment (Madrian and Shea, 2001), and contribution rules (Davis et al. 2024) have a powerful effect on retirement savings behavior. Because locating contributions to Roth accounts requires an active choice, we expect that passive savers using default investment allocations would be more likely to save in default pre-tax accounts. We identify participants who in a plan default's investment. Figure 2 examine the likelihood of making a Roth contribution by default status and age. In our data, 36.1% of participants were plan

investment defaulters. This percentage declines monotonically by age, from 48.6% of participants under age 30 to 26.9% of participants aged 50 and older. Figure 2 displays the predicted probability of making a Roth contribution by plan investment default status and age group. The empirical evidence supports our hypothesis that non-defaulters are more likely to utilize a Roth account. For participants under age 60, defaulters were significantly less likely to make Roth contributions, which decreases by age. A non-defaulter at age 25 was 51.7% more likely compared with a defaulter to make a Roth contribution, which decreased to 18.0% increase at age 55.

Figure 2. Likelihood of making a Roth contribution by age and plan investment defaulter status

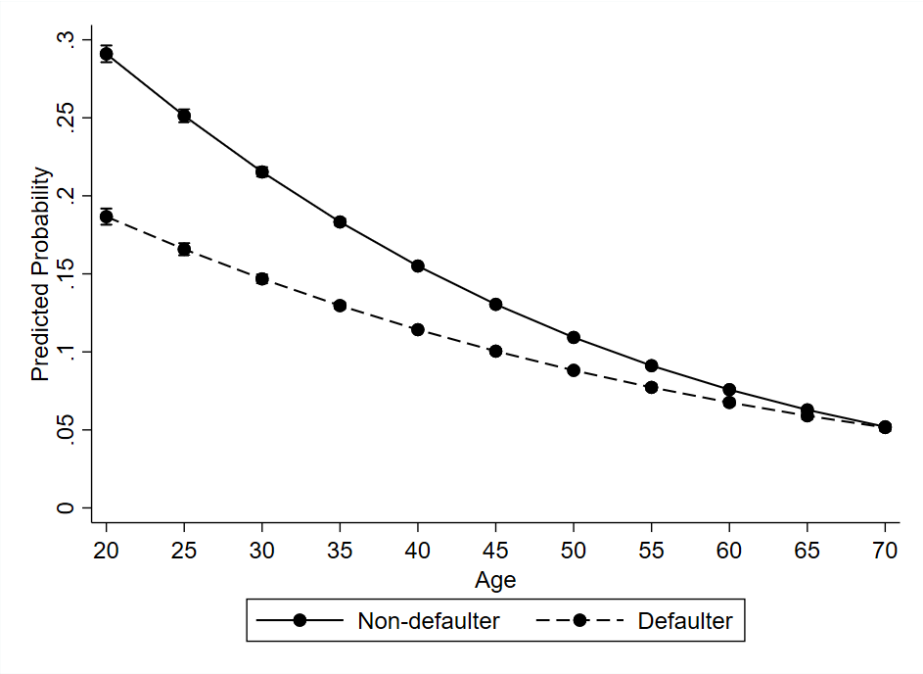


Source: Authors' analysis of administrative records.
Notes: Figure plots predicted probabilities from Logit estimates interacting plan defaulter status and age. Plan defaulter status and age are the only control. Whiskers denote 95 percent confidence intervals with robust standard errors.

The propensity to use a Roth account may also depend on whether a participant has mandatory contributions. This is because participants with mandatory contributions must make additional voluntary contributions if they want to contribute to a Roth account. As discussed, the presence of mandatory contributions increases the attractiveness of a Roth account for participants' next available contribution dollar. Overall, 16.7% of participants with mandatory and voluntary contributions use a Roth account, significantly higher than 10.8% of participants without

mandatory contributions. Figure 3 displays the predicted probability of a Roth contribution by whether a participant has mandatory contributions or not. At each age, participants with mandatory contributions who make additional voluntary contributions are over 52% more likely to make a Roth contribution compared to participants without mandatory contributions, supporting the economic intuition.

Figure 3. Likelihood of making a Roth contribution by age and having mandatory contributions



Source: Authors' analysis of administrative records.
Notes: Figure plots predicted probabilities from Logit estimates interacting mandatory contributor status and age. Mandatory contributor status and age are the only control. Whiskers denote 95 percent confidence intervals with robust standard errors.

In Table 2, we use logit regressions to estimate the likelihood of making a Roth contribution, showing marginal effects and robust standard errors in parentheses. In our base model (1) we control for Age, Gender, Tenure (years) in a TIAA record kept plan, whether the participant had mandatory contributions (Mand), employee contribution amounts, and plan investment

defaulters (Defaulter). Model (2) has a dummy variable for Maximum contributors. Model (3) includes the subset with Salary and Model (4) has Contribution Rates. Model (5) limits the sample to participants with mandatory contributions.

Following Figures 1-4, age, sex, default status, and having mandatory contributions are all significantly related to making Roth contributions. For each additional age, a participant is predicted to use a Roth account by 0.5 percent points (pp) less. Defaulters are 4pp less likely to use Roth accounts. While this may seem small it is a 33% decrease compared to the mean (=-0.04/0.12). Salary has a significantly negative relation – a 1% increase in salary is related to a 1.7pp to 2.6pp decrease in making a Roth contribution. This is intuitive because, all else equal, higher salary contributors are more likely to have a higher marginal tax rate, decreasing the appeal of a Roth contribution. Contribution rates and dollar amounts have limited explanatory power. We find participants with mandatory contributions who make additional voluntary contributions is the strongest predictor of making a Roth contribution. Mandatory contributors were 6.6pp significantly more likely to use Roth accounts, which is a 55% (=.066/.12) increase compared to the mean. Model 5 includes mandatory contributions as a control. For each 1% increase in mandatory contributions, we find a significant increase of 1.8pp in the likelihood of making a Roth contribution.

One objection to Roth accounts is high household income maximum contributors may be more likely to make Roth contributions if their objective is effectively contributing more than qualified limit by using Roth contributions. Overall, we estimate 7.5% of participants in our sample meet the contribution limit. While maximum contributors were less likely to make a Roth contribution (9.4%) than pre-tax only investors (12.2%) in the sample overall, there is no significant difference in Table 2 when control for individual characteristics.

We also control for participants who contribute to a supplemental account, either in addition to contribution to their primary plan (Prim + Supp) or only to a supplemental plan (Supp only). The latter is an indication of overage by a primary defined benefit plan, which is still prominent in the public sector. We find that compared to participants contributing only to a primary plan, those who make additional supplemental contributions were 2 to 3pp more likely to make a Roth contribution. Because few supplemental plans, especially in the public sector [footnote], see Clark, Craig, Freely, and Richardson (2025), have automatic enrollment, making a supplemental contribution requires additional action by the participant. This result that more engaged

participants are more likely to make Roth contributions comports with our 'defaulter' finding. Participants contributing only to the supplemental plan were 0.5pp more likely to make a Roth contribution, which is intuitive if they are in a primary DB plan that provides taxable income in retirement. However, this later result is not significant with the salary subsample.

Table 2. Making a Roth contribution, logit estimates

	(1)	(2)	(3)	(4)	(5)
Age	-0.004***	-0.003***	-0.002***	-0.003***	-0.008***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
Age^2	0.000	0.000	-0.000***	-0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Woman	-0.007***	-0.008***	-0.010***	-0.011***	-0.005
	(0.001)	(0.001)	(0.001)	(0.001)	(0.005)
TIAA Tenure	-0.002***	-0.002***	-0.001***	-0.001***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Defaulter	-0.040***	-0.041***	-0.040***	-0.039***	-0.041***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.005)
Mand	0.066***	0.068***	0.060***	0.058***	
	(0.002)	(0.002)	(0.002)	(0.002)	
Prim + Supp	0.028***	0.030***	0.025***	0.024***	0.075***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.005)
Supp only	0.005**	0.005***	0.001	0.000	
	(0.002)	(0.002)	(0.002)	(0.002)	
Max		-0.004**			-0.133
		(0.002)			(0.096)
EE Contrib ($)	0.000***		0.000***		
	(0.000)		(0.000)		
Log(Salary)			-0.026***	-0.017***	-0.042***
			(0.001)	(0.001)	(0.005)
EE Rate				0.175***	
				(0.009)	
ER Rate				0.001	-0.624***
				(0.018)	(0.103)
Mand EE Rate					2.051***
					(0.101)
N	385,315	385,315	240,271	240,271	22,109
Dep. Var Mean	0.12	0.12	0.11	0.11	0.15

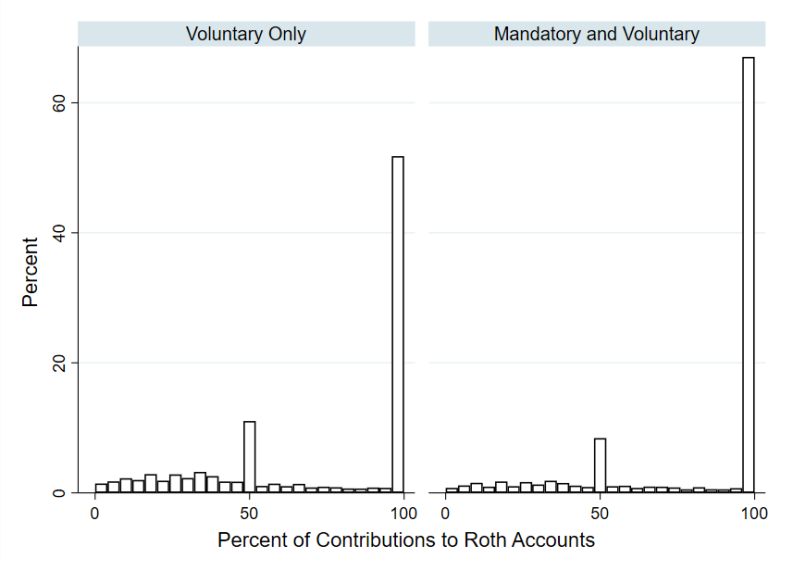
Logit estimates with marginal coefficients shown. Standard errors at the individual level are provided in parenthesis. *, **, *** represents significance at the 10%, 5%, and 1% levels.

4.2 The Intensive Margin: Relative Roth Contributions

In this section we examine the fraction of Roth contributions located in Roth accounts among Roth contributors. Overall, 53.5% of Roth contributors use Roth accounts exclusively for their voluntary contributions and 10.0% used a 50/50 allocation rule.[8] While the prior result suggests intertemporal tax optimization, the latter strategy may be a behavioral effect. With two location options, a participate implementing a naïve 1/n investment strategy (Benartzi and Thaler, 2001; DeMiguel et al. 2009) across tax locations would choose half of their contributions to Roth and half to pre-tax accounts.

Figure 4 shows the fraction of voluntary contributions located to Roth accounts among Roth contributors, faceted by whether participants have mandatory contributions. Again, there is significant difference between participants with and without mandatory contributions; 51.1% of participants without mandatory contributions used Roth accounts exclusively, significantly fewer than 66.7% of participants with mandatory contributions. There is a higher likelihood of making relative Roth contributions between below 50/50 than above but no other notable allocation splits.

Figure 4. Histograms of relative roth contribution amounts by contributor type



Notes: 100 represents all voluntary contributions located in a Roth accounts, while 30 represents 30% of voluntary contribution are located in a Roth account, and similarly throughout.
Source: Author tabulations of administrative data.

[8] We define a 50/50 split as someone who allocates more than 48% but less than 52% of voluntary contributions in a Roth account.

Are maximum contributors who make a Roth investment more likely to further relax the contribution constraint by locating more relative contributions to Roth accounts than Roth investors who are not at the maximum contribution constraint? We find maximum contributors use Roth accounts *less* on the intensive margin. Conditional mean relative contributions to Roth accounts were 62.7% among maximum contributors, significantly less than 73.6% among non-maximum contributors.

Due to the dichotomous distribution of relative Roth contributions, in Table 3 we provide Logit estimates on the likelihood of locating all voluntary contributions to Roth accounts among Roth investors. Marginal effects with robust standard errors in parenthesis are shown with specifications akin to Table 2. We find females, older participants, participants with higher salaries, and maximum contributors were less likely to use Roth accounts exclusively when contributing at least one dollar to a Roth account. Participants with mandatory contributions are significantly more likely to locate all voluntary contributions in Roth accounts. Higher mandatory contribution rates were significantly related to greater likelihood of locating all voluntary contributions in Roth accounts with a high elasticity. For a 1% increase in the mandatory amount, the likelihood Roth investors allocate all available contributions to Roth accounts increases by 2.9pp.

Table 3. Estimates for locating all voluntary contributions to Roth accounts among Roth investors

	(1)	(2)	(3)	(4)
Age	-0.018***	-0.021***	-0.017***	-0.020***
	(0.001)	(0.001)	(0.002)	(0.005)
Age^2	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Woman	-0.033***	-0.018***	-0.038***	-0.012
	(0.005)	(0.005)	(0.006)	(0.016)
TIAA Tenure	-0.002***	-0.004***	-0.003***	0.002**
	(0.000)	(0.000)	(0.000)	(0.001)
Defaulter	-0.079***	-0.069***	-0.076***	-0.067***
	(0.005)	(0.005)	(0.006)	(0.017)
Mand	0.267***	0.221***	0.253***	
	(0.007)	(0.007)	(0.010)	
Prim + Supp	-0.090***	-0.111***	-0.051***	0.092***
	(0.005)	(0.005)	(0.007)	(0.020)
Supp only	-0.005	-0.002	0.011	
	(0.008)	(0.008)	(0.012)	
Max		-0.055***		
		(0.010)		
EE Contrib ($)	-0.000***		0.000***	
	(0.000)		(0.000)	
Log(Salary)			-0.079***	-0.110***
			(0.006)	(0.017)
EE Rate			-1.508***	
			(0.059)	
ER Rate			0.961***	-1.118***
			(0.096)	(0.362)
Mand EE Rate				2.881***
				(0.372)
N	46,247	46,247	26,802	3,726
Dep. Var Mean	0.53	0.53	0.53	0.66

Logit estimates with marginal coefficients shown. Standard errors at the individual level are provided in parenthesis. *, **, *** represents significance at the 10%, 5%, and 1% levels.

4.3. The Intensive Margin: Contribution Rates

We next examine how the location decision varies by employee contribution savings rates. Beshears et al (2017) found that Roth contributors may focus on the amount of salary deferred to savings and not the tax-equivalent amount of pre-purchased retirement consumption. They conclude if the savings rate is the salient feature of savings, Roth contributors would relatively save more.

We provide linear estimates of contribution rates in Table 4 controlling for participants who make Roth contributions. A positive coefficient indicates greater tax-equivalent savings. A negative coefficient indicates equivalent or lower relative savings compared to pre-tax only participants depending on their current and expected tax liability. Columns (1) and (2) estimate employee contribution rates as a percent of salary, while columns (3) and (4) estimate the total employee plus employer rate as a percent of salary. Columns (2) and (4) include only participants with mandatory contributions.

Table 4 documents two main findings. First, we find Roth contributors are significantly more likely to have relatively larger contribution rates, as evidenced by the significantly positive coefficient with Roth investors deferring 0.8% of their salary on the margin compared to non-Roth investors This is true both in terms of their own employee deferral rate as a percent of salary (column 1) and the overall employee plus employer savings rate (column 3). Because we do not know individual's current marginal tax rates, we do not know how much additional retirement consumption Roth savers are purchasing. This result extends the Beshears et al. (2017) finding.

Our second finding is that this result is only true for participants *without* mandatory contributions. Examining employee contribution rates for participants with mandatory contributions in column 2, we find that Roth contributors defer 0.5% less. Extending this effect to total savings rates, the total effect is 0.8% less. We do not focus on the size of these effects, but the direction, and that the estimated coefficients are significantly negative for both models. This indicates that, among participants with mandatory contributions, Roth contributors do not save relatively more. The difference in these two findings highlights how retirement plan design and the incentive of where to locate one's next marginal dollar saved impacts retirement plan participants' decisions.

On a broader scale, the difference in saving rates based on tax-location preference has important policy implications as that many states have launched "auto-IRA" policies (Chalmers et

al. 2022; Dao, 2024). Unlike auto-enrollment in workplace plans that defaults participants in a pre-tax amount at a specified deferral rate, the state-run IRAs (such as OregonSaves or CalSavers) default participants into a Roth account.

Table 4. Estimates of contribution saving rates

	(1)	(2)	(3)	(4)
Roth?	0.008***	-0.005***	0.009***	-0.008***
	(0.000)	(0.001)	(0.001)	(0.002)
Age^2	0.001***	0.002***	0.004***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)
Age^2	-0.000	0.000	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Woman	0.004***	0.004***	-0.000	0.003***
	(0.000)	(0.001)	(0.000)	(0.001)
TIAA Tenure	0.000***	0.000	0.001***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Defaulter	-0.010***	-0.012***	-0.014***	-0.015***
	(0.000)	(0.001)	(0.000)	(0.001)
Mand	0.048***		0.056***	
	(0.001)		(0.001)	
Prim + Supp	0.010***	0.016***	0.020***	0.022***
	(0.000)	(0.001)	(0.000)	(0.001)
Supp only	0.007***		-0.054***	
	(0.000)		(0.001)	
Max	0.096***	0.222***	0.109***	0.236***
	(0.001)	(0.011)	(0.001)	(0.011)
Log(Salary)	-0.013***	-0.007***	-0.014***	-0.013***
	(0.000)	(0.001)	(0.000)	(0.001)
Mand EE Rate		1.297***		2.031***
		(0.018)		(0.025)
Constant	0.144***	0.052***	0.141***	0.130***
	(0.003)	(0.012)	(0.005)	(0.016)
N	240,271	22,109	240,271	22,109
Dep. Var Mean	0.08	0.12	0.15	0.21

OLS estimates with marginal coefficients shown. Standard errors at the individual level are provided in parenthesis. *, **, *** represents significance at the 10%, 5%, and 1% levels.

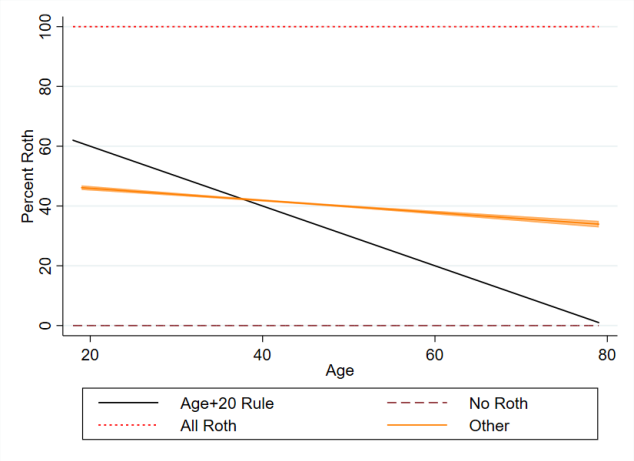
5. Contribution location benchmarks

We next examine how contribution decisions compare to the Brown et al. (2017) optimal location benchmark that individuals should allocate a percent of their retirement plan contributions equal to their "Age+20" to pre-tax accounts and the remainder to Roth accounts, and all to the Roth account if they are in the lowest tax bracket. We examine the age rule only because we do not know household composition, total household income or tax status. We analyze only for employee contributions because participants might not vest with their employer contribution amounts. We categorize participants into three types: 1) participants with only pre-tax contributions (no Roth); (2) participants where all voluntary contributions are Roth contributions (only Roth), and; (3) participants who mix their voluntary contributions (both pre-tax and Roth).

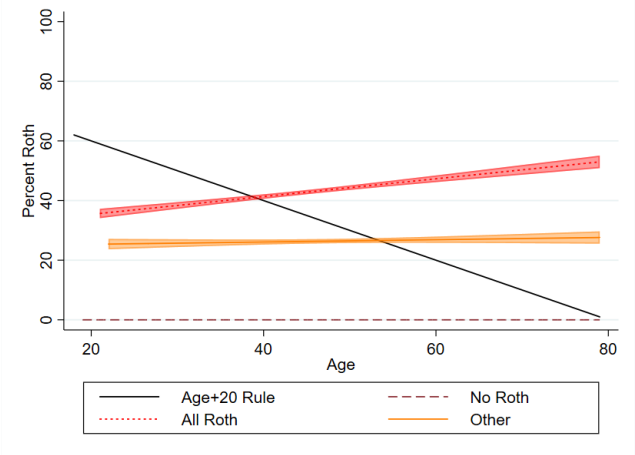
Figure 5 shows the difference between the Age+20 benchmark and participant's employee location split by contributor type. Naturally, when employees have no mandatory contributions and do not mix tax locations for their contributions, they are far from the benchmark. Participants who mix contributions are reasonably close to the benchmark between ages 30 and 50, as are participants using a Roth only strategy for their voluntary contributions then they have mandatory contributions between ages 50 and 60. Using this rule as a benchmark, many participants could likely increase expected retirement consumption and obtain greater retirement consumption 'insurance' by altering their location decisions by applying the simple Brown et al (2017) rule of thumb. Given this result, and the tax liability implication of using suboptimal location strategies, future research should examine default tax location rules for defined contributions plans.

Figure 5. Difference from Age+20 benchmark by contributor type

Panel (a).
Participants without mandatory contributions



Panel (b).
Participants with mandatory contributions



Notes: Linear regression fits shown with 95th percent confidence intervals.

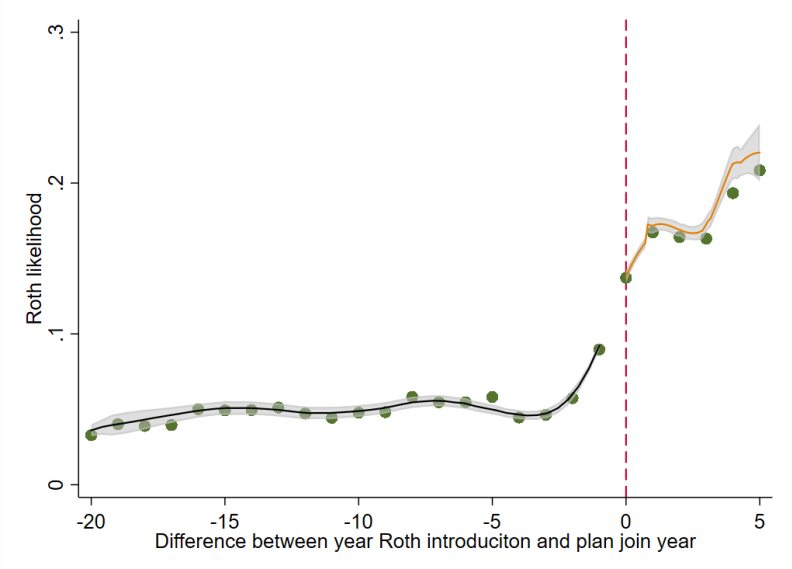
6. Inertia in Contributions Location Decisions

Individuals often display inertia in contributions and asset allocation decisions (Agnew et al. 2003, Ameriks and Zeldes 2004, Samuelson and Zeckhauser 1988). A natural extension is that individuals exhibit similar behavior with their asset location decisions. We hypothesize that if participants have a Roth option when they first join the plan (post-Roth), then they will be more likely to make Roth contributions compared to participants who join prior to a Roth option becoming available (pre-Roth). This is because the latter individual would need to make a subsequent active and different location decision after the introduction of the Roth account option.

To examine this hypothesis, we construct a subsample of our primary dataset examining contribution location decisions in 2018 for 120,129 participants in plans which implemented a Roth account option between December 2012 and December 2017. This allows us to exploit the variation between when a participant joined their plan and when the Roth options became available. In our overall subsample, 10.0% of participants made a Roth contribution in 2018. But 15.7% of participants who immediately had a Roth option available made Roth contributions in 2018, significantly greater than the 6.2% of participants making Roth contributions and who joined their plans prior to the introduction of the Roth account.

Figure 6 displays a scatterplot of the mean fraction of participants who made a Roth contribution in 2018, conditional on in which year they enrolled relative to that plan's Roth account introduction. The scatterplot is fitted with a local polynomial smoothing with a sharp regression discontinuity design. On the horizontal axis, a value of 0 indicates a participant joined the plan within the same month of the Roth introduction up to one-year after the plan's Roth introduction. A value of 1 (-1) indicates joining the plan at least one year after (before) the plan's Roth introduction but less than two years, and so on. We document a large jump in the fraction of participants making a Roth contribution among those enrolling in a plan after the Roth option was available, from 4.9% of the pre-Roth cohort joining at least one year before a Roth option was available, to 9.0% for those joining one year prior to the Roth introduction. Participants who more recently joined their plan may be more likely to 'reset' their contribution decision. The percentage increased further to 14.0% for participants joining in the same year of the Roth introduction, and to over 16.5% for those joining after the Roth option was available.

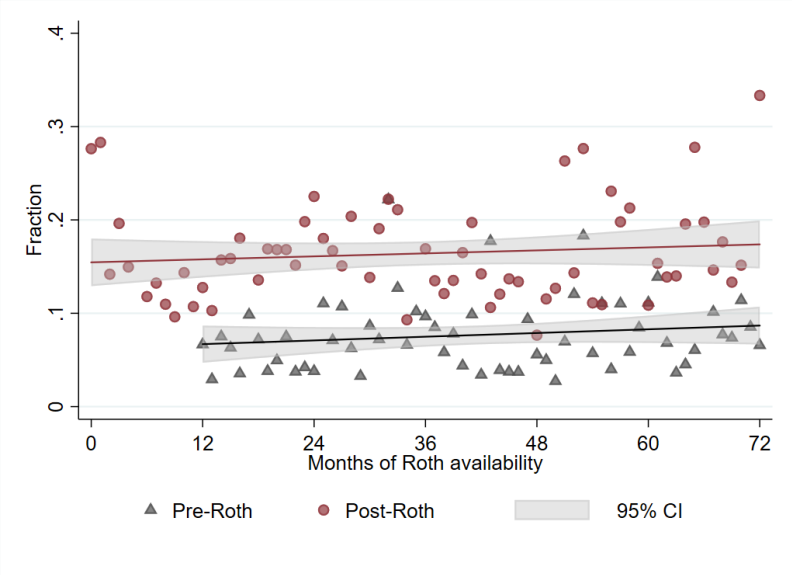
Figure 6. Likelihood of Roth contributions by relative plan join year



Note: Scatter plots show at each year the mean fraction of participants with a Roth contribution by the year they joined the plan relative to the year a Roth account was introduced. Lines show local polynomial fits with degree two and 95th confidence intervals. A value of 0 indicates a participant joined the plan within the same month of the Roth introduction up to one-year after the plan's Roth introduction. A value of 1 (-1) indicates joining the plan at least one year after (before) the plan's Roth introduction but less than two years, and so on.

We next examine whether Roth take-up increases the longer the option has been available. Figure 7 displays the mean proportion of participants with Roth contributions in 2018 for each month following the availability of a Roth option for the Pre and Post cohorts, overlaid with linear regressions. We find a small time trend effect; for each 10 months a Roth option is available, participants are 1pp more likely to make a Roth option. Individuals are unlikely to update contribution locations after their initial decision extending the finding from Beshears et al. (2014) and consistent with earlier studies (Ameriks and Zeldes, 2004; Tang et al. 2012) that DC participants make limited savings and investment changes. We confirm these results with regressions Table 5. Compared to the mean post-Roth participants are 6.3% more likely to make a Roth contribution, a 60% (=0.06/0.10) increase compared to the mean. The marginal effect (0.115) is nearly twice as large for participants with mandatory contributions.

Figure 7. Fraction of participants with Roth contributions for Pre and Post cohorts by length of Roth availability



Note: We define one (two) month as having had a Roth option for at least one (two) month but less than two (three) months; this applies throughout the figure. Linear fitted values with 95% confidence interval are shown. We examine plans introducing Roth accounts between 2012 and 2017 and participant contributions in through the 2018 year, a participant joining a plan prior to a Roth introduction will therefore have at least 12 months of Roth availability.

Table 5. Regression estimates of Roth contribution, pre- and post-Roth cohorts

	(1)	(2)	(3)	(4)
Post Roth	0.064***	0.070***	0.086***	0.115***
	(0.002)	(0.004)	(0.005)	(0.016)
Months since	0.001***	0.001***	0.001***	0.002***
	(0.000)	(0.000)	(0.000)	(0.000)
Months since*Post Roth		-0.000*	-0.001***	-0.002***
		(0.000)	(0.000)	(0.000)
Demographic Controls	Y	Y	Y	Y
Salary Control	N	N	Y	Y
Mand Only	N	N	N	Y
Dep. Var Mean	0.10	0.10	0.10	0.11
N	120,129	120,129	81,135	7,943

Notes: Table 5 displays logit estimates of making a Roth contribution in 2018 at plans that introduced a Roth option between late 2012 and 2017, displaying marginal effects with individual controls. Post Roth is a dummy variable equal to 1 for participants joining a plan after a Roth introduction and 0 if before. We control for how long the Roth option had been available with *Months since. Months since*Post-Roth* is the interaction of *Post-Roth* and *Months since*. We control for characteristics as in Table 2. Estimates on the control coefficients are similar to Table 2.

7. Conclusion

We examine Roth account access and contribution location behavior in the non-profit sector. Overall, nearly 12.0% of participants use Roth accounts. Roth account use increases for younger participants and those who do not use the plan's default investment option, indicating passive savers are more likely to be passive in both the investment and tax location choice. Most Roth investors use Roth accounts for all voluntary contributions. Mandatory employee contributions significantly impact the Roth decision, while employer contributions have a small economic impact.

Future research will need to examine how much of asset location decisions are driven by income expectations, tax expectations, and understanding of the tax location options. Beshears et al (2017) find that there is substantial lack of literacy on tax location options. Our research also speaks to the role for incorporating the asset location decision calculus into financial planning. Greater education, planning tools, and advice in this domain could increase Americans' retirement security.

We are aware of the limitations of our study. We do not know employee's entire household balance sheet. Participants could use Roth IRAs or save through their spouse's plan. Participants may have different belief about future tax rates or the tax properties. And as pension structures

differ here in our environment than the for-profits sector, our results may not be generalizable to the entire DC participant population.

In a broader sense, our research informs how Roth provisions in public policy might affect retirement savers (Horneff et al., 2022). The tax expenditure for retirement savings is a frequent target in policy discussions of the need to raise revenue and reduce deficits. A common proposal is the "Rothification" of all retirement accounts, which increases current revenue within a 10-year budget window but loses revenue in the long-run. Given the relatively higher coverage and use of pre-tax accounts, our results document the disruptive impact this type of policy change could have on both retirement plans and retirement savers.

SECURE 2.0 provides an example of the issues arising from Rothificiation policies. One statue from this Act mandates that 'catch-up' contributions for retirement plan participants age 50 and older must be to a Roth account if the participants earn more than $145,000 in inflation adjusted wages. Previously, participants, at all income levels, had the choice to locate their catch-up contributions to either a Roth or Pre-tax account. Implementation of this provision has already been delayed by the IRS.[9] The additional uncertainty over its implementation increases both regulatory-compliance costs for plan sponsors and financial planning complexity for retirement savers.

[9] https://www.irs.gov/newsroom/irs-announces-administrative-transition-period-for-new-roth-catch-up-requirement-catch-up-contributions-still-permitted-after-2023 (accessed February 11, 2025).

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