Who Uses the Roth 401(k), and How Do They Use It?

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Abstract: Using administrative data from twelve companies that added a Roth 401(k) option between 2006 and 2010, we describe the characteristics of Roth contributions. Approximately one year after the Roth is introduced, 9% of 401(k) participants have positive Roth balances. Roth participation is more than twice as high among 401(k) participants who were hired after the Roth introduction relative to 401(k) participants who were hired before the Roth introduction. In essence, once an employee joins a 401(k) she becomes passive/inattentive, thereby reducing the likelihood of reacting to the introduction of a new Roth option. Conditional on contributing to the Roth, 66% of employee contributions go to the Roth. Half of employees contribute to both the Roth and another 401(k) account, consistent with a tax diversification motive. Roth usage is decreasing in age and less likely among female employees. There is only a weak correlation with salary and tenure once we control for other employee characteristics.

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Since January 1, 2006, plan sponsors have been able to add a Roth 401(k) to defined contribution savings plans. Like contributions to a Roth IRA, employee contributions to a Roth 401(k) or 403(b) are not deductible from current taxable income, but withdrawals of principal, interest, and capital gains in retirement are tax-free. The Plan Sponsor Council of America (2012) reports that 49% of 401(k) plans offered a Roth option in 2011.

In this paper, we describe the characteristics of employees who utilize the Roth 401(k). We also describe how employees use the Roth 401(k). Roth contributions are advantageous to households whose current marginal tax rate is lower than their marginal tax rate in retirement. If households understand this fact, then we would expect younger employees to be more likely to allocate contributions to the Roth. Employees with transitorily low income would also be expected to utilize the Roth 401(k). If households are uncertain about whether their marginal tax rate will be higher or lower in retirement, they may wish to hedge this risk by contributing to both Roth and before-tax accounts in their 401(k).

We use administrative 401(k) plan data from twelve companies that introduced a Roth 401(k) option between 2006 and 2010. We find that approximately one year after the Roth has been introduced, 8.6% of all 401(k) participants at the company have a positive balance in their Roth account. Roth balances make up only 3.4% of total 401(k) balances at these companies on average, a small proportion that partially reflects the short amount of time Roth contributions have been possible relative to other contributions. Looking at flows instead of stocks, Roth contributions constitute 5.4% of employee contributions. Roth contributions are much more significant for those who choose to make them. Conditional on having a positive Roth contribution rate, 65.8% of employee contributions go to the Roth. Consistent with the existence of a tax diversification motive, 54.8% of employees who contribute to the Roth also contribute to another 401(k) account.

Samuelson and Zeckhauser (1988), Choi et al. (2002, 2004), and Beshears et al. (2008) document that many employees are passive in their retirement savings accounts. The low usage of the Roth 401(k) may partially be due to employees who enrolled in the 401(k) when the Roth was unavailable failing to update their 401(k) elections in response

to the introduction of the Roth, rather than an active preference against the Roth. Supporting the importance of the passivity channel, we find that 19.0% of 401(k) participants who were hired after the Roth's introduction have a positive balance in the Roth approximately one year after its introduction. This percentage is much higher than the 7.9% of 401(k) participants hired before the Roth's introduction who have a positive balance in the Roth.

Turning to the demographic covariates of Roth usage within the 401(k) participant population, we find that those with positive Roth balances are younger and more likely to be male. Higher-salary workers are less likely to have a positive Roth balance among 401(k) participants who are post-Roth hires, but more likely among 401(k) participants who are pre-Roth hires. The negative correlation among post-Roth hires is consistent with the Roth being more attractive to workers in temporarily low current tax brackets. However, once age is controlled for, salary has at best a weak association with Roth usage in this group. The positive correlation among pre-Roth hires may be explained by a negative correlation between income and passivity, which would cause higher income employees to be more likely to update their 401(k) elections in response to the Roth's introduction. There is likely also a positive correlation between income and financial literacy, including knowledge of the rules that govern Roth 401(k)'s. At a given point in calendar time, those with higher tenure at the company are less likely to use the Roth among pre-Roth hires, although the association is small once other variables are controlled for.

Conditional on the employee having a positive 401(k) contribution rate, the Roth contribution rate as a fraction of income is initially declining with age but rises again starting in middle age. Men contribute more to the Roth than women, and participants with higher tenure contribute less. Among pre-Roth hires, higher salaries are associated with a small increase in the Roth contribution rate. The demographic patterns are similar for the Roth contribution rate as a fraction of the total employee contribution rate. Conditional on contributing to the Roth, being middle-aged and female are associated with also contributing to another account in the 401(k). Among pre-Roth hires, low salary and high tenure are also associated with mixing contributions.

The remainder of the paper proceeds as follows. In Section I, we summarize some of the institutional rules of the Roth 401(k). Section II describes our data. Section III discusses summary statistics on how employees use the Roth 401(k) and the characteristics of Roth users. Section IV investigates the correlates of Roth usage in a multivariate regression framework. Section V concludes.

I. The rules and economics of the Roth 401(k)

Roth contributions to a 401(k) are not deductible from current-year taxable income, but principal, interest, and capital gains may be withdrawn tax-free if the withdrawal is considered "qualified" because (i) the account has been held for at least five years and (ii) the account owner is either older than 59½, disabled, or deceased. Therefore, $1 of pre-tax income can purchase $(1 - \tau_0)(1 + r)$ of future consumption if a Roth account is used as the savings vehicle and the balance is accessed through a qualified withdrawal, where τ_0 is the household's marginal ordinary income tax rate in the year of the contribution and r is the return earned on the contribution between the contribution and withdrawal dates. Put another way, each dollar contributed to a Roth account buys $1 + r$ of future consumption. For non-qualified withdrawals, the withdrawn principal is not taxed, but the interest and capital gains are subject to ordinary income tax, and if the account owner is younger than 59½, the withdrawn earnings are also assessed a 10% tax penalty under most circumstances.

In contrast, before-tax 401(k) contributions are deductible from current-year income, but the principal, interest, and capital gains are taxed at the ordinary income tax rate upon withdrawal. Hence, $1 of pre-tax income contributed on a before-tax basis buys $(1 + r)(1 - \tau_1)$ of future consumption, where τ_1 is the household's marginal ordinary income tax rate in the year of the withdrawal. An additional 10% tax penalty applies to both the principal and earnings withdrawn by account owners younger than 59½.

After-tax 401(k) contributions are not deductible from current taxable income. At withdrawal, principal is not taxed but interest and capital gains are taxed at the ordinary income tax rate. One pre-tax dollar can buy $(1 - \tau_0)[1 + (1 - \tau_1)r]$ of future consumption if an after-tax 401(k) account is used as the savings vehicle. Equivalently, each dollar contributed to an after-tax account buys $1 + (1 - \tau_1)r$ of future consumption. An

additional 10% tax penalty applies to earnings that are withdrawn by account owners younger than 59½.

If there are no employer matching contributions in the 401(k), withdrawals occur late enough to be considered qualified by the Roth criteria, and investment earnings are positive, then contributing the next dollar of savings to the Roth is a better financial deal than contributing before-tax if and only if $\tau_0 < \tau_1$. In a progressive tax system, τ_1 will typically be less than τ_0 because non-401(k) income in retirement will typically be lower than current income, causing most before-tax 401(k) withdrawal dollars to be taxed at a lower rate than the last dollar of income today. McQuarrie (2008) uses this observation to argue that the Roth 401(k) is inferior to a before-tax 401(k) for many households whose current income pushes them above the lowest marginal tax bracket.[1]

The relative appeal of the Roth increases with the probability of withdrawal before age 59½, since Roth principal is exempt from the 10% early withdrawal penalty but before-tax principal is not. Roth contributions are always a better deal than after-tax contributions if the money is held in the 401(k) long enough to meet the Roth qualifying withdrawal criteria and investment earnings are positive. However, after-tax contributions are sometimes more liquid before age 59½, since some 401(k) plans allow younger employees to make withdrawals from after-tax balances while still employed by the company without demonstrating financial hardship.

Employer matching contributions must always be made using before-tax dollars, meaning that the entire principal and earnings of the match balance are subject to ordinary income tax upon withdrawal. A company may not match certain types of employee contributions (e.g., after-tax contributions), but among the types it does match, the match formula typically does not vary by the type of contribution. This invariance reduces the attractiveness of Roth and after-tax contributions if the employee's marginal 401(k) contribution dollar is being matched. Let m be the rate at which employee contributions are matched. One pre-tax dollar can buy m match dollars if it is saved using a before-tax account, but only $(1 - \tau_0)m$ match dollars if it is saved using a Roth or after-tax account (since τ_0 dollars must be paid in taxes, thereby preventing the entire dollar

[1] See also Ahern et al. (2005) and Kotlikoff, Marx, and Rapson (2008) for other analyses of the relative merits of the Roth 401(k).

from being contributed to the savings plan). The condition under which employees who have no probability of making a non-qualified withdrawal are better off contributing to the Roth rather than the before-tax account is now more restrictive; with an employer match, the Roth is a better financial deal than contributing before-tax if and only if

$$(1 - \tau_0)[1 + m(1 - \tau_1)] > (1 - \tau_1)(1 + m). \tag{1}$$

The combined before-tax plus Roth contributions in a calendar year cannot exceed a certain amount that is adjusted each year. For people younger than 50, this limit was $14,000 in 2005 (the last year in which Roth contributions were not allowed); it has been raised several times since then and stands at $17,500 in 2013. The dollar values for each year in the interim are listed in the matrix below. People age 50 and older are allowed an additional "catch-up" contribution; this additional amount was $4,000 in 2005 and has since been increased to its current level of $5,500. In addition to the limits on employee contributions, there is a limit on the combined employer plus employee contribution to 401(k) accounts. This aggregate limit was set at $42,000 in 2005 and has since been raised to $51,000 in 2013. Because a dollar of Roth balances buys (weakly) more retirement consumption than a dollar of before-tax balances, people who are constrained by the before-tax plus Roth contribution ceiling could find it advantageous to make Roth contributions instead of before-tax contributions in order to extend the 401(k) tax shelter over more effective dollars.

401(k) contribution limits

	Employee contribution limit		Employer plus employee contribution limit	
	Age < 50	Additional catch-up contribution limit if age ≥ 50	Age < 50	Age ≥ 50
2005	$14,000	$4,000	$42,000	$46,000
2006	$15,000	$5,000	$44,000	$49,000
2007	$15,500	$5,000	$45,000	$50,000
2008	$15,500	$5,000	$46,000	$51,000
2009	$16,500	$5,500	$49,000	$54,500
2010	$16,500	$5,500	$49,000	$54,500
2011	$16,500	$5,500	$49,000	$54,500
2012	$17,000	$5,500	$50,000	$55,500
2013	$17,500	$5,500	$51,000	$56,500

II. Data description

To analyze the utilization of the Roth accounts, we use 401(k) administrative data from Aon Hewitt, a large U.S. benefits administration and consulting firm. We selected twelve companies that introduced a Roth option to their 401(k) plan between 2006 and 2010. The data are repeated cross-sectional snapshots of all employees at each calendar-year-end. Each snapshot contains individual-level data on every employee's current plan participation status, plan enrollment date, monthly contribution rates, plan balances, birth date, hire date, salary (for ten of the twelve companies), age, and gender. We restrict our sample to employees between the ages of 20 and 69.

Table 1 shows the characteristics of each company as of year-end 2010. In order to preserve these companies' anonymity, we refer to each company by the letters A through L and only disclose approximate employee counts. The companies are all large, ranging from approximately 10,000 employees to 100,000 employees. Seven of the twelve companies are in the financial services industry, and average and median salaries exceed $100,000 for Companies A, E, F, and I. Hence, the employees at these firms are likely to be more financially sophisticated than the typical US employee. Average age ranges from 35 to 48 years, average tenure at the company ranges from five years to sixteen years, and male percentage ranges from 33% to 76%.

Table 2 summarizes the features of the 401(k) plan at each company as of 2010. Five companies introduced the Roth option in 2006, one in 2007, three in 2008, one in 2009, and two in 2010. Five companies automatically enroll their employees in the 401(k) at before-tax contribution rates of between 2% and 6% of income. The automatic enrollment companies have an average participation rate of 88%, which is higher than the average participation rate of 77% among the companies that have opt-in enrollment schemes. Nine companies match employee contributions up to a threshold between 3% and 8% of income at rates between 25% and 133%. The maximum percent of a paycheck that can be contributed to the 401(k) ranges from 20% to 100%. These maximums are subject to IRS restrictions described earlier on the total dollars that can be contributed within a calendar year.

III. Summary statistics on Roth usage and Roth users

In this section, we present basic summary statistics on how employees use the Roth 401(k) and the characteristics of employees who use the Roth. We report these statistics as of the end of the first calendar year at each company in which the Roth 401(k) was available for at least eleven months. Thus, for the nine companies that introduced the Roth in a January, the numbers in Table 3 reflect usage exactly twelve months after Roth introduction. For Company I, which introduced the Roth on February 1, 2006, the numbers come from the eleventh month after Roth introduction. For Companies B (which introduced the Roth on September 1, 2006) and L (which introduced the Roth on July 1, 2010), we report numbers from sixteen months and seventeen months, respectively, after Roth introduction.

The first column of Table 3 shows that the Roth is used by only a small minority of 401(k) participants. Only between 3.9% and 16.0% of 401(k) participants have a positive balance in the Roth; averaging across the sample (weighting each company by its 401(k) participants), 8.6% of participants have used the Roth. The sample-wide average is affected by the five companies that automatically enroll their employees with default contribution elections that allocate nothing to the Roth (and everything to the before tax account). However, if we restrict the sample to companies without automatic enrollment, the fraction of participants with positive Roth balances rises only to 11.5%. Plan Sponsor Council of America (2012) reports that a higher proportion of their sample (17.4%) contributes to the Roth, but this number is not directly comparable to ours. Their sample comes entirely from 2011, whereas our sample comes from years ranging between 2006 and 2011. Their sample includes companies that have offered a Roth option for many years, whereas we capture the state of Roth participation approximately one year after the Roth's introduction. Nevertheless, our sample may have a lower inherent propensity to contribute to the Roth than the PSCA sample. Aon Hewitt (2012) reports that during 2011, 8.1% of 401(k) participants in the companies in their database with a Roth option contributed to the Roth, which is similar to the 8.6% figure we calculate for the fraction that have positive Roth balances.

The fraction of employee contributed balances held in the Roth is considerably lower than the fraction of employees with positive Roth balances, ranging from 0.4% to 6.5%. The average is 2.4% among all companies, and 4.3% among companies without

automatic enrollment. Roth balances as a percent of total 401(k) balances, which also include employer match balances, are even lower, averaging 1.8% across all companies and 3.4% among companies without automatic enrollment. The small size of Roth balances partially reflects the fact that the numbers in Table 3 are calculated shortly after Roth introduction (eleven to seventeen months). Examining just contribution flows, a somewhat larger fraction of employee contributions during the last pay period of the calendar year are going to the Roth: 5.4% on average across all companies (8.5% excluding automatic enrollment companies), with individual companies ranging from 2.0% to 12.2%.

Although Roth usage is relatively rare, conditional on being used, Roth contributions constitute the majority of an employee's contributions. On average, Roth contributors at year-end are putting 65.8% of their employee contributions in the Roth account. At the individual company level, this conditional average is no lower than 53.8%, and it is as high as 99.9% at Company E, which does not allow employees to contribute to both the Roth account and the before-tax account.

Recall that employer matches are required to be made in before-tax dollars, so any Roth contributor at a company with a match is necessarily engaging in some tax diversification. If employees are unaware that their match is in before-tax dollars, this tax diversification is unwitting. However, a majority of Roth users (54.8%) are actively engaging in tax diversification by simultaneously making *employee* contributions to both the Roth and another 401(k) account. This average is diminished by Company E, which does not allow tax diversification of employee contributions and also does not have a match.

Samuelson and Zeckhauser (1988), Choi et al. (2002, 2004), and Beshears et al. (2008) document that many employees are passive in their retirement savings accounts. Therefore, the low usage of the Roth may partially reflect a sluggish response to its introduction rather than an active preference against the Roth. To explore the role of inertia, we examine how Roth participation differs between 401(k) participants who were hired before Roth introduction and participants who were hired after Roth introduction. Inertia can be generated both by the (possibly time-inconsistent) desire to delay incurring action costs (Carroll et al., 2009) and inattention (Cadena and Schoar, 2011; Choi et al.,

2012). Attention to 401(k) plan features is likely to be especially high at the point employees join the company. Therefore, employees who were hired after Roth introduction are more likely to be aware of the Roth's presence than employees who were hired before the Roth was an option in the plan. At companies without automatic enrollment, the marginal action cost to contribute to the Roth conditional on being a 401(k) participant is also lower for post-Roth hires than for pre-Roth hires. This is because for a 401(k) participant hired after Roth adoption, the Roth option can be chosen while the employee is actively enrolling and has already paid the cost of finding the human resources website or phone number, his password, etc. For a 401(k) participant hired before Roth introduction who enrolled before the Roth was available, the marginal cost of contributing to the Roth includes the cost of regaining access to his 401(k) elections through a website or phone number.

Figure 1 plots the fraction of 401(k) participants with a positive Roth balance at the end of the first calendar year in which the Roth 401(k) was available for at least eleven months. The horizontal axis is the participant's hire month relative to the Roth introduction month. In both companies with and without automatic enrollment, Roth usage is lower among participants who are pre-Roth hires than participants who are post-Roth hires. Higher Roth usage begins with participants hired in the month prior to Roth introduction, perhaps reflecting when the 401(k) plan literature was revised to show the Roth option. The increase in Roth usage is about 8 percentage points in companies without automatic enrollment and 5 percentage points in companies with automatic enrollment.

Tables 4 and 5 expand the figure's sample to include all pre- or post-Roth hires. Table 4 shows that among 401(k) participants who were hired after the Roth's introduction, 19.0% have a positive balance in the Roth, 13.5% of employee contribution balances and 11.4% of total 401(k) balances are held in the Roth, and 19.0% of employee contribution flows are going to the Roth at year-end. These numbers are much higher than the corresponding numbers in Table 5 for 401(k) participants who were hired before the Roth: 7.9% have a positive Roth balance, 1.7% of employee contribution balances and 1.1% of total 401(k) balances are held in the Roth, and 7.4% of employee contribution flows are going to the Roth at year-end.

Conditional on using the Roth, post-Roth hires allocate a greater fraction of their contributions (75.8%) to the Roth than pre-Roth hires (63.9%). This gap narrows considerably when we exclude companies with automatic enrollment from the average; conditional on using the Roth, post-Roth hires in this subsample make 77.4% of their contributions to the Roth, versus 72.8% for pre-Roth hires. Among all of the firms in our study, post-Roth hires are less likely than pre-Roth hires to mix their Roth contributions with other contributions—41.4% versus 57.3%. This difference is smaller when we study only companies without automatic enrollment—39.6% versus 46.5%.

In light of the differences in Roth usage between pre- and post-Roth hires, our analysis going forward will analyze these two populations separately.

Table 6 shows the average age, salary, and gender composition of 401(k) participants among post-Roth hires who do and do not have positive Roth balances. Relative to non-Roth users, Roth users are on average younger by 3.4 years and have a salary that is $11,500 lower, but gender composition is similar across both groups. Excluding companies with automatic enrollment does not qualitatively change these comparative statics. Since Roth contributions are advantageous for households whose current marginal tax rate is lower than their marginal tax rate in retirement, the finding that younger, lower-income households are more likely to contribute to the Roth could indicate that households are responding in the correct direction to the tax incentives created by the Roth. The young are more likely to have higher income in retirement than they do currently, and lower-income individuals are more likely to be among the 47% of tax units that have no current income tax liability (Williams, 2009), so their marginal tax rate in retirement is very likely to be weakly greater than it is today.

The picture changes somewhat for 401(k) participants among pre-Roth hires (Table 7). Roth users are still younger than non-Roth users, but Roth users have a higher average income, and are more likely to be male. Roth users also have lower average tenure at the company. Restricting the sample to companies without automatic enrollment causes the salary relationship to flip sign, however, so that Roth users have a lower salary than non-Roth users, as in the post-Roth hire population.

The instability of the salary effect is somewhat surprising, but the patterns can be rationalized. In principle, the Roth should appeal to tax payers with *temporarily* low

income, not permanently low income. If our income observations are highly correlated with *permanent* income, we should not expect to see a robust relationship between Roth usage and income. In fact, there is even a countervailing effect. Workers with high observed income are likely to be more financially literate, leading them to use the Roth account with relatively *greater* frequency – relatively literate households are more likely to know about and understand the Roth accounts.

Finally, we offer a post hoc reason that the sign of the income effect might change in the pre-Roth cohort. For these workers, Roth usage is only achieved by households that have a very strong preference for the Roth account – strong enough to overcome inertia arising from status quo bias. Only workers with high levels of financial literacy (and consequently high income) may cross this action threshold.

IV. Regression analysis of correlates of Roth usage

In this section, we analyze the correlates of Roth usage in a multivariate regression framework. The dependent variables vary, but all of them are measured as of the end of the first calendar year in which the Roth was available for at least eleven months. The explanatory variables are measured as of the same date and do not change across regressions: age in excess of 20 years, age in excess of 20 years squared, a male dummy, log salary, and log tenure. The two age terms are often divided by 100 or 10,000 so that more significant digits appear in the table. The top rows of the tables show results for regressions that are run separately by company, but the last two rows show coefficients from regressions that pool either all companies with complete data on employee characteristics, or all companies with complete data on employee characteristics that do not have automatic enrollment. Regressions that contain more than one company also control for company dummies. Our discussion will mostly focus on the pooled company regressions with the most comprehensive set of companies.

Table 8 shows coefficients from regressing a dummy for having positive Roth balances on the control variables. Among both post- and pre-Roth hires, older employees are less likely to use the Roth. The second derivative with respect to age is positive, but Roth usage with respect to age does not reach its minimum until age 51.5 among post-Roth hires and age 58.5 among pre-Roth hires, when the probability of Roth usage is 18.2

percentage points and 12.9 percentage points lower, respectively, than for 20 year olds. Men are 2 to 3 percentage points more likely to use the Roth. Salary has at best a weak relationship with Roth usage. There is no significant salary relationship among post-Roth hires, indicating that the negative correlation between Roth usage and salary in Table 6 is driven by Roth users being younger than non-Roth users. In companies without automatic enrollment, the salary coefficient is in fact negative and significant, although small in magnitude—a 10% increase in salary decreases the probability of Roth usage by only 0.1 percentage points. The salary coefficient is significantly positive but small in magnitude for pre-Roth hires—a 10% increase in salary increases the probability of Roth usage by 0.1 percentage points. Unlike for the univariate comparison of means in Table 7, the positive pre-Roth hire relationship with salary in the regression holds even when the sample excludes automatic enrollment companies. Tenure has no correlation with Roth usage in the post-Roth hire cohort, and a significant but small negative correlation with Roth usage in the pre-Roth hire cohort. In the latter group, a 10% increase in tenure decreases the probability of Roth usage by 0.1 percentage points.

In Table 9, we examine the demographic correlates of the Roth contribution rate as a fraction of income, conditional on having a positive total 401(k) contribution rate. Roth contributions initially fall with age before rising. Among post-Roth hires, the Roth contribution rate falls by 1.6% of income from age 20 to 45 and then rises. At age 69, the Roth contribution rate is only 0.13% of income lower than at age 20. Among pre-Roth hires, the Roth contribution rate falls by 1.2% of income from age 20 to 55 and then rises, but at age 69, the Roth contribution rate is still 1.0% of income lower than at age 20. Men contribute 0.9% of income more than women to the Roth in the post-Roth hire cohort, and 0.5% of income more than women in the pre-Roth hire cohort. Salary is uncorrelated with the Roth contribution rate among post-Roth hires, but is positively correlated with the Roth contribution rate among pre-Roth hires. In the latter group, a 10% increase in salary is associated with a 0.03% of income increase in the Roth contribution rate. Tenure is negatively correlated with the Roth contribution rate; a 10% increase in tenure is associated with a 0.02% of income decrease in the Roth contribution rate among post-Roth hires and a 0.003% of income decrease among pre-Roth hires.

The Roth contribution rate reflects both the desired overall savings rate in the 401(k) and the desired fraction of 401(k) balances that are in the Roth. In Table 10, we isolate the latter by using as the dependent variable the Roth contribution rate as a fraction of the total employee contribution rate (i.e. the before-tax plus after-tax plus Roth contribution rate). Among post-Roth hires, the fraction is initially decreasing with age but bottoms out at age 45, when participants allocate 18.8% less to the Roth than 20 year olds. At age 69, participants allocate 8.9% less to the Roth than 20 year olds. For pre-Roth hires, the fraction also decreases with age until 54, when participants allocate 10.3% less to the Roth. Men allocate 3.0% more to the Roth if hired after Roth introduction and 1.7% more if hired before Roth introduction. Salary has a minor effect, being insignificant for post-Roth hires (unless automatic enrollment companies are excluded, in which case a 10% increase in salary is associated with a 0.1 percentage point decrease in the Roth fraction) and a significant but economically small effect among pre-Roth hires, where a 10% increase in salary increases the Roth fraction by 0.09 percentage points. Higher tenure decreases the Roth fraction for both post-Roth hires (0.1 percentage points per 10% increase in tenure) and pre-Roth hires (0.06 percentage points per 10% increase in tenure).

Because matching contributions are required to be in before-tax dollars, the fraction of employee contributions going to the Roth is greater than the fraction of total 401(k) contributions going to the Roth in companies that match contributions. However, we find in untabulated results that the demographic patterns do not change materially when we use the fraction of total 401(k) contributions going to Roth as our dependent variable instead of the fraction of employee contributions going to the Roth.

Finally, in Table 11, we examine the demographic correlates of having a positive non-Roth employee contribution rate conditional on having a positive Roth contribution rate, which is a sign of a deliberate tax diversification strategy. Among post-Roth hires, contributing to both accounts increases with age until age 43, when employees are 42.1 percentage points more likely than 20 year olds to do so, and then decreases to the point where at age 69, employees are 8.5 percentage points less likely to contribute to both accounts than 20 year olds. Contributing to both accounts is 5 percentage points less likely for males, but there is no relationship with salary or tenure. Among pre-Roth hires,

contributing to both accounts also increases with age until age 46, when employees are 32.1 percentage points more likely to do so than 20 year olds, but even 69 year olds are 10.3 percentage points more likely to contribute to both accounts than 20 year olds. Like post-Roth hires, pre-Roth men are 6 percentage points less likely to contribute to both accounts, but unlike post-Roth hires, pre-Roth employees with low salaries and high tenure are more likely to contribute to both, although the effect sizes are economically small and salary is not significant when automatic enrollment companies are excluded.

V. Conclusion

Roth 401(k) usage is relatively uncommon in our sample of firms -- approximately one year after the Roth is introduced, 9% of 401(k) participants have positive Roth balances. But among those who do contribute to the Roth, Roth contributions constitute a large fraction of their contributions. The young are more likely to use the Roth and to allocate a larger fraction of their contributions to it. This correlation could be consistent with a rational response to the Roth's tax incentives, since Roth contributions are advantageous to those whose current marginal tax rate is lower than the marginal tax rate at which those contributions will later be withdrawn.

Roth participation is more than twice as high among 401(k) participants who were hired after the Roth introduction relative to 401(k) participants who were hired before the Roth introduction. Because of passivity or inattention, 401(k) participants do not react to the Roth option when it is introduced after they have already joined the 401(k) plan.

References

Ahern, Michael, John Ameriks, Joel Dickson, Robert Nestor, and Stephen Utkus, 2005. "Tax Diversification and the Roth 401(k)." Vanguard Center for Retirement Research 18.

Aon Hewitt, 2012. "2012 Universe Benchmarks: Measuring Employee Savings and Investing Behavior in Defined Contribution Plans." Aon plc.

Benartzi, Shlomo, and Richard H. Thaler, 2007. "Heuristics and biases in retirement savings behavior." *Journal of Economic Perspectives* 21, pp. 81-104.

Beshears, John, James J. Choi, David Laibson, and Brigitte C. Madrian, 2008. "The Importance of Default Options for Retirement Savings Outcomes: Evidence from the United States." In Stephen J. Kay and Tapen Sinha, editors, *Lessons from Pension Reform in the Americas*, pp. 59-87. Oxford: Oxford University Press.

Cadena, Ximena, and Antoinette Schoar, 2011. "Remembering to Pay? Reminders vs. Financial Incentives for Loan Payments." NBER Working Paper 17020.

Choi, James J., Emily Haisley, Jennifer Kurkoski, and Cade Massey, 2012. "Small Cues Change Savings Choices." NBER Working Paper 17843.

Choi, James J., David Laibson, Brigitte C. Madrian, and Andrew Metrick, 2002. "Defined Contribution Pensions: Plan Rules, Participant Decisions, and the Path of Least Resistance." In James Poterba, ed., *Tax Policy and the Economy* 16, pp. 67-114.

Choi, James J., David Laibson, Brigitte C. Madrian, and Andrew Metrick, 2004. "For Better or For Worse: Default Effects and 401(k) Savings Behavior." In David A. Wise, editor, *Perspectives on the Economics of Aging*, pp. 81-121. Chicago: University of Chicago Press.

Kotlikoff, Laurence J., Ben Marx, and David Rapson, 2008. "To Roth or Not?—That Is the Question." NBER Working Paper 13763.

McQuarrie, Edward F., 2008. "Thinking About a Roth 401(k)? Think Again." *Journal of Financial Planning* (July), pp. 38-48.

Plan Sponsor Council of America, 2012. "PSCA's Annual Survey Shows Company Contributions Are Bouncing Back." Press release. October 11. http://www.psca.org/psca-s-annual-survey-shows-company-contributions-are-bouncing-back (accessed March 29, 2013).

Samuelson, William, and Richard Zeckhauser, 1988. "Status Quo Bias in Decision Making." *Journal of Risk and Uncertainty* 1, pp. 7-59.

Williams, Roberton, 2009. "Who Pays No Income Tax?" Washington D.C.: Tax Policy Center, Urban Institute and Brookings Institution.

Table 1. Company characteristics as of 2010

Company	Industry	Total employees	Average age	Median salary	Average salary	Average tenure	Percent male
A	Pharmaceutical	~ 50,000	43.1	$95,100	$106,089	10.6 years	54%
B	Financial services	~ 10,000	46.4	$77,079	$84,285	11.9 years	42%
C	Financial services	~ 25,000	44.9	$75,049	$86,705	13.4 years	54%
D	Financial services	~ 25,000	43.7	$54,687	$73,679	9.6 years	46%
E	Financial services	~ 50,000	35.0	$140,598	$295,206	4.9 years	61%
F	Financial services	~ 25,000	44.0	$80,304	$148,184	8.4 years	60%
G	Financial services	~ 10,000	47.5	N/A	N/A	12.2 years	53%
H	Financial services	~25,000	40.7	N/A	N/A	8.9 years	33%
I	Business services	~25,000	36.4	$83,900	$109,856	6.6 years	62%
J	Manufacturing	~25,000	46.6	$59,218	$74,808	16.0 years	65%
K	Manufacturing	~100,000	45.7	$67,694	$77,694	13.4 years	76%
L	Financial services	~10,000	42.3	N/A	N/A	8.1 years	35%

Table 2. 401(k) characteristics as of 2010

Company	Participation rate	Enrollment default	Employer match structure	Max contribution allowed (% of salary)	Roth 401(k) introduction date
A	84%	3% before-tax contribution rate	75% match on first 6% of income contributed after 1 year of tenure	50%	1/1/2008
B	98%	3% before-tax contribution rate	70% match on first 6% of income contributed	20%	9/1/2006
C	96%	3% before-tax contribution rate	100% match on first 6% of income contributed; employees with < 5 years of tenure matched at 80%	100%	1/1/2008
D	82%	Non-enrollment	133% match on first 3% of income contributed after 1 year of tenure	45%	1/1/2006
E	49%	Non-enrollment	No match	50%	2/1/2006
F	75%	Non-enrollment	100% match on first 6% of income contributed after 1 year of tenure	100%	1/1/2007
G	88%	Non-enrollment	No match	20%	1/1/2006
H	74%	Non-enrollment	115% match on first 6% of income contributed	20%	1/1/2008
I	86%	Non-enrollment	No match	50%	1/1/2006
J	90%	6% before-tax contribution rate	Either 70% or 100% match on first 6% of income contributed	35%	1/1/2009
K	74%	2% before-tax contribution rate	100% match on the first 2% of income contributed, 50% match on the next 2% of income contributed, and 25% match on the next 4% of income contributed	75%	1/1/2010
L	85%	Non-enrollment	50% match on the first 6% of income contributed	100%	7/1/2010

Table 3. Roth 401(k) utilization after Roth introduction

The variables in this table are measured as of end of first calendar year in which Roth was available for at least eleven months. All averages are equal-weighted by person. Non-balance variables are measured using the 401(k) elections in effect on the measurement date.

Company	% of 401(k) participants with positive balance in Roth	Average % of 401(k) employee contribution balances in Roth	Average % of 401(k) total balances in Roth	Average % of employee contributions going to Roth at year-end	Average % of employee contributions going to Roth at year-end, conditional on positive Roth contribution rate	% employees contributing to both Roth and another 401(k) account at year-end, conditional on positive Roth contribution rate
A	7.6%	1.3%	1.1%	4.1%	58.8%	64.0%
B	5.6%	1.3%	0.6%	2.7%	53.8%	71.7%
C	8.5%	2.0%	1.2%	4.3%	55.6%	66.4%
D	11.4%	3.7%	2.9%	6.7%	64.6%	59.4%
E	8.4%	3.4%	3.1%	7.7%	99.9%	0.1%
F	12.0%	5.2%	4.1%	10.3%	77.3%	37.7%
G	11.0%	3.1%	2.2%	8.8%	76.7%	39.6%
H	9.2%	3.6%	2.6%	5.9%	68.7%	54.0%
I	16.0%	6.5%	5.1%	12.2%	74.1%	46.0%
J	3.9%	0.4%	0.2%	2.0%	54.3%	70.7%
K	6.8%	1.2%	0.7%	3.6%	56.4%	65.7%
L	5.9%	3.0%	1.6%	5.3%	77.9%	40.6%
All	8.6%	2.4%	1.8%	5.4%	65.8%	54.8%
All without autoenrollment	11.5%	4.3%	3.4%	8.5%	73.6%	45.2%

Table 4. Roth 401(k) utilization among post-Roth hires

The variables in this table are measured as of end of first calendar year in which Roth was available for at least eleven months. All averages are equal-weighted by person. Non-balance variables are measured using the 401(k) elections in effect on the measurement date.

Company	% of 401(k) participants with positive balance in Roth	Average % of 401(k) employee contribution balances in Roth	Average % of 401(k) total balances in Roth	Average % of employee contributions going to Roth at year-end	Average % of employee contributions going to Roth at year-end, conditional on positive Roth contribution rate	% employees contributing to both Roth and another 401(k) account at year-end, conditional on positive Roth contribution rate
A	13.6%	7.7%	7.7%	8.7%	66.1%	53.9%
B	12.2%	6.9%	3.5%	7.5%	65.3%	53.8%
C	23.3%	15.3%	9.0%	16.3%	72.5%	46.4%
D	27.5%	17.7%	17.5%	18.3%	71.9%	47.5%
E	12.4%	10.2%	10.2%	12.4%	100.0%	0.0%
F	22.9%	16.9%	16.9%	18.0%	81.7%	31.1%
G	27.3%	19.6%	19.6%	22.3%	79.9%	34.7%
H	33.3%	22.9%	22.9%	23.2%	72.4%	48.8%
I	28.4%	20.5%	19.7%	21.6%	76.4%	42.7%
J	9.5%	8.2%	3.0%	7.8%	71.9%	45.7%
K	10.6%	8.1%	3.8%	8.5%	77.4%	37.7%
L	6.1%	5.4%	3.7%	5.7%	80.9%	39.1%
All	19.0%	13.5%	11.4%	14.3%	75.8%	41.4%
All without autoenrollment	25.0%	17.8%	17.4%	19.0%	77.4%	39.6%

Table 5. Roth 401(k) utilization among pre-Roth hires

The variables in this table are measured as of end of first calendar year in which Roth was available for at least eleven months. All averages are equal-weighted by person. Non-balance variables are measured using the 401(k) elections in effect on the measurement date.

Company	% of 401(k) participants with positive balance in Roth	Average % of 401(k) employee contribution balances in Roth	Average % of 401(k) total balances in Roth	Average % of employee contributions going to Roth at year-end	Average % of employee contributions going to Roth at year-end, conditional on positive Roth contribution rate	% employees contributing to both Roth and another 401(k) account at year-end, conditional on positive Roth contribution rate
A	7.2%	0.9%	0.7%	3.8%	57.9%	65.3%
B	4.9%	0.7%	0.3%	2.2%	50.4%	76.9%
C	7.6%	1.1%	0.7%	3.4%	51.8%	71.0%
D	10.1%	2.5%	1.7%	5.7%	62.8%	62.3%
E	8.0%	2.8%	2.4%	7.2%	99.8%	0.2%
F	10.6%	3.4%	2.4%	9.1%	76.0%	39.6%
G	10.0%	2.0%	1.2%	7.9%	76.1%	40.5%
H	8.1%	2.7%	1.7%	5.1%	67.9%	55.1%
I	14.3%	4.5%	3.1%	10.8%	73.4%	47.0%
J	3.8%	0.3%	0.2%	1.9%	53.3%	71.9%
K	6.6%	0.8%	0.5%	3.3%	54.0%	68.9%
L	5.9%	2.7%	1.4%	5.2%	77.6%	40.7%
All	7.9%	1.7%	1.1%	4.7%	63.9%	57.3%
All without autoenrollment	10.2%	3.0%	2.1%	7.4%	72.8%	46.5%

Table 6. Characteristics of Roth users among post-Roth hires

The variables in this table are measured as of end of first calendar year in which Roth was available for at least eleven months. We exclude people with zero 401(k) balances.

	Age		Salary ($000s)		% male		
Company	Roth users	Non-users	Roth users	Non-users	Roth users	Non-users	N
A	33.9	35.8	69.5	76.8	54.6	47.8	2,323
B	35.2	38.0	64.4	65.0	52.2	42.8	756
C	32.9	35.6	61.8	64.8	59.9	59.2	1,189
D	35.0	38.3	20.5	25.0	51.0	48.3	2,175
E	27.9	31.3	121.5	194.5	72.6	64.3	1,000
F	34.6	39.1	55.7	62.1	67.4	57.2	2,075
G	33.0	38.4	N/A	N/A	53.9	49.0	801
H	34.0	36.6	N/A	N/A	46.1	48.2	958
I	30.9	35.5	62.6	79.2	60.0	60.3	2,978
J	33.7	37.7	63.8	51.3	65.3	65.2	514
K	35.6	37.7	65.0	58.1	78.1	73.5	5,466
L	34.2	36.0	N/A	N/A	53.8	45.4	427
All	33.5	36.9	57.3	68.8	60.5	59.6	20,662
All without autoenrollment	33.0	36.7	52.3	77.3	57.6	55.1	10,414

Table 7. Characteristics of Roth users among pre-Roth hires

The variables in this table are measured as of end of first calendar year in which Roth was available for at least eleven months. We exclude people with zero 401(k) balances.

	Age		Salary ($000s)		% male		Tenure (years)	
Company	Roth users	Non-users	Roth users	Non-users	Roth users	Non-users	Roth users	Non-users
A	40.3	43.6	94.2	94.9	59.1	51.7	9.2	10.8
B	42.5	46.2	74.1	74.4	41.2	41.3	10.7	12.1
C	41.4	45.6	79.3	73.7	59.6	52.0	11.4	14.7
D	39.9	44.4	77.8	78.4	59.6	44.4	8.6	11.6
E	36.2	36.2	313.6	289.5	71.4	61.4	9.7	7.6
F	40.7	44.6	199.4	155.1	70.8	56.7	7.2	8.8
G	41.7	45.5	N/A	N/A	71.0	53.7	8.9	10.2
H	36.5	43.1	N/A	N/A	43.5	32.1	6.9	11.4
I	31.8	37.2	83.2	109.6	64.8	58.3	5.2	7.0
J	43.4	46.7	71.7	70.6	70.4	64.8	14.1	16.6
K	43.4	47.1	82.1	79.8	76.3	73.2	12.6	15.1
L	40.6	44.8	N/A	N/A	48.3	35.8	7.8	11.1
All	39.8	44.6	103.8	96.8	65.3	58.1	9.5	12.5
All without autoenrollment	37.3	42.2	130.4	136.6	62.3	48.8	7.3	9.7

Table 8. Demographic correlates of having positive Roth balance

Each row of this table reports coefficients from a separate least-squares regression where the dependent variable is a dummy for having a positive Roth balance at the end of first calendar year in which Roth was available for at least eleven months. We exclude people with zero 401(k) balances. The regressions control for a constant. Regressions with multiple companies in them also control for company dummies. Standard errors are in parentheses. To preserve the anonymity of the companies, sample sizes are not listed in Panel B.

Panel A: Post-Roth hires						
Company	(Age –20) /100	(Age – 20)^2 /10,000	Male	log(Salary)	log(Tenure)	*N*
A	-1.00**	1.99*	0.05**	-0.02	-0.01	2,085
	(0.32)	(0.82)	(0.02)	(0.02)	(0.01)	
B	-0.43	0.34	0.03	0.02	-0.00	756
	(0.45)	(1.06)	(0.03)	(0.02)	(0.02)	
C	-1.25**	1.94	0.01	0.03	-0.02	1,188
	(0.46)	(1.17)	(0.02)	(0.03)	(0.02)	
D	-2.00**	3.54**	0.02	-0.00	0.01	2,175
	(0.34)	(0.81)	(0.02)	(0.01)	(0.02)	
E	-2.86**	7.29**	0.06**	-0.02	0.02	1,000
	(0.49)	(1.41)	(0.02)	(0.02)	(0.02)	
F	-1.13**	1.32	0.08**	-0.00	-0.05*	2,075
	(0.31)	(0.69)	(0.02)	(0.02)	(0.03)	
G	-1.79**	2.37	0.04	N/A	-0.05	801
	(0.53)	(1.29)	(0.03)		(0.03)	
H	-1.27*	1.98	-0.01	N/A	0.02	958
	(0.53)	(1.31)	(0.03)		(0.04)	
I	-2.10**	3.56**	0.03	-0.09**	-0.01	2,978
	(0.31)	(0.80)	(0.02)	(0.02)	(0.01)	
J	-0.71	0.96	0.00	0.06**	0.05**	514
	(0.46)	(1.17)	(0.03)	(0.02)	(0.02)	
K	-0.34*	0.26	0.02	0.06**	0.03**	5,466
	(0.14)	(0.32)	(0.01)	(0.01)	(0.01)	
L	-0.26	0.41	0.02	N/A	-0.01	427
	(0.40)	(0.96)	(0.02)		(0.02)	
All with complete data	-1.15**	1.82**	0.03**	0.01	0.00	18,237
	(0.10)	(0.24)	(0.01)	(0.00)	(0.00)	
All with complete data and without autoenrollment	-1.94**	3.20**	0.04**	-0.01*	-0.00	8,228
	(0.16)	(0.40)	(0.01)	(0.01)	(0.01)	

Panel B: Pre-Roth hires					
Company	(Age – 20) /100	(Age – 20)^2 /10,000	Male	log(Salary)	log(Tenure)
A	-0.76**	1.07**	0.02**	0.02**	-0.00
	(0.07)	(0.15)	(0.00)	(0.00)	(0.00)
B	-0.25*	0.14	-0.00	0.01	0.00
	(0.12)	(0.24)	(0.01)	(0.00)	(0.00)
C	-0.40**	0.28	0.01**	0.03**	-0.01**
	(0.09)	(0.18)	(0.00)	(0.00)	(0.00)
D	-0.67**	-0.67**	0.05**	0.00*	-0.02**
	(0.09)	(0.09)	(0.00)	(0.00)	(0.00)
E	-1.91**	4.65**	0.03**	0.01**	0.01**
	(0.12)	(0.27)	(0.01)	(0.00)	(0.00)
F	-0.58**	0.50**	0.03**	0.03**	-0.01**
	(0.09)	(0.18)	(0.01)	(0.00)	(0.00)
G	-0.22*	-0.11	0.07**	N/A	-0.01**
	(0.10)	(0.19)	(0.01)		(0.00)
H	-0.77**	1.11**	0.02**	N/A	-0.03**
	(0.07)	(0.15)	(0.00)		(0.00)
I	-1.90**	2.95**	0.04**	-0.01*	-0.01**
	(0.11)	(0.25)	(0.00)	(0.01)	(0.00)
J	-0.32**	0.38**	0.01*	0.01**	-0.00
	(0.06)	(0.11)	(0.00)	(0.00)	(0.00)
K	-0.30**	0.23**	0.01**	0.03**	-0.01**
	(0.03)	(0.07)	(0.00)	(0.00)	(0.00)
L	-0.17	0.10	0.03**	N/A	-0.02**
	(0.15)	(0.30)	(0.01)		(0.00)
All with complete data	-0.67**	0.87**	0.02**	0.01**	-0.01**
	(0.02)	(0.05)	(0.00)	(0.00)	(0.00)
All with complete data and without autoenrollment	-1.14**	1.66**	0.04**	0.01**	-0.01**
	(0.05)	(0.10)	(0.00)	(0.00)	(0.00)

* Significant at 5% level. ** Significant at 1% level.

Table 9. Demographic correlates of Roth contribution rate

Each row of this table reports coefficients from a separate least-squares regression where the dependent variable is the Roth contribution rate at the end of first calendar year in which Roth was available for at least eleven months. A 1% contribution rate corresponds to a dependent variable value of 1, not 0.01. We exclude people with zero 401(k) balances. The regressions control for a constant. Regressions with multiple companies in them also control for company dummies. Standard errors are in parentheses. To preserve the anonymity of the companies, sample sizes are not listed in Panel B.

Panel A: Post-Roth hires						
Company	(Age – 20)	$(\text{Age} - 20)^2$ /100	Male	log(Salary)	log(Tenure)	*N*
A	-0.13**	0.27**	0.55**	0.02	-0.15	2,005
	(0.03)	(0.08)	(0.15)	(0.20)	(0.13)	
B	-0.06*	0.10	0.39*	0.13	-0.05	695
	(0.03)	(0.07)	(0.17)	(0.15)	(0.13)	
C	-0.16**	0.35**	0.30	0.36	-0.23	1,159
	(0.04)	(0.11)	(0.23)	(0.25)	(0.18)	
D	-0.14**	0.33**	0.45*	0.12	-0.12	2,063
	(0.03)	(0.08)	(0.19)	(0.10)	(0.19)	
E	-0.52**	1.46**	0.83	0.36	-0.21	877
	(0.11)	(0.33)	(0.51)	(0.42)	(0.57)	
F	-0.06	0.07	2.19**	-0.31	-1.44	2,029
	(0.10)	(0.22)	(0.63)	(0.50)	(0.86)	
G	-0.15*	0.30	0.94*	N/A	0.09	762
	(0.07)	(0.16)	(0.38)		(0.36)	
H	-0.10**	0.21*	0.19	N/A	-0.18	877
	(0.04)	(0.09)	(0.21)		(0.25)	
I	-0.30**	0.58**	0.31	-0.17	-0.19	2,815
	(0.04)	(0.10)	(0.22)	(0.26)	(0.18)	
J	-0.06	0.11	-0.10	0.21	0.20	425
	(0.04)	(0.10)	(0.22)	(0.18)	(0.17)	
K	-0.06**	0.11**	0.11	0.44**	0.12	4,994
	(0.01)	(0.03)	(0.09)	(0.06)	(0.06)	
L	-0.00	0.00	-0.07	N/A	0.17	325
	(0.03)	(0.07)	(0.17)		(0.12)	
All with complete data	-0.13**	0.26**	0.55**	0.02	-0.23**	17,062
	(0.02)	(0.04)	(0.10)	(0.07)	(0.08)	
All with complete data and no autoenrollment	-0.20**	0.39**	0.87**	-0.10	-0.43*	7,784
	(0.03)	(0.08)	(0.19)	(0.13)	(0.19)	

Panel B: Pre-Roth hires					
Company	(Age – 20)	$(\text{Age} - 20)^2$ /100	Male	log(Salary)	log(Tenure)
A	-0.05**	0.07**	0.16**	0.21**	-0.03
	(0.01)	(0.01)	(0.03)	(0.04)	(0.02)
B	-0.02**	0.02	-0.02	0.04*	0.05*
	(0.01)	(0.02)	(0.04)	(0.02)	(0.02)
C	-0.04**	0.05**	0.08*	0.24**	-0.04
	(0.01)	(0.02)	(0.04)	(0.04)	(0.02)
D	-0.02**	0.02	0.29**	0.02	-0.12**
	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)
E	-0.23**	0.02	0.58**	0.85**	0.20
	(0.03)	(0.01)	(0.16)	(0.10)	(0.11)
F	-0.12**	0.15	1.03**	1.10**	-0.03
	(0.04)	(0.08)	(0.24)	(0.12)	(0.12)
G	-0.02	0.01	0.72**	N/A	-0.09
	(0.02)	(0.03)	(0.08)		(0.05)
H	-0.04**	0.07**	0.19**	N/A	-0.15**
	(0.00)	(0.01)	(0.03)		(0.02)
I	-0.18**	0.29**	0.32**	-0.05	0.06
	(0.01)	(0.03)	(0.06)	(0.06)	(0.04)
J	-0.02**	0.02*	0.03	0.09**	0.01
	(0.00)	(0.01)	(0.02)	(0.02)	(0.01)
K	-0.03**	0.04**	0.05**	0.20**	-0.03*
	(0.00)	(0.01)	(0.02)	(0.02)	(0.01)
L	-0.01	0.02	0.23*	N/A	-0.23**
	(0.02)	(0.04)	(0.11)		(0.07)
All with complete data	-0.07**	0.10**	0.21**	0.32**	-0.03*
	(0.00)	(0.01)	(0.02)	(0.01)	(0.01)
All with complete data and no autoenrollment	-0.13**	0.20**	0.51**	0.48**	-0.07*
	(0.01)	(0.02)	(0.05)	(0.04)	(0.03)

* Significant at 5% level. ** Significant at 1% level.

Table 10. Demographic correlates of Roth contribution as a percent of total employee 401(k) contribution

Each row of this table reports coefficients from a separate least-squares regression where the dependent variable is the Roth contribution rate as a percent of the total employee 401(k) contribution rate at the end of first calendar year in which Roth was available for at least eleven months. A dependent variable value of 1 corresponds to 1%, not 100%. We exclude people with zero 401(k) balances. The regressions control for a constant. Regressions with multiple companies in them also control for company dummies. Standard errors are in parentheses. To preserve the anonymity of the companies, sample sizes are not listed in Panel B.

Panel A: Post-Roth hires						
Company	(Age – 20)	$(\text{Age} - 20)^2$ /100	Male	log(Salary)	log(Tenure)	*N*
A	-1.19**	2.35**	4.26**	-1.06	-1.67	2,005
	(0.24)	(0.61)	(1.16)	(1.53)	(1.02)	
B	-0.98**	1.56	2.91	0.90	-0.89	695
	(0.33)	(0.80)	(1.87)	(1.72)	(1.51)	
C	-1.73**	3.22**	-0.29	1.28	-1.82	1,159
	(0.37)	(0.93)	(1.99)	(2.20)	(1.62)	
D	-1.86**	3.49**	4.37**	-0.28	0.58	2,063
	(0.27)	(0.65)	(1.52)	(0.85)	(1.53)	
E	-2.84**	7.35**	4.98*	-2.14	2.17	877
	(0.52)	(1.48)	(2.31)	(1.90)	(2.59)	
F	-1.18**	1.68**	8.14**	0.38	-6.69**	2,029
	(0.27)	(0.60)	(1.72)	(1.36)	(2.35)	
G	-2.11**	3.48**	5.08	N/A	-3.58	762
	(0.47)	(1.16)	(2.75)		(2.59)	
H	-1.31**	2.00	1.23	N/A	1.80	877
	(0.44)	(1.09)	(2.55)		(3.03)	
I	-2.49**	4.69**	2.55	-7.78**	-0.33	2,815
	(0.26)	(0.68)	(1.45)	(1.72)	(1.20)	
J	-0.83	1.58	1.11	1.58	2.26	425
	(0.43)	(1.10)	(2.54)	(2.08)	(1.98)	
K	-0.43**	0.49	1.62	4.53**	0.20	4,994
	(0.12)	(0.29)	(0.85)	(0.58)	(0.61)	
L	-0.10	0.02	1.66	N/A	3.17	325
	(0.41)	(0.99)	(2.51)		(1.82)	
All with complete data	-1.32**	2.32**	3.03**	0.36	-1.13**	17,062
	(0.08)	(0.20)	(0.50)	(0.36)	(0.42)	
All with complete data and no autoenrollment	-2.03**	3.64**	4.28**	-1.48**	-0.30	7,784
	(0.14)	(0.34)	(0.82)	(0.57)	(0.81)	

Panel B: Pre-Roth hires					
Company	(Age – 20)	$(\text{Age} - 20)^2$ /100	Male	log(Salary)	log(Tenure)
A	-0.59**	0.89**	1.65**	1.85**	-0.41**
	(0.05)	(0.10)	(0.20)	(0.25)	(0.14)
B	-0.38**	0.52**	-0.27	0.38*	0.09
	(0.07)	(0.14)	(0.32)	(0.16)	(0.19)
C	-0.49**	0.66**	0.72**	1.63**	-0.80**
	(0.06)	(0.11)	(0.24)	(0.24)	(0.17)
D	-0.47**	0.58**	3.67**	-0.15	-1.45**
	(0.06)	(0.12)	(0.27)	(0.17)	(0.17)
E	-1.22**	2.42**	3.62**	1.24**	-0.43
	(0.13)	(0.32)	(0.60)	(0.38)	(0.42)
F	-0.74**	0.89**	3.26**	2.72**	-1.79**
	(0.09)	(0.18)	(0.53)	(0.28)	(0.27)
G	-0.49**	0.45*	6.03**	N/A	-1.02**
	(0.10)	(0.18)	(0.47)		(0.32)
H	-0.77**	1.30**	1.46**	N/A	-2.43**
	(0.06)	(0.12)	(0.31)		(0.19)
I	-1.83**	3.06**	3.67**	-1.05*	-0.91**
	(0.10)	(0.22)	(0.42)	(0.46)	(0.30)
J	-0.28**	0.37**	0.43**	0.73**	-0.02
	(0.04)	(0.07)	(0.16)	(0.15)	(0.09)
K	-0.30**	0.37**	0.62**	1.44**	-0.38**
	(0.02)	(0.04)	(0.13)	(0.12)	(0.07)
L	-0.40*	0.47	0.87	N/A	-2.25**
	(0.17)	(0.32)	(0.80)		(0.53)
All with complete data	-0.61**	0.90**	1.72**	0.89**	-0.57**
	(0.02)	(0.03)	(0.08)	(0.07)	(0.05)
All with complete data and no autoenrollment	-1.06**	1.59**	3.65**	0.79**	-1.44**
	(0.04)	(0.08)	(0.21)	(0.14)	(0.13)

* Significant at 5% level. ** Significant at 1% level.

Table 11. Demographic correlates of having positive Roth and positive non-Roth employee contribution rates

Each row of this table reports coefficients from a separate least-squares regression where the dependent variable is a dummy for having both positive Roth and positive non-Roth employee contribution rates at the end of first calendar year in which Roth was available for at least eleven months. The sample is restricted to employees who have a positive Roth contribution rate on this date. A dependent variable value of 1 corresponds to 1%, not 100%. The regressions control for a constant. Regressions with multiple companies in them also control for company dummies. Standard errors are in parentheses. To preserve the anonymity of the companies, sample sizes are not listed in Panel B.

Panel A: Post-Roth hires						
Company	(Age – 20) /100	$(\text{Age} - 20)^2$ /10,000	Male	log(Salary)	log(Tenure)	*N*
A	4.02**	-8.51*	-0.12*	-0.09	0.06	279
	(1.19)	(3.33)	(0.06)	(0.09)	(0.05)	
B	3.15	-4.94	-0.22	0.13	-0.11	80
	(1.99)	(5.50)	(0.11)	(0.15)	(0.09)	
C	3.86**	-8.13*	0.03	0.06	0.01	261
	(1.14)	(3.17)	(0.06)	(0.08)	(0.05)	
D	3.35**	-7.38**	-0.07	0.04	-0.05	526
	(0.74)	(1.82)	(0.04)	(0.03)	(0.05)	
E	---	---	---	---	---	---
F	3.04**	-6.68**	-0.11*	-0.03	0.10	447
	(0.75)	(1.85)	(0.05)	(0.04)	(0.06)	
G	1.73	-2.88	-0.09	N/A	-0.03	213
	(1.13)	(2.94)	(0.07)		(0.06)	
H	2.18*	-3.63	-0.08	N/A	-0.05	281
	(1.04)	(2.62)	(0.06)		(0.08)	
I	4.46**	-10.00**	-0.02	0.07	-0.05	797
	(0.65)	(1.86)	(0.04)	(0.05)	(0.03)	
J	2.36	-6.96	-0.00	0.24	-0.11	46
	(3.06)	(8.65)	(0.16)	(0.15)	(0.17)	
K	2.82**	-5.35**	-0.02	-0.10*	0.07*	551
	(0.76)	(1.90)	(0.05)	(0.05)	(0.03)	
L	-7.69	17.92	0.01	N/A	0.06	23
	(4.41)	(10.67)	(0.24)		(0.17)	
All with complete data	3.60**	-7.70**	-0.05**	0.00	0.01	2,987
	(0.31)	(0.82)	(0.02)	(0.01)	(0.02)	
All with complete data and no autoenrollment	3.77**	-8.34**	-0.06*	0.03	-0.03	1,770
	(0.39)	(1.03)	(0.02)	(0.02)	(0.02)	

Panel B: Pre-Roth hires					
Company	(Age – 20) /100	(Age – 20)^2 /10,000	Male	log(Salary)	log(Tenure)
A	2.65**	-4.79**	-0.08**	-0.17**	0.03
	(0.47)	(1.03)	(0.02)	(0.03)	(0.01)
B	4.81**	-9.09**	-0.00	-0.05	-0.01
	(1.08)	(2.35)	(0.05)	(0.03)	(0.04)
C	3.26**	-6.15**	-0.04	-0.09**	0.06**
	(0.59)	(1.24)	(0.03)	(0.03)	(0.02)
D	0.68	-1.29	-0.10**	0.04**	0.08**
	(0.43)	(0.94)	(0.02)	(0.01)	(0.01)
E	---	---	---	---	---
F	2.00**	-3.51**	0.01	-0.05**	0.03*
	(0.48)	(0.99)	(0.03)	(0.02)	(0.01)
G	2.44**	-5.11**	-0.10**	N/A	-0.02
	(0.56)	(1.14)	(0.03)		(0.02)
H	3.37**	-7.88**	-0.07**	N/A	0.09**
	(0.50)	(1.15)	(0.03)		(0.02)
I	4.20**	-8.68**	-0.07**	-0.12**	-0.00
	(0.50)	(1.34)	(0.02)	(0.03)	(0.02)
J	2.81**	-5.27**	-0.02	-0.15**	0.03
	(0.70)	(1.45)	(0.03)	(0.03)	(0.02)
K	2.83**	-5.17**	-0.05**	-0.03	0.02*
	(0.27)	(0.55)	(0.02)	(0.02)	(0.01)
L	1.96	-4.25	-0.03	N/A	0.05
	(1.63)	(3.54)	(0.07)		(0.05)
All with complete data	2.39**	-4.45**	-0.06**	-0.03**	0.03**
	(0.16)	(0.33)	(0.01)	(0.01)	(0.01)
All with complete data and no autoenrollment	1.92**	-3.53**	-0.07**	-0.00	0.04**
	(0.25)	(0.55)	(0.01)	(0.01)	(0.01)

* Significant at 5% level. ** Significant at 1% level.

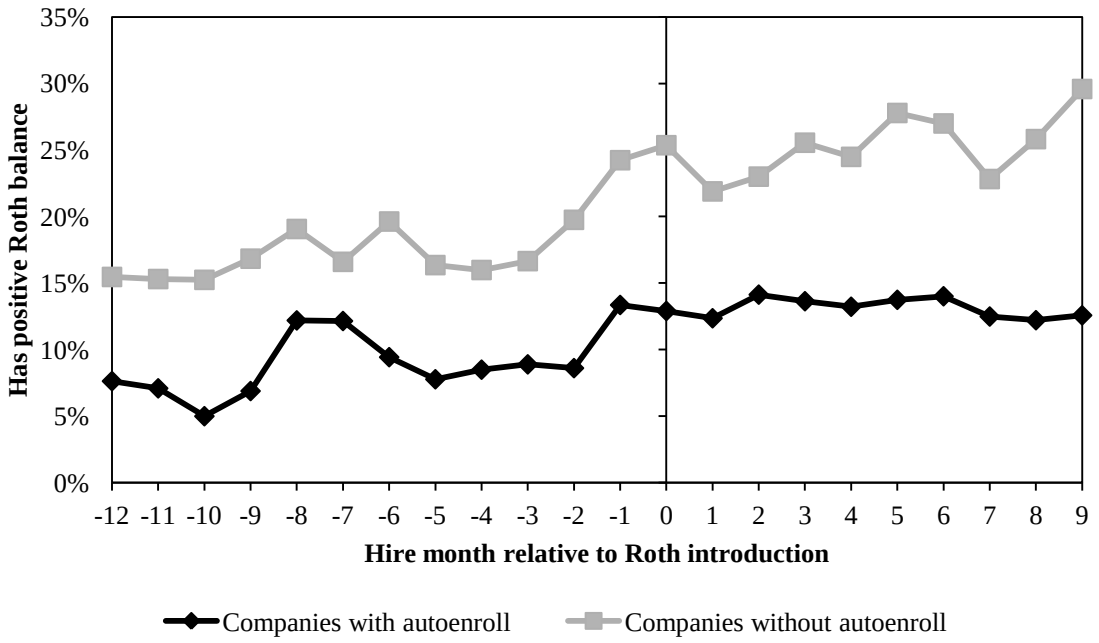

Figure 1. Percent of 401(k) participants with positive Roth balances, by hire month relative to Roth introduction.