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

John Beshears, James J. Choi, David Laibson, and Brigitte C. Madrian

The Economic Growth and Tax Relief Reconciliation Act of 2001 allowed plan sponsors to add a Roth 401(k) option to defined contribution savings plans starting on January 1, 2006. 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 percent of 401(k) plans offered a Roth option in 2011.

In this chapter, 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

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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 percent of all 401(k) participants have a positive balance in their Roth account. Roth balances make up only 1.8 percent 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 percent 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 percent of employee contributions go to the Roth. Consistent with the existence of a tax diversification motive, 54.8 percent 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 reflect an active preference against the Roth, but it can also be partially explained if employees who enrolled in the 401(k) when the Roth was unavailable fail to update their 401(k) elections in response to the introduction of the Roth. Supporting the importance of the passivity channel, we find that 19.0 percent 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 percent 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 the Roth 401(k). 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 (before-tax plus after-tax plus Roth). 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 associated with mixing contributions.

The remainder of the chapter proceeds as follows. In section 12.1, we summarize some of the institutional rules of the Roth 401(k). Section 12.2 describes our data. Section 12.3 discusses summary statistics on how employees use the Roth 401(k) and the characteristics of Roth users. Section 12.4 investigates the correlates of Roth usage in a multivariate regression framework. Section 12.5 concludes.

12.1 The Rules and Economics of the Roth 401(k)

We begin by describing the tax treatment of three different types of 401(k) contributions: Roth contributions, before-tax contributions, and after-tax contributions. 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 (a) the account has been held for at least five years, and (b) the account owner is either older than 59.5, disabled, or deceased. Therefore, the marginal dollar of pretax 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 plus the marginal reduction in means-tested benefits (such as the Earned Income Tax Credit) due to the additional dollar of taxable income 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 nonqualified withdrawals, the withdrawn principal is not taxed, but the interest and capital gains are subject to ordinary income tax and may reduce means-tested benefits and increase taxation of Social Security benefits received in the year of the withdrawal. If the account owner is

younger than 59.5, the withdrawn earnings are also assessed a 10 percent 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, the marginal dollar of pretax income buys $(1 + r)(1—\tau_1)$ of future consumption if it is contributed to a before-tax account, where τ_1 is the household's marginal ordinary income tax rate in the year of the withdrawal plus an adjustment if the withdrawal generates a marginal increase in taxation of Social Security benefits or a reduction in means-tested benefits. An additional 10 percent tax penalty applies to both the principal and earnings withdrawn if the account owner is younger than 59.5.

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, and this interest and capital gains income may affect means-tested benefits and taxation of Social Security benefits. The marginal dollar of pretax income 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 percent tax penalty applies to earnings that are withdrawn by account owners younger than 59.5.

If there are no employer-matching contributions in the 401(k) and withdrawals occur late enough to be considered qualified by the Roth criteria, then saving the next pretax dollar in the Roth is a better financial deal than saving it before tax, if and only if $\tau_0 < \tau_1$. In a progressive tax system whose rules stay fixed over time, 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 59.5, since Roth principal is exempt from the 10 percent 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 some-

1. McQuarrie (2008) also considers how tax laws may change in his analysis. Burman, Gale, and Weiner (1998) find that between 1980 and 1995, changes in tax laws had a much larger effect on individuals' marginal tax rates than variation induced by lifecycle income patterns. See Ahern et al. (2005) and Kotlikoff, Marx, and Rapson (2008) for other analyses of the relative merits of the Roth 401(k).

times more liquid before age 59.5, 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.

Although employers can structure their savings plans to allow Roth, before-tax, and after-tax employee contributions, employer matching contributions must 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 might not match certain types of employee contributions (e.g., after-tax contributions), but among the types of contributions 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. To see this, let m be the rate at which employee contributions are matched. The marginal pretax dollar can earn 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 and given up in benefits, thereby preventing the entire dollar from being contributed to the savings plan). The condition under which employees who have no probability of making a nonqualified 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

$$(1) \qquad (1—\tau_0)[1 + m(1—\tau_1)] > (1—\tau_1)(1 + m).$$

Another factor affecting the attractiveness of Roth versus regular before-tax contributions is whether employees are constrained by the contribution limits on 401(k) plans. Internal Revenue Service regulations stipulate that the combined before-tax plus Roth contributions in a calendar year cannot exceed a certain limit that is adjusted each year. For people younger than fifty, this limit was $14,000 in 2005 (the last year before Roth contributions were 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 table 12.1. People age fifty and older are allowed an additional "catch-up" contribution; this additional amount was $4,000 in 2005 and has since been increased to its 2013 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 for people under the age of fifty. 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.

Table 12.1 401(k) contribution limits

	Employee before-tax plus Roth 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

12.2 Data Description

To analyze the utilization of Roth accounts, we use 401(k) administrative data from Aon Hewitt, a firm with a large US benefits administration and consulting business. 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 nine of the twelve companies), and gender. We restrict our sample to employees between the ages of twenty and sixty-nine.

Table 12.2 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. Eight of the twelve companies are in the financial services industry, and average 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 thirty-five to forty-eight years; average tenure at the company ranges from five years to sixteen years; and male percentage ranges from 33 percent to 76 percent.

Table 12.3 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 percent and 6 percent of income. The automatic enrollment companies have an average participation rate of 88 percent, which is higher

Table 12.2 **Company characteristics as of 2010**

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

Table 12.3 **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	Nonenrollment	133% match on first 3% of income contributed after 1 year of tenure	45	1/1/2006
E	49	Nonenrollment	No match	50	2/1/2006
F	75	Nonenrollment	100% match on first 6% of income contributed after 1 year of tenure	100	1/1/2007
G	88	Nonenrollment	No match	20	1/1/2006
H	74	Nonenrollment	115% match on first 6% of income contributed after 1 year of tenure	20	1/1/2008
I	86	Nonenrollment	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	Nonenrollment	50% match on the first 6% of income contributed	100	7/1/2010

than the average participation rate of 77 percent among the companies that have opt-in enrollment schemes. Nine companies match employee contributions up to a threshold between 3 percent and 8 percent of income at rates between 25 percent and 133 percent. The maximum percent of a paycheck that can be contributed to the 401(k) ranges from 20 percent to 100 percent. These maximums are subject to IRS restrictions described earlier on the total dollars that can be contributed within a calendar year.

12.3 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 for each company as of the end of the first calendar year 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 12.4 reflect usage exactly twelve months after Roth introduction. For company E, 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 eighteen months, respectively, after Roth introduction.

The first column of table 12.4 shows that the Roth is used by only a small minority of 401(k) participants. Only between 3.9 percent and 16.0 percent 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 percent 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 percent. Plan Sponsor Council of America (2012) reports that a higher proportion of their sample (17.4 percent) 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 percent 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 percent figure we calculate for the fraction that have positive Roth balances.

The fraction of employee contribution balances held in the Roth is considerably lower than the fraction of employees with positive Roth balances,

Table 12.4 **Roth 401(k) utilization after Roth introduction**

Company	The % 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	The % of 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

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

ranging from 0.4 percent to 6.5 percent. The average is 2.4 percent among all companies, and 4.3 percent among companies without automatic enrollment. Roth balances as a percent of total 401(k) balances, which also include balances from the employer match and profit-sharing contributions, are even lower, averaging 1.8 percent across all companies and 3.4 percent among companies without automatic enrollment. The small size of Roth balances partially reflects the fact that the numbers in table 12.4 are calculated shortly after Roth introduction (eleven to eighteen months). Examining just contribution flows, a somewhat larger fraction of employee contributions during the last pay period of the calendar year is going to the Roth: 5.4 percent on average across all companies (8.5 percent excluding automatic enrollment companies), with individual companies ranging from 2.0 percent to 12.2 percent.

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 percent of their employee contributions in the Roth account. At the individual company level, this conditional average is no lower than 53.8 percent, and it is as high as 99.9 percent at company E, which does not allow employees to contribute to both the Roth account and the before-tax account.[2]

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 percent) 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. Much of the diversification we observe is not consistent with employees following a naïve 50-50 rule; conditional on having a positive Roth contribution rate, only 15.0 percent has a Roth contribution rate that is equal to the before-tax contribution rate (not shown in tables), which is far below the 54.8 percent engaging in active tax diversification.[3]

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 gener-

2. There is only one person in our company E data who anomalously has both a positive before-tax contribution rate and a positive Roth contribution rate.

3. The fraction that has a Roth contribution rate equal to the sum of the before-tax and after-tax contribution rates, conditional on having a positive Roth contribution rate, is 13.6 percent.

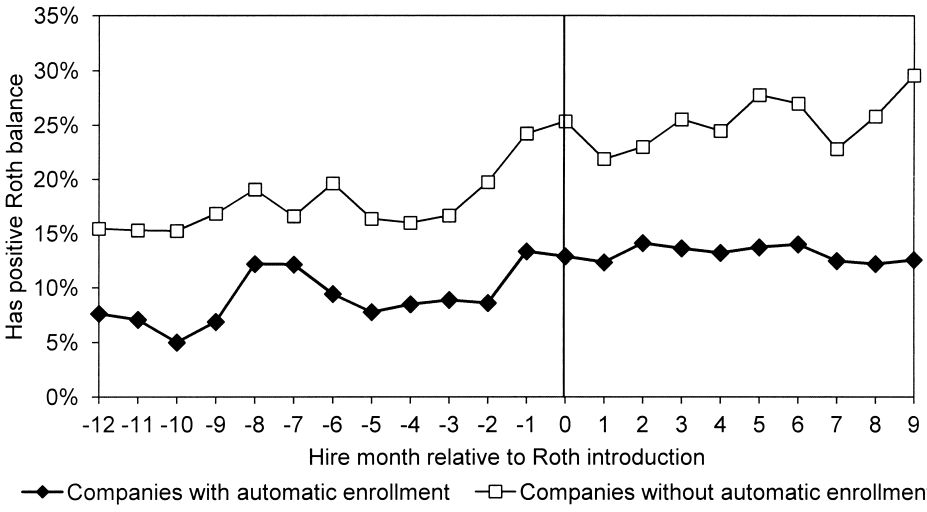

Fig. 12.1 Percent of 401(k) participants with positive Roth balances, by hire month relative to Roth introduction

ated 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, and so forth. 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 12.1 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 12.5 and 12.6 expand the figure's sample to include all pre- or post-Roth hires, not just those hired in a narrow window around Roth introduction. Table 12.5 shows that among 401(k) participants who were hired after the Roth's introduction, 19.0 percent have a positive balance in the Roth, 13.5 percent of employee contribution balances and 11.4 percent of total 401(k) balances are held in the Roth, and 14.3 percent of employee contribution flows are going to the Roth at year end. These numbers are much higher than the corresponding numbers in table 12.6 for 401(k) participants who were hired before the Roth: 7.9 percent have a positive Roth balance, 1.7 percent of employee contribution balances and 1.1 percent of total 401(k) balances are held in the Roth, and 4.7 percent 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 percent) to the Roth than pre-Roth hires (63.9 percent). 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 percent of their contributions to the Roth versus 72.8 percent 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 percent versus 57.3 percent. This difference is smaller when we study only companies without automatic enrollment—39.6 percent versus 46.5 percent.

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 12.7 shows the average age, average 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 the two groups. Excluding companies with automatic enrollment does not qualitatively change the results of these comparisons. 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 percent of tax units that have no current income tax liability (Williams 2009), so their marginal tax rate in retirement is more likely to be weakly greater than it is today.

The picture changes somewhat for 401(k) participants among pre-Roth hires (table 12.8). 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

Table 12.5 **Roth 401(k) utilization among post-Roth hires**

Company	The % 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	The % of 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

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

Table 12.6 **Roth 401(k) utilization among pre-Roth hires**

Company	The % 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	The % of 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

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

Table 12.7 **Characteristics of Roth users and nonusers among post-Roth hires**

	Age		Salary ($000s)		% male		
Company	Roth users	Nonusers	Roth users	Nonusers	Roth users	Nonusers	*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

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

Table 12.8 **Characteristics of Roth users and nonusers among pre-Roth hires**

	Age		Salary ($000s)		% male		Tenure (years)	
Company	Roth users	Nonusers	Roth users	Nonusers	Roth users	Nonusers	Roth users	Nonusers
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

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

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

12.4. 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 twenty years, age in excess of twenty years squared, a male dummy, log salary (when available), 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 12.9 shows coefficients from regressing a dummy for having positive Roth balances on the control variables. Among both post- and pre-Roth hires, older 401(k) participants 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 fifty-two among post-Roth hires and age fifty-nine among pre-Roth hires, when the probability of Roth usage is 18.2 percentage points and 12.9 percentage points lower, respectively, than for twenty-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 12.7 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 percent 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 percent increase in salary increases the probability of Roth usage by 0.1 percentage points. Unlike for the univariate comparison of means in table 12.8, 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 percent increase in tenure decreases the probability of Roth usage by 0.1 percentage points.

In table 12.10, we examine the demographic correlates of the Roth contribution rate as a fraction of income, conditional on having a positive total 401(k) balance. Roth contributions initially fall with age before rising. Among post-Roth hires, the Roth contribution rate falls by 1.5 percent of income from age twenty to forty-five and then rises. At age sixty-nine, the Roth contribution rate is only 0.12 percent of income lower than at age twenty. Among pre-Roth hires, the Roth contribution rate falls by 1.0 percent of income from age twenty to fifty-three and then rises, but at age sixty-nine, the Roth contribution rate is still 0.8 percent of income lower than at age twenty. Men contribute 0.5 percent of income more than women to the Roth in the post-Roth hire cohort, and 0.2 percent 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 percent increase in salary is associated with a 0.03 percent of income increase in the Roth contribution rate. Tenure is negatively correlated with the Roth contribution rate; a 10 percent increase in tenure is associated with a 0.02 percent of income decrease in the Roth contribution rate among post-Roth hires and a 0.002 percent 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 in the Roth. In table 12.11, 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 forty-eight, when participants allocate 18.8 percentage points less to the Roth than twenty-year-olds. At age sixty-nine, participants allocate 9.0 percentage points less to the Roth than twenty-year-olds. For pre-Roth hires, the fraction also decreases with age until fifty-four, when participants allocate 10.3 percentage points less to the Roth. Men allocate 3.0 percentage points more to the Roth if hired after Roth introduction and 1.7 percentage points more if hired before Roth introduction. Salary has a minor

Table 12.9 Demographic correlates of having positive Roth balance

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	0.02	–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)	

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***	–0.76***	0.05***	0.00**	–0.02***
	(0.09)	(0.17)	(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)

Notes: Each row of this table reports coefficients from a separate ordinary least squares regression where the dependent variable is a dummy for having a positive Roth balance at the end of the first calendar year in which Roth was available for at least eleven months. We exclude people with zero 401(k) balances. The regressions include 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.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 12.10 Demographic correlates of Roth contribution rate

A. Post-Roth hires

Company	(Age – 20)	(Age – 20)² / 100	Male	log(salary)	log(tenure)	*N*
A	–0.13***	0.26***	0.54***	0.01	–0.16	2,085
	(0.03)	(0.08)	(0.14)	(0.19)	(0.13)	
B	–0.06**	0.10	0.36**	0.14	–0.01	756
	(0.03)	(0.07)	(0.15)	(0.14)	(0.11)	
C	–0.15***	0.34***	0.28	0.35	–0.24	1,188
	(0.04)	(0.10)	(0.22)	(0.24)	(0.18)	
D	–0.13***	0.32***	0.44**	0.09	–0.15	2,175
	(0.03)	(0.08)	(0.18)	(0.10)	(0.18)	
E	–0.45***	1.29***	0.66	0.17	–0.27	1,000
	(0.10)	(0.29)	(0.45)	(0.36)	(0.51)	
F	–0.06	0.06	2.12***	–0.27	–1.51*	2,075
	(0.10)	(0.22)	(0.62)	(0.49)	(0.84)	
G	–0.14**	0.27*	0.86**	N/A	0.01	801
	(0.06)	(0.15)	(0.37)		(0.35)	
H	–0.09**	0.20**	0.21	N/A	–0.24	958
	(0.03)	(0.08)	(0.20)		(0.24)	
I	–0.29***	0.56***	0.30	–0.12	–0.26	2,978
	(0.04)	(0.10)	(0.21)	(0.25)	(0.18)	
J	–0.04	0.08	–0.08	0.19	0.27**	514
	(0.03)	(0.08)	(0.18)	(0.15)	(0.12)	
K	–0.05***	0.10***	0.10	0.42***	0.16***	5,466
	(0.01)	(0.03)	(0.08)	(0.06)	(0.05)	
L	–0.00	–0.00	–0.03	N/A	0.05	427
	(0.02)	(0.05)	(0.13)		(0.10)	
All with complete data	–0.12***	0.24***	0.52***	0.01	–0.19***	18,237
	(0.01)	(0.04)	(0.09)	(0.06)	(0.07)	
All with complete data and no autoenrollment	–0.19***	0.37***	0.81***	–0.10	–0.47***	8,228
	(0.03)	(0.08)	(0.18)	(0.12)	(0.18)	

B. Pre-Roth hires

Company	(Age – 20)	(Age – 20)^2 / 100	Male	log(salary)	log(tenure)
A	–0.05***	0.07***	0.15***	0.21***	–0.03
	(0.01)	(0.01)	(0.03)	(0.04)	(0.02)
B	–0.02***	0.02	–0.02	0.04**	0.04**
	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)
C	–0.04***	0.05***	0.08**	0.24***	–0.04
	(0.01)	(0.02)	(0.04)	(0.03)	(0.02)
D	–0.02***	0.02	0.28***	0.03	–0.12***
	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)
E	–0.14***	0.27***	0.40***	0.48***	0.01
	(0.03)	(0.06)	(0.12)	(0.07)	(0.08)
F	–0.09***	0.12*	0.78***	1.02***	0.06
	(0.03)	(0.06)	(0.19)	(0.10)	(0.10)
G	–0.01	–0.01	0.64***	N/A	0.00
	(0.01)	(0.02)	(0.07)		(0.04)
H	–0.03***	0.05***	0.19***	N/A	–0.14***
	(0.00)	(0.01)	(0.02)		(0.01)
I	–0.17***	0.28***	0.26***	0.06	0.04
	(0.01)	(0.03)	(0.05)	(0.06)	(0.04)
J	–0.02***	0.02**	0.02	0.10***	0.00
	(0.00)	(0.01)	(0.02)	(0.02)	(0.01)
K	–0.03***	0.05***	0.04**	0.20***	–0.03***
	(0.00)	(0.01)	(0.02)	(0.02)	(0.01)
L	–0.00	0.01	0.25***	N/A	–0.13***
	(0.02)	(0.03)	(0.08)		(0.05)
All with complete data	–0.06***	0.09***	0.18***	0.31***	–0.02**
	(0.00)	(0.01)	(0.02)	(0.01)	(0.01)
All with complete data and no autoenrollment	–0.11***	0.18***	0.42***	0.46***	–0.05*
	(0.01)	(0.02)	(0.05)	(0.03)	(0.03)

Notes: Each row of this table reports coefficients from a separate ordinary least squares regression where the dependent variable is the Roth contribution rate at the end of the first calendar year in which Roth was available for at least eleven months. A 1 percent contribution rate corresponds to a dependent variable value of 1, not 0.01. We exclude people with zero 401(k) balances. The regressions include 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.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

Table 12.11 **Demographic correlates of Roth contribution as a percent of total employee 401(k) contribution**

A. Post-Roth hires

Company	(Age – 20)	(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)	

B. Pre-Roth hires

Company	(Age – 20)	(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)

Notes: Each row of this table reports coefficients from a separate ordinary 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 the first calendar year in which Roth was available for at least eleven months. A dependent variable value of 1 corresponds to 1 percent, not 100 percent. We exclude people with zero 401(k) balances. The regressions include 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.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

effect, being insignificant for post-Roth hires (unless automatic enrollment companies are excluded, in which case a 10 percent 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 percent 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 percent increase in tenure) and pre-Roth hires (0.06 percentage points per 10 percent 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 12.12, 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 forty-three, when employees are 42.1 percentage points more likely than twenty-year-olds to do so, and then decreases to the point where at age sixty-nine, employees are 8.5 percentage points less likely to contribute to both accounts than twenty-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 forty-seven, when employees are 32.1 percentage points more likely to do so than twenty-year-olds, but even sixty-nine-year-olds are 10.3 percentage points more likely to contribute to both accounts than twenty-year-olds. As with 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.

12.5 Conclusion

Roth 401(k) usage is relatively uncommon in our sample of firms; approximately one year after the Roth is introduced, only 8.6 percent 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 total 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

Table 12.12 **Demographic correlates of having a positive non-Roth employee contribution conditional on having a positive Roth contribution**

A. Post-Roth hires

Company	(Age – 20) / 100	(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)	

Table 12.12 (continued)

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)

Notes: Each row of this table reports coefficients from a separate ordinary 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 the 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. The regressions include 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.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

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 quickly to the Roth option when it is introduced after they have already joined the 401(k) plan.

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Comment

James M. Poterba

This is an interesting chapter that offers empirical evidence on the role of Roth 401(k) plans in the saving decisions of US workers. Roth 401(k)s first became available in 2001, but uncertainty about whether the legislation that created them would expire in 2010 initially slowed their diffusion. In 2006, tax legislation made them permanent. This chapter explores the experience of a small group of large firms that adopted Roth 401(k) plans between 2006 and 2010. The notable findings include: the take-up rate for Roth 401(k)s has been quite slow; age and income have modest predictive power in explaining Roth 401(k) participation, but much remains unexplained; and inertia appears to play an important role in the choice between regular and Roth 401(k) plans. Each of these findings is informative and is likely to stimulate follow-on research.

The chapter begins by discussing the choice problem facing an individual who has access to both a regular and a Roth 401(k). The problem is an extended version of the standard asset location problem, in which an individual must choose between saving in a taxable and a tax-deferred account. When both a Roth and a regular 401(k) are available, the individual must choose how much to save in each tax-deferred account. Corner solutions are possible—contributing to only one type of account—as are solutions that involve some "diversification" through contributions to both accounts. The chapter explains that even when an individual chooses to direct all of her contributions to a Roth 401(k), any employer-matching contributions must be placed in a regular 401(k). This means that anyone choosing the "Roth only" strategy at a firm with matching contributions is de facto diversified. There is an upper limit on the amount that can be contributed to either a Roth or a regular 401(k). That limit is $17,500 in 2013, and it is the same for both regular and Roth 401(k)s.

James M. Poterba is the Mitsui Professor of Economics at the Massachusetts Institute of Technology and president and chief executive officer of the National Bureau of Economic Research.

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