$100 Bills on the Sidewalk: Suboptimal Saving in 401(k) Plans

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Abstract: It is typically difficult to determine whether households save optimally. But in some cases, savings incentives are strong enough to imply sharp normative restrictions. We consider employees who receive employer matching contributions in their 401(k) plan and are allowed to make discretionary, penalty-free, in-service withdrawals. For these employees, contributing below the match threshold is a dominated action. Nevertheless, half of employees with these clear-cut incentives *do* contribute below the match threshold, foregoing matching contributions that average 1.3% of their annual pay. Providing these "undersavers" with specific information about the free lunch they are giving up fails to raise their contribution rates.

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Despite widespread popular concern that American households are not saving properly for retirement, it is typically difficult to demonstrate that a household's savings decisions are suboptimal. The lifecycle savings problem is sufficiently complex and economic theory sufficiently rich that few restrictions can be imposed on the range of savings behaviors we should observe in the absence of mistakes; nearly any choice can be theoretically justified by some combination of preferences and information unobserved by the econometrician.

In this paper, we identify a sizeable group of employees whose observable choice set in an important retirement savings vehicle, the 401(k), includes actions that are clearly precluded by normative economic theory. These individuals, who are over 59½ years old, have their 401(k) contributions matched by their employer; that is, for every dollar they contribute up to a certain threshold, their employer will make an additional proportional contribution. Furthermore, they have virtually unconstrained access to their 401(k) balances because their companies allow employees over 59½ to make discretionary[1], penalty-free[2], in-service[3] 401(k) withdrawals. For these individuals, a contribution rate below the match threshold is a *dominated* strategy. Nevertheless, we find that many of these employees are not contributing up to the match threshold. We calculate a *lower bound* on the welfare losses for these below-threshold employees by computing the difference between the payoffs to their current savings strategy and one which clearly dominates.

The dominating strategy we consider for these below-threshold employees is increasing their contribution rate up to the match threshold. This incremental contribution triggers an instantaneous windfall gain because of the employer match. The employee then immediately withdraws the incremental contribution. This strategy, which we will refer to as the "withdrawal strategy," has no impact on the employee's non-401(k) finances and hence need not affect current levels of consumption. However, it increases the employee's 401(k) balance by the amount of the incremental contribution multiplied by the employer match rate. Because this withdrawal strategy is not necessarily the globally optimal strategy for the employee, the

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[1] That is, they can withdraw money for any reason. In particular, they do not have to document financial hardship in order to access their balances.

[2] The 10% (federal) tax penalty on early 401(k) withdrawals only applies to employees under the age of 59 ½, and our sample only includes companies that allow employees to make 401(k) withdrawals without jeopardizing their ability to make future contributions to the 401(k) plan.

[3] That is, they can withdraw money from the company-sponsored 401(k) while still employed at the firm.

increased 401(k) balance represents a lower bound on the welfare gain available to the employee if she perfectly optimized.

The lower bound on welfare loss can be substantial. Consider a 60-year-old employee who does not currently contribute to her 401(k) plan but whose company would match her contributions dollar-for-dollar up to 5% of her salary. If her biweekly salary is $2,000, then the incremental value of contributing up to the match threshold is bounded below at $2,000 × 5% = $100 every two weeks. Executing the withdrawal strategy, she would end up with an extra $2,600 in her 401(k) account each year. Alternatively, if the firm allows it, she could withdraw the $2,600 in employer matching contributions as well and increase her consumption by $2,600 per year without decreasing her assets relative to her non-contributing strategy.

Despite the large gains from contributing up to the employer match threshold, we find that roughly half of our sample of older employees picks a dominated contribution rate below the match threshold. We refer to those employees contributing less than the match threshold who could profitably benefit from the withdrawal strategy described above as "undersavers." (We use this term narrowly for those whose 401(k) contributions are too low; we do not mean to imply that these employees are necessarily saving too little in a normative sense, since it may be optimal for them to follow the withdrawal strategy and use the proceeds to *increase* their current consumption while leaving their savings path unchanged.) The average annual welfare loss found among these "undersavers" is 1.3% of their yearly salary.

The fact that so many employees in our sample fail to take full advantage of the employer match is surprising because one would *a priori* expect this population to be particularly eager to contribute to their 401(k). Since they are at least 59½ years old, the need for retirement savings should be salient to them. Having decades of experience managing their money, they should be more financially savvy than their younger counterparts. And, with an average of 14.3 years of tenure at their respective companies, they have had ample time to familiarize themselves with their 401(k) plans.

To better understand why these employees do not take full advantage of their 401(k) match, we analyze a combined survey/field experiment conducted jointly with Hewitt Associates, the benefits administration and consulting firm that supplied our 401(k) data. Survey responses indicate that neither perceived direct transactions costs nor satiation explain the failure to contribute to the match threshold. Rather, undersavers appear to be much less financially

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sophisticated and knowledgeable about their firm's 401(k) plan. Nevertheless, explaining the foregone opportunity—while highlighting the fact that there is no loss of liquidity from contributing up to the match threshold—produces only an infinitesimal response, raising 401(k) contribution rates by one tenth of one percentage point relative to a control group. Evidence that undersavers are more prone to delay taking other profitable actions suggests that time-inconsistent preferences may also play a role in undermining optimal contribution choices.

The paper proceeds as follows. Section I describes our data and the procedures we used to select our sample. Section II discusses how we identify suboptimal savers and the methodology we use to calculate a lower bound on their welfare losses. Section III presents the welfare loss calculation results and compares the 401(k) contribution behavior of employees over 59½ years of age with their younger coworkers. Section IV presents the survey/field experiment and discusses potential reasons why undersavers are reluctant to contribute up to the match threshold. Section V concludes by evaluating the efficacy of educational interventions and monetary incentives for raising the savings rate of low savers.

I. Data description

Our data come from Hewitt Associates, a large benefits administration and consulting firm. The sample consists of a series of year-end cross-sections on all employees at seven firms from 1998 through 2002.[4] These cross-sections contain demographic information such as birth date, hire date, gender, state of residence, and compensation. The cross-sections also contain point-in-time information on 401(k) savings outcomes, including participation status in the plan, date of first participation, the year-end contribution rate, and total balances. In addition, the cross-sections have annual flow measures on individual and employer contributions to the 401(k) plan, early withdrawals from the 401(k) plan, and the total transfer of assets across the funds in the plan.

The seven firms were selected because they offer an employer match and it is possible for employees over the age of 59½ to make discretionary, penalty-free, in-service withdrawals. Specifically, these firms (1) offered a matching contribution proportional to the employee's own contribution up to a threshold, and (2) allowed employees older than 59½ to make 401(k)

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[4] For the one company at which at which the field experiment was conducted, we have additional cross-sectional snapshots for August 1, 2004 and November 1, 2004.

withdrawals for any reason while employed without an ensuing freeze on contributions. The companies span many different industries: consumer products, electronics, health care, manufacturing, technology, transportation, and utilities.

Table 1 summarizes the 401(k) plan rules at our seven companies. The maximum gain from the company match in our sample is 6% of annual salary for a subsample of employees at Company A who are matched at a 100% rate up to 6% of their pay. Company C offers the smallest potential gain of 0.75% of annual salary, as it only matches 25 cents per dollar for the first 3% of pay contributed to the 401(k) plan.

Employees do not have access to their employer match money until it is vested. If an employee is only 80% vested when he leaves the company, he forfeits 20% of the balances accrued in his employer match account. If the employer allows withdrawals from the employer match account, an employee can only withdraw the vested amount. The fraction of employer match money vested is typically a function of an employee's tenure at the company. Companies C, F, and G use a graded vesting schedule in which the fraction of match balances vested increases gradually with years of service until the employee is 100% vested. In contrast, Companies A, B, and E have cliff vesting schedules in which employees are not vested at all before achieving five years of tenure and are 100% vested thereafter. Employer match contributions at Company D are fully vested immediately. Four of the companies with graded or cliff vesting schedules fully vest employees who reach a certain age even if they would not be fully vested based on their tenure (Companies B, C, E and G).

Not being vested can eliminate an undersaver's gains from contributing up the match threshold. If an employee is not vested and knows that she will leave the company before becoming even partially vested, then the additional employer match reaped is worth nothing to her. We do not wish to count such employees as foregoing a free lunch. We describe our methodology for accounting for vesting in Section II.

Time and effort are costly, so withdrawals must be easy to execute, since this is the only part of the withdrawal strategy that must be actively executed by the employee once it has been initiated (contributions to the 401(k) are automatically deducted from each paycheck). Easy withdrawals are available at all of our companies; participants can request withdrawals by calling a toll-free number. Four of our companies' plan documents include check processing times; three indicate that they issue checks within a week of the request, and the fourth mails checks in two to

three weeks. We show in Section IV that employees do not believe transactions in their 401(k) to be particularly time-consuming. Furthermore, the monetary costs of withdrawing once every three months rather than every pay cycle are trivial for reasonable costs of capital, so any effort required to withdraw money can be expended infrequently.[5] These minimal costs of delay also imply that the minimum withdrawal amount or maximum withdrawal frequency restrictions that some of our companies impose are of little consequence.

Table 2 reports summary demographic statistics as of year-end 1998 for the 6,483 active employees in our sample who were older than 59½ and eligible to receive matching contributions at the beginning of 1998. For the sake of comparison, we also present demographic statistics on the 401(k)-match-eligible population under the age of 59½ at these firms.

II. Calculating a Lower Bound for Welfare Losses

We calculate a lower bound on the welfare losses that accrue to undersavers by taking the difference between the match contributions they actually received in 1998 and the maximum possible match they could have received based on their compensation, the employer matching formula, and the IRS contribution limits.[6] This represents the additional 401(k) balances they would have accrued (before capital gains) by following the withdrawal strategy described in the introduction. There are two relevant IRS contribution limits. First, IRS section 402(g)(3) sets a maximum dollar limit on elective deferrals which was $10,000 per year in 1998 (this limit has been increased in subsequent years). Second, IRS section 415(b)(1)(A) precludes employee 401(k) contributions out of compensation above a certain amount, which was set at $160,000 in 1998 (this threshold has also been increased in subsequent years). In a plan that matches 100% of contributions up to 5% of salary, an employee who earned $200,000 in 1998 could only receive a maximum of $8,000 that year in matching contributions ($160,000 × 0.05). We take both of these restrictions into account when calculating the losses that accrue to undersavers.[7]

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[5] Calculations available upon request from authors.

[6] We could alternatively identify undersavers using the year-end contribution rate in the cross-sectional data. We choose not to do this because employees can change their contribution rate throughout the year, so the year-end contribution rate (which is a point-in-time measure) may not accurately indicate the matching contributions the employee received throughout the year.

[7] Because the match threshold for employees in our sample does not exceed 6%, the $10,000 contribution limit does not in practice constrain any employees from receiving the full employer match specified under their plan rules once the $160,000 compensation limit is accounted for.

As mentioned above, an employee's valuation of the match that she could have received by contributing up to the match threshold may be significantly affected by her vesting status and consequently the length of her future tenure at the company. The employer match is worthless for an employee who is currently completely unvested and knows she will leave the company before she is even partially vested.[8] On the other hand, the employer match should be fully valued if the currently unvested employee is completely confident that she will stay at the company until she is fully vested.

Because we do not know each employee's subjective probability of leaving the company, we adopt two different approaches to incorporate vesting into our loss calculations. The first method is an *ex ante* measure in which the loss from not contributing to the employer match threshold is calculated as the employer match foregone multiplied by the participant's vested percentage *at the time of the contribution*.[9] For example, consider an employee in a firm with a dollar-for-dollar match up to 5% of pay whose vesting percentage increases from 0% to 20% on July 1, 1998. In calculating the 401(k) losses in calendar year 1998, this *ex ante* approach would not include any foregone match on contributions made prior to July 1, 1998. After this date, when the employee's vesting percentage increases to 20%, her calculated losses are only 20% of the foregone employer match. So if this hypothetical employee contributed 2% of her salary every pay period, then her losses for the year as a fraction of her annual salary would be defined as

$$\frac{1}{2}\big(0\%\times\big(5\%-2\%\big)\times100\%\big)+\frac{1}{2}\big(20\%\times\big(5\%-2\%\big)\times100\%\big)=0.3\%\,.$$

Note that this calculation will understate expected losses by ignoring all continuation values from contributing to the plan.

Our second approach to calculating losses uses the employee's actual realized employment history at the company to calculate the *ex post* loss from not contributing to the match threshold in 1998. In other words, we calculate expected losses under the assumption that employees have perfect foresight about how long they will stay at their company. In the example above, if the employee left the company at some later date having been 80% vested in her employer match account, her calculated loss for 1998 would be

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[8] These employees may still realize some tax benefit if they participate in the 401(k).
[9] Because we only observe an employee's total contributions for a calendar year, we assume that the contribution rate was constant throughout that year.

$$\frac{1}{2}\left(80\% \times (5\% - 2\%) \times 100\%\right) + \frac{1}{2}\left(80\% \times (5\% - 2\%) \times 100\%\right) = 2.4\%.$$

Note that the *ex post* loss calculation will be at least as large as the *ex ante* loss calculation, and a greater fraction of employees will be classified as "*ex post* undersavers" than "*ex ante* undersavers."[10]

When withdrawing money from the 401(k) plans of Companies A, D, and F, after-tax accounts must be depleted first. For employees at these companies who have accrued significant capital gains in their after-tax accounts, executing the withdrawal strategy may cause them to pay taxes on those capital gains earlier than they would have otherwise. Only 9% of employees older than 59½ and under the threshold at these three firms have after-tax account balances. In order to avoid having to calculate the loss due to any capital gains tax that may be associated with the withdrawal strategy, we simply do not classify as an undersaver anybody at these three firms who had a positive balance in his or her after-tax account at year-end 1998, regardless of his or her 401(k) contribution rate or the potential size of the capital gain in the after-tax account. This conservative assumption leads us to understate the fraction of employees who are foregoing free lunches.

III. Welfare Loss Results

Table 3 reports the frequency and magnitude of *ex ante* and *ex post* undersaving in 1998. Using the *ex ante* loss calculation, 49% of match-eligible employees over 59½ at our seven firms are not fully exploiting the employer match despite being currently vested. Of these, 79% are not contributing to the 401(k) plan at all. The remaining 21% are participating in the 401(k) plan but contributing below the match threshold. The resulting average loss is substantial, ranging from 0.8% to 2.2% of annual salary across the seven firms with a corresponding annual dollar loss between $131 and $755. The average loss across all seven firms is 1.3% of annual salary, or

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[10] In Company C, there are four employees for whom we cannot calculate *ex post* losses in the conventional manner because they are not fully vested as of year-end 2002, which is when our data end. For these employees, we predict their probability of leaving in future years from a probit model on the probability of leaving for all Company C employees in the 1998-2002 data. We then use this predicted probability of leaving in our calculation of the expected *ex post* loss for these four employees. The dependent variable in this regression is whether the employee left the company in the year following the data snapshot. The explanatory variables used are gender, marital status, age, the log of tenure, and the log of salary. Because these four employees represent only 0.06% of our total 59½+ sample, they have a negligible impact on our results.

$256. The aggregate dollars foregone constitute 18.4% of the maximum employer match dollars potentially available to employees over 59½ at the seven firms.

When using the *ex post* loss measure, the fraction of undersavers and the size of their losses increase, as expected. However, the differences between the *ex ante* and *ex post* losses are not large. Only an additional 5.3% of employees are counted as undersavers using the *ex post* loss definition, and the average annual loss is only $2.35 higher than the average *ex ante* loss. The reason for this similarity is that 83% of employees over 59½ years old are fully vested as of January 1, 1998, and most of the others are almost fully vested. Hence, for most employees over age 59½, the *ex ante* value of the employer match is the same as or close to its *ex post* value.

Four of the seven firms in our sample invest the match in employer stock and restrict diversification.[11] Since a match in employer stock is worth less than a match that can be diversified, our calculations for these four companies overstate the potential welfare loss.[12] However this bias is likely to be small. First, in our sample of firms, the four firms with employer stock restrictions have the four *lowest* fractions of *ex ante* undersavers, so the restriction does not appear to be driving our results. Second, the diversification restrictions only partially affect the employees in our analysis. Two of the four firms allow diversification after a two-year holding period; one allows diversification after age 50; and the last of the four allows salaried employees to diversify half of the match after age 55. Recall that all of the employees in our sample are at least 59½ years old.

Even after accounting for any discount employees might place on a match in employer stock, Table 3 is likely to grossly understate the cumulative magnitude of the welfare losses because the loss is calculated over only one year. Most of the undersavers in our sample have had several years of tenure with their firm since age 59½, and over half have *never* participated in their company's 401(k) plan.[13] Thus, they have forefeited matching contributions for many years. We do not attempt an exact calculation of these cumulative amounts because doing so would require information on 401(k) eligibility, the 401(k) match, and employee compensation before 1998, which we do not have.

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[11] Companies A, D, E, and F.
[12] Several papers calculate discounts for portfolios that are partially invested in employer stock (Poterba (2003), Meulbroek (2002), and Brennan and Torous (1999)). Paradoxically, Benartzi, et al. (2004) report that 20% of their survey respondents would *prefer* $1,000 of employer stock which they could not diversify until age 50 to $1,000 invested without restrictions.
[13] 52% of *ex ante* undersavers and 53% of *ex post* undersavers have never participated in their company's 401(k) plan.

Table 4 presents the results of using a much simpler definition of losses than that in Table 3. The full amount of *any* matching contribution foregone is considered a loss, without regard to the employee's vesting status or the impact of capital gains taxes on after-tax account withdrawals. We refer to all employees contributing below the match threshold in Table 4 as "sub-match savers." The conceptual distinction between "sub-match savers" and "undersavers" is simply whether with withdrawal strategy can be profitably employed. For reasons discussed earlier, some of the "sub-match savers" in Table 4 are not necessarily saving suboptimally ("undersaving") because they may never get access to their match balances.[14]

We present Table 4 for two purposes. First, we would like to compare the behavior of employees older than 59½ to that of employees younger than 59½. However, the withdrawal strategy discussed in this paper is not available to employees younger than 59½ because they must both demonstrate financial hardship and pay a 10% tax penalty to withdraw money from their 401(k).[15] Thus, the notional idea of the *ex ante* or *ex post* losses calculated in Table 3 for employees older than 59½ does not extend to younger workers. We can, however, make an apples-to-apples comparison of older and younger employees if we simply consider the total matching contributions that are foregone. Second, other 401(k) datasets may not contain all of the information needed to calculate *ex ante* and *ex post* losses. The simpler measure in Table 4 allows for easier comparability of this paper's results with tabulations from other similar data sources.

The top half of Table 4 presents statistics on employees older than 59½. 56.7% of employees over 59½ are sub-match savers. Recall that 49.0% of employees are *ex ante* undersavers (Table 3), so almost all sub-match savers are in fact undersavers. The $263 average sub-match saver loss is only slightly higher than the *ex ante* undersaving loss as well.

The bottom half of Table 4 presents statistics on employees *younger* than 59½. Interestingly, the fraction of sub-match savers is quite similar for the younger and older employees: 53.9% versus 56.7%. The composition of their behavior is different, however.

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[14] The group of *ex ante* and *ex post* undersavers as we have been defining them will be a subset of the sub-match savers.

[15] Firms are not required to allow employees to make hardship withdrawals, although many do so. There are some limited circumstances under which employees younger than 59 ½ can withdraw 401(k) balances without incurring a 10% tax penalty. These include permanent disability, a court order pursuant to a divorce, medical expenditures in excess of 7.5% of income, and some specific cases of early retirement or following a permanent layoff. Home purchase, education, or general financial hardship do not exempt employees from paying a tax penalty on early withdrawals.

Younger sub-match savers tend to contribute positive amounts that are less than the match threshold, whereas most older sub-match savers fail to contribute anything at all to the 401(k). Although the fraction of younger sub-match savers is lower than the fraction of older sub-match savers, the $450 annual average loss for younger sub-match savers is much larger. The larger losses for younger employees are due to their higher salary (see Table 2), as their average loss as a fraction of pay is actually slightly lower (1.30% versus 1.35%).

Figure 1 plots the fraction of sub-match savers, *ex ante* undersavers, and *ex post* undersavers by age. Consistent with the results in Tables 3 and 4, the three series track each other closely for ages above 59½. Over the entire working life, the sub-match saver series is U-shaped: the fraction of sub-match savers declines with age until the mid-50s and increases thereafter. One might have expected a discrete drop in the fraction of sub-match savers at age 59½, when the 401(k) becomes very close to a liquid asset. That the failure to exploit the 401(k) match begins to increase at precisely the time when the economic reasons for participation become most compelling is surprising. This may arise from a selection effect generated by low savers who are less able to afford to retire and thus remain in the labor force longer. Alternatively, this phenomenon may reflect consumption smoothing by older employees whose wages are falling and who are unaware of the 401(k) withdrawal privileges available only to older workers (Table 2 shows that the older employees have lower wages than their younger counterparts). We discuss other potential explanations for older workers' failure to exploit the 401(k) match in Section IV.

Table 5 presents the results of probit regressions for the likelihood that employees fail to exploit the full employer match. The sample in the first three regressions is employees older than 59½. The dependent variables are dummies for being an *ex ante* undersaver, being an *ex post* undersaver, and being a sub-match saver, respectively. The sample in the fourth regression is match-eligible employees under 59½, and the dependent variable is a dummy for being a sub-match saver. Both the probit coefficients and marginal effects (slopes) at the sample means are reported.

We find that men are 5 to 8 percentage points more likely to forego matching contributions than women, while the married are 4 to 7 percentage points less likely to forego matching contributions. Those with higher pay are substantially less likely to leave match money on the table. Among younger employees, age is negatively related to leaving money on the table,

while the reverse is true for older employees, a pattern consistent with Figure 1. Finally, those with higher tenure are less likely to forego matching contributions. The one exception to this result is in the *ex ante* undersaver regression for those over age 59½. This anomaly is explained by the fact that individuals with very low tenure are much more likely to be completely unvested and thus not classified as *ex ante* undersavers.

IV. Survey/Field Experiment

Given the low direct costs of initiating 401(k) participation, it is quite striking that such a high fraction of employees forfeit employer matching contributions, especially among workers over age 59½.

To gain further insight into why employees are contributing suboptimally to their 401(k), and to see if providing information about the matching opportunities would increase 401(k) savings, we conducted a field experiment at Company A in partnership with Hewitt Associates. On August 3 and 4, 2004, we mailed treatment and control surveys to 889 Company A employees over the age of 59½.[16] All surveys were accompanied by a cover letter printed on the employer's letterhead. The 889-person sample includes all 689 employees at Company A who were contributing less than the match threshold as of the beginning of August 2004, as well as 200 randomly selected employees contributing at or above the match threshold.

We (unevenly) divided our sample of 889 employees into two subgroups: a control group and a treatment group. We sent control surveys to approximately half of the employees contributing below the match threshold (344 selected at random from the population of 889) and to 200 randomly selected employees contributing at or above the match threshold. This control survey included questions about the employee's satisfaction with and knowledge about the 401(k) plan, general financial literacy, and savings preferences.

We sent treatment surveys to the other 345 employees contributing below the match threshold. The treatment survey was identical to the control survey, except that it included an additional five questions at the end (Questions 26 through 30). The survey is reproduced in Appendix A. Question 26 explains that the company matched the first 6% of salary contributed to the 401(k). Question 27 explains that transactions in the 401(k) could be made via the Internet,

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[16] We also mailed surveys to 4000 employees below the age of 59½. Results from those respondents are available on request.

a touch-tone phone system, or by speaking to a benefits center representative on the phone. Question 28 explains that penalty-free withdrawals from the 401(k) are available for any reason for participants over age 59½. Question 29 asks respondents to calculate the amount of employer match money they would lose each year if they did not contribute to the 401(k) (respondents received a matrix of match amounts corresponding to various match rates and salaries to aid in this calculation; see Appendix A). Question 30 asks if the employee is interested in raising his contribution rate to 6% in light of the losses calculated in question 29. We estimate that it would take employees about 15 minutes to complete the control survey and 18 minutes to complete the treatment survey.

For 200 employees in each of the three groups (below the match threshold control group, above the match threshold control group, below the match threshold treatment group), we included a $1 bill with the survey and promised to send them a $50 American Express Gift Cheque if they responded no later than August 27, 2004 in an enclosed postage-paid envelope. The cover letter that accompanied the survey is reproduced in Appendix B.

Respondents from the remaining 289 people below the match threshold who received the survey were entered into a raffle, along with all respondents younger than 59½, for a personal digital assistant, an MP3 player, and a digital camera.[17,18] Gift Cheques were sent and raffle prizes awarded on September 17, 2004.

A total of 232 employees responded—128 contributing below the match threshold and 104 contributing at or above the match threshold—resulting in an overall response rate of 26%.[19] Interestingly, the response rate among employees contributing at or above the match threshold was much higher (52%) than among employees below the threshold (19%), even though the former group's median income is higher than the latter's. Apparently, the difference in employees' willingness/ability to collect cheap money in 401(k) accounts extends to other domains.

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[17] Budget constraints precluded us from offering a $50 Gift Cheque to all respondents. Assignment to the Gift Cheque and raffle groups was random, and comparing the characteristics (age, compensation, tenure, participation in the 401(k) plan) of employees who received these different response incentives suggests that the two groups are indeed very similar.

[18] There were three raffle winners, one for each of the prizes.

[19] For employees older than 59½ and contributing below the match threshold, the response rate was 24% among those receiving the $50 American Express Gift Cheque and 11% among those entered into the raffle.

We first examine whether perceived transactions costs keep employees from exploiting the employer match. Responses to Question 3 of the survey indicate that in general, respondents do not believe that joining the 401(k) plan and conducting transactions in it are time-consuming. The average respondent who was not participating in the 401(k) plan believed that it would take 1.7 hours to join the plan, 1.3 hours to change their plan contribution rate for the first time, and 1.5 hours to change their plan asset allocation for the first time. The average respondent who is actually in the 401(k) plan reported lower averages of 1.4, 0.6, and 0.6 hours, respectively. Consistent with these responses, none of the employees who claimed in question 23 that they did not ever plan on enrolling in the 401(k) cited in question 25 the time it takes to enroll as a reason for non-participation. Therefore, the perceived time costs of conducting transactions in the 401(k) are not enough to justify the large amounts of money employees below the match threshold forego. Our survey does not measure the indirect transactions costs of 401(k) participation, namely the costs of figuring out one's optimal 401(k) contribution rate and asset allocation. The evidence on financial literacy discussed below indicates that these may be substantial.

We now consider whether those who were not contributing up to the match threshold felt little need to save more for retirement. Is their current wealth high enough that there is little value to further increasing consumption during retirement? This possibility is rejected by the data. Consistent with other survey evidence on the relationship between actual and perceived-to-be-optimal savings rates (see, for example, Choi et al. (2002), Bernheim (1995), and Farkas and Johnson (1997)), 86% of employees below the match threshold and 70% of employees at or above the match threshold do not think they are saving enough, according to Question 16. Those under the threshold report in Question 15 an average actual savings rate of 7.4% but believe they should be saving 17.1%. The corresponding averages for those at or above the threshold are 15.3% and 20.0%, respectively.[20] Remarkably, among respondents who think they should be saving more, only 33% of those below the threshold and 22% of those at or above the threshold report being unable to do so in Question 16; the remainder claim they could afford to save at least $520 more per year ($10 per week).

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[20] Despite these stated convictions about optimal savings rates, only 30% of those under the threshold and 47% of those at or above the threshold were able to give an answer in Question 18 about how much wealth they would need to live comfortably in retirement.

Having ruled out several mechanisms that might explain why so many employees fail to fully exploit their employer match, what does matter? We find striking differences in financial literacy between undersavers and those contributing at or above the match threshold. For example, only 8% of undersavers report themselves to be a very or relatively knowledgeable investor, compared to 20% of those at or above the match threshold. This self-perceived lack of financial expertise is borne out in the answers to more objective questions on financial literacy. For example, in their response to Question 20, 53% of employees below the match threshold incorrectly believe their own employer's stock to be less risky than a large U.S. stock mutual fund. Only 26% of employees at or above the threshold share this erroneous belief.[21] Employees below the threshold are less knowledgeable about their 401(k) plan features. In Question 4, only 21% were able to correctly state their employer match rate, and only 27% were able to correctly state the match threshold. In contrast, employees at or above the threshold were able to correctly state these figures 41% and 59% of the time, respectively.

Our survey responses also suggest that procrastination[22] plays some role in driving the undersaving that we observe. Recall that a much higher proportion of employees at or above the threshold (52%) than employees below the threshold (19%) collected $50 for completing our 15-minute survey, even though the former group's median income is higher than the latter's. In addition, among survey respondents, the average respondent contributing at least up to the match threshold took 15.1 days to mail the survey back to us, while the average respondent below the threshold took 17.2 days. Finally, in Question 10, we find that fewer respondents at or above the match threshold (11%) than respondents under the threshold (16%) report themselves to often or almost always leave things to the last minute. This gap is likely to understate the true difference in self-perceived procrastination between the two groups since the sample is right-truncated; the inveterate delayers never returned the survey and so did not answer Question 10.

The primary purpose of the survey was to see how much undersavers would increase their 401(k) contributions if the benefits of the employer match and the penalty-free, discretionary withdrawal rules were explained to them. Recall that we implemented a treatment condition that added Questions 26 through 30 to the baseline survey. The median respondent to

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[21] See John Hancock Financial Services (2002) and Benartzi et al. (2004) for the results from other surveys asking similar questions.
[22] Laibson (1997), O'Donoghue and Rabin (1999), and Choi, et al. (2004b) analyze models in which time-inconsistent preferences lead people to undersave and procrastinate.

Question 29 calculated that she would lose $1,200 each year by not contributing to the match threshold.[23]

Table 6 presents the average 401(k) contribution rates on August 1, 2004 (immediately prior to the survey mailing) and November 1, 2004 (approximately two months after the response deadline) for employees who were under the match threshold at the time of the survey mailing.[24] The average contribution rates of the control group and the treatment group increase over this period, but by a very small amount (0.08% of pay for the control group and 0.16% of pay for the treatment group).[25] The average difference in the contribution rate changes between the two groups was only 0.08% of pay and statistically insignificant. Using receipt of the treatment survey as an instrument for reading and returning the treatment survey, we estimate the treatment effect to be a 0.53 percentage points increase in the contribution rate (*t*-statistic 0.87). Consistent with other financial education research that tracks participant behavior in administrative data (Madrian and Shea (2005), Choi et al. (2002), Duflo and Saez (2003)), it appears that giving workers information does not meaningfully raise their 401(k) contribution rates, even when the recommended action exploits a free lunch. We should acknowledge, however, that the results here are for a selected sample. Individuals older than 59½ years who are not contributing up to their 401(k) match threshold may be particularly insensitive to financial education.

IV. Conclusion

Despite the presence of employer matching contributions in 401(k) plans, a substantial fraction of employees fails to contribute up to their employer's match threshold. For many employees it is possible to rationalize their willingness to leave employer 401(k) matching contributions on the table by appealing to factors such as liquidity constraints, early withdrawal penalties, and incomplete vesting. In this paper, we examine the 401(k) savings choices of a

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[23] This is larger than the average *ex post* loss of $756 reported in Table 3 for Company A. However, the $1,200 median response to Question 29 was calculated relative to not participating in the 401(k) plan. A comparable calculation using data from 1998 on individuals contributing below the match threshold or not all gives a median loss of $991. The remainder of the discrepancy is likely accounted for by increases in salaries between 1998 and 2004.

[24] There are fewer than 689 employees in the table because some employees left the company before November 1, 2004.

[25] 7 members of the control group increased their contribution rate, while 8 members of the treatment did. 1 control and no treatment group members decreased their contribution rate over this same period.

group of employees for whom these explanations do not apply. These employees are older than 59½, receive employer matching contributions, are largely fully vested, and can withdraw their 401(k) balances at any time (with no tax penalty). For these employees, contributing below the match threshold is a dominated strategy. Nevertheless, half of them do so. The average foregone match in 1998 is over $250, or 1.3% of annual pay. The foregone match over a longer time horizon is likely much larger.

We examine several possible explanations for this population's failure to optimally exploit the employer match. Based on survey evidence, we rule out direct transactions costs and satiation. We find evidence that employees who fail to exploit the employer match are less financially literate than those at or above the match threshold, which may indicate substantial indirect transactions costs (i.e., decision-making costs) associated with 401(k) participation. We also find evidence for procrastination.

Many financial education interventions are intended to increase savings rates by describing the benefits of saving. Consistent with previous evidence, our survey finds that most employees already believe that they should be saving more than they currently are. However, even though employees think they should save more, our effort to facilitate such savings had no effect. This is intriguing because we described a highly profitable savings strategy that generates no liquidity costs. The failure to induce employees to exploit a significant arbitrage opportunity leads us to be pessimistic about other educational interventions promoting savings strategies that aren't as easy or costless to pursue. Some employees apparently need more than good advice to get them to save. We note, though, that the group we study may be a particularly intractable population.

Our results are also cause for pessimism about the ability of monetary incentives alone to increase savings in the left tail of the savings distribution. Despite offering costly matching programs with strong marginal incentives, the firms studied here were able to induce only half of their older employees to contribute up to the match threshold. Although matching alone does not appear sufficient to increase savings in the left tail, it may be more effective when combined with other interventions that account for employee passivity (Madrian and Shea (2001), Benartzi and Thaler (2004), Choi, et al. (2002 and 2004a, b)) or that sharply reduce the complexity of the 401(k) participation decision (Choi, et al. (2005), Duflo, et al. (2005), Mitchell, Utkus, and Yang (2005)).

Finally, the results in this paper speak more generally to the role of the no-arbitrage condition in economic equilibria. Among the population studied in this paper, *unexploited* arbitrage opportunities are commonly observed, despite the fact that the potential gains are large and the necessary strategy to capitalize on these gains is simple and widely socially encouraged. Our evidence suggests that in non-market domains like retirement saving where the failure to maximize cannot be exploited by others, arbitrage opportunities may persist in equilibrium.

Appendix A: Treatment Survey

1. What percentage of your pay are you currently contributing to your 401(k)? If you aren't contributing, write "0" in the blank. Don't count employer contributions to your plan.
   (a) Before-tax contributions: _____% of pay   ☐ I don't know
   (b) After-tax contributions: _____% of pay   ☐ I don't know

2. For each statement, please check the box that best represents your views.

	Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
(a) I have enough information about the rules of my 401(k)					
(b) I have a good understanding of the investment choices my 401(k) offers					
(c) I'm satisfied with the investment choices my 401(k) offers					
(d) My 401(k) meets my retirement needs					
(e) I'd rather save for retirement in my 401(k) than outside my 401(k)					
(f) My company's 401(k) plan is better than other companies' 401(k) plans					

3. We want to know how long it took you to do certain things in the 401(k) for the first time. If you haven't done these things, we want to know how long you *think* they would take you. Check the appropriate box and fill in the blanks for each of parts (a) through (c).

(a) It ☐ **would take me/**☐ **actually took me** about _____ hours and _____ minutes to join my 401(k) plan.

(b) It ☐ **would take me/**☐ **actually took me** about _____ hours and _____ minutes to change my contribution rate for the first time after joining the 401(k) plan.

(c) It ☐ **would take me/**☐ **actually took me** about _____ hours and _____ minutes to change the funds I'm invested in for the first time after joining the 401(k) plan

We want to find out how well your company has communicated its 401(k) plan features to you. Please answer the questions <u>without</u> looking at your 401(k) plan documents.

4. Please fill in the following blanks, or indicate that you don't know the answer.

For every before-tax dollar I contribute to the 401(k) up to _____% of my salary, my employer makes a matching contribution to the plan of _____ cents.

☐ I don't know how much my employer matches my contributions

5. Does your company's 401(k) plan offer the following investment options?

(a) US stock market fund	☐ Yes	☐ No	☐ I don't know
(b) Stable value fund	☐ Yes	☐ No	☐ I don't know
(c) Bond fund	☐ Yes	☐ No	☐ I don't know
(d) Commodities fund	☐ Yes	☐ No	☐ I don't know
(e) International stock fund	☐ Yes	☐ No	☐ I don't know
(f) Your employer's stock	☐ Yes	☐ No	☐ I don't know
(g) Real estate investment trust	☐ Yes	☐ No	☐ I don't know

6. Which of the following statements best describes your beliefs about the withdrawal rules that currently apply to you in your 401(k)? (*Please check only one box.*)
☐ If I have money in my 401(k), I can't withdraw it
☐ If I have money in my 401(k), I can withdraw it, but I will pay taxes plus a penalty on the withdrawal
☐ If I have money in my 401(k), I can withdraw it without any penalty, but I will pay taxes on the withdrawal
☐ I don't know

7. Which of the following statements best describes your beliefs about the loan rules that currently apply to you in your 401(k)? (*Please check only one box.*)

☐ If I have money in my 401(k), I can't take out any loans from it
☐ If I have money in my 401(k), I can have a limited number of loans from it at one time
☐ If I have money in my 401(k), I can take out as many loans as I want from it at a time
☐ I don't know

8. How knowledgeable an investor would you consider yourself?
(*Please check only one box.*)

☐ Very knowledgeable
☐ Relatively knowledgeable
☐ Somewhat knowledgeable
☐ Less than knowledgeable
☐ Not at all knowledgeable

9. Which of the following statements best describes how often you think about your retirement savings? (*Please check only one box.*)

☐ I think about my retirement savings a great deal
☐ I think about my retirement savings sometimes
☐ I rarely think about my retirement savings
☐ I never think about my retirement savings

10. Which of the following statements best describes you?
(*Please check only one box.*)

☐ I never leave things to the last minute
☐ I rarely leave things to the last minute
☐ I sometimes leave things to the last minute
☐ I often leave things to the last minute
☐ I almost always leave things to the last minute

11. Which of the following best describes your level of education?
(*Please check only one box.*)

☐ Some high school
☐ High school degree
☐ Some college
☐ College degree
☐ Some graduate school
☐ Graduate school degree

12. What is your marital status?
    (*Please check only one box.*)
    ☐ Single
    ☐ Married
    ☐ Separated
    ☐ Divorced

13. Imagine that you just won a $500 prize in a raffle. What would you do with your
    winnings? (*Please check only one box.*)
    ☐ I would save the entire prize.
    ☐ I would use the entire prize to pay down my debts.
    ☐ I would spend the entire prize.
    ☐ I would save _____%, pay down debts with _____%, and spend _____%.
      (These percentages should add up to 100%)

14. Suppose that you decided to save an *extra* $1,000 of your annual income, and you had
    a financial planner who would help you do this. Where would you instruct your
    planner to make this investment? The dollar amounts below should sum to $1,000.
    (*Please check all boxes that apply and fill in amounts to the right.*)

    ☐ The checking account at my bank or other financial institution $ _____
    ☐ The savings account at my bank or other financial institution $ _____
    ☐ An Individual Retirement Account (IRA) $ _____
    ☐ My employer's 401(k) plan $ _____
    ☐ A college savings account (for example, 529 plan) $ _____
    ☐ A brokerage account $ _____
    ☐ A stock mutual fund outside a 401(k) plan $ _____
    ☐ A bond mutual fund outside a 401(k) plan $ _____
    ☐ Other (please indicate) _____ $ _____

15. (a) What percent of your household income do you think you should *ideally* be saving
       for retirement right now? If you don't know, answer with your best guess.

       _____% of my household income

    (b) What percent of your household income are you *actually* saving for retirement
       right now?

       _____% of my household income

16. If you think you are already saving enough for retirement, check here. ☐

    If not, how much more do you think you could commit to saving than you currently are?
    (*Please check only one box.*)
    ☐ I can't afford to save any more
    ☐ $10 per week
    ☐ $20 per week
    ☐ $40 per week
    ☐ $50 or more per week

17. Suppose you decided to cut your spending by $2 a day in order to save more for retirement. (This comes out to saving $730 more per year.) Where would you cut your spending the most?
    ☐ Food
    ☐ Clothing
    ☐ Entertainment
    ☐ Alcohol/cigarettes
    ☐ Other (please indicate) _____

18. About how much would your household need to have saved by the time you retire in order to live comfortably in retirement?

    I/we would need to save $_____   ☐ I don't know

19. After you retire, do you expect your household's monthly spending to be lower than, about the same as, or higher than your monthly spending right before you retire?
    (*Please check only one box.*)
    ☐ Lower
    ☐ About the same
    ☐ Higher

20. Rate each of the following investments' riskiness on a scale of 1 to 5.
    1 indicates "no risk" and 5 indicates "very high risk."

	No risk			Very high risk		
(a) A large US stock mutual fund	1	2	3	4	5	☐ Don't know
(b) Your employer's stock	1	2	3	4	5	☐ Don't know
(c) A savings account at your bank	1	2	3	4	5	☐ Don't know
(d) Bonds	1	2	3	4	5	☐ Don't know
(e) Stable value/money market fund	1	2	3	4	5	☐ Don't know
(f) Stock of a typical *Fortune* 500 company	1	2	3	4	5	☐ Don't know
(g) An international stock mutual fund	1	2	3	4	5	☐ Don't know
(h) An emerging markets stock mutual fund	1	2	3	4	5	☐ Don't know

SKIP THIS PAGE IF YOU'RE <u>NOT</u> CONTRIBUTING TO YOUR COMPANY 401(k) PLAN RIGHT NOW.

21. For each of questions (a) through (d), please check the box that best describes your plans.
    In the next <u>two</u> months:

    (a) I plan to ☐ *raise* / ☐ *lower* / ☐ *maintain* my 401(k) contribution rate
    (b) I ☐ *plan* / ☐ *do not plan* to make a withdrawal from my 401(k) plan
    (c) I ☐ *plan* / ☐ *do not plan* to take a loan out of my 401(k) plan
    (d) I ☐ *plan* / ☐ *do not plan* to change the mix of funds in which I am invested

22. If you're *not* planning on making any of the changes in question 21, check here. ☐

    If you *are* planning on making some changes, when are you planning on making them?
    (*Please check only one box.*)
    ☐ In the next few days
    ☐ In the next week
    ☐ In the next two weeks
    ☐ In the next month
    ☐ In the next two months

SKIP THIS PAGE IF YOU <u>ARE</u> CONTRIBUTING TO YOUR COMPANY 401(k) PLAN RIGHT NOW.

23. When do you plan to begin contributing to your company's 401(k) plan?
    (*Please check only one box.*)
    ☐ In the next few days
    ☐ In the next week
    ☐ In the next two weeks
    ☐ In the next month
    ☐ In the next two months
    ☐ In the next _____ (more than two months)
    ☐ I do not plan on ever contributing to the 401(k) plan

24. If you're *not* planning on ever contributing to the 401(k) plan, check here. ☐

    If you *are* planning on contributing some day, what percent of your salary do you expect to contribute when you start?
    _____% of my salary

25. If you *are* planning on contributing to the 401(k) plan some day, check here. ☐

    If you're *not* planning on ever contributing to the 401(k) plan, what are the main reasons?
    (*Please check all boxes that apply.*)
    ☐ I don't want to save right now
    ☐ I can't afford to save right now
    ☐ I'd rather save in accounts outside of the 401(k)
    ☐ I don't have enough information to know how much to save
    ☐ I don't understand my company's 401(k) plan
    ☐ It takes too long to sign up for my company's 401(k) plan
    ☐ There's always a chance I might be changing jobs or retiring soon
    ☐ My company 401(k) match isn't high enough
    ☐ I'm worried about the state of the stock market/financial markets
    ☐ I'm worried about corporate scandals and accountability
    ☐ Other. Please specify
    _____

In this section, you will be told some facts about your 401(k) plan.

26. Your company offers its employees a matching contribution on the first 6% of salary contributed to their before-tax 401(k) account. When did you become aware of this fact?
(Please check only one box.)
☐ I just became aware of this fact
☐ I may have known this fact before, but I'm not sure
☐ I definitely knew this fact before

27. Your company lets you make transactions in your 401(k) by using the Internet. You can also call a toll-free number, where you can use an automated touch-tone system or speak to a benefits center representative. When did you become aware of these facts?
(Please check only one box.)
☐ I just became aware of at least one of these facts
☐ I may have known these facts before, but I'm not sure
☐ I definitely knew these facts before

28. If you ever need the money in your 401(k) for any reason, you can withdraw it without penalty once you're over 59½ years old. You'll pay ordinary income tax on any money withdrawn that hasn't already been taxed. When did you become aware that penalty-free withdrawals are available?
(Please check only one box.)
☐ I just became aware of these facts
☐ I may have known these facts before, but I'm not sure
☐ I definitely knew these facts before

29. Suppose you're contributing $0 to your before-tax 401(k) account. How much employer match money would you lose *each year* from not contributing 6% of your salary?
(*Use the table below to get an approximate answer. If you aren't sure what your employer match rate is, use your best guess.*)

| *Example: If your salary is $30,000 and your match rate is 50%, then your annual loss is $900.* |

I would lose $_____ in matching contributions every year from contributing 0% instead of 6% of my salary to my before-tax 401(k) account.

Annual employer match lost from not contributing										
Annual	Employer match rate									
Salary	0%	16.7%	25%	30%	40%	50%	60%	65%	75%	100%
$10,000	$0	$100	$150	$180	$240	$300	$360	$390	$450	$600
$20,000	$0	$200	$300	$360	$480	$600	$720	$780	$900	$1,200
$30,000	$0	$301	$450	$540	$720	$900	$1,080	$1,170	$1,350	$1,800
$40,000	$0	$401	$600	$720	$960	$1,200	$1,440	$1,560	$1,800	$2,400
$50,000	$0	$501	$750	$900	$1,200	$1,500	$1,800	$1,950	$2,250	$3,000
$60,000	$0	$601	$900	$1,080	$1,440	$1,800	$2,160	$2,340	$2,700	$3,600
$70,000	$0	$701	$1,050	$1,260	$1,680	$2,100	$2,520	$2,730	$3,150	$4,200
$80,000	$0	$802	$1,200	$1,440	$1,920	$2,400	$2,880	$3,120	$3,600	$4,800
$90,000	$0	$902	$1,350	$1,620	$2,160	$2,700	$3,240	$3,510	$4,050	$5,400
$100,000	$0	$1,002	$1,500	$1,800	$2,400	$3,000	$3,600	$3,900	$4,500	$6,000

30. Does your answer to the previous question make you interested in raising your contribution rate to 6% so you won't lose any more employer match money?
☐ Yes. I plan to do so in the next _____ weeks.
☐ No, I'm already contributing 6% or more before-tax to the 401(k) plan.
☐ No, my losses aren't large enough.
☐ I don't know.

Appendix B: Cover Letter Sent to Treatment Subjects

Dear <Company A employee>:

Would you like to earn $50 for about 15 minutes of your time?

Company A wants to better understand the retirement saving and investment issues facing its employees. We are inviting you to participate in a survey that Company A is conducting with researchers from Harvard University, the Wharton School of the University of Pennsylvania, and Hewitt Associates, the company that performs the recordkeeping for Company A Savings Plan.

As a way of saying thanks in advance for your help with this effort, we've enclosed a dollar bill in this mailing. You will receive an additional $50 American Express® Gift Cheque from the researchers, simply by

1) Reading the Official Gift Check Rules on the reverse side of this letter

2) Completing the enclosed questionnaire

3) Mailing the questionnaire with your name and current address to Hewitt Associates in the postage-paid envelope provided <u>by no later than 8/27/2004</u>

Gift Cheques are accepted at over a million locations—virtually everywhere American Express® Travelers Cheques are welcome. Returning the enclosed questionnaire indicates that you've fully read and agreed to the Official Gift Check Rules.

Your participation in the survey is important. The responses you provide, combined with those provided by other employees eligible to participate in Company A Savings Plan, will help the researchers understand the barriers to saving and investing for retirement. All gift checks will be mailed three weeks after the survey closing date.

Your responses and information are completely confidential. Company A <u>will never see</u> your individual responses to the questionnaire, and answers to questions will not be used to identify individuals. Hewitt will report results to Company A only in aggregate form.

We look forward to your participation!

Sincerely,

Jane Doe
Director, Retirement Benefits
Company A

Official Gift Check Rules

American Express® Gift Cheques will be awarded only to those invited to participate in this survey. American Express® Gift Cheques are accepted virtually everywhere American Express® Travelers Cheques are welcomed. For further details regarding rules, policies and limitations that may apply to the use of American Express® Travelers Cheques, visit "www.aeis.com/American_Express_Gift_Cheques.html" via the internet or call (888) 853-9899. Hewitt Associates and the Researchers are not responsible for lost, late or misdirected mail. Hewitt Associates and the Researchers reserve the right to cancel American Express® Gift Cheque payments if the package containing the Cheque is returned undeliverable.

If you have questions regarding your American Express® Gift Cheque, please write to the following address:

<Address>

Void where prohibited.

Each participant agrees to release, indemnify, and hold harmless Hewitt Associates, and their affiliates, parents, subsidiaries, advertising and promotion agencies and their respective officers, directors, employees, representatives and agents from any and all liability for any injuries, loss or damage of any kind to any person, including death, and property arising in whole or in part, directly or indirectly, from acceptance, possession, use or misuse of the gift check as a result of participation in the survey.

In no event will Hewitt Associates, their affiliates, parents, subsidiaries, advertising and promotion agencies and their respective officers, directors, employees, representatives and agents be responsible for any damages or losses of any kind, including direct, indirect, incidental, or consequential or punitive damages arising from your participation in the survey. All gift checks are provided without warranty of any kind, express or implied, including but not limited to warranties of purchases made with gift checks, fitness for a particular purpose or non-infringement.

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FIGURE 1. Failure to Exploit the Full 401(k) Match
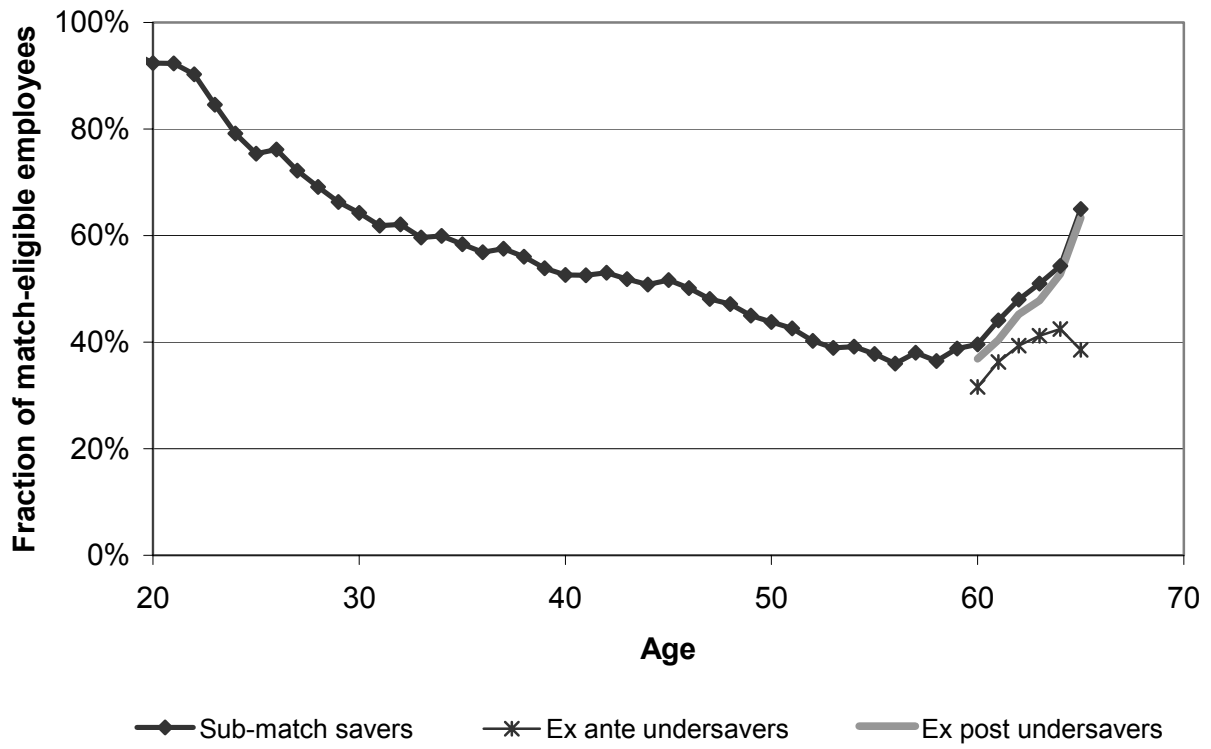
Table 1. 401(k) Plan Rules at Seven Firms (1998)

	Company A	Company B	Company C	Company D	Company E	Company F	Company G
Eligibility	Immediate	Only non-union employees after 1,000 hours of service in a year	January 1 following hire	3 months of service	Non-temporary employees after 1 month of service	Salaried employees immediate; union employees after 3 months of service	Immediate
Contributions	Before-tax and after-tax	Before-tax and after-tax	Before-tax	Before-tax	Before-tax and after-tax	Before-tax and after-tax	Before-tax
Employer match rate	25% to 100% match on first 6% of pay contributed	50% match on first 4% of pay contributed	25% match on first 3% of pay contributed (before-tax contributions only)	100% match on first 3% of pay contributed; 50% match on next 3% of pay contributed	75% match on first 2% of pay contributed; 50% match on next 3% of pay contributed	20% to 35% match on first 6% of pay contributed	100% match on first 3% of pay contributed; 50% match on next 3% of pay contributed; no match in first year
Match invested in employer stock	Yes, diversification restricted	No	No	Yes, diversification restricted	Yes, diversification restricted	Yes, diversification restricted	No
Vesting	5-year cliff	5-year cliff or 100% at age 65	5-year graded from 3 to 7 years of tenure or 100% at age 65	Immediate	5-year cliff or 100% upon retirement at or after age 55	5-year graded from 1 to 5 years of tenure	4-year graded from 2 to 5 years of tenure or 100% at age 60
Withdrawal restrictions	$250 minimum; no more than 1 per month; order of account depletion: after tax, match, before tax	No restrictions	Matching contributions not available for withdrawal	No more than 1 per month; order of account depletion: after tax, match (in account more than 2 years), before tax	1-year contribution suspension after withdrawals from matched account; match can only be withdrawn after 2 years	$100 minimum; no more than 6 per year; order of account depletion: after tax, before tax, match	Order of account depletion: match, before tax
Withdrawal procedures	Call toll-free number; checks mailed next week	Call toll-free number; checks cut within 2 business days	Call toll-free number; checks mailed in 2-3 weeks	Call toll-free number. Check processing time not in documents.	Call toll-free number; withdrawals processed within 1 week	Call toll-free number. Check processing time not in documents.	Call toll-free number. Check processing time not in documents.

Table 2. Demographic Characteristics at Seven Firms (1998)

	Company A	Company B	Company C	Company D	Company E	Company F	Company G	All
Total number active employees	Over 20,000	Over 5,000	Over 50,000	Over 10,000	Over 20,000	Over 30,000	Over 10,000	Over 135,000
Employees 59½+ eligible for 401(k) match								
Fraction male (%)	91.7%	87.5%	17.0%	69.0%	73.4%	63.1%	58.9%	55.7%
Average age (years)	62.6	69.7	64.7	62.6	62.7	63.0	63.6	65.2
Average tenure (years)	16.0	6.3	14.4	18.4	22.5	22.2	12.1	14.3
Median salary	$32,427	$8,182	$21,559	$57,290	$40,830	$43,008	$43,711	$25,826
401(k) participation rate	82.7%	26.4%	45.9%	96.6%	68.1%	71.9%	90.1%	53.7%
Median 401(k) balance of participants	$36,711	$2,509	$8,934	$27,080	$49,260	$62,665	$33,822	$48,063
Number of employees	817	1,543	2,436	145	383	917	242	6,483
Employees <59½ eligible for 401(k) match								
Fraction male	81.7%	52.5%	19.2%	76.8%	70.6%	65.5%	65.9%	54.1%
Average age (years)	43.7	38.8	41.0	43.9	42.3	43.2	39.2	42.1
Average tenure (years)	10.9	5.2	8.0	17.6	14.1	15.3	7.7	11.5
Median salary	$32,323	$21,053	$26,719	$62,057	$38,592	$46,569	$44,843	$37,152
401(k) participation rate	81.0%	39.3%	43.0%	96.5%	72.3%	81.0%	79.6%	67.8%
Median 401(k) balance of participants	$22,144	$4,018	$5,295	$26,013	$17,382	$34,413	$14,942	$17,679
Number of employees	23,260	4,783	53,435	14,678	19,529	37,649	12,377	165,711

Source: Authors' calculations.

Table 3. Welfare Losses, 1998: Employees Over Age 59½

Loss Calculation Approach	Company A	Company B	Company C	Company D	Company E	Company F	Company G	All
Ex ante losses								
Number of ex ante undersavers	198	1,045	1,379	36	81	337	103	3,179
Fraction ex ante undersavers	24.2%	67.7%	56.6%	24.8%	21.1%	36.8%	42.6%	49.0%
Fraction non-participants	53.5%	92.6%	81.7%	11.1%	55.6%	71.8%	21.4%	79.1%
Fraction participants < threshold	46.5%	7.4%	18.3%	88.9%	44.4%	28.2%	78.6%	21.0%
Average ex ante undersaver loss ($)	$754.91	$131.18	$155.30	$328.35	$678.68	$540.79	$633.22	$256.36
Average ex ante undersaver loss (% of pay)	2.24%	1.64%	0.77%	1.02%	1.95%	1.67%	1.50%	1.30%
Aggregate match dollars foregone (% of maximum match available)	11.9%	62.7%	41.0%	3.1%	10.4%	18.1%	12.2%	18.4%
Ex post losses								
Number of ex post undersavers	212	1,153	1,580	36	81	344	114	3,520
Fraction ex post undersavers	25.9%	74.7%	64.9%	24.8%	21.1%	37.5%	47.1%	54.3%
Fraction non-participants	55.2%	92.8%	82.4%	11.1%	55.6%	71.2%	21.1%	79.7%
Fraction participants < threshold	44.8%	7.2%	17.6%	88.9%	44.4%	28.8%	78.9%	20.3%
Average ex post undersaver loss ($)	$756.41	$136.17	$168.88	$328.35	$678.68	$550.48	$616.88	$258.72
Average ex post undersaver loss (% of pay)	2.29%	1.68%	0.82%	1.02%	1.95%	1.69%	1.47%	1.32%
Aggregate match dollars foregone (% of maximum match available)	12.4%	62.7%	43.4%	3.1%	10.4%	18.4%	11.8%	19.4%

Source: Authors' calculations. The sample is employees age 59½ and older who are eligible to receive a 401(k) matching contribution. See the text for the definition of ex ante and ex post undersavers and a description of how their welfare losses are calculated. The numbers in this table account for incomplete vesting and the potential to incur capital gains taxes if withdrawals are made from after-tax accounts.

Table 4. Foregone Employer Matching Contributions, 1998: Comparing Employees Younger and Older Than 59½

	Company A	Company B	Company C	Company D	Company E	Company F	Company G	All
Employees age ≥59½								
Number of sub-match savers	250	1,234	1,598	52	81	344	114	**3,673**
Fraction sub-match savers	30.6%	80.0%	65.6%	35.9%	21.1%	37.5%	47.1%	**56.7%**
Fraction non-participants	56.4%	91.4%	82.5%	9.6%	55.6%	71.2%	21.1%	**79.1%**
Fraction participants < threshold	43.6%	8.6%	17.5%	90.4%	44.4%	28.8%	78.9%	**20.9%**
Average sub-match saver loss ($)	$736.89	$136.38	$177.20	$290.72	$678.68	$550.48	$616.88	**$262.86**
Average sub-match saver loss (% of pay)	2.31%	1.66%	0.86%	0.93%	1.95%	1.69%	1.47%	**1.35%**
Aggregate match dollars foregone (% of maximum match available)	13.7%	64.5%	44.4%	3.9%	10.4%	18.4%	11.8%	**20.2%**
Employees age <59½								
Fraction sub-match savers	37.8%	80.8%	74.1%	47.2%	32.4%	38.5%	66.7%	**53.9%**
Fraction non-participants	50.0%	74.7%	76.9%	7.4%	46.4%	44.2%	30.5%	**47.2%**
Fraction participants < threshold	50.0%	25.3%	23.1%	92.6%	53.6%	55.8%	69.5%	**52.8%**
Average sub-match saver loss ($)	$806.24	$259.94	$207.25	$501.69	$669.42	$586.01	$874.42	**$450.11**
Average sub-match saver loss (% of pay)	2.44%	1.33%	0.84%	1.00%	1.88%	1.35%	2.01%	**1.30%**
Aggregate match dollars foregone (% of maximum match available)	16.5%	48.2%	51.9%	8.3%	16.4%	20.5%	24.0%	**26.6%**

Source: Authors' calculations. The sample is all employees eligible to receive the 401(k) match. Sub-match savers are all such employees not contributing up to the match threshold in the 401(k) plan (including non-participants). The numbers in this table do not account for incomplete vesting and the potential to incur capital gains taxes if withdrawals are made from after-tax accounts (see text for details).

Table 5. Predictors of Foregoing Employer Matching Contributions

	Dependent variable							
	Ex ante undersaver		*Ex post* undersaver		Sub-match saver			
	Sample: ≥59 ½		Sample: ≥59 ½		Sample: ≥59 ½		Sample: <59 ½	
Independent variables	Coefficient	Slope	Coefficient	Slope	Coefficient	Slope	Coefficient	Slope
Male	0.1580**	0.0630**	0.1913**	0.0755**	0.2077**	0.0805**	0.1155**	0.0456**
	(0.0454)	(0.0180)	(0.0466)	(0.0183)	(0.0474)	(0.0184)	(0.0080)	(0.0032)
Married	-0.1033**	-0.0412**	-0.1311**	-0.0517**	-0.1688**	-0.0654**	-0.1170**	-0.0461**
	(0.0417)	(0.0166)	(0.0427)	(0.0168)	0.0431	(0.0167)	(0.0076)	(0.0030)
Age	0.0644**	0.0257**	0.0401**	0.0158**	0.0257**	0.0100**	-0.0085**	-0.0034**
	(0.0046)	(0.0018)	(0.0047)	(0.0019)	(0.0048)	(0.0019)	(0.0004)	(0.0002)
Log(Tenure)	0.0662**	0.0264**	-0.1575**	-0.0621**	-0.2960**	-0.1147**	-0.2028**	-0.0801**
	(0.0217)	(0.0086)	(0.0223)	(0.0088)	(0.0236)	(0.0091)	(0.0043)	(0.0017)
Log(Salary)	-0.4786**	-0.1909**	-0.6295**	-0.2483**	-0.7135**	-0.2765**	-0.7390**	-0.2919**
	(0.0249)	(0.0099)	(0.0280)	(0.0110)	(0.0304)	(0.0116)	(0.0073)	(0.0029)
Firm FEs	Yes		Yes		Yes		Yes	
Sample Size	N = 6,481		N = 6,481		N = 6,481		N = 165,651	

Source: Authors' calculations. This table presents the results of a probit regression for the likelihood of foregoing employer matching contributions in 1998 (see text for the definitions of undersavers and sub-match savers). The sample is restricted to 401(k)-match-eligible employees. *Male* and *Married* are dummies set to one if the participant is male and married, respectively. *Age* is the participant's age on December 31, 1998. *Tenure* is the number of years since the participant's original hire date as of December 31, 1998. *Salary* is the participant's annualized salary in 1998. Firm fixed effects are included, although their coefficients are not reported. The columns labeled "Coefficient" present coefficient estimates from the probits. The columns labeled "Slope" present marginal effects evaluated at the means of the explanatory variables. The marginal effect reported for the dummy variables is the effect of changing the variables from 0 to 1. Standard errors are in parentheses. * denotes significance at the 5% level. ** denotes significance at the 1% level.

Table 6. Field Experiment Results

	Control group	Treatment group	*t*-statistic of difference
Pre-survey contribution rate	1.73%	1.48%	1.38
Post-survey contribution rate	1.81%	1.64%	0.86
Change (post-pre)	0.08%	0.16%	0.86
Sample size	N = 341	N = 337	—

Source: Authors' calculations. This table shows the average 401(k) contribution rates on August 1, 2004 (pre-survey) and November 1, 2004 (post-survey) for Company A employees contributing under the match threshold at the beginning of August 2004. The last column gives the *t*-statistic for the null that there is no difference between the two groups.