Turning Workers into Savers? Incentives, Liquidity, and Choice in 401(k) Plan Design

Abstract - We use data on five hundred 401(k) pension plans to evaluate how employer matching incentives influence retirement saving. Company matches prove to have a small effect on participation and saving rates; only one in ten non–highly compensated workers joins the plan because of employer match incentives, while one–quarter fails to join even though the match offers real return premiums of up to five percent. We find that liquidity and investment constraints in 401(k) plans have negligible effects on plan saving patterns. Our research underscores the importance of default strategies to bolster pension saving including the automatic enrollment approach outlined in the 2006 Pension Protection Act and non–elective employer contributions.

INTRODUCTION

Company–sponsored defined contribution (DC) plans are now at the heart of the US private–sector retirement system, with nearly 60 million private sector employees holding $2 trillion in 401(k) pension assets.1 Those who contribute to a 401(k) plan throughout their working careers can anticipate replacement incomes of nearly 60 percent from these plans; indeed, for Baby Boomers, company–based DC plans will provide larger retirement benefits than Social Security.2 Against this optimistic backdrop, however, there is concern that some employees may fail to properly exercise the new responsibilities imposed on them by participant–directed DC plans, particularly if they fail to join their 401(k) plans, save inadequately, overly concentrate their portfolios in a single asset, or spend their retirement savings too quickly.3

This paper seeks to explain how the incentives embedded in 401(k) plans influence workers’ propensity to save on a

1 In this paper, we use the term “401(k)” to include both 401(k) and 403(b) savings plans. The former are offered in the corporate sector; the latter, by non–profit employers. More than 70 percent of US DC plans are 401(k)–type programs and 85 percent of DC plan participants have a 401(k) feature. For further details see Buessing and Soto (2006).


tax–deferred basis. Specifically we evaluate how saving behavior is influenced by 401(k) plan design features, including the structure of the promised employer match, the presence of loans, and the investment menu design, and to differentiate these effects from saving patterns attributable to workers’ own preferences or firm–specific characteristics. We also evaluate the determinants of employer actual costs for matching contributions as well as how these costs vary across workforce and firm characteristics. We focus on the 401(k) plan as the unit of analysis, rather than on individual employees, as this is critical in understanding how firm–specific rules shape the incentives for retirement saving.

Prior research has focused mainly on how employer matching contributions in a DC plan might shape employee retirement saving behavior and, to a lesser extent, why employers might offer such incentives to workers. We develop an empirical model of these incentives using a rich new dataset of more than 500 defined contribution pensions covering nearly 740,000 employees, with unique detail on plan design, employer, and workforce characteristics. In particular, the dataset includes high–quality information on the design of matching contributions as well as investment and liquidity features of each plan. Only with this sort of highly nuanced plan–specific information is it possible to properly quantify the complex set of incentives and constraints shaping employee saving.

Our empirical results using this large and rich cross–section of pension plans point to two main conclusions. First, and most importantly, the incentive effects of employer matching contributions are quite small. For instance, in a typical plan, 65 percent of non–highly compensated workers participate in the retirement plan independent of the employer match, and 25 percent fail to participate at all. Only ten percent of workers respond to the match and join the plan as a result. Importantly, these results are after controlling for the unique liquidity and investment constraints of 401(k) plans. Second, the typical employer promises a three percent match but pays much less due to low employee saving rates. Overall, workers forfeit about half of the promised employer saving incentive (after controlling for workforce and firm differences).

These results underscore the limited efficacy of using contribution matches to boost retirement saving. More broadly, matching contributions appear to do little to turn workers into savers, with 90 percent of workers ignoring these employer incentives. To foster broader participation in 401(k) plans, consideration should be given to other approaches such as automatic enrollment, non–elective employer contributions, and mandatory employee contributions. Additionally, our research substantiates the importance of provisions such as those in the 2006 US Pension Protection Act (PPA) encouraging automatic enrollment, and the UK National Pension Savings Scheme, which combines automatic enrollment with employer matching contributions for workers not covered by a private–sector pension. Our findings on matching incentives, liquidity, and investment choice are also relevant when considering possible models for a

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4 The US PPA supersedes state labor laws that may have prohibited an automatic contribution arrangement, and also specifies that the Department of Labor identify appropriate default investments for such programs. Moreover, the PPA’s new safe harbor for 401(k) plans exempts a plan from nondiscrimination testing rules if it provides certain matching or non–elective contributions, and automatically enrolls and automatically escalates employee 401(k) contributions. The new UK program is a national savings plan covering workers with no private–sector pension coverage. Workers are automatically enrolled, and if they remain in the scheme, employers must make required contributions—in effect, matching contributions contingent on automatic enrollment.
reformed Social Security system or other public defined contribution systems with individual accounts, as well as the design of private–sector 401(k) plans.

In what follows, we first briefly review the characteristics of 401(k) plans as well as prior research. Next we describe our data and methodology. We then report on an analysis of the determinants of employee savings behavior, followed by an assessment of employer matching costs. A final section offers conclusions and implications.

CHARACTERISTICS OF 401(K) PLANS

US employers may choose to voluntarily provide tax–qualified retirement plans to their workers; today most private–sector firms with a company–based program offer a 401(k) plan.5 401(k) plans are funded principally by employee contributions from wages, known as “elective deferrals.” Employer contributions are typically in the form of matching contributions, which are contingent on employee contributions, although some employers may offer a non–matching contribution for all eligible employees, whether or not they participate in the plan.

Workers receive meaningful tax incentives for 401(k) contributions. In 2001, the year of our study, employee 401(k) contributions were tax–deductible up to the section 402(g) limit of $10,500. All employer contributions (up to specified limits) are also non–taxable to the employee at the time they are made. All employer and employee contributions, along with related earnings, compound tax–free until withdrawn. Plan withdrawals are subject to tax only when they are taken (typically later in life when tax rates may be lower).6

Besides the annual 402(g) contribution limit, retirement plans are also subject to nondiscrimination testing (NDT) rules for employee pre–tax elective deferrals.7 To implement these rules, a plan sponsor must divide eligible workers into two groups: highly compensated employees (HCEs, earning $85,000 or more in 2001) and non–highly compensated employees (NHCEs, or those earning below $85,000 in 2001). In the most common situation covering employee contributions (the so–called ADP or “actual deferral percentage” test), the HCEs’ plan contribution rate may not exceed that of the NHCEs by more than two percent.8 Moreover, when calculating plan saving rates under the NDT rules, the employer can only count pay subject to the section 401(a) definition of compensation, which caps the maximum level of annual pay considered for retirement plan purposes ($170,000 in 2001). Consequently an employee earning $1 million and contributing $10,500 would have an actual plan contribution rate of just over one percent ($10,500 divided by $1 million), but his plan saving rate for nondiscrimination testing purposes would be 6.18 percent ($10,500 divided by $170,000). Figure 1 demonstrates this effect generally for HCEs making the maximum 402(g) contribution at various income levels.

5 The retirement program offered by the employer may consist exclusively of a 401(k) plan, or it might combine the 401(k) plan with another type of defined benefit or defined contribution program.

6 There are no particular employer tax incentives in offering a 401(k) plan, as plan contributions, like wages, are a tax–deductible expense. Some suggest that companies may derive a benefit from offering employer stock within a DC plan, but productivity gains from company stock tend to be negligible and may reflect employer and employee myopia about benefits and costs (Benartzi, Thaler, Utkus, and Sunstein, 2007; Mitchell and Utkus, 2003).

7 The NDT rules are distinct from the general nondiscrimination rules, which require, among other details, that the “rights, features and benefits” of a plan be allocated equitably across eligible participants.

8 In the most common case of the ADP test, if the saving rates of the NHCEs fall between two percent and eight percent, the HCE saving rate cannot be more than two percent higher. There are different rules for lower and higher NHCE deferral rates.
Under the NDT rules, as the number of HCEs contributing the maximum (and the number earning more than $170,000) rises, plan contribution rates for the HCE group converge toward 6.18 percent for NDT testing purposes (in 2001). As a result, employers generally must encourage NHCEs to save at least 4.18 percent of earnings (two percent less than the HCE threshold of 6.18 percent) in order to comply with nondiscrimination testing. NHCE savings rates will actually have to be higher than 4.18 percent if not all HCEs contribute the maximum (or more of the HCE population earns between $85,000 and $170,000 per year). When many NHCEs fail to join the plan (i.e., their deferral rate is zero), it becomes difficult to satisfy this criterion, and the plan will “fail testing.” In this case, employers will typically limit contributions by the highly paid (to an amount below $10,500) in order to comply with the rules.9

Beyond these tax considerations, there are two structural constraints that employees face when deciding whether to participate in an employer’s plan. First, by law 401(k) saving is relatively illiquid. As a rule, the participant’s savings must remain in the plan until the worker changes jobs or retire, and he faces a ten percent tax penalty if the withdrawal occurs before age 59½. There are exceptions to this: many 401(k) plans offer limited access via a loan program, for instance, allowing participants to borrow up to half their balance with no tax consequences to a maximum of $50,000.10 Some plans permit after–tax contributions, which are typically liquid and available for withdrawal at any time.11

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9 The plan may also refund HCE’s excess contributions, which is a laborious and time–consuming process for the employer and may require the employee to file a revised tax return.

10 Loans are an optional provision. Participants can typically borrow their own contributions and earnings, plus employer matching contributions and earnings, but may not be able to borrow other types of employer contributions.

11 While after–tax contributions may be withdrawn typically at any time, earnings are tax–deferred and are subject to restrictions and taxation upon withdrawal. Because of their liquidity, after–tax contributions compete with pre–tax saving. According to the Profit Sharing/401(k) Council of America (2004), nearly half of plans with 5,000 or more participants offer an after–tax feature, compared to less than five percent of plans with fewer than 200 participants.
And in other cases, participants facing financial hardships may request in-service withdrawals. But generally, the money is intended for retirement purposes and there are limits to pre-retirement access. Second, 401(k) saving is restricted to a rather limited investment menu. For instance, the employer may include in the menu a dozen or so funds and would not permit access to all retail mutual fund and brokerage account offerings.

To some extent, these limitations may be offset by the fact that many employers offer incremental compensation, the matching contribution, as a reward for plan saving. In practice, as we noted below, promised matching contributions vary from zero to over six percent of pay. In the modal case, an employee who contributes six percent of pay to a 401(k) plan receives a match of three percent (the equivalent of an instantaneous return of 50 percent on plan saving), for a total plan savings rate of nine percent of income.

**PRIOR RESEARCH**

Prior research on the relationship of employee plan saving rates to employer matching contributions has indicated some degree of saving responsiveness, yet the results are far from uniform. For instance, one approach is to assess responses to the introduction of a match (versus having no match at all); several studies indicate that this boosts plan participation and plan contribution rates, though the estimated magnitude of this effect ranges widely (from a low of three to more than 25 percent). These results seem sensible since offering a match (other things equal) boosts the incentive to save and should increase the attractiveness of the plan.

Other studies examine the impact of raising an existing match, and these report more mixed findings: some show saving increases, while others indicate negligible or negative effects. Here the economic intuition is a bit more complex: if an employer raises an existing match by a modest amount, the increase may have been too small to have a material effect on saving rates; for example, a small match increase might be insufficient to offset the liquidity and investment costs associated with 401(k) plans. Of course, it is possible that raising the match rate could have a negative effect, if employees thought in terms of a target lifecycle saving level.

A drawback of many previous studies is that they have had data for only one or a handful of companies, thus limiting the breadth of plan designs under study.

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12 In our sample less than one percent of participants took in-service withdrawals and so we ignore them as a potential source of liquidity for 401(k) savings.

13 These prior studies come to different conclusions mainly because of methodological differences across the works. The studies differ on four important parameters: the unit of analysis (the individual employee or the plan), the data on the employer match (whether detailed information on the match design is available or not), the complexity of retirement plan design (whether a full specification of the entire plan design is present), and the complexity of federal tax rules (as we describe below).


16 For example, an employee with a nine percent target saving rate might contribute six percent of her own salary with a three percent match, but curtail her own contribution to five percent if the employer raises the match to four percent. Pence (2002) posits that workers participating in 401(k) plans have a greater interest in saving than other workers.
These company–specific analyses also lacked access to detailed information on matching, liquidity, and investment menu elements of plan design that we discuss below, and sometimes they lacked information on whether other retirement plans besides the 401(k) plan were available. Researchers using individual–level survey data (e.g., the Survey of Consumer Finances) cannot capture needed information on plan design and peer effects, and typically they have lacked key data on specific match formulas available.

DATA AND METHODOLOGY

In our current effort, we extend the literature in two key ways by utilizing a rich set of administrative records for more than 500 401(k) plans managed by Vanguard for the 2001 plan year. First, the dataset contains essential details regarding cross–firm level variation in the pension plan offerings. This file reports information on important design features including the employer’s match formula, features of the plan’s investment menu, the presence of other retirement plans (such as a defined benefit or other DC plan), and indicators of participant access to plan accumulations prior to retirement. We also obtained records on the more than 740,000 employees in the firms offering these plans; these data included workers’ age, sex, job tenure, annual salary, plan participation, plan contribution amounts, and asset and contribution allocation information.

Second, the plan–based files permit us to directly incorporate the complex tax rules governing 401(k) plan contributions for highly paid employees. Thus, we can not only take into account the Section 402(g) annual cap of $10,500 (in 2001), but also the status of each employee as an NHCE or HCE participant under federal nondiscrimination testing rules. Prior studies using firm microeconomic data have tended either to overlook these limits or to ignore the impact of nondiscrimination testing on savings patterns.

Our first empirical model, summarized in equation [1] below, links measures of employee participation and contribution (Part or Contribute) to key explanatory variables. These include (1) a vector of plan design features (PD), including the design of the match, features of the investment menu, and pre–retirement money access methods such as loans and after–tax savings; (2) a vector of worker characteristics (EE), capturing employee tastes for saving independent of plan design; and (3) a vector of employer–level variables (ER), including plan size, the industry of the plan sponsor, and the presence of other types of retirement plans:

17 The identity of individual firms and plan participants is masked. Union plans are excluded from our sample of 507 plans, since there the match is collectively bargained rather than determined solely by the employer.
18 This dataset does not have the information on employees’ other savings, such as bank accounts, mutual funds, stock brokerage accounts, etc. However, according Moore and Mitchell (2000), Americans do not have much saving outside of Social Security and pensions. Based on the 1992 Health and Retirement Study, Social Security and pensions accounted for 61 percent of total wealth, 18 percent of net housing, and 20 percent of net financial wealth for the median ten percent of study participants. Lusardi and Beeler (2006) compare the HRS cohort (age 51–56 in 1992) with Early Baby Boomers (EBB, age 51–56 in 2004), and find that the EBB cohort owns more stocks and IRAs than the HRS cohort, but differences are not statistically significant.
19 The dataset does not include measures of employee educational attainment or workplace financial education programs; however, all employees received plan enrollment material and a quarterly plan newsletter, and all had access to online educational materials. Since we lack data on vesting schedules for employer contributions, indicating participants’ ability to take employer contributions with them when they change jobs, we also investigated tenure patterns (in an analysis available on request) and the results are similar to those reported below.
Part_or_Contribute = \beta_0 + \beta_1 \cdot PD_j + \beta_2 \cdot ER_j + \beta_3 \cdot EE_i + \varepsilon_1.

This formulation allows us to distinguish the impact of features of the 401(k) plan design, versus saving patterns attributable to employee characteristics and features of the sponsoring firm.

To capture the impact of nondiscrimination testing and contribution limits accurately in equation [1], we evaluate employee saving behavior separately for NHCEs and HCEs at the firm level. By definition, this isolates the nondiscrimination testing constraints to the HCE regression only. In practice, it also restricts the 402(g) constraint to the HCE regression as well, because only 2.5 percent of NHCE’s versus 41 percent of HCEs, are at the 402(g) limit.20

In a second formulation, we measure employer expenditures for 401(k) matching contributions, taking into account the fact that actual employer costs (as opposed to the promised match amounts) depend on actual employee saving at each firm.21 The dependent variable of interest in equation [2] is, therefore, the employer’s actual match cost as a percentage of total pay (ActualMatchCost). We examine how this actual cost varies according to plan design elements (PD), worker characteristics (EE), and employer–side variables (ER):

ActualMatchCost = \lambda_0 + \lambda_1 \cdot PD_j + \lambda_2 \cdot ER_j + \lambda_3 \cdot EE_i + \varepsilon_2.

In particular, the question of interest is how the actual expenditure of the employer relates to workforce and firm level characteristics.

DESCRIPTIVE STATISTICS

In our sample, the mean employer is a mid–sized firm with about 1,500 employees; some 82 percent offered a match for employee 401(k) plan contributions (see Table 1).22 Matching formulas range from zero (18 percent of plans) to very generous matches of more than dollar–for–dollar on at least six percent of pay (for two percent of plans). Panel A shows that the median match by firms offering a match is 50 cents per dollar on the first six percent of employee contributions, confirming Papke’s finding in an early study (1995). But more interesting is the finding that employer match patterns are extremely nonlinear: the average firm matches an average of 55 cents per dollar on the employee’s first three percent of salary.

20 There are two other constraints of note—although in our firm–level analysis none of these appears to be binding on the plans in the aggregate in our sample. Under IRS section 415, total employee and employer contributions to any tax–deferred retirement plan cannot exceed 25 percent of pay or $35,000. For example, a worker earning $40,000 in 2001 could only receive total employer and employee contributions of $10,000. Also, a 15 percent limit for profit–sharing plans applied in 2001, since 401(k) plans are technically organized as profit–sharing plans under US law. As a result, they must generally limit employee and employer contributions to 15 percent of the firm’s total wage bill. Depending on how many eligible participants actually join the plan and the amounts contributed, plan participants could be subject to a 15 percent (or occasionally higher) limit on the sum of employer and employee contributions.

21 Here we consider only costs of matching contribution. We acknowledge but cannot measure other administrative costs, including legal and compliance costs, recordkeeping fees, and expenditures on employee communications.

22 Even in the one of five plans that did not provide a “match,” some proportion does have employer contributions elsewhere in the retirement benefit design—whether to a defined benefit plan, a companion money purchase plan, a companion profit–sharing or employee stock ownership (ESOP) plan, or a profit–sharing or ESOP contribution to the 401(k) plan itself. The other DC plan contributions are not considered “matching” contributions because they are made to all eligible employees, not just 401(k) participants; they may be discretionary; and they are not made contemporaneously with employee 401(k) contributions. Sometimes, however, these other contributions are described as a “match” by employers.
contributed; 37 cents per dollar on the next three percent of pay; and only five cents per dollar for the next two percent of pay. There is also substantial variation in the so–called “match cap,” which is the amount the employee must deposit to obtain the largest possible employer subsidy: the mean is around five percent of pay, while the median is six percent.

Panel B of Table 1 and Figure 2 explore further the nonlinearity of matching contributions. The most prevalent formula is a single–tier match such as $0.50 on the dollar to six percent of pay. Another 11 percent of the plans offers a multi–tier formula, where the employer offers a higher incentive on the first level of pay (such as 100 percent on the first two percent of employee contributions) and a lower incentive on subsequent levels of pay (such as 50 percent on the next two percent).

In the empirical analysis we divide these highly nonlinear 401(k) match patterns into an incentive element, reflecting how much the employee is rewarded per dollar contributed, and a liquidity element, indicating how much compensation the employee must “tie up” in the 401(k) plan in order to receive the entire employer incentive payment. Accordingly, we define the $F3\_Match$ term that indicates the value of the employer’s matching contribution on the first three percent of pay contributed by the employee (i.e., from zero to three percent); $N3\_Match$ captures the rate on the next three percent of pay (i.e., from four to six percent of pay); and $N2\_Match$ reflects the value of the match on an additional two percent of pay (i.e., over six and up to eight percent of pay). Another variable, $Contr4MaxMatch$, captures how much the employee must
contribute to receive the maximal subsidy offered by the employer. For example, in a tiered formula that paid dollar–for–dollar up to two percent of pay, and 50 cents per dollar from two to four percent of pay, the maximum required employee contribution is four percent. For the single–tier match plans, the maximum amount employers promise is in the form of matching contribution. About one–third of all plans promises to provide less than three percent of pay; about one–third offers exactly three percent; and about one–third, more than three percent.23

Turning to other plan design features, the 507 plans in our dataset offer an average of 12.6 investment choices in their plan menus; 19 percent offer employer stock as an investment choice; and two–thirds of the investment options are equity funds. In terms of pension liquidity, the overwhelming majority of the plans (85 percent) offer a loan feature, while a quarter permit after–tax contributions. As noted earlier, the sponsoring firm may also offer other retirement plans along with the 401(k) plan. Table 2 indicates that the 401(k) plan designs fall into three broad categories: firms offering 401(k) plans alone (some 39 percent of plans); firms offering 401(k) plans accompanied by another DC plan such as a money purchase, profit–sharing, or ESOP plan (28 percent); and firms providing 401(k) plans paired with some form of DB plan (34 percent of plans).24 Indeed, this variation underscores that it is too simplistic to describe the time trend in private pension

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23 At the employee level, since more participants are in large plans, nearly four in ten participants are provided with a match equivalent to three percent of pay. But this three percent promise can manifest itself in quite different ways in terms of required employee contribution: as a $0.50 on the dollar match on a six percent employee contribution, as a $1 for dollar match on a three percent employee contribution, or, less frequently, something in–between.

24 In the case of DC plans, a 401(k) participant may receive an employer contribution to a companion money purchase plan, profit–sharing plan, or Employee Stock Ownership Plan (ESOP). The profit–sharing or ESOP contribution may be integrated within the 401(k) plan itself, or it may be in a standalone plan.
provision as a simple shift from DB plans to 401(k) plans.

A summary of average employee characteristics (for the over 740,000 eligible non–participants and plan participants in our sample) is provided in Table 3. Looking across plans, the average participant in the average plan is male, is nearly 43 years of age, earns $63,900 per year, and has spent almost nine years on the job. The average plan participation rate is 77 percent,\textsuperscript{25} with contribution rates for those saving in the plan amounting to 6.8 percent of pay; the average 401(k) account balance is $54,400. An interesting observation is that, although the typical employer–promised match is three percent of pay, the cost of this match to the median employer is actually only two-thirds this value, or just under two percent of pay. In other words, workers forfeit much of the match because they fail to participate in their plans (63 percent of 1.1 percent, or 0.7 percent of pay), or because they fail to save at a rate needed to earn the full employer match (37 percent of 1.1 percent, or 0.4 percent of pay).\textsuperscript{26} In terms of investment decisions, employees contribute 74 percent of their new money to equity funds, and 14 percent to company stock. The average participant avails himself of only 3.5 of the investment choices in his pension portfolio, versus the 12.6 funds offered. About one–quarter of participants in the average plan is registered to use the Internet to manage their accounts in 2001; 15 percent have a loan outstanding.

A key attribute of the plan–level data is that we can compute with some accuracy what fraction of the covered workers falls into the highly compensated employee group under federal nondiscrimination testing rules. In the average plan, almost one–fifth (19 percent) of participants are highly compensated employees who differ in important ways from their NHCE counterparts. Table 3 shows that HCEs have substantially higher account balances, are older, are longer–tenured, and predominantly male. As expected, HCEs participate at much higher rates in the 401(k) plans than do NHCEs (91 vs. 74 percent). However, HCEs contribute at roughly the same rate of pay as NHCEs (6.8 vs. 6.9 percent), reflecting the impact of federal contribution limits. In the data set, HCEs control about 41 percent of the 401(k) assets in the average plan, though they represent 19 percent of participants. In terms of investments, HCEs contribute slightly more to equities (79 vs. 73 percent); they use the web more frequently to manage their accounts (42 vs. 23 percent); and they are somewhat less likely to take a loan (11 vs. 15 percent).

\textsuperscript{25} This is the participation rate calculated at the plan level. Across the universe of employees, the participation rate is 66 percent. The reason for this difference is that participants are skewed to the largest plans, and larger plans tend to have lower participation rates, often because they offer another retirement plan besides the 401(k) plan.

\textsuperscript{26} This accords with recent findings of Choi et al. (2004).
Table 3 also indicates how many employees are subject to other pension tax limits. More than one-tenth (11 percent) of participants in the average plan were at the 402(g) limit of $10,500 for pre-tax 401(k) plan contributions (in 2001). But this average conceals important cross-group differences: 41 percent of the highly compensated employees are at the limit, while just under three percent of the non-highly compensated are thus constrained. We are also able to estimate that 10 percent of plans are subject to employer-imposed NDT caps (these “caps” influence only 1.2 percent of HCEs in our entire sample). Finally, we estimate that about six percent of participants in the average plan are subject to either the Sec-
tion 415 limit (25 percent of pay or $35,000) or any other plan–specific limit.

MULTIVARIATE ANALYSIS

Next we report results of the multivariate analyses of 401(k) plan participation and contribution behavior, and employer actual match costs. Both of our empirical models (equations [1] and [2]) are estimated using ordinary least squares. Table 4 focuses on employee saving patterns, where we see that a larger employer match on the first three percent of pay and a higher match threshold have a significantly positive impact on participation rates of lower–paid employees (column 1).27 Yet the magnitude is not large: each $0.10 increase in the match rate raises NHCE participation rates by around one percentage point (i.e., from 74 to 75 percent). Further, among the NHCEs, participation incentives peter out between three and six percent of pay, and responses turn negative for matches above six percent of pay. As noted earlier, the minimum required NHCE plan contribution rate would be 4.18 percent (assuming all HCEs contributed the maximum and earned over $170,000 per year in 2001). In our empirical results, the incentives for saving shift from positive under three percent of pay, to neutral in the three to six percent range. These results provide some suggestive evidence that match incentives may be motivated in part by nondiscrimination testing.

Another finding relates to the impact of investment constraints on plan participation. Offering a larger investment menu encourages more NHCEs to participate but at a declining rate. Indeed, participation appears to peak when the employer offers 30 funds, falling after that \[-1.177/(-0.02*2) = 30\]. It is interesting that offering more funds has a powerful positive effect on the fraction of highly paid workers who are saving at the maximum allowable limit. This controls on the mix of funds offered, which also has an interesting independent effect. Specifically, if the investment menu includes a larger share of equity funds, this is associated with lower NHCE participation, and the effect is relatively powerful: if the proportion of stock funds rises by ten percent, the participation rate of NHCEs falls by 1.62 percentage points. In effect, NCHE participants exhibit not only “choice overload” as suggested by Jiang and Iyengar (forthcoming), but also “equity fund overload.”

Factors influencing the level of plan contributions are also interesting. As the match generosity rises (in particular, on the first three percent of pay), NCHE contribution rates fall, as if employer matching substituted for employee contributions.28 Plan contribution rates are also very sensitive to the relaxation of liquidity constraints: the presence of a loan, while not associated with plan participation, does raise plan contribution rates by ten percent (consistent with Munnell et al.

27 There is some support for this in previous studies: Papke (1995) and Papke and Poterba (1995) use firm–level analysis and they detect a positive association between plan participation and match generosity. However they do not exploit the detailed nonlinearity of the match rate as here. Papke (1995) uses aggregate Form 5500 data, so she must infer rough match rates from actual plan contributions of employers and employees. Papke and Poterba (1995) have a small sample of plans (43). Both studies have access to only a few independent variables including the match rate, plan size, and the presence of another plan.

28 Previous studies using firm–based data offer mixed results on this point. Thus, Papke (1995) reports that introducing a match raised employee contributions, but the marginal change in employee contributions was negative at higher match rates. Papke and Poterba (1995) found that introducing a match increased employee contributions but they reported no effect of higher match rates. Research using individual–level data also provides mixed conclusions: Clark and Schieber (1998), Cunningham and Engelhardt (2002), and Huberman et al. (2007) suggest that higher match rates increase employee contribution rates; Kusko et al. (1998) report a negative effect; and Munnell et al. (2000) find no impact.
TABLE 4

PLAN–LEVEL PARTICIPATION AND CONTRIBUTION RESPONSES TO 401(K) DESIGN FEATURES

<table>
<thead>
<tr>
<th>Plan Characteristics</th>
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<th>Participant contribution rate</th>
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<td>[1.525]</td>
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<td>[0.055]*</td>
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<td>[1.746]</td>
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<td>[0.192]**</td>
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<td>[0.022]</td>
<td>[0.201]</td>
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<td>[0.007]**</td>
<td>[0.011]</td>
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<td></td>
<td>[0.216]**</td>
<td>[0.022]</td>
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<td><strong>R–squared</strong></td>
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Notes: Estimated using ordinary least squares. * significant at 5%; ** significant at 1%. Robust standard errors in brackets. Industry controls included.
As expected, allowing employees to make after-tax contributions reduces pre-tax contributions.29 Also of note are the different marginal results for NHCEs and HCEs in both equations. These differences manifest themselves not only in the varying coefficient estimates but also in the $R^2$s for the two data sets. For the NHCE population, our two models explain 30 percent and 39 percent of the plan contribution and plan participant decision; for the HCE population, the $R^2$s fall to 11 percent and 19 percent, respectively. No doubt the reduced explanatory power of the HCE equation is due to the binding constraint of the 402(g) contribution limit, although it could also be attributable to the exclusion of other unobserved characteristics, such as differences in financial literacy of knowledge.

The marginal effects for the two NHCE regressions are summarized in Figure 3, where we display combinations of NHCE participation and contribution rates as a function of matching contributions (holding demographics and firm characteristics at their sample means). The most striking finding is the small variation in predicted plan participation due to changes in the match design (Panel A). The empirical model implies that close to 65 percent of NHCEs at the typical firm would join their 401(k) plan regardless of the presence of a match. Plan participation would be estimated to rise over a narrow range, by five to 15 percentage points, responding to a range of match offerings, from a modest ($0.25 per dollar on the first three percent of pay) to a very generous match ($1.00 per dollar up to six percent of pay). At the modal promised employer match ($0.50 per dollar on six percent), over one-quarter of NHECs fails to participate in the 401(k) plan; even with a generous match, more than 20 percent still fails to join. In terms of plan contributions, we find that more generous matches are associated with small declines in NHCE contribution rates (Figure 3, Panel B). By contrast, the positive effect of a loan on contribution rates is much more pronounced.

Another way to assess the plan participation results is to estimate the implicit return that employees forfeit when they fail to take advantage of the employer match. For example, an employee who contributed $1 to a 401(k) and earned a four percent real return over 30 years could anticipate $3.24 in retirement assets from this contribution. If she also received $1 in matching employer contributions for her dollar contribution, her retirement balance would instead total $6.48. In other words, had she not received the match, she would have had to earn a real return of 6.4 percent on her contributions—2.4 percent per annum real above the four percent baseline—to attain the equivalent amount of retirement saving.

More generally, the implicit return on the employer match over $n$ years is that rate $r$ that equates the present value of employee contributions to the present value of the employee’s account balance at retirement including both employee and employer contributions. Figure 4 summarizes the results for the median 42-year-old participant over 20 years of future 401(k) saving.30 For companies where no employer match is offered, the expected return on the employee’s contributions is assumed to be the expected

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29 In terms of employee traits, we find that mean compensation, tenure, and the fraction female are all significant factors in predicting plan participation and contribution rates. Age is insignificant as there is little cross-plan age variation.

30 In practice, we assume that 401(k) savings grow at a real market rate of return, $r_m$, of four percent; that the employer is offering various match designs to our average non-highly compensated workforce (mean earnings of $42,000, six percent contribution rate); and that savings occur for 20 years (from the mean workforce age of 42 to age 62).
Figure 3. Incentive Effect of the Employer Match on Non–Highly Compensated Employees (NHCE)

Panel A. Impact of Match and Loan on Participation (at sample means)

Panel B. Impact of Match and Loan on Contribution Rate (at sample means)
real rate of return on 401(k) investments, which we assume is four percent (for a balanced portfolio of stocks and bonds, the typical allocation in our dataset). For alternative match designs ranging from $0.25 on the dollar on three percent of pay, up to $1.00 per dollar on six percent of pay, the implicit rate of return on employee contributions ranges from 4.7 percent to 9.5 percent. In effect, participants who do join the plan solely due to the match must expect a premium greater that the four percent benchmark return, ranging from 0.7 to 5.5 percent depending on the plan design.31

Overall, then, in a typical 401(k) plan, only ten percent of non–highly compensated workers are induced to save in the plan, and around 25 percent fail to join the plan at all, based on company–offered incentives that grant a substantial one to five percent premium over expected market returns. Such indifference to retirement saving cannot be explained by liquidity constraints, inasmuch as relaxing liquidity constraints via a loan feature has no effect on participation rates among the non–highly paid and increases contribution rates for participants by only ten percent. Nor are investment restrictions a strong explanation, since expanding investment choice has a two–edged effect, increasing participation generally but also inducing some degree of choice overload. Thus, we are left with a strikingly strong level of “savings aversion,” one which seems rather resistant to important economic incentives.

Evidence regarding the cost of employer matching contributions appears in Table 5, where we see that actual employer expenditures as a percent of the employer’s total wage bill are linked to match design, not surprisingly. More generous match

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31 We acknowledge that these calculations overlook the risk premia associated with future contribution patterns, as well as the uncertainty of job tenure with a given employer. Yet despite these return premia, it is remarkable that so many non–participants still judge 401(k) saving to be “not worth” the costs.
rates on the first three and the next three percent of compensation (F3_Match and N3_Match) are associated with higher employer match costs. Offering a loan has a small effect: loans raise employee contributions at the margin, and so they imply that more plan participants receive a larger matching contribution. Marginal effects show that small changes in match rates can raise costs by eight to 12 percent. Adding loans raises employer match outlays by 15 percent.

As noted earlier, the typical plan has a promised match rate of three percent, but this costs an employer only two percent of pay due to the failure of employees to maximize plan saving. In effect, employees forfeit about one-third of promised retirement compensation. It is worth noting that companies with higher-paid workforces are also those that generally pay higher matching contributions (c.f., Mitchell, Utkus and Yang (2006)), and higher-paid employees are also those who tend to save and participate at higher levels. The overall result, then, is that higher-paid workers capture a larger retirement subsidy than lower-paid employees.

Next we summarize estimated employer costs across several match designs, controlling for the tendency of better-paid workers to receive and take advantage of better match offers. Figure 5 shows the impact of match patterns and loans on employer costs. For example, if an employer promised a match of $0.25 on a dollar up to three percent, the actual cost to the employer would be 0.25 percent of employee salary, though the promised match is 0.75 percent (0.25*3% = 0.75%). That means the employee would forfeit 66 percent of the promised match ((0.75% – 0.25%)/0.75% = 66%). Using similar calculations, forfeited compensation amounts range from 66 percent of the smallest promised match ($0.25 on the dollar on three percent of pay) down to 42 percent of pay for a very generous match ($1 per dollar on six percent of pay). Controlling for cross-plan compositional differences, the average amount of forfeited pay is 50 percent of the match—in essence, the pure cost of forfeited compensation. Of the half of retirement compensation that employers do end up paying, two-thirds is attributable directly to the offered match, while another third is attributable to the higher employee saving triggered by the loan feature.

DISCUSSION AND CONCLUSIONS

Our unique data set on more than 500 retirement plans has provided an in-depth examination of the complex
set of incentives embedded in 401(k) pensions. Results confirm that employer matching contributions have a very small effect on workers’ decisions to join a 401(k) plan, inducing only ten percent of eligible workers in the typical plan to participate. Notwithstanding the fact that employer matching contributions offer a substantial implicit real return premium on employee saving, some 25 percent of eligible workers still fail to join their employer plans. After controlling for differences in employee demographics, we conclude that overall, workers effectively forfeit half of their promised retirement compensation by failing to contribute at the employer match level. These results highlight how daunting it is to incentivize retirement saving using matching efforts, with savings decisions by nine out of ten workers determined by their own propensity to save (or not!), rather than because of employer incentives. We also show that the liquidity and investment constraints inherent in these plans have only modest influences on plan participation and saving rates.

These findings suggest that alternative policies may be needed to enhance retirement security among low-income and low-tenured populations. These include automatic enrollment (c.f., Madrian and Shea (2001), Choi, Laibson, and Madrian (2004), and Choi, Laibson, Madrian, and Metrick (2006)), authorized initially by the US Internal Revenue Service in 1997 and recently further buttressed by the 2006 Pension Protection Act. The same objective can be achieved if employers make non-elective contributions for all workers, substituting corporate retirement saving preferences in place of employees’ weak tastes for saving, or mandatory plan contributions, which creates savings patterns independent of firm-, employee- or plan-specific characteristics. Mandatory savings are also seen in certain private and public sector US plans, and in some public defined contribution systems in Australia, Singapore, Chile, and elsewhere.
Although not the main focus of our analysis, our results also shed some light on the question of why some employers offer matches in the first place. A handful of studies have focused on employer motivations for offering 401(k) matches. As noted in Brady (2005), some analysts have suggested that matching contributions are motivated largely by federal nondiscrimination testing rules. Another rationale could be employee demand—specifically, that better–paid workers demand more generous tax–deferred employer matches (Mitchell, Uttus, and Yang, 2006). A third possibility is that employers use the 401(k) match to attract and retain a workforce with specific characteristics—as argued by Ippolito (1997), matches are used to reward workers with lower discount rates.

Our results provide some preliminary evidence about the NDT effects, with the match incentive strongest on the first three percent of contributions by lower–paid employees. They also suggest that if matching contributions reflect employers’ efforts to attract and retain low discounters, they seem to be a rather inefficient mechanism toward that end since so few workers respond to 401(k) plan incentives. Also, the typical employer devotes very little, only about two percent of wages, on this form of compensation, implying a relatively low reward for discounting behavior. Accordingly, we offer preliminary evidence that the motivation for matching contributions is more likely to be due to nondiscrimination testing or based on employee demand for tax–deferred compensation.

Finally, plan sponsors and policymakers should be aware that investment menu design and loan features have mixed effects on employee saving behavior. More choice expands participation, but too many complex choices lead to “choice overload.” Striking the right balance between choice and complexity is key for corporate pension sponsors, public sector employers, and Social Security designers of any individual investment accounts program. More broadly, matching contributions appear to do little to turn workers into savers, with nine out of ten workers making 401(k) decisions based on their own savings preferences, not the employer incentive. If the aim of retirement and tax policy is to foster broader participation in 401(k) plans, consideration should be given to other savings approaches, such as automatic enrollment, non–elective employer contribution, or mandatory contributions that may increase incremental retirement wealth. In this vein, our research substantiates the importance of provisions in the US Pension Protection Act (PPA) of 2006, designed to encourage automatic enrollment, as well as the UK National Pension Savings Scheme, which combines automatic enrollment with employer matching contributions for workers not covered by a private–sector pension. Our findings on matching incentives, liquidity, and investment choice are also relevant when considering possible models for a reformed Social Security system or other public defined contribution systems with individual accounts, as well as private–sector 401(k) plans.

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32 When too few lower–paid employees contribute to their 401(k) plans, this can constrain more highly paid employees from tax–deferring much of their pay. In such a situation, an employer may be induced to introduce matching contributions to permit highly paid employees to take maximum advantage of the plan.
the NBER programs on Aging and Labor Economics. Opinions expressed herein are those of the authors alone, and not those of The Wharton School, Vanguard, or any other institution with which the authors may be affiliated.

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