

**Have 401(k)s Raised Household Saving?
Evidence from the Health and Retirement Study**

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September 29, 2000

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Abstract

401(k)-type pension arrangements are the most popular tax subsidy to household saving in the U.S. This study uses self- and firm-reported pension information, Social Security, and household wealth data from 1992 Health and Retirement Study (HRS) to examine the extent to which 401(k) pension plans have raised household saving. Comparison of self- and firm-reported pension information indicates significant measurement error in self-reported 401(k) eligibility. This error has biased the estimated 401(k) saving effects in all previous studies upward significantly and differentially by income category. There is evidence of significant measurement error in pension assets as well. Overall, the estimates that account for both types of measurement error suggest that 401(k)s have not raised household saving. All of the estimates are significantly lower than those implied by previous studies that have found large effects. The most plausible explanation for the large estimated offset to household saving is firm-level substitution of 401(k)s for other pensions. Even though very little of the average dollar of 401(k) wealth appears to be new household saving, 401(k)s may have stimulated saving significantly for lower-to-middle income households and, hence, increased retirement income security for an important segment of the population.

1. Introduction

The most popular tax subsidy to household saving in the United States is the 401(k)-type pension arrangement. 401(k)s subsidize saving through income-tax deferral on wages and salary dedicated to retirement saving and through investment accrual at the pre-tax interest rate. Although enabled by legislation in 1978, they effectively were not adopted until the Internal Revenue Service issued clarifying rules in 1981. Since then, they have grown remarkably and become the primary vehicle for retirement saving. In 1996, 33% of all private pension assets, 33% of all pension plans, and 45% of all active pension participants were in 401(k)s. The \$104 billion in 401(k) contributions represented 61% of all pension contributions and 38% of National Income and Product Account (NIPA) personal saving that year. Benefits paid from 401(k)s represented 38% of total pension benefits disbursed.¹

Despite their prominent role, the empirical evidence about their effects on household saving has been debated heavily. In a series of influential papers, Poterba, Venti, and Wise (1994a, 1994b, 1995, 1996, 1998a) and Venti and Wise (1996) have argued that 401(k) saving is predominantly new and not offset by declines in other saving. In contrast, Engen, Gale, and Scholz (1994, 1996) and Engen and Gale (1996, 2000) argued that 401(k) saving has been offset significantly by reductions in other saving. Even more striking is that these opposing findings were estimated using the same data: the 1984, 1987, and 1991 Surveys of Income and Program Participation (SIPP).

The fundamental difficulty in this literature is that unobserved heterogeneity in household saving may bias estimated saving effects. For example, some households may be “savers,” others not. Savers save more in all forms, including 401(k)s, so that a positive correlation between 401(k) participation and high saving is not evidence necessarily of a causal effect.

¹ These figures are the author's calculations from U.S. Department of Labor (2000). See Turner and Beller (1992) and Employee Benefit Research Institute (1995) for excellent discussions of trends in retirement benefits. Poterba (1994a), Papke

Poterba, Venti, and Wise (1994a, 1994b, 1995, 1996, 1998a) and Venti and Wise (1996) have developed numerous strategies to circumvent this problem.² The most convincing is quasi-experimental and termed “the eligibility experiment” [Poterba, Venti, and Wise (1995)]. Because 401(k)s are employment-based, only employees at firms with a plan are eligible to participate. They argued that the firm’s adoption is largely exogenous with respect to any given worker’s unobserved taste for saving.³ Therefore, they estimated the 401(k) saving effect by a comparison of the *financial* assets (401(k) assets included) of eligible (the treatment group) and ineligible (the control group) households in the SIPP. All of the difference in financial assets between the groups was due to the difference in 401(k) assets. Although their characterization of these findings was that the bulk of 401(k) wealth was new saving, their estimates clearly implied that 401(k)s raised household saving dollar-for-dollar.⁴

One shortcoming of their analysis is the emphasis on financial assets rather than all assets that finance retirement consumption. Such assets include financial as well as pension and Social Security assets.⁵ Unfortunately, the SIPP did not measure the latter sources of wealth. The current paper adopts the Poterba, Venti, and Wise eligibility experiment framework, but uses household wealth data from the 1992 Health and Retirement Study (HRS). The HRS surveyed individuals born between 1931-41 and their spouses (regardless of birth year). It has detailed data on pension assets (on the current and previous jobs) reported both by the respondent and the firm. In addition, it has matched Social Security assets from the Social Security Administration (SSA). It is the only household data source with this information.

(1999), Papke, Petersen, and Poterba (1996), Engen, Gale, and Scholz (1996), Hubbard and Skinner (1996), and Poterba, Venti, and Wise (1996, 1998a, 1998b) analyzed aspects of the growth in 401(k)s relative to other retirement saving vehicles.

² These methods are described in detail in Poterba, Venti, and Wise (1996, 1998a).

³ Specifically, they argued that eligibility was exogenous *conditional on income*. This is discussed in more detail in the text below.

⁴ In fact, Bernheim (1999) interpreted this evidence as consistent with 401(k)s having *crowded in* saving at ratios greater than 1:1.

⁵ In principle, housing equity can finance retirement consumption, although, in practice, the elderly spend down very little housing equity [Venti and Wise (1984, 1989, 1990a, 1991)].

The key question is whether 401(k)-eligible households have greater total assets to finance retirement. I am able to replicate the Poterba, Venti, and Wise findings for financial assets: eligible households have significantly higher financial assets than ineligible households, and all of the difference is due to 401(k) assets. However, when the saving measure is broadened to include *all* pension assets, there is no difference between eligible and ineligible households using the self-reported pension data in the HRS. There is a significant negative correlation between 401(k) and non-401(k) pension assets. In particular, ineligible households self-reported more assets in defined benefit pensions than eligible households.

However, a comparison of the self- and firm-reported pension data indicates significant measurement error in eligibility in the self-reported data that varies with household income. Lower-to-middle income households understate eligibility. High-income households overstate eligibility. Furthermore, the measurement error is highly correlated with saving behavior. Analyses with self-reported eligibility (all of the previous literature) yield estimated saving effects that are biased upward significantly.

In addition, there is significant measurement error in self-reported pension assets. When firm-reported pension assets and eligibility are used instead of the self-reported data to address this measurement error, a different picture emerges. 401(k)s generate economically large and sometimes statistically significant household saving effects for lower-to-middle income households: the average dollar contributed generates between 70 cents and one dollar of new household saving. However, these saving effects attenuate with income. They are much smaller economically (and even negative) and not statistically different from zero for middle-to-upper income households. Over all households, 38 cents of the average dollar of 401(k) wealth represent new household saving, with an estimated standard error of 16 cents. However, defined contribution and 401(k) assets derived from the firm-reported data likely significantly overstate actual values. When the firm- and self-reported plan value data are integrated to better reflect

actual values, a qualitatively similar pattern of large saving effects that decline with income is found, but the overall impact on household saving is estimated to be minus 8 cents, with a standard error of 29 cents, and not statistically different than zero.

Overall, there is little evidence that 401(k)s have raised household saving. All estimates are significantly lower than those implied by the Poterba, Venti, and Wise studies but similar to those in Engen and Gale (2000). They also contrast with the findings of Engelhardt (1996) and Venti and Wise (1986, 1990) for other tax subsidies to saving. One plausible explanation for the large estimated offset to household saving is firm-level substitution of 401(k)s for other pensions. In addition, even though very little of the average dollar of 401(k) wealth appears to be new household saving, the best specifications indicate 401(k)s may have stimulated saving significantly for lower-to-middle income households and, hence, increased retirement income security for an important segment of the population.

The paper is organized as follows. Sections 2 and 3 describe 401(k)-type pension arrangements and the existing evidence on 401(k) saving effects, respectively. The empirical analysis from the HRS is described in section 4. Section 5 discusses corroborating firm-level evidence on pension plan substitution. There is a brief conclusion.

2. 401(k)-Type Pension Arrangements

Unlike Individual Retirement Accounts (IRA's), 401(k)-type pension arrangements are employment-based. Only employees of firms that offer these plans are eligible. They are defined contribution plans and are a subset of Cash or Deferred Arrangements (CODA's). Legally, the term "401(k)" refers to defined contribution plans qualified under section 401(k) of the Internal Revenue Code (IRC). However, researchers, policy makers, and the media frequently use this term loosely to describe plans that offer elective employee pre-tax contributions based on salary reduction. The array of plans with this feature is remarkably broad. For example, savings or thrift plans that allow pre-tax contributions from salary reduction must follow rules for 401(k)s.

The same applies to profit-sharing plans. Qualified nonprofit organizations and public school systems can sponsor elective tax-deferred savings plans under section 403(b) of the IRC. Essentially, 403(b)'s operate like 401(k)s. Plans for state and local government employees qualified under section 457 of the IRC also have 401(k)-type features.

Their distinguishing feature is they allow employees to make elective contributions on a pre-tax basis, funded by a reduction in the employee's salary. Hence, they are referred to frequently as Salary Reduction Arrangements (SRA's). The employer may contribute as well, often matching a pre-determined fraction of the employee's elective contribution. The typical match is 50% of employee contributions up to 6% of wages and salary. The account funds accrue at the pre-tax interest rate and are taxed as ordinary income at withdrawal.

3. Existing Evidence on 401(k) Saving Effects

In a series of influential papers using the 1984, 1987, and 1991 SIPP, Poterba, Venti, and Wise (1994a, 1994b, 1995, 1996, 1998a) and Venti and Wise (1996) developed various empirical methods to estimate the 401(k) saving effect. Each attempted to minimize the bias from unobserved heterogeneity. While these methods and the sheer size of their published work are too large to discuss here, their findings consistently point to a very large 401(k) saving effect: on the order of a dollar-for-dollar stimulus to household saving. The interested reader is referred to Bernheim (1997, 1999), Hubbard and Skinner (1996), Poterba, Venti, and Wise (1996, 1998a), and Engen, Gale, and Scholz (1996) for extensive reviews of these methods.

The most convincing method is the "eligibility experiment" in Poterba, Venti, and Wise (1995). Employers determine 401(k) eligibility. They argued that firms have adopted them such that eligibility essentially was random with respect to any given worker. Specifically, they showed empirically that eligibility differed across income categories but, *within* income category, was not correlated with characteristics such as age. They used this to estimate the saving effect of 401(k)s.

Their empirical strategy was in two parts. First, they compared the total *financial* assets (401(k)s included) of eligible to ineligible households. A necessary condition for a positive saving effect was that eligible households should have had higher total financial assets than ineligible households, *ceteris paribus*. Second, they compared the non-401(k) assets of eligible to ineligible households. A necessary condition for a positive saving effect was that the non-401(k) assets of eligible households should have been no different than those of ineligible households, *ceteris paribus*. That is, all of the difference in financial assets between the two groups should have been due to 401(k) assets.

Econometrically, this comparison can be written as

$$A_{ai} = \beta_a + \gamma_a D_i^{Eligible} + \varepsilon_i, \quad (1)$$

where i indexes the household, $i=1, \dots, n$, a denotes the asset measure, A is the dollar amount of assets, $D_i^{Eligible}$ is a dummy variable that is one if the household is eligible for a 401(k) and zero otherwise, and ε is a random error term. γ measures the effect of eligibility on asset balances. If eligibility is exogenous, then $Cov(D^{Eligible}, \varepsilon) = 0$, and the 401(k) saving effect, γ , can be estimated consistently. But because Poterba, Venti, and Wise argued that eligibility was exogenous *conditional on income*, they estimated these between-group differences controlling for income. They also controlled for age, education, and marital status. Their regression specification was

$$A_{ai} = \sum_{j=1}^7 \beta_{aj} Y_{ij} + \sum_{j=1}^7 \gamma_{aj} (Y_{ij} \times D_i^{Eligible}) + \theta' X_i + \varepsilon_{ai} \quad (2)$$

where X was the vector of demographic characteristics and Y_{ij} was an indicator variable that was one if household i had income in interval j and zero otherwise. The asset measures analyzed were total financial assets, non-IRA-401(k) assets, 401(k) assets, and IRA assets. The income intervals (in thousands) were less than 10, 10-20, 20-30, 30-40, 40-50, 50-75, and over 75. γ_{aj} is

the 401(k) saving effect for each asset type and income category, respectively. Now, given income and demographics, the identifying assumption is

$$\text{Cov}(D^{\text{Eligible}}, \varepsilon | X, Y) = 0. \quad (3)$$

Because the distribution of assets is right-skewed, Poterba, Venti, and Wise estimated the parameters in (2) with median regression (separately for the 1984, 1987, and 1991 SIPP). The median regression estimator produces consistent estimates of the 401(k) saving effects (by income category), γ_{aj} . In addition, these estimates are efficient relative to mean regression. Their results for 1991 are reproduced in Table 1. It shows the conditional median asset balances for eligible and ineligible households by asset measure and income category. These balances were calculated with the parameter estimates from (2) evaluated at the sample mean of the demographic variables. Eligible households had significantly higher total financial asset balances than ineligible households. These differences were economically large for all income categories and statistically significant at the 5% level for 6 of the 7 categories. Importantly, there was little difference between eligible and ineligible households for non-IRA-401(k) financial assets. In only 3 of 7 categories were the groups statistically different and those differences were not large economically. This was evidence of no offset *within* financial-asset saving.⁶ Because the non-IRA-401(k) financial assets were the same but the total financial assets differed due to 401(k) assets, they interpreted this as evidence in favor of a substantial 401(k) saving effect.

Under this empirical strategy, it was important that eligible and ineligible households did not differ at the onset of the program (effectively, 1981). The earliest household survey with 401(k) information was the 1984 SIPP. For 1984, just three years after the IRS clarified plan rules, they found *no* difference in non-IRA-401(k) assets between eligible and ineligible households. This was important supporting evidence of a substantial saving effect.

⁶ They found similar results for 1987.

There have been a number of criticisms of this method.⁷ First, although there was no substitution *within* financial assets, there may have been substitution *between* financial and non-financial assets that could have accounted for the asset differences between eligible and ineligible households [Engen and Gale (1996, 2000) and Engen, Gale, and Scholz (1994, 1996)]. For example, as aggregate 401(k) assets rose significantly in the late 1980's, mortgage debt rose as well. Engen and Gale (1996, 2000) found substitution between 401(k) assets and mortgage debt in this period using the SIPP. In particular, 401(k)-eligible households had greater financial assets than ineligible households, but more mortgage debt as well. Strikingly, the two groups did not differ in terms of total private wealth.⁸ However, Poterba, Venti, and Wise (1996, 1998a) performed a related analysis in the SIPP and concluded the opposite: no substitution between 401(k) assets and mortgage debt.

Second, there may have been substitution between financial assets and public and private pensions. Almost all estimates of 401(k) saving effects have used the SIPP.⁹ The SIPP asked respondents direct questions on 401(k) eligibility, had detailed questions on income and financial and 401(k) assets, and having started in 1984, roughly covered the expansion of 401(k)s. However, it had no information on two important components of retirement saving: the present value of claims to non-401(k) pension plans (i.e., defined benefit and non-401(k) defined contribution plans) and Social Security.

The private pension omission is problematic. From the description above, it is clear there were two types of ineligible households. First, there were households with no pension coverage during their lifetime. Second, there were households that had pension coverage from plans other than 401(k)s. The linchpin of the quasi-experimental framework above was that eligibility was exogenous (conditional on income and demographics). But this may not have been true because

⁷ See Bernheim (1999) and Engen, Gale, and Scholz (1996), for example.

⁸ Private wealth was defined as the sum of financial and housing assets less the sum of financial and mortgage debt.

401(k) eligibility and other pension coverage may have been correlated inversely if there was firm-level substitution of 401(k)s for other pension plans. In principle, such substitution in combination with substitution of other pension assets for financial assets could have accounted for positive saving effects estimated in previous studies. For example, ineligible households might have had greater other pension wealth because many after-tax thrift plans were converted to 401(k)s in the 1980's [Andrews (1992), Papke (1995, 1999)]. Those assets would have appeared in the SIPP as 401(k) assets for eligible households but not measured for ineligible households.¹⁰ This could have accounted for the asset differences Poterba, Venti, and Wise found. Similarly, the Social Security omission could have biased the estimated effects if Social Security was greater for ineligible than eligible households and there was an offset between Social Security and financial assets.

However, the most frequent criticism has been that eligibility is not exogenous [Engen, Gale, and Scholz (1994, 1996), Engen and Gale (1996, 2000), Bernheim (1999), Ippolito (1996)]. Rather, it is positively correlated with workers' taste for saving. A number of theoretical explanations have been put forth. First, workers with a high taste for saving sort themselves to firms that offer pensions, and, in particular, 401(k)s [Allen, Clark, and McDermed (1993), Curme and Even (1995), Ippolito (1996), Even and McPherson (1996)]. Second, firms with 401(k)s may have adopted them in response to employee interest. This may have been true especially in small firms. In a survey of firms by Buck Consultants (1989), employee interest was cited as a reason for 401(k) adoption by 63.5% of firms. Finally, Ippolito (1996) has argued that firms may have used 401(k)s, and matching, in particular, to direct additional compensation to workers with a low rate of time preference as part of an optimal employee retention policy.¹¹

⁹ Pence (1999) and Sabelhaus and Ayotte (1999), who used the Surveys of Consumer Finances (SCF), and Bernheim and Garrett (1996), who used a Merrill Lynch survey, have been exceptions.

¹⁰ This and other mechanisms for explicit and implicit firm-level substitution of 401(k)s for other pensions are discussed in Section 5 below.

¹¹ Pence (1999) has represented one of the few attempts to control directly for tastes for saving in the eligibility experiment framework. She used the 1995 Survey of Consumer Finances (SCF), which asked a set of qualitative questions on reasons for

4. New Evidence from the HRS

Overall, the arguments for and against the exogeneity of eligibility both have some plausibility. Because it is very difficult to conceive of an empirical strategy (short of a randomized trial) to illustrate convincingly the relationship (or lack thereof) between eligibility and tastes, the current paper adopts the Poterba, Venti, and Wise eligibility experiment methodology. It maintains the assertion that eligibility conditional on income and demographics is not correlated with tastes for saving. An important contribution is to estimate the 401(k) saving effect accounting for other public and private pension wealth. Specifically, it uses detailed data on 401(k)s, other pensions, Social Security, and private wealth from wave 1 of the Health and Retirement Study (HRS) and examines whether 401(k)s have stimulated retirement saving, more broadly defined.¹²

The HRS has a number of advantages. First, it contains detailed data on household financial and housing wealth. Arguably, they are as good or better than the SIPP data. Second, the study obtained detailed information from both the respondent and employer on private pensions on current and past jobs.¹³ Third, respondents were asked permission to link their survey responses to administrative earnings histories and benefits records from the Social Security Administration (SSA). With detailed financial, housing, pension, and Social Security wealth, the HRS is the

saving (retirement, emergencies, kids' education, or, don't save), risk-taking (above average risks, average risks, no risks), planning horizon (short-term, medium-term, long-term), bequest expectations, and uncertainty about the economy. Consistently, eligible households more frequently reported they saved for retirement, had a longer planning horizon, and took greater risks than ineligible households. In addition, eligible households were less likely to have reported they did not save and were uncertain about the economy. Her estimates for (2) using the SCF confirmed the Poterba, Venti, and Wise findings for total financial assets. However, when a set of dummy variables for responses to the qualitative questions were added to the specification to control directly for tastes for saving, the estimated difference in total financial assets between eligible and ineligible households fell by about 25% and frequently was no longer statistically significant. These results can be interpreted in a number of ways. Naturally, they suggest eligibility is correlated with a taste for saving. However, two of the three reasons most highly correlated with eligibility were "reported saving for retirement" and "had a longer planning horizon." It is conceivable that the eligible households gave these answers *because* they were eligible for a 401(k). That is, the "treatment" of 401(k) eligibility itself may have affected attitudes toward retirement saving and planning. In the end, it is not possible to separately identify whether these qualitative responses reflect tastes for saving independent of eligibility.

¹² The HRS is a longitudinal study of a sample of individuals age 51-61 in 1992. These individuals and spouses (regardless of the spouse's age) were included in the study. There were a total of 12,652 individuals in the first wave (1992) that comprised 7,607 households. Detailed descriptions, discussion, and background information on the structure of the HRS can be found in Moon and Juster (1995), Smith (1995), Gustman and Steinmeier (1999a, 1999b), and Gustman, Mitchell, Samwick, and Steinmeier (1999).

only household survey to give complete coverage of the household portfolio. Finally, the survey was well timed. Because they were 51-61 in 1992, the main respondents were 40-50 in 1981, the effective starting date for 401(k)s. Therefore, the HRS sample moved through their prime retirement saving years *during* the expansion of the 401(k) program. Any 401(k) saving effect should have been apparent in the HRS data.

The primary disadvantage is that the HRS only covers one birth cohort (i.e., those born 1931-41). The estimated saving effects may not apply to younger cohorts. This is discussed in more detail in the conclusion.

4.2. Empirical Results with the Self-Reported Data

A sample of households from the 1992 HRS (Wave 1) was drawn. Each household contained at least one individual with a current job who reported they were not self-employed. This selection rule was identical to that in Poterba, Venti, and Wise (1994, 1995). The final sample consisted of 4,318 households. Overall, 35 percent of these households were 401(k) eligible and, as in other studies, eligibility rose with household income. A detailed description of the sample and eligibility are given in Appendix A.

Conditional median asset balances by eligibility and income categories for the HRS are shown in Table 2. As in Poterba, Venti, and Wise (1995), these were calculated using the median regression parameter estimates from (2) evaluated at the sample mean of the demographic variables. Importantly, their findings were replicated in the HRS. Across all income categories, eligible households had greater total financial assets than ineligible households (panel A). These differences were economically large and statistically significant. The p -value for the test of the null hypothesis that this difference is zero is in square brackets. All p -values were based on bootstrapped estimated variances with 300 replications. Also, the differences in non-IRA-401(k) financial assets were small and not statistically significant (panel

¹³ These data are described in detail in Appendix A. Gustman, Mitchell, Samwick, and Steinmeier (1999) and Gustman and

B). This suggests no substitution *within* financial assets and that all 401(k) assets represented new saving.

However, the results change when the asset measure is total financial and private pension assets (panel E). Pension assets are the present value of the household's claims to assets in defined benefit and defined contribution plans and the present value of any annuitized pensions. It captures pension assets on current and past jobs and was calculated by Venti and Wise (1997) from the self-reported pension information in wave 1 of the HRS. For all income categories, there are no statistically or economically significant differences between eligible and ineligible households. In addition, in four of the six categories, the economic differences are small. Furthermore, in four categories, ineligible households actually have *more* assets than eligible households. These findings are due to an inverse correlation between 401(k) eligibility and non-401(k) pension assets (panel F). Ineligible households have much greater other pension wealth. Once this other wealth is accounted for, the Poterba, Venti, and Wise results go away.¹⁴

For each income category in Table 2, the panel E wealth differences are consistent estimates of the true differences between eligible and ineligible households (under the identifying assumption (3)). To evaluate the *economic* magnitude of these estimates and their implications for aggregate household saving, the amount of new household saving per dollar of 401(k) wealth was calculated by dividing these estimates by the mean 401(k) balance for eligible households in that category.¹⁵ These quotients are shown at the bottom of the table. Four of the six estimates are negative. The largest estimate is 54 cents for households with income greater than \$75,000.

Because the household saving effects differed by income category, two weighted-average saving effects are presented at the bottom of Table 2. The first calculates the average effect by multiplying the income-category saving effects by income-category weights based on the

Steinmeier (1999c) have provided comprehensive evaluations of this information.

¹⁴ Similar results using mean regression are available from the author upon request.

¹⁵ This follows the method in Engelhardt (1996).

fraction of aggregate households in each category. These fractions, in turn, were calculated from the HRS household analysis sampling weights. This “household-weighted” average new household saving per dollar of 401(k) wealth was -0.02. That is, the “average” household had a 401(k) household saving effect of minus 2 cents. The standard error associated with this estimate was 48 cents. However, from a purely *fiscal* perspective, what matters is the impact of 401(k)s on *aggregate* household saving. Even though 401(k)s appear to have decreased saving for lower-to-middle income households, these households may have accounted for a comparatively small fraction of all dollars accumulated in 401(k)s. Specifically, households with income between \$20,000 and \$75,000 accounted for 65.1 percent of all 401(k) households, but just 47.8 percent of all 401(k) wealth. Therefore, the second measure calculates the weighted-average effect by multiplying the income-category saving effects by income-category weights based on the fraction of aggregate 401(k) wealth (in dollars) in each income category. These fractions, in turn, were calculated using both the sampling weights and the household 401(k) wealth data. This “dollar-weighted” average new household saving per dollar of 401(k) wealth was 0.15. That is, 15 cents of the average dollar in a 401(k) represented new household saving. The standard error associated with this estimate was 31 cents. The 95 percent confidence interval for the household saving effect is from minus 47 to 77 cents. This point estimate is significantly lower than that implied by the Poterba, Venti, and Wise studies but similar to those in Engen and Gale (2000).

Panels G through K give results for alternative asset categories. There was little difference in the present value of claims to Social Security between eligible and ineligible households (panel G).¹⁶ These balances are statistically different for three categories, but small in percentage terms: eligible households had 5 to 8 percent more in Social Security assets than ineligible

¹⁶ These data are described in Appendix A. Because not all respondents gave permission to match Social Security records, the estimates in panels G and K were over a slightly smaller sample of 3,927 households. When all specifications in Table 2 were run over this sample of 3,927 households, the results did not change.

households. Therefore, in terms of lifetime earnings, the two groups were similar. To the extent unobserved heterogeneity, such as in the rate of time preference, is correlated with lifetime earnings, this result gives some support to the assertion that eligibility was exogenous. Eligible households had greater total financial and housing wealth than ineligible households (panel H). This must be attributed to 401(k) assets, because the groups did not differ greatly in terms of housing wealth (panel I). In particular, eligible households did not have significantly less housing wealth than ineligible households. However, when other pension wealth is added and total non-Social Security wealth is considered (panel J), there were no differences between eligible and ineligible households. Finally, the asset measure in panel K is total wealth. It is the sum of financial, housing, pension, and Social Security wealth. It is the broadest measure. Although for many income categories, eligible households have greater total wealth, these differences are not statistically significant. There appears little evidence in favor of a 401(k) saving effect at any income level.

4.3. Measurement Error in Eligibility

Like all of the previous literature, this analysis relied on self-reported 401(k) eligibility. However, individuals may have misreported plan type. This could have happened for a number of reasons: someone with a defined benefit reported a defined contribution plan (or vice versa); someone with a non-401(k) defined contribution plan reported a 401(k); someone with a defined benefit and 401(k) plan reported just the defined benefit plan, etc. In any of these (or the many other possible) cases, 401(k) eligibility, the primary explanatory variable in equation (2), was measured incorrectly.

The HRS is well suited to address measurement error in eligibility. It administered a Pension Provider Survey (PPS) to and attempted to obtain Summary Plan Descriptions (SPD) for all pensions from employers of all individuals that self-reported a (current or past) pension-covered job. The match rates were 65 percent of those currently working (in wave 1) in pension-covered

jobs, 66 percent for the last job for those not working, and 35 percent for jobs held five years or longer prior to the current (last) job for those working (not working).

To examine the extent of reporting error in 401(k) eligibility on the current job, Table 3 compares eligibility based on the matched firm-reported pension information with that from the self-reported information.¹⁷ Results for the primary sample are shown in Panel A. It contains all observations from the self-reported sample (of 4,318 households) used above that had matched firm pension records on *all* pension-covered jobs.¹⁸ Even though this is a strict criterion for inclusion, it ensures a sample in which eligibility is measured precisely.¹⁹ Because of the less-than-perfect match rates described above, this sample contains 1,312 of the 4,318 households in the self-reported data sample from above.²⁰

The results in panel A indicate significant measurement error in self-reported 401(k) eligibility on the current job. For all households with pension coverage on the current job, 43.4 percent were actually eligible based on the firm-reported data compared to 41.2 percent with the self-reported data. However, this masks important variation in error across household income categories. Lower-income households were more likely to have classified themselves incorrectly as ineligible. This error was large. Actual eligibility averaged 8.5 *percentage points* higher than self-reported eligibility for households with annual income under \$40,000. This represented a 21 *percent* difference in the two eligibility rates. In contrast, higher-income households were more likely to have classified themselves incorrectly as eligible. This error was large, too. Self-reported eligibility was 9.6 *percentage points* higher than actual eligibility for households with annual income above \$75,000.²¹ This represented a 20 *percent* difference in the two eligibility

¹⁷ The firm-reported eligibility measure is described in Appendix A.

¹⁸ That is, if an individual had two pension-covered jobs, then matched records were needed on both jobs for the individual to have entered this sample. For married households, both spouses needed to have met this criterion.

¹⁹ The sample will be broadened in the sensitivity analysis below.

²⁰ Of the 4,318 households in the sample for the self-reported data analysis in Table 2, only 3,013 were in pension-covered current jobs. So the 1,312 households just described represent 43.5 percent of comparable households in Table 2.

²¹ Poterba, Venti, and Wise (1994, 1995) motivated their specification in equation (2) by the fact that even though eligibility (self-reported in the SIPP) rose with income, conditional on income, eligibility was unrelated to demographic factors, such as age. Table 3 shows that actual eligibility for those that were pension covered on the current job was remarkably even across

rates. Similar results were obtained in panel B, where the sample selection criterion was loosened to include all households with matched records on the current job.²²

The type of error was striking as well. In panel A of Table 4, 37.3 percent of these households correctly self-reported not eligible. In panel B, 21.9 percent correctly reported eligible. However, 21.5 percent failed to self-report eligible when actually eligible (panel C). In 83 percent (i.e., $235/282=0.83$) of these misclassified cases, the household reported a defined benefit plan but not the 401(k).²³ The other 17 percent of these cases (i.e., $47/282=0.17$) involved individuals who reported a non-401(k) defined contribution plan, such as a profit-sharing plan, that actually was qualified legally under section 401(k) of the IRC because it provided for voluntary employee contributions through salary reduction. About 19 percent of households erroneously reported eligible when actually ineligible (panel D). Almost 64 percent (i.e., $162/254=0.638$) of these misclassified cases involved a household that reported a defined benefit plan and mistakenly reported a 401(k) plan.

Tables 3 and 4 indicate significant measurement error in self-reported 401(k) eligibility. This is a very important finding because all of the previous literature has used self-reported data to determine eligibility.²⁴ Therefore, all previous estimates of the saving effect of 401(k)s potentially were biased and inconsistent, and, at a minimum, should be viewed with caution.

Table 5 provides insight into the sign and relative magnitude of the bias. Households could have reported pension information that classified them as eligible when actually ineligible. Columns 1 and 2 show the percent of the subsample of 1,312 households with matched pension

household income categories. It is only when households that had no pension coverage during their lifetime are added to the samples in panels A and B, respectively, that eligibility rises with income (obviously, these additional households were ineligible for a 401(k) and have zero pension wealth). Expanding the sample in panel A with these additional households, the eligibility rates for the six income categories in ascending order are 15.7, 27.1, 31.0, 36.2, 37.4, and 40.8 percent, respectively. This implies that the positive eligibility-household income profile is solely due to differences across household income categories in the rate of pension coverage, a fact pointed out by Engen, Gale, and Scholz (1994).

²² That is, the difference between the samples in panels A and B is that panel A required matched records on *all* pension-covered jobs (current or past), whereas panel B required a match on just the pension-covered current job. This expanded the sample significantly because, as described above, the match rate was lowest on pensions from past jobs.

²³ One plausible explanation for this failure is that individuals eligible for, but not voluntarily contributing to, the 401(k) may have neglected to report the 401(k) as a separate plan in Section F of the survey.

records in each self-/firm-reported eligibility cell by household income category. Cell sizes are in parentheses. In panel A, 12.9 percent of households with income less than \$20,000 reported eligible when actually ineligible. This figure *rose* with household income. In panel F, 26.9 percent of households with income greater than \$75,000 reported eligible when actually ineligible. In contrast, households could have reported not eligible when actually eligible. In panel A, 22.1 percent of households with income less than \$20,000 reported not eligible when actually eligible. This figure *fell* with household income. In panel F, 17.3 percent of households with income greater than \$75,000 reported not eligible when actually eligible.

Columns 3 through 8 show the unconditional mean balances for three asset measures for each eligibility cell. The unconditional median balances are in square brackets. The last line of each panel shows the *p*-value for the Kruskal-Wallis non-parametric test of the null hypothesis of equal cell asset distributions. Failure to reject the null hypothesis is evidence that the measurement error in eligibility was uncorrelated with saving behavior, which suggests previous estimates of 401(k) saving effects with self-reported eligibility were consistent (subject to the identifying assumption (3)). Interestingly, across household income categories in columns 3 and 4, there were no statistically significant differences in the cell distributions of non-401(k) financial assets. This suggests that the measurement error in eligibility was not correlated with non-401(k) financial asset saving. However, across household income categories in columns 5 and 6, there were statistically significant differences in the cell distributions of total financial assets. Both at the mean and median, households who reported not eligible, but were actually eligible, had relatively low total financial assets.²⁵ These “low” savers were attributed erroneously to the ineligible group in analyses with self-reported eligibility. In contrast, both at the mean and median, households who reported eligible, but were actually ineligible, had

²⁴ Gustman and Steinmeier (1999b) in the HRS used matched firm-records to estimate the offset to household saving from private pensions, but did not focus on 401(k)s specifically.

²⁵ Indeed, they appear similar to those who correctly reported they were ineligible.

relatively high total financial assets.²⁶ These “high” savers were attributed erroneously to the eligible group in analyses with self-reported eligibility. Heuristically, this clearly biased toward finding a positive 401(k) saving effect when the test is based on total financial assets, as in the previous literature.²⁷

This description is heuristic because, technically, the bias from using self-reported eligibility depends on the size of assets shifted between cells weighted by the percent of the sample in each cell shown in columns 1 and 2. But as described above, the percent of the sample in each cell changed as income rose. This implies that the bias is *differential* by income category. For example, for households with income less than \$20,000 (panel A), the “low” savers mistakenly attributed to the ineligible group were 22.1 percent of the sample, whereas the “high” savers mistakenly attributed to the eligible group were 12.9 percent of the sample. In comparison, for households with income greater than \$75,000 (panel F), the “low” savers mistakenly attributed to the ineligible group in analyses with self-reported eligibility were 17.3 percent of the sample, whereas the “high” savers mistakenly attributed to the eligible group were 26.9 percent of the sample. So, the measurement error bias, while positive for all income categories, is expected to be greater for higher-income households than lower-income households. This is born out in the analysis of conditional median balances in Tables 6 and 7 below.

Columns 7 and 8 of Table 5 suggest that the correlation of the measurement error and saving is even more complex. These columns show mean and median cell balances for total financial and pension assets. In four of the six household income categories, there are statistically significant differences (at the nine percent level or less) in the cell distributions of total financial and pension assets. The largest *p*-value is only 0.20. This suggests that the measurement error is correlated with total financial and pension asset saving. But the cell patterns across income

²⁶ Indeed, they appear similar to those who correctly reported they were eligible.

categories are now quite different than those in columns 5 and 6. For households with income under \$30,000, those who reported not eligible, but were actually eligible, had relatively *high* median total financial and pension assets. This was because they had non-401(k) pension assets. These tended to be households with a defined benefit plan and a 401(k) who did not report the 401(k). For households with income under \$30,000, those who reported eligible, but were actually ineligible, had relatively *low* total financial and pension assets. In contrast, for households with income over \$50,000, those who reported not eligible, but were actually eligible, had relatively *low* median total financial and pension assets. For households with income over \$50,000, those who reported eligible, but were actually ineligible, had relatively *high* total financial and pension assets.

4.4. Empirical Results with the Firm-Reported Eligibility

This section presents new estimates of the effect of 401(k)s on household saving using the firm-reported eligibility in the HRS. The primary sample consists of the 1,312 households that had matched firm pension records on *all* pension-covered jobs (i.e., those that appeared in panel A of Table 3 and in Tables 4 and 5) plus all households that had no pension coverage during their lifetime. These additional 925 households were ineligible for a 401(k) and had zero pension wealth. Thus, the primary sample consists of 2,237 (=1,312+925) households, or 51.8 percent of the original sample of 4,318 households used in analysis with the self-reported data in Table 2.

Recall, there were no economic or statistically significant 401(k) effects in the self-reported data in Table 2. As a benchmark, equation (2) was re-estimated using self-reported eligibility, but on the sample of 2,237 household for which firm-reported eligibility is measured. The implied conditional median total financial and pension assets by eligibility and income are

²⁷ Note that the difference between non-401(k) and total financial assets is 401(k) assets (and IRAs). This implies that the assets that are being shifted between cells in columns 5 and 6 due to the measurement error are truly non-401(k) pension assets that households incorrectly self-reported as 401(k) assets.

shown in Table 6. In general, the results are similar to those in Table 2. There are no differences between eligible and ineligible households in non-401(k) financial assets and large differences in total financial assets in panels B and A of Table 6, respectively. Panels C and D of Table 6 show total financial and pension assets and non-401(k) pension assets, respectively.²⁸ Five of the six differences were positive between eligible and ineligible households in total financial and pension assets, but four of these were not statistically significant. There were statistically significant differences for households with income in the \$40,000-50,000 and \$50,000-75,000 categories, but in the former, ineligible households actually had *more* assets than eligible households. Across income categories, there is little statistical evidence of a 401(k) saving effect.²⁹

The amount of new household saving is shown at the bottom of the table. In contrast to Table 2, five of these estimates are positive. However, the two statistically significant estimates, for households with income between \$40,000 and \$50,000 and between \$50,000 and \$75,000, respectively, are implausibly large in absolute value. The dollar-weighted new household saving per dollar of 401(k) wealth was 0.71. The standard error associated with this estimate was 45 cents. In an absolute sense, this estimate is much larger than that from Table 2 of 15 cents, which, importantly, suggests that sample selection alone may have an important role in estimates of the effectiveness of 401(k)s.

The analyses in Tables 3 through 5 predicted that measurement error in eligibility biased upward the estimated 401(k) saving effect based on a comparison of total financial assets. To isolate the effect of measurement error in eligibility on the estimates, Table 7 presents

²⁸ The conditional median balances for these asset categories are somewhat higher in Table 6 than Table 2 for the four largest income categories. This is consistent with Gustman and Steinmeier (1999c) who found that, even conditional on income and other factors, the probability of a household having had a matched firm pension record increased non-linearly with the amount of self-reported pension assets.

²⁹ Table 2 presented results for additional measures of wealth, including Social Security. Results for additional measures of wealth that included non-financial assets, such as housing, were similar to those in Table 2 and not reported. The restricted data access agreement governing the use of the HRS firm pension records and Social Security records does not allow the firm-

conditional median asset balances by eligibility on the current job and household income categories using firm-reported eligibility. That is, the only difference between Tables 6 and 7 is in the measure of eligibility. A comparison of Tables 6 and 7 confirms this prediction. Like the results in Table 6, those in panel A of Table 7 show that eligible households had greater total financial assets than ineligible households in five of the six income categories. However, unlike Table 6, the magnitudes of the differences were substantially *less*; in fact, between two and four times less. In addition, only the difference for households with income less than \$20,000 was statistically significant.

Recall, that households who reported not eligible, but were actually eligible, had relatively low total financial assets. These “low” savers were attributed erroneously to the ineligible group with self-reported eligibility in Table 6. In Table 7, these households have been moved into the eligible group, and pulled down that group’s median. On the other hand, households who reported eligible, but were actually ineligible, had relatively high total financial assets. These “high” savers were attributed erroneously to the eligible group in Table 6. In Table 7, these households have been moved into the ineligible group, and pulled up that group’s median. Importantly, the assets that are being shifted in this case are truly non-401(k) pension assets that households incorrectly self-reported as 401(k) assets *because they misreported eligibility*. Once eligibility is measured correctly, the conditional medians were more similar, so much so that there were no *statistical* differences for all income categories except the lowest. On an *economic* basis, though, the differences in panel A still represent a substantial portion of mean 401(k) wealth shown by income category at the bottom of the table.

Table 5 also showed that the measurement error in eligibility was uncorrelated with non-401(k) financial asset saving. This was confirmed in panel B of Table 7. The differences in non-

reported 401(k) eligibility measures from Peticolas (1999) to be linked to the Social Security wealth data. Hence, estimation with wealth measures that included Social Security could not be performed.

401(k) financial assets were small, not statistically different from zero, and quite similar in magnitude to those in Table 6.

A third prediction from Tables 3 through 5 was that the measurement error bias was differential by income and dependent on non-401(k) pension assets. In panel C of Table 7, the asset measure is total financial and pension assets. For the lower three income categories, eligible households had higher balances than ineligible households, although the differences were statistically different from zero only for households with income between \$20,000 and \$30,000. In contrast, for the upper three income categories, eligible households had *lower* balances than ineligible households, and the differences were statistically different from zero (at the ten percent level or less) for households with income between \$40,000 and \$50,000 and greater than \$75,000, respectively.

The implied saving effects are shown at the bottom of the table. They are implausibly large and positive for lower-income households and implausibly large and negative for higher-income households. A comparison of these effects with those at the bottom of Table 6 indicates that incorrect measurement of eligibility biased 401(k) saving effects based on total financial and pension assets downward for lower-income households and upward for higher-income households. Effectively, this tilted the estimated saving-income profile.

An examination of panels D in Tables 6 and 7, respectively, provides a clear explanation. Households who reported not eligible, but were actually eligible, had significant non-401(k) pension assets. Recall from Table 4 that these were predominantly households with defined benefit plans and 401(k)s, but likely did not report being eligible because they were not contributing to the 401(k). In Table 7, these households have been moved into the eligible group and raised that group's median non-401(k) pension assets (panel D). But because there were relatively more of these households in the lower-income categories, as shown in Table 5, the movement of these households into the eligible group had a *larger* effect in raising non-401(k)

pension assets for lower- than higher-income eligible households. On the other hand, households who reported eligible, but were actually ineligible, had significant non-401(k) pension assets. In Table 7, these households have been moved into the ineligible group and pulled up that group's median non-401(k) pension assets (panel D). But because there were relatively more of these households in the higher-income categories, as shown in Table 5, the movement of these households into the ineligible group had a *larger* effect in raising non-401(k) pension assets for higher- than lower-income ineligible households. These differential effects clearly show how the measurement error tilted the estimated saving-income profile. The dollar-weighted new household saving per dollar of 401(k) wealth in Table 7 is minus one dollar and 28 cents, with a standard error of 68 cents.

4.5. Measurement Error in Pension Assets

The estimated saving effects shown at the bottom of Table 7 are implausibly large in absolute value. Issues about precision notwithstanding, one might speculate that these estimates themselves suggest a failed specification test for the eligibility experiment framework. However, like all of the previous literature, the analysis in Tables 2 through 7 relied on self-reported pension assets. The primary advantage of such assets is that they represent what the household believed its pension entitlement to have been. To the extent forward-looking models of saving behavior are based on expectations, then self-reported pension assets are an appropriate measure [Gale (1995, 1998), Lusardi (1999), Feldstein (1978)].

Nonetheless, there are important reasons to believe that measurement error in pension assets might be severe. First, individuals may not have reported plan values accurately. This may have been especially severe for defined benefit plans, which rely on, sometimes complicated, formulas based on salary, age, years of service, early and normal retirement dates, etc., of which the individual may not be well aware. Even small errors in reporting the early and normal retirement dates can change the implied accrual profile and present value calculation dramatically. This

would have resulted in dependent variable measurement error for those specifications above based on total financial and pension assets. Participants in defined contribution plans may have had better knowledge of their account balances, and, hence, less reporting error for plan values. Second, measurement error in reported plan type, as documented in Table 4, almost surely was correlated highly with error in reported plan value. In this sense, the explanatory variable measurement error likely exacerbated the dependent variable measurement error. Gustman and Steinmeier (1999c) examined measurement error in the HRS pension data extensively and found these patterns of measurement error in pension assets.³⁰ Third, the self-reported pension assets used above contained many missing values that ultimately were imputed. Specifically, Venti and Wise (1997) reported almost 40 percent of HRS households had to have had at least one piece of information imputed in order to construct the self-reported pension wealth used. This resulted in additional measurement error.

The key issue, then, is to determine the extent to which better measurement of pension assets can make the estimates in Table 7 more plausible. In some respects, the HRS is well suited to address measurement error in pension assets. It administered a Pension Provider Survey (PPS) to and attempted to obtain Summary Plan Descriptions (SPD) for all pensions from employers of all individuals that self-reported a (current or past) pension-covered job. Importantly, these matched firm data do not have individual-level information on contributions or balances, rather only contain plan type, eligibility rules, benefit formulae, employer contribution rates, early and normal retirement dates and other information described in the Summary Plan Description. These are useful especially for the calculation of defined benefit assets and defined contribution assets due to mandatory employer and employee contributions.

To gauge the importance of measurement error in pension assets, Table 8 presents conditional median asset balances by firm-reported eligibility on the current job and household

³⁰ Mitchell (1988), Gustman and Steinmeier (1989), Starr-McCluer and Sunden (1999) have examined error in self-reported

income categories for the HRS firm-reported pension assets on the same sample of 2,237 households from Tables 6 and 7.³¹ The measure of pension assets is the present value of claims to assets in defined benefit and defined contribution plans and the present value of any annuitized pensions based on the firm-reported data. Specifically, it is pension wealth scenario 1 from the HRS Pension Present Value Database (Level 1) by Peticolas and Steinmeier (1999) and is described in more detail in Appendix A.

The results in panel A show that eligible households had greater total financial assets than ineligible households for the firm-reported sample. These differences were economically large and statistically significant. Also, the differences in non-IRA-401(k) financial assets were small and not statistically significant (panel B). In panel C, the asset measure is total financial and private pension assets. In contrast to the results in Tables 2, 6, and 7, there are statistically significant differences in total financial and pension assets between eligible and ineligible households in the lower-income categories. For example, 401(k)-eligible households with incomes less than \$20,000 had \$7,134 more in total financial and pension assets than ineligible households. This difference was statistically significant at the 7 percent level. Eligible households with incomes in the \$20,000-30,000 and the \$30,000-\$40,000 categories had \$29,429 and \$35,992, respectively, more in total financial and pension assets than ineligible households, with both differences statistically significant. Although positive, there were no statistically significant differences for the highest three income categories.

The estimates of new household saving per dollar of 401(k) wealth are substantial for lower-to-middle income households: 91, 78, and 95 cents for households with income less than \$20,000, \$20,000-30,000, and \$30,000-40,000, respectively. Importantly, this effect attenuates with income. For households with \$50,000-75,000 in income, the household saving effect is

pension values in the SCF.

³¹ As above, these were calculated using the median regression parameter estimates from (2) evaluated at the mean of the demographic variables in the firm-reported sample.

estimated as 1 cent. This pattern of declining saving effects with income is consistent with the recent findings of Engen and Gale (2000), who used self-reported 401(k) information from the SIPP. In addition, it is not inconsistent with the view that higher-income households have had greater opportunities or incentives for substitution between components of wealth. While large, the saving effects for the lower-to-middle income households are similar in magnitude to those found by Engelhardt (1996) for a Canadian tax subsidy to saving and Venti and Wise (1986, 1990b) for IRA's.³² The "dollar-weighted" average new household saving per dollar of 401(k) wealth was 0.38. That is, 38 cents of the average dollar in a 401(k) represented new household saving. The standard error associated with this estimate was 16 cents. The 95 percent confidence interval for the household saving effect is from 6 to 70 cents. This point estimate is significantly lower than that implied by the Poterba, Venti, and Wise studies and slightly higher than the largest estimate (30 cents) in Engen and Gale (2000).

Unfortunately, there is very little information in the matched firm records that would allow for the accurate calculation of individual balances in voluntary contributory plans like 401(k)s. Peticolas and Steinmeier (1999) calculated voluntary employee contributions by assuming that the individual had contributed at the self-reported voluntary contribution rate in 1992 (wave 1) for each past year eligible (i.e., contribution rates were time-invariant).³³ If the contribution rate was missing in 1992, the individual was imputed to have contributed each year at a 5 percent rate, the sample mean contribution rate for those with non-missing values. Clearly, these assumptions likely mean that firm-reported exceeds actual 401(k) wealth. Indeed, for the subsample of 257 households that both were self- and firm-reported 401(k)-eligible, the ratio of sample mean firm- to self-reported 401(k) wealth was 2.6. In addition, 80 percent of these households had firm-reported 401(k) wealth that exceeded self-reported 401(k) wealth.

³² However, the estimates for IRA's have been a subject of much debate [Bernheim (1997, 1999), Hubbard and Skinner (1996), Poterba, Venti, and Wise (1996, 1998a), Engen, Gale, and Scholz (1996)].

³³ See Madrian and Shea (2000) and Kusko, Poterba, and Wilcox (1998) for analyses of 401(k) contribution behavior across time.

There are some important implications. First, for households that *correctly* reported their pension plan type, there likely was less measurement error in self-reported than firm-reported defined contribution assets. Second, for those that incorrectly reported plan type, the firm-reported defined contribution assets significantly overstate actual, but unobserved, defined contribution assets. Third, if actual voluntary contribution rates varied around the average of 5 percent by income level (e.g., higher contribution rates at higher income levels), then the degree of overstatement will be differential by income level. Finally, if the frequency of missing values in contribution rates, and, therefore, imputations in the firm data, varied by income level (e.g., more imputations at lower income levels), then the degree of overstatement will be differential by income level.

Consequently, equation (2) was estimated using the following pension asset data (in the dependent variable): firm-reported data for all defined benefit plans; firm-reported data for all incorrectly self-reported defined contribution plans (i.e., reported a defined benefit when actually had a defined contribution plan); and, self-reported data for all correctly self-reported defined contribution plans. This minimizes the error in defined benefit and correctly self-reported defined contribution assets. However, it should be emphasized that defined contribution assets are still overstated for those that failed to correctly self-report defined contribution plans.

The conditional median total financial and pension assets by eligibility and income categories are shown in Table 9. The differences between eligible and ineligible households are less precisely estimated. Household saving effects from 401(k)s are large for lower-income households and attenuate as income rises. In fact, 401(k)s *crowd in* saving at a ratio of 2.5:1 for households with income under \$20,000. These effects are even negative for higher-income households, although not statistically different from zero. The estimated dollar-weighted average household saving effect is minus 8 cents with a standard error of 29 cents. This is substantially lower than the estimate of 38 cents in Table 8 that used firm-reported plan values for all

households. Importantly, a comparison of mean 401(k) wealth by income category in Tables 8 and 9 clearly shows that firm-reported 401(k) assets likely greatly overstates actual 401(k) assets. The average ratio of mean 401(k) in Table 8 to Table 9 is 2:1.

Table 10 reports conditional median total financial and pension assets by eligibility and income categories from the estimation of

$$A_{ai} = \sum_{j=1}^7 \beta_{aj} Y_{ij} + \sum_{j=1}^7 \gamma_{aj} (Y_{ij} \times D_i^{Eligible}) + \theta' X_i + \sum_{j=1}^7 \phi_{aj} (Y_{ij} \times D_i^{DCError}) + \varepsilon_{ai}. \quad (4)$$

Because defined contribution assets are overstated for those that failed to correctly self-report defined contribution plans, equation (4) modifies (2) by adding a dummy variable, $D_i^{DCError}$, that is one if the household failed to correctly report a defined contribution plan and zero otherwise. This dummy directly accounts for this overstatement, and the effect is allowed to vary with income category. The results are similar to those in Table 9. However, now the estimated saving effect in the lowest income category, 1.04, is more plausible.³⁴

5. Corroborating Evidence on Plan Substitution

Overall, there is little effect of 401(k)s on household saving. Because there appears to have been no substitution within financial assets and 401(k) eligibility was inversely correlated with other pension assets, the results imply significant firm-level substitution of 401(k) for other pension assets. This section briefly discusses findings from the previous literature that corroborate these findings.

One of the most striking developments in workplace compensation in the last two decades has been the shift from defined benefit to defined contribution pensions. As Figure 1 clearly shows, participation in defined benefit plans has fallen dramatically, while that for defined contribution plans, and 401(k)s, in particular, has risen dramatically. Although there is debate as to the cause of this shift [Clark and McDermed (1990), Gustman and Steinmeier (1992), Kruse

(1995)], the figure makes it clear that, because most of the growth in defined contribution plans has been due to 401(k)s, one potential explanation for the findings in Tables 2 and 6 through 10 is firm-level substitution of 401(k)s for other pensions.

Papke (1999) identified four pathways for plan substitution, of which three are explicit, and the fourth, implicit. First, firms may have replaced existing defined benefit plans with 401(k)s. Papke (1999) examined IRS Form 5500 filings for firms with defined benefit plans in 1985. She compared those to the 1992 filings for the same firms. On average, for every defined benefit plan terminated, three 401(k) plans were created. This implied 33 percent substitution.³⁵

Second, firms may have replaced existing defined contribution plans with 401(k)s. In particular, many after-tax thrift and savings plans may have been converted to 401(k)s to capture the benefits of pre-tax saving. Andrews (1992) has provided striking evidence of this from Form 5500 filings. Only 1,703 401(k) plans existed in 1983. In 1987, there were 45,054 such plans. But of these, 15,689 had been established *before* 1984. This implied that 13,986 401(k) plans (or 31%) in 1987 were converted from some other pension type. Andrews claimed the bulk of these conversions were from after-tax thrift plans. Papke (1999) has provided further evidence. From 1985 to 1992, on average, for every defined contribution plan terminated, three 401(k)s were created. The evidence of Andrews and Papke combined suggest a significant fraction of 401(k) plans have been converted from other pensions.

One shortcoming of these studies has been the focus on plan rather than pension asset substitution. If the distribution of pension plan assets is skewed (to a relatively small number of plans), there could have been little substitution of pension plan assets toward 401(k)s even if many plans were substituted. Based on Form 5500 filings from 1984-95, Benjamin (2000)

³⁴ Appendix B describes sensitivity analysis of the results in Tables 8 through 10 to a number of alternative specifications and samples. The results were very robust.

³⁵ Papke, Petersen, and Poterba (1996) also examined 401(k) substitution for defined benefit plans. They found very little substitution based on a mail/phone survey of 43 firms. Unfortunately, these firms represented just 5.5% of the 786 firms contacted in the original survey. Although the results are interesting, the low response rate raises concerns about how their results generalize to the population of firms.

calculated for 1992 that 32 percent of aggregate assets in 401(k) plans were converted from other plans. Based on Form 5500 filings, Engen, Gale, and Scholz (1996) reported that, in 1985, 85 percent of 401(k) balances, 39 percent of plans, 65 percent of participants, and 66 percent of contributions were from plans created before 1982 and thought to have been conversions of non-401(k) plans. However, these figures have declined in magnitude over time. Specifically, they also reported that, in 1991, the majority of balances, 42 percent of participants, and 47 percent of contributions were from plans created before 1982 and thought to have been conversions of non-401(k) plans.

Third, with the advent of 401(k)s, firms may have kept existing plans, but added 401(k)s as supplements and channeled all additional pension resources to 401(k)s. In general, there has been little convincing empirical evidence for this, although numerous anecdotes suggest some firms capped existing defined benefit plans when they adopted a 401(k). However, Figure 1 plots the time path of participation in supplemental defined contribution plans, most of which currently are 401(k)s. Interestingly, the fraction of the work force covered by such plans has remained remarkably constant across time. There was rise in such plans beginning in 1981, the year that the IRS issued clarifying regulations for 401(k)s, but no growth since 1984. Although there may be other interpretations, this may suggest most 401(k)s that currently are supplemental plans were conversions. It also suggests that most of the growth in 401(k)s has been as primary plans.

Fourth, new firms since (or existing firms predating) the expansion of 401(k)s in 1981, first deciding to offer a pension *after* 1981 may have adopted 401(k)s when they otherwise would have adopted a defined benefit or non-401(k) defined contribution plan in the absence of the 401(k) program. This can be characterized as implicit substitution. Unfortunately, because this is a counterfactual, it is not possible to know the magnitude of this form of substitution.

The results in Tables 2 and 6 through 10 suggested significant substitution of 401(k) for other pension assets. Overall, evidence from the existing literature using Form 5500 data is not inconsistent with significant substitution having occurred. However, given the debate in the pension literature over the causes of the shift from defined benefit to defined contribution plans, other interpretations may apply.

7. Conclusion

The paper has a number of very important implications for research on pensions and saving. First, 401(k) eligibility is not exogenous with respect to other pensions. There appears to have been significant substitution of 401(k) for other pension assets. The incorporation of all pension assets gives a decidedly dimmer view of the household saving effects from 401(k)s. Second, the wide range of estimated saving effects implies that, with the right mix of sample, eligibility, and pension asset measure, virtually any prior about the effect of 401(k)s and saving could be confirmed. Third, measurement error in eligibility matters. All of the previous literature used self-reported eligibility, which exhibits significant measurement error. This error has biased the estimated 401(k) saving effects upward significantly and differentially by income category. Fourth, measurement error in pension assets matters. The combination of correctly measured eligibility and self-reported pension assets yielded implausible results. Plausible results were obtained only when pension assets were measured more accurately. Fifth, access to matched firm pension records is critical for the analysis of pensions and saving. Finally, and ironically, perhaps the greatest weakness of this study is that even for all its emphasis on the importance of measurement error, in the end, 401(k) wealth, the object of study, is the most poorly measured. This highlights the need for improvements in survey methodology to better measure 401(k) pension assets.

Overall, the best estimates in this paper suggest that 401(k)s have not raised household saving. Unfortunately, the estimate most favorable to a modest saving effect (38 cents in Table 8) used the least plausible firm-reported pension assets. All of the estimates are significantly lower than those implied by the Poterba, Venti, and Wise studies but similar to those in Engen and Gale (2000). They also contrast with the findings of Engelhardt (1996) and Venti and Wise (1986, 1990) for other tax subsidies to saving.³⁶ One plausible explanation for the large estimated offset to household saving is firm-level substitution of 401(k)s for other pensions. In addition, even though very little of the average dollar of 401(k) wealth appears to be new household saving, specifications in which eligibility and pension assets were more accurately measured (Tables 8 through 10) indicated 401(k)s may have stimulated saving significantly for lower-to-middle income households and, hence, increased retirement income security for an important segment of the population.

There are important caveats to this study. First, the HRS samples used consist primarily of individuals born in 1931-41. Because households of all ages were not included, this study's findings may not apply to other, particularly younger, birth cohorts, for which it is possible there may be larger saving effects. Second, the estimated saving effects in the best specifications (Tables 8 through 10) showed some sensitivity to how pension assets were measured. Because there is currently no completely acceptable way to measure pension assets, especially 401(k) assets, it is conceivable that alternative measures of pension assets not used here could imply a positive true saving effect, although the results in this paper make it likely to be small. Finally, because it is very difficult to conceive of an empirical strategy to illustrate convincingly there is no relationship between 401(k) eligibility and tastes for saving, this study adopted the eligibility experiment methodology. Specifically, it maintained the assertion that eligibility conditional on

³⁶ Because the best estimates in this paper suggest that 401(k)s have not raised household saving, the effect on national saving was not explored because it would be expected to be zero or even negative. However, Appendix C does present the results of

income and demographics is not correlated with tastes for saving. It should be emphasized that this is just an assertion, and that many of the criticisms of this approach in the previous literature still may be valid here.

Appendix A: Data and Variable Descriptions

Self-Reported Information on 401(k)-Type Arrangements - Detailed questions on pensions on the current job were posed to respondents and spouses in Section F of the HRS questionnaire. Individuals were asked first if they were “included” in a pension, retirement, or tax-deferred savings plan (Question F37):

“Now I'd like to ask about pension or retirement plans on your job, *sponsored by your employer or union*. This includes not only basic pension or retirement plans, but also tax-deferred plans like thrift, savings, 401k, deferred profit sharing, or stock ownership plans. Are you included in any such pension, retirement, or tax-deferred plan with this employer? [IF RESPONDENT MENTIONS IRA OR KEOGH PLANS, NOTE IN MARGIN AND SAY: “We will ask about these later in the interview. Here, I just want to find out about other plans operated through your employer.”]”

If the individual answered “yes,” then detailed questions followed about each plan for that job, up to 3 plans. This self-reported information included the type of plan, e.g., formula-based (DB), account-based (DC), or combination.³⁷

Those with a DC plan were asked to identify the type. The questionnaire listed five potential answers: thrift or savings; 401(k)/403(b)/SRA; profit-sharing; stock purchase/employee stock option (ESOP); and, other.³⁸ In the public use version of the HRS, the “other” category responses were coded: annuity (including tax-deferred, such as TIAA-CREF); money purchase plan; IRA-SEP; simplified employee pension plan (SEPP); combinations of 401(k)/403(b)/SRA and profit-sharing; combinations of thrift or savings and stock purchase/ESOP; combinations of 401(k)/403(b)/SRA and stock purchase/ESOP; and, other. In the current paper, plans self-reported as combinations of 401(k)/403(b)/SRA and thrift or savings were considered 401(k)-type arrangements. This is the same definition as used by Poterba, Venti, and Wise (1994, 1995). Those self-reported as combinations of profit-sharing and stock purchase/ESOP were considered profit-sharing plans.

For those individuals not “included” in a pension or retirement plan (Question F37), some additional questions followed (Questions F37a-f). The sequence of these questions is depicted in Figure A-1. These included whether the employer offered any such plans (Question F37a) and, if so, whether the individual was eligible to be included in these plans (Question F37b).³⁹ Unfortunately, the HRS did not ask what type of plans these were. However, tabulations in the 1995 Survey of Consumer Finances found over 80% of individuals that reported they were not “included” in, but were eligible for, a pension were actually eligible for a 401(k). Pence (1999) had a similar finding. Therefore, all HRS individuals that reported they were not included but were offered a pension plan were deemed 401(k)-eligible.

Sample Selection and Comparison of Self-Reported 401(k) Eligibility - A sample of households from the 1992 HRS (Wave 1) was drawn. Each household contained at least one individual with a current job who reported they were not self-employed (Question F3). This selection rule was similar to that of previous studies. The final sample consisted of 4,318 households. Using the

³⁷ In addition, questions were asked about the number of years included in the plan, the amount of the employer contribution, the amount of the employee contribution, and the balance in the plan. If the individual had more than three plans on the current job, then the *sum* of the balances on the fourth and higher plans was asked as well.

³⁸ If the response fell in the “other” category, the type of plan was noted.

³⁹ The actual wording for these questions was “Does your employer offer any such plans?” and “Are you eligible to be included in any of these plans?,” respectively.

HRS household-level analysis weights, these households represented 10,267,886 aggregate households age 51-61. Of these, 1463 were eligible for a 401(k)-type arrangement. Using the HRS household-level analysis weights, these households represented 3,580,927 aggregate households age 51-61.

The first row of panel A of Table A-1 shows the percentage of households eligible for a 401(k) under this paper's definition. All figures were calculated using the HRS household-level analysis sampling weights. Overall, 35 percent of households 51 to 61 years old were eligible. Similar to the findings of previous studies, such as Poterba, Venti, and Wise (1994, 1995, 1998a), eligibility rose with household income. Importantly, these tabulations are broadly consistent with those for households of similar age shown in rows 2-5 of panel A from various waves of the SIPP and CPS done by Poterba, Venti, and Wise (1995, 1998a). This gives some confidence that the measurement method for eligibility was not unreasonable.

The first row of panel B shows the percentage of eligible households that participated in a 401(k), where "participated" means having made a contribution to a 401(k) during the survey year.⁴⁰ Almost 74 percent of eligible households 51 to 61 years old participated. In addition, the first row in panel C shows the percentage of *all* households that participated. About 26 percent of these households participated. Similar to the findings of previous studies, participation measured in panels B and C rose with household income. These tabulations are broadly consistent with those for households of similar age from various waves of the SIPP and CPS. As a comparison, panel D shows the percentage of households with an IRA. A total of 44.5 percent of households 51 to 61 had an IRA. IRA participation rose with income as well. A comparison of panels C and D indicates that overall more households participated in IRA's than in 401(k)s. However, a comparison of panels B and D indicates that participation was greater for 401(k)s than IRA's among *eligible* households.

Self-Reported Pension Assets – Self-reported pension assets are the present value of the household's claims to assets in defined benefit and defined contribution plans and the present value of any annuitized pensions. It captures pension assets on current and past jobs. It was calculated by Venti and Wise (1997) from the self-reported pension information in wave 1 of the HRS.

Firm-Reported Pension Information – The HRS administered a Pension Provider Survey (PPS) to and attempted to obtain Summary Plan Descriptions (SPD) for all pensions from employers of all individuals that self-reported working in a pension-covered job.⁴¹ Specifically, for those working in wave 1, the current employer and the employer from the most recent past job that lasted at least five years were contacted. For those retired, the last employer and the employer from the most recent job that lasted at least five years prior to the last were contacted. In terms of the HRS survey instrument, these employers corresponded to the pension-covered job in Section F and the first pension-covered job in section H for those working in wave 1, and to the pension-covered job in Section G and the first pension-covered job in Section H for those retired in wave 1. Employers from the second and third jobs in Section H were not contacted. See Gustman and Steinmeier (1999c) for a detailed explanation. The match rates were 65% (or 2896 jobs) of those working in pension-covered jobs in wave 1, 66% (or 915 jobs) for the last job for those not working in wave 1, and 35% (or 994 jobs) for jobs held five years or longer prior to the current (last) job for those working (not working). These matched firm data do not have

⁴⁰ Alternatively, a household could have been defined as having participated if it had had a positive 401(k) balance regardless of current contribution status. The first definition was adopted to be consistent with previous studies.

⁴¹ Unfortunately, the HRS did not contact employers of individuals that self-reported no pension coverage on the job, so that the firm-reported data cannot shed light on the extent to which individuals misreported their pension coverage status on the job.

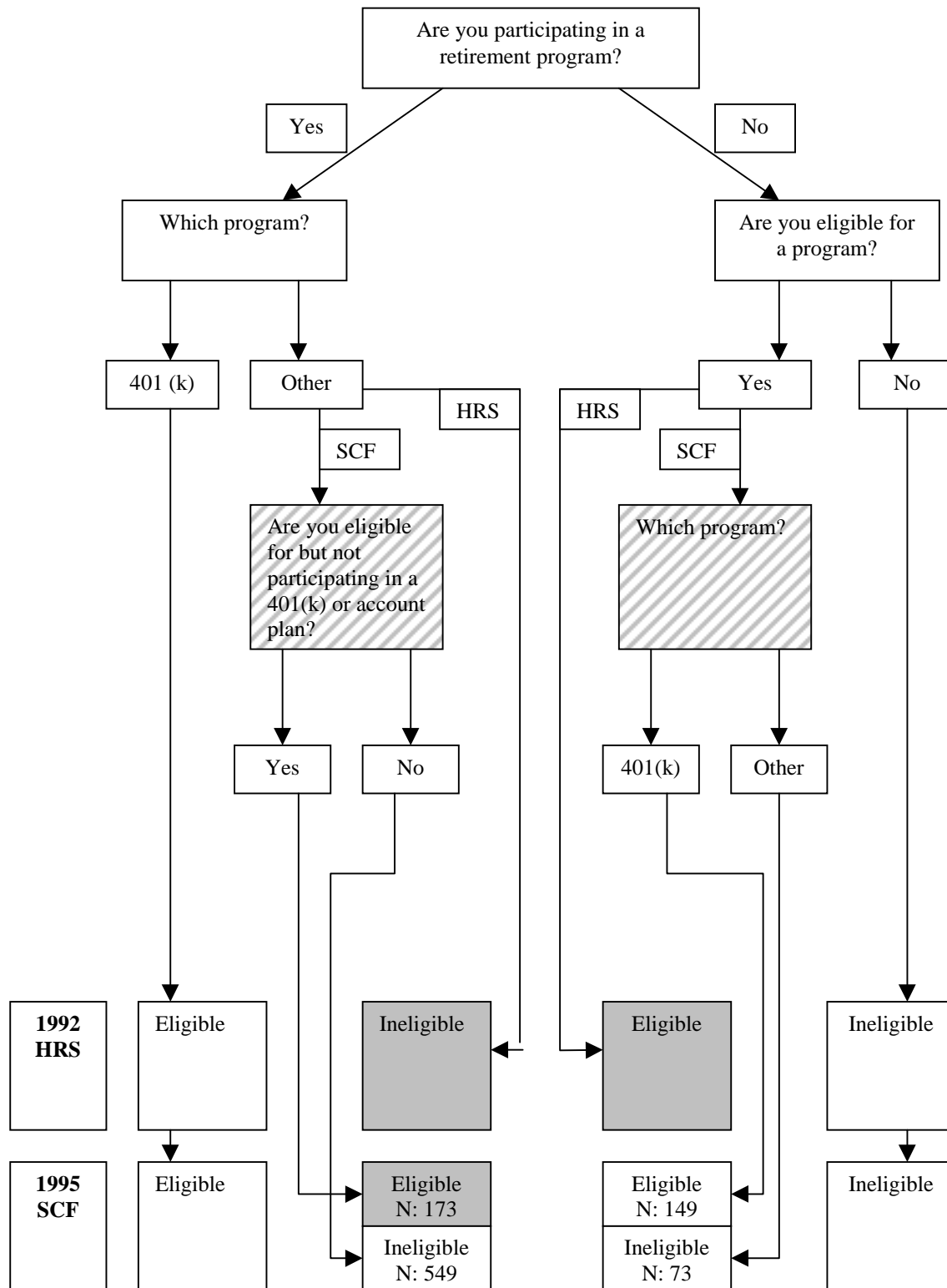
individual-level information on contributions or balances, rather only contain plan type, eligibility rules, benefit formulae, employer contribution rates, early and normal retirement dates and other information described in the Summary Plan Description.

Social Security Assets - The measure used came from two sources. First, there were matched Social Security earnings histories for 9,029 respondents. For these individuals with, Social Security wealth came from the restricted access Earnings and Benefits File (EBF) for the 1992 HRS from the Social Research Center at the University of Michigan. The calculation of the Social Security assets in the EBF is described in Mitchell, Olson, and Steinmeier (1996). For individuals without matched records, Social Security wealth was imputed using self-reported information on earnings histories in the 1992 and 1996 HRS (waves 1 and 3) following the method in Gustman and Steinmeier (1999a).

Firm-Reported 401(k) Eligibility - Peticolas (1999) developed a dataset of variables from the matched firm data that indicated whether the individual had been eligible for a tax-deferred voluntary retirement savings plan. For each pension, it was determined whether the employer provided such a plan and whether it had been available to the individual at the time of the wave 1 interview for current jobs and at the time of past employment for past jobs. For the purposes of this study, those cases that were determined definitively that the individual had been eligible for such a plan were deemed “401(k)-eligible” based on the firm data. Specifically, I used the “Deferred Tax Voluntary Retirement Savings Available” flag in the Peticolas (1999) data to measure 401(k) eligibility. There are cases, particularly for matched records with past employers, in which tax-deferred retirement savings plans were introduced after the individual left the firm (measured by the “Plan Inception Subsequent to Respondent’s Tenure” variable) as well as cases in which there was not enough information in the matched records to determine definitively whether such a plan had been available (measured by the “Insufficient Information to Determine Availability” variable). These variables were not used to determine 401(k) eligibility.

Firm-Reported Pension Assets - This measure is the present value of claims to assets in defined benefit and defined contribution plans and the present value of any annuitized pensions based on the firm-reported data. It is from the Pension Present Value Database (Level 1) by Peticolas and Steinmeier (1999). This database contains the present value of claims to pensions under nine different interest rate/wage growth/inflation scenarios. Present values used here were calculated according to the baseline scenario (Scenario 1) which assumed a nominal interest rate of 6.3 percent, annual nominal wage growth of 5 percent, and annual inflation rate of 4 percent. The other 8 scenarios represent departures from this baseline. See Peticolas and Steinmeier (1999) for details. It should be emphasized that the firm-reported data may provide a rather poor measure of DC wealth. The firm-reported data do not have individual-level information on contributions or balances in DC plans. Instead, they only contain DC plan type (401(k), non-401(k), etc.), eligibility rules, employer contribution rates, etc. There is very little information that would allow for the accurate calculation of *individual* balances in voluntary contributory plans such as 401(k)s.

Figure A-1. 401(k) Eligibility Questions in the 1992 HRS and 1995 SCF



Question asked in 1995 survey only.

Contains both eligible and ineligible households.

Source: Author's adaptation of Pence (1999) Appendix B.
 Note: N refers to the number of observations in that cell in 1995 the SCF.

TABLE A-1
 IRA and 401(k) Participation Rates and Eligibility by Age
 and Income Category and Survey^a

Survey	Age Category	Annual Household Income (thousands of dollars)							
		All (1)	Less than 10 (2)	10 to 20 (3)	20 to 30 (4)	30 to 40 (5)	40 to 50 (6)	50 to 75 (7)	More than 75 (8)
<i>A. Percentage of Households Eligible for a 401(k)</i>									
1992 HRS	51 to 61	35.3	7.2	21.4	25.6	32.2	39.5	46.1	55.9
1991 SIPP	45 to 55	35.9	2.1	16.5	27.6	32.8	48.7	56.4	52.5
1991 SIPP	55 to 65	28.9	7.9	14.4	20.9	36.5	37.7	51.9	37.0
1993 SIPP	51 to 61	39.1	---	---	---	---	---	---	---
1993 CPS	51 to 61	45.6	---	---	---	---	---	---	---
<i>B. Percentage of Eligible Households Participating in a 401(k)</i>									
1992 HRS	51 to 61	73.8	31.7	52.5	72.1	72.6	69.4	78.5	82.9
1991 SIPP	45 to 55	72.3	72.5	51.5	57.6	58.5	81.6	75.1	88.1
1991 SIPP	55 to 65	72.3	85.2	68.3	49.0	72.5	67.8	84.0	85.7
1993 SIPP	51 to 61	66.9	---	---	---	---	---	---	---
1993 CPS	51 to 61	77.0	---	---	---	---	---	---	---
<i>C. Percentage of Households Participating in a 401(k)</i>									
1992 HRS	51 to 61	25.9	2.3	11.2	18.4	23.2	27.3	35.9	46.0
1991 SIPP	45 to 55	25.9	1.5	8.5	15.9	19.2	39.8	42.3	46.3
1991 SIPP	55 to 65	20.9	6.7	9.8	10.2	26.5	25.6	43.6	31.7
1993 SIPP	51 to 61	26.1	---	---	---	---	---	---	---
1993 CPS	51 to 61	33.0	---	---	---	---	---	---	---
<i>D. Percentage of Households with an IRA</i>									
1992 HRS	51 to 61	44.5	13.3	22.2	31.4	42.1	46.9	58.7	73.6
1991 SIPP	45 to 55	35.3	6.0	12.9	24.9	31.3	47.3	50.2	66.3
1991 SIPP	55 to 65	43.8	14.8	24.1	37.6	45.7	59.5	63.4	75.5

^aFollowing Poterba, Venti, and Wise (1994), participation is defined as the household having made a contribution to a 401(k) during the survey year. Tabulations are weighted using the HRS household-level analysis weights and based on the sample of 4,318 HRS households described in the text. When weighted, this sample represents 10,267,886 aggregate households aged 51 to 61 in 1992. The 1991 SIPP tabulations are from Poterba, Venti, and Wise (1995), Table 2. The 1993 SIPP and CPS tabulations are from Poterba, Venti, and Wise (1997), Table 6. Annual household income is in thousands of nominal dollars.

Appendix B: Additional Sensitivity Analysis

This appendix presents the results of additional specifications that used firm-reported pension assets. First, all analyses in the previous literature, and up to here in this paper, have defined 401(k) eligibility based on the pension plan on the *current* job. However, as time has elapsed since the effective inception of 401(k)s in 1981, it is increasingly likely that as individuals changed jobs, they may not have been eligible based on the current job, but nonetheless have had exposure to 401(k)s due to eligibility on *past* jobs. Because the HRS obtained matched records for pensions on past jobs, the definition of eligibility can be redefined to all households that were *ever* eligible, i.e., on either the current or past jobs. This was done and equation (2) was re-estimated using the new eligibility measure on the sample of 2,237 households used. This did not change any of the results.

Second, two criteria for inclusion in the samples used in Tables 6 through 10 were that at least one individual in the household had a current job and was not self-employed.⁴² Whereas the omission of the self-employed is defensible in this context, many households were excluded because of the lack of a current job due to retirement. Because the 401(k) tax subsidy to saving produces a substitution effect that raises saving and an income effect that may induce retirement [Feldstein (1974)], it is possible that some households that were 401(k)-eligible in a past job do not appear in the sample because they had retired. Furthermore, if these households were differentially higher savers *because of 401(k)s*, then the results in Tables 6 through 10 may be underestimates of the true household saving effects because the sample selection criteria would have differentially excluded high-saving 401(k)-eligible households.

To explore this hypothesis, all retired households that were not self-employed on the job prior to retirement and had matched firm records for their past pension-covered jobs were added back into the firm-reported sample. This new sample was composed of the base sample of 2,237 households plus 1,015 retired households, for a total of 3,252 households. Equation (2) was re-estimated using the eligibility on either the current or past job on the new sample of 3,252 households. The results were similar. The estimated household saving effects were somewhat higher for the higher-income categories but not as precisely estimated. Overall, there did not appear to be strong support for the hypothesis that the estimated household saving effects were biased downward due to the exclusion of retired households.⁴³

Finally, the sample used in Tables 6 through 10 contained all households that had matched firm pension records on *all* pension-covered jobs. Although it ensured a sample in which 401(k) eligibility and pension wealth were measured precisely, this was a strict criterion for inclusion because of the low match rate (35 percent) on past pension-covered jobs. Consequently, a new sample was formed that contained all households that had matched firm pension records on just the *current* pension-covered job.⁴⁴ This expanded the sample from 2,237 to 3,173 households. The results from the replication of Tables 8 through 10 with the expanded sample did not differ qualitatively from those with the smaller sample. In general, the differences between eligible and ineligible households were less precisely estimated. Household saving effects from 401(k)s were large for lower-income households and attenuate as income rises. The earlier results appeared robust to changes in the sample selection criteria.

⁴² These were criteria used by Poterba, Venti, and Wise (1994, 1995) and, in the current paper, were chosen to make the sample(s) consistent with those used in the previous literature.

⁴³ However, it should be emphasized that this can be viewed as a low-powered test of this hypothesis simply because the retired households may have been spending down their assets in retirement.

⁴⁴ That is, if an individual had two pension-covered jobs, then a matched record was needed only on the current job for the individual to have entered the new sample. For married households, both spouses needed to have met this new criterion.

Appendix C: The Effect of 401(k)s on National Saving

This appendix presents stylized estimates of the government revenue loss from the provision of 401(k)s under the assumption that the household saving effect is the upper-bound estimate of 38 cents per dollar of 401(k) wealth as in Table 8. This effect on government saving then is added to the household saving gain to calculate the effect on national saving.

Estimation of the revenue loss is difficult for a number of reasons. First, the annual revenue loss depends on the point in the lifecycle. Because each dollar contributed is tax-deductible, the government loses revenue in the year of contribution. The revenue loss continues as long as the individual works and contributions accrue at the pre-tax interest rate. But when the individual retires, withdrawals are taxable as ordinary income and government revenue is positive. In addition, marginal tax rates are typically lower when retired than working, so that withdrawals are taxed at a lower rate than when the contributions were made. All of this requires the revenue calculations be done in present value. Second, as is well known in the literature on IRA's and 401(k)s, the present value of the revenue loss depends crucially on the discount rate and the marginal tax rates when working and retired. Third, as Feldstein (1995) and Hubbard and Skinner (1996) persuasively argued and illustrated, the revenue loss critically depends on how much 401(k)s add to the capital stock and generate additional corporate income tax revenue.

The calculation of the revenue loss follows Feldstein (1995) and the description in this paragraph paraphrases his exposition.⁴⁵ Consider an individual that begins a 401(k) at age α , retires at age 65, and dies at age 79. Let t index age, $t = \alpha, \dots, 79$. The individual contributes C_t to a 401(k) through age 64 and zero thereafter. At retirement, the stock of 401(k) wealth is used to finance a constant annual withdrawal, R_t , through age 79. There are no pre-retirement withdrawals.⁴⁶ Let θ_t , r , and τ denote the individual's marginal personal income tax rate, the real pre-tax rate of return on additions to the corporate capital stock, and the marginal corporate income tax rate, respectively. Assume an economy without growth and that all additions to the corporate capital stock are through equity. Then Feldstein (1995) derived the revenue effect by age, T_t , as

$$T_t = -\theta_t[C_t - R_t + (1 - \tau)rB_t] + \tau(A_t - B_t)r. \quad (3)$$

A_t is wealth accumulated in the 401(k) and is defined as

$$A_t = [1 + (1 - \tau)r]A_{t-1} + C_t - R_t. \quad (4)$$

B_t is the counterfactual capital stock, i.e., the capital stock that would have been accumulated in the absence of 401(k)s had C_t been contributed to a taxable savings vehicle.⁴⁷ It is defined as

$$B_t = [1 + (1 - \theta_t)(1 - \tau)r]B_{t-1} + \lambda C_t - W_t. \quad (5)$$

⁴⁵ Feldstein (1995) analyzed the revenue loss from fully tax-deductible IRA's, but his method is applicable to 401(k)s as well.

⁴⁶ See Engelhardt (1999b), Korczyk (1996), and Poterba, Venti, and Wise (1998c) for analyses of pre-retirement lump-sum pension distributions in the HRS.

⁴⁷ I assume that the alternative to a 401(k) is saving in an after-tax saving vehicle, rather than, say, a fully-tax-deductible IRA. In practice, eligibility for fully-deductible IRA's is limited by household adjusted gross income. See Poterba, Venti, and Wise (1995) and Engen, Gale, and Scholz (1994) for analytical comparisons between IRA's, 401(k)s, and after-tax saving vehicles, as well as empirical analyses of IRA-401(k) asset substitution.

Define κ as the fraction of a dollar of 401(k) wealth that is new saving. λ is the fraction of a dollar of 401(k) wealth that would have been saved otherwise, i.e., in the absence of 401(k)s. Thus, $\lambda = 1 - \kappa$. Finally, the counterfactual stock of wealth is used to finance a constant annual withdrawal, W_t , through age 79. The terminal conditions are $A_{79} = 0$ and $B_{79} = 0$, respectively.

Equation (3) can be modified slightly to

$$T_t = -\theta_t C_t + \theta_t R_t - \theta_t [(1 - \tau)rB_t] + \tau(A_t - B_t)r \quad (6)$$

to make clear the per period sources of revenue loss. The first term of the right-hand side of (6) is the revenue loss from the personal income tax while the individual works because annual contributions are tax-deductible. The second term is the revenue gain from the personal income tax in retirement because withdrawals are fully taxable. The third term is the revenue loss from the personal income tax while working because 401(k) funds accumulate at the real pre-tax rate of return. The final term is the revenue gain from the corporate income tax due to additions to the corporate capital stock.

Given parameters values $(\alpha, \tau, r, \theta_t, \lambda)$, equations (3)-(5) and the terminal conditions describe T_t , the age-profile of the revenue loss from the provision of 401(k)s. Because the estimated household saving effects, κ , in Table 8, as well as marginal personal income tax rates, θ_t , vary by household income, an age-profile of the revenue loss was calculated for each household income category in Table 8. Specifically, the system was parameterized by household income category for a representative household according to the category means of the sample used in Table 8. First, the average age of the head of household in the sample was 55 and did not vary across income categories. Second, following Hubbard and Skinner (1996), who based their calculations on Employee Benefit Research Institute (1994) and Siegel (1992), r was assumed to be 5.55%, the average portfolio return from 1900-1990, and constant across income categories. Third, it was assumed that the representative household had been eligible for the 401(k) for six years as of 1992, i.e., it began contributing at age 49 (or in 1986), so $\alpha = 49$.⁴⁸ Fourth, a constant real path of contributions when working was assumed, i.e., $C_t = C$. For each income category, the contribution amount was set so that, at the real pre-tax return, r , A_{55} would match the category mean 401(k) wealth for eligible households at age 55 in the HRS. Fifth, for each income category, λ was set equal to one minus that category's estimated household saving effect in Table 8.

The marginal tax rates are key parameters in the revenue calculations. For each income category, the marginal personal income tax rate, θ , was assumed to be constant while working and equal to the income category mean federal marginal tax rate on the first-dollar of household capital income in wave 1 (i.e., 1992) of the HRS. The rate was calculated for each household using Internet TAXSIM at the NBER. Unfortunately, there has been very little empirical analysis of the extent to which marginal tax rates decline at retirement. One exception is Burman, Gale, and Weiner (1998). They used a large panel of income tax returns from the Continuous Work History Survey (CWHS) that allowed them to hold household characteristics fixed. They calculated marginal tax rates on IRA contributions and withdrawals by income category under a number of different tax law, contribution, and withdrawal scenarios. To measure how much marginal tax rates fall at retirement, for each income category, I used the percentage difference between marginal tax rates for households that contributed in 1982 and withdrew in 1995 but were treated as if the 1995 tax law had applied in 1982. These were taken from Burman, Gale,

⁴⁸ This corresponded to the sample mean number of years that households self-reported in Section F they had been "included" in their 401(k).

and Weiner (1998), Table 3. These “constant-law” marginal tax rates provide a clean measure of the effect of retirement on marginal tax rates holding household characteristics and tax law fixed. For each income category, I then multiplied the marginal personal income tax rate while working (defined above) by the respective percentage decline in marginal tax rates to generate a first-dollar marginal tax rate on capital income while retired.⁴⁹ This tax rate was assumed to be constant while retired.

Because T_t varies with point in the lifecycle and the household saving effects in Table 8 applied to a sample in which the average age of the head of 401(k)-eligible households was 55, the revenue loss is calculated in present value at age 55 for each income category. Following Hubbard and Skinner (1996), the discount rate used was 5.55%. Finally, for each income category, the present value of the revenue loss is expressed as a fraction of that category’s mean 401(k) wealth for eligible households. This yields the present value of the revenue loss per dollar of 401(k) wealth, which is shown in Table C-1 under three different corporate income tax scenarios.

Panel A shows the case in which the marginal corporate income tax rate is zero. This is a baseline in the sense that the effect of 401(k)s on government saving is constrained to come from the personal income tax only. The dollar-weighted average household saving effect is 38 cents. The dollar-weighted average government saving effect is –37 cents. Therefore, the dollar-weighted average effect of 401(k)s on national saving is 1 cent. That is, 401(k)s break even with respect to the personal income tax.

However, panel A ignores the fact that the household saving effect increases the corporate capital stock, which generates new corporate income tax revenue. In panels B and C, the impact on government saving is recalculated to reflect this corporate tax effect. As noted in Feldstein (1995) and Hubbard and Skinner (1996), spillovers to the corporate tax significantly reduce the revenue loss from 401(k)s. The results in panel B assumed an effective marginal corporate income tax rate of 17 percent. This was half of the statutory rate of 34 percent that applied in 1992. In panel B, the dollar-weighted average government saving effect is –27 cents. Therefore, the dollar-weighted average effect of 401(k)s on national saving is 11 cents. The results in panel C assumed the effective marginal corporate income tax rate equaled the statutory rate. In panel C, the dollar-weighted average government saving effect is –13 cents. Therefore, the dollar-weighted average effect of 401(k)s on national saving is 25 cents.

⁴⁹ Burman, Gale, and Weiner (1998) also calculated marginal tax rates on contributions and withdrawals by age category. As a sensitivity check, I used the percentage difference in these to construct marginal tax rates when retired and these revenue simulations produced results very similar to those in Table 9.

TABLE C-1
Estimates of New National Saving per Dollar of 401(k) Wealth by Household
Income Category and Effective Corporate Marginal Income Tax Rate

Saving Measure	Annual Household Income (thousands of dollars)						Household- Weighted Average	Dollar- Weighted Average
	< 20 (1)	20-30 (2)	30-40 (3)	40-50 (4)	50-75 (5)	> 75 (6)		
<i>A. Zero Effective Corporate Marginal Income Tax Rate</i>								
Household	0.91	0.78	0.95	0.53	0.01	0.37	0.52	0.38
Government	-0.06	-0.18	-0.17	-0.29	-0.52	-0.39	-0.30	-0.37
National	0.85	0.60	0.78	0.24	-0.51	-0.02	0.22	0.01
<i>B. 17 Percent Effective Corporate Marginal Income Tax Rate</i>								
Household	0.91	0.78	0.95	0.53	0.01	0.37	0.52	0.38
Government	0.16	0.01	0.06	-0.15	-0.49	-0.30	-0.17	-0.27
National	1.07	0.79	1.01	0.38	-0.48	0.07	0.35	0.11
<i>C. 34 Percent Effective Corporate Marginal Income Tax Rate</i>								
Household	0.91	0.78	0.95	0.53	0.01	0.37	0.52	0.38
Government	0.37	0.19	0.27	-0.03	-0.46	-0.21	-0.03	-0.13
National	1.28	0.97	1.22	0.50	-0.45	0.16	0.49	0.25

Notes: The new household saving estimates are from Table 8. The government saving estimates represent the present value at age 55 of the annual gain in federal government revenue from the provision of 401(k)s relative to a taxable savings instrument per dollar of 401(k) wealth. Their calculation follows Feldstein (1995) and is described in Appendix C. Negative government saving means a loss in government revenue. The new national saving is the sum of the household and government saving estimates and is expressed per dollar of 401(k) wealth. The statutory corporate marginal income tax rate in 1992 was 34 percent.

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TABLE 1
 Conditional Median Asset Balances by 401(k) Eligibility and
 Income: Poterba, Venti, and Wise Results from the 1991 SIPP

Asset Category and Eligibility Status	Annual Household Income (thousands of dollars)						
	<10	10-20	20-30	30-40	40-50	50-75	>75
A. Total financial assets							
Eligible for a 401(k)	2,033	4,045*	5,499*	8,683*	14,470*	26,093*	51,080*
Not eligible for a 401(k)	1,378	1,997	2,558	3,256	6,206	10,080	29,842
B. Non-IRA-401(k) assets							
Eligible for a 401(k)	538	1,138	1,500	2,835*	4,724	8,699*	18,188*
Not eligible for a 401(k)	663	1,063	1,411	2,052	4,250	5,437	17,000
C. 401(k) Assets							
Eligible for a 401(k)	1,171	1,008	1,211	2,092	3,073*	4,833*	14,300*
Not eligible for a 401(k)	0	0	0	0	0	0	0
D. IRA assets							
Eligible for a 401(k)	0	0	0	0	0	1,437	6,029*
Not eligible for a 401(k)	0	0	0	0	0	978	2,882

*Difference between eligibles and non-eligibles is significant at the 5 percent significance level.

Source: Poterba, Venti, and Wise (1995), Table 3, panel (a).

TABLE 2
 Conditional Median Asset Balances by 401(k) Eligibility and Income:
 Results from Self-Reported HRS Data

Asset Category and Eligibility Status	Annual Household Income (thousands of dollars)					
	<20	20-30	30-40	40-50	50-75	>75
A. Total financial assets						
Eligible	9,457	16,235	30,011	29,708	62,318	118,204
Not eligible	4,559	6,606	10,509	13,755	27,129	52,659
Difference	4,898	9,629	19,502	15,953	35,189	65,545
[p-value]	[0.0001]	[0.0001]	[0.00001]	[0.0004]	[0.00001]	[0.00001]
B. Non-IRA-401(k) financial assets						
Eligible	2,465	4,148	7,449	8,949	14,972	28,919
Not eligible	2,378	3,811	6,076	7,065	12,835	24,486
Difference	87	337	1,373	1,885	2,137	4,434
[p-value]	[0.81]	[0.61]	[0.23]	[0.36]	[0.31]	[0.46]
C. 401(k) Assets						
Eligible	1,145	4,754	8,271	6,725	15,317	29,669
Not eligible	0	0	0	0	0	0
Difference	1,145	4,754	8,271	6,725	15,317	29,669
[p-value]	[0.00001]	[0.00001]	[0.00001]	[0.00001]	[0.00001]	[0.00001]
D. IRA assets						
Eligible	0	0	0	0	6,000	20,000
Not eligible	0	0	0	0	3,000	13,000
Difference	0	0	0	0	3,000	7,000
[p-value]	[0.85]	[1.00]	[1.00]	[1.00]	[0.19]	[0.05]
E. Total financial and pension assets						
Eligible	25,297	44,075	69,997	86,431	152,843	331,149
Not eligible	23,222	46,006	72,520	100,942	158,401	293,752
Difference	2,075	-1,931	-2,523	-14,511	-5,558	37,397
[p-value]	[0.43]	[0.96]	[0.88]	[0.51]	[0.88]	[0.28]
F. Non-401(k) pension assets						
Eligible	6,601	8,900	14,332	29,037	75,910	164,898
Not eligible	9,000	19,775	45,764	63,787	84,502	176,837
Difference	2,399	-10,875	-31,432	-34,750	-8,592	-11,939
[p-value]	[0.09]	[0.01]	[0.00001]	[0.005]	[0.47]	[0.68]

TABLE 2
(Continued)

Asset Category and Eligibility Status	Annual Household Income (thousands of dollars)					
	<20	20-30	30-40	40-50	50-75	>75
G. Social Security Assets						
Eligible	103,529	117,137	130,185	140,813	147,876	157,309
Not eligible	98,198	115,385	124,391	134,077	138,882	144,337
Difference	5,331	1,752	5,794	6,734	8,994	12,972
[<i>p</i> -value]	[0.03]	[0.56]	[0.18]	[0.12]	[0.004]	[0.02]
H. Financial and Housing Wealth						
Eligible	44,489	55,403	77,901	81,838	130,589	214,723
Not eligible	29,202	46,611	59,475	66,953	83,650	142,754
Difference	15,287	8,792	18,426	14,885	46,939	71,969
[<i>p</i> -value]	[0.16]	[0.33]	[0.06]	[0.30]	[0.00001]	[0.004]
I. Housing Wealth						
Eligible	27,640	32,790	42,374	40,467	58,001	75,081
Not eligible	18,298	34,563	38,515	48,215	46,470	64,012
Difference	9,432	-1,773	3,859	-7,748	11,531	11,069
[<i>p</i> -value]	[0.01]	[0.67]	[0.46]	[0.14]	[0.005]	[0.15]
J. Non-Social Security Wealth						
Eligible	75,908	108,704	153,447	165,019	271,702	517,663
Not eligible	62,340	107,307	153,660	196,343	260,721	459,940
Difference	13,518	1,397	-213	-31,324	10,981	57,723
[<i>p</i> -value]	[0.41]	[0.98]	[0.99]	[0.50]	[0.77]	[0.29]
K. Total Wealth						
Eligible	184,005	231,427	282,346	304,325	408,602	659,054
Not eligible	163,319	218,828	282,530	329,114	400,531	595,120
Difference	20,686	12,599	-186	-24,789	8,071	63,934
[<i>p</i> -value]	[0.53]	[0.61]	[0.99]	[0.44]	[0.82]	[0.33]
Mean 401(k) Wealth for Eligible Households	8,034	10,882	15,839	21,611	37,987	69,572
New Household Saving per Dollar of 401(k) Wealth	0.26	-0.18	-0.16	-0.67	-0.15	0.54
Household-Weighted Average New Household Saving per Dollar of 401(k) Wealth						-0.02 (0.48)
Dollar-Weighted Average New Household Saving per Dollar of 401(k) Wealth						0.15 (0.31)
Number of Observations						4,318

Notes: Conditional median asset balances derived from the parameter estimates from equation (2) evaluated at the sample means of the demographic variables for the sample of 4,318 households defined in the text. The estimates in panels G and K were over a sample of 3,927 households. Standard errors are in parentheses. *p*-values for the test of the null hypothesis of no difference in assets are in square brackets. Standard errors and *p*-values are based on bootstrapped estimated variances with 300 replications. New household saving per dollar of 401(k) wealth is the difference in total financial and pension assets between eligible and ineligible households divided by the mean 401(k) wealth for eligible households from the self-reported data for each income category, respectively.

TABLE 3
 Self-Reported Versus Firm-Reported 401(k) Eligibility for Households with
 Pension Coverage on the Current Job By Household Income Category
 (in percent)

Data Source	Annual Household Income (thousands of dollars)						
	All	< 20	20 to 30	30 to 40	40 to 50	50 to 75	> 75
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>A. Households with Matches on Current and Past Jobs</i>							
Self-Reported	41.2	30.7	35.9	33.2	37.1	48.0	57.7
Firm-Reported	43.4	39.9	44.0	41.9	41.3	44.0	48.1
<i>B. Households with Match on Current Job</i>							
Self-Reported	41.7	28.1	36.1	35.0	37.3	48.5	55.9
Firm-Reported	45.0	40.1	45.5	44.6	42.0	45.2	50.8

Notes: Author's calculations based on the sample of 1,312 households with matched firm pension records on current and past jobs in panel A and the sample of 2,248 households with matched firm pension records on the current job in panel B. Data sources for self- and firm-reported eligibility are described in Appendix A.

TABLE 4
Type of Measurement Error for Pension on Current Job

Sample: 1,312 Households with Matches on Current and Past Jobs		
Self-/Firm-Reported 401(k) Eligibility Category	Percent of Sample in Category	Number of Observations in Category
A. Self-Reported Not Eligible, Firm-Reported Not Eligible	38.3	489
B. Self-Reported Eligible, Firm-Reported Eligible	21.9	287
C. Self-Reported Not Eligible, Firm-Reported Eligible	21.5	282
1. Self-reported defined benefit plan, failed to report 401(k) plan	17.9	235
2. Self-reported defined contribution plan, failed to report 401(k) plan	3.6	47
D. Self-Reported Eligible, Firm-Reported Not Eligible	19.3	254
1. Self-reported defined benefit plan, erroneously reported 401(k) plan	12.3	162
2. Self-reported defined contribution plan, erroneously reported 401(k) plan	7.0	92

Notes: Author's calculations based on the sample of 1,312 households with matched firm pension records on current and past jobs. Similar results were obtained in the sample of 2,248 households with matched firm pension records on the current job and are not shown. Data sources for self- and firm-reported eligibility are described in Appendix A.

TABLE 5
Mean and Median Assets by Measurement Error Cell and Household Income Category

Self-Reported Eligibility Category	Sample: Households with Matches on Current and Past Jobs							
	Percent of Sample in Cell (Cell Size)		Mean [Median] Non- 401(k) Financial Assets		Mean [Median] Total Financial Assets		Mean [Median] Total Financial and Pension Assets	
	Not Eligible	Eligible	Not Eligible	Eligible	Not Eligible	Eligible	Not Eligible	Eligible
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Firm-Reported Eligibility Category								
A. Households with Income < \$20,000								
Not Eligible	47.2 (77)	22.1 (36)	10,018 [500]	10,995 [250]	15,451 [500]	16,842 [250]	55,521 [39,474]	46,729 [25,691]
Eligible	12.9 (21)	17.8 (29)	12,007 [50]	17,271 [1,500]	22,593 [3,000]	25,863 [7,004]	43,289 [7,325]	43,841 [21,128]
<i>p</i> -Value for Test of Equal Asset Distributions			0.19		0.0001		0.05	
B. Households with \$30,000 in Income								
Not Eligible	38.3 (80)	25.8 (54)	14,520 [2,050]	13,377 [2,500]	19,383 [3,000]	19,271 [4,750]	69,712 [53,626]	70,802 [50,097]
Eligible	17.7 (37)	18.2 (38)	8,248 [3,000]	8,204 [2,000]	23,736 [18,300]	23,629 [12,000]	52,404 [32,500]	51,304 [35,868]
<i>p</i> -Value for Test of Equal Asset Distributions			0.77		0.0001		0.14	
C. Households with \$30,000-\$40,000 in income								
Not Eligible	40.5 (88)	26.3 (57)	17,239 [6,500]	21,231 [6,000]	23,034 [11,625]	31,731 [9,000]	149,700 [132,488]	131,236 [94,968]
Eligible	17.5 (38)	15.7 (34)	40,627 [10,100]	23,276 [5,040]	73,123 [44,000]	60,638 [26,911]	130,865 [100,087]	98,816 [68,385]
<i>p</i> -Value for Test of Equal Asset Distributions			0.38		0.0001		0.09	

TABLE 5
Continued

Sample: Households with Matches on Current and Past Jobs								
Self-Reported Eligibility Category	Percent of Sample in Cell (Cell Size)		Mean [Median] Non- 401(k) Financial Assets		Mean [Median] Total Financial Assets		Mean [Median] Total Financial and Pension Assets	
	Firm-Reported Eligibility Category							
	Not Eligible (1)	Eligible (2)	Not Eligible (3)	Eligible (4)	Not Eligible (5)	Eligible (6)	Not Eligible (7)	Eligible (8)
D. Households with \$40,000-\$50,000 in income								
Not Eligible	42.2 (90)	20.7 (44)	23,640 [6,000]	22,055 [9,750]	33,785 [12,000]	35,351 [17,250]	208,952 [202,596]	180,995 [166,410]
Eligible	16.4 (35)	20.7 (44)	34,761 [10,000]	21,917 [8,075]	81,554 [40,000]	47,876 [28,177]	207,314 [175,150]	112,996 [79,985]
<i>p</i> -Value for Test of Equal Asset Distributions			0.77		0.0001		0.001	
E. Households with \$50,000-\$75,000 in income								
Not Eligible	33.8 (102)	18.2 (55)	41,345 [11,700]	44,184 [17,000]	59,974 [20,500]	61,222 [26,500]	274,408 [254,846]	214,759 [170,000]
Eligible	22.2 (67)	25.8 (78)	74,688 [17,000]	49,106 [14,750]	86,507 [69,500]	103,472 [70,000]	272,990 [272,668]	257,098 [189,828]
<i>p</i> -Value for Test of Equal Asset Distributions			0.43		0.0001		0.20	
F. Households with income > \$75,000								
Not Eligible	25.0 (52)	17.3 (36)	87,835 [25,000]	91,482 [37,500]	142,431 [67,500]	117,549 [50,350]	514,778 [484,480]	530,408 [328,625]
Eligible	26.9 (56)	30.8 (64)	135,570 [35,800]	69,670 [40,000]	266,847 [115,000]	176,810 [129,000]	654,293 [551,299]	397,145 [319,425]
<i>p</i> -Value for Test of Equal Asset Distributions			0.86		0.003		0.003	

Notes: Columns 1 and 2 show the percent of the sample of 1,312 households with matched pension records in each self-/firm-reported eligibility cell by household income category. Cell sizes are in parentheses. Columns 3 through 8 show the unconditional mean balances for three asset measures for each eligibility cell. The unconditional median balances are in square brackets. The last line of each panel shows the *p*-value for the Kruskal-Wallis non-parametric test of the null hypothesis of equal cell asset distributions. Failure to reject the null hypothesis is evidence that the measurement error in eligibility was uncorrelated with saving behavior.

TABLE 6
 Conditional Median Asset Balances by 401(k) Eligibility on Current Job and
 Household Income Category: HRS Results with Self-Reported Pension Assets and Self-Reported Eligibility
 on the Firm-Reported Sample

Dependent Variable and Eligibility on Current Job	Annual Household Income (thousands of dollars)					
	< 20	20-30	30-40	40-50	50-75	> 75
A. Total Financial Assets						
Eligible	4,843	13,477	28,607	28,839	64,324	123,208
Not Eligible	2,559	5,303	11,083	12,277	24,496	58,005
Difference	2,284	8,174	17,524	16,562	39,828	65,203
[<i>p</i> -value]	[0.04]	[0.004]	[0.06]	[0.01]	[0.0001]	[0.004]
B. Non-IRA-401(k) Financial Asset						
Eligible	1,731	2,875	7,753	6,032	14,386	39,018
Not Eligible	1,564	2,881	6,652	6,295	12,449	26,707
Difference	167	-6	1,100	-264	1,937	12,311
[<i>p</i> -value]	[0.39]	[0.99]	[0.57]	[0.93]	[0.56]	[0.19]
C. Total Financial and Pension Assets						
Eligible	17,003	39,014	88,310	86,820	224,536	388,101
Not Eligible	15,991	37,342	73,264	142,190	168,383	325,295
Difference	1,012	1,672	15,045	-55,369	55,152	62,805
[<i>p</i> -value]	[0.39]	[0.80]	[0.39]	[0.05]	[0.03]	[0.28]
D. Non-401(k) Pension Assets						
Eligible	3,308	4,867	17,965	37,464	123,588	237,618
Not Eligible	3,953	10,208	45,207	99,266	111,727	193,501
Difference	-645	-5,342	-27,243	-61,802	11,862	44,117
[<i>p</i> -value]	[0.31]	[0.68]	[0.39]	[0.22]	[0.69]	[0.28]
Mean 401(k) Wealth for Eligible Households	3,243	10,285	22,979	18,120	32,274	79,123
New Household Saving Per Dollar of 401(k) Wealth	0.31	0.16	0.65	-3.06	1.71	0.79
Household-Weighted Average New Household Saving per Dollar of 401(k) Wealth						0.32 (0.38)
Dollar-Weighted Average New Household Saving per Dollar of 401(k) Wealth						0.71 (0.45)
Number of Observations						2,237

Notes: Conditional median asset balances derived from the parameter estimates from equation (2) evaluated at the sample means of the demographic variables for the sample of 2,237 households defined in the text. Standard errors are in parentheses. *p*-values for the test of the null hypothesis of no difference in assets are in square brackets. Standard errors and *p*-values based on bootstrapped estimated variances with 300 replications. New household saving per dollar of 401(k) wealth is the difference in total financial and pension assets between eligible and ineligible households divided by the mean 401(k) wealth for eligible households from the self-reported data for each income category, respectively.

TABLE 7
 Conditional Median Asset Balances by 401(k) Eligibility on Current Job and
 Household Income Category: HRS Results with Self-Reported Pension Assets and Firm-Reported
 Eligibility on the Firm-Reported Sample

Dependent Variable and Eligibility on Current Job	Annual Household Income (thousands of dollars)					
	< 20	20-30	30-40	40-50	50-75	> 75
A. Total Financial Assets						
Eligible	3,781	7,615	13,662	21,077	44,942	95,939
Not Eligible	2,538	5,615	16,787	15,729	33,703	79,433
Difference	1,243	2,000	-3,125	5,348	11,239	16,506
[p-value]	[0.03]	[0.20]	[0.47]	[0.23]	[0.28]	[0.51]
B. Non-IRA-401(k) Financial Asset						
Eligible	1,674	2,646	6,528	6,976	13,654	34,336
Not Eligible	1,602	2,906	7,904	6,118	12,409	28,130
Difference	72	-260	-1,376	858	1,245	11,206
[p-value]	[0.77]	[0.79]	[0.44]	[0.72]	[0.70]	[0.27]
C. Total Financial and Pension Assets						
Eligible	20,635	49,635	78,743	91,891	178,047	325,658
Not Eligible	15,068	31,341	74,510	136,812	193,971	404,010
Difference	5,567	18,294	4,233	-44,921	-15,924	-78,352
[p-value]	[0.42]	[0.01]	[0.80]	[0.10]	[0.55]	[0.06]
D. Non-401(k) Pension Assets						
Eligible	4,526	26,075	48,829	64,346	106,780	188,231
Not Eligible	3,679	5,820	26,282	81,374	123,728	227,800
Difference	847	20,255	22,547	-17,028	-16,948	-39,579
[p-value]	[0.37]	[0.005]	[0.05]	[0.45]	[0.38]	[0.36]
Mean 401(k) Wealth for Eligible Households	1,714	5,338	9,170	6,506	21,928	43,417
New Household Saving Per Dollar of 401(k) Wealth	3.25	3.42	0.46	-6.90	-0.73	-1.80
Household-Weighted Average New Household Saving per Dollar of 401(k) Wealth						-0.49 (1.00)
Dollar-Weighted Average New Household Saving per Dollar of 401(k) Wealth						-1.28 (0.68)
Number of Observations						2,237

Notes: Conditional median asset balances derived from the parameter estimates from equation (2) evaluated at the sample means of the demographic variables for the sample of 2,237 households defined in the text. Standard errors are in parentheses. *p*-values for the test of the null hypothesis of no difference in assets are in square brackets. Standard errors and *p*-values based on bootstrapped estimated variances with 300 replications. New household saving per dollar of 401(k) wealth is the difference in total financial and pension assets between eligible and ineligible households divided by the mean 401(k) wealth for eligible households from the self-reported data for each income category, respectively.

TABLE 8
 Conditional Median Asset Balances by 401(k) Eligibility on Current Job and
 Household Income Category: HRS Results with Firm-Reported Pension Assets and Eligibility

Dependent Variable and Eligibility on Current Job	Annual Household Income (thousands of dollars)					
	< 20	20-30	30-40	40-50	50-75	> 75
A. Total Financial Assets						
Eligible	5,836	22,659	46,919	39,034	95,508	165,739
Not Eligible	2,374	4,875	13,795	12,037	24,668	60,068
Difference	3,462	17,784	22,124	26,997	70,840	105,671
[p-value]	[0.15]	[0.01]	[0.001]	[0.001]	[0.0002]	[0.002]
B. Non-IRA-401(k) Financial Asset						
Eligible	1,674	2,646	6,528	6,976	13,654	34,336
Not Eligible	1,602	2,906	7,904	6,118	12,409	28,130
Difference	72	-260	-1,376	858	1,245	11,206
[p-value]	[0.77]	[0.79]	[0.44]	[0.72]	[0.70]	[0.27]
C. Total Financial and Pension Assets						
Eligible	17,594	59,747	101,788	102,983	161,702	366,021
Not Eligible	10,458	30,318	65,796	80,606	160,624	305,863
Difference	7,134	29,429	35,992	22,377	1,078	60,158
[p-value]	[0.07]	[0.02]	[0.003]	[0.26]	[0.97]	[0.18]
Mean 401(k) Wealth for Eligible Households	7,867	37,978	37,895	41,877	76,799	164,378
New Household Saving Per Dollar of 401(k) Wealth	0.91	0.78	0.95	0.53	0.01	0.37
Household-Weighted Average New Household Saving Per Dollar of 401(k) Wealth						0.52 (0.15)
Dollar-Weighted Average New Household Saving per Dollar of 401(k) Wealth						0.38 (0.16)
Number of Observations						2,237

Notes: Conditional median asset balances derived from the parameter estimates from equation (2) evaluated at the sample means of the demographic variables for the sample of 2,237 households defined in the text. Standard errors are in parentheses. *p*-values for the test of the null hypothesis of no difference in assets are in square brackets. Standard errors and *p*-values based on bootstrapped estimated variances with 300 replications. New household saving per dollar of 401(k) wealth is the difference in total financial and pension assets between eligible and ineligible households divided by the mean 401(k) wealth for eligible households from the firm-reported data for each income category, respectively.

TABLE 9
 Conditional Median Total Financial and Pension Asset Balances by 401(k) Eligibility on Current Job and
 Household Income Category: Results for the Integration of Firm- and Self-Reported Pension Assets

Eligibility on Current Job	Annual Household Income (thousands of dollars)					
	< 20	20-30	30-40	40-50	50-75	> 75
Eligible	17,691	45,591	84,485	85,214	141,642	284,184
Not Eligible	10,424	30,167	63,738	87,051	160,395	305,499
Difference	7,267	15,424	20,747	-1,837	-18,753	-21,315
[p-value]	[0.01]	[0.23]	[0.39]	[0.83]	[0.04]	[0.80]
Mean 401(k) Wealth for Eligible Households	2,874	19,769	23,463	20,070	38,422	85,997
New Household Saving Per Dollar of 401(k) Wealth	2.53	0.78	0.88	-0.09	-0.49	-0.25
Household-Weighted Average New Household Saving Per Dollar of 401(k) Wealth						0.35 (0.29)
Dollar-Weighted Average New Household Saving per Dollar of 401(k) Wealth						-0.08 (0.29)
Number of Observations						2,237

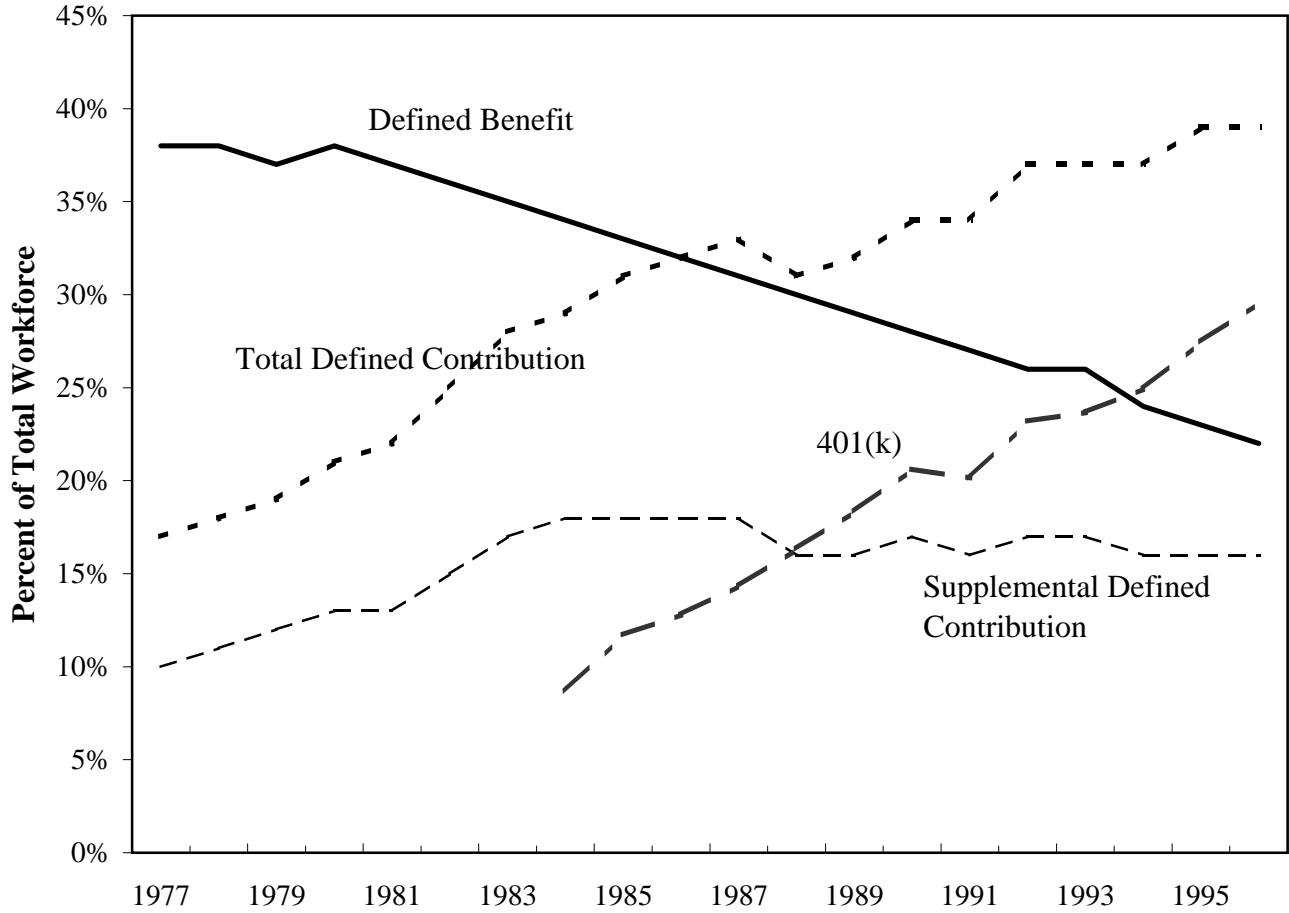
Notes: Conditional median asset balances derived from the parameter estimates from equation (2) evaluated at the sample means of the demographic variables for the sample of 2,237 households defined in the text. Standard errors are in parentheses. *p*-values for the test of the null hypothesis of no difference in assets are in square brackets. Standard errors and *p*-values based on bootstrapped estimated variances with 300 replications. New household saving per dollar of 401(k) wealth is the difference in total financial and pension assets between eligible and ineligible households divided by the mean 401(k) wealth for eligible households from the firm-reported data for each income category, respectively.

TABLE 10
 Conditional Median Total Financial and Pension Asset Balances by 401(k) Eligibility on Current Job and Household Income Category: Results for the Integration of Firm- and Self-Reported Pension Assets, Controlling for Error in Reported Defined Contribution Plan

Eligibility on Current Job	Annual Household Income (thousands of dollars)					
	< 20	20-30	30-40	40-50	50-75	> 75
Eligible	12,625	41,395	65,253	86,205	133,687	268,849
Not Eligible	9,625	25,534	48,026	87,245	157,108	282,126
Difference	3,000	15,861	17,227	-1,040	-23,421	-13,277
[p-value]	[0.41]	[0.28]	[0.41]	[0.96]	[0.40]	[0.76]
Mean 401(k) Wealth for Eligible Households	2,874	19,769	23,463	20,070	38,422	85,997
New Household Saving Per Dollar of 401(k) Wealth	1.04	0.80	0.73	-0.05	-0.61	-0.15
Household-Weighted Average New Household Saving Per Dollar of 401(k) Wealth						0.17 (0.32)
Dollar-Weighted Average New Household Saving per Dollar of 401(k) Wealth						-0.09 (0.34)
Number of Observations						2,237

Notes: Conditional median asset balances derived from the parameter estimates from equation (2) evaluated at the sample means of the demographic variables for the sample of 2,237 households defined in the text. Standard errors are in parentheses. *p*-values for the test of the null hypothesis of no difference in assets are in square brackets. Standard errors and *p*-values based on bootstrapped estimated variances with 300 replications. New household saving per dollar of 401(k) wealth is the difference in total financial and pension assets between eligible and ineligible households divided by the mean 401(k) wealth for eligible households from the firm-reported data for each income category, respectively.

Figure 1. Pension Plan Participation by Plan Type, 1977-1996



Source: U.S. Department of Labor (2000), Tables E4 and E23.