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## ABSTRACT

This paper presents new evidence on the potential importance of 401(k) assets in contributing to the retirement resources of future retirees. We use data on past 401(k) participation rates by age and income decile, along with information on average 401(k) contribution rates, to project the future 401(k) contribution trajectories of households that are currently headed by individuals between the ages of 29 and 39. We allow for the possibility of pre-retirement withdrawal of 401(k) assets when individuals experience employment transitions. By combining data from the Health and Retirement Survey on the likelihood of "cashing out" a 401(k) account conditional on a job change, with data from other sources on the probability of job change, it is possible to estimate the prospective pre-retirement "leakage" from 401(k) accounts. Our central findings are that for households reaching retirement age between 2025 and 2035, 401(k) balances are likely to be a much more important factor in financial preparation for retirement than they are today. We estimate that average 401(k) balances in 2025 will be between five and ten times as large as they are today, and would represent one-half to twice Social Security wealth (depending on investment allocation and based on current Social Security provisions). For persons retiring in 2035 we estimate that 401(k) balances will be three-quarters to two and one-half times Social Security wealth. Moreover, we find that pre-retirement withdrawals have a small effect on the balance in 401(k) accounts. We estimate that these withdrawals typically reduce average 401(k) assets at age 65 by about five percent. This is largely because most households who are eligible for a lump sum distribution when they change jobs choose to keep their accumulated 401(k) assets in the retirement saving system. These households either leave their assets in their previous employer's 401(k) plan, or they roll the assets over to another retirement saving account, such as a new 401(k) or an Individual Retirement Account. Most of those who do withdraw assets have very small accumulated balances. By comparison, the expense ratio charged by the financial institutions administering 401(k) accounts has a larger effect on retirement resources than the possibility of pre-retirement withdrawal.

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The way households support themselves in retirement is changing rapidly. Historically, households in the United States have relied on a combination of Social Security, employer-provided defined benefit pensions, and personal saving to support their retirement years. In the last fifteen years, however, retirement saving programs such as 401(k) plans have become an increasingly common component of household retirement planning. Today, more than 35 million workers participate in 401(k) saving plans, and the annual contribution flow to these plans exceeds $100 billion. The tax-deferred nature of wealth accumulation in 401(k)-type plans, coupled with often generous employer matching contributions that enhance the value of employee contributions, make these plans a powerful vehicle for accumulating retirement wealth. Mass market books, such as Iwaszko and O'Connell (1999) and Merritt (1997), have extolled the wealth-building power of 401(k) accounts.

In Poterba, Venti, and Wise (hereafter PVW) [1998a], we showed that even with conservative assumptions about the future growth of 401(k) contributions, the average 401(k) balance for households reaching retirement in 2025 will be approximately equal to the average actuarial present value of Social Security benefits. This represents roughly a ten-fold increase in the importance of 401(k) accumulations between the late 1990s and 2025.

Although 401(k) plan accumulations are likely to account for a very substantial share of the net worth of future retirees, unlike Social Security benefits, they can be affected by a number of individual decisions. Individuals who work at firms that offer 401(k) plans must decide whether or not to participate in their employer's plan. Those who do not participate forego the opportunity to accumulate retirement wealth in this

tax-deferred form. Conditional on participating, individuals must decide how much of their earnings to contribute to the plan.

When 401(k) participants leave jobs at which they have participated in a 401(k) plan, they can withdraw their accumulated 401(k) assets from the retirement saving system. When such withdrawals occur before the recipient is 59 1/2, they are taxed as ordinary income, as all 401(k) payouts are, and they are also subject to a 10 percent "early withdrawal" penalty tax. Participants who leave their jobs can also choose to leave their 401(k) accumulation in their former employer's plan, or to roll-over their assets either into an Individual Retirement Account (IRA) or into the 401(k) plan of a new employer. The flexibility afforded by these three options enhances the portability of 401(k) benefits. It reduces the risk, not uncommon in defined benefit pension plans, of forfeiting pension benefits as a result of job change. However, the flexibility associated with the 401(k) withdrawal option raises the possibility that 401(k) participants may draw down their account balances before retirement, and thereby reach retirement without assets in a 401(k) account.

A number of recent studies have noted that conditional on choosing to withdraw assets from the 401(k) system, i.e. conditional on receiving a "lump sum distribution," many individuals use their withdrawal in a way that does not preserve retirement saving. In PVW [1998b], we showed, however, that older workers, and those who receive larger lump sum distributions, are much more likely to preserve the retirement benefits of their lump sum distributions through IRA rollovers or other forms of saving. These findings, based on data from the current Population Survey, are confirmed in Sabelhaus and Weiner's (1999) analysis of tax return information.

Until recently, there was no information on the probability that a worker leaving a

job would decide to withdraw assets from the employer's 401(k) plan and therefore receive a lump-sum distribution. Analyzing the behavior of those who received lump sum distributions therefore provided only a partial account of benefit leakage from 401(k) plans. In an important recent study, however, Hurd, Lillard, and Panis [1998] analyze data on the disposition of defined contribution pension assets when workers change jobs. They analyze information from the Health and Retirement Survey and find that very few participants in these pension plans select the withdrawal option when they leave their jobs.

In this paper we draw together previous research on withdrawals from retirement saving plans to gauge the importance of such withdrawals on the saving balances of future retirees. We expand the algorithm for projecting future 401(k) balances that we developed in PVW (1998a) to allow for job changes during an individual's working life, and the associated risk of 401(k) asset withdrawal. While we abstract from many detailed features of the asset withdrawal process, we allow for age-specific job termination risks, and for balance-specific probabilities of withdrawing assets from a 401(k) account. We also allow for realistic expenses of managing the assets in 401(k) plans.

We find that even though a substantial number of workers change jobs, and could withdraw their 401(k) assets, the modest withdrawal rate and the small size of most withdrawals reduce retirement saving only modestly. Our central estimates suggest that the opportunity to take 401(k) withdrawals reduces retirement saving at retirement by approximately five percent. Even after allowing for pre-retirement withdrawals, we find that 401(k) saving will expand rapidly over the next three decades, and that 401(k) assets at retirement are likely to grow, on average, to be roughly as

important as current Social Security wealth in contributing to households' retirement financing.

This paper is divided into six sections. The first summarizes the recent studies that have explored the importance of lump sum distributions from 401(k) plans and other retirement saving plans. The second section describes our algorithm for projecting the 401(k) balances of future cohorts of retirees, and particularly our attempts to allow for pre-retirement asset withdrawals. We calibrate our model using data from the 1993 Survey of Income and Program Participation and the Health and Retirement Survey. Section three presents evidence on how actual 401(k) balances for households in the Health and Retirement Survey compare with the balances that our algorithm would have predicted for these households, had we not known their actual plan balance. The fourth section reports our projected future account balances and examines the importance of pre-retirement withdrawals in affecting these balances. Section five reports preliminary statistics on 401(k) participation from the 1995 Survey of Income and Program Participation, and uses these data to provide some indication of the plausibility of our projected rates of 401(k) expansion. Finally, a brief concluding section suggests several directions for further work.

## 1. What Do We Know About Lump Sum Distributions and 401(k) "Leakage"?

The growth of retirement saving accounts, in particular 401(k) accounts, during the last two decades has substantially expanded the financial assets of many U.S. households. The expansion of personal retirement saving has raised new questions about the impact of individual financial decisions on preparation for retirement. Poterba and Wise (1999) note that there are several dimensions, including plan participation,

contribution level, asset allocation, date of asset withdrawal, and whether or not to annuitize account payouts, along which individuals can influence their 401(k) retirement accumulation.

One of the most important decisions individuals face is whether to draw down assets in retirement saving accounts before retirement. A number of summary statistics on the prevalence of lump sum distributions have raised concern about the possibility that households are not preserving their retirement saving. The most recent data on the extent and use of such distributions are from the U.S. Department of Labor [1995]. The data are based on the September 1994 "Retiree Pension and Health Benefits Supplement" to the Current Population Survey. This survey shows that 9.1 million individuals (all over the age of 40) reported that they had received at least one lump sum distribution from a pension plan or retirement saving account. This is nearly ten percent of the over-40 population, and it is an even greater share of the labor force in this age range.

The mean lump sum distribution, measured in 1994 dollars, was $22,309. More than half of these distributions (52.8 percent) were received by workers who were between the ages of 30 and 49 at the time of the distribution. The CPS questionnaire included information on lump sum distributions from a range of different retirement plans. Payouts from defined benefit plans in which the separating employee had accumulated only a small vested pension benefit, from traditional defined contribution pension plans, as well as from 401(k)-like retirement saving programs were included in the CPS survey. Of the 9.1 million lump sum distributions reported in the survey, 2.7 million were identified as from defined benefit plans, 5.3 million were from defined contribution plans, and 1.1 million distributions were received by individuals who could

not identify the type of plan that they were from.

Probably the greatest concern with the substantial number of lump sum distributions is that many of their recipients report that they did not use their distributions to provide income in retirement. Table 1 shows the uses lump sum distributions reported in the 1994 Current Population Survey supplement. More than one quarter of those who reported a single primary use of their lump sum distribution (1.82 million of the 6.86 million respondents with a primary use) indicated that their distribution was used to finance a consumer durable purchase or to pay other expenses. Only 33.9 percent reported that they rolled-over their lump sum distribution into an IRA or a retirement plan with a new employer. A substantial additional group, comprising 39.5 percent of the primary-use respondents, indicated that their distribution was used for something that could be construed as saving, but was not targeted for retirement income support. Responses in this category include depositing the lump sum distribution in a saving account, paying off debts, or using the proceeds for home renovations.

Previous work, including Chang (1996) and PVW (1998b), has shown that the use to which a lump sum distribution is put is a function of household age and the size of the distribution. Thus an asset-weighted version of Table 1 would show a different allocation of lump sum distributions than the person-weighted tabulation that is actually reported in the table. Older workers, and those with larger distributed balances, are more likely to choose a rollover option or to report that they saved their distribution. The fraction of lump sum distribution <u>dollars</u> that are withdrawn from the 401(k) system is much smaller than the fraction of <u>individuals</u> who receive lump sum distributions who report that they withdrew funds from their retirement saving. There is also some

evidence, reported for example in Bassett, Fleming, and Rodriguez (1998), and Chang (1996) that the share of lump sum distributions that are rolled over into saving vehicles or new retirement saving accounts has increased over time.

The critical difficulty with using data on lump sum distributions to study asset leakage from the 401(k) system is that individuals who leave jobs with 401(k) plans can choose whether or not to receive a lump sum distribution. The sample of lump sum distribution recipients provides no insight on the probability that an individual experiencing a job separation will decide to withdraw funds from the 401(k) system. The individual could also choose to allow the 401(k) balance to remain with the previous employer, or to roll the 401(k) balance into a 401(k) plan at a new employer. Neither of these options would trigger a lump sum distribution. If most individuals experiencing a job separation choose one of these options, then the probability of 401(k) leakage might be quite small even if most of those taking lump sum distributions do not roll over their 401(k) assets.

Hurd, Lillard, and Panis (1998) use data on individuals in the Health and Retirement Survey (HRS) who experience a job change between either the first and second survey waves, or between the second and third waves, to estimate the probability of asset withdrawal. Their findings show that only 20.5 percent of the workers leaving defined contribution pension plans (including 401(k) plans), and 16.4 percent of those leaving jobs with defined benefit plans, choose to cash out their accumulations in the form of lump sum distributions. Moreover, the cash-out probability is lower for those with large balances. Only 6.7 percent of the assets held in defined contribution plans by those who experience job termination are withdrawn from the retirement saving system. These statistics suggest that the possibility of withdrawing

assets from a 401(k) plan is not likely to have a large impact on the prospective growth of assets in these plans.

Engelhardt (1999) performs a related calculation using data from the HRS. Using data on individual reports of past lump sum distributions, he "accumulates" the value of these withdrawals under the counter-factual assumption that they had been left in retirement saving accounts. He finds that for the median household that received a lump sum distribution, the current value of this distribution is between 8 and 11 percent of the value of Social Security wealth and other pension wealth. The range depends on assumptions about the way 401(k) participants invest their assets.

These findings suggest that lump sum distributions from 401(k)-type plans have probably not had a large effect on the accumulated balances in these retirement saving accounts. However, it is still possible that such distributions will have a larger effect on future accumulations in these accounts, since 401(k) plans will be available to more young workers in the future than in the past. Young workers have much higher job turnover rates than older workers. The calculations we present below are designed to provide new insight on the prospective importance of such pre-retirement payouts.

## 2. An Algorithm for Projecting Future 401(k) Balances

This section describes our approach to forecasting the 401(k) balances at retirement for currently working cohorts. We build on our prior work, reported in PVW (1998a), but expand our previous algorithm to incorporate job change, lump sum distributions, and potential asset leakage from the 401(k) system into our analysis. We also introduce administrative costs of asset management into our forecasting algorithm.

Our procedure for projecting the 401(k) assets of future retirees relies on a cohort representation of data on 401(k) participation and contribution behavior. The notation C(j) refers to the cohort of age j in 1984. C(27), for example, refers to the cohort aged 27 in 1984. Figure 1, which is reproduced from our earlier paper, shows 401(k) eligibility rates for six cohorts that are based on SIPP data for 1984, 1987, 1991, and 1993. Our analysis focuses on the C(25) and C(15) cohorts, which were 33 and 23, respectively, in 1993. For the C(25) cohort, age 55 occurs in 2015, and age 65 in 2025. The C(15) cohort reaches each of these ages ten years later.

To ensure adequate sample sizes, each of the "cohort" points plotted in Figure 1 is based on a group of families with household heads born in a five-year interval. The C(25) cohort therefore includes families with heads aged 23-27 in 1984. The C(25) cohort is identified by the oval symbols. The eligibility rate of this cohort was roughly 15% in 1984, but it had risen to almost 45% by 1993 when the cohort was 33 years old. A similar increase in eligibility is evident for each of the other five cohorts. It is also clear that there is a very large "cohort effect". At any age each successively younger cohort has a higher contribution rate than the cohort five years older. This difference is approximately 20 percentage points. For example, 44% of the C(27) cohort was 401(k)-eligible when this cohort was 35 years old, compared with about 20% of the five-year-older C(32) cohort when it was 35.

The information in Figure 1 illustrates the cross-section relationship between age and eligibility at each survey date. The seven markers along the top of the figure represent the 1993 cross-section relationship, between age and eligibility. It shows rising eligibility at young ages, followed by a plateau. Comparable data for earlier years show a less pronounced effect of age on eligibility.

### 2.1 Projecting Future 401(k) Participation Rates

Extrapolation of cohort trends would quickly lead to the implausible projection of eligibility rates of over 100%. On the other hand, it is equally clear that when the C(27) cohort reaches age 40 its eligibility rate will be greater than the rate of the C(32) cohort at age 40. Thus instead of extrapolating the cohort data, we parameterize the relationship between age and eligibility, assuming that the apparent cohort effects in the figure are year effects and simply represent the spread of 401(k)s with time. With reference to Figure 1, this means that we estimate eligibility by allowing the cross-section relationship to shift upward over time. When we allow for both cohort and year effects in regression equations in which 401(k) participation rates are the dependent variables, the cohort effects are typically not statistically significantly different from zero and the time effects exhibit most of the explanatory power.

The difficulty with extrapolating past experience to project future 401(k) balances can be illustrated by reference to the C(27) cohort. If 401(k) plans continue to spread, then the 1993 cross-sectional relationship between eligibility and age will clearly understate the future eligibility of the C(27) cohort. In part this is simply because 401(k)s will undoubtedly continue to expand. But, in addition, the 1993 relationship is determined in part by how the past diffusion of 401(k) plans occurred. If the diffusion of plans has been slower in small firms with younger workers than in large firms, then the cross-section relationship would tend to look as it does in the figure. In the 1993 cross-section there is a noticeable reduction in eligibility with age. This is much less apparent in the 1984 cross-section. Thus we can only use formal estimates as a guide to future patterns.

We assume that by 2013, which is twenty years after the 1993 survey on which

our data are based, the eligibility rate for 55-year-olds (the C(27) cohort) will be 50 percent higher than the eligibility rate of the cohort that was 55 in 1993. This assumption is based on the past growth in eligibility and participation rates reported on IRS Form 5500 and in Current Population Survey (CPS) data. Form 5500 reports[1] show that the number of 401(k) participants increased by 52 percent over the five-year period between 1988 and 1993. Employment grew by 4% over this period. Data from the CPS show a 45% increase in the participation rate in 401(k) plans, which is roughly consistent with the Form 5500 data. The Form 5500 data also show that aggregate 401(k) contributions increased by 76 percent, or by much more than the increase in participation. Aggregate earnings increased about 25% over this period, so if the average fraction of earnings contributed were stable, the growth in earnings and participation would predict a 77 percent increase in aggregate contributions. This is very similar to the observed change.

### 2.2 Cross-sectional Age-Participation Profiles and Participation Projections

Our projections are based on recent 401(k) participation data along with assumptions on the future evolution of both eligibility and participation. We recognize throughout our analysis that there is an important relationship between earnings, eligibility, and participation, and we allow for this by estimating cross-sectional probit equations relating eligibility or participation to age and indicator variables for earnings deciles. We model participation for household i as:

$$(1) \quad P_i = \beta_1 A_i + \beta_2 A_i^2 + \sum_{d=1}^{10} \gamma_d D_{di} + \varepsilon_i$$

where A is age and the $D_d$ are indicator variables which identify the household's earnings decile. The most important parameters are the $\gamma_d$, which indicate the effect of

earnings decile $D_d$ on participation. These coefficients are the basis for our stratification of 401(k) accumulation patterns by household earnings. In PVW [1998a], we report estimation results from models like (1) for eligibility, participation given eligibility, and participation, using 1988 and 1993 SIPP data. We do not reproduce those results here.

We use our projection algorithm to explore future 401(k) balances for households headed by individuals in the C(25) cohort, the C(15) cohort, and for a cohort that is exposed to a mandatory 401(k)-type program with universal contributions. The last case resembles some of the proposals that have recently been discussed in the U.S. Social Security reform debate.

To project future 401(k) asset accumulation for the C(25) cohort, we assume that when this cohort is 55 years old (in 2015) it will have a 401(k) participation rate 50 percent higher than that of the cohort that was 55 in 1993. We further assume that its participation rate at 65 will be five percent higher than this, that is, 55 percent higher than that of the cohort that was 55 in 1993. The projections by earnings decile start from the 1993 401(k) participation rates. Because higher income households have higher participation rates, the projections yield a widening difference between the participation rates of high- and low-income families as they age. Tthe extent of this dispersion is likely to be one of the most uncertain features of our projections.

Figure 2, also drawn from PVW (1998a), illustrates the C(25) projection, as well as the C(15) projection. To further place the projections in the context of the historical data, a projection for the C(27) cohort is also shown in the figure.

The members of the C(15) cohort were 15 years old in 1984. Even though this cohort is only ten years younger than the C(25) cohort, we find it substantially more difficult to make plausible assumptions about their future 401(k) participation rates. We

think of the C(15) projections as representing 401(k) accumulation in a setting in which participation is substantially higher than with the C(25) projections, but considerably short of universal coverage. We believe that future 401(k) participation will indeed be higher than the C(25) projections suggest. Our C(15) projections assume that 401(k) participation rates for the median wage earner are 20 percentage points greater than the C(25) rates. Rates for the highest and lowest decile workers in the C(15) cohort are assumed to be slightly less than twenty percent greater than those of comparable workers in the C(25) cohort.[2] This twenty percentage point increase in 401(k) participation for cohorts ten years apart is modest compared with what we have observed in recent years. In Figure 1, for example, we find that 401(k) eligibility has risen by twenty percentage points for cohorts only five years apart. Our projections therefore assume future 401(k) eligibility growth at roughly half the recent rate.

Finally, we consider a third scenario for future 401(k) growth, in which everyone contributes a fixed share of their salary to a 401(k) plan. Universal coverage might arise if 401(k)s spread even more rapidly in the future than they have in the past, or it might arise as part of a mandatory saving program. Various types of mandatory saving systems have been suggested as one way to address the prospective funding difficulties of the Social Security system.

### 2.3 Earnings Histories

Our projections of future 401(k) balances assume that all households that contribute to a 401(k) plan contribute nine percent of their earnings. In PVW (1998a), we show that the average contribution rate as a share of earnings is extremely stable across earnings deciles. There is, of course great variation across households within deciles, but we are primarily interested in forecasting averages. A household's earnings

history is therefore a critical determinant of its 401(k) accumulation.

The starting point of our algorithm is a set of "pseudo-earnings histories" of Health and Retirement Survey respondents beginning at age 25. In analyzing the HRS earnings histories, we have divided the families in the HRS into deciles according to their 1992 earnings. In principle, the Social Security earnings histories of the HRS respondents can be used to determine average earnings by age within each decile. Venti and Wise (1997) note, however, that there is one important limitation to this method. Historical earnings are reported only up to the Social Security earnings limit, while actual earnings in the top two or three deciles may be substantially higher than Social Security reported earnings. Because of this limitation, we rely on information in the annual March Current Population Survey (CPS) data files, which report earnings well above the Social Security maximum.[3] The ratio of the CPS maximum to the Social Security maximum has ranged from a low of just under 2 in 1981 to a high of over 20 in 1964. In 1991 the CPS reported earnings up to a maximum of $200,000, while the Social Security maximum was $53,400.

Our procedure for constructing earnings histories for HRS households is as follows. We first identify earnings deciles, as described above, using the 1992 earnings of each HRS family. Then, using the March CPS data we calculate earnings deciles by age for the years 1964-91. Using published data on median earnings prior to 1964, we extrapolate this series back to 1956, thereby obtaining earnings histories by decile for the years 1956 to 1991. Finally, we assign each HRS household to a CPS decile according to the household's 1992 earnings decile. The CPS earnings histories begin at age 25 and a given household is assumed to have been in the same decile since age 25. [4]

## 2.4 The Projection Algorithm

Given a household's "pseudo-earnings history," we construct a "pseudo-401(k) contribution record." Within each earnings decile, each household is randomly assigned to 401(k) participation status, based on the 401(k) participation probabilities discussed above. Then, as the household ages, we vary its 401(k) participation status. In PVW (1998a), we assumed that if a household had a 401(k) account at a given age, it remained a 401(k) participant until retirement. In the present paper, we allow for job separations that lead some 401(k) participants to become non-participants.

To illustrate the procedure, we suppress variation across earnings deciles, which we use in our actual projections. We define $P_a$ as the participation rate in 401(k) plans at age a. Suppose that $L_a$ is the probability that an a-year-old person with a 401(k) plan leaves his employer. This event will end a 401(k)-participation spell, although it is possible that another 401(k) participation spell will begin when the affected individual finds another job.

The difference between the fraction of the population participating in 401(k) accounts at ages a and a+1 reflects two offsetting flows. These are the fraction of the population that enters 401(k) participation at age a, $E_a$, and the fraction of the population that participated in a 401(k) plan at age a, but left the 401(k) system by age a+1. The fraction of the population that leaves a 401(k) job at age a is $L_a*P_a$. The net change in 401(k) participation at age a is therefore:

$$(2) \qquad P_{a+1} - P_a = E_a - L_a \cdot P_a$$

We know the values of $P_{a+1}$ and $P_a$, and we can estimate the probability of job leaving. We can therefore derive the flow of new entrants to the 401(k) system that is necessary

to generate observed age-specific participation rates. This is just

$$(3) \qquad E_a = P_{a+1} - P_a(1 - L_a)$$

where $P_a$ denotes the probability of 401(k) participation at the beginning of the year when a cohort is age a, and $L_a$ denotes the probability of leaving 401(k) participation during the year when the cohort is age a.

New 401(k) entrants must be drawn from the non-participant pool at age a. The probability that an a-year-old nonparticipant will join a 401(k) plan $(J_a)$ is simply the ratio of the fraction of the population that represents new 401(k) entrants, $E_a$, to the fraction that is currently not participating in 401(k) plans, $1 - P_a*(1-L_a)$. This implies that

$$(4) \qquad J_a = \frac{E_a}{1 - P_a(1 - L_a)} = \frac{P_{a+1} - P_a(1 - L_a)}{1 - P_a(1 - L_a)}.$$

It is possible for someone who joins the 401(k) participant group to be a previous 401(k) participant. This means that the number of current 401(k) participants will, in general, differ from the number of individuals who have ever participated in a 401(k). It also implies that some new entrants to 401(k) participation at age a will have positive 401(k) balances as a result of 401(k) participation on a prior job.

We should note in passing that this algorithm for projecting the evolution of 401(k) participation corrects a previous modeling error. If there is no chance of leaving a 401(k) job, so $L_a = 0$ as in our previous work, then $J_a = (P_{a+1} - P_a) / (1 - P_a)$, from equation (4). In PVW(1998a), we <u>incorrectly</u> set the probability that non-participants would become 401(k) participants to $(P_{a+1} - P_a)$. Thus we underestimated the

probability of joining a 401(k) plan, which had the effect of understating the fraction of currently young households who would participate in a 401(k) plan before retirement. This under-estimated the future importance of 401(k) account balances. We note the size of this error below.

Our projections consider three possible rate of return scenarios, corresponding to nominal rates of return of 6 percent, 9.3 percent, and 12.7 percent on 401(k) assets. We think of these returns as the returns, on average, on an all bond portfolio, a 50-50 split between bonds and stocks, and an all stock portfolio. Ibbotson Associates (1997) reports that the historical average pretax return on corporate bonds has been 6 percent per year, while large-capitalization stocks have returned an average of 12.7 percent per year since 1926. These returns are the pretax returns available on a portfolio with no management fees. Because most 401(k) plans are administered by financial intermediaries who charge for their services, we also consider the effect of reducing the feasible return on the bond portfolio by 35 basis points, and the return on the equity portfolio by 70 basis points. Our calculations highlight the importance of such asset management costs in determining 401(k) wealth at retirement.

We also demonstrate the effect of the randomness of stock and bond returns. We do this by drawing annual returns for our bond and stock portfolios from the empirical distributions of returns on corporate bonds, and large company stocks, in Ibbotson Associates (1997). We construct 1000 projections using this random draw algorithm, and then show the distribution of returns. It is important to emphasize that randomness represents macro variation, which affect all plan members. We do not account for variation among participants due to differences in asset allocation among our three assets. Nor do we give attention to individual variation within earnings deciles

due to different 401(k) participation rates. And, of course, we do not account for additional variation that would result from investment in individual stocks for example. In future work we will address this individual risk.

We now turn to the problem of modeling the dynamics of 401(k) account balances. When a household leaves a job with a 401(k) plan, one of two things may happen to the accumulated asset balance. In principle, a job leaver could decide to divide a 401(k) accumulation between these alternatives, but we assume that there are no fractional account balances.

First, the job-leaver may decide to preserve the assets in the retirement system. They could leave the assets in the former employer's 401(k) plan, although no further contributions would be made, or to roll the assets over into an IRA. In this case, the assets will continue to accumulate until retirement. We use $1\text{-}Q_a$ to denote the probability that 401(k) assets remain in the retirement system at the time of a job transition.

Second, with probability $Q_a$, a job changer can decide to withdraw the assets from the 401(k) system. This would trigger a lump sum distribution, and would create "leakage" from the stock of retirement assets. We use the notation $A_a$ to define 401(k) plan assets for a household of age a, and $B_a$ to denote the asset balance of job leavers who cash out their 401(k) assets. We allow $Q_a$ to depend on the size of the 401(k) account balance $(A_a)$ at the time of the job termination, so $Q_a = Q_a(A_a)$.

The equation for the evolution of 401(k) balances is therefore:

$$A_{a+1} = A_a(1+r) + C_{a+1} \cdot P_{a+1} \cdot I_{a+1} - B_a \,. \tag{5}$$

where $C_{a+1}$ denotes the 401(k) contribution rate as a fraction of income, and

$I_{a+1}$ denotes household income. We can express $B_a$ as the product of three terms:

$$(6) \qquad B_a = A_a \cdot L_a \cdot Q_a(A_a),$$

These are respectively the 401(k) balance at the beginning of the year when a cohort turns age a, the probability of leaving the 401(k) job during that year, and the probability of withdrawing the balance conditional on leaving the job. We allow the job-leaving probability to vary with age, and the probability of asset withdrawal conditional on job separation to depend on the accumulated asset balance. We calculate $Q_a$ separately for each household, so it depends on each household's accumulated 401(k) balance. In future work we hope to expand the set of household characteristics that affect each of these probabilities.

**2.5 Calibrating the Rates of Job Separation and Cash-Out**

Two key parameters that determine the magnitude of 401(k) leakage are the age-specific job leaving probability, $L_a$, and the asset-balance-specific probability of cashing out a 401(k) plan balance, $Q_a(A_a)$.

There is a substantial literature on both the rate at which jobs end, and the characteristics of individuals and jobs that are associated with job termination. For example, Farber (1997) reports age-specific rates of job losing, and Neumark, Polsky, and Hansen (1999) present recent evidence on both job turnover rates and job tenure distributions from the Current Population Survey. None of the existing literature provides precisely the values of $L_a$ that we require. This is because we are interested in job termination rates for employees at firms that offer 401(k) plans. Some previous

evidence suggests that job termination rates are lower at firms that offer pension plans, and that termination rates are also declining in the length of the job's tenure. Gustman and Steinmeier (1995) report, for example, that in the 1984 and 1985 Surveys of Income and Program Participation, men aged 31-50 without a pension had a 19.5 percent annual separation rate. In the same data set, men with either a defined benefit or an defined contribution pension plan had a 6.1 percent separation rate.

To provide more recent evidence on mobility rates, we analyzed data from the retrospective section of the Health and Retirement Survey. By working backwards from the current job, it is possible to assemble information on both pension coverage on previous jobs, and on the respondent's age at the time when the job ended. Table 2 reports our findings for separation rates at jobs with defined contribution pension plans. The job mobility rates are much lower than those in most other studies of labor market turnover. For 40-year-old men, for example, the rate is only 1.2 percent per year. This may be an artifact of the long-term retrospective nature of the HRS questions, or it may be the result of other factors.

Since we are not sure why the HRS-based mobility rates are so low, and since very low mobility rates will make the risk of withdrawals from the 401(k) system seem very small, we are reluctant to use the HRS findings without some modification. We have therefore assumed that the job-leaving probability ($L_a$) for persons aged 25-34 is 6 percent. We assume that this probability declines to 4.5 percent for those aged 35-44, 4 percent for those aged 45-54, and then rises to 5 percent for those aged 55-64. We believe that a case can be made for using even lower mobility rates, in which case the impact of potential 401(k) leakage would be even smaller than our findings below suggest.

In calibrating $Q_a(A_a)$, the probability of withdrawing assets from a 401(k) plan as a function of the accumulated asset balance, we rely on the work of Hurd, Lillard, and Panis (1998). They provide the only comprehensive analysis of dispositions from defined contribution plans. Their analysis uses the Health and Retirement Survey to calculate the probability of various uses of existing defined contribution plan balances conditional on a job separation. We treat their probabilities of retaining an account through the former employer's 401(k) plan (their probabilities refer to all defined contribution plans), rolling assets over into an IRA or other tax-advantaged saving vehicle, and annuitizing the 401(k) balance, as "rollovers." Each of these dispositions has, in a different way, the effect of preserving the 401(k) balance so that the assets can be used to support retirement consumption. A fourth option in their classification scheme, cashing out the 401(k) balance, is the one that we regard as triggering asset leakage from the 401(k) system.

Hurd, Lillard, and Panis (1998) find that the likelihood of cashing out is strongly related to the size of the 401(k) account balance. They provided us with unpublished tabulations that indicate the cash-out probabilities for various 401(k) balances, as well as the number of observations in the HRS dataset that were used to estimate each of these balance-specific probabilities. Table 3 reports these probabilities and associated summary statistics. We use the data in Table 3 to randomly assign the balances of job leavers to cash-out or rollover status.

One difficulty that arises in using a set of balance-specific probabilities for asset withdrawal, as we do here, is that the Hurd, Lillard, and Panis (1998) findings relate to balances at a single point in time. We need to apply them to potential 401(k) cash-outs over an entire working lifetime. To do this we assume that 401(k) balances at different

dates can be converted to balances in 1992 dollars using a 3.2 percent annual inflation rate.

### 3. Validating the Algorithm: Projecting 401(k) Balances for Current HRS Households

Before projecting the 401(k) assets at retirement for future cohorts of retirees, we tried to evaluate the ability of our algorithm to predict the observed 401(k) balances of current cohorts of retirees and near-retirees. We use our algorithm to predict 401(k) balances for households in the Health and Retirement Survey. We did this using a "basic" version of our algorithm, without any administrative costs for 401(k) asset management and with certain returns. In essence, we ask whether the SIPP cohort data on 401(k) participation, together with the CPS data on contributions, can explain the observed distribution of 401(k) balances in the HRS. While a high correspondence between actual and predicted values in this case does not necessarily demonstrate the validity of our algorithm, it provides at least one way of checking for the plausibility of our findings.

Table 4 reports the mean 1992 assets of the HRS respondents, stratified according to earnings decile. (This table is drawn from PVW (1998a). It provides a point of reference against which to evaluate our projected 401(k) balances. The table reports only mean asset balances because our 401(k) balance projections focus on means. While the median asset holdings for many categories are substantially below the mean holdings, the primary comparison that we make is between 401(k) balances and Social Security wealth. Mean and median Social Security wealth are very similar.

We estimate accrued Social Security wealth at age 65 for the HRS respondents, assuming that each respondent were to work until that age. A family's Social Security

wealth is the simple sum of the mortality weighted present value of each member's benefit stream; we do not consider survivorship benefits, which could raise the total value of Social Security wealth by more than one third. These accrued benefit levels are converted to 1992 dollars using the Social Security Administration's intermediate forecast of the average annual interest rate provided by the Board of Trustees of the OASDI trust fund. For comparability, the projected 401(k) balances discussed below also assume that a person works until age 65. The actual HRS 401(k) balances reported in Table 4, however, are 1992 balances when the respondents were 51 to 61. Personal retirement balances could easily double by the time the respondents attain age 65, through the combined effect of asset returns and additional contributions during remaining years of employment.

When the 401(k) program began in 1982, members of the 1992 HRS sample were 41 to 51 years old. We assume that in 1982, these families began to participate in 401(k) plans at rates estimated from the SIPP and to contribute at rates estimated from the CPS. We ask how close simulated balances based on these assumptions are to the actual 1992 balances of the HRS respondents.

We first use the SIPP data to estimate participation profiles by age for the cohorts whose members were 51 to 55 and 56 to 60 in 1992, at the time of the HRS. Then, to estimate contributions, we use family earnings histories, derived as described above. Within each earnings decile, beginning in 1982, we randomly assign families to participation status, based on SIPP estimates of participation by age and earnings decile for each of the two cohorts.[5] We then randomly assign job change and cash-out status, also as described above. Based on our estimates from the CPS data, we assume a contribution rate of eight percent in all years between 1982 and 1992. This is

somewhat less than the average rate of 8.7 percent -- including both employee and employer matching contributions -- reported in the 1993 CPS data, and the nine percent rate that we assume throughout our projections of future 401(k) balances. This is because there is some evidence that 401(k) contribution rates have increased over time, and we are trying to track the 1982-1992 experience.

Table 5 shows our projected 401(k) balances, as of 1992, for the HRS sample. This table is similar to a table in PVW (1998a), but it is based on an algorithm that allows for job terminations. The table reports results stratified by earnings decile. On average the simulated values do not differ greatly from the observed balances reported in the HRS. Using the bond rate of return seems to give the closest match. Even the simulated balances by earnings decile are typically not far from the HRS reported balances. These results suggest that with roughly accurate assumptions about contribution and participation behavior, we are able to replicate the actual distribution of 401(k) balances. We do not necessarily view our ability to track the past evolution of 401(k) balances as a strong endorsement for the future success of our algorithm, because our historical success does not provide any evidence that our assumptions for the future are plausible.

## 4. Projections of 401(k) Balances of Future Retirees

We now use our projection algorithm to estimate the balances at age 65 of future cohorts. We assume that our estimated earnings profiles represent the past earnings of the HRS families, and we estimate what they would have accumulated in a 401(k) had they had the participation rates that we project for the C(25) and the C(15) cohorts. We also consider what would have happened if there had been universal 401(k) coverage in past years. The projections reported below assume a 35 basis point

annual administrative cost on 401(k) investments in bonds, and a 70 basis point cost on stock investments.

Table 6 reports the results of our projections for the C(25) cohort, the group that will turn 65 in 2025. The first column of the table shows the average value of Social Security wealth for each earnings decile. The remaining columns show our projected 401(k) balances when the C(25) cohort reaches age 65. These values are reported in 1992 dollars, for comparability with the first column. Our projected 401(k) balances are the pretax balances in 401(k) accounts. A family with these balances would pay taxes as the 401(k) balance was drawn down, so the after-tax value of the 401(k) accumulation is smaller than what we report. In contrast, no tax will be paid on most Social Security benefits. To place our estimates in perspective, it is helpful to refer to the family wealth data in Table 4. One statistic that provides a useful point of reference is the mean actual 1992 balance in 401(k) accounts for HRS respondents: $10,808. We can compare the average value of projected 401(k) balances against this magnitude. In addition, we can compare the 401(k) balances to Social Security wealth, under current provisions, and these values are shown in the first column of the table.

Table 6 shows two components of 401(k) accumulation, or potential accumulation, for each asset allocation assumption. The first column is the sum of the projected 401(k) balance and the balances in any "rollover accounts" at age 65. Since we view assets that are kept within the retirement saving system as tantamount to 401(k) assets, we group these two asset categories together. We do not report the split between 401(k) and rollover assets, although in many of our projections, the rollover balance actually exceeded that in the 401(k) account. We suspect that this reflects job mobility rates that are too high, over some age ranges, for our 401(k) participants. We

also report the value of "foregone saving" for each earnings decile. This is the additional amount that would have been available for retirement support had the assets not been cashed out. It is the value of simulated 401(k) withdrawals accumulated to age 65 under various assumptions about the rate of return on 401(k) assets. Engelhardt (1999) presents a similar statistic for actual lump sum distributions claimed by HRS respondents.

The results in Table 6 suggest that pre-retirement withdrawals from 401(k) plans do not have a significant effect on 401(k) balances at retirement. For those who will reach retirement in 2025, the C(25) cohort, we project 401(k) assets at retirement ranging from $57,900 to $181,400, depending on our assumption about how the assets are invested. These levels are large relative to the average Social Security wealth of $103,400 for these households, and they are much larger than the (actual) mean 401(k) balance of $10,800 in 1992, when the HRS respondents were 51 to 61.

For each projection, the ratio of projected 401(k) to Social Security wealth varies a great deal depending on lifetime earnings. Because the C(25) projections assume the continuation of current low participation rates in the lowest income deciles, families in the first and second income deciles accumulate very little in 401(k) assets, no matter what the rate of return. Beginning with the third decile, however, 401(k) assets at retirement would likely be substantial relative to Social Security wealth. For families with incomes in the upper four deciles of the income distribution, the mean 401(k) balance exceeds Social Security wealth provided at least half of the 401(k) assets were allocated to stocks. The after-tax income associated with the 401(k) balance could still fall below the value of Social Security payments for some of these households, since 401(k) distributions are likely to be taxed more heavily than Social Security benefits.

If 401(k) participants invest all of their assets in stocks, and if stocks continue to deliver returns like those in the last seven decades, then 401(k) plus rollover wealth would exceed Social Security wealth (on average) in the five highest income declies. Since Social Security benefits do not rise substantially with lifetime income above roughly the median of the income distribution, it is not surprising that 401(k) balances, which are based on contributions that were proportional to earnings, become larger than Social Security benefits at higher income levels. We suspect that our C(25) projections underestimate future 401(k) participation by low-income households, but we have yet to find a way to address this difficulty.

As emphasized above, in comparing the projected differences in participation rates by earnings decile, it is important to recognize that actual experience for particular households could well be quite different from our mean projections, even if our average participation rates are realistic. The dispersion of 401(k) accumulations is substantial in every earnings decile.

The second column in each panel of Table 5 reports the value that 401(k) assets that were withdrawn in the form of lump sum distributions would have attained if they had been allowed to remain within the 401(k) system. The results show that the value of this "foregone saving" is small relative to the value of 401(k) balances for most earnings deciles. On average, the foregone saving is less than five percent of the value of the 401(k) and rollover balance. For households in the bottom deciles of the earnings distribution, the foregone saving is larger relative to the 401(k) accumulation. This is because we have assumed that the probability of cashing out a smaller 401(k) balance is larger than that for a larger balance. Households in the bottom part of the

earnings distribution are more likely to have small balances than are households higher up in the earnings distribution.

One way to place the magnitude of such lump sum distributions in perspective is to note that the impact of a 35 or 70 basis point annual administrative charge on 401(k) accounts is much larger, in terms of assets at retirement, than the impact of lump sum distributions. The foregone saving, due to pre-retirement withdrawals, reduces accumulated assets in the all bond portfolio by 3.5% and in the all stock portfolio by 4.4%. If we had not charged 401(k) accounts with any expenses for investment management, the projections would have ranged from $61,200 to $209,200, or between five and thirteen percent greater than the projections we report. That is, the administration expense reduces accumulated balances in the bond portfolio by 5.4% and balances in the stock portfolio by 13.3%. Thus reductions in administration expenses could do more to increase saving than reduction in pre-retirement withdrawals

Table 7 presents information similar to that in Table 6, except we now focus on the C(15) cohort. Under the C(15) assumptions, the mean 401(k) balances at age 65 range from $74,300 to $247,100. These projections imply substantially larger 401(k) assets relative to Social Security wealth for the lower earnings deciles than the earlier C(25) projections. In the C(15) case, even the families in the third decile could accumulate pretax 401(k) assets that could be an important fraction of Social Security wealth. If 401(k) accounts were invested in assets that earned returns as high as those on equities in the last seventy years, then even those in the fourth income decile would accumulate 401(k) assets that were larger, on average, than their Social Security wealth.

Finally, Table 8 presents additional information like that in Tables 6 and 7, except that we now consider the case of universal coverage for 401(k) plans. In modeling universal coverage, we assume that all workers contribute to a 401(k) plan, but that they may withdraw their accumulated 401(k) balance if they change jobs. One could alternatively model the case in which account balances must be held until the individual reaches age 65. By adding together our 401(k) and rollover balance, and the foregone saving entry, we can evaluate the balance that would accumulate in such accounts.

We project that universal 401(k) coverage, even with withdrawals allowed at job change, would result in substantially higher mean 401(k) balances at age 65 than either our C(25) or C(15) participation assumptions. The differences are particularly pronounced in the lower part of the income distribution. We project mean 401(k) balances at age 65 ranging from $98,100 to $356,300, depending on the asset allocation for 401(k) accounts. Universal coverage could yield mean pretax 401(k) balances that would exceed Social Security wealth in all but the lowest lifetime earnings decile, at least if 401(k) investors earned returns comparable to those on equities over the last seven decades. In the case of universal coverage, 401(k) assets would almost surely represent an important share of Social Security wealth even in the lowest income deciles.

The results in Tables 6 through 8 can be used to assess the importance of our earlier modeling error in the definition of $J_a$. By adding together the "401(k) + Rollover" column, and the "foregone saving" column, we can estimate the total 401(k) balance at retirement if there were no potential withdrawals. Appendix Table A-1

reports new calculations that are comparable to our previous estimates. In particular, our previous calculations did not allow for administrative costs on 401(k) investments. The results in Table A-1 preserve this assumption, and therefore differ from the results in Tables 6 and 7. Comparing the results in Appendix Table A-1 with those in our earlier paper suggests that our modeling error understated the projections by about 20 percent.

All of our projections so far assume that 401(k) investors earn the same return in every year, conditional on their asset allocation. In practice, both stock and bond returns are random, and there is substantial uncertainty surrounding the retirement wealth that will be associated with a given contribution history. To consider this possibility, we replaced our assumption of certain returns with a random returns scenario. We illustrate our findings for the C(25) cohort. In each year of our projection, we draw one value from the post-1926 distribution of actual bond and stock returns reported in Ibbotson Associates (1997). Because returns are now random, the projected value of 401(k) balances at retirement will differ across projections, depending on the random returns that happen to be drawn in a given projection. We ran one thousand such projections for the C(25) cohort, and tabulated our findings.

Table 9 shows the distribution of the mean 401(k) wealth at retirement, averaged across all earnings deciles. The entries in this table are comparable to the last row of Table 6. The results are graphed in Figure 3. The results show that the median 401(k) balance at retirement, especially when a substantial share of the 401(k) portfolio is invested in equities, is below the mean. In the case of a 50-50 bond-stock portfolio, for example, Table 6 shows a mean 401(k) and rollover balance of $98,800, while the median value is $94,600. The mean in this case lies between the 50$^{th}$ and 60$^{th}$

percentiles of the distribution. For the all stock case, the mean is between the 60th and 70th percentiles of the distribution of realized outcomes. The most appropriate single measure is unclear. The results also draw attention to the great differences between the bond and stock distributions. For example, 95% of bond returns are below $85,800, but only slightly more than 20% of stock returns are below this level.

We plan further work in the future on random asset returns and the growth of 401(k) balances. The results above, however, make clear the wide variation in potential system-wide returns, especially stock market returns.

## 5. An Early Review of Post-1993 401(k) Participation and Contribution Behavior

The projections of future 401(k) growth reported above were based on 1993 data from the Survey of Income and Program Participation. We now have data for 1996, from the SIPP, which permits us to evaluate the plausibility of our 1993-based projections. We have not yet recalibrated the projections to use the 1996 data, because we are waiting for some additional SIPP information on pension coverage and household net worth.

The 1996 SIPP data suggest that, if anything, our projections for 401(k) expansion have been conservative. Figure 4 is just like Figure 1, but with two additions. The 1996 data have been added for each cohort, and data for two younger cohorts–C(22) and C(17)–have been added. The C(27) starting point for our earlier projections is circled. It is clear that eligibility rates have continued to rise. The figure shows age-specific 401(k) eligibility rates for different age cohorts.

Figure 5 shows participation rates for these same cohorts, including the 1996 data. The participation rate increases between 1993 and 1996 were very substantial.

Following the dotted lines on the figure can identify differences between the participation rates of successive cohorts at selected ages. For example, the participation rate of persons in the C(27) cohort at age 38 was about ten percentage points higher that the rate of persons in the C(32) cohort at age 38. The difference between the C(17) and C(22) cohort at age 28 is 8 percentage points. Recall that our projections assume that 401(k) participation rises by twenty percentage points every ten years. Note that while we refer to the latest data as being from 1996, in fact, these data were collected closer to 2 1/2 years after the 1993 survey. Thus the annual increase in eligibility has been greater than the graphical comparison implies.[6]

Figure 5 includes the information in Figure 2 as well as 1996 data and data for the C(22) cohort. The actual eligibility rate of the C(27) cohort at age 38 is in fact somewhat greater than our projected rate. In addition, the C(22) rate at age 33 is well above the projected rate for the C(25) cohort at that age. These comparisons suggest that our projections are conservative, at least over their first few years. One of our future plans is to use the 1996 data, along with new SIPP-based information on asset balances, to recalibrate our benchmark participation and contribution rates for different ages.

## 6. Conclusions and Future Directions

This paper presents new evidence on amount of retirement saving that currently-working households are likely to accumulate in their 401(k) plans. Today's young and middle aged households have much higher 401(k) participation rates than current retirees did at similar ages. In addition, the rate of 401(k) participation has risen and seems likely to continue to rise for all age groups. As a result, 401(k) saving is likely to

play a much larger part in the financial preparation for retirement of future retirees than of current and past retirees.

We present new estimates of the amount of such saving that households reaching age 65 in 2025, and in 2035, are likely to accumulate. We improve on previous estimates by explicitly recognizing the possibility of pre-retirement withdrawals from the 401(k) system through lump-sum distributions, and by allowing for asset management costs associated with 401(k) accounts. We find that lump sum distributions have a relatively small impact on the amount of saving that households accumulate in 401(k) accounts. The possibility of taking lump-sum distributions appears to reduce retirement accumulations by only about five percent relative to what they would be if households were prevented from taking such distributions. This effect is smaller than the effect of allowing for modest administrative expenses for these accounts.

Our calculations assume that participation and contribution behavior would be the same if there were no lump sum distributions as they are at present. In fact, the option of withdrawing assets as a lump sum may encourage 401(k) participation by some households. Recognizing the potential effect of 401(k) plan provisions on participation decisions is a topic we reserve for future work.

Projecting the average 401(k) account balance for those who will retire two and three decades into the future is necessarily fraught with great uncertainty. Some sources of uncertainty, such as systematic changes in household attitudes toward saving, or reforms of the Social Security system that alter the basic structure of financial preparation for retirement, are difficult to predict. There are other sources of uncertainty in our projections, however, that can be reduced with further empirical work.

One difficulty with our current algorithm is that it is based on data that are less reliable for younger individuals than for older ones. With respect to lump sum distributions, the Current Population Survey only asks individuals over age 40 about their pension benefits and past lump-sum payouts. The Health and Retirement Survey, the other premier source of information on pension benefits, is limited because the basic sampling frame was individuals between the ages of 51 and 62 in 1992. Although the HRS includes retrospective questions that elicit some data on employment transitions before individuals joined the HRS panel, there is naturally some concern about the quality of the resulting data for job separations that occurred long ago. Job transitions that occur early in an individual's career typically do not involve large 401(k) balances, but because there are many years remaining before the individuals receiving these balances would retire, they could grow to represent substantial retirement resources.

A second area in which our algorithm could be improved is in the link between job separation and job tenure. Jobs that have already lasted a long time tend to have lower probabilities of ending than "younger" jobs. At the moment, our algorithm allows for age-dependent probabilities of job separation, but we have not allowed for an individual's job tenure, or an individual's earnings decile, to affect the probability of a job transition and the associated possibility of a 401(k) withdrawal. The ideal database for our purposes would identify workers who participate in 401(k) plans and then permit estimates of job change probabilities conditional on age, earnings, and the worker's job tenure. The significant expansion of the set of questions about pension coverage in the 1996 Survey of Income and Program Participation should provide much of the information that is needed for such a detailed calculation.

Finally, our analysis has focused on retirement as an event that occurs at age 65. In practice, some 401(k) participants are likely to leave the labor force before that age, and therefore to begin drawing down their 401(k) account balances earlier than our assumptions imply. Other workers may remain in the labor force after age 65, particularly in future decades when the Social Security retirement age is higher than at present. For these workers, 401(k) assets are likely to be larger than our projections suggest, both because they will have more years for accruing tax-deferred returns and because they will contribute for more years than our calculations suggest. Allowing for a distribution of retirement ages is something we hope to incorporate in future versions of our algorithm.

In addition, although we give some attention to the system-wide risk due to randomness in market returns, we do not treat the additional individual risk due to 401(k) participation and individual asset allocation decisions.

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| Table 1: Uses of Lump Sum Pension Plan Distributions Reported in September 1994 CPS Supplement | | |
|---|---|---|
| Use of Lump Sum Distribution | Number of Recipients (millions) | Percent of Primary Use Recipients |
| Retirement Saving | 2.32 | 33.9% |
| Business or Home Expansion, or Repaying Debts | 1.46 | 21.3 |
| Other Saving or Investments | 1.25 | 18.2 |
| Current Spending | 1.82 | 26.6 |
| Total Identifying Primary Use | 6.85 | 100.0 |
| Multiple Uses | 1.53 | ---- |
| Other Uses or No Response | 0.73 | ---- |
| TOTAL | 9.10 | ---- |
| Source: U.S. Department of Labor (1995), Table C5. | | |

| Table 2: Probability of Leaving a Job at Various Ages, Conditional on Job Offering a Defined Contribution Pension Plan | | |
|---|---|---|
| Age | Men | Women |
| 30 | 1.25% | 1.73% |
| 35 | 1.47 | 1.36 |
| 40 | 1.19 | 1.18 |
| 45 | 2.05 | 1.69 |
| 50 | 3.51 | 4.21 |
| 55 | 5.26 | 4.26 |
| Source: Authors' tabulations using Wave 1 of the Health and Retirement Survey. | | |

| Table 3: Probability of Cashing Out a Defined Contribution Plan, Conditional on Opportunity to Withdraw Funds and on Size of Defined Contribution Balance | | |
|---|---|---|
| 401(k) Balance at Time of Separation ($1992) | Number of Sample Observations | Cash-Out Probability |
| < $ 2000 | 60 | 60.00 |
| 2000-5000 | 44 | 38.64 |
| 5000-10000 | 40 | 27.50 |
| 10000-15000 | 30 | 13.33 |
| 15000-25000 | 52 | 21.15 |
| 25000-50000 | 46 | 2.17 |
| 50000-100000 | 41 | 4.88 |
| > 100000 | 34 | 2.94 |
| ALL | 347 | 23.92 |
| Source: Tabulations from the Health and Retirement Survey by Constantijn Panis. | | |

**Table 4: Mean 1992 Assets of HRS Families**

| Earnings Decile | Asset Category | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total Wealth | Total Wealth Excluding Social Security | Employer Pension Assets | Total Personal Retire-ment | Non-Retire-ment Financial | 401(k) Assets | Social Security Wealth |
| First | 270238 | 208721 | 39162 | 9679 | 44964 | 620 | 61517 |
| Second | 228538 | 154438 | 40002 | 11114 | 27692 | 1025 | 74100 |
| Third | 251170 | 167115 | 34394 | 9857 | 27194 | 2648 | 84055 |
| Fourth | 269872 | 176423 | 36749 | 10586 | 29904 | 2192 | 93449 |
| Fifth | 301348 | 199755 | 52522 | 20754 | 36609 | 4049 | 101593 |
| Sixth | 378252 | 270121 | 75745 | 21483 | 45592 | 6366 | 108131 |
| Seventh | 415763 | 301077 | 94361 | 31245 | 46029 | 11322 | 114686 |
| Eighth | 479383 | 354268 | 105368 | 40228 | 61423 | 13514 | 125115 |
| Ninth | 590440 | 458410 | 133091 | 44373 | 84192 | 19767 | 132030 |
| Tenth | 1007740 | 864328 | 219055 | 109441 | 148277 | 48709 | 143412 |
| ALL | 415833 | 312441 | 82212 | 30465 | 54724 | 10808 | 103392 |

Source: Authors' tabulations from 1992 Health and Retirement Survey, Wave 1. All entries are measured in 1992 dollars.
Note: The sample includes all families with head aged 51 to 61, at least one member employed, and having matched Social Security records. The Social Security wealth does not include the value of spousal survivorship benefits. It is the sum of benefits based on the husband's and the wife's earnings.

| Table 5: Mean of Simulated 401(k) Balances, and 401(k) Plus Rollover Balances, Health and Retirement Survey Families | | | | | | | |
|---|---|---|---|---|---|---|---|
| Earnings Decile | Observed HRS 401(k) Balance | Means of Simulated 401(k) Balances | | | Means of Simulated 401(k) and Rollover Balances | | |
| | | Bonds | 50-50 | S&P 500 | Bonds | 50-50 | S&P 500 |
| First | 620 | 164 | 175 | 185 | 183 | 196 | 208 |
| Second | 1025 | 666 | 710 | 753 | 755 | 809 | 862 |
| Third | 2648 | 1677 | 1794 | 1908 | 1968 | 2110 | 2251 |
| Fourth | 2192 | 2665 | 2853 | 3038 | 3133 | 3373 | 3621 |
| Fifth | 4049 | 4205 | 4504 | 4797 | 5023 | 5407 | 5781 |
| Sixth | 6366 | 6467 | 6929 | 7383 | 7743 | 8341 | 8924 |
| Seventh | 11322 | 9407 | 10079 | 10739 | 11316 | 12184 | 13038 |
| Eighth | 13514 | 13990 | 14997 | 15987 | 16766 | 18027 | 19289 |
| Ninth | 19767 | 20612 | 22106 | 23574 | 24806 | 26716 | 28619 |
| Tenth | 48709 | 29677 | 31788 | 33863 | 35944 | 38688 | 41409 |
| All | 10808 | 8953 | 9593 | 10223 | 10764 | 11585 | 12400 |
| Source: Authors' tabulations and projections from 1992 Health And Retirement Survey. | | | | | | | |

| Table 6: Projected Mean 401(k) and "Rollover" Balances at Retirement, and Foregone Saving Due to 401(k) Withdrawals: C(25) Cohort with 35 Basis Point Reduction for Bonds and 75 Basis Point Reduction for Stocks | | | | | | | |
|---|---|---|---|---|---|---|---|
| Earnings Decile | Social Security Wealth | All Bond Portfolio | | 50-50 Bond/Stock Porfolio | | All Stock Portfolio | |
| | | 401(k) + Rollover | Fore-gone Saving | 401(k) + Rollover | Fore-gone Saving | 401(k) + Rollover | Fore-gone Saving |
| First | 61.5 | 0.7 | 0.2 | 1.4 | 0.3 | 2.7 | 0.6 |
| Second | 74.1 | 5.1 | 0.5 | 9.2 | 0.9 | 17.3 | 1.8 |
| Third | 84.1 | 11.7 | 0.9 | 20.7 | 1.6 | 38.8 | 3.1 |
| Fourth | 93.4 | 22.1 | 1.4 | 38.8 | 2.5 | 72.9 | 4.8 |
| Fifth | 101.6 | 29.4 | 1.6 | 50.7 | 3 | 93.9 | 6.1 |
| Sixth | 108.1 | 40.2 | 2 | 69.2 | 3.8 | 128 | 7.8 |
| Seventh | 114.7 | 67.4 | 2.4 | 116.6 | 4.8 | 216.4 | 10.1 |
| Eighth | 125.1 | 89.3 | 3.2 | 153.5 | 6.3 | 283.4 | 13.2 |
| Ninth | 132.0 | 123.4 | 3.7 | 210.5 | 7.7 | 386.7 | 16.1 |
| Tenth | 143.4 | 189.4 | 4.8 | 317.6 | 9.5 | 574.2 | 19.6 |
| | | | | | | | |
| TOTAL | 103.4 | 57.9 | 2.1 | 98.8 | 4 | 181.4 | 8.3 |
| Note: All entries in thousands of 1992 dollars | | | | | | | |

**Table 7: Projected Mean 401(k) and "Rollover" Balances at Retirement, and Foregone Saving Due to 401(k) Withdrawals: C(15) Cohort with 35 Basis Point Reduction for Bonds and 75 Basis Point Reduction for Stocks**

| Earnings Decile | Social Security Wealth | All Bond Portfolio | | 50-50 Bond/Stock Porfolio | | All Stock Portfolio | |
|---|---|---|---|---|---|---|---|
| | | 401(k) + Rollover | Fore-gone Saving | 401(k) + Rollover | Fore-gone Saving | 401(k) + Rollover | Fore-gone Saving |
| First | 61.5 | 2 | 0.4 | 3.8 | 0.8 | 7.5 | 1.6 |
| Second | 74.1 | 10.7 | 1.1 | 19.4 | 2.1 | 37.6 | 4.2 |
| Third | 84.1 | 21.8 | 1.7 | 39.6 | 3 | 76.5 | 6.2 |
| Fourth | 93.4 | 36.7 | 2.3 | 66.3 | 4.3 | 128.1 | 8.8 |
| Fifth | 101.6 | 47.3 | 2.5 | 84 | 5 | 160.1 | 10.6 |
| Sixth | 108.1 | 61.7 | 3 | 109.3 | 6 | 207.8 | 12.9 |
| Seventh | 114.7 | 89.7 | 3.4 | 159.5 | 6.9 | 304.7 | 14.9 |
| Eighth | 125.1 | 112.4 | 4.2 | 198.4 | 8.7 | 377 | 18.7 |
| Ninth | 132.0 | 145.6 | 4.5 | 255 | 9.6 | 482 | 20.5 |
| Tenth | 143.4 | 215.4 | 5.6 | 370.7 | 11.5 | 689.9 | 24.2 |
| | | | | | | | |
| TOTAL | 103.4 | 74.3 | 2.9 | 130.6 | 5.8 | 247.1 | 12.2 |

Note: All entries in thousands of 1992 dollars.

**Table 8: Projected Mean 401(k) and "Rollover" Balances at Retirement, and Foregone Saving Due to 401(k) Withdrawals Assuming Universal 401(k) Participation with 35 Basis Point Reduction for Bonds and 75 Basis Point Reduction for Stocks**

| Earnings Decile | Social Security Wealth | All Bond Portfolio | | 50-50 Bond/Stock Porfolio | | All Stock Portfolio | |
|---|---|---|---|---|---|---|---|
| | | 401(k) + Rollover | Fore-gone Saving | 401(k) + Rollover | Fore-gone Saving | 401(k) + Rollover | Fore-gone Saving |
| First | 61.5 | 11.3 | 2.5 | 22.4 | 4.9 | 47.3 | 10.1 |
| Second | 74.1 | 33.1 | 3.6 | 64.7 | 7.3 | 134.5 | 15.6 |
| Third | 84.1 | 49.9 | 4 | 96.3 | 8.1 | 198.4 | 17.9 |
| Fourth | 93.4 | 65.2 | 4.4 | 124.5 | 8.9 | 254.8 | 18.9 |
| Fifth | 101.6 | 80.6 | 4.6 | 151.5 | 9.7 | 305.7 | 21.8 |
| Sixth | 108.1 | 95.9 | 5.1 | 178.4 | 10.6 | 356.7 | 24 |
| Seventh | 114.7 | 113.5 | 4.6 | 209.3 | 9.7 | 415.7 | 21.9 |
| Eighth | 125.1 | 133.9 | 5.4 | 244.2 | 11.4 | 480.8 | 25.7 |
| Ninth | 132.0 | 163.6 | 5.4 | 295.5 | 11.6 | 577.2 | 25.6 |
| Tenth | 143.4 | 234 | 6.5 | 413.3 | 13.6 | 792.1 | 29.1 |
| | | | | | | | |
| TOTAL | 103.4 | 98.1 | 4.6 | 180 | 9.6 | 356.3 | 21.1 |

Note: All entries in thousands of 1992 dollars.

**Table 9: Distribution of Projected Mean 401(k) and "Rollover" Balances at Retirement, and Foregone Saving Due to 401(k) Withdrawals: C(25) Cohort, 1,000 Draws from Empirical Distribution of Returns Adjusted for Administrative Costs (35 Basis Points for Bonds and 75 Basis Points for Stocks)**

| Percentile | All Bond Portfolio | | 50-50 Bond/Stock Porfolio | | All Stock Portfolio | |
|---|---|---|---|---|---|---|
| | 401(k) + Rollover | Fore-gone Saving | 401(k) + Rollover | Fore-gone Saving | 401(k) + Rollover | Fore-gone Saving |
| 5 | 39.9 | 1.3 | 50.3 | 1.8 | 49.6 | 1.7 |
| 10 | 43.3 | 1.4 | 57.7 | 2.1 | 60.6 | 2.2 |
| 20 | 46.4 | 1.6 | 68.1 | 2.5 | 81.6 | 3.1 |
| 30 | 49.7 | 1.7 | 76.7 | 2.9 | 102.2 | 4.1 |
| 40 | 52.1 | 1.8 | 83.7 | 3.3 | 123.5 | 5.1 |
| 50 | 56.1 | 1.9 | 94.6 | 3.7 | 145.8 | 6.3 |
| 60 | 59.1 | 2.1 | 103.5 | 4.2 | 177.1 | 7.8 |
| 70 | 63.1 | 2.3 | 115.1 | 4.7 | 211.4 | 9.6 |
| 80 | 68.8 | 2.5 | 127.9 | 5.4 | 255 | 12.2 |
| 90 | 76.6 | 2.8 | 149 | 6.5 | 345 | 16.9 |
| 95 | 85.8 | 3.2 | 178.3 | 7.8 | 450.2 | 27.2 |

Note: All entries in thousands of 1992 dollars.

**Appendix Table A1: Projected 401(k) Balances at Retirement Reported in Poterba, Venti, and Wise (1998a)**

| Earnings Decile | Cohort C(25) (Age 65 in 2025) | | | Cohort C(15) (Age 65 in 2035) | | |
|---|---|---|---|---|---|---|
| | Bonds | 50-50 | Stocks | Bonds | 50-50 | Stocks |
| First | 974 | 1839 | 3699 | 2556 | 4927 | 10123 |
| Second | 5759 | 10691 | 21175 | 12605 | 24000 | 48841 |
| Third | 13092 | 24173 | 47843 | 24506 | 46469 | 94560 |
| Fourth | 24820 | 45500 | 89863 | 41142 | 77766 | 158417 |
| Fifth | 32848 | 59385 | 115971 | 53390 | 99686 | 201061 |
| Sixth | 45282 | 81172 | 159549 | 69710 | 129458 | 260355 |
| Seventh | 74286 | 134308 | 262478 | 98953 | 184478 | 372183 |
| Eighth | 98624 | 177764 | 346543 | 124006 | 229812 | 461382 |
| Ninth | 134707 | 240686 | 465290 | 159150 | 292720 | 583877 |
| Tenth | 204271 | 357826 | 680483 | 233532 | 420937 | 825739 |
| All | 63466 | 113394 | 219289 | 81955 | 151034 | 301654 |

Note: Authors' calculations as described in the text. Results for Universal 401(k) Participation are the same as those in Poterba, Venti, and Wise (1998a).

1. See U.S. Department of Labor [1997]. The form 5500 reports tabulate contributions to private sector 401(k) plans. They do not include contributions to section 457 (public sector) or 403(b) (non-profit) plans, or public employees' contributions to 401(k) plans.

2. We projected participation for all ages of the C(15) cohort by adding a constant term to the participation probit equation so that the C(25) projections for the 5th and 6th income deciles would increase by 20 percentage points. The same constant term was added to the probit equations for all income deciles. The highest deciles don't increase by 20 points because of the upper limit of 100 percent. The lower deciles are increased less than 20 points, because of the properties of the probit functional form.

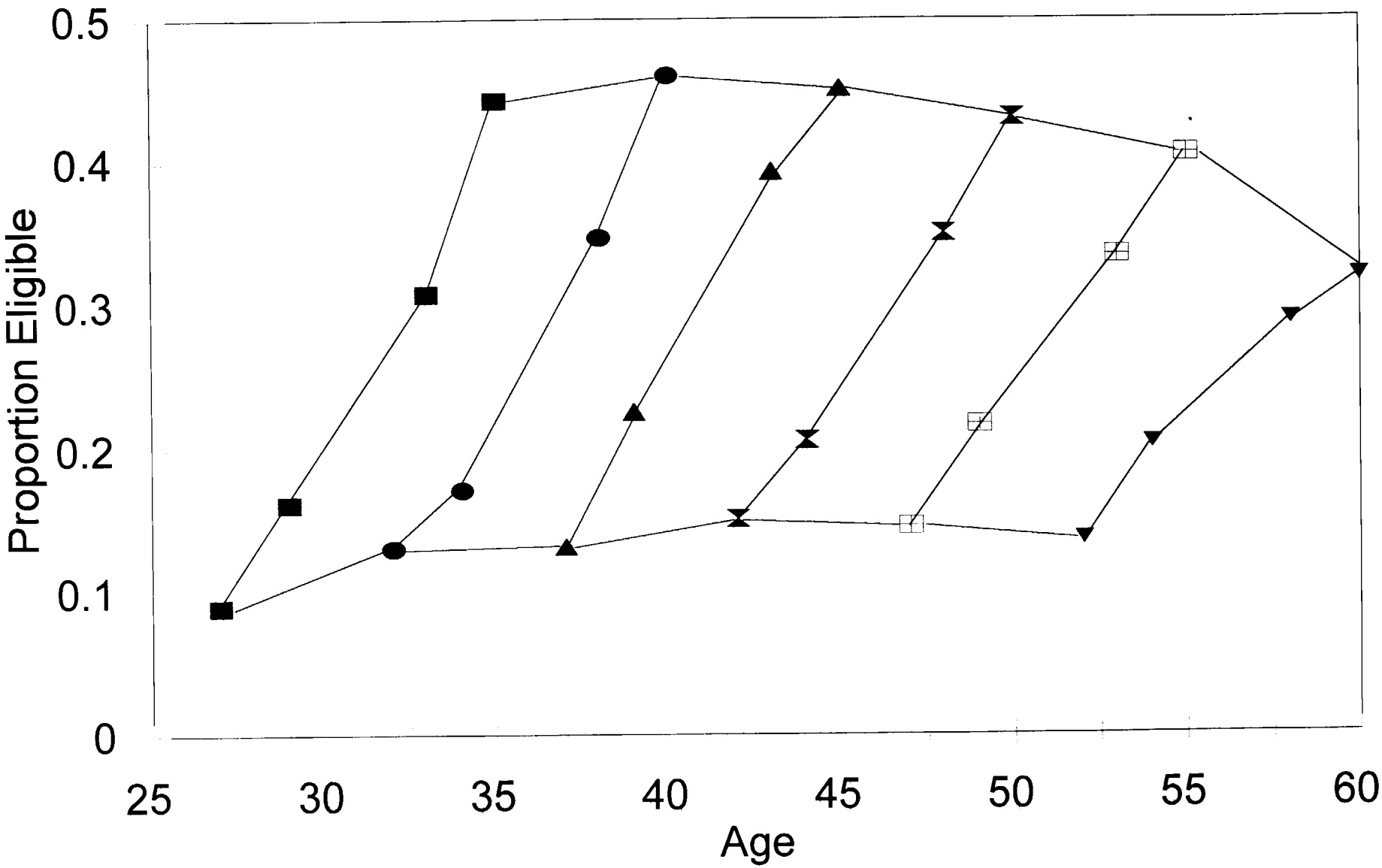
3. These data were obtained from the CPS Utilities, provided to us by Unicon Inc. We actually construct a "synthetic HRS" sample of persons age 41 to 51 in each of the 10 earnings deciles in 1982. This sample is "aged" through 1992, assigning families to participate and contribute to a 401(k) at rates determined by the estimates from the SIPP and the CPS and recognizing the possibility of job terminations.

4. This is a significant assumption, since in fact relative household income does vary from year to year. Whether such variation matters substantially for 401(k) accumulations over a lifetime is an issue we hope to consider in the future.

5. The actual survey dates and the number of "years" after the 1984 wave 4, which was interviewed between September and December 1994, are as follows: 1985 Wave 7 and 1986 Wave 4, January-April 1987 (2 years); 1990 Wave 4, February-May 1991 (6 years); 1991 Wave 7 and 1992 Wave 4, February- May 1993 (8 years); and 1993 Wave 9, October 1995-January 1996 (11 years).

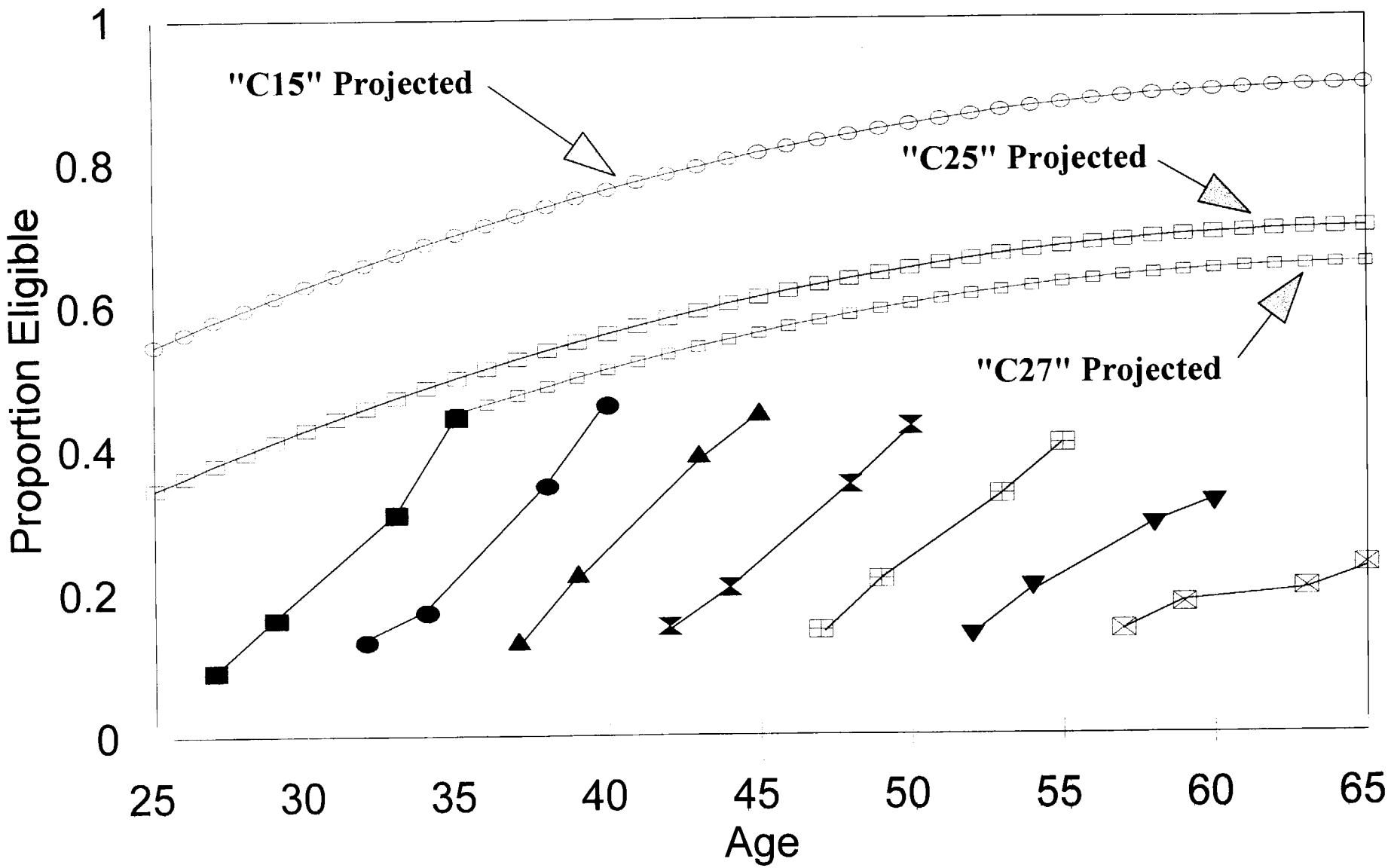
# F1. 401(k) Eligibility by Cohort

1984 1987, 1991, 1993



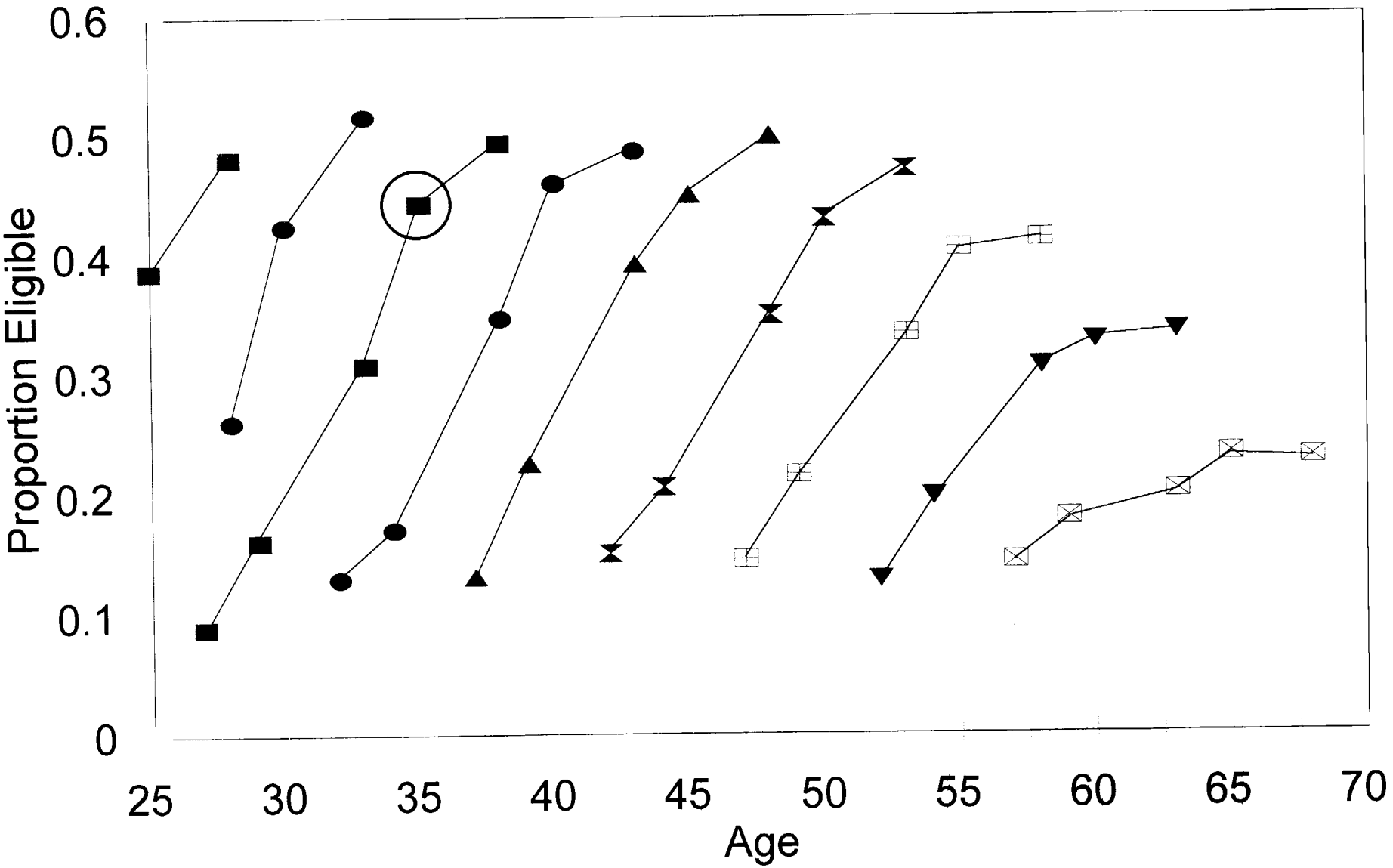
# F2. 401(k) Eligibility by Cohort

## With Illustrative Projections



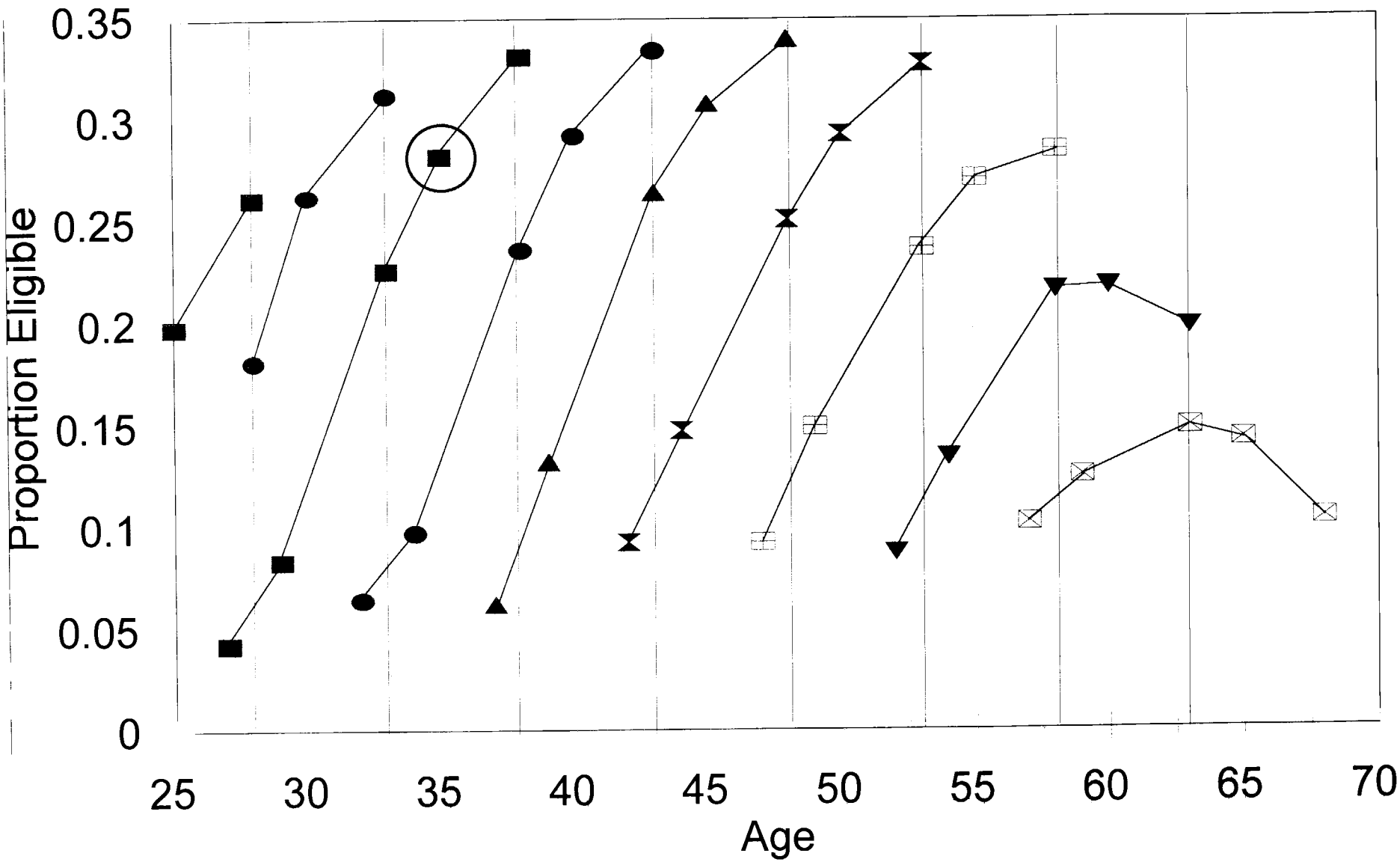
# F3. 401(k) Eligibility by Cohort

## 1984 1987, 1991, 1993, 1996



# F4. 401(k) Participation by Cohort

## 1984 1987, 1991, 1993, 1996



# F5. 401(k) Eligibility by Cohort

## With Illustrative Projections