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The Rise of 401(k) Plans, Lifetime Earnings, and Wealth at Retirement

James M. Poterba, Steven F. Venti, and David A. Wise

Over the past two-and-a-half decades there has been a fundamental change in the way people save for retirement in the United States. There has been a rapid shift from saving through employer-managed defined benefit (DB) pensions to defined contribution (DC) retirement saving plans that are largely controlled by employees. Just two or three decades ago, employer-provided DB plans were the primary means of saving for retirement in the United States. But since that time, 401(k) and other personal retirement accounts have become the principal form of retirement saving in the private sector. More than 80 percent of private retirement plan contributions in 2000 and 2001 were to 401(k) and other personal accounts. The DB plans have remained an important form of retirement saving for federal employees and for state and local employees, although even for these employees personal retirement accounts are becoming increasingly important. Contributions to personal retirement plans accounted for only 12 percent of total contributions to Federal pension plans in 2000, but had increased to 17 percent by 2004. We do not have quantitative data on state and local DC

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plans but anecdotal evidence suggests that contributions to these plans are growing rapidly as well. This transition to personal retirement saving has important implications for the well-being of the elderly and perhaps for design changes in Social Security as well.

In Poterba, Venti, and Wise (2007a), we described the rise of 401(k) plans and the implications of this rise for the flow of assets into and out of 401(k) plans over the next four decades. In Poterba, Venti, and Wise (2007b) we described the decline in DB plans and assessed the implications of the decline for the flow of assets into and out of DB plans over the next four decades. Our projections suggest that the average (over all persons) present value of real DB benefits at age sixty-five achieved a maximum in 2003, when this value was $72,637 (in year 2000 dollars), and then began to decline. The projections also suggest that by 2010 the average level of 401(k) assets at age sixty-five will exceed the average present value of DB benefits at age sixty-five. Thereafter the value of 401(k) assets grows rapidly, attaining levels much greater than the historical maximum present value of DB benefits. If equity returns between 2006 and 2040 are comparable to those observed historically, by 2040 average projected 401(k) assets of all persons age sixty-five will be over six times larger than the maximum level of DB benefits for a sixty-five-year-old achieved in 2003 (in year 2000 dollars). Even if equity returns average 300 basis points below their historical value, we project that average 401(k) assets in 2040 would be 3.7 times as large as the value of DB benefits in 2003.

These analyses consider changes in the aggregate level of pension assets. Although the projections indicate that the *average* level of retirement assets will grow very substantially over the next three or four decades, it is also clear that the accumulation of assets in 401(k)-like plans will vary across households. Whether a person has a 401(k) plan is strongly related to income. Low-income employees are much less likely than higher-income employees to be covered by a 401(k) or similar type of tax-deferred personal account plan. Thus, in this chapter we focus on the accumulation of 401(k) assets by lifetime earnings deciles. Because we are interested in the relationship between Social Security wealth and the future change in 401(k) assets, we also consider the accumulation of 401(k) assets by Social Security wealth deciles. We consider in particular how the combined accumulation of Social Security and 401(k) assets will change over the next three-and-a-half decades.

In section 10.1 we set out background data that helps to put in context the projections we present in this chapter. In section 10.2 we set out the method that we use to project 401(k) assets. In section 10.3 we describe the average level of 401(k) assets for cohorts that attain retirement age in each year through 2040. In section 10.4 we describe the rise in 401(k) assets by lifetime earning deciles and by Social Security wealth deciles and then consider how the total of Social Security and 401(k) assets will change between 2000 and 2040.

10.1 Background

We describe first the relationship between age and earnings, and current 401(k) eligibility and participation rates. We then describe current levels of dedicated retirement assets—Social Security and private pensions—for persons near retirement age.

Table 10.1 shows 401(k) plan eligibility and participation rates by annual earnings and by age in 2003, based on data from the Survey of Income and Program Participation (SIPP). The table shows 401(k) eligibility and participation rates for families that have been created by matching SIPP data for persons. The "age" of the family is the age of the reference person. A family participates in (is eligible for) a 401(k) plan if either spouse participates in (is eligible for) a 401(k) plan. The sample is restricted to families with positive earnings in 2003. These eligibility and participation rates pertain to all employer-based 401(k)-like saving plans, but exclude participation in Keogh and individual retirement account (IRA) plans. Eligibility rates do not differ much by age. But families with low earnings are much less likely than families with higher earnings to be covered by 401(k) plans. Over 87 percent of families with earnings greater than $100,000 per year were eligible for a 401(k) plan; less than 36 percent of families with earnings less than $25,000 per year were eligible. Participation follows a similar pattern. About 80 percent of families with annual earning over $100,000 participate; about 20 percent of families with earnings less than $25,000 participate.

It is likely that in the future 401(k) participation rates will also vary by earnings and thus the level of 401(k) assets will vary by earnings. In other words, there is likely to be a strong relationship between lifetime earnings

Table 10.1 **401(k) eligibility and participation, by age and earnings**

	Age			
Earnings	< 35	35–50	50–65	All
		Eligibility		
< $25k	33.6	37.8	34.0	35.2
25–50	65.0	66.1	64.1	65.2
50–100	79.9	81.3	78.0	80.1
> $100k	86.7	88.4	85.6	87.2
All	56.4	64.0	56.5	59.6
		Participation		
< $25k	17.4	23.5	20.0	20.4
25–50	47.8	50.5	50.6	49.7
50–100	65.8	70.5	67.5	68.6
> $100k	75.1	81.3	80.6	80.0
All	40.4	51.0	44.1	45.9

Source: Author's calculations from the 2003 SIPP.

and 401(k) assets. Thus, the level of 401(k) assets relative to Social Security wealth will also vary greatly among families. In particular, the ratio of 401(k) assets to the present value of Social Security benefits is likely to be highest among families with greater Social Security benefits.

Table 10.2 shows average dedicated retirement assets in 2000 for households with heads sixty-three to sixty-seven by "*lifetime* earnings" deciles. Unlike table 10.1, this table includes families in which no member is employed, as well as families that include an employed person. Dedicated retirement assets include DB and 401(k) pension wealth as well as Social Security wealth and balances in IRA and Keogh plans. These estimates are based on data from the Health and Retirement Study (HRS). They pertain to families comprised of persons for whom the HRS obtained Social Security earnings records. The earnings are corrected for the Social Security earnings limit, as described in the appendix. The calculations for each asset category are also explained in the appendix.

There are several key features of the data. First, the category "401(k) assets" includes all 401(k)-like plans, such as 403(b) plans, 457 plans, employee stock option plans, supplemental retirement accounts, thrift saving plans, stock and profit-sharing plans, money purchase plans, as well as traditional employer-provided DC plans. Second, for this age group in particular, 401(k) and IRA assets must be considered jointly. A large fraction of assets in IRA plans are "rollovers" from 401(k) plans. Many new retirees "rollover" 401(k) assets into an IRA plan when they retire or have "rolled over" 401(k) assets into an IRA in the past when they changed jobs. For example, 89 percent of flows into IRA accounts were rollovers in 1996, 89 percent in 1997, 93 percent in 1998, 95 percent in 1999, and 96 percent were rollovers in 2000.[1] In the subsequent analyses we present projections of 401(k) assets, including assets that would have been rolled over into IRA accounts. Third, the sum of 401(k) and IRA assets is large, greater than average DB assets for all deciles combined. But even for the lower lifetime earnings deciles the amounts in personal retirement accounts are substantial. Recall that IRA and 401(k) plans were introduced in 1982 so that households whose heads were sixty-three to sixty-seven in 2000 could have contributed for (at most) eighteen years to such plans. Copeland (2004) reports that persons with IRA accounts in 2001 had contributed an average of 8.2 years and persons with 401(k) plans in 2001 had contributed an average of 7.2 years.

Fourth, both dedicated retirement assets and total wealth increase noticeably with lifetime earnings, as would be expected. Following, we consider the ratio of assets and total wealth to lifetime earnings and find that this ratio does not show a systematic relationship to lifetime earnings.

Table 10.3 is similar to table 10.2 except that the deciles are defined by Social Security wealth (the discounted present value of expected Social

1. See Figure 5 of Holden et al. (2005).

Table 10.2 **Mean household assets by lifetime earnings decile, HRS respondents age 63 to 67 (year 2000 dollars)**

Lifetime earnings decile	Sum of lifetime earnings	SS wealth	DB pension wealth	401(k) assets	IRA and Keogh assets	401(k) + IRA and Keogh assets	Total dedicated retirement assets[a]	Other nonretirement nonhousing assets	Home equity	Total wealth
1	70,993	74,074	65,372	168	23,157	23,325	162,771	79,037	59,948	301,756
2	341,717	97,345	42,877	989	11,162	12,151	152,373	57,763	49,415	259,551
3	622,660	109,638	76,101	4,363	19,492	23,855	209,593	103,125	65,070	377,788
4	950,451	131,219	72,846	18,528	29,523	48,051	252,117	88,598	79,012	419,726
5	1,336,716	176,401	89,382	12,010	31,994	44,004	309,787	141,396	94,958	546,142
6	1,722,307	196,484	73,890	20,745	66,958	87,703	358,077	154,865	90,008	602,949
7	2,063,969	225,868	94,841	23,210	67,263	90,473	411,182	229,444	96,835	737,461
8	2,398,018	244,630	118,559	12,166	95,415	107,581	470,770	221,927	121,249	813,946
9	2,760,500	260,767	129,356	36,990	116,659	153,649	543,772	264,321	136,891	944,984
10	3,565,347	279,080	151,608	124,323	295,400	419,723	850,412	540,170	203,659	1,594,241
All	1,612,059	181,373	92,288	26,098	77,716	103,814	377,475	191,457	100,833	669,765

[a]Sum of DB, 401(k), SS, IRA, and Keogh assets.

Table 10.3 **Mean household assets by Social Security wealth, HRS respondents age 63 to 67 (year 2000 dollars)**

Social Security wealth decile	Sum of lifetime earnings	SS wealth	DB pension wealth	401(k) assets	IRA and Keogh assets	401(k) + IRA and Keogh assets	Total dedicated retirement assets[a]	Other nonretirement nonhousing assets	Home equity	Total wealth
1	580,433	4,130	102,978	4,689	30,909	35,598	142,707	114,801	76,699	334,207
2	439,816	63,202	45,689	3,638	15,744	19,382	128,272	77,025	46,049	251,347
3	809,662	104,223	77,392	13,945	25,255	39,200	220,815	67,327	53,617	341,760
4	1,196,148	144,732	84,379	19,690	50,006	69,696	298,806	130,049	84,076	512,931
5	1,413,009	185,295	89,797	18,934	47,513	66,447	341,540	142,331	108,009	591,880
6	1,693,391	220,624	53,015	26,382	54,731	81,113	354,752	179,014	96,581	630,347
7	2,053,137	243,583	78,149	19,908	72,888	92,796	414,527	198,514	98,891	711,932
8	2,469,990	260,405	121,052	33,613	122,325	155,938	537,395	272,371	131,956	941,722
9	2,641,173	275,658	125,599	78,679	168,943	247,622	648,878	393,285	148,379	1,190,542
10	2,820,765	311,403	144,801	41,332	188,555	229,887	686,091	339,298	163,932	1,189,321
All	1,612,059	181,373	92,288	26,098	77,716	103,814	377,475	191,457	100,833	669,765

[a]Sum of DB, 401(k), SS, IRA, and Keogh assets.

Security benefits) instead of lifetime earnings. A noticeable feature of these data is that households in the lowest Social Security wealth decile have relatively large personal pension wealth—$138,576 in non-Social Security dedicated retirement assets, compared to $88,697 for households in the lowest lifetime earnings decile. In addition, this group has an average of $334,207 in total wealth, somewhat greater than the total wealth of households in the lowest lifetime earnings decile. This apparent anomaly is, in part, a consequence of our measurement of lifetime earnings, which is based on Social Security earnings records. Some households were likely not eligible for Social Security over their entire working lives. Thus, in some years a person may have worked in a job not covered by the Social Security system. Earnings in these years are not included in the Social Security earnings records and thus not included in our measure of lifetime earnings. Thus, actual earnings may be greater than measured earnings, particularly in the lowest lifetime earnings decile.

Finally, in table 10.4 we show ratio of dedicated retirement assets to lifetime earnings and the ratio of total wealth to lifetime earnings. We consider these ratios by lifetime earnings decile (the left three columns of the table) and by Social Security wealth decile (the right three columns of the table). Recall that our "lifetime earnings" are based on earnings reported to the Social Security Administration. Persons who were never covered by Social Security are not in the data. Persons who were covered by Social Security for only a portion of their working lives are in the data, but for some their actual earnings may be considerably larger than Social Security earnings. The difference between actual and Social Security earnings is likely to be the

Table 10.4 **Ratio of dedicated retirement assets to Social Security lifetime earnings and ratio of total wealth to lifetime earnings, by lifetime earnings decile and by Social Security wealth decile**

Lifetime earnings decile	Dedicated retirement assets	Total wealth	Social Security wealth decile	Dedicated retirement assets	Total wealth
1	2.29	4.25	1	0.25	0.58
2	0.45	0.76	2	0.29	0.57
3	0.34	0.61	3	0.27	0.42
4	0.27	0.44	4	0.25	0.43
5	0.23	0.41	5	0.24	0.42
6	0.21	0.35	6	0.21	0.37
7	0.20	0.36	7	0.20	0.35
8	0.20	0.34	8	0.22	0.38
9	0.20	0.34	9	0.25	0.45
10	0.24	0.45	10	0.24	0.42
All	0.23	0.42	All	0.23	0.42

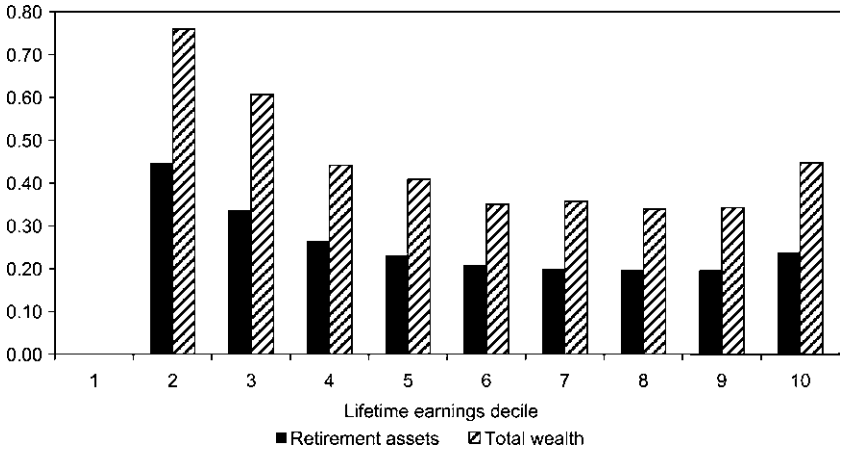

Fig. 10.1 Ratio of retirement assets to lifetime earnings and ratio of total wealth to lifetime earnings, by lifetime earnings decile

greatest for persons with low reported Social Security earnings, as discussed following.

Consider first the ratios by lifetime earnings decile, which are graphed in figure 10.1 (excluding the data for the lowest decile). The ratio of dedicated retirement assets to lifetime earnings (shown as dark bars in the figure) in the fourth to the tenth deciles varies only between 0.20 and 0.27. The variation in the ratio of total wealth to lifetime earnings is, to us, also surprisingly small over the fourth to the tenth deciles, ranging from 0.34 to 0.45. These data suggest that when dedicated retirement assets at age sixty-five are compared to lifetime earnings, the "retirement replacement rate" does not vary greatly by lifetime income. The data also seem to suggest that the total "saving rate" (including Social Security, housing wealth, and nonretirement financial assets) may not vary greatly by lifetime earnings deciles and in particular that the saving rate may not increase systematically with lifetime earnings. However, we emphasize the accumulation of retirement assets and not the saving rate as typically measured. There has been considerable analysis of this issue by others and we do not pursue the question further here.[2]

Since we are particularly interested in the relationship between Social Security wealth and other assets, we want to consider the ratios for deciles defined by Social Security wealth. They are shown in the last three columns of table 10.4 and are graphed in figure 10.2. The ratio of dedicated retirement assets to lifetime earnings within Social Security wealth deciles ranges

2. Gustman and Steinmeier (1999) and Venti and Wise (1998) find a relatively flat wealth to lifetime earnings profile. Dynan, Skinner, and Zeldes (2004) find an upward sloping profile. They also present a comprehensive review of the literature on this topic.

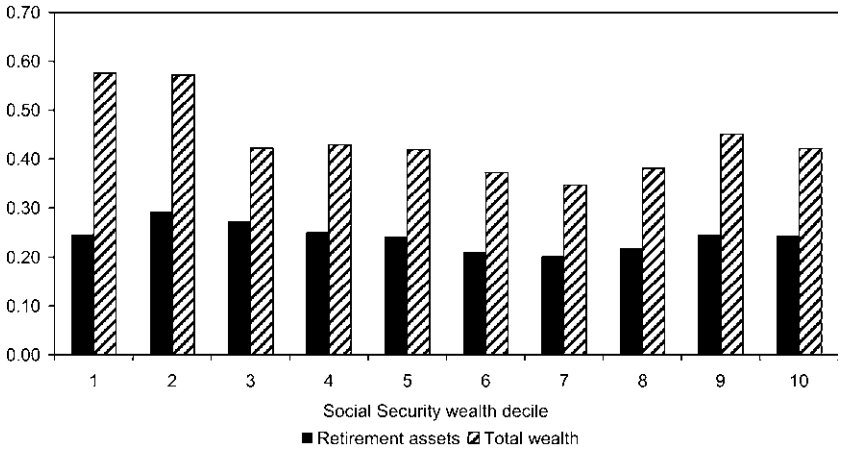

Fig. 10.2 Ratio of retirement assets to lifetime earnings and ratio of total wealth to lifetime earnings, by Social Security wealth decile

from a low of 0.20 in the seventh decile to 0.29 in the second decile, with no systematic pattern by decile. The ratio of total wealth to lifetime earnings ranges from 0.35 in the seventh decile to 0.58 in the first decile. Families with the lowest Social Security wealth accumulate more total wealth (relative to lifetime earnings) than families with greater Social Security wealth.

From table 10.4 it can be seen that lifetime earnings by Social Security wealth decile differ from lifetime earnings by lifetime earnings deciles. For example, the average of lifetime earnings in the lowest lifetime earnings decile is $70,993, but the average of lifetime earnings for families in the lowest Social Security wealth decile is $580,433. That is, many families with the lowest Social Security wealth have lifetime earnings well above the lowest lifetime earnings decile; the average within the lowest Social Security wealth decile is just below the average in the third earnings decile. Again, this apparent anomaly seems to be due to persons who were not covered by Social Security over their entire working lives and thus had low Social Security wealth even though they had substantial lifetime earnings over the period that earnings were reported to the Social Security Administration.

In the subsequent sections of this chapter we consider how the rise of 401(k) plans will change the accumulation of assets at retirement. In particular we consider how 401(k) assets within lifetime earning deciles and within Social Security wealth deciles will change over time. For the purposes of this chapter we assume that future generations of retirees will receive the same Social Security benefits, and thus have the same Social Security wealth, as current retirees (in year 2000 dollars). Of course, the Social Security benefit formula will likely be different for retirees in 2040 than for retirees in 2006. We begin in the next section by explaining how we project 401(k) assets in

the future. We then describe projections by lifetime earnings decile and by Social Security wealth decile. In particular, we show how the level of assets shown in tables 10.2 and 10.3 change with the rise in 401(k) assets.

10.2 Projecting 401(k) Assets at Retirement

In Poterba, Venti, and Wise (2007a), we developed projections of aggregate 401(k) assets in future years. In this chapter, we consider how the accumulation of 401(k) assets varies across families with different lifetime earnings histories. In this section, we borrow liberally from the discussion in the earlier paper to explain how the projections are developed, but here we add additional detail about the projection of participation rates by earnings.

We first set out the calculations that are the basis for our projections of 401(k) wealth. We denote persons by the subscript i. Cohorts are denoted by subscript c. Associated with each person in each cohort is a lifetime earnings profile. The earnings of person i in cohort c at age a are denoted by $E_{ci}(a)$. The zero-one indicator that person i in cohort c participates in a 401(k) plan at age a is denoted by $P_{ci}(a)$, the rate of return earned on 401(k) assets that were held at the beginning of the year when the person attained age a is denoted by $R_{ci}(a)$, and the contribution rate is denoted by C (expressed as a proportion of earnings). The value of the 401(k) assets held by person i in cohort c at age a is given by

$$W_{ci}(a) = \sum_{t=0}^{a} \left\{ \prod_{j=0}^{t} [1 + R_{ci}(a-j)] \right\} C_{ci}(a-t), \tag{1}$$

where $C_{ci}(a-t) = E_{ci}(a-t) \cdot P_{ci}(a-t) \cdot c$. This calculation is made for every person (i.e., earnings history) for every age in every cohort. In practice, separate calculations are made for wealth in stocks and bonds and the assumed rates of return do not vary by individual. In particular, the 401(k) wealth of person i in cohort c at sixty-five is given by

$$W_{ci}(65) = \sum_{t=0}^{65} \left\{ \prod_{j=0}^{t} [1 + R_{ci}(65-j)] \right\} C_{ci}(65-t). \tag{2}$$

This accumulation is calculated for each person (earnings history) in our sample.

We then obtain the average wealth held by the population of all persons age sixty-five for a cohort c. To do this we need to know how many persons of type i are in the population. Denote the number of persons with lifetime earnings profile i in cohort c at age sixty-five by N_{ci} (to be determined by population projections). Then the average of 401(k) assets held by all persons in cohort c at age sixty-five is given by

$$\overline{W}_c(65) = \sum_i \left(\frac{N_{ci}(65)}{\sum_{j=1}^{j} N_{cj}(65)} \right) \cdot W_{ci}(65), \tag{3}$$

where J is the number of persons (earnings histories) in the sample. In practice, we do not have population forecasts associated with each earnings history in the sample. Instead, we project total assets using population projections for groups of persons with the same demographic characteristics. The Office of the Actuary of the Social Security Administration has developed population projections by calendar year and age and by gender and marital status. Each earnings history in our sample can also be identified by the gender and marital status of the person. We first calculate the average of $W_{ci}(65)$ separately for each of the four gender-marital status pairs and denote this average by $\overline{W}_{c,gm}$. Then the average wealth at sixty-five for each cohort is determined by

$$\overline{W}_c(65) = \sum_{gm} \left(\frac{N_{c,gm}(65)}{\sum_{j=1}^{GM} N_{c,j}(65)} \right) \cdot \overline{W}_{c,gm}(65), \tag{4}$$

where the sum is over the four gm (gender-marital-status groups) and the number of persons in each of these groups is taken from the Social Security Administration demographic projections.

To implement these calculations we need to develop projections of future 401(k) participation rates and earnings and we need to make assumptions about future 401(k) contribution rates, rates of return, cash-out probabilities, and 401(k) withdrawals. We begin by describing projections of average 401(k) participation rates for each cohort. We then describe the other assumptions that are needed to obtain estimates of 401(k) asset accumulation.

10.2.1 Average Participation Rates

We use data from the SIPP to track the spread of 401(k) plans over the past two decades and to develop projections of future 401(k) assets. Various SIPP surveys enable us to collect data on participation in (and eligibility for) 401(k) plans in 1984, 1987, 1991, 1993, 1995, 1998, and 2003. Each SIPP survey is a random cross-section sample of the population. The cross-section data can be used to create "synthetic" cohorts. For example, to construct cohort data for the cohort that was age twenty-five in 1984 we use the 1984 panel to obtain data for persons twenty-five in that year, the 1987 panel to obtain data for persons who were twenty-eight in that year, the 1991 panel to obtain data for persons who were thirty-two in that year, and so forth. The cohort that was twenty-five in 1984 was forty-four in 2003. We sometimes label a cohort by the age of the cohort in 1984 and sometimes by the year in which the cohort attains age sixty-five. For example, the cohort that is age twenty-five in 1984 attains age sixty-five in 2024 and is referred to as the C25 or the R2024 cohort. The unit of observation in the SIPP is an individual and our projections of 401(k) participation rates are made at the individual level. For some later analyses we aggregate individual-level results to show projections for families.

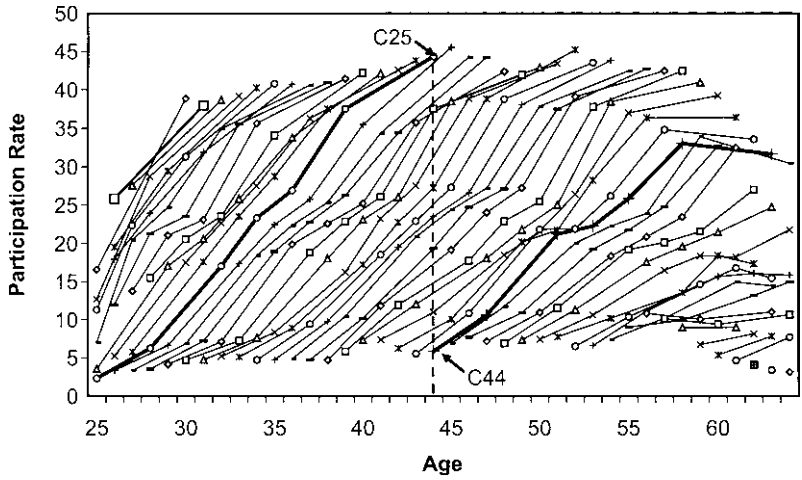

Fig. 10.3 Person participation rate by cohort

We begin with historical participation rates for individuals by cohort, as shown in figure 10.3. The earliest SIPP data are for 1984 and the most recent data are for 2003. We will use these data to project 401(k) participation at ages twenty-five through sixty-five for a large number of cohorts, ranging from the cohort that attains age sixty-five in 1982 through the cohort that attains age sixty-five in 2040. Only a few of the cohorts (shown in the bottom right of figure 10.3) had attained age sixty-five by 2003. Thus, for all but a few of the cohorts we must project participation rates from the last observed age in 2003 to age sixty-five.

The participation rate is the eligibility rate times the participation rate given eligibility. The future eligibility rate will depend in particular on the spread of 401(k) plans to small employers. We know that eligibility rates have increased very rapidly over the past two decades, and that participation, given eligibility, increased substantially over the 1984 to 2003 period, as shown in Poterba, Venti, and Wise (2007a). We have not found a compelling way to formally project future rates of eligibility or participation conditional on eligibility. Thus, we have simply made "plausible" assumptions about future participation rates and use them to project future cohort participation rates for persons in cohorts not covered in the SIPP data.

Simple extrapolations of the cohort data are likely to yield implausibly large participation rates. Consider, for example, the participation rates at age forty-four highlighted by the vertical dashed line in figure 10.3. The C44 cohort attained age forty-four in 1984 and had a participation rate of 5.8 percent at that time. The C25 cohort attained age forty-four in 2003, nineteen years later, and had a participation rate of 44.3 percent. On average, the participation rate at age forty-four increased about 2 percentage points

with each successively younger cohort. Were this rate to continue, the participation rate of the C12 cohort at age forty-four (that the C12 cohort will attain in 2016) would be 70.3 percent ($44.3 + 13 \times 2$). We suspect that this estimate of the future participation rate is too high, because 401(k) plans have already diffused through the segments of the corporate population that have workforces that find these plans most attractive, and that have the lowest per-employee administrative costs of implementing a plan.

Estimation of cohort effects by fitting the aforementioned profiles shows some compression with successively younger cohorts. In addition, figure 10.3 suggests that within cohorts, the increase in participation rates was lower between the last two data points for each cohort, 1998 and 2003, than for earlier intervals of comparable length. These features of the data suggest that the rate of growth of 401(k) participation may be slowing.

To recognize the apparent compression in the cohort effects and the apparent decline in the rate of within-cohort increase in participation rates, we make future projections for each cohort based on its observed 2003 participation rate. We assume that the annual increase in future participation rate will be smaller than that between 1998 and 2003. In particular, we assume that the future annual rate of increase declines by 0.12 percent per year. With this assumption, the projected future participation rates for the C25 and the C12 cohorts would be as shown in figure 10.4, which also shows the actual participation rates for these cohorts in 2003 and earlier years. Based

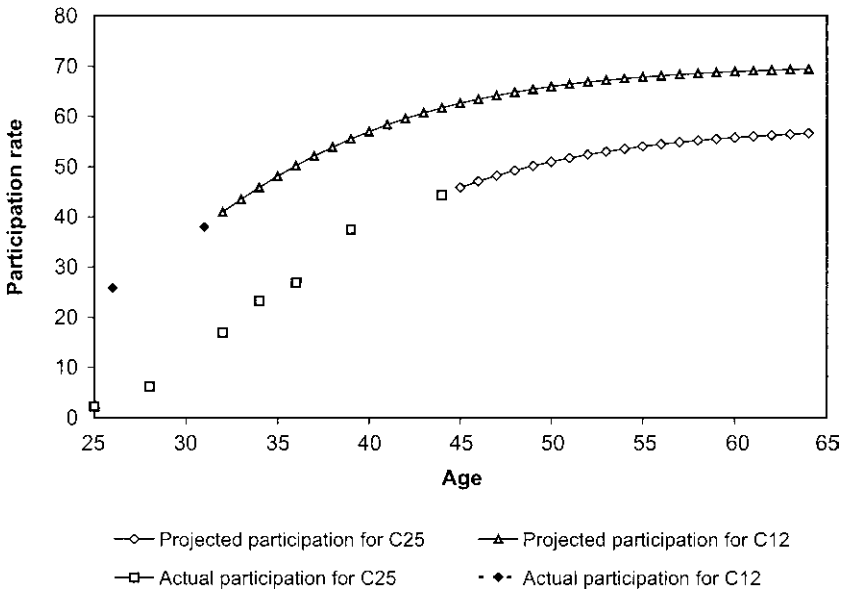

Fig. 10.4 Projected participation rates for cohorts C25 (R2024) and C12 (R2037)

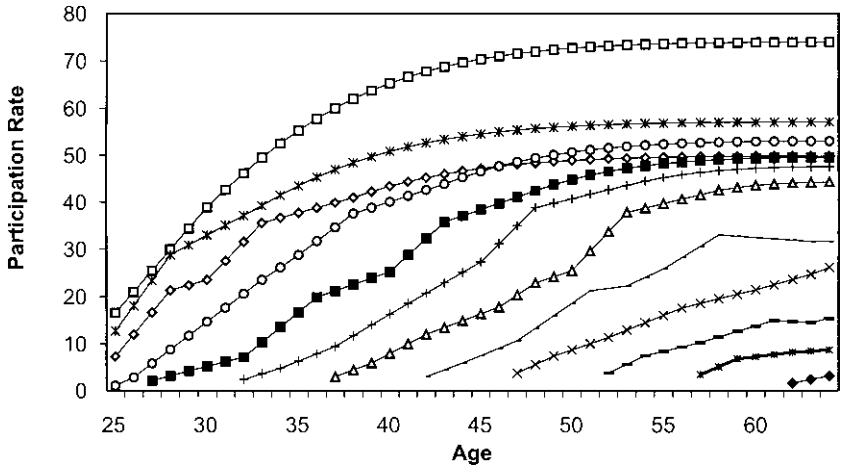

Fig. 10.5 Interpolated (1982–2003) and projected (2004–2040) participation rates for selected cohorts

on these projections, the participation rate of the C12 cohort when it attains age forty-four in 2016 would be 61.7 percent, compared to 44.3 percent for the C25 cohort, which attained age forty-four in 2003. At age sixty-four, the participation rate would be 56.6 percent for the C25 cohort and 69.4 percent for the C12 cohort.

Figure 10.5 shows the projected average participation rates for selected cohorts from C11 (R2038) to C64 (R1985). The figure also shows the interpolated participation rates between the years for which data are available prior to 2003. The decline in the rate of growth of 401(k) participation between 1998 and 2003 (the last two years for which SIPP data are available) is noticeable for many of the cohorts shown in the figure. The figure shows projections for selected cohorts. The projection algorithm we use includes projections for all cohorts from C65 (R1984) through C9 (R2040).

10.2.2 Participation Rates by Earnings

Figure 10.5 shows projections of the average 401(k) participation rate by age and cohort. Participation rates also increase with earnings, given age and cohort. As with projections of average participation rate by age and cohort, we know of no compelling way to project rates by earnings level. Thus, we use a procedure that we believe yields plausible results. In particular, we believe that the procedure yields plausible variation in asset accumulation by earnings, indicating the order of magnitude of differences that are likely to occur.

We begin with SIPP data on 401(k) participation in 2003. We first calculate participation rates by earnings decile within five-year age intervals beginning

Table 10.5 **Actual and fitted participation probabilities by age interval and earnings decile within age interval, from the 2003 SIPP**

	Age interval								
Earnings decile	25–30	30–35	35–40	40–45	45–50	50–55	55–60	60–65	All
				Actual probabilities					
1 (lowest)	12.9	17.3	17.3	16.9	20.4	19.7	18.0	10.7	17.1
2	21.8	22.1	20.5	24.4	25.0	26.7	28.2	23.8	23.8
3	23.3	25.7	30.3	33.2	34.0	41.4	35.5	29.1	31.4
4	25.8	34.8	38.3	40.4	48.7	43.4	42.7	45.5	39.2
5	32.8	44.2	43.9	49.0	54.3	49.8	57.0	39.8	46.5
6	39.3	41.7	48.8	54.5	49.9	54.2	51.7	44.4	48.3
7	45.5	49.3	57.0	60.4	59.9	56.5	59.0	53.8	55.2
8	51.9	55.7	57.7	65.3	56.7	63.7	60.1	56.6	58.6
9	54.4	60.0	62.9	66.2	66.3	60.6	67.7	62.1	62.5
10 (highest)	55.7	62.3	69.8	69.0	70.1	74.5	72.6	62.0	67.2
All	36.6	41.8	45.2	48.3	49.0	49.7	49.8	43.2	45.4
				Fitted probabilities					
1 (lowest)	11.5	14.3	16.4	18.4	18.9	19.3	19.4	15.2	16.5
2	18.0	21.8	24.4	26.9	27.5	28.1	28.2	22.9	24.6
3	24.8	29.2	32.3	35.1	35.8	36.4	36.5	30.5	32.4
4	31.0	36.0	39.2	42.3	43.0	43.7	43.8	37.3	39.4
5	36.6	41.8	45.2	48.3	49.0	49.7	49.8	43.2	45.4
6	41.5	46.8	50.2	53.4	54.0	54.7	54.8	48.2	50.4
7	45.8	51.2	54.7	57.7	58.4	59.1	59.2	52.6	54.9
8	50.0	55.4	58.8	61.8	62.4	63.1	63.2	56.8	59.0
9	54.3	59.6	62.9	65.8	66.5	67.1	67.2	61.0	63.1
10 (highest)	59.0	64.2	67.4	70.1	70.7	71.3	71.4	65.5	67.5
All									

with age twenty-five to age thirty and ending with age sixty to age sixty-five. These rates are shown in the top panel of table 10.5. One feature of these data that we rely on in making projections is that the average participation rate within an age interval is typically close to the fifth decile participation rate within that interval. And the overall participation rate is close to the overall participation rate for the fifth decile. We fit these participation rates with a probit model, allowing estimation of separate coefficients by earnings decile within each of the eight five-year age intervals. We then calculate the probit coefficients for each earnings decile for the average participation rates (over all age groups). These probit coefficients are shown by the markers in figure 10.6. The average effects can be fitted very well by a third-order polynomial as shown in the figure.

The fitted relationship between average participation rates by earnings decile can be used to fit the participation rates for each of the age intervals.

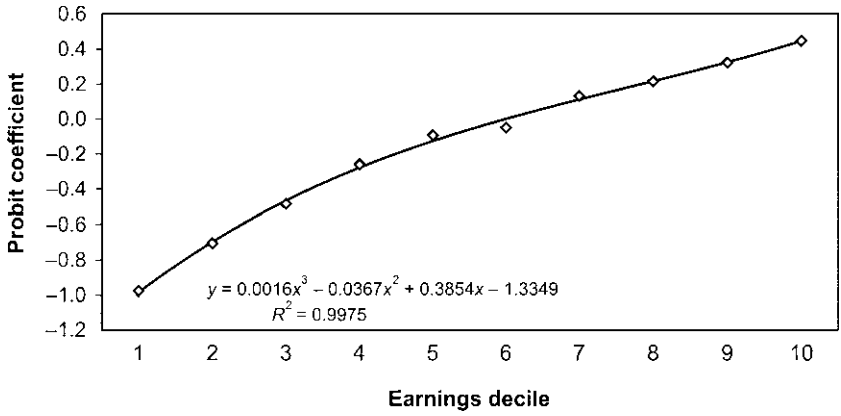

Fig. 10.6 Probit coefficients for average of age interval participation rates, by earnings decile in 2003

For example, suppose we want to estimate the participation rates for persons in the sixty to sixty-five age interval. We follow this procedure: first, we determine the constant term in the polynomial fit (figure 10.6) such that the predicted probability for the fifth decile for the sixty to sixty-five age interval is equal to the average probability for this age interval (0.432). Then using this constant term, we use the polynomial to determine the probit coefficient for each of the other earnings deciles. The corresponding fitted participation probabilities are shown under the sixty to sixty-five heading in the second panel of table 10.5. The fitted probabilities for each of the other age intervals are also shown in the second panel of the table. We judge that, on average, the fitted participation rates by age interval are rather close to the actual participation rates.

These estimated probit coefficients are used to project 401(k) participation rates by earnings decile for a given age within a cohort in future years. In particular, we assume that the *average* projected participation rate (as discussed in the previous section and illustrated in figure 10.5) corresponds to the participation rate of the fifth earnings decile. Consider, for example, the participation rates at age sixty. Figure 10.5 shows the projected average (over all earnings deciles) participation rate at age sixty for several cohorts. We want to project participation rates for each earnings decile at age sixty for each of these cohorts. Following the procedure described before, we first determine the constant term in the polynomial fit (in figure 10.5) such that the participation rate in the fifth earnings decile is equal to the average projected participation rate. Then using the polynomial with this constant term, we predict the participation rate for each of the earnings deciles. Table 10.6 shows the projected participation rates for persons age sixty in cohorts retiring in 2000, 2010, 2020, 2030, and 2040. The average projected rate is

Table 10.6 **Illustration: Projected participation rates at age 60 by earnings decile for three cohorts—R2000, R2020, and R2040**

	Cohort		
Earnings decile	R2000	R2020	R2040
All	43.4	60.7	74.1
1 (lowest)	15.3	27.9	41.6
2	23.0	38.2	53.0
3	30.6	47.3	62.1
4	37.5	54.7	68.9
5	43.4	60.7	74.1
6	48.4	65.5	78.0
7	52.8	69.5	81.2
8	57.0	73.0	83.9
9	61.2	76.5	86.4
10 (highest)	65.7	80.0	88.8

shown in the first row of the table, labeled "All." The remaining rows show projected participation rates for each earnings decile. The probit procedure insures that the projected participation rates by earnings decile are in the 0 to 1 interval. The increase in the participation rate in the tenth decile is from 65.7 in 2000 to 88.8 percent in 2040. The implied increase in the first decile is rather large, from 15.3 in 2000 to 41.6 percent in 2040. Thus, there is some compression of the variation in participation rates by earnings decile. Whether this implication in particular is plausible depends on the spread of 401(k) plans to small firms with low-wage employees over the next three or four decades. Clearly, the results depend on the participation rate and other assumptions we have made.

10.2.3 Asset Allocation and Rate of Return

We assume that 60 percent of 401(k) contributions are allocated to large-capitalization equities and 40 percent to corporate bonds. The projections use actual annual pretax returns through 2005. Beginning in 2006, we make projections based on two rate of return assumptions. First, we assume that the average annual nominal return on equities is 12 percent and that the average nominal return on corporate bonds is 6 percent. Ibbotson Associates (2006) reports that the historical arithmetic mean of pretax returns on long-term corporate bonds has been 6.2 percent per year, while large-capitalization stocks have returned an average of 12.3 percent over the period 1926 to 2005. Second, we assume that the rate of return on equities is 300 basis points less than the historical rate. These returns are the pretax returns available on a portfolio with no management fees. We have not as yet accounted for asset management fees. The average dollar weighted management fee on stock funds is currently about 70 basis points.

10.2.4 Job Separation, Lump Sum Distributions, and Cashouts

At age twenty-five each person is assigned to a 401(k) job based on the participation probability for that person's age, cohort, and earnings. In subsequent years each person either remains in the 401(k) job or leaves the 401(k) job. Job separation rates are estimated from the 1998 SIPP for five-year age intervals. These rates are shown in the first column of table 10.7. Separation rates are allowed to vary by age, but not by time in job. Estimated annual rates range from a high of 23 percent for the youngest workers to 12.1 percent for workers age fifty to fifty-four. After leaving a 401(k) job persons enter a pool of "non-participants." In each year, members of this pool are selected for a new 401(k) job at a rate that makes the overall participation rate for persons of a particular age and cohort equal to the projected probability for that age and cohort. A similar projection algorithm, with an identical treatment of transitions in and out of 401(k) participation, is described in Poterba, Venti, and Wise (2001).

The probability that a 401(k) accumulation is cashed out is determined by the job separation rate, the probability that the employees take a lump sum distribution (LSD), and the probability that a lump sum distribution is cashed out rather than rolled over into an IRA. That is, the probability of a cashout is given by:

$$\Pr[\text{cashout}] = \Pr[\text{job separation}] \times \Pr[\text{LSD}] \times \Pr[\text{LSD cashout}].$$

The probabilities associated with each of the components of the cashout decision are shown in table 10.7.

When employees separate from a job they may choose to keep their accu-

Table 10.7 **Cashout: Probability of job separation, probability of LSD | job separation, and probability of cashout | LSD**

Probability of job separation[a]		Probability LSD | separation[a]	Probability cash out | LSD[b]	
Age	Percent	Percent	Size of distribution	Percent of dollars cashed-out
25–29	23.0	57	< $1,000	77.2
30–34	15.6	57	1,000–2,000	67.7
35–39	15.6	57	2,000–5,000	49.6
40–44	13.6	57	5,000–10,000	52.8
45–49	13.9	57	10,000–15,000	39.1
50–54	12.1	57	15,000–25,000	37.8
55–59	12.5	57	25,000–50,000	28.8
60–64	15.7	57	50,000–100,000	8.2
			> $100,000	10.2
All	15.1	57.0		27.2

[a]Authors' calculation based on SIPP data.

[b]From Hurd, Lilliard, and Panis (1998), based on HRS data.

mulation with their old employer or they may decide to take a LSD. The SIPP only provides information on the disposition of a LSD. Thus, we are unable to obtain the probability of a LSD given job separation by age from the SIPP. We use the average rate of 57 percent obtained by Hurd, Lilliard, and Panis based on data from the Health and Retirement Study (HRS). On average, the probability of a cashout in a given year is $(.151) \times (.570) \times (.272) = 0.0234$.

This cashout probability differs from the probability in Poterba, Venti, and Wise (2001). In that paper, the average was about 0.0108. The principle reason for the difference is the job separation rates. In the earlier chapter we used estimates based on retrospective information in the HRS. The average separation rate based on that source was 0.048, compared to the average rate of 0.151 based on the SIPP estimates.[3] In the earlier paper our average estimate of the (probability of a LSD) $\times$ (probability of cashout | LSD) was 0.226. The average of these two components used here is somewhat smaller: $(.570) \times (.272) = 0.155$.

10.2.5 Withdrawals

The projections reported here assume a crude withdrawal scheme. Annual withdrawals are assumed to be 2 percent of balances between ages sixty-five and seventy-and-a-half. At older ages, the amount withdrawn from the 401(k) is (1/Remaining Life Expectancy) times the 401(k) balance. These withdrawal assumptions likely overstate amounts withdrawn from 401(k) plans. Berkshadker and Smith (2005) show that over 50 percent of current IRA holders do not make their first withdrawal before age seventy.

10.2.6 Earnings

To estimate the 401(k) contributions of a cohort, we need to determine the earnings and the contribution rates of cohort members. The key to developing an earnings history is access to a long time series of earnings by a single individual or a family. We use the HRS, which provides linked Social Security earnings histories for respondents who agreed to the link. These data represent earnings histories for a sample of individuals who were between the ages of fifty-two and sixty-one in 1992. The implicit assumption in our analysis is that the distribution of earnings histories that will be realized by younger cohorts will be similar to the earnings histories of the HRS respondents.

To develop earnings histories for younger cohorts we begin with the Social Security earnings histories of the HRS respondents, available for the years 1961 through 1991.[4] Earnings for 1992 through 2000 are obtained directly from HRS respondents. We begin with the earnings of the cohorts that

3. The estimate of 15.1 percent is approximately 5 percent lower than estimates reported by Stewart (2002), based on Current Population Survey data.

4. We used a two-limit tobit specification (with a separate equation for each year) to impute SS earnings for persons censored at the upper Social Security earnings limit.

attained age sixty-five in 1998, 1999, and 2000. We obtain lifetime earnings for all single persons that attained age sixty-five in these years and for all persons in two-person families in which the male partner attained age sixty-five in these years. The earnings of the 1998 cohort are "aged" two years and the earnings of the 1999 cohort are "aged" one year, based on the Social Security average wage index. We then treat these earnings histories as a random sample of the earnings of the cohort that attained age sixty-five in 2000 (the "R2000" cohort). The sample reports actual earnings histories, including years with zero earnings, so it recognizes that individuals may not be employed in some years. We implicitly assume that the employment rate and the distribution of employment by age are similar for future cohorts as for past ones. (The "R2000" cohort contains some female spouses who were not sixty-five in 2000.)

To make projections for the earnings of younger cohorts, we inflate the "R2000" sample using the intermediate earnings growth assumptions reported in the 2005 Annual report of the Board of Trustees of the Social Security Administration. Similarly, to project a sample of earnings for older cohorts we deflate the earning of the "R2000" cohort based on the Social Security average wage index. This method does not account for any potential change in the relative earnings of high-and low-wage persons.

10.2.7 Contribution Rate

We assume a contribution rate of 10 percent of earnings, including both the employee and the employer contributions. There are several sources of information on contribution rates. Data from the 2003 SIPP are shown by age interval in table 10.8. The overall median of the total of employee and employer contributions is 9.8 percent. The employee and employer medians are 5.7 percent and 3.0 percent, respectively. The overall mean is 12.6 percent. The mean rates may be substantially affected by reporting errors.

Table 10.8 **Employee and employer 401(k) contribution rates as a percent of earnings, for individuals, based on 2003 SIPP**

	Employee		Employer		Total	
Age	Mean	Median	Mean	Median	Mean	Median
25–29	6.8	5.0	4.6	3.0	11.4	9.0
30–34	7.7	5.2	4.6	3.0	12.4	9.3
35–39	7.9	5.8	4.7	3.0	12.5	9.7
40–44	7.8	5.7	4.6	3.0	12.4	10.0
45–49	8.0	6.0	4.8	3.0	12.8	10.0
50–54	8.6	6.0	4.3	3.0	13.0	10.0
55–59	9.1	6.0	4.6	3.0	13.7	10.0
60–64	8.7	6.0	4.6	3.0	13.3	10.0
All	8.0	5.7	4.6	3.0	12.6	9.8

Poterba, Venti, and Wise (1998) reported contribution rates based on the 1993 Current Population Survey (CPS). The average employee contribution rate was 7.1 percent and the average employer rate was 3.1 percent. The 1998 Form 5500 data show that about 32 percent of dollars are contributed by employers, which is roughly consistent with the 2003 SIPP median percent and with the 1993 CPS values. Holden and VanDerHei (2001) analyzed the responses to an Employee Benefit Research Institute (EBRI)-Investment Company Institute (ICI) survey and report that in 1999 the average total contribution rate was 9.7 percent. Cunningham and Engelhardt (2002) report that, based on HRS data, the average employee contribution rate was 6.6 percent in 1991, which is again generally consistent with the estimates based on SIPP and on CPS data.

For several reasons, however, the contribution rate in future years is uncertain. One reason for uncertainty about future contribution rates is the effect of increases in contribution limits. Legislation over the past several years has increased contribution limits very substantially and now future increases are indexed to inflation. Our projections assume that contributions as a percent of salary will be unaffected by the rising limits. In part, the effect of rising limits depends on how many participants are constrained by the contribution limits now and whether fewer participants or more participants will be constrained by future limits. Holden and VanDerHei (2001) report that in 1999, 11 percent of participants with incomes over $40,000 contributed at the legislated maximum, 13 percent of those with incomes between $70,000 and $80,000 did, and 18 percent of those with incomes between $80,000 and $90,000 contributed at the legislated maximum. Thus, one question is how wage growth will interact with rising limits to affect the proportion of persons at the limit. Even though the limits have increased and are now indexed to the Consumer Price Index (CPI), wages are likely to increase faster than the CPI. The Social Security Administration assumes future wage growth of 3.9 percent and future inflation of 2.8 percent. The legislated maximum, however, may not be the effective limit for many employees. Holden and VanDerHei (2001) report that 52 percent of participants in 1999 faced employer imposed limits below the legislated maximum. The number of participants that is constrained by these limits is unknown. And how the limits set by employers might change in the future is also unknown.

In addition, we have not accounted for the recent Pension Protection Act of 2006 that gives employers latitude to set more "saving friendly" defaults in 401(k) plans. Beshears et al. (2008) survey some of the recent evidence on how changing defaults for enrollment, contribution rates, and asset allocation can significantly increase retirement saving through 401(k) plans. Thus, our 401(k) projections may underestimate the actual accumulation of assets in these plans. Finally, the legislated increases in contribution limits may affect participant decisions of how much "should" be saved for retirement. The government-set limits may serve to "frame" employee decisions.

10.3 Average 401(k) Assets at Retirement

The 401(k) projection algorithm discussed previously is based on the earnings histories and contribution rates of persons. In this section we present results based on these data. In the next section, we combine results for persons to present projected asset accumulation for families. The average *per person* of 401(k) assets at age sixty-five (in 2000 dollars) is shown in figure 10.7, for cohorts attaining age sixty-five in years 1982 through 2040 (R1982 to R2040). Two profiles are shown, one assuming the average historical rate of return for equities and the other assuming the historical rate less 300 basis points. The projected average of 401(k) assets increases very substantially over the next thirty-five years. If the historical rate of return on equities is assumed, the average increases from about $29,000 in 2000, to $137,000 in 2020, to $452,000 by 2040 (all in year 2000 dollars). Assuming the historical rate of return on equities less 300 basis points, the average increases from $29,000 in 2000 to $269,000 by 2040. The projected increase is due to the increase in the participation rates of younger cohorts, to real wage growth, and to the increase in the number of years that 401(k) contributions were possible for successively younger cohorts. The 401(k) program effectively began in 1982 so cohorts retiring before 2020 were unable to make contributions early in their working lives. Persons who attained age sixty-five in 2000 could have contributed to a 401(k) plan for (at most) eighteen years and on average contributed for a little over seven years. For the cohort that will attain age sixty-five in 2040, 401(k) plans will have been available over the entire working life.

Figure 10.8 shows the average of 401(k) assets at retirement for persons who *have 401(k)* plans. For persons with plans, the average increases from

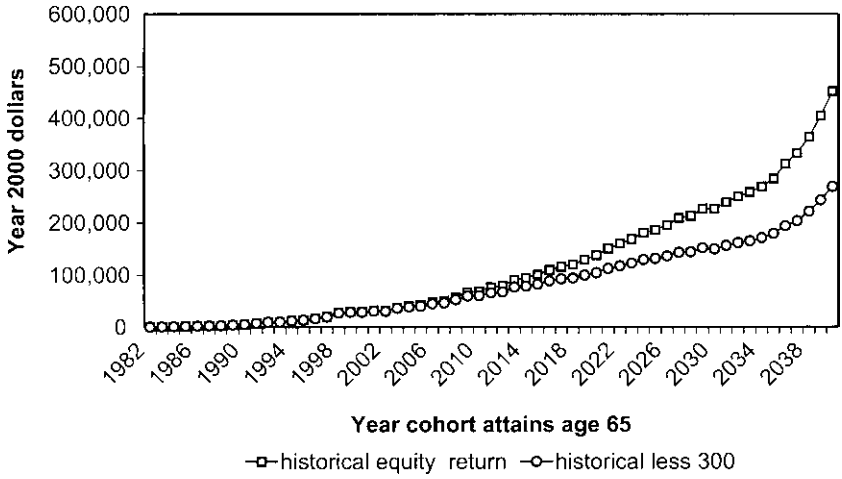

Fig. 10.7 Average 401(k) assets at age 65, by year of retirement, all persons

about $87,000 in 2000 to $580,000 by 2040, assuming historical rates of equity return, and to $335,000 assuming historical returns less 300 basis points.

For comparison, the maximum average (over all persons) of the present value of DB benefits at age sixty-five was about $73,000, attained in 2003. Thereafter benefits in DB plans decline, based on the projections in Poterba, Venti, and Wise (2007b). The comparison is shown in detail in figure 10.9 that is the same as figure 10.7 but with the addition of the DB projections.

To check our projection algorithm, we compared our estimate of the

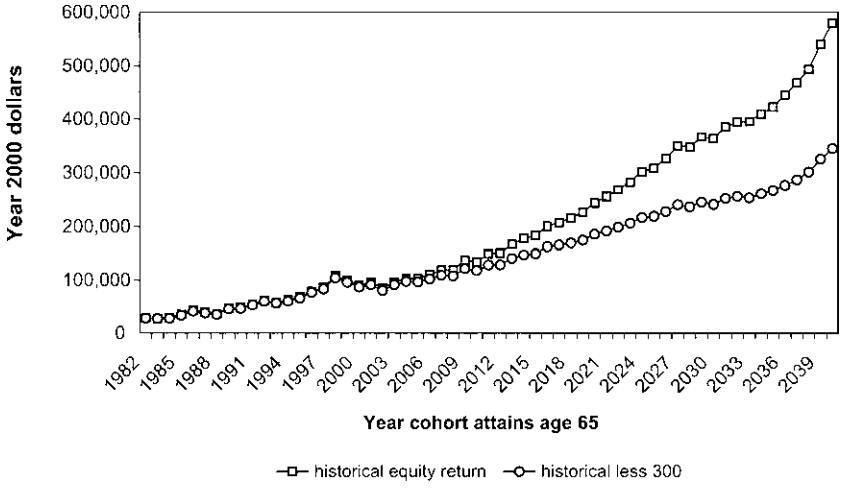

Fig. 10.8 Average 401(k) assets at age 65 for persons with a 401(k), by cohort

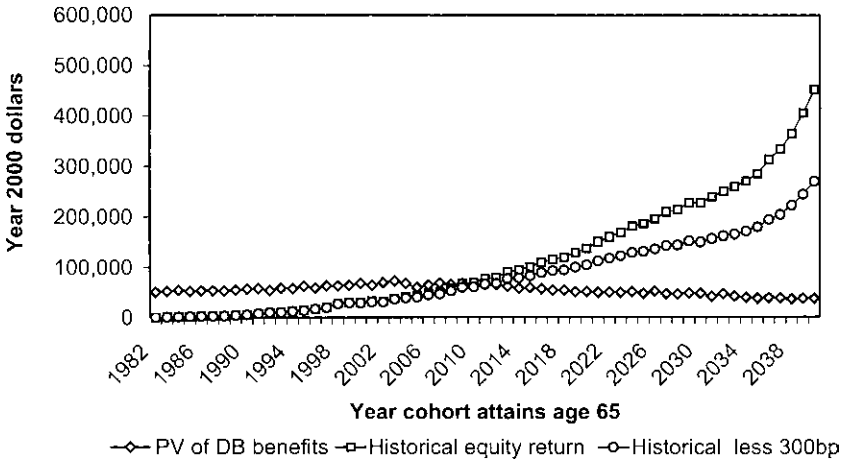

Fig. 10.9 Average 401(k) assets at age 65 and the PV of DB benefits at age 65, all persons

mean 401(k) assets of persons who attained age sixty-five in 2000 with the mean 401(k) assets of HRS respondents between the ages of sixty-three and sixty-seven in 2000. The HRS mean (for persons) is $25,892, compared to our projected mean of $29,708. However, the mean 401(k) balance in the HRS excludes amounts that were originally accumulated in 401(k) plans but later rolled into IRAs; our projected 401(k) balance includes amounts that were rolled over into an IRA. Thus, it appears that our projection is quite plausible compared to the HRS mean.

10.4 Future 401(k) Assets at Retirement by Lifetime Earnings Decile and by Social Security Wealth Decile

We first consider projections of 401(k) assets at retirement. We then consider how combined Social Security and 401(k) wealth at retirement will change in the coming decades.

Tables 10.9 and 10.10 show projected 401(k) assets at retirement. The tables show projections assuming that historical equity returns will continue in the future and assuming that future returns will be equal to historical returns less 300 basis points. Table 10.9 shows projections by lifetime earnings deciles. Table 10.10 shows projections by Social Security wealth deciles. The tables show assets for families, determined by reforming the original HRS families for whom the earnings histories were obtained.

There are several important features of these projections. First, as expected, families in the lowest lifetime earnings decile accumulate very little in 401(k) assets.[5] But this is not true for families in the lowest Social Security wealth decile. Some families in the lowest Social Security wealth decile have substantial lifetime earnings (as explained before) and on average accumulate substantial 401(k) assets. Second, the average increase in 401(k) assets of families is very large—from $43,764 in 2000 to $575,117, assuming historical rates of return, and from $43,764 to $348,284, assuming historical returns less 300 basis points.

Table 10.11 shows the ratio of 401(k) assets in 2040 to 401(k) assets in

5. Most of the "families" in the lowest lifetime earnings decile are single women and all have zero or very low earnings. The mean lifetime earnings for families in this decile is about $70,000, or an average of $1,700 (in year 2000 dollars) per year. Those with zero lifetime earnings accumulate no 401(k) wealth. Others, with low and intermittent earnings, have low 401(k) participation rates and if they do participate have high cash-out rates. Thus, they accumulate little or no 401(k) wealth as well. However, many families in this decile are not poor. Despite zero or low lifetime earnings, many have substantial Social Security wealth. This is because many are apparently widowed or divorced and, although they are not entitled to Social Security benefits based on their own earnings, they are entitled to substantial Social Security wealth based on survivor benefits. However, our measure of lifetime earnings for these single-person families does not include the earnings of the former spouse, so our algorithm does not generate 401(k) balances for the surviving spouse. In principal, these "401(k)-poor" surviving spouses could be assigned the 401(k) assets of their former spouses, but we cannot do this because the former spouse left the household before reaching age sixty-five in 2000 and is thus not in our sample.

Table 10.9 **Mean projected 401(k) assets for cohorts retiring in 2000, 2010, 2020, 2030, and 2040, by lifetime earnings decile, for families (in year 2000 dollars)—historical equity return and historical return less 300 basis points**

	Cohort (year attains age 65)				
Lifetime earnings decile	R2000	R2010	R2020	R2030	R2040
	Assuming historical equity rate of return				
1 (lowest)	0	158	366	1,372	3,688
2	627	3,405	7,100	21,917	50,857
3	3,532	12,421	28,647	47,770	128,600
4	8,506	29,355	57,614	120,706	274,958
5	19,437	82,367	166,268	272,135	489,558
6	37,215	92,391	203,597	390,004	644,261
7	48,740	112,424	300,917	508,402	822,220
8	68,860	177,574	361,543	647,329	947,474
9	83,385	186,913	434,814	622,449	1,134,979
10 (highest)	166,405	343,137	577,632	895,179	1,242,580
All	43,764	104,159	213,632	353,106	575,117
	Assuming historical equity rate of return less 300 basis points				
1 (lowest)	0	147	335	810	2,072
2	627	3,158	5,908	13,638	31,625
3	3,532	11,542	22,996	31,442	81,916
4	8,506	26,995	46,223	81,744	172,671
5	19,437	75,555	128,920	179,540	292,902
6	37,215	84,785	156,523	253,293	382,988
7	48,740	102,944	230,322	333,852	484,933
8	68,860	162,660	277,968	424,948	560,366
9	83,385	170,459	335,284	417,112	680,937
10 (highest)	166,405	315,294	454,171	614,789	785,150
All	43,764	95,487	165,699	235,388	348,284

2000. The ratios are shown by lifetime earnings decile in the top panel of the table and by Social Security wealth decile in the bottom panel. Ratios are shown for historical rates of equity return and for historical rates less 300 basis points. The *relative* increase between 2000 and 2040 is substantially greater for the lowest lifetime earnings deciles than for the highest deciles (excluding the lowest decile for which projected 401(k) assets are zero in 2000). The ratios range from 81.1 in the second decile to 7.5 in the tenth decile, assuming historical rates of return and from 50.4 in the second decile to 4.7 in the tenth decile, assuming historical rates of return less 300 basis points.

The large relative increase for families in the lowest earnings deciles is due in large part to the very low assets in 2000. The large increase between 2000 and 2040 among families in the lowest lifetime earnings interval may be especially sensitive to our assumptions about the spread 401(k) partici-

Table 10.10 **Mean projected 401(k) assets for cohorts retiring in 2000, 2010, 2020, 2030, and 2040, by Social Security wealth decile, for families (in year 2000 dollars)—historical rate of return and historical rate less 300 basis points**

Social Security wealth decile	Cohort (year attains age 65)				
	R2000	R2010	R2020	R2030	R2040
	Assuming historical equity rate of return				
1	6,552	19,577	50,967	83,375	147,153
2	1,079	7,584	13,337	25,568	84,322
3	22,631	49,828	103,310	186,639	337,767
4	22,623	51,521	82,494	163,541	247,881
5	15,188	44,150	116,633	199,554	353,425
6	23,592	78,883	185,703	302,433	523,799
7	39,964	130,346	247,766	492,913	792,127
8	66,531	167,486	398,453	571,714	975,052
9	102,415	222,430	413,099	728,271	1,082,121
10	136,842	269,395	526,433	774,407	1,198,301
All	43,764	104,159	213,632	353,106	575,117
	Assuming historical equity rate of return less 300 basis points				
1	6,552	18,013	39,642	53,388	89,574
2	1,079	7,022	11,000	17,191	52,321
3	22,631	45,798	81,065	126,900	207,786
4	22,623	47,353	64,765	111,164	156,241
5	15,188	40,588	90,753	131,134	210,784
6	23,592	72,332	143,977	198,485	312,788
7	39,964	119,473	189,323	319,429	462,750
8	66,531	152,689	306,398	380,269	583,300
9	102,415	203,970	322,565	487,597	663,471
10	136,842	247,269	408,920	526,464	738,273
All	43,764	95,487	165,699	235,388	348,284

pation to lower-income workers. Nonetheless, the projections suggest very large increases in 401(k) retirement assets for families in all but the lowest lifetime earnings decile. Even in the second lifetime earnings decile projected assets by 2040 are quite large, $50,857 compared to $627 in 2000, assuming historical rates of equity returns.

The relative increase in 401(k) assets by Social Security wealth decile follows a very different pattern. Assuming that 401(k) assets increase with lifetime earnings, the pattern reflects the lifetime earnings of families in each Social Security wealth decile. There are several noticeable features of the relative increases between 2000 and 2040. First, the growth of 401(k) assets is substantial in all Social Security wealth deciles. Second, there is no systematic pattern of the increase in 401(k) assets by Social Security wealth decile. Although the lowest relative increase is for the tenth decile and the highest for the second decile (assuming historical rates of return), there is no pattern in the growth rates of 401(k) assets in the second through tenth

Table 10.11 **Ratio of 401(k) assets in 2040 to assets in 2000, for families, by lifetime earnings decile, and by Social Security wealth decile—historical rate of equity return and historical rate less 300 basis points**

Decile	Historical rate of return	Historical less 300
	Lifetime earnings deciles	
1	—	—
2	81.1	50.4
3	36.4	23.2
4	32.3	20.3
5	25.2	15.1
6	17.3	10.3
7	16.9	9.9
8	13.8	8.1
9	13.6	8.2
10	7.5	4.7
All	13.1	8.0
	Social Security wealth deciles	
1	22.5	13.7
2	78.1	48.5
3	14.9	9.2
4	11.0	6.9
5	23.3	13.9
6	22.2	13.3
7	19.8	11.6
8	14.7	8.8
9	10.6	6.5
10	8.8	5.4
All	13.1	8.0

Social Security wealth deciles. The same findings hold if we assume historical return on equity less 300 basis points.

One of our principal goals has been to understand how the rapid increase in 401(k) assets will change the combined level of Social Security and 401(k) assets. There are of course other assets that can be used for support in retirement, but Social Security wealth and 401(k) assets will be the principal dedicated retirement assets. Table 10.12 shows the sum of Social Security and 401(k) saving at age sixty-five in years 2000, 2010, 2020, 2030, and 2040 for each decile of the lifetime earnings distribution. These projections assume that real Social Security benefits will remain constant at their 2000 level. The top panel of the table shows the sum of retirement assets assuming historical rates of equity returns; the bottom panel shows the sum assuming historical rates less 300 basis points. The increase in the sum of Social Security wealth and 401(k) assets is large for all lifetime income deciles, except for the first decile. The average of the sum of Social Security wealth and 401(k) assets increases from $225,593 in 2000 to $756,956 in 2040, assuming historical

Table 10.12 **Social Security wealth plus projected 401(k) assets for cohorts retiring in 2000, 2010, 2020, 2030, and 2040, by lifetime earnings decile, for families (in year 2000 dollars)—historical equity return and historical return less 300 basis points**

Lifetime earnings decile	Cohort (year attains age 65)				
	R2000	R2010	R2020	R2030	R2040
	Assuming historical equity return				
1	71,189	71,347	71,555	72,561	74,877
2	98,524	101,302	104,997	119,814	148,754
3	113,997	122,886	139,112	158,235	239,065
4	147,720	168,569	196,828	259,920	414,172
5	198,267	261,197	345,098	450,965	668,388
6	231,846	287,022	398,228	584,635	838,892
7	275,279	338,963	527,456	734,941	1,048,759
8	312,926	421,640	605,609	891,395	1,191,540
9	343,158	446,686	694,587	882,222	1,394,752
10	445,310	622,042	856,537	1,174,084	1,521,485
All	225,593	285,988	395,461	534,935	756,946
	Assuming historical equity return less 300 basis points				
1	71,189	71,336	71,524	71,999	73,261
2	98,524	101,055	103,805	111,535	129,522
3	113,997	122,007	133,461	141,907	192,381
4	147,720	166,209	185,437	220,958	311,885
5	198,267	254,385	307,750	358,370	471,732
6	231,846	279,416	351,154	447,924	577,619
7	275,279	329,483	456,861	560,391	711,472
8	312,926	406,726	522,034	669,014	804,432
9	343,158	430,232	595,057	676,885	940,710
10	445,310	594,199	733,076	893,694	1,064,055
All	225,593	277,316	347,528	417,217	530,113

rates of return and from $225,593 to $530,113, assuming historical rates of return less 300 basis points (all in year 2000 dollars). Table 10.13 shows comparable results for each decile of the Social Security wealth distribution.

To help compare the increases across the lifetime earnings deciles, the top panel of table 10.14 shows the ratio of the sum of Social Security wealth and 401(k) assets in 2040 to the sum of Social Security wealth and 401(k) assets in 2000 for each lifetime wealth decile. The first column of the table shows the ratios assuming historical rates of return and the second column shows the ratios assuming historical rates less 300 basis points. On average, families in 2040 are projected to have 3.36 times as much as Social Security and 401(k) wealth in 2040 as they had in 2000. In all but the first two deciles, real retirement assets more than double between 2000 and 2040. However, the projections suggest essentially no growth of total retirement assets among

Table 10.13 **Social Security wealth plus projected 401(k) assets for cohorts retiring in 2000, 2010, 2020, 2030, and 2040, by Social Security wealth decile, for families (in year 2000 dollars)—historical equity return and historical return less 300 basis points**

Social Security wealth decile	Cohort (year attains age 65)				
	R2000	R2010	R2020	R2030	R2040
	Assuming historical equity return				
1	11,473	24,498	55,888	88,296	152,074
2	65,101	71,606	77,359	89,590	148,344
3	127,176	154,373	207,855	291,184	442,312
4	168,124	197,022	227,995	309,042	393,382
5	201,465	230,427	302,910	385,831	539,702
6	244,505	299,796	406,616	523,346	744,712
7	283,749	374,131	491,551	736,698	1,035,912
8	326,950	427,905	658,872	832,133	1,235,471
9	378,004	498,019	688,688	1,003,860	1,357,710
10	448,204	580,757	837,795	1,085,769	1,509,663
All	225,593	285,988	395,461	534,935	756,946
	Assuming historical equity return less 300 basis points				
1	11,473	22,934	44,563	58,309	94,495
2	65,101	71,044	75,022	81,213	116,343
3	127,176	150,343	185,610	231,445	312,331
4	168,124	192,854	210,266	256,665	301,742
5	201,465	226,865	277,030	317,411	397,061
6	244,505	293,245	364,890	419,398	533,701
7	283,749	363,258	433,108	563,214	706,535
8	326,950	413,108	566,817	640,688	843,719
9	378,004	479,559	598,154	763,186	939,060
10	448,204	558,631	720,282	837,826	1,049,635
All	225,593	277,316	347,528	417,217	530,113

families in the very lowest earnings decile. The projected increase is 50 percent among families in the second lifetime earnings decile. The same patterns hold assuming historical returns less 300 basis points.

The bottom panel of table 10.14 shows the ratio of assets in 2040 to assets in 2000 for each Social Security wealth decile. The increases for each of the Social Security wealth deciles exhibit striking uniformity, except for the first decile. The increase in the first decile is very large. Again, this apparently anomalous ratio for the lowest Social Security wealth decile reflects the relatively low level of projected 401(k) assets in 2000. The ratios are shown in figure 10.10 for all but the first decile. If historical equity returns continue in the future, the sum of Social Security wealth and 401(k) assets will more than double between 2000 and 2040, for all Social Security wealth deciles. If future equity returns are equal to the historical average less 300

Table 10.14 **Ratio of the sum of Social Security and 401(k) assets in 2040 to the sum of Social Security and 401(k) assets in 2000 by lifetime earnings decile and by Social Security wealth decile—historical rates of equity returns and historical rates less 300 basis points**

Decile	Historical rate of return	Historical rate of return less 300 basis points
	Lifetime earnings deciles	
1	1.05	1.03
2	1.51	1.31
3	2.10	1.69
4	2.80	2.11
5	3.37	2.38
6	3.62	2.49
7	3.81	2.58
8	3.81	2.57
9	4.06	2.74
10	3.42	2.39
All	3.36	2.35
	Social Security wealth deciles	
1	13.25	8.24
2	2.28	1.79
3	3.48	2.46
4	2.34	1.79
5	2.68	1.97
6	3.05	2.18
7	3.65	2.49
8	3.78	2.58
9	3.59	2.48
10	3.37	2.34
All	3.36	2.35

basis points the ratio will be greater than 1.5 in all deciles. Thus, the rise of 401(k) plans significantly bolsters total retirement saving for families with low Social Security wealth as well as for families with high Social Security wealth. Similar patterns emerge (although the magnitudes are lower) if we assume that future equity returns are 300 basis points less than their historical average.

10.5 Summary and Discussion

We have projected the accumulation of 401(k) assets for families retiring through 2040. Our goal has been to understand how the rise of personal retirement saving plans will change the wealth of persons at retirement. In particular, we compare the sum of Social Security wealth and 401(k) assets for families that attain age sixty-five in 2000 to the sum of Social Security

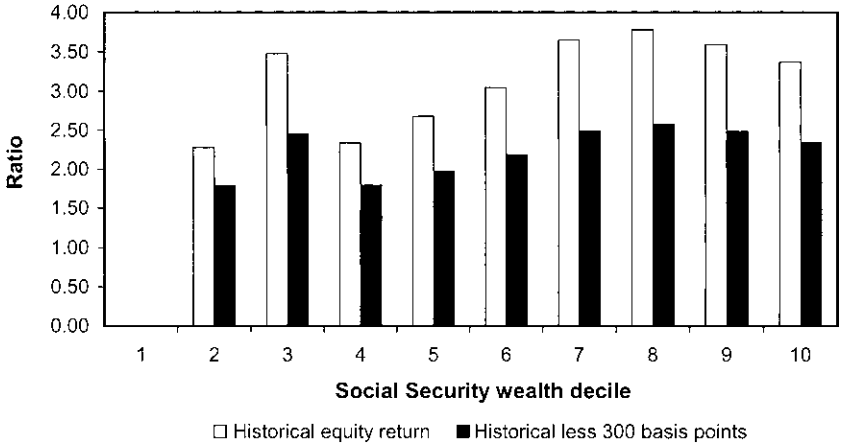

Fig. 10.10 Ratio of the sum of Social Security wealth + 401(k) assets in 2040 to the sum in 2000, for Social Security wealth deciles, by equity return

wealth and 401(k) assets in 2040. We consider the growth of retirement assets by Social Security wealth decile as well as by lifetime earnings decile. Because the projections are based on a series of assumptions with uncertain validity, the projections are subject to considerable uncertainty. We believe, however, that the projections provide a reasonable indicator of how the rise in 401(k) plans will affect the total retirement assets of future retirees.

We have not emphasized DB pension benefits in these calculations because our projections indicate that the proportion of retirement saving in DB plans will decline substantially in the coming decades. In addition we have not emphasized IRA assets, primarily because we are unable to distinguish assets accumulated from IRA contributions from rollovers from 401(k) to IRA accounts. Our 401(k) projections include such rollovers.

The 401(k) system is not yet fully mature. A person who retired in 2000, for example, could have contributed to a 401(k) for at most eighteen years and the typical 401(k) participant had only contributed for a little over seven years. Even current retirees could have contributed only in the latter half of their working lives. Nonetheless, the current accumulation of 401(k) assets is substantial. Projections in Poterba, Venti, and Wise (2007a) show that in 2007 401(k) assets at age sixty-five were over 60 percent of the total of 401(k) and DB assets. By 2040, the projections show that 401(k) assets will be between 4.30 and 6.85 times as large as DB assets. The private pension system is moving from a DB to a personal account system and workers who retire three decades from now will have had the opportunity to contribute to a 401(k) plan over their entire working lives (as many as forty years in our projections).

How will the maturing of the 401(k) system affect the sum of the Social

Security wealth and 401(k) assets of future retirees? Our projections show that if the historical rate of equity return continues in the future then, on average, the sum of family Social Security wealth plus the 401(k) assets of retirees will more than triple between 2000 and 2040 (in year 2000 dollars). If the equity return is equal to the historical rate less 300 basis points, the sum of these retirement assets will more than double.

We find that the rate of growth of the sum of Social Security wealth and 401(k) assets is surprisingly uniform across deciles of the distribution of lifetime earnings. Assuming historical rates of equity return, we find that the sum of these retirement assets more than doubles between 2000 and 2040 for all but the first two deciles of the distribution of lifetime earnings. Our projections also show little growth in the sum of Social Security and 401(k) assets for families in the lowest decile of lifetime earnings; the projected growth for families in the second decile is 50 percent.

We emphasize the projected growth of the sum of Social Security wealth and 401(k) assets for each Social Security wealth decile. We find substantial increases in each decile. Assuming historical rates of return, the sum of these retirement assets at age sixty-five in 2040 ranges from a low of 228 percent to a high of 378 percent of the sum in 2000 (excluding the larger increase for the first decile). If the future rate of return on equities is equal to the historical rate less 300 basis points, the sum of Social Security wealth and 401(k) assets at age sixty-five in 2040 ranges from 179 percent to 258 percent of the sum in 2000, depending on the Social Security wealth decile.

Appendix

Tables 10.2 and 10.3 present components of wealth by lifetime earnings decile and by Social Security wealth decile. These components are calculated for all single-person families age sixty-three to sixty-seven and for all two-person families with male head age sixty-three to sixty-seven in 2000. The calculations are all based on Health and Retirement Study (HRS) data.

Lifetime earnings are calculated using the Social Security earnings records for the years 1951 to 1991 and HRS respondent reported earnings for the years 1992 to 2000. A tobit specification is used for each year to impute earnings for persons constrained by the Social Security earnings limit. Earnings in each year are converted to year 2000 dollars using the Social Security average wage index and then summed to obtain lifetime earnings. Respondents that do not have matching Social Security earnings records are not included in tables 10.2 and 10.3.

401(k) wealth is our estimate of 401(k) wealth obtained from HRS respondents and pertains to balances in plans on the respondent's current

job as well as on former jobs.[6] The estimate includes assets in all 401(k)-like plans, including assets in traditional employer-provided DC plans. Each HRS respondent is asked if they have a pension plan and, if so, whether it is "Type A" (benefits are usually based on a formula involving age, years of service, and salary), "Type B" (money is accumulated in an account for you), or "both." Associated with the latter two responses is a follow-up question asking for the plan balance.

DB wealth is the sum of pension wealth from two sources. If the respondent is employed in 1998 then DB wealth on the *current* job is calculated as the present value of expected benefits, assuming that the respondent will continue to work to the normal retirement age.[7] These present value calculations (made by HRS staff) are based on features of the pension plan obtained from the employer. These estimates of pension wealth are only available for 1998, so the present value in 2000 is obtained by assuming that DB wealth grew 4 percent per year from 1998 and 2000. DB wealth from *prior* jobs is based on respondent-reported receipt of "pension and annuity benefits" in 2000. We calculate the mortality-adjusted present value of pension income for each person in the household reporting such income in 2000. We assume that the pension income reported in 2000 remains constant in the future. We also assume a 3 percent real discount rate and we use a unisex life table. No adjustments are made for survivor benefits or for cost-of-living adjustments that are common in state and local pensions.

Social Security wealth is the present value of Social Security benefits in 1992, assuming that the respondent continued to work until the normal retirement age.[8] These estimates of Social Security wealth are only available in 1992 dollars so we convert these values to year 2000 dollars using the CPI.

Other components of total wealth, including IRA balances and housing equity, are reported values from the 2000 wave of the HRS.

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6. See documentation for the HRS data file "Imputations for Pension-Related Variables," v1.0, June 2005.

7. See documentation for the HRS data file "Imputations for Pension Wealth, v2.0," December 2006.

8. These data were obtained from the HRS restricted use data file "Summary of Earnings and Projected Benefits."

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Comment

Robert J. Willis

This chapter is the third in a sequence of papers by this team that investigates the implications of the growth of 401(k) plans as the major source of pension wealth in the United States. Since I also served as discussant of the

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