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Appendix: EBRI/ICI 401(k) Accumulation Projection Model¹

by Sarah Holden and Jack VanDerhei²

OVERVIEW

Results presented in Holden and VanDerhei (November 2002) are drawn from a comprehensive model that projects replacement rates from 401(k) plan accumulations at retirement—whether held in 401(k) balances at employer(s) or in rollover individual retirement accounts (IRAs)—primarily using detailed administrative data on a very large sample of 401(k) plan participants. A standard methodology to build such a model is to use current typical behaviors across different age groups to project how individuals are

likely to behave over time as they age. Thus, the EBRI/ICI 401(k) Accumulation Projection Model analyzes the behaviors of 2.5 million 401(k) plan participants drawn from the year-end 2000 database collected by the Employee Benefit Research Institute (EBRI)³ and the Investment Company Institute (ICI)⁴ in their collaborative effort—the EBRI/ICI Participant-Directed Retirement Plan Data Collection Project.⁵

This Appendix details the elements of the EBRI/ICI 401(k) Accumulation Projection Model. In the EBRI/ICI 401(k) Accumulation Projection Model, each participant starts at year-end 2000 with a 401(k) account balance, the asset allocation of that account balance, his or her annual salary, his or her contribution activity, and information on whether the account has a loan outstanding (Figure A1). The model is used to project the 401(k) participants through the remainder of their full working careers, each year assigning

¹ This Appendix presents detailed information corresponding to the model used to derive the results presented in Holden and VanDerhei (November 2002). The EBRI/ICI model primarily is based on 401(k) participant behavior observed in the EBRI/ICI Participant-Directed Retirement Plan Data Collection Project. In addition, information taken from other surveys is used to model participant income changes over time; frequency of and activities associated with job change; and individual retirement account (IRA) activities. The EBRI/ICI model focuses on 401(k) plan participants and is distinct from the EBRI-ERF (Education and Research Fund) Retirement Income Projection Model (see VanDerhei and Copeland (July 2002; April 2001)).

² Sarah Holden, Senior Economist, Research Department at the Investment Company Institute (ICI) and Jack VanDerhei, Temple University, Employee Benefit Research Institute (EBRI) Fellow. Special thanks to Craig Copeland, Senior Research Associate at EBRI, who tabulated Current Population Survey (CPS) and Survey of Consumer Finances (SCF) data; Luis Alonso, Research Associate at EBRI, who maintains the EBRI/ICI project databases; and Darrin Helsel, Research Analyst at ICI, who provided research support.

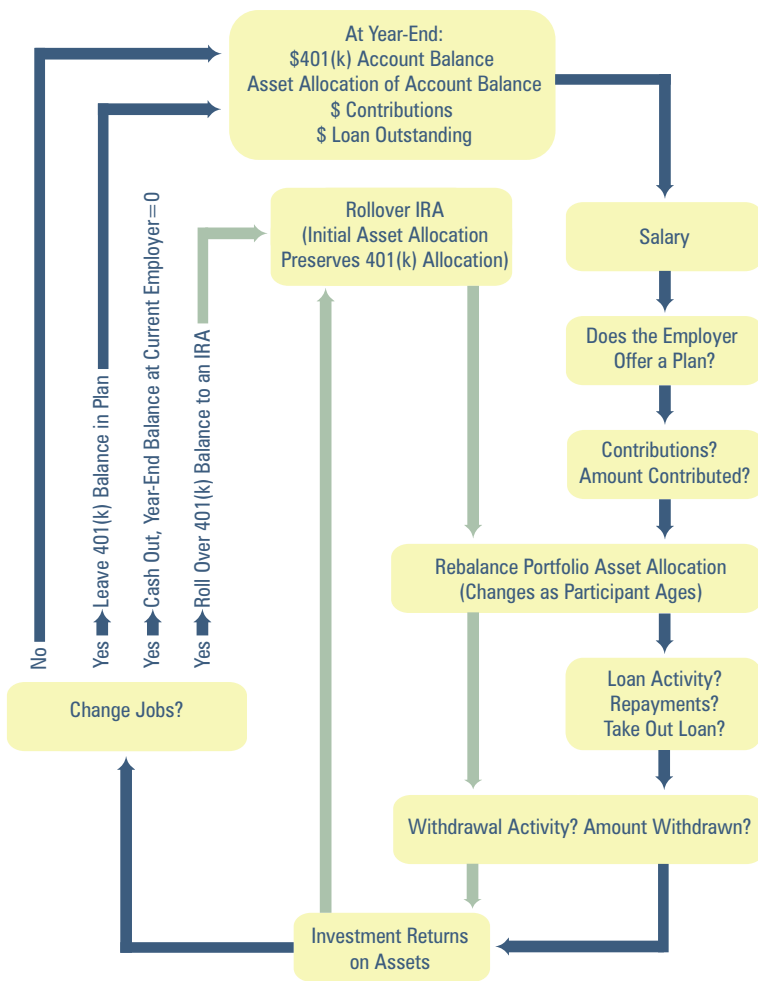
³ The Employee Benefit Research Institute is a nonprofit, nonpartisan, public policy research organization, which does not lobby or take positions on legislative proposals.

⁴ The Investment Company Institute is the national association of the American investment company industry. Its membership includes 8,982 open-end investment companies (“mutual funds”), 513 closed-end investment companies, and six sponsors of unit investment trusts. Its mutual fund members manage assets of approximately \$6.4 trillion, accounting for approximately 95 percent of total industry assets, and represent more than 90 million individual shareholders.

⁵ In this effort, EBRI and ICI have collected data from some of their members that serve as plan recordkeepers and administrators. The EBRI/ICI data collection project is the most comprehensive source of 401(k) plan participant-level data available to date. The EBRI/ICI data are unique because they cover a wide variety of plan administrators and recordkeepers and, therefore, a wide range of plan sizes offering a variety of investment alternatives. The data include demographic information, annual contributions, plan balances, asset allocation, withdrawals, and loan balances. For the most recent annual update, see Holden and VanDerhei (November 2001).

FIGURE A1

Diagram of Annual Growth Cycle of 401(k) Accumulations¹ in the EBRI/ICI 401(k) Accumulation Projection Model



¹In the model, both 401(k) balances at current and previous employers and rollover IRA balances are projected.

Source: EBRI/ICI 401(k) Accumulation Projection Model

them typical behavior both inside the 401(k) plan and upon job change. Thus, typical behaviors observed today across different age groups (cross-sectional data) are used to forecast how individuals *might* behave as they age over time in the model. Each model activity is explained in the three sections of this Appendix—participant characteristics, participant activity inside the 401(k) plan, and participant behavior over working career.

⁶ CPS data for 1999, 2000, and 2001 were used. The CPS is a monthly survey of about 50,000 households conducted by the U.S. Bureau of the Census for the Department of Labor’s Bureau of Labor Statistics (see the References for the website). The survey has been conducted for more than 50 years. The CPS is the primary source of information on the labor force characteristics of the U.S. population.

PARTICIPANT CHARACTERISTICS

Assignment of Gender and Education

Individuals enter the projection model at year-end 2000 with age and income characteristics.

To forecast participant activity inside a 401(k) plan, future incomes must be estimated for each participant. The evolution of an individual’s income varies with gender and education level, neither of which is known for participants. Thus, to project income for each of the 2.5 million 401(k) participants in the model, a gender (male or female) and education level (less than high school, high school, some college, college, or graduate school) must be assigned to each participant.

To assign each participant a gender and education level, the gender and education composition of Current Population Survey (CPS)⁶ private wage and salary workers participating in pension or retirement plans is used. EBRI/ICI 401(k) participants are grouped according to age and income and then assigned a gender and education level. For example, Figure A2 shows the gender and education composition of the CPS participants age 25 to 29 and earning an annual salary between \$40,000 and \$49,999. In the model, each participant in that age and salary grouping is randomly (stochastically) assigned a gender and education level.

To understand how the model does this, think of the pie chart in Figure A2 as a spinner from a game. The model spins the spinner and, depending on where it stops, assigns that particular EBRI/ICI 401(k) participant the gender and education level indicated. Because there is equal probability of stopping at any given point in the circle, the distribution of EBRI/ICI participants will replicate the distribution of the CPS participants within each

age and income grouping. A different “spinner” is created and used for each age and income group. Having been attributed with gender and education, the EBRI/ICI 401(k) participants are ready to have their incomes projected.⁷

Participant Income

As is standard with simulation model methodology, the EBRI/ICI model assumes that the current configuration of income across age groups is indicative of the path an individual’s salary might develop along over time. As detailed in this section, each individual participant’s income changes over time in the model based on ordinary least squares (OLS) regression results using CPS data (for all private wage and salary workers), an individual correction coefficient (ICC), and the assumed growth rate of the average national wage.

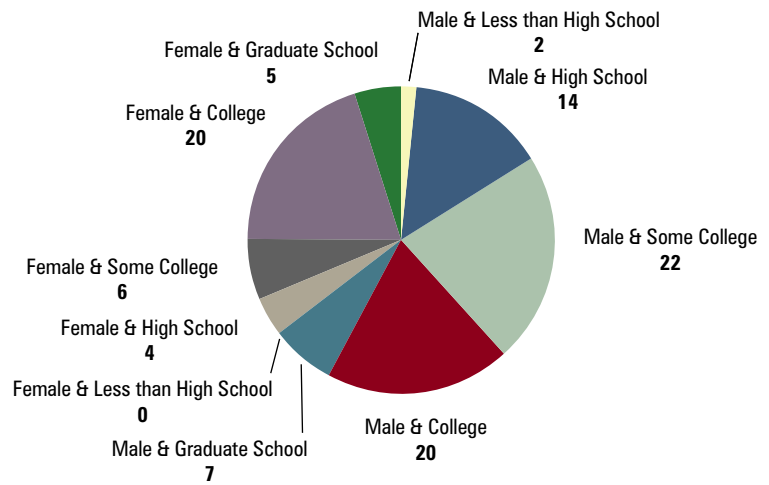
OLS Regressions. To determine the current relationship between age, gender, education level, and salary for each gender (male or female) and education group (less than high school, high school, some college, college, or graduate school), OLS regressions of the following form were estimated:

$$WAGE_PCT = \alpha + \beta_1 * AGE + \beta_2 * AGESQ + \epsilon,$$

where the variables are defined as follows: WAGE_PCT = average wage by age as a percent of the average national wage; AGE = worker’s age; and AGESQ = worker’s age squared. Using CPS data for all private wage and salary workers, the results show that, on average, a male with a college education at age 25 with a salary that is 1.2 times the average national wage, would have a salary at age 55 that is 2.4 times the average national wage, and a salary at age 65 that is 2.3 times the average national wage (Figure A3). In addition, on average, a female with a college education at age 25 with a salary that is about equal to the average national wage, would have a salary at age 55 that is nearly 1.5 times the

FIGURE A2

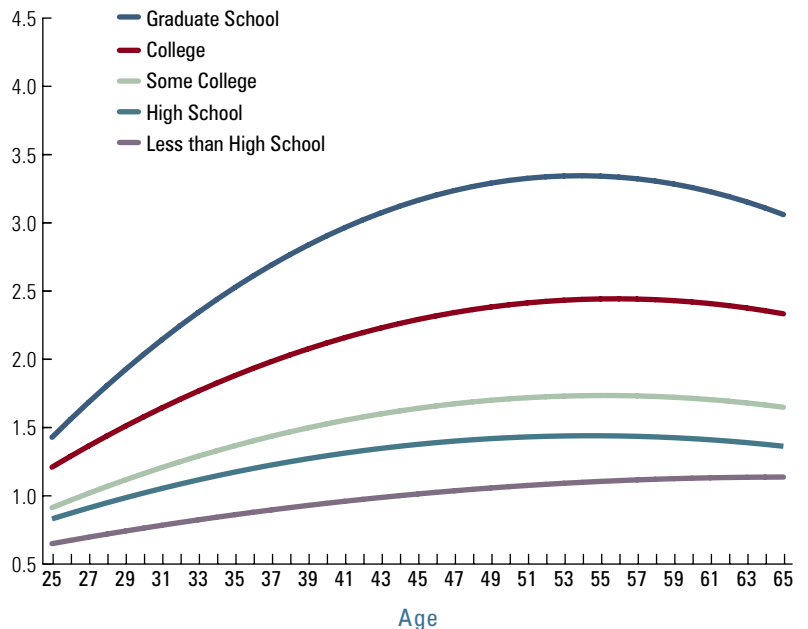
Distribution of Participants Age 25 to 29 with \$40,000 to \$49,999 Annual Salary, by Gender and Education Level
(percent of participants)



Source: Tabulations of Current Population Survey (CPS) data for private wage and salary pension or retirement plan participants

FIGURE A3

Predicted Ratio of Wage to Average National Wage, Males, by Education Level and Age

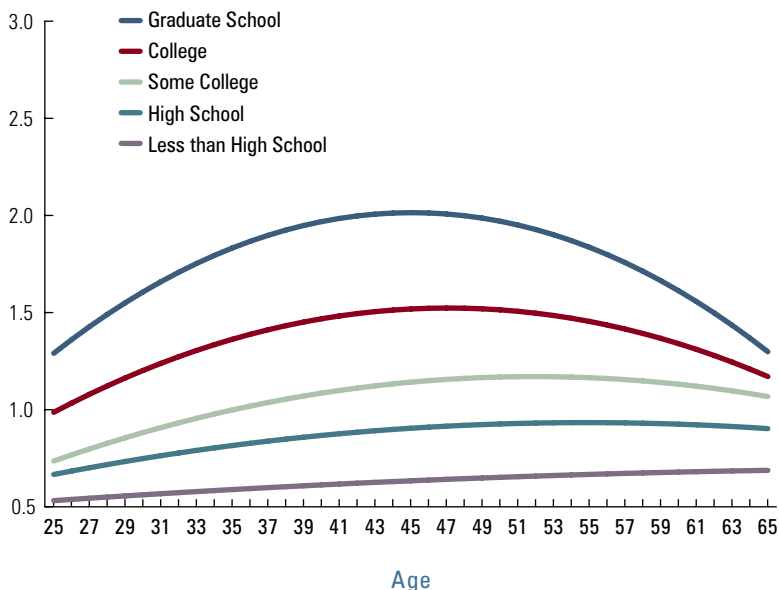


Source: OLS regression analysis of Current Population Survey (CPS) data for all private wage and salary workers

⁷ Although participants are assigned a gender, the analysis presented in Holden and VanDerhei (November 2002) is not carried out on a gender-specific basis. This is because most of the other behaviors in the EBRI/ICI 401(k) Accumulation Projection Model were not gender-specific. For examples of research on differences in retirement situations for males and females, see Even and Macpherson (December 2001); Shaw and Hill (April 2001); Bajtelsmit and Jianakoplos (November 2000); Johnson (March 1999); National Economic Council Interagency Working Group on Social Security (October 1998); and Bajtelsmit and Bernasek (1996).

FIGURE A4

Predicted Ratio of Wage to Average National Wage, Females, by Education Level and Age



Source: OLS regression analysis of Current Population Survey (CPS) data for all private wage and salary workers

average national wage, and a salary at age 65 that is 1.2 times the average national wage (Figure A4).

Individual Correction Coefficient. Because not every individual with the same age, gender, and education group has exactly the same wage, each individual is assigned an individual correction coefficient (ICC) that is used to adjust his or her wages throughout his or her career path. The individual correction coefficient is:

$$ICC = WAGE / (\text{Predicted_WAGE_PCT} * NATL_WAGE),$$

where WAGE is the individual’s annual salary in the 2000 EBRI/ICI database; Predicted_WAGE_PCT is the estimated result for an individual of that age, gender, and education characteristics using the coefficients from the regression equation; and NATL_WAGE is the average national wage in 2000.⁸ The ICC is applied to all predicted values of that person’s wage at each and every point in his or her career.

Average National Wage. The OLS regression and ICC determine the relationship between the individual participant’s income and the average national wage at any given point in time. Thus, the final element in the projection of each participant’s income is average national wage in each year of the model. The average national wage, rising 4.4 percent per year, is projected to follow the path of the long-range intermediate assumption from the Social Security Administration (1998) *Annual Trustees Report*.⁹ In each year in the model, an annual income is projected for each participant using the average relationships between age, education, gender, and the average national wage; an ICC that relates the individual to those average relationships; and the average national wage projected for the given year.¹⁰

PARTICIPANT ACTIVITY INSIDE THE 401(k) PLAN

Contributions

The contribution behavior in the model is based on the contribution activity of 2.5 million 401(k) participants drawn from the year-end 2000 EBRI/ICI database.¹¹ The model assumes that the year-end 2000 behavior of 401(k) participants is representative of individuals’ behaviors at different ages. Thus, in the model, participants who are in their twenties today are projected to behave like current participants in their sixties when they reach their sixties in the projection model.

In each year of the projection, the model first determines whether a participant’s 401(k) account receives a contribution (whether from the

⁸ The average national wage in 2000 was \$32,155 (see the U.S. Social Security Administration’s website, www.ssa.gov, for the National Average Wage Index).

⁹ Toder et al. (September 1999) follow this assumption as well. See Table I.E1 in the U.S. Social Security Administration (1998) *Annual Trustees Report*.

¹⁰ Holden and VanDerhei (November 2002) reports replacement rates for birth cohorts of participants by income quartile at age 65. The income quartiles are based on projected final five-year average salary immediately prior to retirement. Among participants reaching age 65 between 2005 and 2009, the real (in 2000 dollars) cut-off points for the income quartiles are: first quartile—\$36,740, second quartile—\$51,240, and third quartile—\$73,930. Among participants reaching age 65 between 2020 and 2024, the real cut-off points for the income quartiles are: first quartile—\$34,630, second quartile—\$52,310, and third quartile—\$80,730. Among participants reaching age 65 between 2035 and 2039, the real cut-off points for the income quartiles are: first quartile—\$37,830, second quartile—\$56,820, and third quartile—\$87,140.

¹¹ For a detailed analysis of 401(k) plan participants’ contribution behavior, see Holden and VanDerhei (October 2001).

participant, the employer, or both), and then how much (as a percent of salary). There is only slight variation in contribution activity across participants—most (91 percent, on average) participants in 2000 had employee and/or employer contributions to their 401(k) accounts. Lower income participants are a little less likely to have contributions. For example, among participants in their twenties, 92 percent of those earning \$40,000 or less had contributions to their accounts in 2000, while 96 percent of those earning more than \$40,000 had contributions (Figure A5).

Contribution activity also tends to vary somewhat with age as well. For example, among participants earning between \$40,000 and \$80,000, 96 percent of those in their twenties had contributions, 93 percent of those in their forties, and 94 percent of those in their sixties (Figure A5). Based on a participant's age, tenure, and salary, the model projects whether the participant's account receives a contribution.¹²

When it is projected that a contribution occurs for the participant, an OLS regression equation based on recent 401(k) participant behavior predicts the percent of salary contributed. The percent of salary projected to be contributed (whether by the employee, the employer, or both) in a given year is based on the participant's age, age-squared,¹³ tenure, tenure-squared, salary, and salary-squared in that year.¹⁴ Contributions are limited by Internal Revenue Code (IRC) regulations, which are projected to change over time as legislated by the Economic Growth and Tax Relief Reconciliation Act (EGTRRA) of 2001.¹⁵ Figure A6 plots the predicted total contribution rates by

FIGURE A5

Contribution¹ Activity of 401(k) Plan Participants,² 2000

(percent of participants in age and salary group with contributions)

Age Cohort	Salary Group		
	\$40,000 or less	>\$40,000 to \$80,000	>\$80,000
20s	92	96	96
30s	89	93	95
40s	89	93	93
50s	89	91	91
60s	89	94	95

¹ Contributions include employee and/or employer contributions into the 401(k) account in 2000.

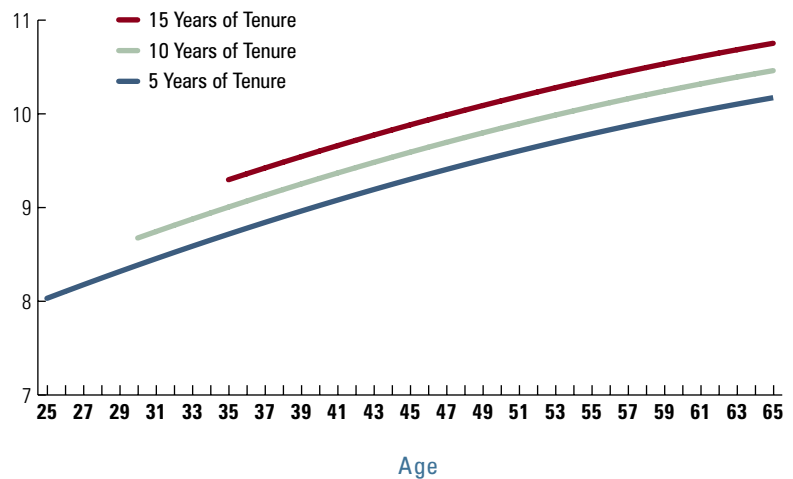
² Sample of 2.5 million 401(k) plan participants at year-end 2000.

Source: Tabulations from EBRI/ICI Participant-Directed Retirement Plan Data Collection Project

FIGURE A6

Predicted Total Contribution Rate by Age and Tenure

(percent of salary contributed by employee and/or employer)



Note: Predicted total contribution rate for a participant with \$45,000 annual salary and age and tenure indicated. Regression based on sample of 2.3 million participants with contributions at year-end 2000.

Source: OLS regression analysis using data from EBRI/ICI Participant-Directed Retirement Plan Data Collection Project

¹² Think of the model creating a “spinner” for each age, tenure, and salary group and then spinning it to determine whether a given participant in that group had a contribution.

¹³ It is a common research practice to include a squared term in order to capture nonlinear behavior in an OLS regression.

¹⁴ In the projection, all dollar-denominated independent variables are entered in real dollar values in all regression estimation equations because the regression analyses were carried out using 2000 data. (Otherwise, inflation of nominal values would distort the regression equations’ predicted results.)

¹⁵ In the model projections, it is assumed that EGTRRA provisions do not sunset.

FIGURE A7

Loan Activity of 401(k) Plan Participants by Age and Salary Group, 2000

(percent of participants in age and salary group with loans outstanding)

Age Cohort	Salary Group		
	\$40,000 or less	>\$40,000 to \$80,000	>\$80,000
20s	7	8	9
30s	11	12	10
40s	11	13	9
50s	9	10	8
60s	5	5	4

Note: Sample of 1.6 million 401(k) plan participants at year-end 2000.

Source: Tabulations from EBRI/ICI Participant-Directed Retirement Plan Data Collection Project

age for three different examples of tenure. The regression analysis finds that total contributions as a percent of participant salary tends to rise with both age and tenure.

Loans

In the model, participants with loans outstanding at year-end 2000 are projected to repay their existing loan balances. Participants without loan balances are projected to borrow in the future based on loan activity evident in the year-end 2000 EBRI/ICI database. Historically and in the projection, few participants take loans from their 401(k) accounts (Figure A7). The likelihood of a participant taking out a loan is based on his or her age, tenure, and salary in the year in question. The model used to assign these probabilities is based on the 401(k) participants' loan activity in 2000.

If a participant is projected to take out a loan,¹⁶ an OLS regression equation predicts the percentage of account borrowed (Figure A8),¹⁷ subject to IRC regulations limiting loans to the lesser of \$50,000 or 50 percent of the vested account balance.¹⁸ In the model, the loan is projected to be repaid over the subsequent five years,^{19,20} earning the bond rate of return. Once the participant no longer has an outstanding

¹⁶ The model randomly assigns loan origination based on the probability that a participant in a given age, tenure, and salary group has a loan outstanding.

¹⁷ See text footnote 14.

¹⁸ IRC Section 72(p)(2)(A) establishes a maximum limit for loans equal to the lesser of 50 percent of the vested account balance or \$50,000. Amounts exceeding this limit may be treated as a taxable distribution.

¹⁹ In order for the loan not to be treated as a distribution from the plan, it generally must be repaid within five years, see Internal Revenue Service (IRS), *Publication 575*. (This IRC exception also applies to loans that are used to buy a main home, regardless of their repayment term.) Furthermore, unpublished ICI data from a 401(k) household survey (see ICI (Spring 2000) for the published survey results) suggest that the vast majority of 401(k) participants who took a loan from their 401(k) plan repaid the loan in full within five years.

²⁰ In the model, it is assumed that if the participant changes jobs within the five-year repayment window, then the remaining loan balance is immediately repaid in full to the account.

FIGURE A8

Regression Equation¹ to Model Percentage of Account Taken as a Loan²

Independent Variables	Ratio of Loan Amount to Participant Account Balance ³
Constant	0.4065 * (56.42)
Age	-2.93E-03 * (-8.45)
Age-Squared	2.30E-05 * (5.80)
Tenure	-2.08E-03 * (-27.26)
Tenure-Squared	1.68E-05 * (17.45)
Salary	9.08E-08 * (4.88)
Salary-Squared	3.22E-13 * (7.24)
Account Balance ³	-9.02E-07 * (-145.00)

* Significant at the 1 percent level.

¹The figure reports OLS regression estimates (t-statistics reported in parentheses).

²Sample of 0.2 million participants with loan balances outstanding at year-end 2000.

³Participant account balance at year-end 2000 with loan balance added back to it.

Source: OLS regression analysis using data from EBRI/ICI Participant-Directed Retirement Plan Data Collection Project

loan balance, the model determines whether the participant at that new point in his or her career is projected to take out a loan, and if so, then projects how much is borrowed.

401(k) Withdrawals

In some circumstances, participants are permitted to take withdrawals from their 401(k) accounts. However, unlike plan loans, withdrawals are not paid back to the account. For each year in the model, it is projected whether a

FIGURE A9

Withdrawal Activity of 401(k) Plan Participants by Age and Salary Group, 2000
(percent of participants in age and salary group with withdrawals)

Age Cohort	Salary Group		
	\$40,000 or less	>\$40,000 to \$80,000	>\$80,000
20s	3	2	1
30s	4	4	3
40s	4	5	4
50s	4	5	5
60s	8	9	8

Note: Sample of 1.1 million 401(k) plan participants at year-end 2000.

Source: Tabulations from EBRI/ICI Participant-Directed Retirement Plan Data Collection Project

given participant takes a withdrawal. The model assumes that as participants move through the projection they behave in the same way as current older 401(k) participants in the year-end 2000 EBRI/ICI database. Given an individual's age, tenure, and salary, and the withdrawal behavior of participants in 2000, the model projects whether a participant makes a withdrawal.²¹ Because of differing legal restrictions, pre-retirement withdrawals made prior to age 59½ are modeled separately from withdrawals made by participants in their sixties.²² EBRI/ICI participant data indicate that very few (only 4.5 percent, on average) participants had taken withdrawals in 2000. Historically and in the forecast, participants who are younger are less likely to have taken a withdrawal than older participants (Figure A9). Even

FIGURE A10

Regression Equation¹ to Model Percentage of Account Taken as a Withdrawal²

Independent Variables	Ratio of Withdrawal Amount to Participant Account Balance ³	
	Participants Age 20 to 59	Participants in Their 60s
Constant	0.4132 * (42.79)	1.6502 * (5.17)
Age	-6.85E-03 * (-16.12)	-0.03415 * (-3.60)
Age-Squared	6.08E-05 * (13.83)	1.92E-04 * (2.73)
Tenure	-1.95E-04 * (-2.67)	-1.26E-03 * (-8.45)
Tenure-Squared	-1.60E-06 * (-4.04)	-4.96E-06 * (-3.92)
Salary	-2.64E-07 * (-15.15)	-2.23E-07 * (-3.89)
Salary-Squared	1.05E-13 * (10.01)	4.91E-13 * (5.80)
Account Balance ³	-2.12E-07 * (-52.38)	-1.22E-07 * (-15.85)

* Significant at the 1 percent level.

¹The figure reports OLS regression estimates (t-statistics reported in parentheses).

²Sample of nearly 0.1 million participants with withdrawals in 2000.

³Participant account balance at year-end 2000 with withdrawal added back to it.

Source: OLS regression analysis using data from EBRI/ICI Participant-Directed Retirement Plan Data Collection Project

among participants in their sixties, very few—only 8.5 percent—took a withdrawal in the year 2000.

If the model projects that a participant takes a withdrawal, an OLS regression predicts the amount of the account balance withdrawn.²³ The projected amount withdrawn (as a percentage of the account balance) is based on age, age-squared, tenure, tenure-squared, salary, salary-squared, and account balance (Figure A10). The percentage of account withdrawn among participants making withdrawals tends to fall as account size rises.

²¹ The model does not explicitly account for the possibility that some plans may penalize participants who take hardship withdrawals by suspending contributions. The safe harbor determination of hardship withdrawals previously resulted in a mandatory 12-month suspension period when no deferrals may be made. EGTRRA reduced the suspension period to six months.

²² Under current law, any participant who is 59½ or older can take withdrawals without penalty from his or her account, whether still employed or not (and provided the plan permits such withdrawals). (However, such withdrawals are still taxed as ordinary income.) Participants younger than 59½ may only be eligible for hardship withdrawals while still working for the employer. The IRC regulations require the satisfaction of two conditions for hardship withdrawals of elective amounts: (1) the withdrawal must be made due to a participant's immediate and heavy financial need; and, (2) the withdrawal must be limited to the amount necessary to satisfy the financial need. (These requirements may be satisfied by meeting established safe harbors or the employer may adopt a facts and circumstances determination.) Because the model projects future withdrawal activity to be similar to the withdrawal activity observed among EBRI/ICI 401(k) participants in 2000, it assumes that the current regulations continue to prevail in the future. (See Perdue (2002).)

²³ See text footnote 14.

FIGURE A11

Average Asset Allocation^{1,2} of 401(k) Plan Participants³ by Age, 2000

(percent of account balances)

Age Cohort	Equity Funds	Balanced Funds	Bond Funds	Money Funds	Guaranteed Investment Contracts	Company Stock	Other Stable Value Funds	Other	Unknown	Total
20s	61.4	8.6	4.3	4.3	4.0	15.4	0.5	0.7	0.5	100
30s	60.2	8.0	3.8	3.3	4.6	18.4	0.4	0.8	0.4	100
40s	54.8	8.0	4.2	3.8	7.5	19.7	0.6	1.0	0.4	100
50s	49.2	8.0	5.3	4.4	11.5	19.1	1.1	1.0	0.4	100
60s	39.8	8.0	7.7	5.4	19.3	16.3	2.2	0.9	0.4	100
All	51.3	8.0	5.1	4.2	10.4	18.6	1.0	0.9	0.4	100

¹Dollar-weighted average asset allocation. Row percentages may not add to 100 percent because of rounding.

²Investment options are grouped into nine categories. Equity funds consist of pooled investments primarily investing in stocks, whether in equity mutual funds, bank collective trusts, life insurance separate accounts, or other pooled investments. Bond funds are any pooled account invested in bonds, and balanced funds are pooled accounts invested in both stocks and fixed-income securities. Company stock is equity in the plan’s sponsor (the employer). Money funds consist of those funds designed to maintain a stable share price. Guaranteed investment contracts (GICs) are insurance company products that guarantee a specific rate of return on the invested capital over the life of the contract. Other stable value funds include synthetic GICs (a portfolio of fixed-income securities “wrapped” with a guarantee—typically by an insurance company or bank—to provide benefit payments according to the plan at book value), or other similar instruments. The “other” category is the residual for other investments, such as real estate funds. The final category, “unknown,” consists of funds that could not be identified.

³Based on 11.8 million 401(k) plan participants in 35,367 plans with \$579.8 billion in assets at year-end 2000.

Source: Tabulations from EBRI/ICI Participant-Directed Retirement Plan Data Collection Project (Holden and VanDerhei (November 2001))

Asset Allocation

As participants move through the model, they are projected to reallocate their portfolios based on the variation in asset allocation by age observed in the year-end 2000 EBRI/ICI database. The rebalancing in the projection reflects that younger participants tend to have higher percentages of their accounts invested in equity securities, while older participants tend to favor fixed-income securities (Figure A11). Although participants’ accounts are rebalanced over time based on observed average tendencies, individual preferences for certain classes of assets are preserved relative to the average behavior of a given age group in the projection. Thus, if a participant who in his or her twenties had a higher allocation to equity funds than the average, then he or she is projected to have a higher allocation relative to the average behavior of each age group as that participant is aged in the model.

Investment Returns

In the EBRI/ICI 401(k) Accumulation Projection Model, rates of return are projected for three investment categories: diversified equity funds²⁴ and the equity portion of balanced funds;²⁵ company stock (the employer’s stock); and all other investments (bond funds, the

fixed-income security portion of balanced funds,²⁶ GICs, money funds, other stable value funds, other, and unknown).²⁷ Historic returns for these three broad categories are used to project investment returns in the model.

There are two basic ways to model investment returns: (1) deterministic, and (2) random (stochastic). In a deterministic model, investment returns follow a certain path assumed by the researchers. For example, in the EBRI/ICI model, the “all other investments” are projected to earn a projected nominal total return of 5.3 percent each year (based on long-term government bond total returns from 1926 to 2001 reported in Ibbotson (2002)). In a stochastic model, the particular return earned in a given time period is left to chance but is drawn from a range of possible results typically based on historical experience over a long time period.

²⁴ “Funds” include mutual funds, bank collective trusts, life insurance separate accounts, and other pooled investments.

²⁵ Generally, equities represent about 60 percent of balanced mutual funds’ asset holdings (see ICI, *Quarterly Supplemental Data*).

²⁶ Generally, fixed-income securities represent about 40 percent of balanced mutual funds’ asset holdings (see ICI, *Quarterly Supplemental Data*).

²⁷ See Figure A11, figure footnote 2, for a description of the investment categories.

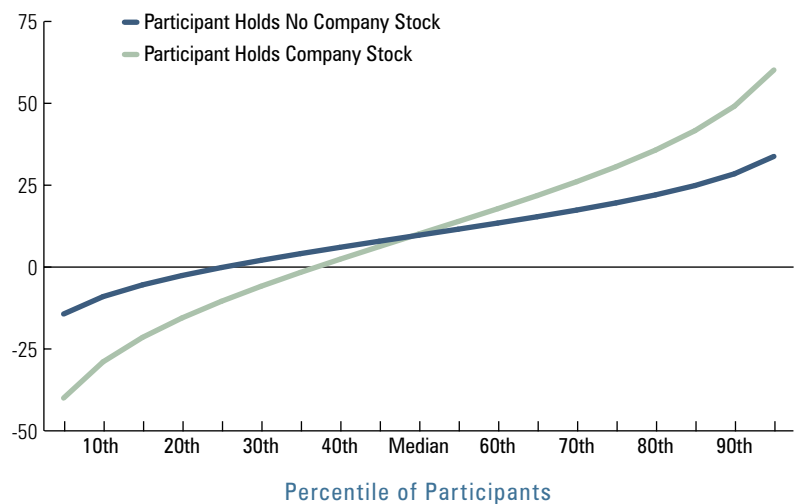
In the EBRI/ICI projection model, stochastic returns are forecast for the equity securities and company stock. Each participant is projected to have a single stochastically determined path of plan balances, and thus, a single final stochastically determined 401(k) accumulation. In any given year in the model, each participant's equity and company stock holdings each earn a randomly selected rate of return drawn from their respective distributions of the range of historical returns. In the baseline case, the distributions of these returns are based on the historical experience of the S&P 500 from the beginning of 1926 to the end of 2001.²⁸

A participant's return in a given year is dependent upon his or her particular asset allocation and on where the participant falls, by chance, along the range of possible returns for the equity-related holdings. Consider, for example, the distribution of returns possible for average participants in their forties in a given year. The median annual rate of return for average participants in their forties is about 10 percent (Figure A12). Because a single stock tends to experience a wider variation than a diversified market portfolio,²⁹ the range of investment returns is much wider for participants holding company stock. While 25 percent of participants in their forties without company stock, on average, are projected to draw a negative investment return on their entire balance in a given year, 35 percent of participants in their forties with company stock are projected to draw a negative investment return in a given year. Nevertheless, while 25 percent of participants in their forties without company stock are projected to experience returns of 19.6 percent or more in a given year, 25 percent of participants in their forties with company stock are projected to have returns of 30.6 percent or more.

FIGURE A12

Distribution of Portfolio Returns for Average 401(k) Participants in Their Forties

(annual rate of return; percent)



Sources: Tabulations from EBRI/ICI Retirement Accumulation Projection Model and Ibbotson (2002)

PARTICIPANT BEHAVIOR OVER WORKING CAREER

Job Change

Analysis of workers in the 1998 Survey of Consumer Finances (SCF), finds that the length of time that an individual stays with a given job—job duration—varies with age. This observed pattern of job duration by age is used in the model to project future job duration for 401(k) participants as they change jobs over the projection. For each participant in a given age group, the model spins a spinner that stochastically assigns how long the participant is projected to remain at his or her current job.³⁰ For example, for a participant who is between 25 and 35 years old, the model projects a two-year job duration 34 percent of the time, a more-than-two-to-eight-year job duration 30 percent of the time, a more-than-eight-to-10-year job duration 8 percent of the time, and 10-or-more years remaining on the job 28 percent of the time (Figure A13). The projection model does not consider that participant for a job change again until the end of that tenure.

²⁸ The "S&P 500" total equity returns used in the analysis are from Ibbotson (2002). The Ibbotson series used is "large company stocks total returns."

²⁹ See Purcell (July 2002).

³⁰ Job duration is assigned in two-year increments (i.e., a participant is given two or four or six or, and so on, up to 32 years of tenure at most). Older participants' tenure may be truncated by retirement.

FIGURE A13

Distribution of Job Duration by Age

(percent of individuals in each age cohort)

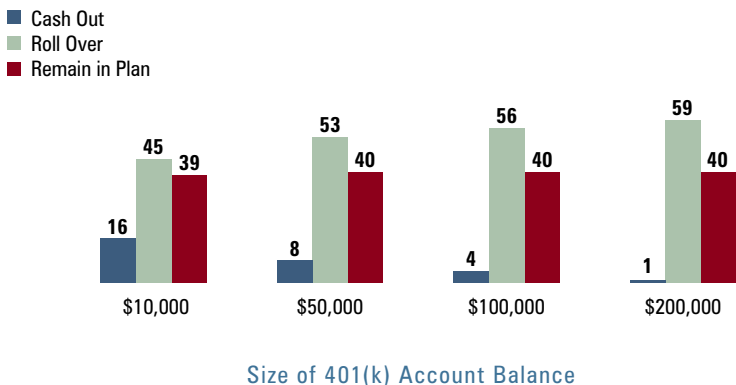
Age Cohort	2 Years	>2 to 8 years	>8 to 10 years	>10 years
25 to 34 years old	34	30	8	28
35 to 44 years old	21	21	6	52
45 to 54 years old	12	15	5	68
55 to 69 years old	10	17	7	66

Source: Tabulations of 1998 Survey of Consumer Finances data

FIGURE A14

Disposition of 401(k) Account Balances at Job Change by Selected Account Balance Size

(percent of participants with given size of account balance)



Note: Components may not sum to 100 percent because of rounding.

Source: Tabulations and regression analysis of Fidelity Investments (2001) and McCarthy and McWhirter (2000) data

In the 1998 SCF and therefore in the projection model, younger employees are more likely to have shorter job duration than older employees. For example, 34 percent of employees age 25 to 34 years old have up to a two-year job duration, while only 10 percent of employees age 55 to 69 years old have such short employment (Figure A13). Older employees are more likely to have long job duration. Indeed, only 28 percent of employees age 25 to 34 stay at their current jobs for more than 10 years, while 68 percent of employees age 45 to 54 stay for more than 10 years.

In the projection, when the 401(k) participant’s job duration ends, the model moves the participant to a new employer and projects a new job duration for the participant based on his or her new age group. In addition, at job change in the model, the participant may opt to (i) leave his or her 401(k) account balance at the previous employer’s plan, (ii) cash out the entire balance, or (iii) roll over the entire 401(k) balance into an IRA.

Leave Balance, Cash Out, or Roll Over?

The EBRI/ICI model, combining behavior observed in two separate research studies,³¹ projects the disposition of 401(k) account balances upon job change.³² Historically and in the model at job change, about 40 percent of participants choose to leave the balance with the soon-to-be-previous employer regardless of the size of the account balance (Figure A14). However, among participants taking the 401(k) balances, larger account balances are more likely to be rolled over and smaller account balances are more likely to be cashed out.³³

IRA Asset Allocation and Investment Returns

At rollover, the asset allocation of the 401(k) balance is maintained within the new rollover IRA.³⁴ In the model, the asset allocation of the IRA balance changes over time as the participant ages, just as the 401(k) account is rebalanced. Rollover IRA assets earn the same rates of return as the 401(k) account assets for a given participant in a given year.

³¹ See Fidelity Investments (2001) and McCarthy and McWhirter (2000).

³² It should be noted, however, that because these studies are based on recordkeeping of plan administrators, it is possible that some of the initially cashed out balances may end up reinvested in an IRA within the 60-day window permitted by the IRS.

³³ Figure A14 presents the tendencies for participants with selected account balance sizes for the purposes of illustration. The model uses a continuous OLS regression analysis to predict the disposition of 401(k) account balances at job change (see text footnote 14).

³⁴ Thus, participants who held company stock in their 401(k) plans continue to hold company stock in their IRAs.

FIGURE A15

IRA Withdrawal Assumptions

(percent of individuals in age group)

Age Cohort	Make a Withdrawal	Memo: Percent of IRA Balance Withdrawn
29 years old or less	11.8	43.1
30 to 58 years old	8.8	18.2
59 to 69 years old	28.2	13.2

Source: Sabelhaus (December 2000)

IRA Withdrawals

IRA owners may choose to take withdrawals from their IRAs and are projected to behave as found in Sabelhaus (December 2000). Because withdrawals taken prior to age 59½ may be assessed a penalty³⁵ (in addition to ordinary income taxes), very few young individuals withdraw from their IRAs. For example, only 11.8 percent of individuals who are 29 or younger take an IRA withdrawal, compared with 28.2 percent of individuals older than 58 (Figure A15). However, among the few younger individuals taking withdrawals, the amount withdrawn is sizable—43.1 percent of their IRA balance, on average. Once a rollover IRA is created for a participant, each year thereafter the model randomly assigns withdrawal activity to the IRA owners based on their age group.

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³⁵ For discussion of when the 10 percent penalty applies and exceptions to the penalty rule, see IRS (2001) *Publication 590 Individual Retirement Arrangements (IRAs)*. The projection model assumes that rules under current law continue to apply.

³⁶ For the complete Bibliography, see Holden and VanDerhei (November 2002).

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