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Amount of Savings Needed for Health Expenses for People Eligible for Medicare: Unlike the Last Few Years, the News Is Not Good, *by Paul Fronstin, Dallas Salisbury, and Jack VanDerhei, EBRI*

- Medicare beneficiaries pay a share of their health expenses out-of-pocket because of program deductibles and other cost sharing. In 2012, Medicare covered 60 percent of the cost of health care services for Medicare beneficiaries ages 65 and older, while out-of-pocket spending accounted for 13 percent, and private insurance covered 15 percent.

- In 2015, a 65-year-old man needs $68,000 in savings and a 65-year-old woman needs $89,000 if each has a goal of having a 50 percent chance of having enough money saved to cover health care expenses in retirement. If either instead wants a 90 percent chance of having enough savings, $124,000 is needed for a man and $140,000 is needed for a woman. This analysis does not factor in the savings needed to cover long-term care expenses.

- Savings targets increased between 6 percent and 21 percent between 2014 and 2015. For a married couple both with drug expenses at the 90th percentile throughout retirement who want a 90 percent chance of having enough money saved for health care expenses in retirement by age 65, targeted savings increased from $326,000 in 2014 to $392,000 in 2015.

How Does the Probability of a "Successful" Retirement Differ Between Participants in Final-Average Defined Benefit Plans and Voluntary Enrollment 401(k) Plans? *by Jack VanDerhei, EBRI*
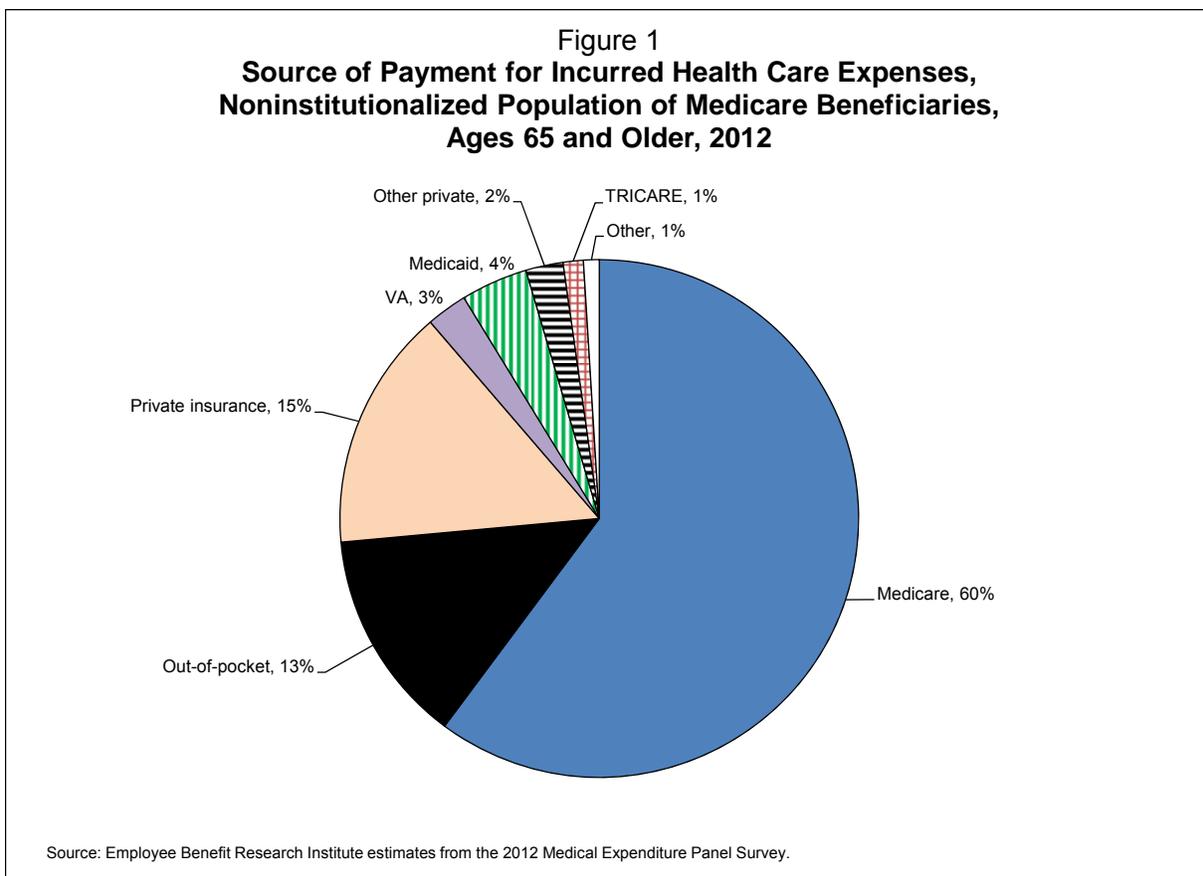
- Using baseline assumptions (defined in the study), it appears that the defined benefit (DB) plan has a higher probability of achieving a real replacement (when combined with Social Security payments) of 60 percent than the voluntary enrollment (VE) 401(k) plans for the first three income quartiles.

- If a 70 percent replacement rate is used as a threshold, participants in the third-and fourth-income quartiles have a much higher probability of success with the 401(k) plans than the DB plans.

- When the threshold is set at a higher (and according to many financial planners, more realistic) replacement rate of 80 percent, the 401(k) plans have a much higher probability of success than the counterfactual DB plans for all groups except for the lowest-income quartile (where the results are virtually even).

Amount of Savings Needed for Health Expenses for People Eligible for Medicare: Unlike the Last Few Years, the News Is Not Good

By Paul Fronstin, Ph.D., Dallas Salisbury, and Jack VanDerhei, Ph.D., Employee Benefit Research Institute

Introduction

In 2012, Medicare covered 60 percent of the cost of health care services for Medicare beneficiaries ages 65 and older, while out-of-pocket spending accounted for 13 percent, and private insurance covered 15 percent (Figure 1). Medicare was never designed to cover health care expenses in full. Deductibles for inpatient and outpatient services were included in the program when it was established in 1965. As recently as 2003, when outpatient prescription drugs were added as an optional benefit, the program included a then-controversial coverage gap known as the so-called "donut hole." While the Patient Protection and Affordable Care Act of 2010 (PPACA) included provisions to reduce the size of this coverage gap, PPACA did not eliminate it. By 2020, enrollees will pay 25 percent of the cost of prescription drugs when in the coverage gap for both generic and brand-name drugs. In the future, individuals may pay a greater share of their overall costs because of the combination of the financial condition of the Medicare program and cutbacks to employment-based retiree health programs (Fronstin and Adams, 2012).

Figure 1
**Source of Payment for Incurred Health Care Expenses,
Noninstitutionalized Population of Medicare Beneficiaries,
Ages 65 and Older, 2012**

Other private, 2%
TRICARE, 1%
Other, 1%
Medicaid, 4%
VA, 3%
Private insurance, 15%
Medicare, 60%
Out-of-pocket, 13%

Source: Employee Benefit Research Institute estimates from the 2012 Medical Expenditure Panel Survey.

This analysis updates previous estimates by the Employee Benefit Research Institute (EBRI) on savings needed to cover health insurance premiums and health care expenses in retirement (Fronstin, Salisbury, and VanDerhei, 2014). Unlike EBRI's 2014 report, this analysis finds that the savings targets for a 65-year-old retiring in 2015 have

increased, with the increase ranging from 6–21 percent. This report discusses the model, the savings targets, and reasons for the recent increase in savings targets.

Modeling Technique

Determining how much money an individual or married couple needs in retirement to cover health insurance premiums and health care expenses is a complicated process. The amount of money a person needs depends on the age at which he or she retires; length of life after retirement; the availability and source of health insurance coverage to supplement Medicare; health status and out-of-pocket expenses; the rate at which health care costs increase; and interest rates and other rates of return on investments. In addition, public policy that changes any of the above factors also affects spending on health care in retirement. While it is possible to come up with a single number that individuals can use to set retirement savings goals, a number based on averages is too small for approximately one-half of the population.

This analysis uses a Monte Carlo simulation model[1] to estimate the amount of savings needed to cover health insurance premiums and out-of-pocket health care expenses in retirement. Estimates are presented for those who supplement Medicare with a combination of individual health insurance through Medigap Plan F coverage and Medicare Part D for outpatient prescription drug coverage. For each source of supplemental coverage, the model simulates 100,000 observations, allowing for the uncertainty related to individual mortality and rates of return on assets in retirement,[2] and computes the present value of the savings needed to cover health insurance premiums and out-of-pocket expenses in retirement at age 65. These observations are used to determine asset targets for adequate savings to cover retiree health costs 50 percent, 75 percent, and 90 percent of the time. Estimates are also jointly presented for a stylized couple, both of whom are assumed to retire simultaneously at age 65.

Savings Targets to Cover Health Insurance Premiums and Out-of-Pocket Costs in Retirement

Figure 2 contains the savings estimates for a person who turns age 65 in 2015 and who purchases Medigap Plan F to supplement Medicare as well as Medicare Part D outpatient drug benefits. It also includes our prior year estimates. As discussed above, there is uncertainty related to a number of variables, such as health care costs, longevity, and interest rates. Among people with Medicare Part D, there is also the uncertainty related to health status and prescription drug use.

Projections of savings needed to cover out-of-pocket expenses for prescription drugs are highly dependent on the assumptions used for drug utilization. There are three sets of columns of estimates in Figure 2: in the first, prescription drug use is at the median throughout retirement; in the second set, prescription drug use is at the 75th percentile throughout retirement; and in the third set, prescription drug use is at the 90th percentile throughout retirement. Under each set of columns, a comparison of the savings targets is presented for 2011–2015.

Separate estimates are presented for men and women. Because women have longer life expectancies than men, women will generally need larger savings than men to cover health insurance premiums and health care expenses in retirement regardless of the savings targets. In other words, women will need greater initial savings than men even when both set the same goal—for example, of having a 90 percent chance of having enough money to cover health expenses in retirement.

Median Drug Expenses: As shown in Figure 2, in 2015 a man with median prescription drug expenses needs $68,000 in savings and a woman needs $89,000 if each has a goal of having a 50 percent chance of having enough money saved to cover health expenses in retirement. If either instead wants a 90 percent chance of having enough savings, $124,000 is needed for a man and $140,000 is needed for a woman.

Chance of Having Enough Savings	**Median** Prescription Drug Expenses Throughout Retirement				
	2011	2012	2013	2014	2015
Men					
50%	$71,000	$70,000	$65,000	$64,000	$68,000
75%	107,000	105,000	96,000	93,000	99,000
90%	136,000	135,000	122,000	116,000	124,000
Women					
50%	95,000	93,000	86,000	83,000	89,000
75%	124,000	122,000	111,000	106,000	114,000
90%	156,000	154,000	139,000	131,000	140,000
Married Couple					
50%	166,000	163,000	151,000	147,000	158,000
75%	231,000	227,000	207,000	199,000	213,000
90%	287,000	283,000	255,000	241,000	259,000
Chance of Having Enough Savings	**75th Percentile** of Prescription Drug Expenses Throughout Retirement				
	2011	2012	2013	2014	2015
Men					
50%	$80,000	$79,000	$74,000	$72,000	$76,000
75%	120,000	119,000	108,000	104,000	110,000
90%	154,000	153,000	137,000	129,000	138,000
Women					
50%	107,000	106,000	97,000	93,000	99,000
75%	140,000	139,000	125,000	119,000	127,000
90%	176,000	176,000	156,000	146,000	156,000
Married Couple					
50%	187,000	186,000	170,000	165,000	175,000
75%	260,000	258,000	233,000	222,000	237,000
90%	323,000	321,000	286,000	270,000	288,000
Chance of Having Enough Savings	**90th Percentile** of Prescription Drug Expenses Throughout Retirement				
	2011	2012	2013	2014	2015
Men					
50%	$106,000	$102,000	$96,000	$88,000	$104,000
75%	154,000	147,000	137,000	126,000	151,000
90%	194,000	185,000	172,000	156,000	188,000
Women					
50%	138,000	132,000	124,000	114,000	136,000
75%	178,000	170,000	158,000	144,000	173,000
90%	221,000	210,000	195,000	176,000	212,000
Married Couple					
50%	244,000	234,000	220,000	202,000	240,000
75%	332,000	317,000	295,000	270,000	323,000
90%	407,000	387,000	360,000	326,000	392,000

Figure 2

Savings Needed for Medigap Premiums, Medicare Part B Premiums, Medicare Part D Premiums and Out-of-Pocket Drug Expenses for Retirement at Age 65 in 2011–2015

Source: Author simulations based on assumptions described in the text.

A couple both with median drug expenses needs $158,000 to have a 50 percent change of having enough money to cover health expenses in retirement. They need $213,000 to have a 75 percent chance of covering their expenses and $259,000 to have a 90 percent chance of covering their expenses. These estimates are 6–8 percent higher than the savings targets estimated in 2014.

75th Percentile in Drug Expenses: Needed savings in 2015 for a man with drug expenditures at the 75th percentile throughout retirement is $76,000 if he wants a 50 percent chance of having enough savings to cover health care expenses in retirement. For a woman, the savings target is $99,000 at the 50-percent target. If either instead wants a 90 percent chance of having enough savings, $138,000 is needed for a man, and $156,000 is needed for a woman.

A couple both with drug expenses at the 75th percentile needs $175,000 to have a 50 percent change of having enough money to cover health care expenses in retirement. They need $237,000 to have a 75 percent chance of covering those expenses, and $288,000 to have a 90 percent chance of covering their expenses. These estimates are 6–7 percent higher than the savings targets estimated in 2014.

90th percentile in Drug Expenses: Individuals at the 90th percentile in drug spending at and throughout retirement experienced an 18–21 percent increase in needed savings in the EBRI model. In 2015, a man needs $104,000 in savings and a woman needs $136,000 if each has a goal of having a 50 percent chance of having enough money saved to cover health care expenses in retirement. If either instead wants a 90 percent chance of having enough savings, $188,000 is needed for a man and $212,000 is needed for a woman.

A couple both with drug expenses at the 90th percentile needs $240,000 to have a 50 percent chance of having enough money to cover health care expenses in retirement. They need $323,000 to have a 75 percent chance of covering their expenses and $392,000 to have a 90 percent chance of covering their expenses.

Explaining the Increase in Savings Targets between 2014 and 2015

As mentioned above, while savings targets declined between 2011 and 2014, they increased between 6 and 21 percent between 2014 and 2015. For a married couple both with drug expenses at the 90th percentile throughout retirement who wanted a 90 percent chance of having enough money saved for health care expenses in retirement by age 65, their targeted savings increased from $326,000 in 2014 to $392,000 in 2015.

There are a number of factors that go into our model that can result in an increase or decrease in needed savings. The main reason for the increase in needed savings is related to the adjustment that is made each year to rebaseline out-of-pocket spending associated with prescription drug use. Out-of-pocket spending is tied to the Medical Expenditure Panel Survey (MEPS) and 2012 is now the most recent year of data available. Actual out-of-pocket spending at the median, 75th and 90th percentiles were higher than projected for 2012 when projections were based on pre-2012 data. As a result of the rebaselining, data on out-of-pocket spending for prescription drugs for 2012 and beyond have increased.

The increase in savings needed as a result of higher out-of-pocket spending on prescription drugs has been offset by other factors. The EBRI model uses Congressional Budget Office (CBO) and Centers for Medicare & Medicaid Services (CMS) projections for premium and health care cost increases in the future, and both of their projections of spending growth have slowed in recent years (Congressional Budget Office, 2014) (Levine and Buntin, 2013); EBRI's estimate baselines are adjusted annually to account for this change. One adjustment was made this year to smooth out the effects of a projected 52 percent increase in Medicare Part B premiums in 2016 for new Medicare beneficiaries. Also, there have been slight improvements in the cost of Medicare Part D and CMS-projected growth rates in Part D premiums. In addition, using a person age 65 in 2015 instead of in 2014 means one less year until the coverage gap in Part D phases down to 25 percent coinsurance.

While savings targets increased between 2014 and 2015, the savings targets for persons with prescription drug use at either the median or 75th percentile continue to be lower than they were in 2012. For persons with prescription drug use at the 90th percentile, savings targets continue to be below where they were in 2011.

Conclusion

Individuals should be concerned about saving for health insurance premiums and out-of-pocket expenses in retirement for a number of reasons. Medicare generally covers only about 60 percent of the cost of health care services for Medicare beneficiaries ages 65 and older, while out-of-pocket spending accounts for 13 percent. Furthermore, the percentage of private-sector establishments offering retiree health benefits has been falling. This is also true in the public sector.

This report provides estimates for the savings needed to cover health insurance to supplement Medicare and out-of-pocket expenses for health care services in retirement. PPACA is reducing cost sharing in the Part D coverage gap or so-called "donut hole." By 2020, coinsurance in the coverage gap will be phased in to 25 percent. This year-to-year reduction in coinsurance will continue to reduce the savings needed for health care expenses in retirement, all else equal, for individuals with the highest drug use, which is one reason why this analysis finds past reductions in needed savings for health care expenses in retirement. Improvements in the outlook for growth in premiums related to the Medicare program also contributed to past declines in savings targets. However, more recently, these declines were offset by larger increases in out-of-pocket spending on prescription drugs as a result of rebaselining.

It is important to note that many individuals will need more than the amounts cited in this report. This analysis does not factor in the savings needed to cover long-term care expenses,[3] nor does it take into account the fact that many individuals retire before becoming eligible for Medicare. However, some workers will need to save less than what is reported if they choose to work past age 65, thereby postponing enrollment in Medicare Parts B and D if they receive health benefits as active workers.

Finally, issues surrounding retirement-income security are certain to become an even greater challenge in the future, as policymakers begin to realistically address financial issues in the Medicare program with solutions that may shift more responsibility for health care costs to Medicare beneficiaries.

References

Congressional Budget Office. *The 2014 Long-Term Budget Outlook.* Washington, DC: Congressional Budget Office, July 2014.

Employee Benefit Research Institute. *Measuring and Funding Corporate Liabilities for Retiree Health Benefits.* Washington, DC: Employee Benefit Research Institute, 1987.

_____. *Retiree Health Benefits: What Is the Promise?* Washington, DC: Employee Benefit Research Institute, 1989.

Fronstin, Paul. "Retiree Health Benefits: What the Changes May Mean for Future Benefits." *EBRI Issue Brief,* no. 175 (Employee Benefit Research Institute, July 1996).

_____. "Employee Benefits, Retirement Patterns, and Implications for Increased Work Life." *EBRI Issue Brief,* no. 184 (Employee Benefit Research Institute, April 1997).

_____. "Retiree Health Benefits: Trends and Outlook." *EBRI Issue Brief,* no. 236, (Employee Benefit Research Institute, August 2001).

_____. "The Impact of the Erosion of Retiree Health Benefits on Workers and Retirees." *EBRI Issue Brief,* no. 279 (Employee Benefit Research Institute, March 2005).

_____. "Savings Needed to Fund Health Insurance and Health Care Expenses in Retirement." *EBRI Issue Brief,* no. 295 (Employee Benefit Research Institute, July 2006).

_____. "Sources of Coverage and Characteristics of the Uninsured: Analysis of the March 2007 Current Population Survey." *EBRI Issue Brief,* no. 310 (Employee Benefit Research Institute, October 2007).

_____. Testimony. U.S. Congress. Senate Special Committee on Aging. *Scrambling for Health Insurance Coverage: Health Security for People between 55–64 Years of Age,* 3 April 2008.

Fronstin, Paul, and Nevin Adams. "Employment-Based Retiree Health Benefits: Trends in Access and Coverage, 1997−2010." *EBRI Issue Brief,* no. 377 (Employee Benefit Research Institute, September 2012).

Fronstin, Paul, and Dallas Salisbury. "Retiree Health Benefits: Savings Needed to Fund Health Care in Retirement." *EBRI Issue Brief,* no. 254, (Employee Benefit Research Institute, February 2003).

_____. "Health Care Expenses in Retirement and the Use of Health Savings Accounts." *EBRI Issue Brief*, no. 271, (Employee Benefit Research Institute, July 2004).

Fronstin, Paul, Dallas Salisbury, and Jack VanDerhei. "Savings Needed to Fund Health Insurance and Health Care Expenses in Retirement: Findings from a Simulation Model." *EBRI Issue Brief,* no. 317 (Employee Benefit Research Institute, May 2008).

_____. "Savings Needed to Fund Health Insurance and Health Care Expenses in Retirement: An Examination of Persons Ages 55 and 65 in 2009." *EBRI Notes,* Vol. 30, no. 6 (Employee Benefit Research Institute, June 2009).

_____. "Funding Savings Needed for Health Expenses for Persons Eligible for Medicare." *EBRI Issue Brief,* no. 351 (Employee Benefit Research Institute, December 2010).

_____. "The Impact of Repealing PPACA on Savings Needed for Health Expenses for Persons Eligible for Medicare." *EBRI Notes,* Vol. 32, no. 8 (Employee Benefit Research Institute, August 2011).

_____. "Savings Needed for Health Expenses for People Eligible for Medicare: Some Rare Good News." *EBRI Notes,* Vol. 33, no. 10 (Employee Benefit Research Institute, October 2012).

_____. "Amount of Savings Needed for Health Expenses for People Eligible for Medicare: More Rare Good News." *EBRI Notes,* Vol. 34, no. 10 (Employee Benefit Research Institute, October 2013).

_____. "Amount of Savings Needed for Health Expenses for People Eligible for Medicare: Good News Not So Rare Anymore." *EBRI Notes,* Vol. 35, no. 10 (Employee Benefit Research Institute, October 2014).

Levine, Michael, and Melinda Buntin. "Why Has Growth in Spending for Fee-for-Service Medicare Slowed?" *CBO Working Paper 2013-06* (Congressional Budget Office, August 2013).

Salisbury, Dallas L., and Paul Fronstin. "How Many Medicare Beneficiaries Will Lose Employment-Based Retiree Health Benefits if Medicare Covers Outpatient Prescription Drugs?" *EBRI Special Report SR-43* Washington, DC: Employee Benefit Research Institute, July 18, 2003.

VanDerhei, Jack. "Measuring Retirement Income Adequacy: Calculating Realistic Income Replacement Rates." *EBRI Issue Brief,* no. 297 (Employee Benefit Research Institute, September 2006).

_____. "Retirement Savings Shortfalls for Today's Workers." *EBRI Notes,* Vol. 31, no. 10 (Employee Benefit Research Institute, October 2010).

VanDerhei, Jack, and Craig Copeland. "Can America Afford Tomorrow's Retirees: Results From the EBRI-ERF Retirement Security Projection Model." *EBRI Issue Brief,* no. 263 (Employee Benefit Research Institute, November 2003).

Endnotes

[1] A technique used to estimate the likely range of outcomes from a complex process by simulating the process under randomly selected conditions a large number of times.

[2] Nominal, after-tax rates of return were assumed to follow a log-normal distribution with a mean of 1.078 and a standard deviation of 0.101. This provided a median nominal annual return of 7.32 percent.

[3] See VanDerhei (2006) for estimates of the impact of long-term care expenses on the amounts needed for sufficient retirement income at the 50th, 75th, and 90th percentiles.

How Does the Probability of a "Successful" Retirement Differ Between Participants in Final-Average Defined Benefit Plans and Voluntary Enrollment 401(k) Plans?

By Jack VanDerhei, Ph.D., Employee Benefit Research Institute

Introduction

A recent study from the Center for Retirement Research (CRR) at Boston College (Munnell, Aubry and Crawford, 2015) has garnered a considerable amount of attention primarily because the authors have had to "change their story" and have concluded that "the accumulation of retirement assets has not declined as a result of the shift from defined benefit [DB] to defined contribution [DC] plans." While there is much to question in the methodology employed in the analysis (including the assumption of a constant 5.5 percent rate of return for both types of plans and the reliance on a previous CRR study that had shown at least 1.5 percent of assets had leaked out of the defined contribution system each year), the authors were correct in concluding that the nature of the accumulation process has shifted dramatically and that the effect of these shifts "can be identified only by looking at data on individuals as opposed to those from our national accounts."

Fortunately, at least three studies have already been undertaken to provide this type of analysis. This *EBRI Notes* article begins with a review of the previous academic literature and summarizes previous EBRI research analyzing the conditions under which voluntary-enrollment (VE) 401(k) plans are likely to provide an accumulation of retirement assets at least equivalent to those provided under a counterfactual[1] final-average DB plan. New research is then presented to show the percentage of "successful" retirements by income quartile for workers currently ages 25–29 who will have more than 30 years of simulated eligibility for participation in a 401(k) plan. Results are first presented for both voluntary-enrollment 401(k) plans and final-average DB plans with a 1.5 percent accrual rate. Sensitivity analysis is provided by also analyzing the comparative success rates of final-average defined benefit plans with accrual rates of 1.0 and 2.0 percent.

Previous Academic Literature

Samwick and Skinner (2004) used two different approaches to compare a representative sample of defined benefit plans with a representative sample of 401(k) plans in an attempt to determine the adequacy of 401(k) plans relative to private-sector DB plans. Under the first approach, they constructed a counterfactual simulation to estimate benefits for the sample of workers covered by their actual pension plan in the Pension Provider Surveys (PPS) of 1983 or 1989[2] and assigned each worker a randomly chosen 401(k) plan from the Survey of Consumer Finances (SCF) in the years 1989 through 2001. In both the DB and 401(k) scenarios, the time series of earnings were identical for each worker, who was assumed to have worked at the firm from each worker's actual date of hire until age 62. In the second approach, the authors analyzed a hypothetical-benchmark worker with the average characteristics (age, date of hire, earnings) of the PPS sample.

When Samwick and Skinner considered the counterfactual where individuals in DB plans were assigned participation in randomly chosen 401(k) plans using 1983 workers and DB plans, they found median benefits of $9,440 (all values are in 1995 dollars and represent real annuities) for actual workers with just a DB pension in the PPS (assuming they continued working at their current jobs until age 62). Assigning randomly chosen 401(k) plans from 1995[3] for the same earnings produced median benefits of $11,004. When 401(k) enrollees with zero contributions were included, the median fell to $9,950. Performing the same counterfactual experiment using the sample of plans from the PPS 1989 survey for workers with only DB plans, median benefits were found to be lower for 401(k) plans ($11,274) compared with DB plans ($12,524). Including noncontributors in the sample reduced median 401(k) benefits further to $10,176.

In their analysis of the benchmark hypothetical worker, Samwick and Skinner found that the 1989 DB plan provided a higher median payment ($13,151) than the corresponding 1989 401(k) plan ($10,633). However, by 1995, median benefits were higher for 401(k) plans ($13,942) and continued to be higher in both 1998 ($15,113) and 2001 ($16,338). The authors attributed the results to higher contribution rates to 401(k) plans over time and a shift away from the very low-yield short-term bonds

As part of their sensitivity analysis for the 1995 401(k) balances on the benchmark analysis, the authors changed the 401(k) plan assumptions in three different ways. First, they assumed that the participants who were determined to have no contributions were added to the analysis (this had the effect of reducing the 1995 401(k) median balance to $13,624). Secondly, they assumed that equity returns were 2 percentage points lower than the baseline assumption of 7.95 percent real rate of return (this had the effect of decreasing the 401(k) median balance to $12,081). Third, they assumed that administrative fees were lowered to 30 basis points (this increased the 401(k) median balance to $15,373).

One of the most important aspects of their study dealt with the analysis of job changes. Although the hypothetical-benchmark worker was assumed to have been covered by the same pension plan from ages 31 to 62 in the main comparison, a separate portion of the study attempted to deal with the impact of 401(k) cashouts at job change, as well as the back-loading of DB accruals. A series of stylized job durations were modeled and the present value of pension wealth for the 1989 DB plans and 1995 401(k) plans was simulated. The ratio of these two present values provided information on how much of the 401(k) account balance could have been cashed out before the 401(k) plan would have provided a smaller retirement benefit than the DB plan. From this analysis they concluded that (for the benchmark worker), those with a long career (ages 31–65) under the same pension could have cashed out 18 percent of the 401(k) balance and still would have had the same median pension-benefit as that provided by the DB plans. Under an alternative scenario where the benchmark worker had three jobs (working from ages 31–42, 42–53, and 53–65) and received median benefits, the worker would have needed to roll over just 68 percent of 401(k) balances to have ended up with the same median-pension benefit as that provided by the DB plan.

Although the Samwick and Skinner analysis represented a significant advancement in the analysis of the relative adequacy of retirement benefits from DB plans vs. 401(k) plans,[4] there were two issues inherent to the use of SCF data at that time that need to be considered in the interpretation of the results. First, there were only a small percentage of workers in the SCF survey who claimed to have been covered only by a 401(k) plan but reported no employee or employer 401(k) contribution. This percentage ranged from 2.7 to 4.7 percent, depending on the year of the SCF survey used in the analysis.[5] Second, given the limited information available with respect to asset allocation in the SCF survey, the authors were forced to assign shares of equity in each 401(k) plan to 0, 50, or 100 percent, and workers were assumed to rebalance their portfolio over time to maintain the same asset share.[6]

Poterba, Rauh, Venti and Wise (2007) used information from actual retirement plans that covered respondents in the Health and Retirement Study (HRS).[7] They used actual lifetime-earnings trajectories along with the historical distribution of returns on financial assets to calculate the resulting asset balance at age 63 and concluded that the benefits provided by private-sector DB plans were almost always less than DC plans under the parameterizations they studied. The authors assumed that an individual contributed a fixed percentage of his or her earnings to a DC plan each year during a working life that began at age 28. This was determined by drawing from a distribution of combined employer and employee contributions as a percentage of pay for HRS males with *positive* contributions to DC plans.[8]

Poterba, Rauh, Venti, and Wise assumed that the distribution of returns was given by an empirical distribution of returns during the 1926 to 2003 period: a time when the average annual arithmetic real return on large-cap U.S. equities was 9.2 percent and long-term U.S. government bonds had a real return of 2.8 percent.[9] Overall investment returns were obtained by combining this return information with seven different asset allocation strategies for each individual's DC account and netting out investment-related expenses.[10] Job histories were constructed for each of the

HRS respondents in their sample based on earnings history and responses to various HRS questions about job tenure with the assumption that no one in the sample had more than three DB-eligible jobs during their working career.

Although their findings represented an important first step toward comparing the relative risks of DB and DC plans using the actual earnings histories, there were some caveats acknowledged by the authors that should be examined in the interpretation of the results. First, they did not allow for lump-sum distributions from DC plans.[11] Second, they did not allow for differences in asset allocation patterns. Third, they limited the simulation of wealth accumulation to households that were exposed to either DC or DB plans *throughout* their working career. Perhaps most important to an accurate interpretation of the results was that, while they did randomize the generosity parameters of the private-sector DB plans within their sample of 25 HRS plans, there was no similar treatment accorded DC plans. Indeed, they assumed that a given combined employee- and employer-contribution percentage would apply throughout the participant's lifetime, even when job changes occurred.[12]

Previous EBRI Research

VanDerhei (June 2013) analyzed this topic by making use of a modified version of the EBRI Retirement Security Projection Model® (RSPM) to compare simulated retirement benefits available under voluntary-enrollment (VE) 401(k) plans with those that would be available from a counterfactual simulation of (a) a high-three-year, final-average DB plan and (b) a cash-balance plan. Both of the counterfactual DB plans used the same sequence of eligibility, wage, and job change information simulated for the DC plan. At age 65, a nominal annuity was assumed to be purchased by the DC participant and a pairwise comparison was made between that value and what would have been available under the final-average DB plan and cash-balance plan under the same employment history.

Unlike the procedures adopted by Samwick and Skinner (2004) and Poterba et al. (2007), the generosity parameters used to model both matching and nonelective contributions for VE 401(k) plans were hand-coded from plan-specific data of approximately 1,000 large DC plans for salaried employees from Benefit SpecSelect™ (a trademark of AonHewitt[13]) in 2005.[14]

The simulation model constructed for that study adopted the basic structure of the RSPM.®[15] Initial and subsequent eligibility for 401(k) plans and participation in VE 401(k) plans was based on an integration of the distribution of DC-plan-participant status by age and earnings found in the U.S. Census Bureau's Survey of Income and Program Participation (SIPP), along with the participation probabilities among eligible employees in VE plans from Fidelity.[16] Additional employee behavior in VE plans was based on a joint distribution of asset-allocation and contribution behavior as a function of employee age and income from a subset of the year-end 2011 EBRI/ICI Participant-Directed Retirement Plan Data Collection Project (VanDerhei, Holden, Alonso and Bass, 2012).

All simulation results were based on the annual return assumptions used in Finke, Pfau and Blanchett (2013). The baseline results were generated from stochastic annual returns with a log-normal distribution and an arithmetic mean of 8.6 percent real return for stocks and 2.6 percent real return for bonds. Sensitivity analysis was conducted in this study by reducing the returns by 200 basis points.

Perhaps the most challenging set of assumptions to develop in a model of this type is the serial correlation of 401(k) plan eligibility between jobs. The baseline case in Holden and VanDerhei (2002) assumed that, if an employee was a 401(k) participant in the current job, this status would remain constant in every subsequent job until retirement. Knowing that this was certainly too optimistic for many employees, sensitivity analysis was provided by assuming that there would be a random chance of being eligible for a 401(k) plan in a subsequent job.

Until empirical information is available to track individual employees from one job to the next and track their 401(k) eligibility status, one needs to rely on some type of assumption for this variable. Because there appears to be a well-documented body of evidence that individuals with a propensity to save seek out 401(k) sponsors (or vice versa),[17] an

admittedly ad-hoc approach has been developed to compute eligibility probabilities conditional upon the eligibility status on the previous job, as shown below:

> Let z = the unconditional probability of being covered (empirical value as a function of age and wage).

> Let x = the probability of being covered given that the participant's last job was covered.

> Let y = the probability of being covered given that the participant's last job was NOT covered.

VanDerhei and Copeland (2008) analyzed two cases for x:[18]

1. Complete independence (e.g., x=z=y).

2. An ad-hoc assumption that the value of x will be halfway between the unconditional value and 100 percent. In other words, $x = (1+z)/2$ and $y = (z-.5*(z)(1+z))/(1-z)$.

There is no way to tell at this point which of these assumptions is likely to be more realistic. However, all simulations were conducted using *both* sets of assumptions to check the sensitivity of the results in VanDerhei and Copeland (2008), and in most cases there were not significant differences between the two assumptions. All results in VanDerhei (June 2013) make use of the second assumption.

A similar dilemma arises with respect to participation rates (among eligible employees) over their working careers. Industry data exists on these conditional participation rates by age and salary; however, current data does not allow researchers to determine whether these probabilities change once the employees have participated in a 401(k) plan.

In essence, three different assumptions might be hypothesized to deal with participation at job change (assuming the employees are eligible):

1. *Complete independence (based on their current age and income):* Current conditional-participation probabilities do not depend on whether they were previously participants.

2. *A "once a participant, always a participant (if eligible)" scenario:* Once an individual has been simulated to be a participant, he or she will continue to be a participant every time he or she is eligible.

3. *An intermediate situation:* Similar to the second assumption above with respect to eligibility.

Assumption 2 appears overly optimistic and assumption 3 is used as the baseline assumption in the study. However, assumption 1 is used as part of the sensitivity analysis.

Because the study focuses on the account balance at age 65 in a current or previous employer's 401(k) as well as any individual retirement account (IRA) rollovers originating from 401(k) accounts, it simulates the likelihood that a participant will cash out the 401(k) balance at preretirement job termination.[19] The current model uses cashout information by age and account balance from Vanguard.[20]

The analysis in the VanDerhei article (June 2013) was entirely forward-looking: It tracked accumulations only resulting from post-2013 contributions. All existing balances were ignored, but simulations were limited to employees who were ages 25–29 at the time of the study.

Unlike the 10 distinct gender- and education-age-earnings profiles typically used in RSPM,[®] this study uses the employee's current earnings and assumes (similar to Pang and Warshawsky, 2013) that earnings grow at 3.9 percent annually before age 55 and then at 2.8 percent until retirement. However, one of the sensitivity analyses tests the impact of the post-age-55 assumption of zero-real-wage growth.

Given the need to convert the DC account balance to a nominal annuity for comparison purposes with the final-average DB plan, the choice of an annuity purchase price is an essential assumption. One obvious choice would be to determine the rate at which a 65-year-old would be able to convert a lump-sum distribution to a nominal annuity in today's market. However, these rates (14.70 for males and 16.31 for females) were at historically high values and could certainly bias the results toward a more favorable comparison for DB plans. Although these rates are used for some of the comparisons, it is thought that using an implied annuity purchase price for a time when bonds rates were closer to historical norms would provide a better benchmark.

For purposes of this determination, average-annuity-rate data for different age groups and genders from 1986–2013 have been obtained,[21] and the gender-specific prices at age 65 are regressed against Moody's AAA Corporate Bond yields and a time dummy (to control for changes in life expectancy over this period of time). Using the regression coefficients and multiplying by the maximum value of the time variable (viz., today) and the average corporate bond rate during that time period (6.85 percent), the benchmark annuity purchase prices are determined to be 11.61 for males and 12.34 for females.

The analysis includes many different sensitivity analyses to show what would happen as each of the baseline assumptions is changed. These included, inter alia:

- Reducing the expected future rate of return by 200 basis points.

- Pricing the annuity at the lower discount rates in 2013.

- Increasing the DB accrual rate from the median generosity parameter of 1.5 percent to 1.82 percent.

A major shortcoming of this type of presentation is that confining the counterfactual simulation to either a 1.5 percent or 1.82 percent benefit accrual as the counterfactual rate for the DB plan provides relevant comparisons for only a subset of the plans. Therefore, VanDerhei (December 2013) provided additional analysis that in essence came up with a "break even" accrual rate that a counterfactual final-average DB plan would need in order to provide larger benefits than the 401(k) provided. This had the distinct advantage of letting one immediately apply the numbers on the figures with the plan actually being used to see if the 401(k) would be assumed to be better or worse.
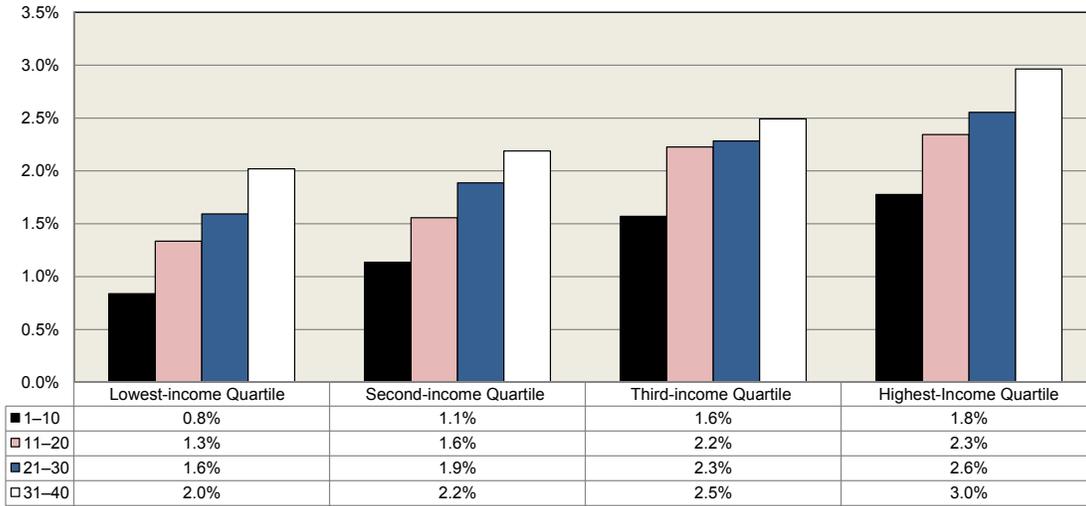
Figure 1 shows that under the baseline assumptions, a male in the lowest-income quartile with 31–40 years of eligibility would need to have a median accrual rate of 2.0 percent in the final-average DB plan to provide equivalent retirement benefits to those simulated from the VE 401(k) plan. However, a male in the highest-income quartile with the same number of years of eligibility would require a median accrual rate of 3.0 percent, reflecting the lower participation rates for participants with lower salaries. This increases to 2.2 percent for the next income quartile and 2.5 percent for the third-income quartile.

Given their longer life expectancies at age 65 (and hence higher annuity purchase prices in the individual market), females would be expected to need lower DB accrual rates for equivalency. And, in fact, comparing Figures 1 and 2 shows that for most combinations of years-of-eligibility category and income quartile the median DB accrual rate for females is less than, or equal to, the corresponding rate for males.[22]
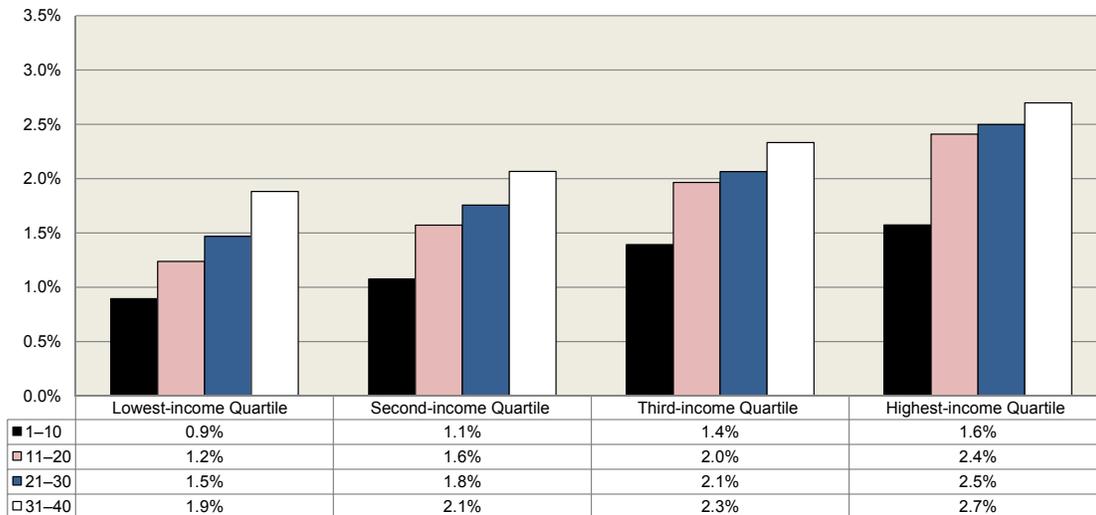
Probability of a "Successful" Retirement

This *Notes* article expands the research in VanDerhei (June 2013) by simulating the percentage of "successful" retirements by income quartile for workers currently ages 25–29 who will have more than 30 years of simulated eligibility for participation in a 401(k) plan. For purposes of this *Notes* article, "success" is defined as achieving an *X* percent real replacement rate from Social Security and 401(k) accumulations combined as defined in VanDerhei and Lucas (2010) where X = 60, 70 or 80.[23]

Figure 1
Median of Final-average DB[a] Plan Generosity Parameters Needed for Equivalence With VE[b] 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: Baseline Assumptions for Males

	Lowest-income Quartile	Second-income Quartile	Third-income Quartile	Highest-Income Quartile
■ 1–10	0.8%	1.1%	1.6%	1.8%
▨ 11–20	1.3%	1.6%	2.2%	2.3%
■ 21–30	1.6%	1.9%	2.3%	2.6%
□ 31–40	2.0%	2.2%	2.5%	3.0%

Source: Employee Benefit Research Institute Retirement Security Projection Model® Version 1931.
The numbers represent the annual accrual percentage that would be multiplied by final-average salary and years of participation.
Assumptions: historical rates of return; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as they react to the account balance in the 401(k) plan; annuity purchase price = 11.61 (males age 65 with today's longevity assumptions but priced when average corporate bond rate = 6.85%).
[a] Defined benefit.
[b] Voluntary enrollment.

Figure 2
Median of Final-average DB[a] Plan Generosity Parameters Needed for Equivalence With VE[b] 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: Baseline Assumptions for Females

	Lowest-income Quartile	Second-income Quartile	Third-income Quartile	Highest-income Quartile
■ 1–10	0.9%	1.1%	1.4%	1.6%
▨ 11–20	1.2%	1.6%	2.0%	2.4%
■ 21–30	1.5%	1.8%	2.1%	2.5%
□ 31–40	1.9%	2.1%	2.3%	2.7%

Source: Employee Benefit Research Institute Retirement Security Projection Model® Version 1931.
The numbers represent the annual accrual percentage that would be multiplied by final-average salary and years of participation.
Assumptions: historical rates of return; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as they react to the account balance in the 401(k) plan; annuity purchase price = 12.34 (females age 65 with today's longevity assumptions but priced when average corporate bond rate = 6.85%).
[a] Defined benefit.
[b] Voluntary enrollment.

The EBRI/ICI 401(k) database has been used to provide annual reports based on actual account balances of large cross sections of 401(k) plan participants since 1996.[24] Looking at consistent participants in the EBRI/ICI 401(k) database in the wake of the financial crisis (over the six-year period from year-end 2007 to year-end 2013), a joint EBRI/Investment Company Institute (ICI) analysis found that the average 401(k) account balance fell 25.8 percent in 2008, then rose from 2009 to 2013.[25] Overall, the average account balance in this consistent sample increased at a compound, annual, average growth rate of 10.9 percent over the 2007–2013 period.

While this information is certainly useful to evaluate assertions (and anecdotal claims) with respect to the impact of the financial crisis on 401(k) plans, it needs to be supplemented with simulation modeling for a proper evaluation of the potential of 401(k) plans to produce "adequate" income replacement for several reasons:

- The EBRI/ICI 401(k) database does not contain information on IRA rollovers and therefore may represent only a fraction of a participant's retirement accumulations if he or she has had job changes.

- Even if one looks only at 401(k) participants who have had decades of tenure with their current employer, there is a significant likelihood that they would not have been eligible to participate in a 401(k) plan during their entire career with their current employer.[26]

- An analysis based solely on current balances will not incorporate the impact of future employee activity (such as potential cashout behavior at job change), nor the impact of future financial market returns.
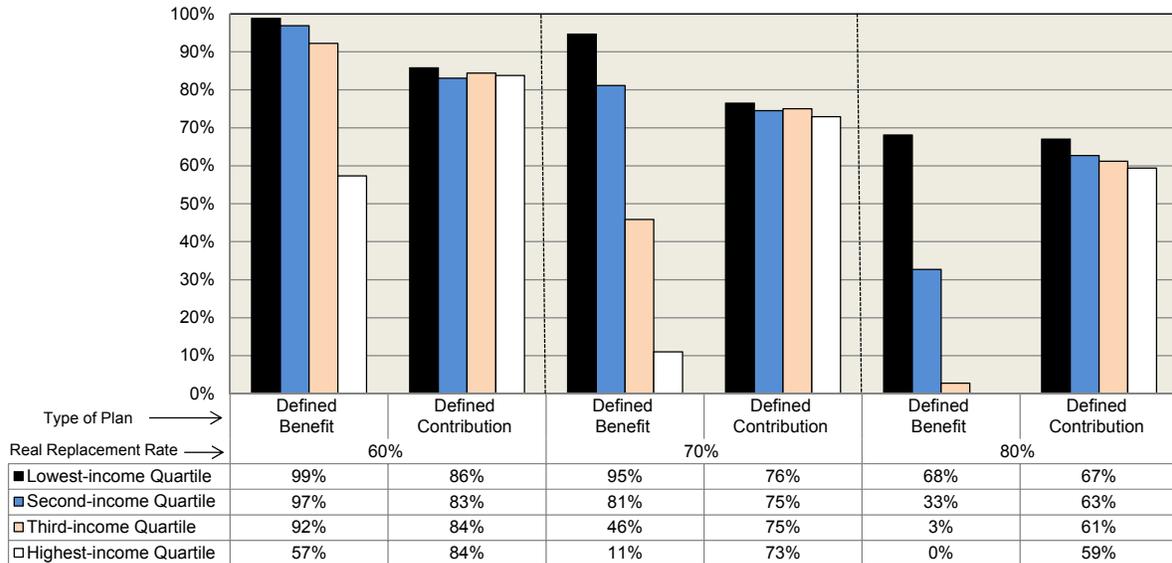
To assist in the evaluation of the role of 401(k) plans, EBRI has used its RSPM® to analyze the potential of 401(k) plans to produce "adequate" income replacement. This analysis provides probabilities of successful retirement (defined below) by income quartile for voluntary-enrollment 401(k) plans. Given that the objective of this analysis is to focus on the *potential* for 401(k) plans to produce a threshold level of income replacement at retirement, this analysis is limited to individuals who are simulated to have more than 30 years of eligibility to participate (whether or not they actually choose to participate in each of those years) by the time they reach age 65.[27]

Figure 3 summarizes the projections for the percentage of "successful" retirements for 401(k) participants, by income quartile, for those currently ages 25–29 in a *voluntary-enrollment* 401(k) plan. The analysis assumes that workers retire at age 65, and that all balances are converted into an inflation-adjusted annuity at an annuity purchase price of 18.62 at that point.[28] The annual income provided by this annuity in the first year of retirement is added to the simulated Social Security retirement benefit provided for the worker (spousal benefits are not included), and the combined retirement income is expressed as a percentage of the salary the worker was simulated to have earned at age 64.

One difficulty in evaluating the potential of any type of retirement income source is the determination of the threshold for "success." While there have been a number of attempts to quantify this in the past,[29] there appears to be little consensus on the appropriate level(s).[30] Therefore, this analysis uses three alternative "success" thresholds: attaining 60, 70, and 80 percent (respectively) of the preretirement income replaced by the combination of the annuitized value of the 401(k) accumulations[31] combined with the primary Social Security benefit amounts.

The top row in the grid for Figure 3 shows that for the lowest-income quartile,[32] 86 percent of the workers currently ages 25–29 who will have more than 30 years of eligibility for participation in a VE 401(k) plan are simulated to be able to replace at least 60 percent of their age-64 salary from their annuitized 401(k) accumulations and Social Security. In contrast, if these same workers (with similar wage and job turnover) are in a final-average DB plan with a 1.5 percent accrual rate, the probability of "success" increases to 99 percent. This differential in favor of this specific type of DB plan vs. VE 401(k) plans remains positive for the second- and third-income quartiles (97 vs. 83 percent and 92 vs. 84 percent); however the probability of success is much higher for the highest-income quartile under VE 401(k) plans (84 percent) than for the DB plan (57 percent).

Figure 3
**Percentage of Successful* Retirements by Income Quartile:
Voluntary Enrollment 401(k) Plans vs. Counterfactual Final-average
Defined Benefit Plan With a 1.5% Accrual**

Type of Plan ⟶	Defined Benefit	Defined Contribution	Defined Benefit	Defined Contribution	Defined Benefit	Defined Contribution
Real Replacement Rate ⟶	60%		70%		80%	
■ Lowest-income Quartile	99%	86%	95%	76%	68%	67%
■ Second-income Quartile	97%	83%	81%	75%	33%	63%
▫ Third-income Quartile	92%	84%	46%	75%	3%	61%
▫ Highest-income Quartile	57%	84%	11%	73%	0%	59%

Source: Employee Benefit Reearch Institute Retirement Security Projection Model,® version 1931c.
* "Success" is defined as achieving an X percent real replacement rate from Social Security and 401(k) accumulations combined as defined in VanDerhei and Lucas (2010) where X = 60, 70 or 80. The population simulated consists of workers currently ages 25–29 who will have more than 30 years of simulated eligibility for participation in a 401(k) plan. Workers are assumed to retire at age 65, and all 401(k) balances are assumed to be converted into a real annuity at an annuity purchase price of 18.62.

When the threshold for success is increased to 70 percent in Figure 3, the influence of the Primary Insurance Amount (PIA)[33] formula for Social Security benefits becomes even more apparent. While the probability of success for the lowest-income quartile is larger for DB plans (95 percent) than 401(k) plans (76 percent), the difference narrows for the second-income quartile (81 percent for DB and 75 percent for 401(k)). The advantage for 401(k) vs. DB is considerable for the third-income quartile (75 percent vs. 46 percent) and is extraordinarily large for the highest-income quartile (73 percent vs. only 11 percent for defined benefit plans).

By the time the threshold for success reaches 80 percent in Figure 3, only the lowest-income quartile has a similar probability of success for DB (68 percent) as VE 401(k) (67 percent). Very few of the second-income quartile (33 percent) will meet the 80 percent threshold under the DB plan compared to 63 percent under the 401(k) plan. Given the reduced replacement rates for higher-income individuals under Social Security, virtually none of the individuals in the top half of the income distribution meet the threshold for success (3 percent for the third-income quartile and virtually 0 percent for the highest-income quartile) under a DB plan. This is in contrast to 61 and 59 percent under 401(k) plans for the third- and fourth-income quartiles, respectively.

Sensitivity analysis is provided by also analyzing the comparative success rates of final-average DB plans with accrual rates of 1.0 and 2.0 percent. Figure 4 provides similar analysis for a final-average DB plan with a 2 percent accrual rate and Figure 5 shows the same comparisons for a final-average DB plan with a 1 percent accrual rate.

Future Research

Since the passage of the Pension Protection Act (PPA) in 2006, several EBRI studies[34] have focused on the likely impact of automatic enrollment (AE) on 401(k) participants. While most industry data show that the number of

recently hired workers eligible for participation in an AE 401(k) plan has been increasing steadily since 2007, researchers have still made a number of assumptions with respect to opt-out behavior for plans with automatic escalation of contributions and they need to wait for additional empirical data before parameterization of the models can take place with increased precision.[35] Therefore, despite the upward trend in AE adoption, VE 401(k) plans were the only type of DC plan modeled. A follow-up publication will repeat the analysis for AE plans as soon as there is sufficient time-series information.[36]

Summary

This *Notes* article reviews previous academic literature comparing defined benefit (DB) and defined contribution (DC) plans with respect to their ability to produce retirement income. It then summarizes previous EBRI research analyzing the conditions under which voluntary-enrollment (VE) 401(k) plans are likely to provide an accumulation of retirement income at least equivalent to those provided under a counterfactual final-average DB plan.

New research is then presented to show the percentage of "successful" retirements by income quartile for workers currently ages 25–29 who will have more than 30 years of simulated eligibility for participation in a 401(k) plan. Results are compared for VE 401(k) plans and a final-average DB plan with a 1.5 percent accrual rate.
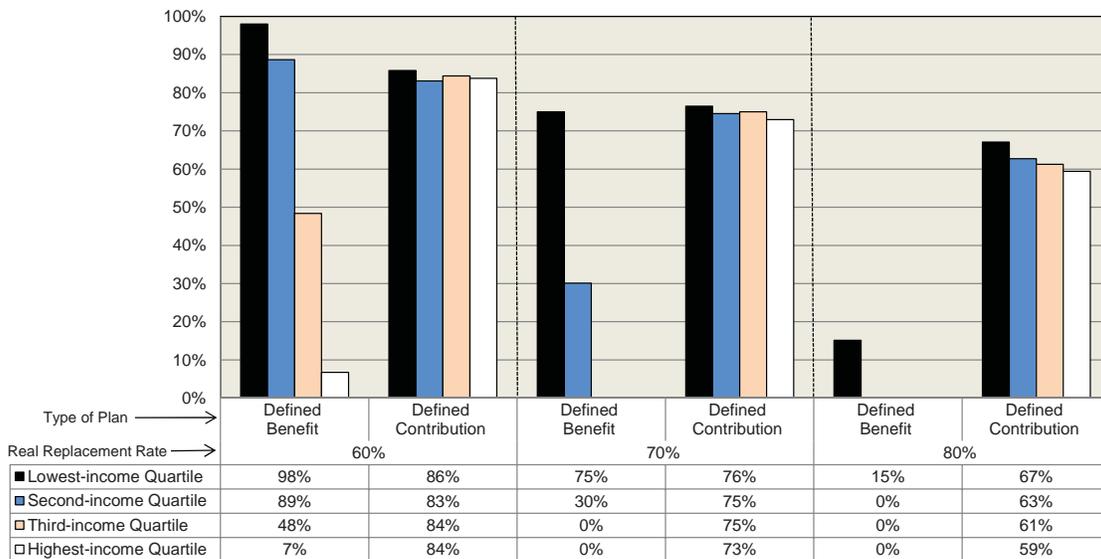
Using baseline assumptions (defined in the study), it appears that the DB plan has a higher probability of achieving a real replacement (when combined with Social Security payments) of 60 percent than the VE 401(k) plans for the first three income quartiles. If a 70 percent replacement rate is used as a threshold, participants in the third-and fourth-income quartiles have a much higher probability of success with the 401(k) plans than the DB plans. When the threshold is set at a higher (and according to many financial planners, more realistic) replacement rate of 80 percent, the 401(k) plans have a much higher probability of success than the counterfactual DB plans for all groups except for the lowest-income quartile (where the results are virtually even).

Figure 4
Percentage of Successful* Retirements by Income Quartile:
Voluntary Enrollment 401(k) Plans vs. Counterfactual
Final-average Defined Benefit Plan With a 2.0% Accrual
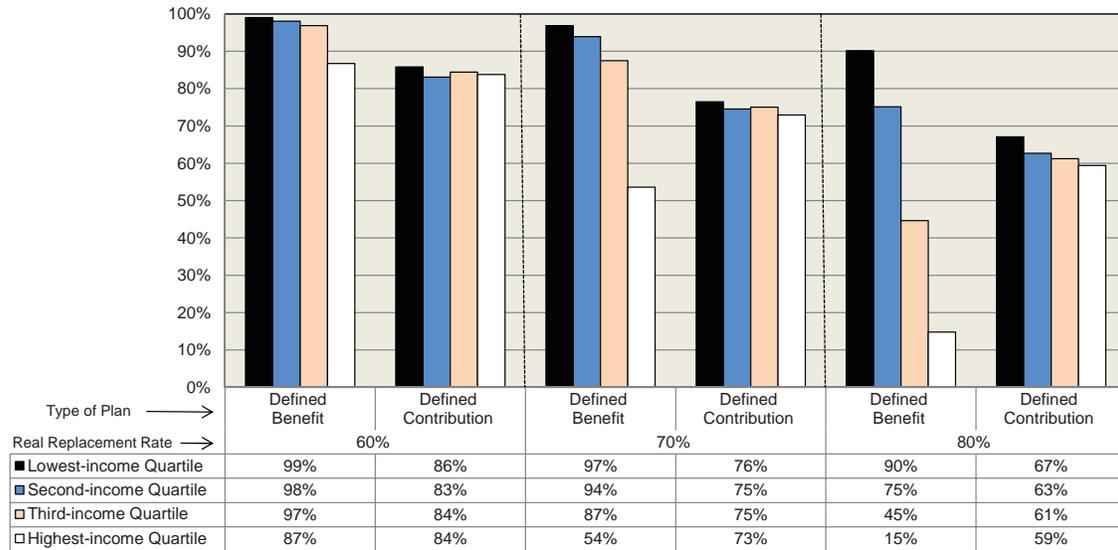
Type of Plan →	Defined Benefit	Defined Contribution	Defined Benefit	Defined Contribution	Defined Benefit	Defined Contribution
Real Replacement Rate →	60%		70%		80%	
■ Lowest-income Quartile	99%	86%	97%	76%	90%	67%
■ Second-income Quartile	98%	83%	94%	75%	75%	63%
□ Third-income Quartile	97%	84%	87%	75%	45%	61%
□ Highest-income Quartile	87%	84%	54%	73%	15%	59%

Source: Employee Benefit Research Insitute Retirement Security Projection Model,® version 1931c.
* "Success" is defined as achieving an X percent real replacement rate from Social Security and 401(k) accumulations combined as defined in VanDerhei and Lucas (2010) where X = 60, 70 or 80. The population simulated consists of workers currently ages 25–29 who will have more than 30 years of simulated eligibility for participation in a 401(k) plan. Workers are assumed to retire at age 65, and all 401(k) balances are assumed to be converted into a real annuity at an annuity purchase price of 18.62.

Figure 5
Percentage of Successful* Retirements by Income Quartile:
Voluntary Enrollment 401(k) Plans vs. Counterfactual
Final-average Defined Benefit Plan With a 1.0% Accrual

Type of Plan →	Defined Benefit	Defined Contribution	Defined Benefit	Defined Contribution	Defined Benefit	Defined Contribution
Real Replacement Rate →	60%		70%		80%	
■ Lowest-income Quartile	98%	86%	75%	76%	15%	67%
■ Second-income Quartile	89%	83%	30%	75%	0%	63%
□ Third-income Quartile	48%	84%	0%	75%	0%	61%
□ Highest-income Quartile	7%	84%	0%	73%	0%	59%

Source: Employee Benefit Research Institute Retirement Security Projection Model,® version 1931c.
* "Success" is defined as achieving an X percent real replacement rate from Social Security and 401(k) accumulations combined as defined in VanDerhei and Lucas (2010) where X = 60, 70 or 80. The population simulated consists of workers currently ages 25–29 who will have more than 30 years of simulated eligibility for participation in a 401(k) plan. Workers are assumed to retire at age 65, and all 401(k) balances are assumed to be converted into a real annuity at an annuity purchase price of 18.62.

References

Finke, Michael S., Wade Pfau, and David Blanchett. "The 4 Percent Rule is Not Safe in a Low-Yield World." *Journal of Financial Planning* 26 (6): 46–55 (January 2013).

Gustman, Alan L. and Thomas L. Steinmeier. "Changing Pensions in Cross-Section and Panel Data: Analysis with Employer Provided Plan Descriptions." *Proceedings,* National Tax Association (November 8–10, 1998): 371-377.

Holden, Sarah, and Jack VanDerhei. "Can 401(k) Accumulations Generate Significant Income for Future Retirees?" *EBRI Issue Brief,* no. 251 (Employee Benefit Research Institute, November 2002).

Ippolito, Richard A. "Pension Plans and Employee Performance." (Chicago: University of Chicago Press, 1997).

MacDonald, Bonnie-Jeanne, and Kevin D. Moore. "Moving Beyond the Limitations of Traditional Replacement Rates." Society of Actuaries (September 2011).

Munnell, Alicia H. Jean-Pierre Aubry, and Caroline V. Crawford. "How Has Shift to Defined Contribution Plans Affected Saving?" Center for Retirement Research at Boston College, (September 2015): Number 15-16

Pang, Gaobo and Mark J. Warshawsky, "Retirement Savings Adequacy of U.S. Workers" (March 12, 2013). Available at SSRN: http://ssrn.com/abstract=2263379

Poterba, James, Joshua Rauh, Steven Venti, and David A. Wise. "Defined Contribution Plans, Defined Benefit Plans, and the Accumulation of Retirement Wealth." *Journal of Public Economics* 91, no. 10 (November 2007): 2062–2086.

Samwick, Andrew A., and Jonathan Skinner. "How Will 401(k) Pension Plans Affect Retirement Income?" *The American Economic Review* 94, no. 1 (March 2004): 329–343.

Utkus, Stephen P. and Jean A. Young. "How America Saves 2013." Vanguard, online at https://institutional.vanguard.com/VGApp/iip/site/institutional/clientsolutions/dc/howamericasaves

VanDerhei, Jack. "What Causes EBRI Retirement Readiness Ratings[TM] to Vary: Results from the 2014 Retirement Security Projection Model.[®]" *EBRI Issue Brief*, no. 396, (Employee Benefit Research Institute, February 2014).

———. "How Much Would it Take? Achieving Retirement Income Equivalency Between Final-Average-Pay Defined Benefit Plan Accruals and Voluntary Enrollment 401(k) Plans in the Private Sector." *EBRI Notes*, vol. 34, no. 12, (Employee Benefit Research Institute, December 2013).

———. "Is Working to Age 70 Really the Answer for Retirement Income Adequacy?" *EBRI Notes,* no. 8 (Employee Benefit Research Institute, August 2012): 10–21.

———. "Reality Checks: A Comparative Analysis of Future Benefits from Private-Sector, Voluntary-Enrollment 401(k) Plans vs. Stylized, Final-Average-Pay Defined Benefit and Cash-Balance Plans." *EBRI Issue Brief,* no. 387 (Employee Benefit Research Institute, June 2013).

———. "Retirement Income Adequacy for Boomers and Gen Xers: Evidence from the 2012 EBRI Retirement Security Projection Model.[®]" *EBRI Notes,* no. 5 (Employee Benefit Research Institute, May 2012): 2–14.

———. "The Expected Impact of Automatic Escalation of 401(k) Contributions on Retirement Income." *EBRI Notes,* no. 9 (Employee Benefit Research Institute, September 2007): 2–8.

_____. "The Impact of Automatic Enrollment in 401(k) Plans on Future Retirement Accumulations: A Simulation Study Based on Plan Design Modifications of Large Plan Sponsors." *EBRI Issue Brief,* no. 341 (Employee Benefit Research Institute, April 2010).

_____. Testimony. Joint DOL/SEC Public Hearing on Target Dates Funds. "How Would Target-Date Funds Likely Impact Future 401(k) Contributions?" (T-160), June 2009. www.ebri.org/pdf/publications/testimony/t160.pdf

VanDerhei, Jack, and Craig Copeland. "The EBRI Retirement Readiness Rating:[TM] Retirement Income Preparation and Future Prospects." *EBRI Issue Brief*, no. 344 (Employee Benefit Research Institute, July 2010).

_____. "The Impact of PPA on Retirement Income for 401(k) Participants." *EBRI Issue Brief,* no. 318 (Employee Benefit Research Institute, June 2008).

VanDerhei, Jack, Sarah Holden, Luis Alonso, and Steven Bass. "What Does Consistent Participation in 401(k) Plans Generate? Changes in 401(k) Account Balances, 2007–2013." *EBRI Issue Brief,* no. 418, (Employee Benefit Research Institute, September 2015).

_____. "401(k) Plan Asset Allocation, Account Balances, and Loan Activity in 2011," *EBRI Issue Brief,* no. 380, and *ICI Research Perspective* 18, no. 9 (Employee Benefit Research Institute and Investment Company Institute, December 2012).

VanDerhei, Jack, Sarah Holden, Luis Alonso, Steven Bass, and AnnMarie Pino. "401(k) Plan Asset Allocation, Account Balances, and Loan Activity in 2013."   *EBRI Issue Brief,* no. 408 (Employee Benefit Research Institute, December 2014).

VanDerhei, Jack, and Lori Lucas. "The Impact of Auto-enrollment and Automatic Contribution Escalation on Retirement Income Adequacy." *EBRI Issue Brief,* no. 349 (Employee Benefit Research Institute, November 2010); and DCIIA Research Report (November 2010).

Endnotes

[1] Counterfactual experiments (contrary to established fact) describe how an observed effect might vary under different sets of conditions and speculate what might have happened if observed facts were different. For economic studies, they typically utilize computer simulation models to run a variety of statistical "what-if" scenarios.

[2] For every respondent or spouse in the 1983 and 1989 SCF samples who reported being covered by a pension, the PPS attempted to obtain the summary plan description for the plan from the pension provider.

[3] The lack of a pension provider survey after 1989 did not allow the authors to do a comparison of the 1995 401(k) plans with 1995 defined benefit plans. Evidence on the extent to which the characteristics of defined benefit plans in 1995 were similar to those in 1990 can be found in Gustman and Steinmeier (1998).

[4] Holden and VanDerhei (2002) developed a stochastic simulation model of 401(k) accumulations and IRA rollovers but they did not compare the resulting benefits to defined benefit plan accruals.

[5] In contrast, Utkus and Young (2013) report Vanguard data showing a participation rate of 59 percent for their voluntary enrollment plans in 2012. However, unlike the Samwick and Skinner analysis, the estimate for Vanguard participants was not limited specifically to those with 401k plans who have no other employer-sponsored pension plan.

[6] VanDerhei, Holden, Alonso, and Bass (2012) report that, as in previous years, the EBRI/ICI database of 24 million 401(k) participants for year-end 2011 shows that participants' asset allocation varied considerably with age. Younger participants tended to favor equity funds and balanced funds, while older participants were more likely to invest in fixed-income securities such as bond funds, GICs and other stable-value funds, or money funds. For example, among participants in their 20s, the average allocation to equity and balanced funds was 75 percent of assets, compared with 50 percent of assets among participants in their 60s.

[7] The sample of defined benefit plan parameters was selected from the 25 largest private-sector defined benefit plans ranked by number of HRS participants (the public sector was analyzed separately in their study). The algorithm used in their study does not allow for migration between the public and the private sectors.

[8] The authors mention that a disadvantage of their approach is that W-2 data cannot identify voluntary non-contributors. The lowest contribution rate assigned to defined contribution plan participants is 1.9 percent of salary per year.

[9] The authors conducted additional sensitivity analysis by performing some simulations in which all equity returns were reduced by 300 basis points.

[10] The asset allocations studied were:

- Treasury Inflation-Protected Securities (TIPS).

- Long-term government bonds.

- Corporate stock.

- 50/50 mix of stocks and TIPS.

- 50/50 stocks and nominal government bonds.

- Lifecycle portfolios that combine stocks and TIPS.

- Lifecycle portfolios that combine stocks and nominal bonds.

[11] Holden and VanDerhei (2002) analyzed the importance of cashout behavior at job change in voluntary-enrollment 401(k) plans and found that it would lower the eventual nominal replacement rate at age 65 from 4.7 percentage points for the highest-income quartile to 13.3 percentage points for the lowest-income quartile.

[12] Utkus and Young (2013) report Vanguard data showing an increase in average deferral rates from 5.8 percent for those ages 25–34 to 9.1 percent for those 55–64 for their voluntary enrollment plans in 2012.

[13] Aon Hewitt, online at https://ceplb03.hewitt.com/benefitspec/reports/home_index.jsp

[14] See VanDerhei (April 2010) for additional detail. The previous study also collected information on automatic enrollment plans that will be used in future research.

[15] For details, see VanDerhei and Copeland (2010).

[16] This information is based on data from 20,000 corporate DC plans and 12 million participant records kept by Fidelity as of Dec. 31, 2012.

[17] See Ippolito (1997) for a detailed description of the literature.

[18] There is a third case, that of complete dependence, which is not used in this report. This case would approximately have x=1 and y=0; however, y will need to be greater than 0 in many cases to account for the fact that z is an increasing function of age.

[19] Job turnover rates were estimated from the 2004 Survey of Income and Program Participation (SIPP) Topical Module 7.

[20] Utkus and Young (2013).

[21] The information is from immediateannuities.com and available at the following site: www.annuityshopper.com/archives/ The author would like to express his gratitude to K. Jeremy Ko for suggesting the data and to Hersh Stern for providing the data in an Excel file.

[22] See VanDerhei (December 2013) for additional results showing the impact of using 2013 annuity purchase prices and/or decreasing the return assumptions by 200 basis points.

[23] It is assumed that workers retire at age 65, and that all 401(k) balances are converted into a real annuity at an annuity purchase price of 18.62.

[24] See VanDerhei, Holden, Alonso, Bass and Pino (December 2014) for the most recent results.

[25] VanDerhei, Holden, Alonso and Bass (September 2015).

[26] The proposed regulations for 401(k) plans were first introduced in November of 1981, and it took several years for many sponsors to introduce the plans. Moreover, many plans that were originally introduced as supplemental plans to existing defined benefit plans have been modified to provide more generous employer contributions at the time the defined benefit plans were frozen (VanDerhei, April 2010).

[27] For an indication of how years of eligibility impact overall Retirement Readiness Ratings, see VanDerhei (February 2014). This analysis simulates the impact of future years of eligibility for a defined contribution plan on the probability of households not running short of money in retirement. As can be seen in Figure 3 of that analysis, the probability that a Gen-Xer household with no future years of defined contribution eligibility will not run short of money in retirement is 38.6 percent. This increases to 59.8 percent for Gen-Xer households with one to nine years of future eligibility and 73.4 percent for those with 10–19 years. More than 17 out of 20 (86.1 percent) of Gen-Xer households with more than 20 years of future eligibility are simulated to not run short of money in retirement. This analysis was for all income quartiles combined. Similar results are found when controlling for relative levels of preretirement income (see Figure 4 of VanDerhei May 2012).

[28] The annuitization of the balances is performed only for purposes of providing an income stream that can be added to the inflation-adjusted annuity provided by Social Security. Indeed, only a small percentage of defined contribution participants currently annuitize their entire account balance at retirement (and even a smaller percentage purchase an inflation-adjusted annuity for the entire amount). When RSPM® is used to compute the Retirement Readiness Rating™ (the probability that a particular cohort will not run short of money in retirement), the defined contribution and IRA balances are not assumed to be annuitized but instead are assumed to be spent down as needed.

[29] See MacDonald and Moore (2011) for a very thorough review of the literature.

[30] One reason for this is the need to determine how potentially catastrophic health care costs (such as nursing home costs) in retirement will be handled. Even though these costs will not be an issue for all retirees, and certainly not a problem in every year of retirement, a multi-year stay in a nursing home in retirement may deplete the retirement savings of a household to the point where it eventually runs short of money in retirement. See VanDerhei (August 2012) for more detail.

[31] The phrase "401(k) accumulations" in this analysis denotes both accumulations in 401(k) accounts at retirement age as well as IRA rollovers that originated from 401(k)-plan accumulations.

[32] RSPM® needs to use information during the worker's entire career to determine preretirement income quartiles (similar to the calculation of average indexed monthly earnings (AIME) for Social Security). This is explained in endnote 17 of VanDerhei and Copeland (2010).

[33] For details on the Primary Insurance Amount formula see http://www.ssa.gov/OACT/COLA/piaformula.html

[34] See VanDerhei (September 2007), VanDerhei and Copeland (June 2008), VanDerhei (April 2010) and VanDerhei and Lucas (November 2010).

[35] See VanDerhei and Lucas (November 2010) for additional detail.

[36] The move to automatic enrollment will have another benefit beyond that provided by increased participation and the possible escalation of employee contributions over time. As more 401(k) sponsors default employees initially into target-date funds as part of the qualified default investment alternative (QDIA), the extreme positions often found in participant-directed asset allocations (e.g., young employees with no equity exposure or employees on the verge of retirement with extremely high equity allocations) are replaced with allocations that are considered more age-appropriate by most experts. See VanDerhei (June 2009) for more detail.

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