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Chapter 3

Retirement Plans and Prospects for Retirement Income Adequacy

Jack VanDerhei

Policymakers, regulators, academics, and individual workers alike have long been focused on quantifying retirement security through the prism of retirement income adequacy, and for good reason. Beginning in the late 1990s, the Employee Benefit Research Institute (EBRI) launched a major project to provide this type of measurement on behalf of several states concerned about the potential cost(s) to social insurance programs should their residents lack sufficient income when they reached retirement age. After conducting studies for Oregon, Kansas, and Massachusetts, we developed a national model for this purpose in 2003—the EBRI Retirement Security Projection Model[®] (RSPM). It was updated in 2010 to incorporate several significant shifts in plan design and the financial markets, notably the impacts of defined benefit (DB) plan freezes, automatic enrollment provisions for 401(k) plans, and the crises in the financial and housing markets.¹ Since that time we have continued to update RSPM on an annual basis to incorporate the impact of changes in financial and real estate market conditions, as well as for underlying demographic trends and modifications in 401(k) participant behavior (based on a database of the actual account activity of some 24 million 401(k) participants).

The aggregate federal deficit number, taking into account current social security retirement benefit levels and the assumption that net housing equity is utilized ‘as needed,’ is currently estimated to be \$4.1 trillion for all Baby Boomers and Gen Xers.² Yet while trillion-dollar deficits are useful in focusing attention on this problem, they do little to help policymakers understand exactly *where* these deficits are coming from—an appreciation that is key to evaluating and implementing effective remedies.

This chapter begins with a brief background on and an overview of the model. Results are then reviewed for the impact retirement plans have on prospects for retirement income adequacy. Baseline results for the probability of *not* running short of money in retirement (measured by the EBRI Retirement Readiness Ratings[®] (RRRs)) are presented, in combination with a sensitivity analysis to illustrate the impact of changing assumptions with

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respect to a series of variables, including rate of return, utilization of housing for financing retirement, and potential modifications to future social security retirement benefits. The next section focuses on how RRR varies with respect to longevity risks and the impact of potential long-term health care costs in retirement (e.g. nursing home costs). This is followed by an analysis of the years until households are projected to run short of money in retirement, and the size of the present value of accumulated deficits in retirement (measured by the Retirement Savings Shortfalls (RSS)). A final section offers a brief summary and conclusions.

Quantifying Retirement Income Adequacy

There are several ways to quantify retirement income adequacy. Most models either (1) account only for the accumulation side of the equation and then rely on some type of replacement rate measure as a threshold for success, or (2) make use of a life cycle model that attempts to smooth/spread some type of consumption-based utility over the decision-maker's lifetime.

The EBRI Retirement Security Projection Model[®] takes a different perspective. Our goal was to determine what percentage of future retirement cohorts would run short of money in retirement and when. Accordingly, the RSPM did not rely on a replacement rate target as a measure of success, because very few households annuitize all (or even most) of their individual accounts in retirement. In other words, a replacement rate focus would overlook the potential longevity risk. Moreover, while an annuity purchase price used in a replacement rate target does rely on an implicit assumption with respect to (at least some) future market returns, it does not typically account for the potential investment risk associated with 'risky' asset allocations. And finally, an obstacle in terms of maintaining retirement income adequacy for households who might otherwise have sufficient financial resources at retirement age is the risk of long-term care costs for a prolonged period. Few retirees have long-term care insurance policies that would cover the potentially catastrophic financial impact of this exposure. Consequently, any attempt to incorporate this into a simple replacement rate threshold needs to be carefully assessed against actual implications.

A life cycle smoothing model was also rejected for the development of RSPM given the extraordinary low levels of 'optimal' savings for low-income individuals at retirement. While there is little doubt that some households may benefit from means-tested programs in retirement (including early eligibility for Medicaid), from a policy perspective, we were interested in setting a threshold that would allow households to afford average expenditures throughout their retirement, while at the same time accounting for uninsured medical costs in retirement (including long-term care costs).

The EBRI Retirement Security Projection Model[®]

One objective of RSPM is to simulate the percentage of the population at risk of not having income adequate to cover average expenses and uninsured health care costs (including long-term care costs) throughout retirement, by income and age groups. RSPM also provides information on the distribution of the likely number of years before those at risk run short of money, as well as the percentage of preretirement compensation they would need as additional savings in order to have a 50, 75, or 90 percent probability of attaining retirement income adequacy.

VanDerhei and Copeland (2010) describe how households are tracked through retirement age and how their retirement income/wealth is simulated for the following components: social security, defined contribution (DC) balances, individual retirement account (IRA) balances, DB annuities and/or lump-sum distributions, and net housing equity.

A household is considered to run short of money in this model if aggregate resources in retirement are insufficient to meet average retirement expenditures. The latter are defined as a combination of deterministic expenses from the Consumer Expenditure Survey (as a function of age and income) and some health insurance and out-of-pocket, health-related expenses, plus stochastic expenses from nursing home and home health care (at least until the point such expenses are covered by Medicaid).³

The baseline version of our model assumes all workers retire at age 65,⁴ that they immediately begin drawing benefits from social security and DB plans (if any), and, to the extent that the sum of their expenses and uninsured medical expenses exceed the projected, after-tax annual income from those sources, immediately begin to withdraw money from their individual accounts (DC and cash balance plans, as well as IRAs). If there is sufficient money to pay expenses without tapping into the tax-qualified individual accounts, those balances are assumed to be invested in a non-tax-advantaged account where the investment income is taxed as ordinary income. Individual accounts are tracked until they are depleted. At that point, any net housing equity is assumed to be added to retirement savings in the form of a lump-sum distribution (rather than a reverse annuity mortgage, or RAM). When all retirement savings are exhausted and if the social security and DB payments are insufficient to pay expenses, the individual is designated as having run short of money.

One of the model's primary outputs is the production of RRRs for various subgroups of the population. The RRR is defined as the percentage of simulated life-paths that do *not* run short of money in retirement.

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Results

Our model focuses on four output metrics for retirement income adequacy:⁵ Retirement Readiness Ratings; years until the household runs short of money in retirement; Retirement Savings Shortfalls; and the percentage of additional compensation that must be saved annually until retirement for a 50, 75, or 90 percent chance of covering simulated expenses. These metrics have been used to analyze the impact of retirement plans on prospects for retirement income adequacy under several scenarios, including those that follow.

Annuitizing DC and IRA balances at retirement age

VanDerhei and Copeland (2004) analyzed the impact of annuitizing DC and IRA balances at retirement age and therefore needed to simulate a significant number of future life-paths to capture the longevity risk experienced by retirees. The output metric used was the median percentage of additional compensation that must be saved annually until retirement for a 75 percent chance of covering simulated expenses. Assuming that all DB participants took lump-sum distributions at retirement, the average annual increase in additional savings needed was 14.9 percent, whereas assuming that all individual accounts were annuitized at retirement had an impact twice as large—but in the opposite direction (a 30.0 percent decrease in additional annual savings needed).

Impact of deferring retirement age

VanDerhei and Copeland (2011) added a new feature that allowed households to defer retirement age past age 65, to determine whether retirement age deferral is indeed sufficiently valuable to mitigate retirement income adequacy problems for most households.⁶ The answer, unfortunately, is not always 'yes,' even if retirement age were deferred into the 80s. RSPM baseline results indicate that the lowest pre-retirement income quartile would need to defer retirement age to 84, before 90 percent of the households would have a 50 percent probability of success. Although a significant portion of the improvement takes place in the first four years after age 65, it tends to level off in the early 70s before picking up in the late 70s and early 80s. Households in higher pre-retirement income quartiles start at a much higher level, and therefore gain less from deferring retirement. If the success rate is moved to a threshold of 70 percent, only two out of five households in the lowest-income quartile would attain retirement income adequacy even if they deferred retirement age to 84. Increasing the threshold to 80 percent reduces the number of lowest pre-retirement income

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quartile households satisfying this standard at a retirement age of 84 to approximately one out of seven. A factor that makes a major difference in the percentage of households satisfying the retirement income adequacy thresholds at any retirement age is whether the worker is still participating in a DC plan after age 65. Doing so results in at least a 10 percentage point difference in the majority of the retirement age/income combinations investigated.⁷

Impact of the low interest rate environment

VanDerhei (2013b) also used RSPM to show that 25–7 percent of Baby Boomers and Gen Xers who would have had adequate retirement income (under historical average return assumptions) were simulated to end up running short of money in retirement, if the historically low interest rates at the time were assumed to be permanent.

Retirement Readiness Ratings

A notable finding of our modelling was the significant importance of stochastic health care costs on overall retirement income adequacy (VanDerhei 2012a). This term is meant to include health care costs in retirement that are not likely to occur every year (in fact they may never occur for many households), but when they do, they may have a catastrophic financial impact due to their daily cost and/or duration. Unlike many other retirement projection models,⁸ RSPM has explicitly included the costs of nursing home and home health care costs in its decumulation model to account for these contingencies. We show the potential impact of ignoring these costs on measurements of retirement income adequacy.

Baseline results

Our baseline scenario labels households with sufficient resources to cover 100 percent of simulated retirement expenses as those who do *not* run short of money in retirement. Yet some retirement planners suggest that many households can successfully cut expenditures when financially constrained. Therefore, we also recompute results for thresholds of two other simulated expense levels.

Panel A of Table 3.1 provides the ratings by age cohort computed at three different income adequacy thresholds: 100, 90, and 80 percent of simulated retirement expenses. It also provides RRR values for two different scenarios: one where stochastic health care costs (i.e. long-term care and home health

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TABLE 3.1 2014 Retirement Readiness Ratings™ with and without long-term care (LTC) and home health costs (HHC)

	% of simulated		
	retirement expenses		
	100	90	80
Panel A: by age cohort			
<i>Early Boomers</i>			
With LTC and HHC	56.7	67.4	82
Without LTC and HHC	71.94	79.43	88.27
<i>Late Boomers</i>			
With LTC and HHC	57.7	67.4	81
Without LTC and HHC	75.61	81.42	88.94
<i>Gen Xers</i>			
With LTC and HHC	58.5	69.8	83.7
Without LTC and HHC	79.03	87.17	95.87
Panel B: by pre-retirement income quartile			
<i>Lowest income quartile</i>			
With LTC and HHC	16.8	30	54.6
Without LTC and HHC	29.97	44.25	69.66
<i>Second</i>			
With LTC and HHC	52.6	65.7	0.827
Without LTC and HHC	79.93	90.54	0.9663
<i>Third</i>			
With LTC and HHC	71.7	81.9	92.7
Without LTC and HHC	93.64	97.52	99.23
<i>Highest income quartile</i>			
With LTC and HHC	86.4	92.9	97.9
Without LTC and HHC	98.73	99.58	99.87
Panel C: by future years of eligibility for a defined contribution plan			
<i>None</i>			
With LTC and HHC	39.67	50.58	69.09
Without LTC and HHC	62.16	70.84	84.31
<i>1–9</i>			
With LTC and HHC	60.63	70.93	83.96
Without LTC and HHC	86.33	91.64	96.78
<i>10–19</i>			
With LTC and HHC	73.15	81.74	91.32
Without LTC and HHC	92.04	95.58	98.4
<i>20+</i>			
With LTC and HHC	85.48	91.56	96.83
Without LTC and HHC	97.91	98.94	99.64

Notes: Percentage of simulated life paths that will not run short of money in retirement at various thresholds. Early Boomers refer to those born 1948–54. Late Boomers refer to those born 1955–64. Gen Xers refer to those born 1965–74.

Source: Author's computations.

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costs) are included, and those in which they are excluded. More than half of the Early Boomers (56.7 percent) are projected to have sufficient retirement resources to cover 100 percent of their simulated expenses in retirement (including long-term care and home health costs). This value increases to more than two-thirds (67.4 percent) if only 90 percent of the simulated expenses need to be covered, and to 82.0 percent if the threshold is decreased to 80 percent of simulated expenses. By contrast, when the Early Boomers' life-paths are simulated assuming no long-term care and home health costs, the RRRs increase substantially (this is the implicit assumption of models that do not take these expenses into account). Now 71.9 percent will not run short of money at a threshold of 100 percent of simulated expenses, rising to 79.4 percent at a 90 percent of simulated expense threshold, and 88.3 percent at an 80 percent expense threshold.

Looking across cohorts, readiness rates for Late Boomer and Gen Xers are very similar to those for Early Boomers when long-term care and home health costs are included.⁹ For the younger cohorts, when these costs are omitted, the RRR values show a definite upward trend in the fraction projected to have sufficient financial resources.

Panel B in Table 3.1 provides readiness rates by pre-retirement wage quartiles at the three different thresholds, for both health care cost scenarios.¹⁰ Unlike Panel A, Panel B indicates large disparities between the various categories analyzed. At a 100-percent simulated expense threshold for the scenario that includes long-term care and home health costs, only 16.8 percent of the simulated life-paths for those in the lowest-income quartile have retirement resources sufficient to prevent them from running short of money in retirement. More than three times as many (52.6 percent) of those in the second-income quartile are projected to have sufficient resources, compared to 71.7 percent for those in the third-income quartile. The maximum value is of 86.4 percent for the highest-income quartile. Some of this disparity declines if the thresholds are relaxed. At an 80 percent of simulated expense threshold, more than half (54.6 percent) of the lowest income quartile are now projected to not run short of money in retirement. This value increases to 82.7 percent for the second quartile, 92.7 percent for the third quartile, and 97.9 percent for the highest income quartile.

Panel C of Table 3.1 shows the positive impact of *future* years of eligibility for a DC plan (regardless of whether the employee chooses to participate) for Gen Xers by pre-retirement wage quartile.¹¹ Again, all three thresholds are shown for both scenarios with respect to long-term care and home health costs. For Gen Xers with no future eligibility for a DC plan, the RRR value is only 39.7 percent, suggesting that more than 60 percent would run short of resources in retirement. This value increases more than 20 percentage points to 60.6 percent projected to not run short for those with 1–9 future years of eligibility in a DC plan, and to 73.2 percent of

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those in this category with 10–19 future years of eligibility in a DC plan. For those with 20 or more future years of eligibility in a DC plan, 85.5 percent are projected to not run short.

Similar results are found for Gen Xers at the other expense thresholds. For example, at an 80 percent of simulated expense threshold, the RRR values range from 69.1 percent for those with no future years of eligibility to 96.8 percent for those with 20 or more years.

Sensitivity analysis

A model as complex as RSPM relies on a large number of assumptions to simulate the financial circumstances of households over their life cycles, to determine if and when they will ultimately run short in retirement. Some of the most important include rates of return in the financial market; how net housing equity is used to finance retirement; and future benefit streams from social security. This section summarizes the impacts of these three assumptions (VanDerhei 2014). In each case, the sensitivity analysis assumes a threshold of 100 percent of simulated expenses, and long-term care and home health costs are included.

Rate of return assumptions

The baseline rate of return used in the 2014 RSPM was 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 (Finke et al. 2013). Net returns were computed by subtracting 78 basis points from gross returns.¹² Although these parameters were based on historical evidence from 1926–2011 (the most recent results available the last time the baseline return assumptions were reset), some may question whether they are too optimistic for today’s Baby Boomers and Gen Xers. Therefore, various ad-hoc reductions (10, 25, and 50 percent) in real returns for both stocks and bonds are also applied, to measure their impact on RRR outcomes.

The RRR for the baseline return assumptions for Early Boomers is 56.7 percent, indicating that just over half of the cohort is projected to have sufficient funds in retirement to cover the expenses outlined. If real returns are decreased by 10 percent (0.86 percent for stocks and 0.26 percent for bonds), the RRR value falls by 1.5 percentage points to 55.2 percent. Decreasing projected real returns by 25 percent results in a reduction to 53.3 percent, while decreasing real returns by 50 percent results in a 6.6 percentage point reduction from the baseline assumptions to 50.1 percent. Similar results obtain for the Late Boomers and Gen Xers, though given

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their somewhat longer average investment horizons, one would expect somewhat larger impacts on their RRRs. Indeed, the difference between the baseline RRR results and those with the 50 percent lower returns increases from 6.6 percentage points for the Early Boomers to 6.8 percentage points for the Late Boomers and 7.8 percentage points for the Gen Xers.

When we explore the impact of return assumptions on the lowest pre-retirement wage quartile, we find a minimal impact, which is to be expected given their relatively low DC and IRA balances. The difference between the baseline RRR results and those with the 50 percent real return reduction for this group is only 0.2 percentage points. This range increases to 5.0 percentage points for the second-income quartile and 6.5 percentage points for the third-income quartile before falling to 4.6 percentage points for the highest-income quartile.¹³

Housing utilization assumptions

In our baseline model, net housing equity is assumed to be accessible as a lump sum when needed. This produces an RRR value of 56.7 percent for Early Boomers. If net housing equity is instead assumed to be annuitized at retirement, the percent of individuals projected to have sufficient financial resources in retirement decreases to 52.6 percent. If net housing equity is not used at all for retirement, the RRR drops to 50.4 percent. Similar results obtain for Late Boomers and Gen Xers.

Modifications in social security retirement benefits

Our baseline RSPM runs assume that future social security retirement benefits under current law will not be modified. Nevertheless, the current Social Security Trustee's Report projects that the funds for Old-Age, Survivors, and Disability Insurance (OASDI) will be exhausted by 2033 (US SSA 2013). This may require benefit reductions for at least some cohorts of retirees. To assess the potential impact of such a change, pro-rata reductions are applied to social security retirement benefits for the sensitivity analysis, and aggregate shortfalls are converted into a pro-rata reduction for all retirees on an annual basis. This would result in a reduction in social security retirement benefits of 21.9 percent in 2033 and would eventually reach a level of 27.0 percent in 2090.¹⁴

Our simulations show this would have only a minimal impact on the Early Boomers, decreasing RRR from 56.7 percent to 56.0 percent. But those in the Late Boomer cohort would be more affected, reducing the RRR by 2.2 percentage points (from 58.5 to 56.3 percent). The reductions would affect the Gen Xers for a larger portion of their retirement years, and

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consequently their RRR would decrease by 6.8 percentage points (from 57.5 to 50.9 percent).

Given the progressive nature of the social security benefit formula, the lowest-income quartile would experience the largest impact, with an RRR reduction of 10.6 percentage points; the value drops by more than half, from 20.9 to 10.3 percent. The impact is smaller for their higher-paid counterparts, for whom social security benefits generally comprise a smaller proportion of post-retirement income. The second-income quartile experiences an RRR reduction of 8.0 percentage points, compared with 5.8 percentage points for the third-income quartile and only 3.5 percentage points for the highest-income quartile.

What drives Retirement Readiness Ratings?

We have also analyzed the replacement-rate levels required to provide retirees with a 50, 75, and 90 percent probability of having ‘sufficient’ retirement income (VanDerhei 2006, 2014). A ‘building block’ approach was adopted where the risks of investment, longevity, and stochastic long-term health care costs were added in incremental layers.¹⁵ In each case, the analysis was conducted assuming a threshold of 100 percent of simulated expenses and that long-term care and home health costs were included.

Longevity

To assess the impact of longevity on retirement income adequacy, we compute longevity quartiles by family status, gender, and age cohort. We find that the RRR (75.8 percent) for the Early Boomers simulated to die in the earliest relative quartile is 19.1 percentage points above the overall average for this age cohort, suggesting that those who die earliest have a better likelihood of not running short. The RRR decreases to 63.1 percent in the second-longevity quartile and 44.9 percent in the third-longevity quartile. For the Early Boomer cohort with the longest relative longevity, the RRR falls all the way to 37.9 percent. Similar patterns are found for younger age cohorts, but there is a noticeable increase in the RRR range between the earliest and latest longevity quartile: 37.9 percentage points for Early Boomers, 41.3 percentage points for Late Boomers, and 49.2 percentage points for Gen Xers.

Stochastic long-term health care costs

To analyze healthcare costs, we arrange our simulated paths into four groups from lowest to highest (based on the present value at age 65 per capita stochastic health care costs in 2014 dollars). Early Boomers in the

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bottom quartile of the health care cost distribution have a RRR of 73.4 percent (meaning that nearly three-quarters of this group will have sufficient funds), while the RRR for those in the top cost quartile—those with highest projected health care costs—drops to 22.9 percent (for a difference of 50.5 percentage points). The younger age cohorts experience similar results, with a somewhat larger range (52.4 percentage points for the Late Boomers and 58.7 percentage points for the Gen Xers).

The probability of not running short of money in retirement is virtually zero for the lowest-income quartile with the highest health care costs.¹⁶ Those in the lowest-income quartile with the lowest health care costs have a much higher probability of having enough money, with an RRR value of 30.0 percent. The second-income quartile has the largest range in RRR values between the lowest and highest quartile of stochastic health care costs (77.1 percentage points), followed by the third-income quartile (66.9 percentage points). The range for the highest-income quartile (40 percentage points) is somewhat larger than the lowest-income quartile (29.9 percentage points); however, the range for both is truncated by the definitional limits of the RRR calculation.

Regression results for retirement readiness ratings

The previous sections analyzed one by one the important ways that Boomer and Gen Xer households are projected to run short of money in retirement. Next we analyze these factors as a group using multivariate regression. Table 3.2 provides six different sets of probit estimates of the probability of running short of money in retirement: using three thresholds each for single and married households. In each case, the scenario includes the costs of long-term care and home health costs.

The top panel in Table 3.2 uses a dependent variable equal to zero if the household does not run short of money in retirement at a 100 percent of simulated expense threshold, or equal to one if it does. The second panel uses a similar definition at a 90 percent threshold, while the third panel uses an 80 percent threshold.

The variables used in this analysis are defined as follows:

- The INCOME variables are dummy variables placing each household into age-specific income quartiles based on indexed career earnings similar to those used in the Average Indexed Monthly Earnings (AIME) calculations (without truncation at the upper end). INCOME2 designates the second income quartile, INCOME3 the third income quartile and INCOME4 the highest income quartile (INCOME1 designating the lowest income quartile is the omitted reference category).
- SINGLEMALE = 1 for males and 0 for females.

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TABLE 3.2 Probit estimates of the probability of running short of money in retirement

Single males and single females				Married households			
Parameter	Estimate	St. Error		Parameter	Estimate	St. Error	
Intercept	-2.251	0.002	***	Intercept	-1.062	0.006	***
AGE	18.201	0.021	***	AGE	11.429	0.055	***
INCOME2	-1.248	0.000	***	INCOME2	-1.050	0.002	***
INCOME3	-1.989	0.000	***	INCOME3	-1.849	0.002	***
INCOME4	-2.663	0.001	***	INCOME4	-2.821	0.002	***
SINGLEMALE	-0.408	0.000	***	ELIGIBLE	-0.017	0.000	***
ELIGIBLE	-0.348	0.000	***	DEATHAGE	12.857	0.067	***
DEATHAGE	26.354	0.024	***	LTC	3.959	0.003	***
LTC	3.440	0.001	***				
Parameter	Estimate	St. Error		Parameter	Estimate	St. Error	
Intercept	-1.503	0.002	***	Intercept	-0.649	0.007	***
AGE	16.310	0.021	***	AGE	8.369	0.063	***
INCOME2	-1.115	0.000	***	INCOME2	-0.941	0.002	***
INCOME3	-1.840	0.000	***	INCOME3	-1.644	0.001	***
INCOME4	-2.513	0.001	***	INCOME4	-2.592	0.001	***
SINGLEMALE	-0.460	0.000	***	ELIGIBLE	-0.028	0.000	***
ELIGIBLE	-0.362	0.000	***	DEATHAGE	2.020	0.078	***
DEATHAGE	11.111	0.024	***	LTC	3.751	0.003	***
LTC	3.604	0.001	***				
Parameter	Estimate	St. Error		Parameter	Estimate	St. Error	
Intercept	0.054	0.002	***	Intercept	0.605	0.010	***
AGE	14.055	0.022	***	AGE	9.826	0.091	***
INCOME2	-0.912	0.000	***	INCOME2	-0.997	0.002	***
INCOME3	-1.566	0.001	***	INCOME3	-1.527	0.002	***
INCOME4	-2.237	0.001	***	INCOME4	-2.371	0.002	***
SINGLEMALE	-0.431	0.000	***	ELIGIBLE	-0.012	0.001	***
ELIGIBLE	-0.357	0.000	***	DEATHAGE	-24.771	0.116	***
DEATHAGE	-17.087	0.027	***	LTC	3.656	0.004	***
LTC	3.513	0.001	***				

* significant at 10% level; ** significant at 5% level; *** significant at 1%. See text for variable definitions.

Sources: Author's computations.

- The ELIGIBLE variable denotes the percentage of future years of work with an employer offering a DC plan.
- DEATHAGE = the age of death (second death in the case of families).
- LTC = the present value of long-term care and home health care costs (in thousands of 2014 dollars).
- The AGE variable is the current age of the individual (older of the two individuals for married).

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In each of the six regressions, the AGE variable has a positive effect, suggesting that older cohorts will actually have a higher probability of running short of money in retirement. The INCOME variables designate the probability of running short of money in retirement relative to the lowest income quartile. In each of the six regressions, the coefficients are monotonically decreasing, which indicates that the higher the relative income level, the lower the probability of running short of money in retirement.

The ELIGIBLE variable is negative in each of the six regressions, suggesting that, all else equal, the more future years a household is eligible for participation in a DC plan (relative to the number of future years they work prior to retirement), the smaller their probability of running short. The LTC variable is positive in all six regressions, which suggests that the larger the present value of long-term care and home health costs (in constant dollars), the higher the probability of running short.

The SINGLEMALE variable is negative in each of the three regressions it was used. This suggests that, compared to single females, men have a smaller probability of running short of money in retirement after controlling for the other factors.

The DEATHAGE variable (designating the age of simulated death) is the only variable whose sign changes as the thresholds vary. For the 100 and 90 percent thresholds, the coefficient is always positive, suggesting that the longer a household lives, the larger the probability that it will run short of money in retirement. By contrast, when the threshold of simulated expenses is lowered to the 80 percent level, the sign changes, indicating an opposite result.¹⁷

Years Until the Households Run Short of Money in Retirement

We are also interested in when shortfalls might occur, if they do. Figures 3.1 through 3.3 provide this type of information for the Boomer and Gen Xer demographics. The analysis is more complicated than a simple computation of when individuals or families run short of *retirement income* (which in most cases will be never, due to lifetime social security benefits). As noted above, an individual or family is considered to ‘run short of money’ here if the household’s aggregate retirement resources are insufficient to meet its aggregate average retirement expenditures goal. This is defined as a combination of deterministic expenses from the Consumer Expenditure Survey (as a function of income) and some health insurance and out-of-pocket health-related expenses, plus stochastic expenses from nursing home and home health care expenses (at least until the point they are picked up by

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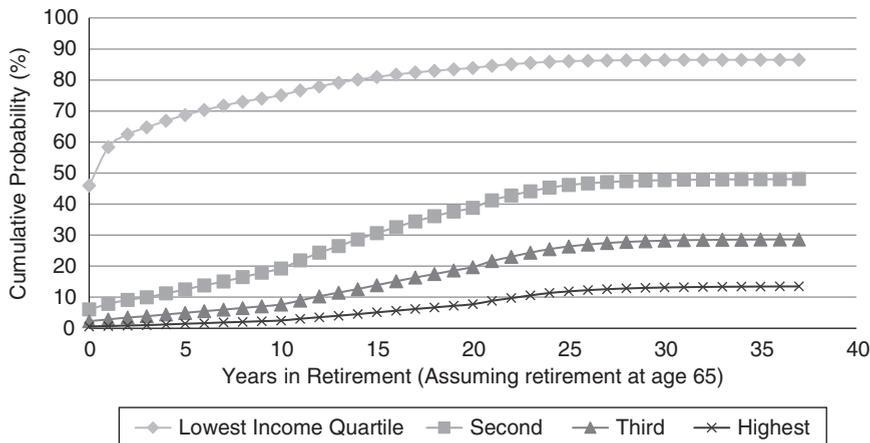


Figure 3.1 Years in retirement before Boomers and Gen Xers run short of money, by pre-retirement income quartile: simulations with the 2014 version of the EBRI Retirement Security Projection Model[®]

Note: An individual or family is considered to run short of money in this version of the model if their aggregate resources in retirement are not sufficient to meet aggregate minimum retirement expenditures defined as a combination of deterministic expenses from the Consumer Expenditure Survey (as a function of income) and some health insurance and out-of-pocket health-related expenses, plus stochastic expenses from nursing home and home health care expenses (at least until the point they are picked up by Medicaid). The resources in retirement will consist of Social Security, account balances from defined contribution plans, IRAs and/or cash balance plans, annuities from defined benefit plans (unless the lump-sum distribution scenario is chosen), and (in some cases) net housing equity (in the form of a lump-sum distribution).

Source: Author's computations.

Medicaid). In each case, the analysis is conducted assuming a threshold of 100 percent of simulated expenses, and long-term care and home health costs are included.

Figure 3.1 shows the distribution of how long retirement money will last for Baby Boomers and Gen Xers (assuming retirement at age 65), by pre-retirement income quartile. For example, after 10 years of retirement, three-quarters of those in the lowest income quartile are projected to have run short of money, 19 percent in the second income quartile, 8 percent in the third income quartile, and 2 percent in the highest income quartile. After 20 years of retirement, 84 percent of those in the lowest income quartile are projected to have run short of money, 39 percent in the second income quartile, 20 percent in the third income quartile, and 8 percent in the highest income quartile. A total of 87 percent of those in the lowest income quartile who retire at age 65 are projected to eventually run short of

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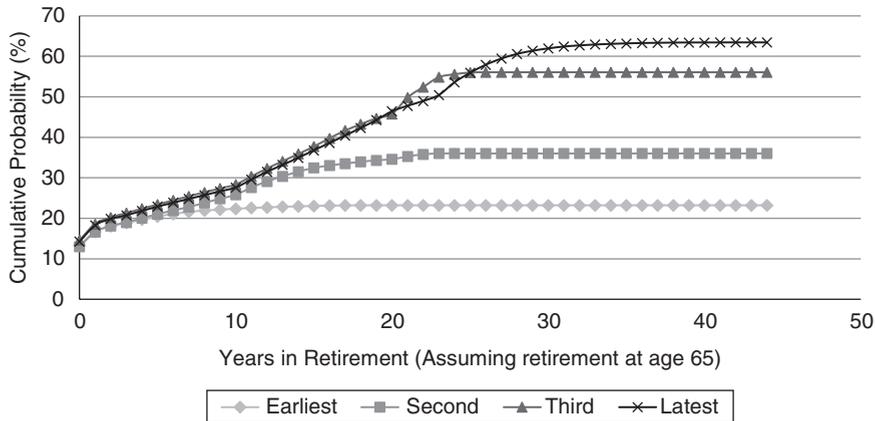


Figure 3.2 Years in retirement before Boomers and Gen Xers run short of money, by relative longevity quartile: simulations with the 2014 version of the EBRI Retirement Security Projection Model[®]

Note: An individual or family is considered to run short of money in this version of the model if their aggregate resources in retirement are not sufficient to meet aggregate minimum retirement expenditures defined as a combination of deterministic expenses from the Consumer Expenditure Survey (as a function of income) and some health insurance and out-of-pocket health-related expenses, plus stochastic expenses from nursing home and home health care expenses (at least until the point they are picked up by Medicaid). The resources in retirement will consist of Social Security, account balances from defined contribution plans, IRAs and/or cash balance plans, annuities from defined benefit plans (unless the lump-sum distribution scenario is chosen), and (in some cases) net housing equity (in the form of a lump-sum distribution).

Source: Author's computations.

money while they are still alive. This value decreases to 48 percent for those in the second income quartile, 29 percent for those in the third income quartile, and 14 percent for those in the highest income quartile.

Figure 3.2 shows the distribution of how long retirement money will last for Baby Boomers and Gen Xers (assuming retirement at age 65) by relative longevity quartile. For example, after 10 years of retirement, 22 percent of those in the earliest longevity quartile class are projected to run short of money compared to 28 percent of those in the latest longevity quartile. After 20 years of retirement, 23 percent of those in the earliest longevity quartile class are projected to have run short of money compared to 46 percent of those in the latest longevity quartile. A total of 23 percent of those in the earliest longevity quartile class who retire at age 65 are projected to eventually run short of money while they are still alive. This value increases to 63 percent for those in the oldest longevity quartile.

Figure 3.3 shows the distribution of how long retirement money is projected to last for Baby Boomers and Gen Xers (assuming retirement at age

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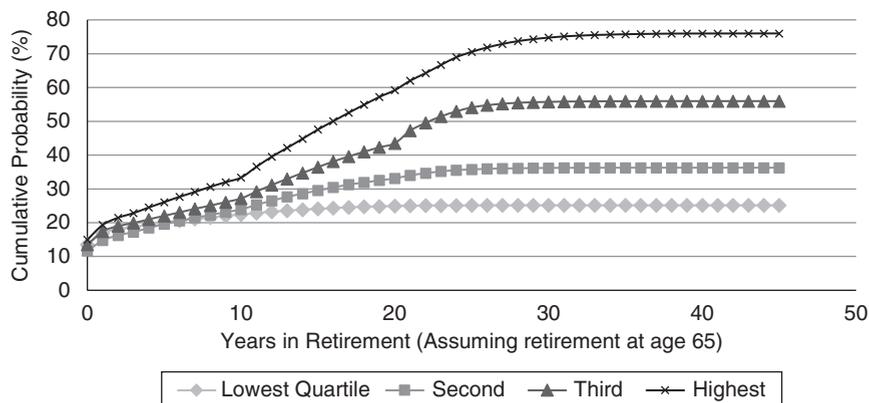


Figure 3.3 Years in retirement before Boomers and Gen Xers run short of money, by quartile of stochastic health care cost: simulations with the 2014 version of the EBRI Retirement Security Projection Model[®]

Note: An individual or family is considered to run short of money in this version of the model if their aggregate resources in retirement are not sufficient to meet aggregate minimum retirement expenditures defined as a combination of deterministic expenses from the Consumer Expenditure Survey (as a function of income) and some health insurance and out-of-pocket health-related expenses, plus stochastic expenses from nursing home and home health care expenses (at least until the point they are picked up by Medicaid). The resources in retirement will consist of Social Security, account balances from defined contribution plans, IRAs and/or cash balance plans, annuities from defined benefit plans (unless the lump-sum distribution scenario is chosen), and (in some cases) net housing equity (in the form of a lump-sum distribution).

Source: Author's computations.

65) by quartile of health care cost. For example: after 10 years of retirement, 22 percent of those in the lowest health care cost quartile are projected to run short of money compared to 33 percent of those in the highest health care cost quartile. After 20 years of retirement, 25 percent of those in the lowest health care cost quartile are projected to have run short of money compared to 59 percent of those in the highest health care cost quartile. A total of 25 percent of those in the lowest health care cost quartile who retire at age 65 are projected to eventually run short of money while they are still alive. This value increases to 76 percent for those in the highest health care cost quartile.

Retirement Savings Shortfalls

It is also useful to model just how large the accumulated deficits are likely to be, conditional on a shortfall. We analyze this assuming a threshold of

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TABLE 3.3 2014 retirement savings shortfalls (US\$) by age cohort, marital status, and gender

	Single Male	Single Female	Married
Panel A: includes those with no shortfall			
Early Boomers	33,778	62,734	19,304
Late Boomers	31,342	65,277	19,566
Gen Xers	38,065	74,256	21,379
Panel B: conditional upon having a positive shortfall			
Early Boomers	93,576	104,821	71,299
Late Boomers	102,287	112,651	76,222
Gen Xers	129,861	133,790	82,083

Note: The Retirement Savings Shortfalls (RSS) are determined as a present value of retirement deficits at age 65.

Source: Author's computations.

100 percent of simulated expenses, and including long-term care and home health costs.

Panel A of Table 3.3 shows the shortfalls by cohort, marital status, and sex, for both Baby Boomers and Gen Xers. We provide information on average individual retirement income deficits as present values at age 65, and we represent how much extra would have to be saved by age 65, to eliminate expected retirement deficits (which, depending on the simulated life-path, could be a relatively short period or could last decades). The additional savings required for those on the verge of retirement (Early Boomers) vary from \$19,304 (per individual) for married households, increasing to \$33,778 for single males and \$62,733 for single females. Even though the present values are defined in constant dollars, the RSS for both genders increase for younger cohorts, mainly due to the assumption that health care-related costs will increase faster than the general inflation rate.

While the RSS values in Panel A of Table 3.3 may appear to be relatively small, considering they represent the sum of present values that may include decades of deficits, it is important to remember that less than half of the simulated life-paths modeled were considered to be 'at risk.' In other words, the average RSS values represented in Panel A of Table 3.3 are reduced by the inclusion of simulated retirement life-paths that will not run short of money. Looking only at those situations where shortfalls are projected, Panel B of Table 3.3 shows that the values for Early Boomers vary from \$71,299 (per individual) for married households, \$93,576 for single males, and \$104,821 for single females. In sum, the average shortfall is large if we focus only on households with a projected shortfall.

As noted above, eligibility for participation in a DC plan can have a significantly positive impact on reducing projected savings shortfalls.

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TABLE 3.4 2014 unconditional retirement savings shortfalls (US\$), by years of future eligibility for participation in a defined contribution plan

Years of Future Eligibility	Income Quartiles				Total
	Lowest	Second	Third	Highest	
0	107,519	74,901	57,179	32,466	78,297
1–9	100,326	73,550	44,821	24,058	52,113
10–19	85,647	49,132	22,201	8,380	32,937
20+	88,857	34,539	13,310	4,751	16,782

Note: The Retirement Savings Shortfalls (RSS) are determined as a present value of retirement deficits at age 65.

Source: Author's computations.

Table 3.4 provides information on the average individual retirement income deficits by the number of future years eligible for coverage in a DC retirement plan for Gen Xers. The deficit values for those assumed to have no future years of eligibility (simulated to never be employed in the future by an organization that provides access to those plans) is \$78,297 per individual. That shortfall decreases substantially for those with 1–9 years of future eligibility, to \$52,113, and even further to \$32,937 for those with 10–19 years of future eligibility. Gen Xers fortunate enough to have at least 20 years of future eligibility in those programs could find their average shortfall at retirement reduced to only \$16,782.

Table 3.4 also provides similar information about the impact of future eligibility for DC plans for Gen Xers, although this time the analysis also controls for relative levels of pre-retirement income. For those in the lowest-income quartile, the average deficit declines from \$107,519 for those with no years of future eligibility to \$88,857 for those with 20 or more years. A similar reduction is found for the higher-income quartiles.

Conclusion

Will Americans have enough to live on in retirement? We address this question using a variety of ‘success’ thresholds and circumstances for the Baby Boomer and Gen Xer generations, most of whom have not yet retired, and for whom changes in behavior and/or policy might still positively influence outcomes.

As outlined, the results are sensitive to assumptions, thresholds, and definitions. If one assumes that 100 percent of simulated expenses in retirement is an adequate income goal, then in aggregate, between 57 and 59 percent of the simulated retirement paths for households in those age cohorts will not run short of money in retirement. Choosing a less restrictive

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threshold increases the percentage of households found to have adequate retirement income: at 90 percent of simulated retirement expenses, between 67 and 70 percent of the households will not run short of money in retirement, and at 80 percent of simulated expenses level, the values increase to 81–84 percent. If one chooses (explicitly, or as many models do today, implicitly) to ignore nursing home and home health costs in retirement, the percentages of households deemed to have adequate retirement income increases even further.

Sensitivity analysis shows that the RRR values are relatively robust with respect to return assumptions. Even with a 50 percent reduction in historical real returns, RRR values only decrease 6.6–7.8 percentage points on average, depending on the age cohort, suggesting a relatively modest impact on retirement readiness by market returns. Assumptions on how housing values are used to finance retirement are more important; yet, on average, the difference between utilizing the net housing equity as a lump sum once other retirement resources are depleted versus not utilizing it at all changes the RRR values by only 4.4–6.3 percentage points, depending on the age cohort.

While it is widely accepted that employment-based retirement plans have played a significant role in providing retirement income to American workers, this chapter also quantifies the impact these programs have in the determination of retirement income adequacy.¹⁸ Analyzing the importance of eligibility for and participation in DC plans is difficult, in view of the various employee behaviors that must be modeled to account for participation, contribution, and asset allocation choices, as well as cash-out versus rollover activity at job change. It is also critically important to accurately portray the variation in plan design among DC plans. This chapter shows that one of the most important factors in determining whether Gen Xers (those with the longest remaining time in the workforce) will have sufficient retirement income is eligibility for participation in an employment-based DC plan. RRR values double for Gen Xers in the lowest-income quartile, when comparing those with 20 or more years of future eligibility to those with no years of future eligibility, while those in the second- and third-income quartiles experience increases in RRR values by 27–30.3 percentage points. Unfortunately not all households are covered by retirement plans for a substantial portion of their working careers.¹⁹ As a result, many households, especially those in the lower income quartiles, appear to be in danger of running short of money in retirement.

For those projected to run short of money in retirement, how rapidly will the shortfall occur? We show that 26 percent of Boomer and Gen Xer households are simulated to run short of money within 10 years of retirement under our baseline assumptions (and at a 100 percent of simulated expense threshold). This increases to 37 percent after 20 years. The timing

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also depends on income; for the lowest income quartile, 75 percent are found to run short of money within 10 years of retirement, and 84 percent within 20 years.

Another way to quantify the shortfalls for those simulated to run short of money in retirement is to compute the present value of all future deficits as of retirement age. In essence, this is the additional amount of money each household would need to have (on an after-tax basis) to avoid running short of money in retirement. Looking only at cases where shortfalls are projected, the values for Early Boomers vary from \$71,299 (per individual) for married households, increasing to \$93,576 for single males and \$104,821 for single females. These values are larger for younger cohorts. For Gen Xers, the values vary from \$82,083 (per individual) for married households, increasing to \$129,861 for single males, and \$133,790 for single females.²⁰

Finally, we have shown that a great deal of the readiness variability can be reduced by risk-management techniques at or near retirement. For example, annuitizing a portion of DC and IRA balances could increase the probability of not running short of money in retirement (VanDerhei 2006; Park 2011). Moreover, affordable long-term care insurance would appear to provide an extremely useful technique to help control the threat of health care cost risk, especially for those in the second- and third-income quartiles.

End notes

1. A brief chronology of RSPM is provided in Appendix A of VanDerhei (2014).
2. This is a decrease from the 2012 number of \$4.3 trillion (VanDerhei 2012*b*). The 2012 number is somewhat smaller than the \$4.6 trillion reported in VanDerhei (2010); however, the baseline assumptions used in the 2010 analysis did not provide for the utilization of net housing equity to ensure retirement income adequacy. When the 2012 analysis is repeated with the same assumptions as used in 2010, the aggregate deficit actually increased to \$4.8 trillion.
3. The stochastic component of health expenditures is the result of simulated health events that would require long-term care in a nursing home or home-based setting for the elderly. Neither of these simulated types of care would be reimbursed by Medicare, because they would be for custodial (rather than rehabilitative) care. To determine whether an individual has these expenses, the following process is undertaken. Each individual reaching the social security normal retirement age has a probability of being in one of four possible assumed 'health' statuses: (1) not receiving either home health or nursing home care; (2) home health care patient; (3) nursing home care patient; (4) dead. The individual is randomly assigned to one of these four categories with a likelihood based upon the estimated probabilities of each event. If the individual does not need long-term care, no stochastic expenses are incurred. Each year, the individual again

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faces these probabilities (the probabilities of being in the different statuses changes as the individual becomes older after reaching age 75, then again at age 85). This continues until death or the need for long-term care. For those who have a resulting status of home health care or nursing home care, their duration of care is simulated based upon the distribution of the durations of care. After a nursing home stay or episode of home health care, each individual has a probability of being discharged to one of the other three states based upon the discharge estimates. The stochastic expenses incurred are then determined by the length of the stay/number of days of care times the per diem charge estimated for the nursing home care and home health care, respectively. For any person without the need for long-term care, this process repeats annually. The process repeats for individuals receiving home health care or nursing home care at the end of their duration of stay/care and subsequently, if not receiving the specialized care again on their next birthdays. Those simulated to die, of course, are not further simulated. As with the basic health care expenses, the qualification of Medicaid by income and asset levels is considered to see how much of the stochastic expenses must be covered by the individual to determine his final expenditures for the care. Only those expenditures attributable to the individual—not the Medicaid program—are considered as expenses to the individual and included the ‘deficit’ calculations.

4. See VanDerhei and Copeland (2011) and VanDerhei (2012*a*) for an analysis of the impact of increasing retirement ages beyond 65.
5. EBRI’s use of RSPM typically is confined to analysis of the current retirement system. However, it has periodically been used to evaluate potential changes to the system, primarily from proposed legislative changes. VanDerhei (2011*d*), RSPM was used to provide preliminary evidence of the impact of the ‘20/20 caps’ on projected retirement accumulations proposed by the National Commission on Fiscal Responsibility and Reform. Later that year, it was used to support testimony before the Senate Finance Committee (VanDerhei 2011*b*) in analyzing the potential impact of various types of tax-reform options on retirement income. This was expanded in VanDerhei (2011*a*). VanDerhei (2012*c*) used new survey results to update the analysis of the potential impact of various types of tax-reform options on retirement income, and VanDerhei (2013*a*) used RSPM to analyze the Obama administration’s fiscal year (FY) 2014 budget proposal to include a cap on tax-deferred retirement savings that would limit the amounts accumulated in specified retirement accounts to that necessary to provide the maximum annuity permitted for a tax-qualified defined benefit plan under current law.
6. This assumes that the worker is physically able to keep working and that there continues to be a suitable demand for his or her skills.
7. VanDerhei (2012*a*) provided additional evidence on whether deferring retirement to age 70 would provide retirement income adequacy for the vast majority of Baby Boomers and Gen Xers.

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8. Many other models either ignore these costs or use deterministic adjustments to replacement rates. However, Bajtelsmit et al. (2013) also use Monte Carlo simulation to simultaneously model stochastic financial, health, long-term care, and life risks.
9. For purposes of this analysis the age cohorts are defined as:
 - Early Boomers (born 1948–54);
 - Late Boomers (born 1955–64);
 - Gen Xers (born 1965–74).
10. Pre-retirement income in RSPM is determined in a manner similar to the average-indexed-monthly-earnings computation for social security with three modifications. All earned income is included up to the age of retirement (i.e. there is no maximum taxable wage base constraint, and the calculation terminates at retirement age); instead of indexing for changes in average national wages, the model indexes based on assumed, after-tax rate of return based on asset allocations that are a function of the individual's age in each year; and percentile distributions are then established based on population statistics for each five-year age cohort.
11. Only Gen Xers are shown in this portion of the analysis, given their longer future working careers until age 65. The analysis focuses on eligibility instead of participation to highlight the public policy issues behind plan sponsorship. Moreover, the gradual evolution from voluntary enrollment type 401(k) plans to automatic enrollment makes the interpretation of the impact of participation problematic.
12. Deloitte Consulting and ICI (2011) found that the median participant-weighted fee for 401(k) plans—including administrative, record-keeping, investment, and other expenses—was 78 basis points.
13. The lack of a monotonically increasing range may seem counterintuitive at first. However, many of those in the highest-income quartile have financial resources considerably above the threshold needed to cover 100 percent of simulated expenses and are more immunized from the impact of a rate-of-return reduction than those in the second- and third-income quartiles.
14. Alternative modifications would result in the same aggregate financial situation for the social security trust fund but would have different distributional consequences. For instance, one could add a new bend point in the Primary Insurance Amount (PIA) formula that would result in a larger reduction for those with a larger Average Indexed Monthly Earnings value.
15. EBRI is currently working on a separate study to model sequence of return risk that will need to be completed before investment risk in the decumulation period can be appropriately analyzed in RSPM.
16. Note that, even though Medicaid eligibility is factored into RSPM, an extended stay in a nursing home is still likely to leave those alive at the end of the nursing home stay (or the surviving spouse) in a financially depleted condition.

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17. Future research will analyze this in more detail.
18. VanDerhei (2011c) has used RSPM to show the tremendous importance of DB plans in achieving retirement income adequacy for Baby Boomers and Gen Xers. Overall, the presence of a DB accrual at age 65 reduces the 'at-risk' percentage by 11.6 percentage points. The DB plan advantage (as measured by the gap between the two at-risk percentages) is particularly valuable for the lowest-income quartile, but also has a strong impact on the middle class (the reduction in the at-risk percentage for the second and third income quartiles combined is 9.7 percentage points).
19. See Copeland (2013), Dushi et al. (2011), and Anguelow et al. (2012) for discussion of retirement plan participation levels.
20. Another way to analyze this is to compute the *additional* percentage of compensation that needs to be saved for a 50, 75, or 90 percent chance of 'success.' See VanDerhei and Copeland (2010) for more detail.

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