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Employee Benefit Research Institute

February 2014 • No. 396

Issue BRIEF

What Causes EBRI Retirement Readiness Ratings™ to Vary: Results from the 2014 Retirement Security Projection Model®

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

AT A GLANCE

- **Retirement income adequacy improved slightly in 2013.** Due to the increase in financial market and housing values during 2013, the probability that Baby Boomers and Generation Xers would NOT run short of money in retirement increases between 0.5 and 1.6 percentage points, based on the Employee Benefit Research Institute (EBRI) Retirement Readiness Ratings (RRRs).
- **Eligibility for participation in an employer-sponsored defined contribution plan remains one of the most important factors for retirement income adequacy**. RRR values double for Gen Xers in the lowest-income quartile when comparing those with 20 or more years of future eligibility with those with no years of future eligibility, while those in the middle income quartiles experience increases in RRR values by 27.1–30.3 percentage points.
- **Future Social Security benefits make a huge difference for the retirement income adequacy of some households, especially Gen Xers in the lowest-income quartile**. If Social Security benefits are subject to proportionate decreases beginning in 2033 (according to the values in Figure 8), the RRR values for those households will drop by more than 50 percent: from 20.9 percent to 10.3 percent.
- **Longevity risk and stochastic health care risk are associated with huge variations in retirement income adequacy.** For both of these factors, a comparison between the most "risky" quartile with the least risky quartile shows a spread of approximately 30 percentage points for the lowest income range, approximately 25 to 40 percentage points for the highest income range, and even larger spreads for those in the middle income ranges.
- **A great deal of the variability in retirement income adequacy could be mitigated by appropriate risk-management techniques at or near retirement age.** For example, the annuitization of a portion of the defined contribution and IRA balances may substantially increase the probability of not running short of money in retirement. Moreover, a well-functioning market in long-term care insurance would appear to provide an extremely useful technique to help control the volatility from the stochastic, long-term health care risk, especially for those in the middle income quartiles.

Jack VanDerhei is research director at the Employee Benefit Research Institute (EBRI). This *Issue Brief* was written with assistance from the research and editorial staffs at EBRI. Any views expressed in this report are those of the authors and should not be ascribed to the officers, trustees, or other sponsors of EBRI, Employee Benefit Research Institute-Education and Research Fund (EBRI-ERF), or their staffs. Neither EBRI nor EBRI-ERF lobbies or takes positions on specific policy proposals. EBRI invites comment on this research.

Recommended Citation: Jack VanDerhei. "What Causes EBRI Retirement Readiness Ratings™ to Vary: Results from the 2014 Retirement Security Projection Model,®" *EBRI Issue Brief,* no. 396, February 2014.

Report Availability: This report is available on the Internet at www.ebri.org

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What Causes EBRI Retirement Readiness Ratings™ to Vary: Results from the 2014 Retirement Security Projection Model®

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

Introduction

Measuring retirement security—or retirement income adequacy—is an extremely important topic. The Employee Benefit Research Institute (EBRI) launched a major project to provide this type of measurement in the late 1990s for several states concerned whether their residents would have sufficient income when they reached retirement age. After conducting studies for Oregon, Kansas, and Massachusetts, EBRI developed a national model in 2003 —the EBRI Retirement Security Projection Model® (RSPM)— and in 2010 it was updated to incorporate several significant changes, including the impacts of defined benefit plan freezes, automatic enrollment provisions for 401(k) plans, and the crises in the financial and housing markets.[1] EBRI has updated RSPM on an annual basis since then for changes in financial and real estate market conditions as well as for underlying demographic changes and changes in 401(k) participant behavior (based on a database of the actual account activity of some 24 million 401(k) participants).

This *Issue Brief* begins with a brief overview of RSPM and then updates the results for 2014. It then provides basic sensitivity analysis of the model to show the impact of changing assumptions with respect to rate of return, utilization of housing for financing retirement, and potential modifications to future Social Security retirement benefits. The final section focuses on how the probability of *not* running short of money in retirement (measured by the EBRI Retirement Readiness Ratings ® (RRRs)) varies with respect to longevity, investment return, and potential long-term health care costs in retirement (e.g., nursing home costs).

EBRI Retirement Security Projection Model®

One of the basic objectives of RSPM is to simulate the percentage of the population at risk of not having retirement income adequate to cover average expenses and uninsured health care costs (including long-term-care costs) at age 65 or older throughout retirement in specific income and age groupings. 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 in terms of additional savings in order to have a 50, 70, or 90 percent probability of 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.
- Defined benefit (DB) annuities and/or lump-sum distributions.
- Net housing equity.

A household is considered to run short of money in this model if aggregate resources in retirement are not sufficient to meet minimum retirement expenditures, 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). This version of the model is constructed to simulate retirement income adequacy, as noted

above. Alternative versions of the model allow similar analysis for replacement rates, standard-of-living calculations, and other ad-hoc thresholds.

The baseline version of the model used for this analysis assumes all workers retire at age 65, that they immediately begin drawing benefits from Social Security and defined benefit 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 (defined contribution 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 the point at which 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 (not a reverse annuity mortgage (RAM)). If all the retirement savings are exhausted and if the Social Security and defined benefit payments are not sufficient to pay expenses, the individual is designated as having run short of money at that point.

One of the primary outputs of RSPM 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. In Appendix B, the RRRs are supplemented with metrics on those projected to have sufficient retirement resources to cover 80 or 90 percent of simulated expenses.

2014 EBRI Retirement Readiness Ratings™

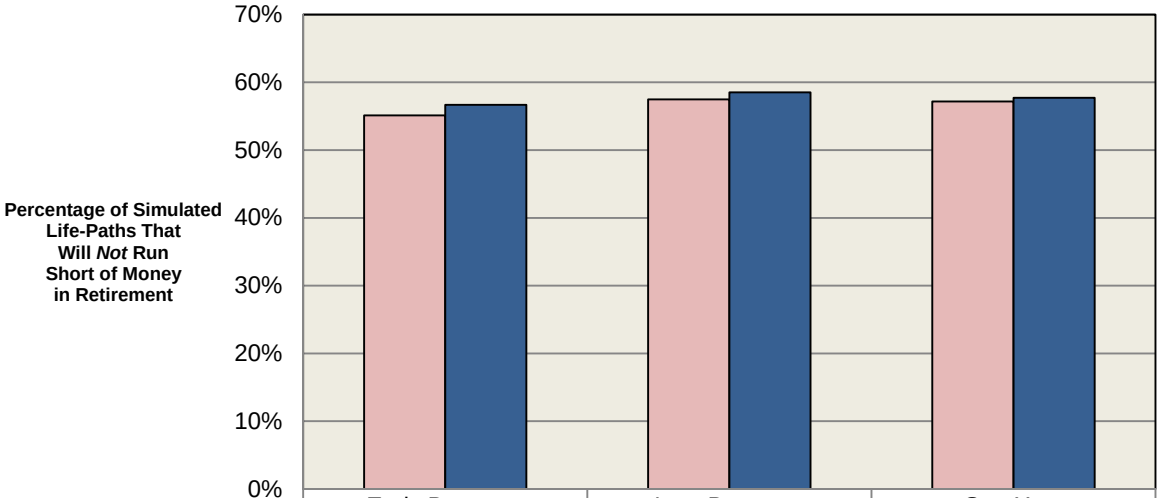
Figure 1 provides the 2014 Retirement Readiness Ratings™ by age cohort with a comparison to last year's numbers. The primary differences between the values this year and those from 2013 reflect the changes in the market value of defined contribution and IRA assets, as well as the increase in housing values during that period. The RRRs increase by 1.6 percentage points, from 55.1 percent to 56.7 percent, for the Early Boomers, 1.0 percentage points from 57.5 percent to 58.5 percent for Late Boomers, and by 0.5 percentage points from 57.2 percent to 57.7 percent for Gen Xers.[2] Given that the primary change in RRRs from 2013 to 2014 is the above-average return in the equity markets,[3] it is not surprising that the older age cohorts with larger defined contribution and IRA account balances[4] show larger improvements.

Figure 2 provides the 2014 RRRs by preretirement wage quartiles[5] compared with results from 2013. Similar to the age-cohort analysis in Figure 1, each of the categories in Figure 2 displays a slight increase in RRR values: 0.4 percentage points for the lowest-income quartile, 0.5 percentage points for the second-income quartile, 1.4 percentage points for the third-income quartile, and 0.9 percentage points for the highest-income quartile. Again, these results are expected given the larger defined contribution and IRA account balances for the higher-income quartiles.

However, unlike Figure 1, Figure 2 shows a tremendous disparity between the various categories analyzed. Only 16.8 percent of the simulated life-paths for entities in the lowest-income quartile have sufficient retirement resources to prevent them from running short of money in retirement. This value more than triples to 52.6 percent for those in the second-income quartile and continues to increase to 71.7 percent for those in the third-income quartile before reaching a maximum value for 86.4 percent for those in the highest-income quartile.

Figure 3 shows the positive impact of *future* years of eligibility (regardless of whether the employee chooses to participate, though there is a high likelihood of participating if eligible) in a defined contribution plan on the 2014 RRR values for Gen Xers by preretirement wage quartile.[6] For those in the lowest-income quartile with no future years of eligibility in a defined contribution plan, the RRR value is only 17.2 percent, indicating that more than 8 in 10 of this cohort are projected to run short of money in retirement. This value increases almost 10 percentage points to 27.1 percent for those in the lowest-income quartile with 1–9 future years of eligibility in a defined contribution plan. The RRR value increases to 35.6 percent for those in this category with 10–19 future years of eligibility in a defined contribution plan, and reaches a maximum value of 35.9 percent for those with 20 or more future years of eligibility in a defined contribution plan.

Figure 1
2013 and 2014 Retirement Readiness Ratings,™ by Age Cohort



	Early Boomers	Late Boomers	Gen Xers
2013	55.1%	57.5%	57.2%
2014	56.7%	58.5%	57.7%

Source: EBRI Retirement Security Projection Model® Versions 1750 and 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Apendix B.

Similar results are found for Gen Xers in the higher-income quartiles. Those in the second-income quartile range from 44.2 percent for those with no future years of eligibility to 71.3 percent for those with 20 or more years, while those in the third-income quartile range from 57.4 percent for those with no future years of eligibility to 87.7 percent for those with 20 or more years. Gen Xers in the highest-income quartile range from 72.5 percent for those with no future years of eligibility to 94.7 percent for those with 20 or more years.

Sensitivity Analysis

Obviously a model as complex as RSPM relies on a lot of assumptions to simulate the financial circumstances of households through the accumulation and decumulation periods to determine if and when they ultimately run short of money in retirement. Some of the most important among these include:

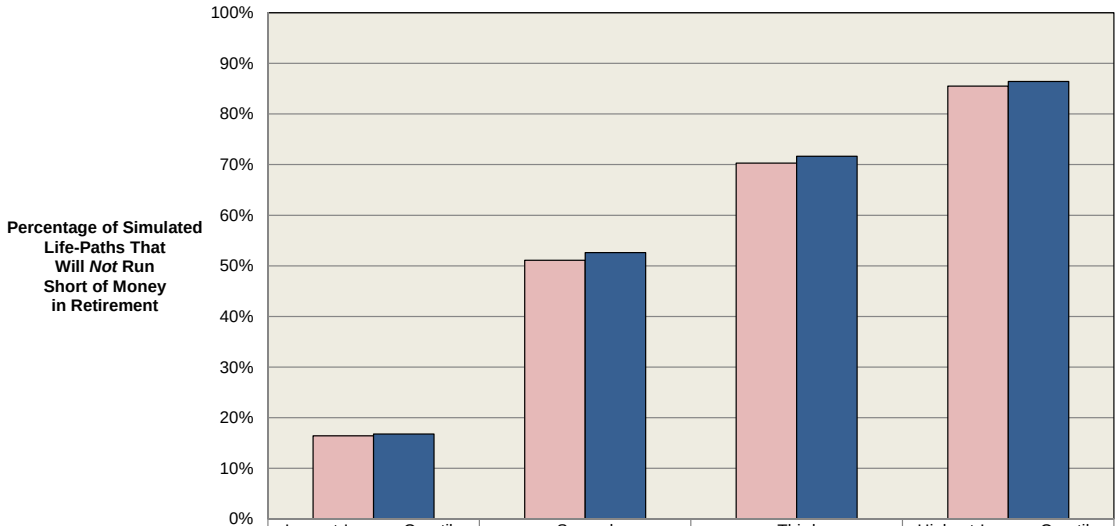
- Rates of return in the financial market.
- What (if anything) is done with net housing equity to finance retirement?
- Future benefits streams under the Social Security retirement system.

This section explores the impact of each of these three assumptions.

Rate-of-Return Assumptions

The baseline returns used in the 2014 RSPM are the same as those used in the 2013 analysis: Returns are 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.[7] Net returns are computed by subtracting 78 basis points from the gross returns.[8] The parameters are based on historical results from 1926–2011, although some may question whether historical results are too high to apply to financial projections for today's Baby Boomers and Gen Xers. Therefore, various ad-hoc reductions (10 percent, 25 percent, and 50 percent) in the real returns for both asset classes are also applied to measure the impact on the overall RRR.

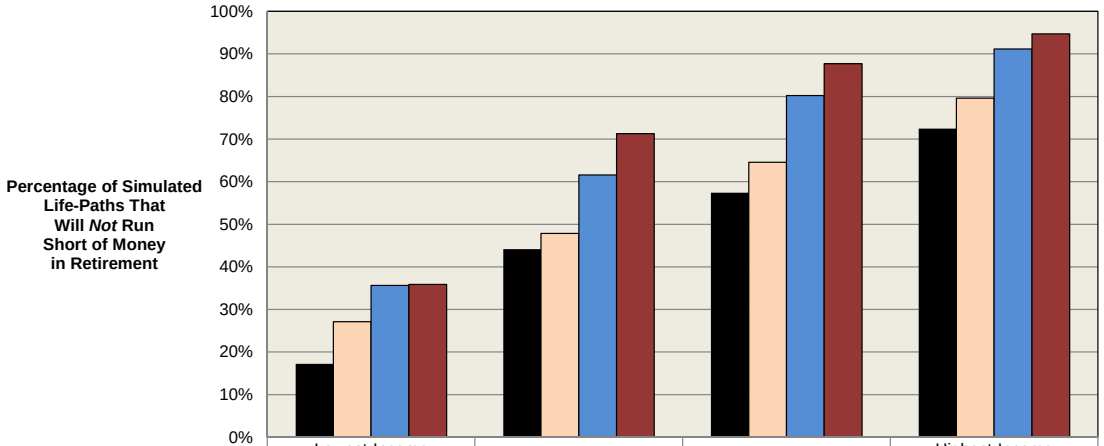
Figure 2
2013 and 2014 Retirement Readiness Ratings,™ by Preretirement Wage Quartile



	Lowest-Income Quartile	Second	Third	Highest-Income Quartile
2013	16.4%	51.1%	70.3%	85.5%
2014	16.8%	52.6%	71.7%	86.4%

Source: EBRI Retirement Security Projection Model® Versions 1750 and 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

Figure 3
Impact of Future Years of Eligibility for a Defined Contribution Plan for Gen Xers on 2014 Retirement Readiness Ratings,™ by Preretirement Wage Quartile



	Lowest-Income Quartile	Second	Third	Highest-Income Quartile
0	17.2%	44.2%	57.4%	72.5%
1-9	27.1%	47.8%	64.5%	79.6%
10-19	35.6%	61.6%	80.2%	91.2%
20 or more	35.9%	71.3%	87.7%	94.7%

Source: EBRI Retirement Security Projection Model® Version 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

Figure 4 shows the impact of return assumptions on the 2014 RRRs by age cohort. For Early Boomers, the RRR for the baseline return assumptions 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 above. When the real returns are decreased by 10 percent (0.86 percent for stocks and 0.26 percent for bonds), the RRR value is reduced by 1.5 percentage points, to 55.2 percent. Decreasing the projected real returns by 25 percent results in a future reduction to 53.3 percent, while decreasing the real returns by 50 percent results in a 6.6 percentage point reduction from the baseline assumption to 50.1 percent. Similar results are found for the Late Boomers and Gen Xers; however given their somewhat longer average investment horizons, one would expect somewhat larger impacts on the RRR values. Indeed, the range between the baseline RRR results and those with the 50 percent-real-return reduction 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.

Figure 5 shows the impact of return assumptions on the 2014 RRRs by preretirement wage quartile. The impact on the lowest-income quartile is minimal, which, as noted above, would be expected given their relatively low defined contribution and IRA balances. The range 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.[9]

Housing-Utilization Assumptions

When the RSPM results were first given in a series of national presentations in 2002, there was little consensus on the best assumption of how net housing equity should be used to finance retirement expenditures. The baseline results for the initial RSPM publication (VanDerhei and Copeland, 2003) assumed that net housing equity would not be used for this purpose, but the results for two alternative assumptions were also included. In the first, an assumption was made that anyone with net housing equity at age 65 would immediately sell the house, convert the resulting net housing equity into a single-premium immediate annuity and move into an apartment.[10] Under the second alternative, the model assumed that the household would remain in the house until the point where there were insufficient financial resources to cover retirement expenses. At that point, the household was assumed to sell the house and move into an apartment; however, the net proceeds were assumed to be used as a lump-sum addition to savings, not annuitized. In recent years, the baseline RSPM assumption for housing utilization has been changed to the one in which net housing equity is used as a lump sum when needed. This was largely in response to the need to better analyze the impact of the financial and real estate market crises at the end of the previous decade (VanDerhei, February 2011).

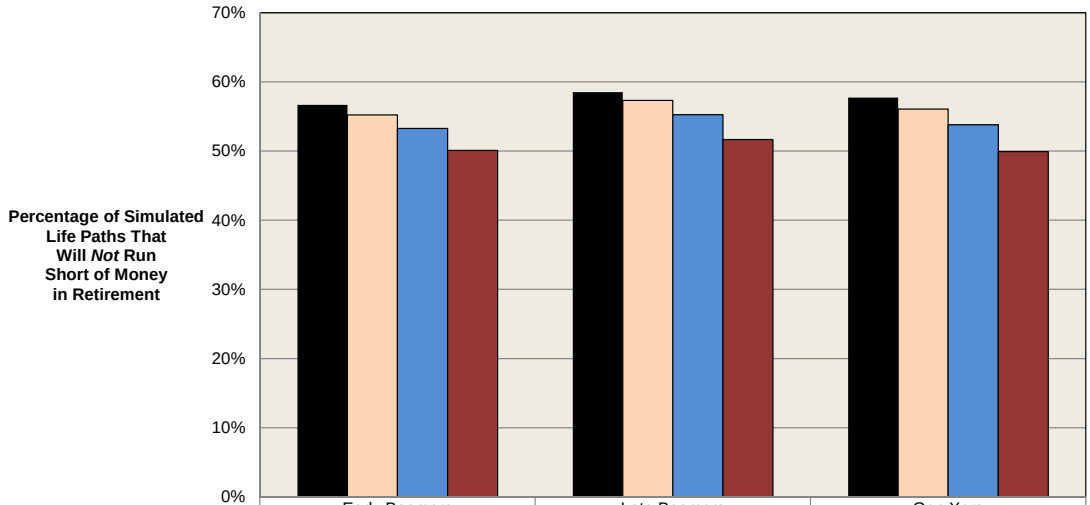
Figure 6 shows the impact of housing-utilization assumptions on the 2014 RRRs by age cohort. The baseline assumption of using net housing equity as a lump sum when needed produces an RRR value of 56.7 percent for Early Boomers. The value (and thus, the number of individuals projected to have sufficient financial resources in retirement) decreases to 52.6 percent when the net housing equity is assumed to be annuitized at retirement. If net housing equity is not assumed to be used to finance retirement, the RRR drops to 50.4 percent. Similar results take place for the Late Boomers and Gen Xers.

Figure 7 shows the impact of housing-utilization assumptions on 2014 RRRs by preretirement wage quartile. The spread in RRRs between the baseline assumption of using net housing equity as a lump sum when needed and an assumption that net housing equity is not used to finance retirement is relatively small for the lowest-income quartile (0.6 percentage points), but falls in the 6- to 8-percentage-point range for their higher-income counterparts.

Modifications in Social Security Retirement Benefits

The baseline RSPM runs assume that future Social Security retirement benefits under current law will not be modified. However, the current Social Security Trustee's Report projects that the funds for Old-Age, Survivors and Disability Insurance (OASDI) will be exhausted by 2033.[11] While this would not result in Social Security retirement benefits being eliminated, left unaddressed it might well require a reduction in benefits for at least some cohorts of retirees. Figure 8 shows the pro-rata reductions applied to Social Security retirement benefits for the sensitivity analysis in which no future funding enhancements are incorporated and aggregate shortfalls are converted into a pro-rata reduction for all

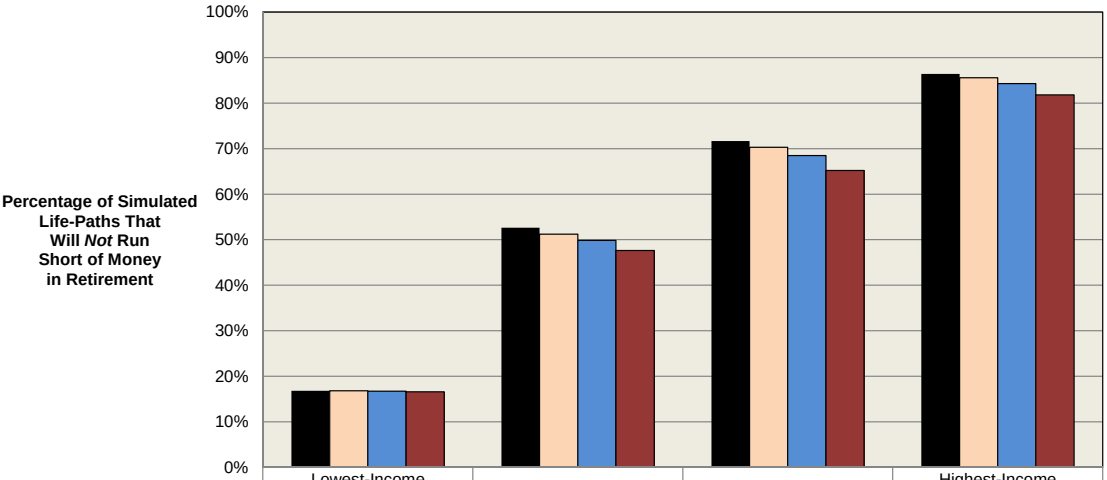
Figure 4
Impact of Return Assumptions on 2014 Retirement Readiness Ratings,™ by Age Cohort



	Early Boomers	Late Boomers	Gen Xers
Baseline Returns	56.7%	58.5%	57.7%
Real Retuns Reduced by 10%	55.2%	57.3%	56.1%
Real Retuns Reduced by 25%	53.3%	55.2%	53.8%
Real Retuns Reduced by 50%	50.1%	51.7%	49.9%

Source: EBRI Retirement Security Projection Model® Versions 1995, 2008, 2013 and 2018.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

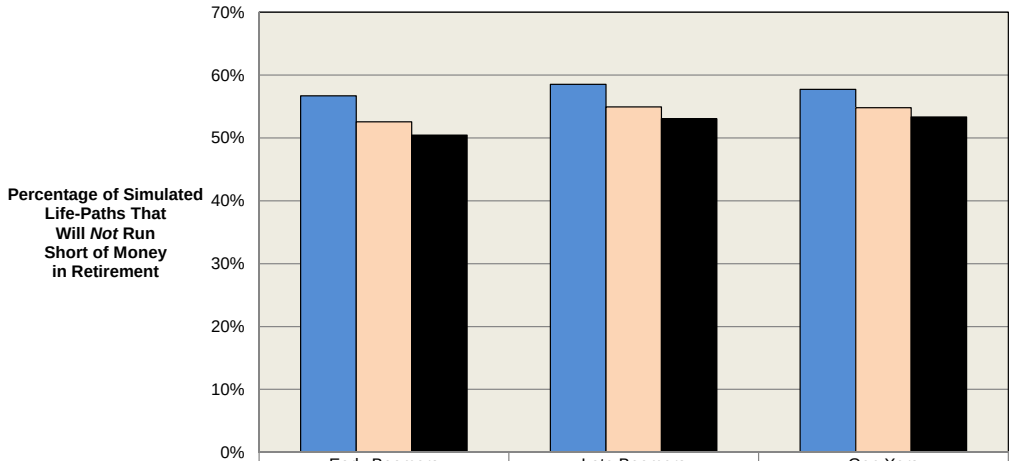
Figure 5
Impact of Return Assumptions on 2014 Retirement Readiness Ratings,™ by Preretirement Wage Quartile



	Lowest-Income Quartile	Second	Third	Highest-Income Quartile
Baseline Returns	16.8%	52.6%	71.7%	86.4%
Real Retuns Reduced by 10%	16.8%	51.2%	70.3%	85.6%
Real Retuns Reduced by 25%	16.7%	49.8%	68.5%	84.3%
Real Retuns Reduced by 50%	16.6%	47.6%	65.2%	81.8%

Source: EBRI Retirement Security Projection Model® Versions 1995, 2008, 2013 and 2018.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

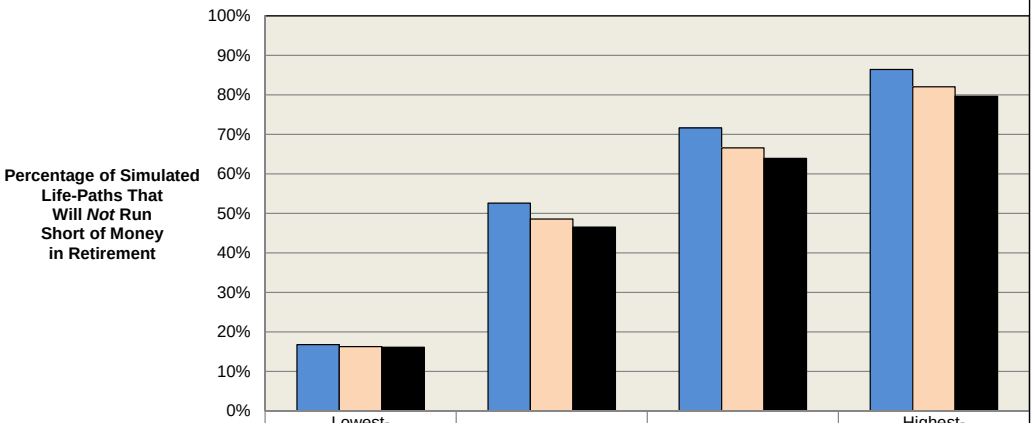
Figure 6
Impact of Housing-Utilization Assmption on 2014 Retirement Readiness Ratings,™ by Age Cohort



	Early Boomers	Late Boomers	Gen Xers
Net housing equity used as a lump-sum when needed	56.7%	58.5%	57.7%
Net housing equity converted to an annuity at retirement	52.6%	55.0%	54.8%
Net housing equity not used to finance retirement	50.4%	53.0%	53.3%

Source: EBRI Retirement Security Projection Model® Versions 1995, 2001 and 2003.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

Figure 7
Impact of Housing-Utilization Assmption on 2014 Retirement Readiness Ratings,™ by Preretirement Wage Quartile



	Lowest-Income Quartile	Second	Third	Highest-Income Quartile
Net housing equity used as a lump-sum when needed	16.8%	52.6%	71.7%	86.4%
Net housing equity converted to an annuity at retirement	16.3%	48.6%	66.6%	82.1%
Net housing equity not used to finance retirement	16.2%	46.5%	63.9%	79.6%

Source: EBRI Retirement Security Projection Model® Versions 1995, 2001 and 2003.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

retirees on an annual basis. This would result in a reduction of 21.9 percent in 2033 and would eventually reach a level of 27.0 percent in 2090.[12]

Figure 9 shows the impact of these reductions in Social Security retirement benefits on 2014 RRRs by age cohort. As expected, given their shorter window of retirement following the projected reductions, there would be only a minimal impact on the Early Boomers (decreasing from 56.7 percent to 56.0 percent). However, those in the Late Boomer cohort would be affected sufficiently to reduce the RRR by 2.2 percentage points (from 58.5 percent to 56.3 percent). The reductions would affect the Gen Xers for a larger portion of their retirement years, and their RRR would decrease by 6.8 percentage points (from 57.5 percent to 50.9 percent).

Figure 10 shows the impact of these reductions in Social Security retirement benefits on 2014 RRRs by preretirement income quartile for Gen Xers only. Given the progressive nature of the Social Security benefit formula, the lowest-income quartile experiences the largest impact, with an RRR reduction of 10.6 percentage points (with the value dropping by more than 50 percent from 20.9 percent to 10.3 percent). The impact is smaller for their higher-paid counterparts, for whom Social Security benefits are a smaller proportion of their 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 RRRs?

In 2006, EBRI provided a detailed analysis of the replacement-rate levels required to provide retirees with a 50, 75 and 90 percent probability of having "sufficient" retirement income.[13] As part of the process used in this analysis, a "building block" approach was adopted where the risks of investment, longevity and stochastic, long-term health care costs were added in incremental layers. The same three risks are analyzed in this section with one major exception—investment risk is measured during the accumulation period instead of the decumulation period.[14]

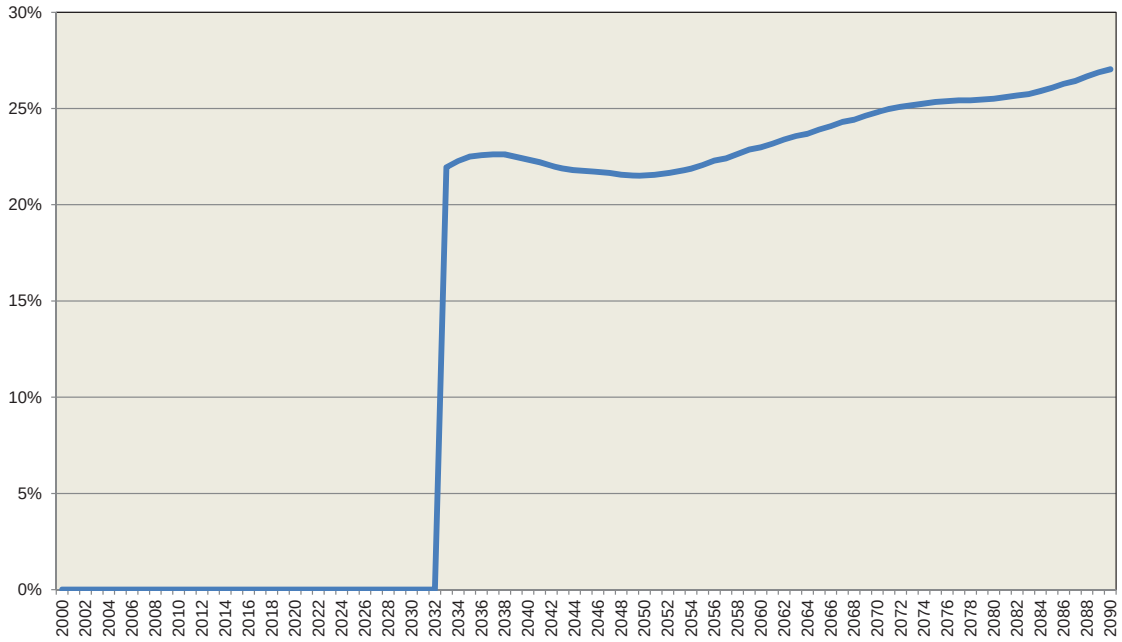
Longevity

In an attempt to assess the impact of longevity on retirement income adequacy, relative longevity quartiles are established based on family status, gender, and age cohort. It should be noted that this analysis would not matter as much if all retirement income was taken in the form of an annuity (either as a real annuity such as Social Security or a nominal annuity such as private-sector defined benefit plans); however, given that only a very small percentage of defined contribution and IRA balances are currently annuitized (and that an increasing percentage of defined benefit accruals are taken as lump-sum distributions when the option is available) the prospect of "out-living" this portion of the retirement wealth is a very real risk for many Baby Boomers and Gen Xers.

Figure 11 shows the impact of relative longevity quartiles on 2014 RRRs by age cohort. For the Early Boomers simulated to die in the earliest relative quartile, the RRR (75.8 percent) is 19.1 percentage points larger than the overall average for this age cohort). The RRR decreases to 63.1 percent in the second-relative-longevity quartile and 44.9 percent in the third-relative-longevity quartile. For the Early Boomer cohort with the longest relative longevity, the RRR falls all the way to 37.9 percent. Similar influences are found for the 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.

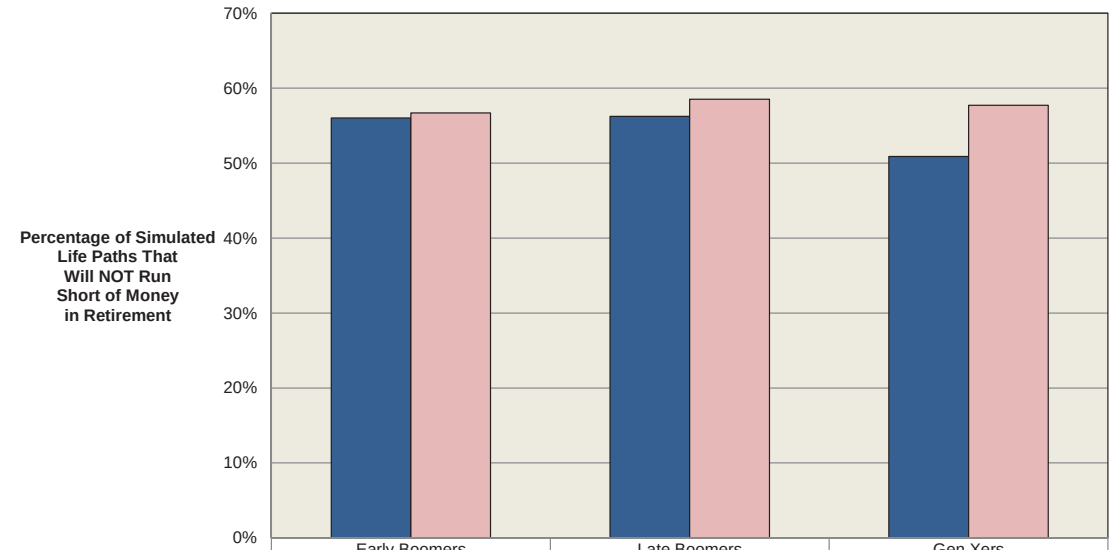
Figure 12 shows the impact of relative longevity quartiles on 2014 RRRs by preretirement income quartile. For the lowest-income quartile simulated to die in the earliest relative longevity quartile, the RRR (36.7 percent) is 19.9 percentage points larger than the overall average for this income cohort. This value decreases to 20.1 percent in the second relative longevity quartile and 5.6 percent in the third relative longevity quartile. For the lowest-income quartile with the longest relative longevity, the RRR falls all the way to 2.8 percent. Similar influences are found for the higher-income quartiles, but the RRR range between the earliest and latest quartile increases from 33.9 percentage points for the lowest-income quartile to 65.9 percentage points for the second-income quartile before falling to 49.4 percentage points for the third-income quartile and 25.4 percentage points for the highest-income quartile.

Figure 8
Pro-Rata Reductions Applied to Social Security Retirement Benefits, by Year



Source: EBRI calculations based on information available at: http://ssa.gov/oact/TR/2013/LD_figIID2.html

Figure 9
Impact of Pro-rata Reductions in Social Secrurity Retirement Benefits (Starting in 2033) on 2014 Retirement Readiness Ratings,™ by Age Cohort

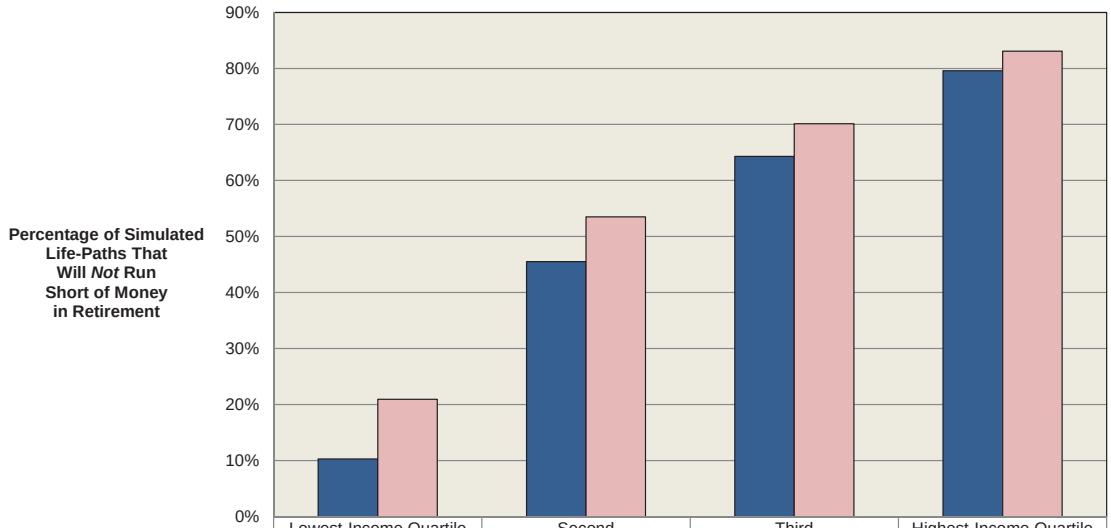


	Early Boomers	Late Boomers	Gen Xers
Social Security Benefits Reduced	56.0%	56.3%	50.9%
No Social Security Reduction	56.7%	58.5%	57.7%

Source: EBRI Retirement Security Projection Model® Versions 1995 and 1997.
Note: The values in this figure represent the percentages of simulated life paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in the appendix.

Figure 10

Impact of Pro-Rata Reductions in Social Secrurity Retirement Benefits (Starting in 2033) for Gen Xers on 2014 Retirement Readiness Ratings,™ by Preretirement Wage Quartile

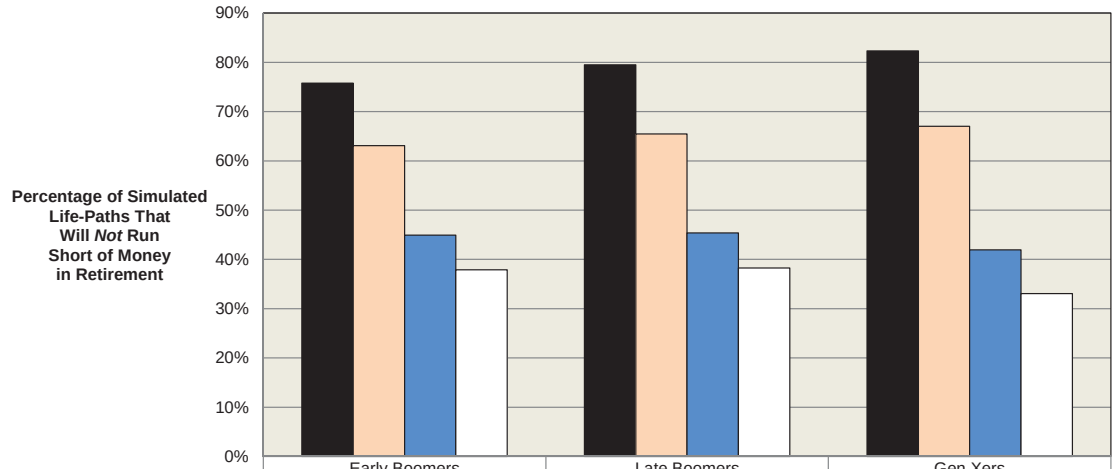


	Lowest-Income Quartile	Second	Third	Highest-Income Quartile
Social Security Benefits Reduced	10.3%	45.5%	64.3%	79.6%
No Social Security Reduction	20.9%	53.5%	70.1%	83.1%

Source: EBRI Retirement Security Projection Model® Versions 1995 and 1997.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

Figure 11

Impact of Relative Longevity Quartile* on 2014 Retirement Readiness Ratings,™ by Age Cohort

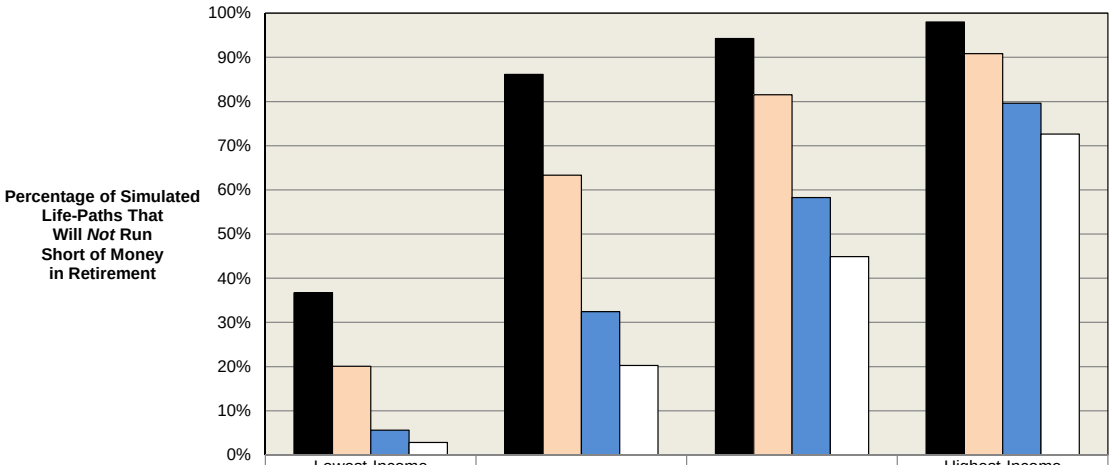


	Early Boomers	Late Boomers	Gen Xers
Earliest Quartile	75.8%	79.5%	82.3%
Second	63.1%	65.5%	67.0%
Third	44.9%	45.4%	41.9%
Latest Quartile	37.9%	38.2%	33.1%

Source: EBRI Retirement Security Projection Model® Version 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.
* The longevity quartile is established relative to family status, gender, and age cohort.

Figure 12

Impact of Relative Longevity Quartile* on 2014 Retirement Readiness Ratings,™ by Preretirement Wage Quartile

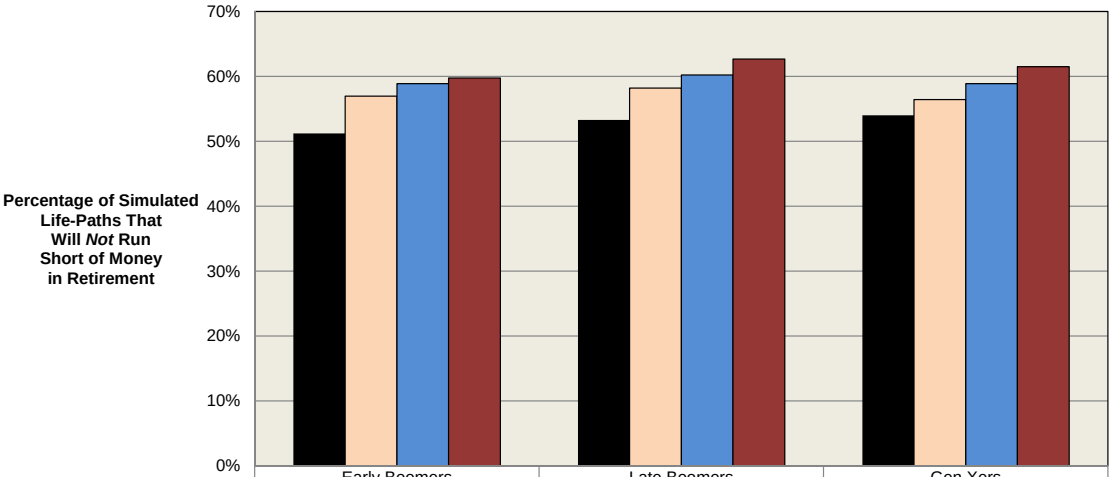


	Lowest-Income Quartile	Second	Third	Highest-Income Quartile
Earliest Quartile	36.7%	86.2%	94.3%	98.0%
Second	20.1%	63.3%	81.5%	90.8%
Third	5.6%	32.4%	58.2%	79.6%
Latest Quartile	2.8%	20.3%	44.9%	72.6%

Source: EBRI Retirement Security Projection Model® Version 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in AppendixB.
* The longevity quartile is established relative to family status, gender, and age cohort.

Figure 13

The Impact of Preretirement Investment Return (Measured as Geometric Return) on 2014 Retirement Readiness Ratings,™ by Age Cohort



	Early Boomers	Late Boomers	Gen Xers
Lowest Quartile	51.2%	53.3%	54.0%
Second Quartile	57.0%	58.2%	56.4%
Third Quartile	58.9%	60.2%	58.9%
Highest Quartile	59.7%	62.7%	61.5%

Source: EBRI Retirement Security Projection Model® Version 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

Investment Return

As mentioned previously, the impact of investment returns on retirement income adequacy is limited to the accumulation period in this analysis. The overall (time-weighted) geometric return experienced for each accumulation period from the current age in 2014 until age 65 is broken into quartiles for each age cohort. Figure 13 shows the impact of the preretirement investment-return quartile on 2014 RRRs by age cohort. Compared with the results in Figure 11, it appears that the relative preretirement investment return has a much smaller overall impact on retirement income adequacy than does the relative longevity risk. Looking at Early Boomers, the spread in RRRs from lowest- to highest-return quartile is only 8.5 percentage points (from 59.7 percent for the highest-income quartile to 51.2 percent for the lowest-income quartile). Similar results are found for the younger cohorts with spreads of 9.4 percentage points for the Late Boomers and 7.5 percentage points for the Gen Xers.

Figure 14 shows the impact of the preretirement investment-return quartile on 2014 RRRs by preretirement wage quartile. Overall, it appears the impact is much larger for the second- and third-income quartiles (with spreads of 4.5 and 4.4 percentage points, respectively) than that experienced by the lowest- and highest-income quartiles. In large part, this is due to many in the lowest-income quartile having such large retirement income "deficits" that even ending up in the upper investment-return quartile provides only a negligible increase in the probability of not running short of money in retirement. In the case of the highest-income quartile, the situation is reversed, and even ending up in the lowest investment-income quartile would move only a relatively small percentage into a financial situation where they were more likely to run short of money in retirement.

Stochastic, Long-Term Health Care Costs

One of the primary findings of VanDerhei (August 2012) was the significant importance of stochastic health care costs on overall retirement income adequacy. This term is meant to include those 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, RSPM has explicitly included the costs of nursing home and home health care costs in its decumulation model since its initial release in 2003 to account for these contingencies.

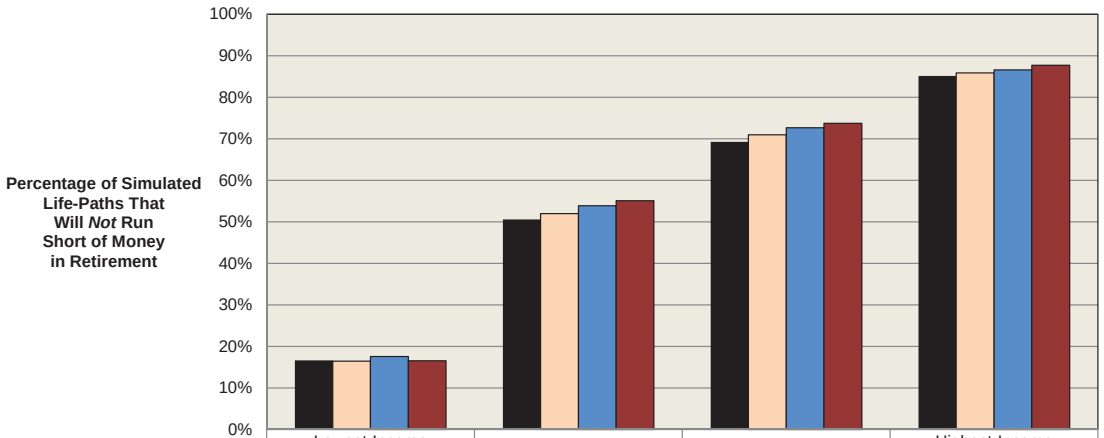
Figure 15 splits the simulated life-paths in retirement for households in each of the three age cohorts by whether they were simulated to incur *any* stochastic health care costs in retirement. For Early Boomer households, the difference in RRRs between those without any stochastic health care costs in retirement (74.8 percent projected to have sufficient financial resources in retirement) and those with at least some (52.3 percent) is 22.5 percentage points. This range increases to 26.6 percentage points for Late Boomers and 33.5 percentage points for Gen Xers, primarily due to the larger inflationary assumptions used for health-care-related costs in the model relative to other retirement expenditures.

Similarly, Figure 16 splits the simulated life-paths in retirement for households in each of the four preretirement wage quartiles by whether they were simulated to incur *any* stochastic health care costs in retirement. The second-income quartile has the largest difference in RRRs between those with and without any stochastic health care costs (46.9 percentage points) followed by those in the third-income quartile (32.2 percentage points) and those in the lowest-income quartile (28.3 percentage points). Those in the highest-income quartile are much more likely to have the financial resources to deal with these costs in retirement without running short of money in retirement, and they experience the smallest RRR difference (at 15.8 percentage points).

Figure 17 provides the results of an analysis similar to Figure 15 but filters out those simulated life-paths with no stochastic health care costs in retirement and categorizes those costs into quartiles (based on the present value at age 65 per capita stochastic health care costs in 2014 dollars). Early Boomers in the bottom quartile of stochastic health care costs have an 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 quartile—those with higher projected health care costs—drops to 22.9 percent (for a range 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).

Figure 14

The Impact of Preretirement Investment Return (Measured as Geometric Return) on 2014 Retirement Readiness Ratings,™ by Preretirement Wage Quartile

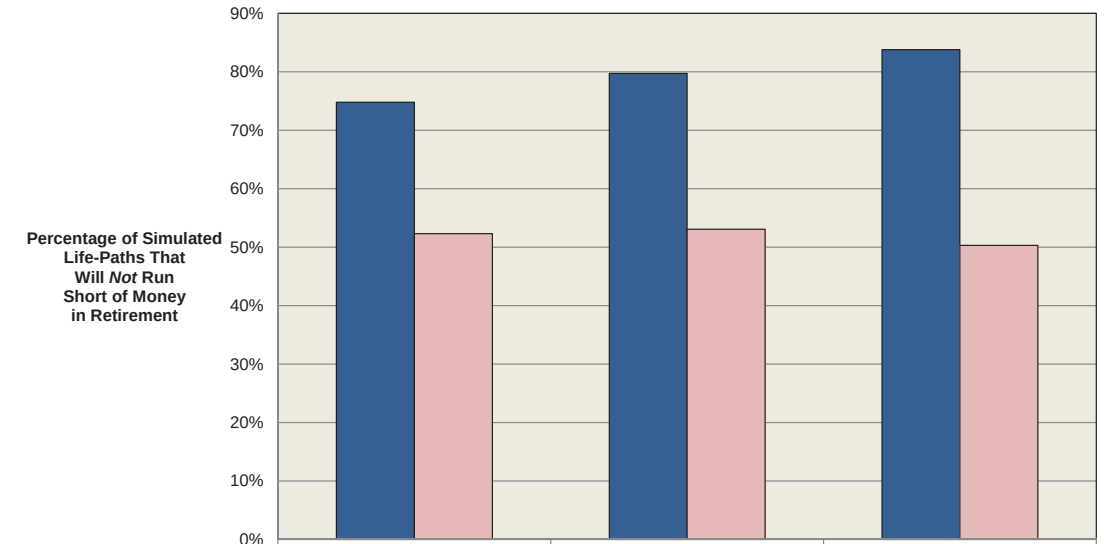


	Lowest-Income Quartile	Second	Third	Highest-Income Quartile
Lowest Quartile	16.6%	50.6%	69.3%	85.1%
Second Quartile	16.5%	52.0%	71.0%	85.9%
Third Quartile	17.6%	53.9%	72.7%	86.6%
Highest Quartile	16.5%	55.1%	73.7%	87.7%

Source: EBRI Retirement Security Projection Model® Version 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

Figure 15

Impact of Stochastic Health Care Costs (in Retirement) on 2014 Retirement Readiness Ratings,™ by Age Cohort

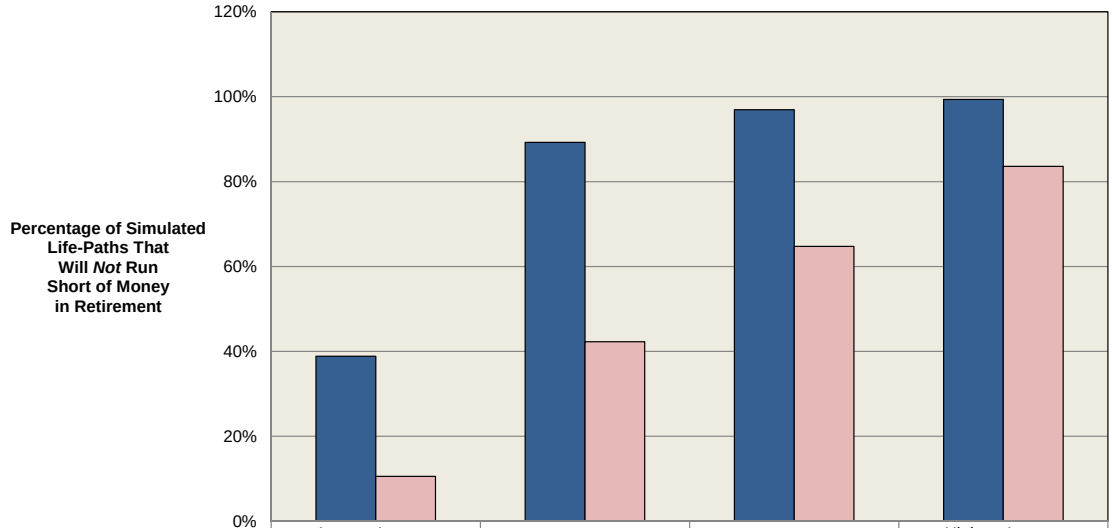


	Early Boomers	Late Boomers	Gen Xers
No Stochastic Health Care Costs	74.8%	79.7%	83.8%
Stochastic Health Care Costs >0	52.3%	53.1%	50.3%

Source: EBRI Retirement Security Projection Model® Version 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

Figure 16

Impact of Stochastic Health Care Costs (in Retirement) on 2014 Retirement Readiness Ratings,™ by Preretirement Wage Quartile

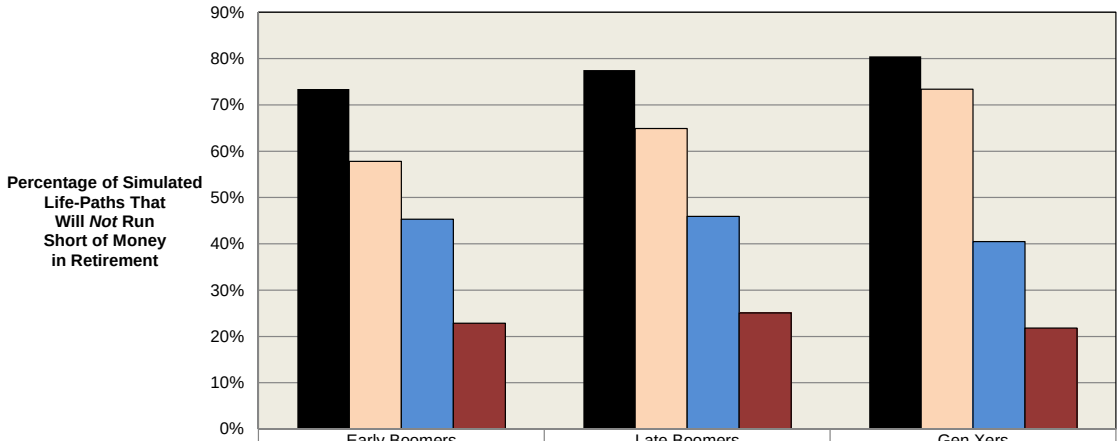


	Lowest-Income Quartile	Second	Third	Highest-Income Quartile
No Stochastic Health Care Costs	38.9%	89.2%	96.9%	99.4%
Stochastic Health Care Costs >0	10.6%	42.3%	64.7%	83.6%

Source: EBRI Retirement Security Projection Model® Version 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

Figure 17

Impact of Stochastic Health Care Costs on 2014 Retirement Readiness Ratings,™ by Age Cohort: Only Those Simulated Retirement Paths With Stochastic Health Care Costs Greater Than Zero



	Early Boomers	Late Boomers	Gen Xers
Bottom Quartile*	73.4%	77.5%	80.5%
Second	57.8%	64.9%	73.4%
Third	45.3%	45.9%	40.5%
Top Quartile	22.9%	25.1%	21.8%

Source: EBRI Retirement Security Projection Model® Version 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.
* Measured as quartile of present value at age 65 per capita stochastic health care costs in 2014 dollars.

Finally, Figure 18 provides a similar analysis to Figure 17, but this time the results are broken out by preretirement wage quartile. The results for the lowest-income quartile show that for this group of families unfortunate enough to experience the highest quartile of stochastic health care costs, the probability of not running short of money in retirement is virtually zero (an RRR value of 0.1 percent).[15] Those in the lowest-income quartile who also experience the lowest quartile of stochastic health care costs have a much higher probability of having enough money, with an RRR value of 30.0 percent.

Similar to Figure 16, 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 the both is truncated by the definitional limits of the RRR calculation.

Conclusion

Due to the increase in financial market and housing values during 2013, the probability that Baby Boomers and Generation Xers would not run short of money in retirement increases between 0.5 and 1.6 percentage points, based on the Employee Benefit Research Institute (EBRI) Retirement Readiness Ratings (RRRs). That analysis reveals that one of the most important factors in determining whether Gen Xers would have sufficient retirement income is eligibility for participation in an employer-sponsored defined contribution plan. RRR values double for Gen Xers in the lowest-income quartile when comparing those with 20 or more years of future eligibility with those with no years of future eligibility, while those in the second- and third-income quartiles experience increases in RRR values by 27 percentage points–30.3 percentage points.

While the assumptions used in the baseline version of the simulation model are important, sensitivity analysis shows that the RRR values are relatively robust with respect to return assumptions. Even with a 50 percent reduction in real return, 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. The assumption with respect to how housing is used to finance retirement can also be important to an individual household; however, on average, the difference between utilizing the net housing equity as a lump sum once other retirement resources are depleted vs. not utilizing it at all only changes the RRR values by 4.4 percentage points to 6.3 percentage points, depending on the age cohort.

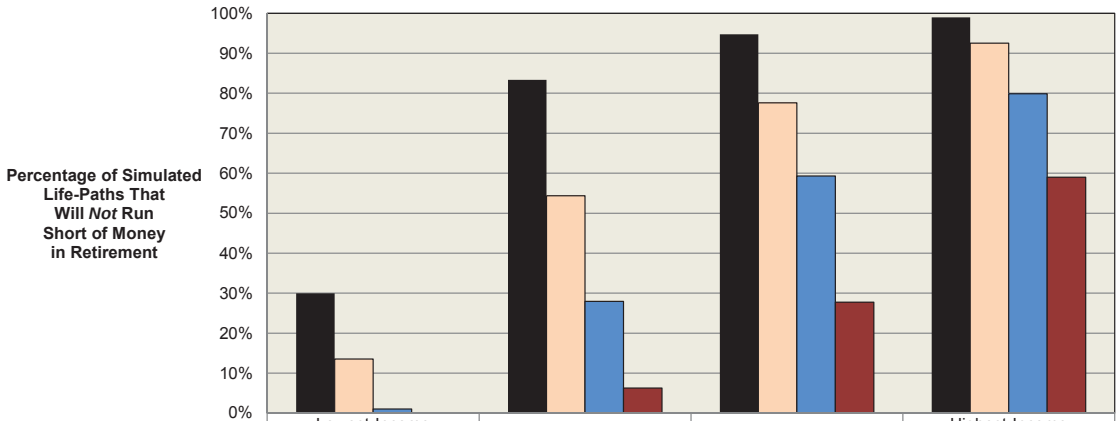
The assumption with respect to future Social Security benefits also makes a huge difference for some households, especially Gen Xers in the lowest-income quartile. If Social Security benefits are, in fact, decreased in 2033 according to the values in Figure 8, the RRR value for those households will drop by more than 50 percent: from 20.9 percent to 10.3 percent.

The degree to which return risk, longevity risk and stochastic health care risk are associated with RRR values is displayed in Figure 19. For each wage quartile, this figure shows the comparison between the most "risky" quartile of the respective factor (e.g., those with the longest relative longevity) with the least risky quartile (e.g., those with the shortest relative longevity) to show the spread between the two. For each wage quartile, the spread between the two RRR values is much larger for longevity and stochastic health care than it is for investment return.[16]

It would appear that while RRR values will depend to a large degree on the household's relative wage level and future years of eligibility in a defined contribution plan (as well as whether future Social Security retirement benefits are reduced), a great deal of the variability in these values could be mitigated by appropriate risk-management techniques at or near retirement age. For example, the annuitization of a portion of the defined contribution and IRA balances may substantially increase the probability of not running short of money in retirement (VanDerhei, September 2006 and Park, 2011). Moreover, a well-functioning market in long-term care insurance would appear to provide an extremely useful technique to help control the volatility from the stochastic, long-term health care risk, especially for those in the second- and third-income quartiles.

Figure 18

Impact of Stochastic Health Care Costs on 2014 Retirement Readiness Ratings,™ by Preretirement Wage Quartile: Only Those Simulated Retirement Paths With Stochastic Health Care Costs Greater Than Zero

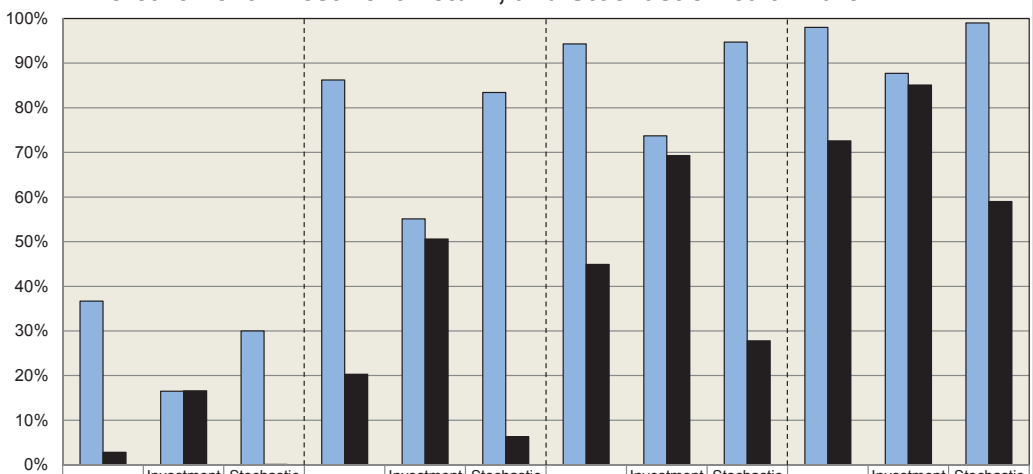


	Lowest-Income Quartile	Second	Third	Highest-Income Quartile
Bottom Quartile*	30.0%	83.4%	94.7%	99.0%
Second	13.6%	54.3%	77.6%	92.5%
Third	1.1%	28.0%	59.3%	79.9%
Top Quartile	0.1%	6.3%	27.8%	59.0%

Source: EBRI Retirement Security Projection Model® Version 1995.
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.
* Measured as quartile of present value at age 65 per capita stochastic health care costs in 2014 dollars.

Figure 19

2014 Retirement Readiness Ratings,™ by Preretirement Wage Quartile: Values for Riskiest and Least-Risky Quartile for the Risks of Longevity, Preretirement Investment Return, and Stochastic Health Care



	Lowest Income			Second			Third			Highest Income		
	Longevity	Investment Return	Stochastic Health	Longevity	Investment Return	Stochastic Health	Longevity	Investment Return	Stochastic Health	Longevity	Investment Return	Stochastic Health
Least Risky Quartile	36.7%	16.5%	30.0%	86.2%	55.1%	83.4%	94.3%	73.7%	94.7%	98.0%	87.7%	99.0%
Riskiest Quartile	2.8%	16.6%	0.1%	20.3%	50.6%	6.3%	44.9%	69.3%	27.8%	72.6%	85.1%	59.0%

Source: EBRI Retirement Security Projection Model.®
Note: The values in this figure represent the percentages of simulated life-paths that will not run short of money in retirement assuming that 100 percent of simulated retirement expenses are paid. Additional information on the percentages that would be able to satisfy less stringent thresholds (viz., 80 and 90 percent of simulated expenses) is provided in Appendix B.

Appendix A: Brief Chronology of the EBRI Retirement Security Projection Model®

- The Retirement Security Projection Model® (RSPM) grew out of a multi-year project to analyze the future economic well-being of the retired population at the state level. The Employee Benefit Research Institute (EBRI) and the Milbank Memorial Fund, working with the office of the governor of Oregon, set out in the late 1990s to see if this situation could be evaluated for the state. The resulting analysis (VanDerhei and Copeland, September 2001) focused primarily on simulated retirement wealth with a comparison to ad hoc thresholds for retirement expenditures.
- The April 2001 *EBRI Issue Brief* (VanDerhei and Copeland, April 2001) highlighted the changes in private pension plan participation for defined benefit (DB) and defined contribution (DC) plans and used the model to quantify how much the importance of individual-account plans was expected to increase because of these changes.
- With the assistance of the Kansas Insurance Department, EBRI was able to create the EBRI Retirement Readiness Rating™ (RRR) based on a full stochastic decumulation model that took into account the household's longevity risk, post-retirement investment risk, and exposure to long-term nursing-home and home-health-care risks. The first state-level RSPM results were presented to the Kansas' Long-Term Care Services Task Force on July 11, 2002 (VanDerhei and Copeland, July 2002), and the results of the Massachusetts study were presented on Dec. 1, 2002 (VanDerhei and Copeland, December 2002).
- RSPM was expanded to a national model—the first national, micro-simulation, retirement-income-adequacy model, built in part from administrative 401(k) data. The initial results were presented at the EBRI December 2003 policy forum (VanDerhei and Copeland, 2003).
- The basic model was subsequently modified for testimony for the Senate Special Committee on Aging to quantify the beneficial impact of a mandatory contribution of 5 percent of compensation. (VanDerhei, January 2004).
- The model was enhanced to allow an analysis of the impact of annuitizing defined contribution and individual retirement account (IRA) balances at retirement age (VanDerhei and Copeland, 2004).
- Additional refinements were introduced to evaluate the impact of purchasing long-term care insurance on retirement income adequacy (VanDerhei, 2005).
- The model was used to evaluate the impact of defined benefit freezes on participants by simulating the minimum employer-contribution rate that would be needed to financially indemnify the employees for the reduction in their expected retirement income under various rate-of-return assumptions (VanDerhei, March 2006).
- Later that year, an updated version of the model was developed to enhance the EBRI interactive Ballpark E$timate® by providing Monte Carlo simulations of the replacement rates needed for specific probabilities of retirement income adequacy under alternative-risk-management treatments (VanDerhei, September 2006).
- RSPM was significantly enhanced for the May 2008 EBRI policy forum by allowing automatic enrollment of 401(k) participants with the potential for automatic escalation of contributions to be included (VanDerhei and Copeland, 2008).
- Additional modifications were added for a Pension Research Council presentation that involved a "winners/losers" analysis of defined benefit freezes and the enhanced employer contributions provided to defined contribution plans at the time the defined benefit plans were frozen (Copeland and VanDerhei, 2010).
- Also in 2009, a new subroutine was added to allow simulations of various styles of target-date funds for a comparison with participant-directed investments (VanDerhei, June 2009).
- In April 2010, the model was completely re-parameterized with 401(k)-plan design parameters for sponsors that had adopted automatic-enrollment provisions (VanDerhei, April 2010).

- A completely updated version of the national model was produced for the May 2010 EBRI Policy Forum and used in the July 2010 *EBRI Issue Brief* (VanDerhei and Copeland, 2010).
- The new model was used to analyze how eligibility for participation in a defined contribution plan impacts retirement income adequacy in September 2010 (VanDerhei, September 2010), and was later used to compute Retirement Savings Shortfalls (RSS) for Baby Boomers and Generation Xers in October 2010 (VanDerhei, October 2010a).
- In October testimony before the Senate Health, Education, Labor and Pensions Committee on "The Wobbly Stool: Retirement (In)security in America," the model was used to analyze the relative importance of employer-provided retirement benefits and Social Security (VanDerhei, October 2010b).
- The November 2010 *EBRI Issue Brief* expanded upon earlier work by EBRI to provide the first results of a new simulation model that estimated the impact of changing 401(k) plan design variables and assumptions on retirement income adequacy. Until recently however, there was extremely limited evidence on the impact of automatic contribution escalation (VanDerhei and Lucas, 2010).
- In February 2011, the model was used to analyze the impact of the 2008–2009 crisis in the financial and real estate markets on retirement income adequacy (VanDerhei, February 2011).
- An April 2011 article introduced a new method of analyzing the results from RSPM (VanDerhei, April 2011). Rather than simply computing an overall percentage of the simulated life-paths in a particular cohort that would not have sufficient retirement income to pay for the simulated expenses, the new method computed the percentage of households that would meet that requirement more than a specified percentage of times in the simulation.
- As explored in the June 2011 *EBRI Issue Brief,* RSPM allowed retirement income adequacy to be assessed at retirement ages later than 65 (VanDerhei and Copeland, June 2011).
- In a July 2011 *EBRI Notes* article (VanDerhei, July 2011), 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.
- The August 2011 *EBRI Notes* article (VanDerhei, August 2011) used RSPM to analyze the impact of defined benefit plans in achieving retirement income adequacy for Baby Boomers and Gen Xers.
- In September, it was used to support testimony before the Senate Finance Committee (VanDerhei, September 2011) in analyzing the potential impact of various types of tax-reform options on retirement income. This was expanded in the November 2011 *EBRI Issue Brief* (VanDerhei, November 2011).
- A March 2012 *EBRI Notes* article (VanDerhei, March 2012) used new survey results to update the analysis of the potential impact of various types of tax-reform options on retirement income.
- The May 2012 *EBRI Notes* article (VanDerhei, May 2012) provided 2012 updates for the previously published RRRs as well as the RSS.
- The June 2012 *EBRI Notes* article (VanDerhei, June 2012) introduced severity categories in the RSS projections for Gen Xers.
- The August 2012 *EBRI Notes* article (VanDerhei, August 2012) 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.
- The September 2012 *EBRI Notes* article (VanDerhei, September 2012) analyzed the impact of increasing the default-contribution rate for automatic enrollment 401(k) plans with automatic escalation of contributions.
- The November 2012 *EBRI Notes* article (VanDerhei, November 2012) reclassified the RRRs to provide additional information on those substantially above the threshold; close to the threshold; and substantially below the threshold.

- The March 2013 *EBRI Notes* article (VanDerhei and Adams, March 2013) used a modified version of RSPM to assess the probability that respondent households would not run short of money in retirement if they did, in fact, accumulate the amount they said would be required in the 2013 Retirement Confidence Survey.
- The June 2013 *EBRI Issue Brief* (VanDerhei, June 2013a) used RSPM to provide a direct comparison of the likely benefits under specific types of DC and DB retirement plans.
- The June 2013 *EBRI Notes* article (VanDerhei, June 2013b) used RSPM to show that 25–27 percent of Baby Boomers and Gen Xers who would have had adequate retirement income under return assumptions based on historical averages were simulated to end up running short of money in retirement if today's historically low interest rates were assumed to be a permanent condition.
- The August 2013 *EBRI Issue Brief* (VanDerhei, August 2013) 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.
- The December 2013 *EBRI Notes* article (VanDerhei, December 2013) used RSPM to expand the analysis in the June 2013 *Issue Brief.* Rather than trying to reflect the real-world variation in DB accruals, the baseline analysis in the previous analysis used the median accrual rate in the sample (1.5 percent of final compensation per year of participation) as the stylized value for the baseline counterfactual simulations. The new research computed the actual final-average DB accrual that would be required to provide an equal amount of retirement income at age 65 as would be produced by the annuitized value of the projected sum of the 401(k) and IRA rollover balances.
- The January 2014 *EBRI Notes* article (VanDerhei, January 2014) used RSPM to model the likelihood that 401(k) participants currently ages 25–29 would have sufficient 401(k) accumulations that, when combined with Social Security benefits, could replace 60, 70 or 80 percent of their preretirement income on an inflation-adjusted basis.

Appendix B

Percentage of Simulated Life Paths That Will NOT Run Short of Money in Retirement at:

Figure			80% of Simulated Expenses	90% of Simulated Expenses	100% of Simulated Expenses
1	2014	Early Boomers	82.0%	67.4%	56.7%
1	2014	Late Boomers	83.7%	69.8%	58.5%
1	2014	Gen Xers	81.0%	67.4%	57.7%
1	2013	Early Boomers	81.2%	66.0%	55.1%
1	2013	Late Boomers	82.9%	68.7%	57.5%
1	2013	Gen Xers	80.3%	66.7%	57.2%
2	2014	Lowest-Income Quartile	54.6%	30.0%	16.8%
2	2014	Second	82.7%	65.7%	52.6%
2	2014	Third	92.7%	81.9%	71.7%
2	2014	Highest-Income Quartile	97.9%	92.9%	86.4%
2	2013	Lowest-Income Quartile	54.3%	29.6%	16.4%
2	2013	Second	81.6%	64.3%	51.1%
2	2013	Third	91.5%	80.6%	70.3%
2	2013	Highest-Income Quartile	97.3%	91.8%	85.5%
3	Lowest-Income Quartile	0	51.7%	28.6%	17.2%
3	Lowest-Income Quartile	1-9	58.8%	38.1%	27.1%
3	Lowest-Income Quartile	10-19	68.9%	49.1%	35.6%
3	Lowest-Income Quartile	20 or more	70.4%	51.7%	35.9%
3	Second	0	74.5%	55.9%	44.2%
3	Second	1-9	75.8%	59.6%	47.8%
3	Second	10-19	86.9%	72.7%	61.6%
3	Second	20 or more	93.2%	82.2%	71.3%
3	Third	0	83.3%	68.0%	57.4%
3	Third	1-9	88.5%	75.9%	64.5%
3	Third	10-19	96.5%	88.6%	80.2%
3	Third	20 or more	98.5%	93.7%	87.7%
3	Highest-Income Quartile	0	92.9%	82.2%	72.5%
3	Highest-Income Quartile	1-9	95.7%	87.6%	79.6%
3	Highest-Income Quartile	10-19	99.3%	96.0%	91.2%
3	Highest-Income Quartile	20 or more	99.7%	97.9%	94.7%
4	Baseline	Early Boomers	82.0%	67.4%	56.7%
4	Baseline	Late Boomers	83.7%	69.8%	58.5%
4	Baseline	Gen Xers	81.0%	67.4%	57.7%
4	10% Reduction	Early Boomers	81.7%	66.4%	55.2%
4	10% Reduction	Late Boomers	83.5%	68.9%	57.3%
4	10% Reduction	Gen Xers	80.4%	66.2%	56.1%
4	25% Reduction	Early Boomers	81.3%	65.4%	53.3%
4	25% Reduction	Late Boomers	82.8%	67.3%	55.2%
4	25% Reduction	Gen Xers	79.4%	64.5%	53.8%
4	50% Reduction	Early Boomers	80.3%	63.4%	50.1%
4	50% Reduction	Late Boomers	81.5%	64.7%	51.7%
4	50% Reduction	Gen Xers	77.9%	61.6%	49.9%

Figure			Percentage of Simulated Life Paths That Will NOT Run Short of Money in Retirement at: 80% of Simulated Expenses	90% of Simulated Expenses	100% of Simulated Expenses
5	Baseline	Lowest-Income Quartile	54.6%	30.0%	16.8%
5	Baseline	Second	82.7%	65.7%	52.6%
5	Baseline	Third	92.7%	81.9%	71.7%
5	Baseline	Highest-Income Quartile	97.9%	92.9%	86.4%
5	10% Reduction	Lowest-Income Quartile	54.7%	29.8%	16.8%
5	10% Reduction	Second	82.3%	64.5%	51.2%
5	10% Reduction	Third	92.5%	81.3%	70.3%
5	10% Reduction	Highest-Income Quartile	97.8%	92.5%	85.6%
5	25% Reduction	Lowest-Income Quartile	54.7%	29.9%	16.7%
5	25% Reduction	Second	81.5%	63.4%	49.8%
5	25% Reduction	Third	92.4%	80.4%	68.5%
5	25% Reduction	Highest-Income Quartile	97.8%	91.9%	84.3%
5	50% Reduction	Lowest-Income Quartile	54.7%	29.9%	16.6%
5	50% Reduction	Second	80.5%	61.4%	47.6%
5	50% Reduction	Third	92.3%	78.7%	65.2%
5	50% Reduction	Highest-Income Quartile	97.7%	91.2%	81.8%
6	Used as Lump Sum	Early Boomers	82.0%	67.4%	56.7%
6	Used as Lump Sum	Late Boomers	83.7%	69.8%	58.5%
6	Used as Lump Sum	Gen Xers	81.0%	67.4%	57.7%
6	Not Used	Early Boomers	78.6%	61.9%	50.4%
6	Not Used	Late Boomers	80.7%	65.1%	53.0%
6	Not Used	Gen Xers	77.9%	63.5%	53.3%
6	Annuitized	Early Boomers	79.8%	63.9%	52.6%
6	Annuitized	Late Boomers	81.6%	66.6%	55.0%
6	Annuitized	Gen Xers	78.9%	64.8%	54.8%
7	Used as Lump Sum	Lowest-Income Quartile	54.6%	30.0%	16.8%
7	Used as Lump Sum	Second	82.7%	65.7%	52.6%
7	Used as Lump Sum	Third	92.7%	81.9%	71.7%
7	Used as Lump Sum	Highest-Income Quartile	97.9%	92.9%	86.4%
7	Not Used	Lowest-Income Quartile	54.0%	29.2%	16.2%
7	Not Used	Second	78.4%	59.8%	46.5%
7	Not Used	Third	88.3%	75.4%	63.9%
7	Not Used	Highest-Income Quartile	94.4%	87.3%	79.6%
7	Annuitized	Lowest-Income Quartile	54.2%	29.4%	16.3%
7	Annuitized	Second	80.0%	61.8%	48.6%
7	Annuitized	Third	89.6%	77.8%	66.6%
7	Annuitized	Highest-Income Quartile	95.3%	89.2%	82.1%
9	No Reduction	Early Boomers	82.0%	67.4%	56.7%
9	No Reduction	Late Boomers	83.7%	69.8%	58.5%
9	No Reduction	Gen Xers	81.0%	67.4%	57.7%
9	SS Benefits Reduced	Early Boomers	81.7%	67.0%	56.0%
9	SS Benefits Reduced	Late Boomers	82.1%	67.5%	56.3%
9	SS Benefits Reduced	Gen Xers	75.6%	61.1%	50.9%
10	No Reduction	Lowest-Income Quartile	54.9%	32.6%	20.9%
10	No Reduction	Second	80.7%	65.0%	53.5%
10	No Reduction	Third	90.6%	79.7%	70.1%
10	No Reduction	Highest-Income Quartile	96.5%	89.9%	83.1%
10	SS Benefits Reduced	Lowest-Income Quartile	43.6%	20.9%	10.3%
10	SS Benefits Reduced	Second	75.1%	58.5%	45.5%
10	SS Benefits Reduced	Third	87.5%	75.2%	64.3%
10	SS Benefits Reduced	Highest-Income Quartile	94.6%	86.9%	79.6%

Figure			Percentage of Simulated Life Paths That Will NOT Run Short of Money in Retirement at: 80% of Simulated Expenses	90% of Simulated Expenses	100% of Simulated Expenses
11	Earliest Quartile	Late Boomers	94.6%	87.7%	79.5%
11	Earliest Quartile	Gen Xers	94.7%	88.8%	82.3%
11	Second Quartile	Early Boomers	87.0%	73.9%	63.1%
11	Second Quartile	Late Boomers	88.5%	76.9%	65.5%
11	Second Quartile	Gen Xers	86.8%	76.1%	67.0%
11	Third Quartile	Early Boomers	73.9%	56.3%	44.9%
11	Third Quartile	Late Boomers	75.2%	57.4%	45.4%
11	Third Quartile	Gen Xers	70.7%	52.9%	41.9%
11	Latest Quartile	Early Boomers	73.8%	52.4%	37.9%
11	Latest Quartile	Late Boomers	73.9%	52.2%	38.2%
11	Latest Quartile	Gen Xers	68.4%	46.1%	33.1%
12	Earliest Quartile	Lowest-Income Quartile	79.2%	57.2%	36.7%
12	Earliest Quartile	Second	96.3%	92.2%	86.2%
12	Earliest Quartile	Third	98.5%	96.8%	94.3%
12	Earliest Quartile	Highest-Income Quartile	99.7%	99.2%	98.0%
12	Second Quartile	Lowest-Income Quartile	64.9%	37.1%	20.1%
12	Second Quartile	Second	88.6%	77.4%	63.3%
12	Second Quartile	Third	95.5%	89.2%	81.5%
12	Second Quartile	Highest-Income Quartile	98.7%	95.5%	90.8%
12	Third Quartile	Lowest-Income Quartile	37.0%	13.7%	5.6%
12	Third Quartile	Second	72.8%	48.2%	32.4%
12	Third Quartile	Third	88.4%	72.2%	58.2%
12	Third Quartile	Highest-Income Quartile	96.4%	88.7%	79.6%
12	Latest Quartile	Lowest-Income Quartile	34.8%	9.0%	2.8%
12	Latest Quartile	Second	70.0%	38.2%	20.3%
12	Latest Quartile	Third	86.5%	64.4%	44.9%
12	Latest Quartile	Highest-Income Quartile	96.0%	85.5%	72.6%
13	Early Boomers	Lowest Quartile	79.8%	62.8%	51.2%
13	Early Boomers	Second Quartile	82.9%	68.2%	57.0%
13	Early Boomers	Third Quartile	82.9%	69.3%	58.9%
13	Early Boomers	Highest Quartile	82.4%	69.3%	59.7%
13	Late Boomers	Lowest Quartile	81.3%	65.5%	53.3%
13	Late Boomers	Second Quartile	83.9%	69.8%	58.2%
13	Late Boomers	Third Quartile	84.5%	71.3%	60.2%
13	Late Boomers	Highest Quartile	85.4%	72.7%	62.7%
13	Gen Xers	Lowest Quartile	79.2%	64.8%	54.0%
13	Gen Xers	Second Quartile	81.0%	66.6%	56.4%
13	Gen Xers	Third Quartile	81.3%	68.2%	58.9%
13	Gen Xers	Highest Quartile	82.6%	70.0%	61.5%
14	Lowest-Income Quartile	Lowest Quartile	54.8%	30.1%	16.6%
14	Lowest-Income Quartile	Second Quartile	55.0%	29.8%	16.5%
14	Lowest-Income Quartile	Third Quartile	54.8%	30.5%	17.6%
14	Lowest-Income Quartile	Highest Quartile	53.9%	29.5%	16.5%
14	Second	Lowest Quartile	81.4%	64.0%	50.6%
14	Second	Second Quartile	82.7%	65.5%	52.0%
14	Second	Third Quartile	83.2%	66.6%	53.9%
14	Second	Highest Quartile	84.1%	67.6%	55.1%
14	Third	Lowest Quartile	92.8%	80.6%	69.3%
14	Third	Second Quartile	93.0%	81.9%	71.0%
14	Third	Third Quartile	92.5%	82.5%	72.7%
14	Third	Highest Quartile	92.4%	82.8%	73.7%
14	Highest-Income Quartile	Lowest Quartile	97.7%	92.2%	85.1%
14	Highest-Income Quartile	Second Quartile	97.9%	92.8%	85.9%
14	Highest-Income Quartile	Third Quartile	97.9%	93.1%	86.6%
14	Highest-Income Quartile	Highest Quartile	97.8%	93.1%	87.7%

Figure			Percentage of Simulated Life Paths That Will NOT Run Short of Money in Retirement at: 80% of Simulated Expenses	90% of Simulated Expenses	100% of Simulated Expenses
17	Early Boomers	Bottom Quartile	97.0%	84.7%	73.4%
17	Early Boomers	Second	83.1%	70.2%	57.8%
17	Early Boomers	Third	81.0%	57.0%	45.3%
17	Early Boomers	Top Quartile	55.8%	35.9%	22.9%
17	Late Boomers	Bottom Quartile	98.0%	89.7%	77.5%
17	Late Boomers	Second	89.9%	79.2%	64.9%
17	Late Boomers	Third	79.3%	57.3%	45.9%
17	Late Boomers	Top Quartile	58.0%	37.8%	25.1%
17	Gen Xers	Bottom Quartile	98.3%	89.8%	80.5%
17	Gen Xers	Second	97.3%	87.0%	73.4%
17	Gen Xers	Third	70.2%	52.3%	40.5%
17	Gen Xers	Top Quartile	54.8%	32.7%	21.8%
18	Lowest-Income Quartile	Bottom Quartile	91.9%	59.3%	30.0%
18	Lowest-Income Quartile	Second	65.4%	36.5%	13.6%
18	Lowest-Income Quartile	Third	36.9%	4.5%	1.1%
18	Lowest-Income Quartile	Top Quartile	9.0%	0.8%	0.1%
18	Second	Bottom Quartile	99.4%	94.8%	83.4%
18	Second	Second	88.9%	75.1%	54.3%
18	Second	Third	76.7%	46.1%	28.0%
18	Second	Top Quartile	51.3%	18.8%	6.3%
18	Third	Bottom Quartile	99.8%	98.4%	94.7%
18	Third	Second	96.0%	88.9%	77.6%
18	Third	Third	90.6%	74.6%	59.3%
18	Third	Top Quartile	77.1%	48.4%	27.8%
18	Highest-Income Quartile	Bottom Quartile	100.0%	99.7%	99.0%
18	Highest-Income Quartile	Second	99.5%	97.3%	92.5%
18	Highest-Income Quartile	Third	97.3%	90.8%	79.9%
18	Highest-Income Quartile	Top Quartile	91.9%	74.9%	59.0%

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Endnotes

[1] A brief chronology of RSPM is provided in Appendix A. See VanDerhei (February 2011) for additional detail on the impact of the 2008–2009 crises in the financial and real estate markets on retirement income adequacy.

[2] In this analysis, Early Boomers are defined as those born between 1948 and 1954; Late Boomers as born between 1955 and 1964; and Gen Xers as born between 1965 and 1974.

[3] Standard & Poor's 500 index increased 31.3 percent in 2013.

[4] VanDerhei, Holden, Alonso and Bass (December 2013) show that for participants in the EBRI/ICI 401(k) database with 20–30 years of tenure with the current employer, the average account balance at the end of 2012 increased from $136,761 for participants in their 40s to $187,425 for participants in their 50s. Copeland (May 2013) shows that for individuals in the EBRI IRA Database, average balances for year-end 2011 were $38,354 for those ages 40–44 and $86,572 for those ages 55–59.

[5] Preretirement income in RSPM is determined in a manner similar to the average-indexed-monthly-earnings computation for Social Security with the following 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.
- Percentile distributions are then established based on population statistics for each five-year age cohort.

[6] Only Gen Xers are shown in this portion of the analysis given their longer future working careers until age 65.

[7] See Finke, Pfau and Blanchett (2013).

[8] A 2011 study by Deloitte Consulting and the Investment Company Institute found that the median participant-weighted fee for 401(k) plans—including administrative, record-keeping, investment, and other expenses—was 78 basis points.

[9] 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.

[10] This option is slightly different than those used in the 2003 and 2010 model formulations. At that time, an assumption was made that the net housing equity is annuitized at the time of retirement as a RAM.

[11] Social Security Administration (2013).

[12] It should be noted that there are alternative modifications possible that would result in the same aggregate financial situation for the Social Security trust fund but would have different distributional consequences (e.g., adding 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).

[13] VanDerhei (September 2006)

[14] 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.

[15] 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.

[16] As pointed out in Endnote 14 the investment return is focused only on the accumulation period. This analysis will be expanded after the appropriate controls are introduced for sequence risk during the decumulation period.

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EBRI Employee Benefit Research Institute Issue Brief (ISSN 0887–137X) is published monthly by the Employee Benefit Research Institute, 1100 13th St. NW, Suite 878, Washington, DC, 20005-4051, at $300 per year or is included as part of a membership subscription. Periodicals postage rate paid in Washington, DC, and additional mailing offices. POSTMASTER: Send address changes to: *EBRI Issue Brief,* 1100 13th St. NW, Suite 878, Washington, DC, 20005-4051.

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