

## How Much Would It Take? Achieving Retirement Income Equivalency Between Final-Average-Pay Defined Benefit Plan Accruals and Automatic Enrollment 401(k) Plans in the Private Sector

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

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### AT A GLANCE

- A rapidly growing public policy concern facing the United States is whether future generations of retired Americans, particularly those in the Baby Boomer and Gen X cohorts, will have adequate retirement incomes. There have been several policy studies in recent years that suggest that the decreasing relevance of defined benefit (DB) plans relative to defined contribution plans (such as 401(k) plans) since the 1980s will have a negative impact on the percentage of future retirees who will achieve a specified level of retirement income adequacy.
- Previous EBRI research reported on a comparative analysis of future benefits from private-sector, voluntary enrollment (VE) 401(k) plans and stylized, final-average-pay defined benefit plans.
- The current research expands the previous research by computing 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 under automatic enrollment (AE) 401(k) plans.
- Assuming historical rates of return as well as annuity purchase prices reflecting average bond rates over the period from 1986 to 2013, the analysis shows that:
  - For males, defined benefit “break-even” rates — or the percentage accrual rate that would be required in order for a DB plan to generate the same retirement income that is projected to come from 401(k) plan participation for a given worker cohort — are rarely less than 1.5 percent of final pay: in only 2 of the 16 combinations of wage quartiles and years of plan eligibility for males are defined benefit “break-even” rates less than 1.5 percent of final pay per years of service.
  - In the case of females, only 5 of the 16 combinations have “break-even” rates under 1.5 percent.
  - When these findings are subjected to the scrutiny of various “stress tests” both by reducing the rate of return assumptions by 200 basis points as well as utilizing current annuity purchase prices, results show that in many cases the AE 401(k) plans lose their comparative advantage to the stylized, final-average DB plans, especially for lower-paid employees as demonstrated by the lower “break-even” accrual rates.

Jack VanDerhei is Director of Research at the Employee Benefit Research Institute (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.

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# How Much Would It Take? Achieving Retirement Income Equivalency Between Final-Average-Pay Defined Benefit Plan Accruals and Automatic Enrollment 401(k) Plans in the Private Sector

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## Introduction

A rapidly growing public policy concern facing the United States is whether future generations of retired Americans, particularly those in the Baby Boomer and Gen X cohorts, will have adequate retirement incomes. A comprehensive answer to this question requires elaborate simulation models incorporating:

- Several forms of retirement income and wealth: Social Security, defined benefit (DB) accruals, defined contribution (DC) assets, individual retirement accounts (IRAs), and net housing equity.
- Retirement expenses: both deterministic expenses that can be estimated from survey data as well as some health insurance and out-of-pocket health-related expenses, plus stochastic expenses from nursing-home and home-health care.

Since 2001, the Employee Benefit Research Institute (EBRI) has conducted dozens of these types of comprehensive studies with its Retirement Security Projection Model<sup>®</sup> (RSPM),<sup>1</sup> and in each case both DB and DC retirement benefits were included at the household level.

However, there have been several policy studies in recent years that suggest that the decreasing relevance of DB plans relative to DC plans since the 1980s<sup>2</sup> will have a negative impact on the percentage of future retirees who will achieve a specified level of retirement income adequacy. While previous EBRI research has consistently demonstrated that the post-2009 Retirement Readiness Ratings for Baby Boomers and Gen Xers are significantly improved relative to 2003, despite the impacts of the crises in the financial and real estate markets in the intervening period,<sup>3</sup> a more direct comparison of the likely retirement benefits under DC and DB plans at this time may be useful in responding to some of these assertions.

The academic literature already contains two excellent analyses of the relative level of retirement benefits produced by DB vs. DC plans (see the descriptions of Samwick and Skinner (2004) and Poterba et al. (2007) below). However, these were prior to the increase in prevalence of automatic enrollment and automatic contribution escalation provisions following the Pension Protection Act of 2006.<sup>4</sup> Recent research<sup>5</sup> has provided EBRI with plan-specific generosity parameters for millions of participants in automatic enrollment (AE) 401(k) plans, and this information is incorporated into this analysis.

While the DC plans modeled in this analysis draw from the actual design experience of several hundred AE 401(k) plans, in the interest of clarity it was decided to limit the comparisons for DB plans to only a high-three-year, final-average DB plan.<sup>6</sup>

Assuming historical rates of return as well as annuity purchase prices reflecting average bond rates over the period from 1986 to 2013, the analysis shows that:

- For males, defined benefit “break-even” rates — or the percentage accrual rate that would be required in order for a DB plan to generate the same retirement income that is projected to come from 401(k) plan participation for a given worker cohort — are rarely less than 1.5 percent of final pay: in only 2 of the 16 combinations of wage quartiles and years of plan eligibility for males are defined benefit “break-even” rates less than 1.5 percent of final pay per years of service.

- In the case of females, only 5 of the 16 combinations have “break-even” rates under 1.5 percent.
- When these findings are subjected to the scrutiny of various “stress tests” both by reducing the rate of return assumptions by 200 basis points as well utilizing current annuity purchase prices, results show that in many cases the AE 401(k) plans lose their comparative advantage to the stylized, final-average DB plans, especially for lower-paid employees as demonstrated by the lower “break-even” accrual rates.

## Previous Research

Samwick and Skinner (2004) used two different approaches to compare a representative sample of defined benefit plans with a representative sample of 401(k) plans in an attempt to determine the adequacy of 401(k) plans relative to private-sector defined benefit plans. Under the first approach, they constructed a counterfactual simulation to estimate benefits for the sample of workers covered by their actual pension plan in the Pension Provider Surveys (PPS), 1983 or 1989,<sup>7</sup> and assigned each worker a randomly chosen 401(k) plan from the Survey of Consumer Finances (SCF) in the years 1989 through 2001. In both the defined benefit and 401(k) scenarios, the time series of earnings were identical for each worker, who was assumed to have worked at the firm from their actual date of hire until age 62. In the second approach, they analyzed a hypothetical benchmark worker with the average characteristics (age, date of hire, earnings) of the PPS sample.

When Samwick and Skinner considered the counterfactual where individuals in defined benefit plans were assigned participation in randomly chosen 401(k) plans using 1983 workers and defined benefit plans, they found median benefits of \$9,440 (all values are in 1995 dollars and represent real annuities) for actual workers with just a defined benefit pension in the PPS (assuming they continue working at their current jobs until age 62). Assigning randomly chosen 401(k) plans from 1995<sup>8</sup> for the same earnings produced median benefits of \$11,004. When 401(k) enrollees with zero contributions were included, the median fell to \$9,950. Performing the same counterfactual experiment using the sample of plans from the PPS 1989 survey for workers with only defined benefit plans, median benefits were found to be lower for 401(k) plans (\$11,274) compared with defined benefit plans (\$12,524). Including noncontributors in the sample reduced median 401(k) benefits further to \$10,176.

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

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

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

received median benefits, they would need to roll over just 68 percent of 401(k) balances to end up with the same benefits as would be received under the defined benefit plan.

Although the Samwick and Skinner analysis represented a significant advancement in the analysis of the relative adequacy of retirement benefits from defined benefit plans vs. 401(k) plans,<sup>9</sup> there are two issues inherent to the use of SCF data at that time that need to be considered in the interpretation of the results. First, there were only a small percentage of workers in the SCF survey who claimed to be covered only by a 401(k) plan but reported no employee or employer 401(k) contribution. This percentage ranged from 2.7 to 4.7 percent, depending on the year of the SCF survey used in the analysis.<sup>10</sup> Second, given the limited information available with respect to asset allocation in the SCF survey, the authors were forced to assign shares of equity in each 401(k) plan to 0, 50, or 100 percent, and workers were assumed to rebalance their portfolio over time to maintain the same asset share.<sup>11</sup>

Poterba, Rauh, Venti, and Wise (2007) used information from actual retirement plans that covered respondents in the Health and Retirement Study (HRS).<sup>12</sup> They used actual lifetime earnings trajectories along with the historical distribution of returns on financial assets to calculate the resulting asset balance at age 63 and conclude that the benefits provided by private-sector defined benefit plans are almost always less than defined contribution plans under the parameterizations they study. The authors assumed that an individual contributes a fixed percentage of his or her earnings to a defined contribution plan each year during a working life that begins at age 28. This was determined by drawing from a distribution of combined employer and employee contributions as a percentage of pay for HRS males with positive contributions to defined contribution plans.<sup>13</sup>

Poterba, Rauh, Venti, and Wise assumed that the distribution of returns is given by an empirical distribution of returns during the 1926 to 2003 period, a time when average annual arithmetic real return on large-cap U.S. equities was 9.2 percent and long-term U.S. government bonds had a real return of 2.8 percent.<sup>14</sup> Overall investment returns were obtained by combining this return information with seven different asset allocation strategies for each individual's defined contribution account and netting out investment-related expenses.<sup>15</sup> Job histories were constructed for each of the HRS respondents in their sample based on earnings history and responses to various HRS questions about job tenure with the assumption that no one in the sample has more than three defined-benefit-eligible jobs during their work career.

Although their findings represent an important first step toward comparing the relative risks of defined benefit and defined contribution plans using the actual earnings histories, there are some caveats acknowledged by the authors that should be examined in the interpretation of the results. First, they did not allow for lump-sum distributions from defined contribution plans.<sup>16</sup> Second, they did not allow for differences in asset allocation patterns. Third, the simulation of wealth accumulation was limited to households that are exposed to either defined contribution or defined benefit plans throughout their working career. Perhaps most important to an accurate interpretation of the results is that while they did randomize the generosity parameters of the private-sector defined benefit plans within their sample of 25 HRS plans, there was no similar treatment accorded defined contribution plans. Indeed, they assumed that a given combined employee and employer contribution percentage would apply throughout the participant's lifetime, even when job changes occur.<sup>17</sup>

The June 2013 *EBRI Issue Brief*<sup>18</sup> provided a comparative analysis of future benefits from private-sector, voluntary-enrollment (VE) 401(k) plans and stylized, final-average-pay DB plans. In that study, we performed a pairwise comparison between the benefits from the VE plan and what would have been available under the final-average-pay plan under the same employment, wage, and eligibility history. Rather than trying to reflect the real-world variation in DB accruals, the baseline 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. Several graphs and tables were produced to show the percentile distribution of the relative gaps between the retirement-income outcomes from a VE 401(k) plan compared with the final-average DB plan, by income quartile as well as by number of years of plan eligibility. This analysis was conducted for the baseline assumptions as well as for several sensitivity analyses.

Following the publication of the June 2013 *EBRI Issue Brief*, several questions were posed dealing with how the results might differ if different accrual rates were assumed for the stylized DB plan. A December 2013 EBRI publication<sup>19</sup> expanded upon the June 2013 *EBRI Issue Brief* by computing for each simulated employee iteration what final-average DB accrual would provide the same 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.

## Methodology

The analysis used for the current study makes use of a modified version of the EBRI Retirement Security Projection Model<sup>®</sup> (RSPM) used in VanDerhei (April 2010) to compare simulated retirement benefits available under AE 401(k) plans with those that would be available from a counterfactual simulation<sup>20</sup> of a high-three-year, final-average-pay defined benefit plan. The counterfactual DB plan uses the same sequence of eligibility, wage, and job change information<sup>21</sup> simulated for the DC plan. At age 65, the defined contribution balance is divided by the annuity purchase price to determine the value of a nominal annuity starting at that age. A pairwise comparison is then made between that value and what would have been available under the final-average<sup>22</sup> plan under the same employment history.

Unlike the procedures adopted by Samwick and Skinner (2004) and Poterba et al. (2007), the generosity parameters used to model both matching and nonelective contributions for AE 401(k) plans were hand-coded from plan-specific data utilized for the EBRI simulations appearing in Green, Lucas, and Hammond (2017).

The new simulation model constructed for this study adopts the basic structure of the RSPM.<sup>®23</sup> Initial and subsequent eligibility for 401(k) plans and participation in 401(k) plans is based on an integration of the distribution of defined-contribution-plan-participant status by age and earnings found in the U.S. Census Bureau's Survey of Income and Program Participation (SIPP), along with the participation probabilities among eligible employees in AE plans from Vanguard.<sup>24</sup>

All simulation results are based on the annual return assumptions used in Finke, Pfau, and Blanchett (2013). The baseline results 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. Sensitivity analysis is conducted in this study by reducing the returns by 200 basis points as well as a temporary reduction from historical norms to conform to consultant expectations.

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

Until empirical information is available to track individual employees from one job to the next and track their 401(k) eligibility status, one needs to rely on some type of assumption with respect to this variable. Because there appears to be a well-documented body of evidence that individuals with a propensity to save seek out 401(k) sponsors (or vice versa),<sup>25</sup> an admittedly ad hoc approach was developed to compute eligibility probabilities conditional upon the eligibility status on the previous job, as shown below:

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

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

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

VanDerhei and Copeland (2008) analyzed two cases for  $x$ :<sup>26</sup>

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

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

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

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

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

1. *Complete independence (based on their current age and income)*: Current conditional-participation probabilities do not depend on whether they were previously participants.
2. *A "once a participant, always a participant (if eligible)" scenario*: Once an individual has been simulated to be a participant, he or she will continue to be a participant every time he or she is eligible.
3. *An intermediate situation* similar to the second assumption above with respect to eligibility.

Assumption two appears overly optimistic and assumption three is used as the baseline assumption in this study.

Because this study focuses on the account balance at age 65 in a current or previous employer's 401(k) as well as any IRA rollovers originating in 401(k) accounts, it simulates the likelihood that a participant will cash out the 401(k) balance at preretirement job termination.<sup>27</sup> The current model uses cashout information by age and account balance from Vanguard.<sup>28</sup>

The analysis in this *Issue Brief* is entirely forward-looking: It tracks accumulations only resulting from post-2018 contributions. All existing balances are ignored, but simulations are limited to employees currently ages 25–29.

Unlike the 10 distinct gender- and education-age-earnings profiles typically used in RSPM,<sup>®</sup> this study uses the employee's current earnings and assumes (similar to Pang and Warshawsky, 2013) that earnings grow at 3.9 percent per annum before age 55 and then at 2.8 percent until retirement.

Given the need to convert the DC account balance to a nominal annuity for comparison purposes with the final-average DB plan, the choice of an annuity purchase price is an essential assumption. One obvious choice would be to determine the rate at which a 65-year-old would be able to convert a lump-sum distribution to a nominal annuity in today's market. However, these rates (14.62 for males and 15.35 for females) are at above average values from a time-series perspective and could certainly bias the results toward a more favorable comparison for DB plans. Although these rates are used for some of the comparisons, it is thought that using an implied annuity purchase price for a time when bond rates were closer to historical norms would provide a better benchmark.

For purposes of this determination, average-annuity-rate data for different age groups and genders from 1986–2013 were obtained,<sup>29</sup> and the gender-specific prices at age 65 are regressed against Moody's AAA Corporate Bond yields and a time dummy (to control for changes in life expectancy over this period of time). Using the regression coefficients and multiplying by the maximum value of the time variable (*viz.*, today) and the average corporate bond rate during that time period (6.85 percent), the benchmark annuity purchase prices are determined to be 11.61 for males and 12.34 for females.



## Results

Figure 1A shows the median of the final-average DB plan generosity parameters required for equivalence with the AE 401(k) plan among male employees currently ages 25–29, by salary quartile and years of eligibility, assuming the baseline (historical) rates of returns for stocks and bonds and the baseline assumption for the annuity purchase price (reflecting average bond rates over the period from 1986 to 2013). Figure 1B provides the same analysis for females.

A “break-even” accrual rate is the percentage accrual rate that would be required in order for a DB plan to generate the same retirement income that is projected to come from 401(k) plan participation for a worker with the same wage and job turnover paths throughout their careers.

Given their higher conditional probabilities of participation in an AE 401(k) plan when eligible as well as lower opt-out rates after the initial year, one would expect that higher-income employees would need a higher DB accrual rate to produce an equivalent level of retirement income as the 401(k) plan. This is indeed what is observed in both Figure 1A and Figure 1B; for all years-of-eligibility categories, the larger income quartiles have higher “break-even” accrual rates. For example, for those in the lowest income quartile, the median DB accrual rate that males (Figure 1A) with 31–40 years of plan eligibility would need in order to generate the same retirement income that they are projected to have with a 401(k) is 2.4 percent of final compensation. This increases to 2.5 percent for the next income quartile and 2.7 percent for the third income quartile. Those in the highest income quartile would need a 3.1 percent accrual rate for equivalency.

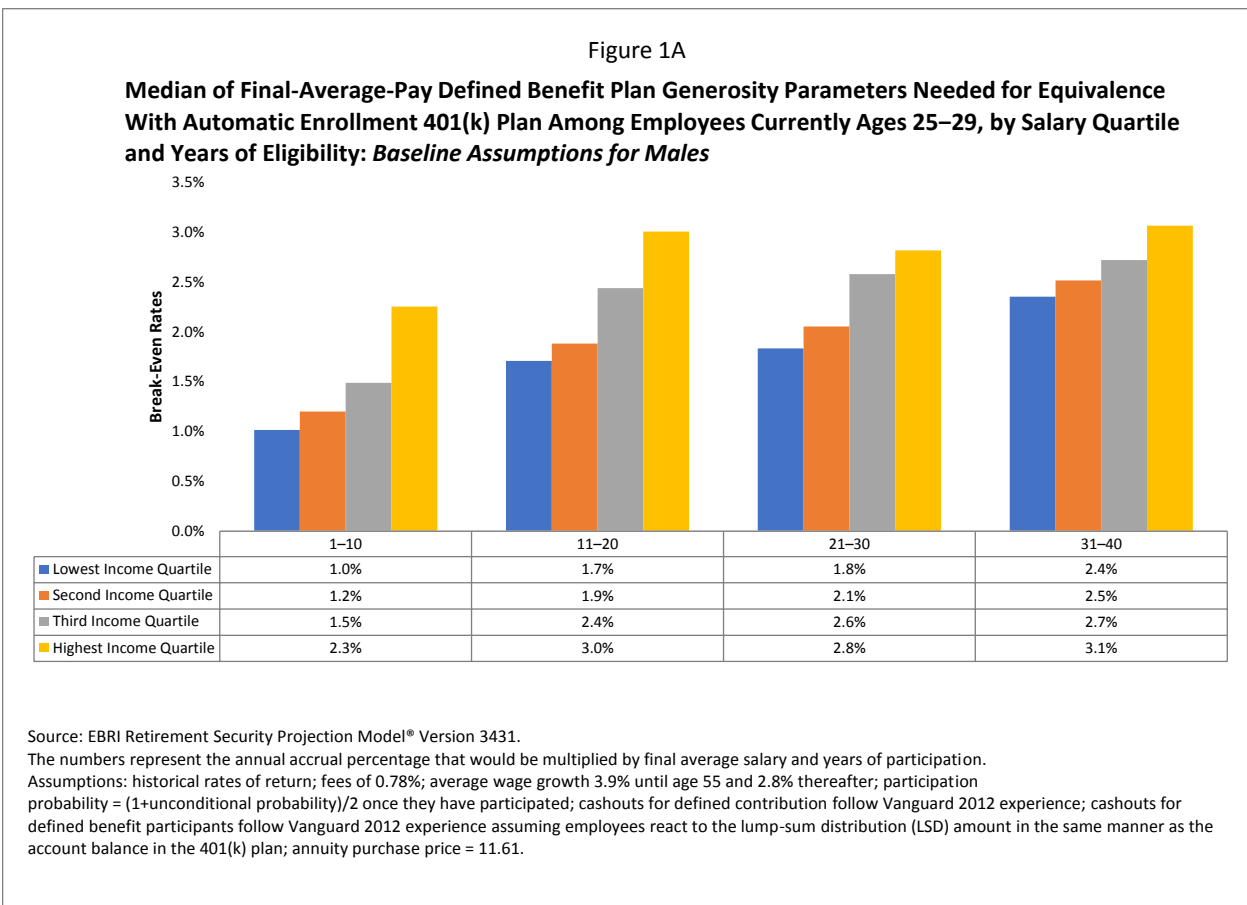
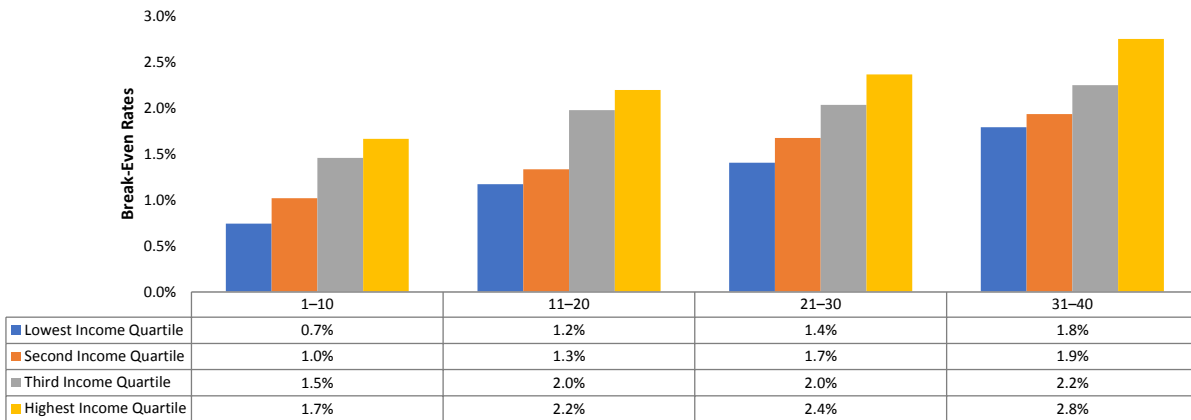


Figure 1B

**Median of Final-Average-Pay Defined Benefit Plan Generosity Parameters Needed for Equivalence With Automatic Enrollment 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: *Baseline Assumptions for Females***



Source: EBRI Retirement Security Projection Model® Version 3431.  
 The numbers represent the annual accrual percentage that would be multiplied by final average salary and years of participation.  
 Assumptions: historical rates of return; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as the account balance in the 401(k) plan; annuity purchase price = 12.34.

Given their longer life expectancies at age 65 (and hence higher annuity purchase prices in the individual market), females would be expected to need lower DB accrual rates for equivalency. And, in fact, comparing figures 1A and 1B shows that for all 16 combinations of years-of-eligibility categories and income quartiles, the median DB accrual rate for females is less than, or equal to, the corresponding rate for males.

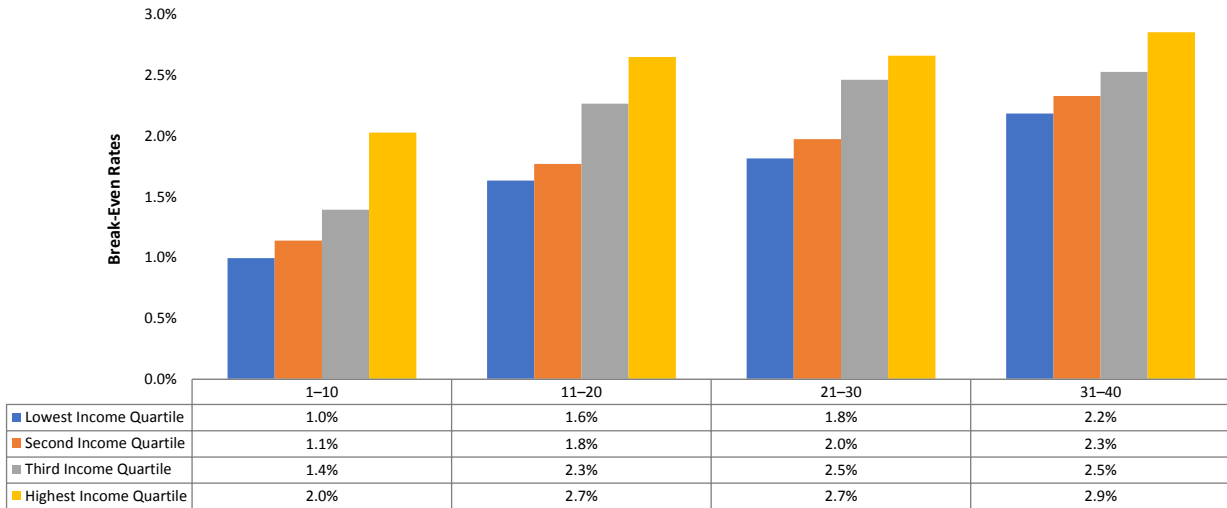
Figures 2A and 2B show the impact on the DB accrual rates needed for equivalency for males and females, respectively, of reducing the assumed rates of return for the first ten years from historical norms to conform to consultant expectations.<sup>30</sup> Because the lower rates of return in the short term would reduce the expected account balances, the DB plan would require a lower accrual rate to provide an equivalent benefit. For example, for the lowest income quartile, the median DB accrual that males (Figure 2A) with 31–40 years of plan eligibility in their careers would need in order to have the same retirement income that they are projected to have with a 401(k) plan is 2.2 percent of final compensation. This is an 8 percent reduction compared with the 2.4 percent value under the baseline return assumptions in Figure 1A.

Figures 3A and 3B show a similar impact of reducing the assumed rates of return; however, this time it is assumed to be a permanent reduction of 200 basis points. For example, for the lowest income quartile, the median DB accrual that males (Figure 3A) with 31–40 years of plan eligibility in their careers would need in order to have the same retirement income that they are projected to have with a 401(k) plan is 1.6 percent of final compensation. This is a 33 percent reduction compared with the 2.4 percent value under the baseline return assumptions in Figure 1A.

Figures 4A and 4B show the impact of assuming future annuity purchase prices are equivalent to today’s higher than average rates. Because the higher annuity purchase prices would reduce the expected monthly retirement income that can be generated from the 401(k) and IRA account balances, the DB plan would require a lower accrual rate to provide an equivalent benefit. For example, for the lowest income quartile, the median DB accrual that males (Figure 4A) with 31–40 years of plan eligibility would need in order to have the same retirement income that they are projected to have with a 401(k) plan is 1.9 percent of final compensation. This is a 21 percent reduction compared with the 2.4 percent value under the baseline assumptions in Figure 1A.

Figure 2A

**Median of Final-Average-Pay Defined Benefit Plan Generosity Parameters Needed for Equivalence With Automatic Enrollment 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: Benchmark Male-Adjusted Annuity Purchase Prices and Return Assumptions Modified for the First Ten Years**



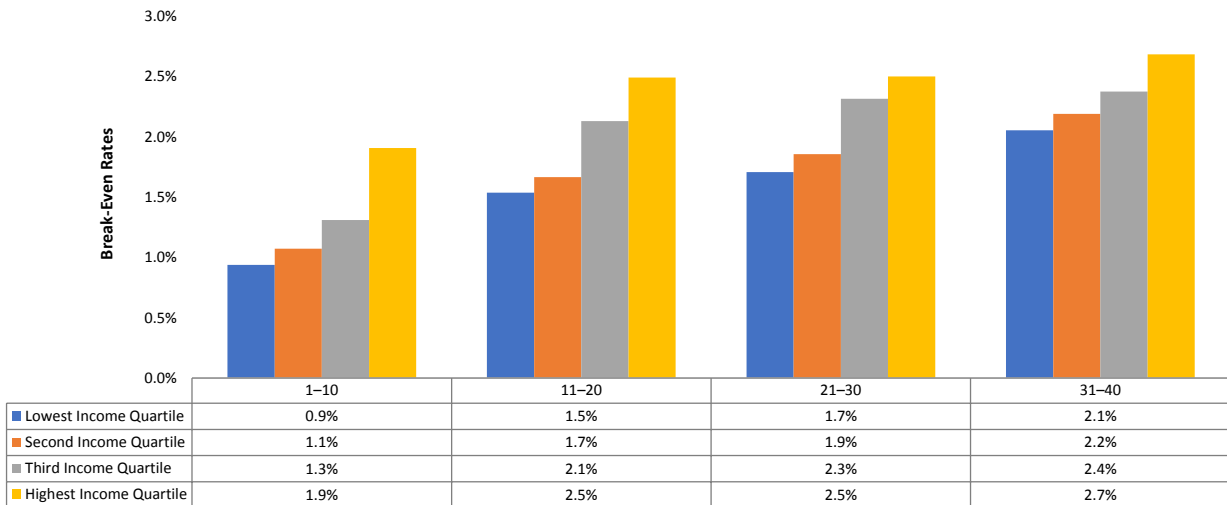
Source: EBRI Retirement Security Projection Model® Version 3431.

The numbers represent the annual accrual percentage that would be multiplied by final average salary and years of participation.

Assumptions: historical rates of return except for the first ten years when it is reduced to a median return for U.S. equities (large cap) and U.S. bonds of 6.0 percent and 2.8 percent respectively; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as the account balance in the 401(k) plan; annuity purchase price = 11.61.

Figure 2B

**Median of Final-Average-Pay Defined Benefit Plan Generosity Parameters Needed for Equivalence With Automatic Enrollment 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: Benchmark Female-Adjusted Annuity Purchase Prices and Return Assumptions Modified for the First Ten Years**



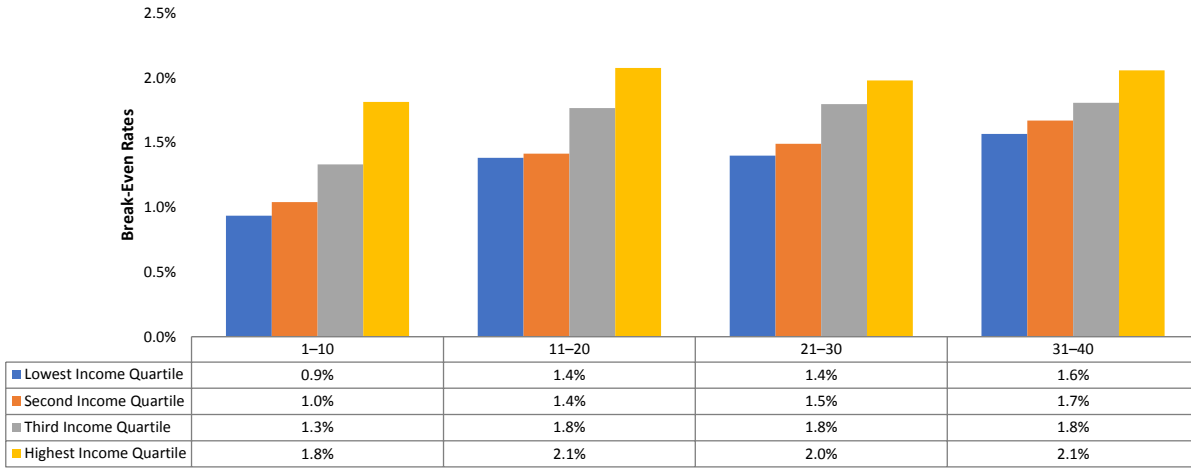
Source: EBRI Retirement Security Projection Model® Version 3431.

The numbers represent the annual accrual percentage that would be multiplied by final average salary and years of participation.

Assumptions: historical rates of return except for the first ten years when it is reduced to a median return for U.S. equities (large cap) and U.S. bonds of 6.0 percent and 2.8 percent respectively; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as the account balance in the 401(k) plan; annuity purchase price = 12.34.

Figure 3A

**Median of Final-Average-Pay Defined Benefit Plan Generosity Parameters Needed for Equivalence With Automatic Enrollment 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: Benchmark Male-Adjusted Annuity Purchase Prices and Return Assumptions Decreased by 200 Basis Points**



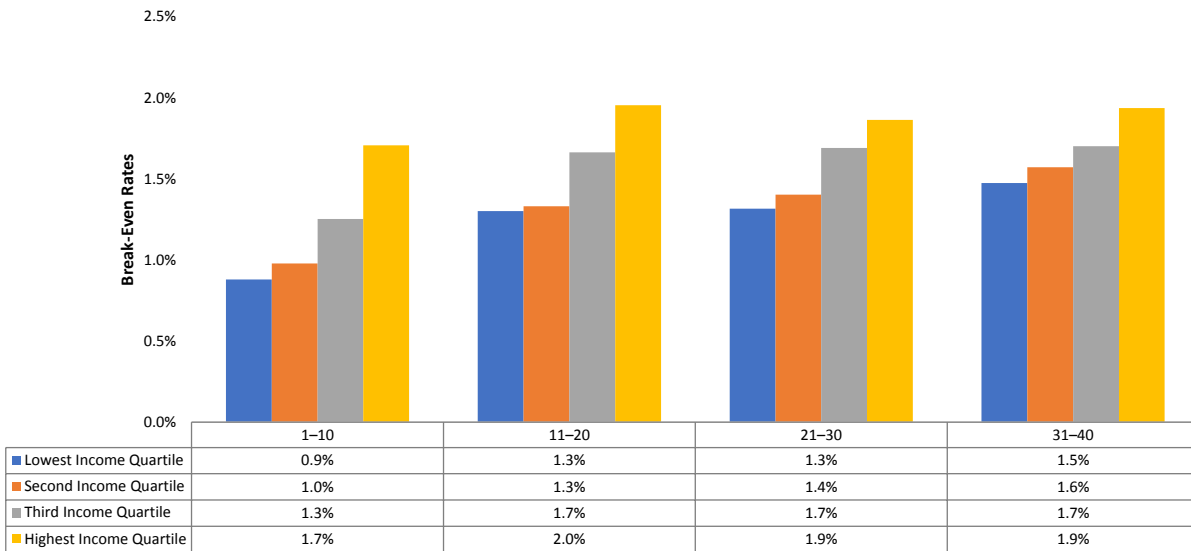
Source: EBRI Retirement Security Projection Model® Version 3431.

The numbers represent the annual accrual percentage that would be multiplied by final average salary and years of participation.

Assumptions: historical rates of return decreased by 200 basis points; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as the account balance in the 401(k) plan; annuity purchase price = 11.61.

Figure 3B

**Median of Final-Average-Pay Defined Benefit Plan Generosity Parameters Needed for Equivalence With Automatic Enrollment 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: Benchmark Female-Adjusted Annuity Purchase Prices and Return Assumptions Decreased by 200 Basis Points**



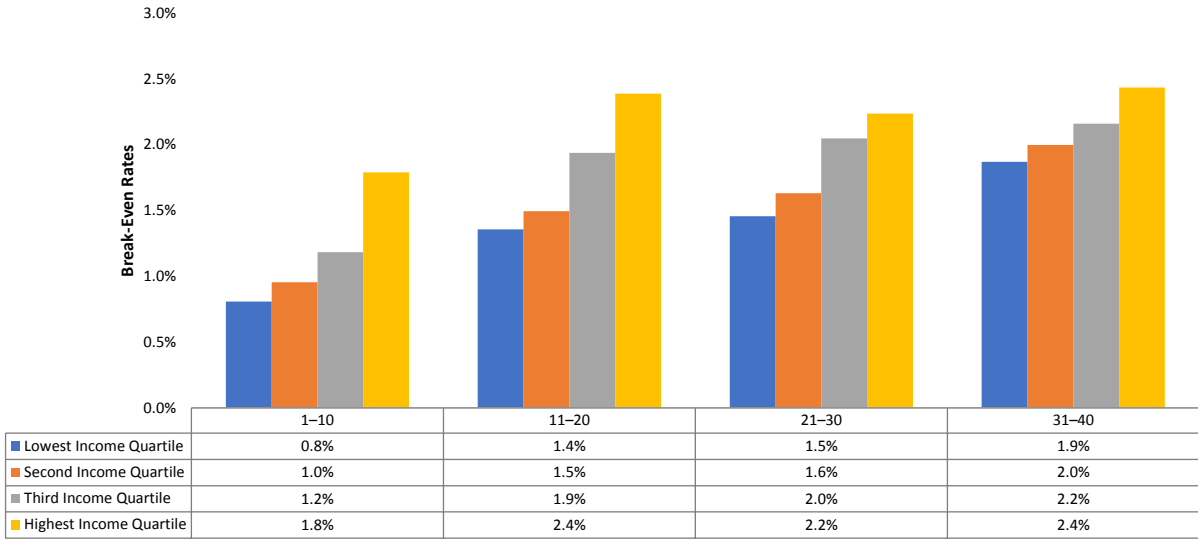
Source: EBRI Retirement Security Projection Model® Version 3431.

The numbers represent the annual accrual percentage that would be multiplied by final average salary and years of participation.

Assumptions: historical rates of return decreased by 200 basis points; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as the account balance in the 401(k) plan; annuity purchase price = 12.34.

Figure 4A

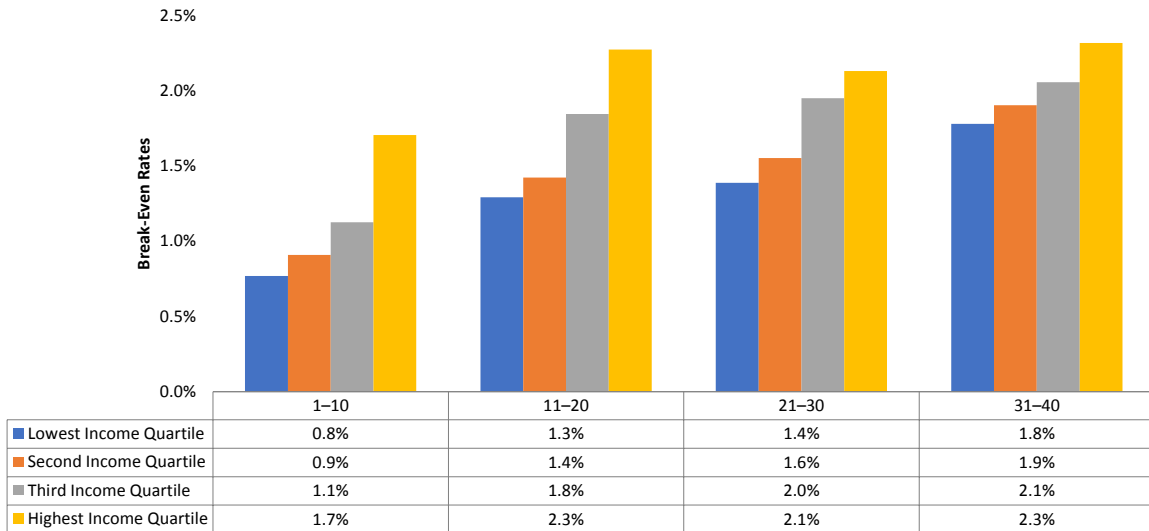
**Median of Final-Average-Pay Defined Benefit Plan Generosity Parameters Needed for Equivalence With Automatic Enrollment 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: *Today's Male-Adjusted Annuity Purchase Prices***



Source: EBRI Retirement Security Projection Model® Version 3431.  
 The numbers represent the annual accrual percentage that would be multiplied by final average salary and years of participation.  
 Assumptions: historical rates of return; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as the account balance in the 401(k) plan; annuity purchase price = 14.62.

Figure 4B

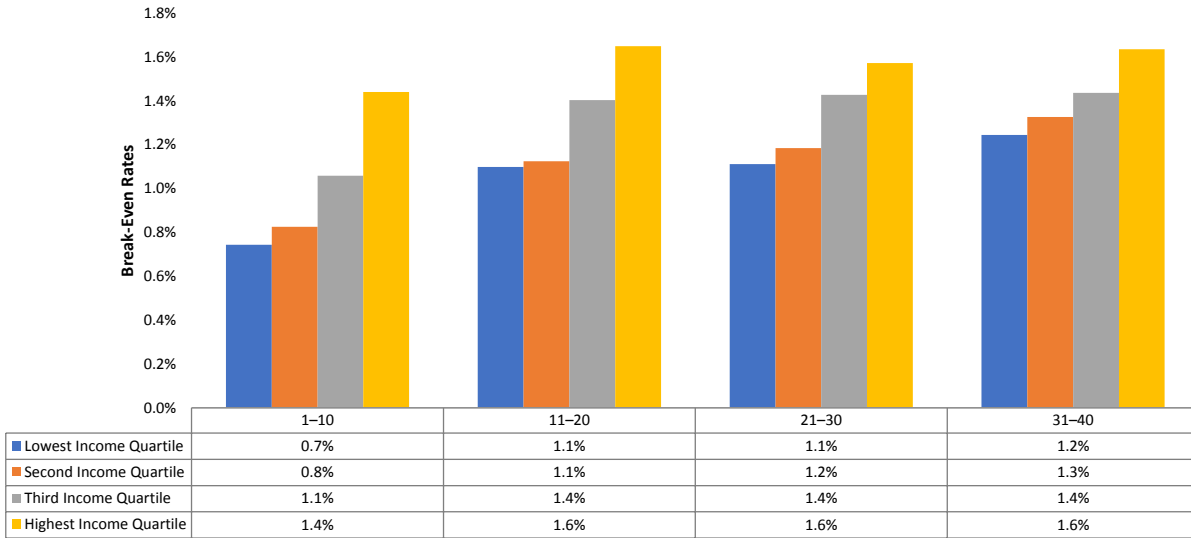
**Median of Final-Average-Pay Defined Benefit Plan Generosity Parameters Needed for Equivalence With Automatic Enrollment 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: *Today's Female-Adjusted Annuity Purchase Prices***



Source: EBRI Retirement Security Projection Model® Version 3431.  
 The numbers represent the annual accrual percentage that would be multiplied by final average salary and years of participation.  
 Assumptions: historical rates of return; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as the account balance in the 401(k) plan; annuity purchase price = 15.35.

Figure 5A

**Median of Final-Average-Pay Defined Benefit Plan Generosity Parameters Needed for Equivalence With Automatic Enrollment 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: *Today’s Male-Adjusted Annuity Purchase Prices and Return Assumptions Decreased by 200 Basis Points***



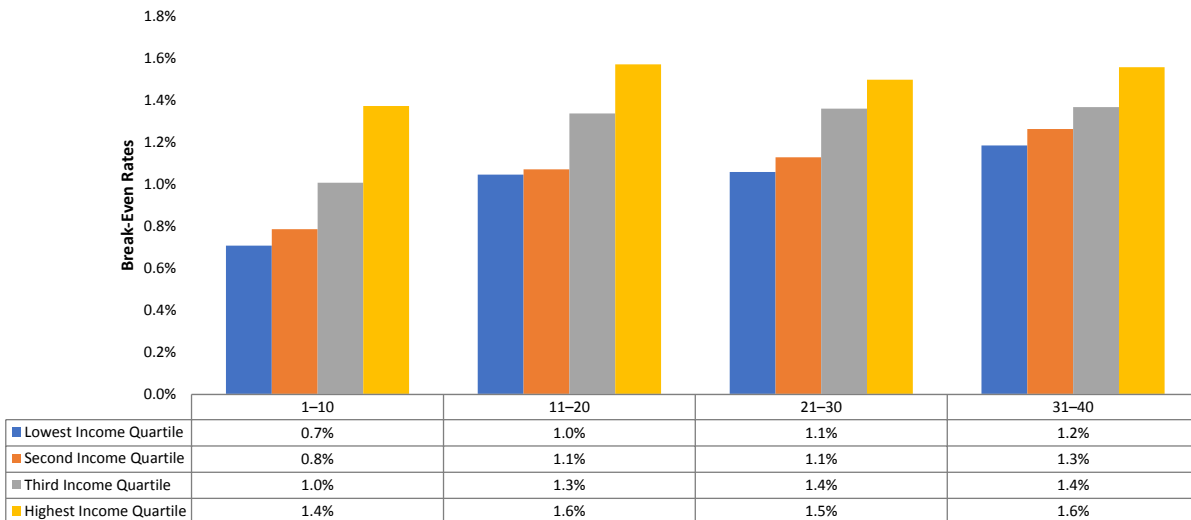
Source: EBRI Retirement Security Projection Model® Version 3431.

The numbers represent the annual accrual percentage that would be multiplied by final average salary and years of participation.

Assumptions: historical rates of return decreased by 200 basis points; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as the account balance in the 401(k) plan; annuity purchase price = 14.62.

Figure 5B

**Median of Final-Average-Pay Defined Benefit Plan Generosity Parameters Needed for Equivalence With Automatic Enrollment 401(k) Plan Among Employees Currently Ages 25–29, by Salary Quartile and Years of Eligibility: *Today’s Female-Adjusted Annuity Purchase Prices and Return Assumptions Decreased by 200 Basis Points***



Source: EBRI Retirement Security Projection Model® Version 3431.

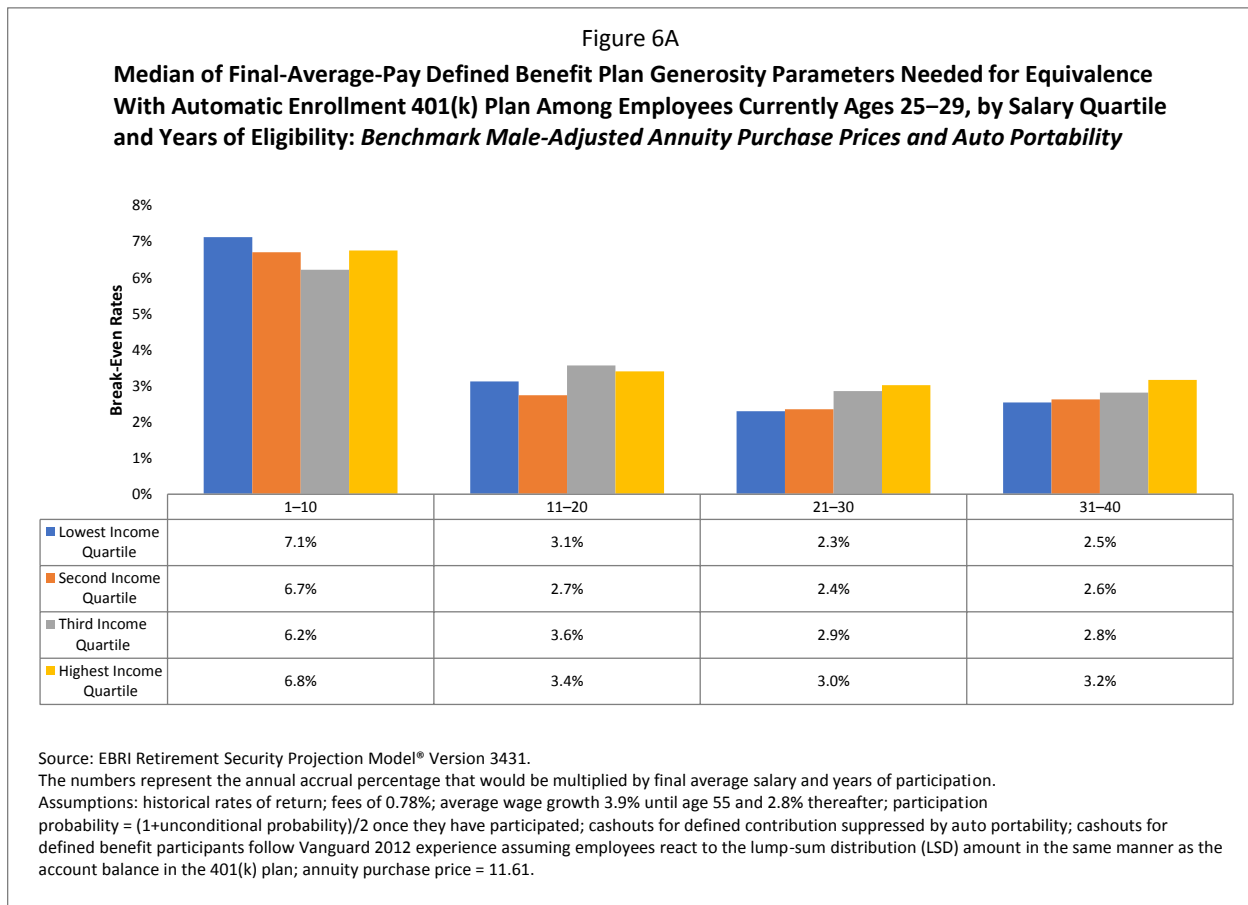
The numbers represent the annual accrual percentage that would be multiplied by final average salary and years of participation.

Assumptions: historical rates of return decreased by 200 basis points; fees of 0.78%; average wage growth 3.9% until age 55 and 2.8% thereafter; participation probability = (1+unconditional probability)/2 once they have participated; cashouts for defined contribution follow Vanguard 2012 experience; cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as the account balance in the 401(k) plan; annuity purchase price = 15.35.

Figures 5A and 5B show the impact of simultaneously reducing the assumed rates of return by 200 basis points and assuming future annuity purchase prices are equivalent to today’s historically high rates. Because both of these modifications would reduce the median DB accrual needed for equivalency separately, one would expect an even larger decrease when they are combined. This is indeed what is seen in these figures. For example, for the lowest income quartile, the median DB accrual that males (Figure 5A) with 31–40 years of plan eligibility would need in order to have the same retirement income that they are projected to have with a 401(k) plan is 1.2 percent of final compensation. This represents a 50 percent reduction from the 2.4 percent value under the baseline assumptions in Figure 1A.

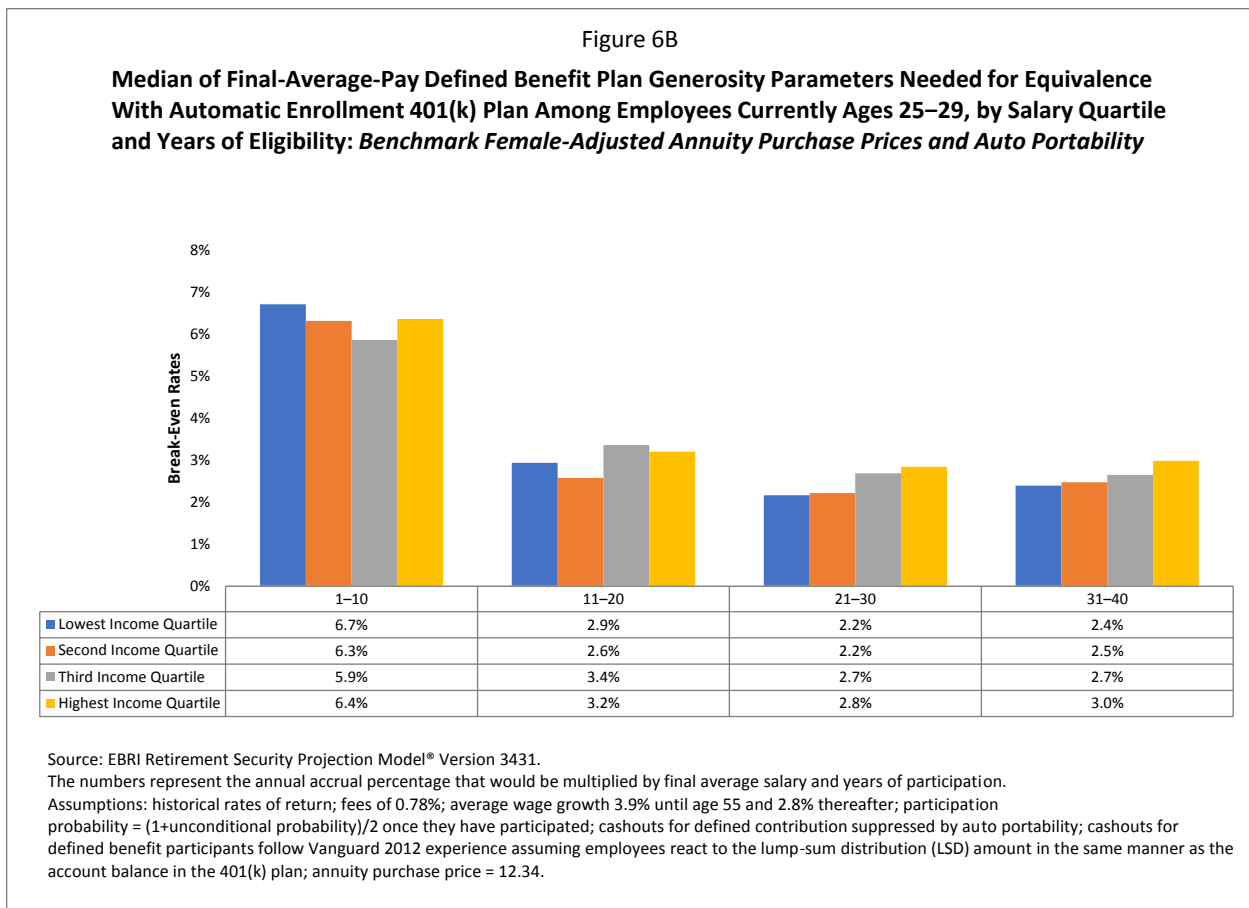
## The Impact of Auto Portability

One of the primary objectives in the development of EBRI’s Retirement Security Projection Model® was to provide a tool that could be used to analyze how various public policy and plan design changes would impact retirement deficits. We have recently analyzed the impact of the Automatic Retirement Plan Act of 2017 (ARPA) proposal on retirement deficits<sup>31</sup> and the impact of adopting auto portability,<sup>32</sup> as well as interaction of auto portability with ARPA.<sup>33</sup> With auto portability, a participant’s account from a former employer’s retirement plan would be automatically combined with their active account in a new employer’s plan. This would help keep the DC assets in the retirement system and — in theory — reduce leakage from cashouts upon employment termination. This is important because studies have found that cashouts are the most significant form of leakage from DC plans, especially among workers with low plan balances.<sup>34</sup>



Figures 6A and 6B show the median of the final-average defined benefit plan generosity parameters that would be needed for equivalence with automatic enrollment 401(k) plans, assuming a full auto portability scenario for the 401(k) plans (but not the defined benefit plans). As expected, the impact of auto portability would be greatest among the lowest income quartile given their lower account balances and the negative correlation between account balances and cashout activity. For example, for those in the lowest income quartile, the median DB accrual that males (Figure 6A) with 21–30 years of plan eligibility would need in order to have the same retirement income that they are projected to have with a 401(k) plan is 2.3 percent of final compensation. This represents a 28 percent increase from the 1.8 percent value under the baseline assumptions in Figure 1A. The results are even more dramatic for males in the lowest income quartile with only 11–20 years of plan eligibility. In this case, the 3.1 percent median accrual rate needed for equivalency is 82 percent greater than the 1.7 percent value in Figure 1A.

Assuming the auto portability scenario for 401(k) plans, the results for those with only 1–10 years of eligibility are at least 6.2 percent for all income quartiles for males (Figure 6A) and at least 5.9 percent for females (Figure 6B). This reflects the larger propensity for those who end up in this category to have shorter tenure positions and hence lower account balances at job change.





## Summary

Over the past 30-odd years, the number of defined benefit (DB) pension plans has continued to decline, while defined contribution (DC) plans have increased in number. Today, some workers are covered both by DB and DC plans, while others are offered only a DC plan and some have only a DB plan. Still others have no workplace retirement plan at all.

As noted in earlier EBRI publications, a rapidly growing public policy concern facing the United States is whether future generations of retired Americans, particularly those in the Gen X cohorts, will have adequate retirement incomes.<sup>35</sup> There have been several policy studies in recent years that suggest that the decreasing relevance of DB plans relative to DC plans (such as 401(k) plans) since the 1980s will have a negative impact on the percentage of future retirees who will achieve a specified level of retirement income adequacy.

In considering these shifts in plan availability and design, plan sponsors, providers, and policy makers naturally look for comparisons in the outcomes provided, the benefits produced based on the application of real-world savings rates, employer contributions and worker tenure within these program designs. Unfortunately, the comparisons are frequently limited by a paucity of real-world data.

This research expands upon previous EBRI publications<sup>36</sup> by computing for several simulated employee contingencies (such as job turnover) what level of final-average DB accrual would provide an equal amount of retirement income at age 65 as would be produced if the projected sum of automatic enrollment 401(k) and IRA rollover balances were annuitized. In so doing, it provides a comparison in median outcomes for a variety of assumptions, both market returns and annuity purchase prices, and should provide a much-needed reference point for policy makers in evaluating these plan designs in view of both current and future workforce trends.<sup>37</sup>

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## Endnotes

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<sup>1</sup> See <https://www.ebri.org/retirement/retirement-security-projection-model> for a listing of 45 publications using the EBRI Retirement Security Projection Model.<sup>®</sup>

<sup>2</sup> See Olson and VanDerhei (1997) for documentation of this trend.

<sup>3</sup> See VanDerhei and Copeland (2010) for initial results.

<sup>4</sup> PPA provided a safe harbor for “qualified automatic contribution arrangements” (“QACA”) deemed to satisfy the ADP/ACP nondiscrimination testing rules provided the plans meet certain requirements.

<sup>5</sup> See Green, Lucas, and Hammond (2017).

<sup>6</sup> RSPM<sup>®</sup> uses a wide variety of defined benefit types in the full simulation model. The model is programmed to allow the employee to participate in a nonintegrated career average plan; an integrated career average plan; a five-year, final-average plan without integration; a three-year, final-average plan without integration; a five-year, final-average plan with covered compensation as the integration level; a three-year, final-average plan with covered compensation as the integration level; a five-year, final-average plan with a PIA offset; a three-year, final-average plan with a PIA offset; a cash balance plan; or a flat benefit plan.

<sup>7</sup> For every respondent or spouse in the 1983 and 1989 SCF samples who reported being covered by a pension, the PPS attempted to obtain the summary plan description for the plan from the pension provider.

<sup>8</sup> The lack of a pension provider survey after 1989 did not allow the authors to do a comparison of the 1995 401(k) plans with 1995 defined benefit plans. Evidence on the extent to which the characteristics of defined benefit plans in 1995 were similar to those in 1990 can be found in Gustman and Steinmeier (1998).

<sup>9</sup> Holden and VanDerhei (2002) developed a stochastic simulation model of 401(k) accumulations and IRA rollovers, but they did not compare the resulting benefits to defined benefit plan accruals.

<sup>10</sup> In contrast, Utkus and Young (2013) report Vanguard data showing a participation rate of 59 percent for their voluntary enrollment plans in 2012. However, unlike the Samwick and Skinner analysis, the estimate for Vanguard participants was not limited specifically to those with 401k plans who have no other employer-sponsored pension plan.

<sup>11</sup> VanDerhei, Holden, Alonso, and Bass (2012) reported that, as in previous years, the EBRI/ICI database of 24 million 401(k) participants for year-end 2011 shows that participants’ asset allocation varied considerably with age. Younger participants tended to favor equity funds and balanced funds, while older participants were more likely to invest in fixed-income securities such as bond funds, GICs and other stable-value funds, or money funds. For example, among participants in their 20s, the average allocation to equity and balanced funds was 75 percent of assets, compared with 50 percent of assets among participants in their 60s.

<sup>12</sup> The sample of defined benefit plan parameters was selected from the 25 largest private-sector defined benefit plans ranked by number of HRS participants (the public sector was analyzed separately in their study). The algorithm used in their study does not allow for migration between the public and the private sectors.

<sup>13</sup> The authors mentioned that a disadvantage of their approach is that W-2 data cannot identify voluntary non-contributors. The lowest contribution rate assigned to defined contribution plan participants is 1.9 percent of salary per year.

<sup>14</sup> The authors conducted additional sensitivity analysis by performing some simulations in which all equity returns were reduced by 300 basis points.

<sup>15</sup> The asset allocations studied were:

- Treasury Inflation-Protected Securities (TIPS).
- Long-term government bonds.
- Corporate stock.
- 50/50 mix of stocks and TIPS.

- 
- 50/50 stocks and nominal government bonds.
  - Lifecycle portfolios that combine stocks and TIPS.
  - Lifecycle portfolios that combine stocks and nominal bonds.

<sup>16</sup> Holden and VanDerhei (2002) analyzed the importance of cashout behavior at job change in voluntary-enrollment 401(k) plans and found that it would lower the eventual nominal replacement rate at age 65 from 4.7 percentage points for the highest income quartile to 13.3 percentage points for the lowest income quartile.

<sup>17</sup> Utkus and Young (2013) report Vanguard data showing an increase in average deferral rates from 5.8 percent for those ages 25–34 to 9.1 percent for those 55–64 for their voluntary enrollment plans in 2012.

<sup>18</sup> VanDerhei (June 2013).

<sup>19</sup> VanDerhei (December 2013).

<sup>20</sup> Counterfactual experiments (contrary to established fact) describe how an observed effect might vary under different sets of conditions and speculate what might have happened if observed facts were different. For economic studies, they typically utilize computer simulation models to run a variety of statistical “what-if” scenarios.

<sup>21</sup> Cashouts for defined benefit participants follow Vanguard 2012 experience assuming employees react to the lump-sum distribution (LSD) amount in the same manner as the account balance in the 401(k) plan.

<sup>22</sup> It is important to note that this analysis deals exclusively with outcomes and not the manner in which they are financed. Defined benefit plans in the private sector are financed exclusively by employer contributions, while employee contributions play a significant part in the funding of 401(k) plans.

<sup>23</sup> For details, see VanDerhei and Copeland (2010).

<sup>24</sup> Utkus and Young (2018).

<sup>25</sup> See Ippolito (1997) for a detailed description of the literature.

<sup>26</sup> There is a third case, that of complete dependence, which is not used in this report. This case would approximately have  $x=1$  and  $y=0$ ; however,  $y$  will need to be greater than 0 in many cases to account for the fact that  $z$  is an increasing function of age.

<sup>27</sup> Job turnover rates were estimated from the 2004 Survey of Income and Program Participation (SIPP) Topical Module 7.

<sup>28</sup> Utkus and Young (2013).

<sup>29</sup> The information is from [immediateannuities.com](http://immediateannuities.com) and available at the following site:

[www.annuityshopper.com/archives/](http://www.annuityshopper.com/archives/) The author would like to express his gratitude to K. Jeremy Ko for suggesting the data and to Hersh Stern for providing the data in an Excel file.

<sup>30</sup> The temporary (ten-year) alternative assumptions were sourced from PIMCO's 2018 Defined Contribution Consulting Support and Trends survey (2018). The median return for U.S. equities (large cap) and U.S. bonds were 6.0 percent and 2.8 percent respectively. The volatilities were 17.0 percent and 4.0 percent.

<sup>31</sup> VanDerhei (May 2018).

<sup>32</sup> VanDerhei (July 2018).

<sup>33</sup> VanDerhei (September 2018).

<sup>34</sup> VanDerhei (June 2014).

<sup>35</sup> See VanDehei (January 2019) for detail on retirement income adequacy for single males, single females, widows, and widowers.

<sup>36</sup> VanDerhei (June 2013) and VanDerhei (December 2013).

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<sup>37</sup> The move to automatic enrollment will have another benefit beyond that provided by increased participation and the possible escalation of employee contributions over time. As more 401(k) sponsors default employees initially into target-date funds as part of the qualified default investment alternative (QDIA), the extreme positions often found in participant-directed asset allocations (e.g., young employees with no equity exposure or employees on the verge of retirement with extremely high equity allocations) are replaced with allocations that are considered more age-appropriate by most experts. See VanDerhei (June 2009) for more detail.

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