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The Impact of PPA on Retirement Savings for 401(k) Participants

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- **Modeling of auto-enrollment results:** This *Issue Brief* simulates (under several assumptions) the likely impact of 401(k) plan sponsors switching from voluntary enrollment systems to automatic enrollment designs with automatic escalation of contributions for a significant portion of workers (not just current 401(k) participants or those eligible to participate).
- **PPA implemented a concept long studied:** The concept of auto-enrollment has been studied since the mid-1990s. Support for the concept grew as various studies showed relatively low participation rates among young and low-income workers, and as more defined benefit plan sponsors began freezing their plans for future (and sometimes current) employees. The Pension Protection Act of 2006 (PPA) created incentives for plan sponsors to implement this concept with its 401(k) safe-harbor auto-enrollment and auto-escalation provisions.
- **Significant impact, especially for low-income:** This analysis indicates that even under the most conservative assumptions for auto-escalation of contributions, switching 401(k) plans to auto-enrollment is likely to have a very significant positive impact in generating additional retirement savings for many workers, especially for low-income workers.
- **Range of increases under auto-enrollment:** When results are aggregated across all income categories, the increase in the value of 401(k) accumulations at age 65 as a multiple of final earnings for those currently ages 25–29 would be approximately 2.4 to 2.6 times final salary by switching from voluntary enrollment to automatic enrollment.
- **Higher-paid unlikely to benefit as much:** Although the aggregate results favor automatic enrollment, distributional analysis of the differences between the two systems indicates that the higher paid are not likely to benefit as much from such a change.
- **Lowest-paid likely to see significantly higher 401(k) accumulations:** The median 401(k) accumulations for the lowest-income quartile of these workers (assuming all 401(k) plans were voluntary enrollment) would only be 0.1 times final earnings at age 65 (this is largely due to the fact that 41 percent of workers—as opposed to participants—were assumed to have zero balances at age 65). However, if all 401(k) plans are assumed to be using the auto-enrollment provisions under PPA, the median 401(k) accumulations for the lowest-income quartile jumps to 2.5 times final earnings under the most conservative assumptions and 4.5 times final earnings under the most beneficial assumptions. Even for the top 25 percent of these workers (when ranked by 401(k) accumulations as a multiple of final earnings), there are large increases: the multiple under a voluntary enrollment scenario is 1.8 times final earnings, whereas auto-enrollment provides multiples ranging from 6.5 to 10.4, depending on auto-escalation of contributions.
- **For many, higher assets from auto-enrollment will still not be enough:** Comparing income replacement targets generated in previous EBRI work with these simulated 401(k) accumulations shows that, even with the large increases that can be expected for many workers under the safe harbor auto-enrollment plans introduced by PPA, and with current-law Social Security benefits, additional resources will still be needed for some of them.

Jack VanDerhei is the research director at EBRI. Craig Copeland is senior research associate at EBRI. This *Issue Brief* was written with assistance from the Institute’s research and editorial staffs. 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, 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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Introduction

A previous simulation study of workers participating in 401(k) plans with voluntary enrollment has shown that under several sets of sensitivity analyses, account balances generated under these plans (and either retained in the original plan or rolled over to a successor employer or an IRA) may replace a significant percentage of preretirement income for workers who participate in the system for their entire working careers.

However, if workers are not always eligible to participate in a 401(k) at work, the relative adequacy of the retirement income that may be generated by these plans falls substantially.¹ Moreover, there have been several studies² which simulate the likely retirement income generated under these plans for all (or a significant portion of) the work force. These studies also find evidence that significant portions of future retirees would reach retirement age with account balances too low (when combined with expected Social Security income) to achieve replacement rates that are able to meet conventionally defined targets (70 to 85 percent of preretirement income).

The concept of automatic enrollment (also known as “negative election”) has been familiar to those in the 401(k) field since the mid-1990s. However, the appeal of a legislative change to make this (and other “defined benefit-like” provisions) more popular as a plan design choice for 401(k) sponsors grew in recent years as industry studies proliferated demonstrating relatively low participation rates among young and low-income workers, and more defined benefit plan sponsors began freezing their plans for future (and sometimes current) employees.

Another simulation study in 2005³ demonstrated how valuable automatic enrollment designs would be to low-income 401(k) participants and, a year later, PPA was enacted with several advantageous provisions for 401(k) sponsors with a specific type of automatic enrollment design. While it will take several years to see whether this type of encouragement is sufficient to switch 401(k) sponsors from a voluntary enrollment design to either a safe harbor automatic enrollment design or something similar, this *Issue Brief* simulates (under several assumptions) the likely impact of future 401(k) accumulations for a significant portion of workers (not just current 401(k) participants or those eligible to participate) if the switch is made.

The reader should be cautioned that this analysis did not attempt to take the next step and evaluate what this change means with respect to the prospects of retirement income adequacy. Such an analysis needs to carefully consider Social Security benefits, net housing equity, IRA balances that do not originate from rollovers, as well as defined benefit accruals. Unfortunately, the funding requirements for the latter were substantially modified by PPA, and researchers are still evaluating the extent to which this is likely to modify the current trends among pension plan sponsors to freeze defined benefit plans and/or modify their structure (for example, by converting them to cash balance plans). Once sufficient evidence has been acquired to make meaningful projections, EBRI will revise its Retirement Security Projection Model[®] to provide a comprehensive analysis of the impact of PPA on retirement income adequacy.

In the interim, one may be interested in comparing the 401(k) accumulations in this report (presented as a multiple of final earnings) with other targets available for determining whether these amounts, when combined with expected Social Security benefits, are likely to be adequate for those with no other sources of retirement income. While many of these targets use average longevity, average (historical) rates of return and average (or no) retiree health care costs and/or nursing home costs, a 2006 simulation study⁴ provided some benchmarks for what an individual may need as a multiple of final earnings to have various chances of being able to meet basic retirement expenses plus any health care/nursing home costs not covered by Medicare (or Medicaid if asset and income thresholds are satisfied).

The following table shows the variation in target multiples of final yearly earnings using this model. The column at the far left is the probability of achieving retirement income adequacy as defined in the previous paragraph. The other four columns show target final earnings multiples for men and women at different levels of income and different retirement ages. These examples assume no equity allocation of assets and no annuitization of an individual’s initial retirement wealth, nor any purchase of long-term care insurance.

Target Final Earnings Multiples, by Gender and Retirement Age

High-Income Individuals (single retirees making more than \$40,450 per year)

Probability of Retirement "Adequacy"	Male Retiring at 65	Female Retiring at 65	Male Retiring at 62	Male Retiring at 68
50%	4.13	5.29	6.29	2.83
75%	7.14	10.13	10.5	5.44
90%	11.9	13.86	17.14	8.97

Low-Income Individuals (single retirees making less than \$15,000 per year)

Probability of Retirement "Adequacy"	Male, Retiring at 65	Female, Retiring at 65	Male, Retiring at 62	Male, Retiring at 68
50%	10.67	16.22	15.87	6.78
75%	22.85	34.23	32.73	19.42
90%	41.99	54.22	57.12	33.75

These target multiples can be reduced (sometimes substantially) by the judicious choice of annuitization and/or purchase of long-term care insurance.

The analysis presented in this report indicates that the adoption of automatic enrollment and automatic escalation in 401(k) plans is likely to have a very significant positive impact in generating additional retirement savings for many workers, especially for low-income workers.

For example, under one set of assumptions used in the *Issue Brief*, the median 401(k) accumulations for the lowest-income quartile of workers currently age 25–29 (assuming all 401(k) plans were voluntary enrollment) would only be 0.1 times final earnings at age 65 (this is largely due to the fact that 41 percent of workers—as opposed to participants—were assumed to have zero balances at age 65). However, if all 401(k) plans are assumed to be using the safe harbor automatic enrollment provisions under PPA, the median 401(k) accumulations for the lowest-income quartile jumps to 2.5 times final earnings under the most conservative assumptions and 4.5 times final earnings under the set of assumptions most beneficial to participants.⁵ Even when one considers the top 25 percent of these workers (when ranked by 401(k) accumulations as a multiple of final earnings), there are large increases: the multiple under a voluntary enrollment scenario is 1.8 times final earnings whereas automatic enrollment provides multiples ranging from 6.5 to 10.4, depending on the assumptions for automatic escalation of contributions.

Comparing the income replacement targets above with these simulated 401(k) accumulations shows that, even with the large increases that can be expected for many workers under the safe harbor automatic enrollment plans introduced by PPA, it will still not be enough for some of them: Additional resources will still be needed.

Previous Research

The retirement income prospects for future generations of retirees have been modeled by EBRI extensively in recent years, in an attempt to more accurately predict how various cohorts of Americans will likely fare in retirement. Results have ranged from very bleak for substantial portions of the U.S. population⁶ to fairly positive for 401(k) participants with continuous coverage throughout their working careers: Results suggest a significant portion of these workers' preretirement income could be replaced by 401(k) accumulations when combined with Social Security (at least Social Security benefits projected under current statutory provisions).

There have been two types of simulation studies in recent years attempting to model the likely retirement income generated by 401(k) plans: those based on administrative records of individual employees currently participating in 401(k) plans, and those based on all (or a significant percentage of) workers whether they are currently participating in a 401(k) plan or not. While each type of simulation model has relative strengths and limitations, it is important to understand that they are designed to answer different questions, or at least answer questions for different subsets of the population. The remainder of this section highlights the major

findings from one type of these models before moving to an explanation of the hybrid model used in this study—one that utilizes parameters estimated from administrative records of actual participants and applies them to a broad segment of the entire population of workers.

Simulation Studies Based on 401(k) Participants in EBRI/ICI Database

Assuming that 401(k) accumulations were used to purchase nominal annuities at age 65, the EBRI/ICI 401(k) Accumulation Projection Model predicts baseline median replacement rates at retirement ranging from 51–69 percent, based on final five-year average salary (“replacement rate” meaning the percentage of a worker’s final salary that is replaced in retirement by a nominal annuity purchased with 401(k) assets).⁷ However, these baseline results were predicated on the assumption that any worker currently participating in a 401(k) plan would *continue to be offered* a 401(k) plan for each future job. If it is assumed that the worker would have only an *average* chance of being offered a 401(k) plan at future jobs, the income replacement rates decrease to a range of 21–26 percent. While this scenario is certainly far too pessimistic to be correct, the disparity between the two sets of results demonstrates the importance of continued participation in a 401(k) plan throughout an employee’s working career.

Phrased another way, a crucial factor in the future retirement security of many Americans is *whether they continue to be offered* a 401(k) plan when they change jobs, and, if they are, *whether they continue to participate* in it and contribute at a significant level of savings.

Modeling the Impact of Automatic Enrollment

A year prior to the enactment of the Pension Protection Act of 2006 (PPA), the EBRI/ICI 401(k) Accumulation Projection Model was used to simulate the impact of universal adoption of automatic enrollment features under a combination of default contribution rates and default investment allocations.⁸ In order that the beneficial effect of the expected increase in participation rates could be included in simulation results, “synthetic” employees were generated in the model to include eligible workers who chose *not to participate* in the 401(k) plan. When these employees were added to the model, the median replacement rates under the baseline assumption mentioned above decreased significantly for the lowest-income quartile (23 percent, down from 51 percent) but only mildly for the highest-income quartile (56 percent, down from 67 percent).

Assuming that *all* 401(k) plan sponsors would adopt automatic enrollment immediately (in 2005), the median replacement rates for the lowest-income quartile increased to 37 percent (from the 23 percent baseline) even under the conservative assumptions of a 3 percent default contribution rate and a money market default investment. When the default contribution rate was increased to 6 percent and the default investment was changed to a life-cycle fund, the median replacement rate for this group increased further to 52 percent.⁹ These results illustrate the very strong improvements that can result from automatic enrollment of workers in a 401(k) plan—especially for the lowest-income workers. However, because this study was written a year prior to the enactment of PPA, it did not include any modeling on automatic escalation of employee contributions.

Last year, data from the 2007 Retirement Confidence Survey (RCS)¹⁰ were used to provide a first approximation for the expected impact of automatic escalation under the PPA safe harbor rules for a number of different assumptions about worker and employer reactions—over and above that already projected to arise from the adoption of automatic enrollment (but before the law went into effect). The 2007 RCS was fielded several months after the enactment of PPA and asked workers how high they would allow their default 401(k) contributions to go.

One of the extremely important plan design decisions a 401(k) plan sponsor must make because of PPA is whether to introduce automatic enrollment features. There is extensive literature on the potential benefits of automatic enrollment on participation rates, especially for young employees and those with low incomes.¹¹ However, there is also a recognition that the introduction of these programs has a tendency to “anchor” participants’ contribution rates and asset allocation to the defaults chosen by the sponsor;¹² hence, the overall increase in expected account balances from adopting these “automatic” 401(k) plans will be a function of both the employee’s relative wage level and the employer’s default decisions.

PPA provided a significant incentive for employers that had not already adopted automatic enrollment to reconsider their decisions. PPA pre-empts state laws that might affect plans adopting automatic enrollment

provisions and provides additional nondiscrimination safe harbor protections for them. To qualify for the automatic enrollment safe harbor, the contribution rate for automatic enrollees must be at least 3 percent of salary during the first year of participation, 4 percent during the second year, 5 percent during the third year, and 6 percent thereafter. The plan may specify a higher contribution up to a maximum of 10 percent.¹³

Modeling the Impact of Automatic Escalation of 401(k) Contributions

Although the automatic escalation of 401(k) contributions described above has been shown to potentially increase employee contributions considerably in a limited number of test cases,¹⁴ these experiments have simply been too recent to show how long and/or to what extent workers are likely to continue the periodic escalations before opting out of any additional increases. There has been detailed exploration of the impact of automatic enrollment on participation decisions, investment allocations, and the desired contribution rate in the pre-PPA environment; however, the inability to measure the worker's optimal stopping point in the automatic escalation process has made it difficult to simulate the impact of PPA on 401(k) accumulations.

Fortunately, as part of the 2007 RCS, this information could be elicited from 456 employees who were currently contributing to a 401(k) plan by their responses to the following question:¹⁵

Suppose your employer automatically increased the percentage of your salary contributed to the plan by 1% each time you received a raise. For example, your contribution might increase from 3% to 4% of your salary with your first raise, and from 4% to 5% with your next raise. You could choose to discontinue the automatic increase at any time. At about what percentage of your salary do you think you would discontinue the automatic increase?

Three percent of the employees responded that they would discontinue the increase immediately or before the first raise. Twenty-five percent indicated a percentage between 1–5 percent, while another 44 percent estimated they would continue until some place in the 6 to 10 percent range. Thirteen percent chose a limit between 11 and 15 percent, while 14 percent indicated they would allow the increase to exceed 15 percent. While there is no guarantee that the survey responses will reflect how 401(k) participants will actually react when given the chance to opt out of additional increases in deferrals, it does provide a useful contrast to the simplistic assumption that all 401(k) participants will allow the annual increases until it reaches a point pre-specified by the employer.¹⁶

This information was added into the simulation model's baseline assumptions from the 2005 simulation study mentioned above with a 3 percent initial default contribution rate and life-cycle default investment. These plan design assumptions were rather obvious, given the requirements for the PPA safe-harbor and the Qualified Default Investment Alternative regulations;¹⁷ however, setting the proper values for other assumptions proved somewhat more problematic.

The first of these assumptions deals with the question of whether employees are likely to maintain their higher contribution rate from a prior job when it comes to setting the initial contribution rate with a new employer. For example, if employees start at a 3 percent contribution rate with the first employer and leave when they have already increased the contribution rate to 6 percent, will they *maintain their contribution rate* when they move to the second employer? Or would they *start over*, and drop back down to 3 percent?

Since it will likely be years before researchers have sufficient information to determine which of these scenarios is more likely, and for whom, the results were simulated separately for both scenarios. The second assumption that is still difficult to set with any certitude is whether the worker's contribution escalation will be constrained by the employer response to the safe harbor minimum (6 percent of compensation) or the safe harbor maximum (10 percent of compensation).

Model Assumptions

The primary objective of this study is to provide an assessment of how “401(k) accumulations” (namely, retirement income available at age 65 that originated in a 401(k) plan—whether or not it is still in an employer's 401(k) plan or has been rolled over to an IRA) are likely to be affected by a move from voluntary enrollment to automatic enrollment (specifically the safe harbor approach as detailed by PPA). As it is far too soon to analyze what percentage of 401(k) sponsors with voluntary enrollment (VE) will adopt an automatic enrollment (AE) approach, similar to previous EBRI analysis of defined benefit freezes,¹⁸ this

analysis models the scenario in which all VE sponsors switch to AE. The results allow the users to determine the likely impact of these changes by applying whatever relative growth in the percentage of AE participants they think is most likely to occur.

In an attempt to make the modeling more tractable, several simplifying assumptions are adopted in this version of the model:

- First, it is assumed that the adoption of PPA will not increase the percentage of workers eligible to be covered by 401(k) plans in the future and/or the generosity of employer contributions to such plans. In light of previous EBRI/Mercer research on the impact of PPA on defined benefit sponsors,¹⁹ this may prove to be a very pessimistic assumption (especially for those defined benefit sponsors that freeze their defined benefit plans). However this assumption was adopted as the current baseline until additional empirical information is available to modify the simulation model.
- Second, it is assumed that all new AE plans adopt the PPA safe-harbor provisions. While there is certainly no guarantee that a significant percentage of VE sponsors converting to AE will find the safe harbor advantages to be sufficiently appealing to subject themselves to these plan design constraints, this assumption does provide a ready point of departure for modeling purposes until such time as empirical evidence is available to modify the simulation model.

The new simulation model constructed for this study adopts the basic structure of the EBRI/ERF Retirement Income Projection Model.²⁰ The model is based on private-sector wage and salary workers ages 21–64 with at least \$10,000 in annual earnings found in the 2001 Survey of Income and Program Participation (SIPP) Topical Module 7.²¹ A predicted ratio of wage to average national wages was estimated as a function of gender, education level, and age similar to that used in Holden and VanDerhei (2002) and future average national wages were assumed to follow the intermediate assumptions used by the Board of Trustees of the OASDI Trust Funds.²² Initial and subsequent eligibility for both types of 401(k) plans and participation in a VE plan was based on an integration of the distribution of defined contribution plan participant status by age and earnings found in SIPP along with the participation probabilities among eligible employees in VE plans from Fidelity Investments (2007).

Additional employee behavior in voluntary enrollment plans was based on a joint distribution of asset allocation and contribution behavior as a function of employee age and income from the year-end 2006 EBRI/ICI Participant-Directed Retirement Plan Data Collection Project (VanDerhei, Holden, Copeland and Alonso, 2007). Participation behavior, contribution activity, and asset allocation for automatic enrollment plans were based on an integration of data from Nessmith, Utkus and Young (2007); Fidelity (2007); and Choi, Laibson and Madrian (2004).

All simulation results were based on annual returns data from Ibbotson and Associates (2007).²³ Time series data for the years 1926 through 2006 were used for Large Cap Stocks and Long-Term Corporate Bonds to simulate the portfolios of all 401(k) participants. The simulated rates of return used a modified version of the method of overlapping periods (Schleef and Eisinger, 2007; and Cooley et al., 2003).²⁴

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 only 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. Since there appears to be a well-documented body of evidence that individuals with a propensity to save would seek out 401(k) sponsors (or vice versa),²⁵ 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 = unconditional probability of being covered (empirical value as a function of age and wage).

Let x = probability of being covered given that your last job was covered.

Let y = probability of being covered given that your last job was NOT covered.

There are two cases for x in this paper:²⁶

1. Complete independence (e.g., $x=z=y$).
2. An ad-hoc assumption that the value of x will be half-way 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.

Since this study focuses on account balances 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 job termination, as well as the likelihood of leaving it with the previous employer or rolling it over to the new employer or an individual retirement account (IRA). The current model uses a similar approach to Holden and VanDerhei (2002) for this as well as the probability of a preretirement distribution from an IRA rollover.

The analysis in this paper is entirely forward-looking: It only tracks accumulations resulting from post-PPA (2008 or later) contributions. All existing balances are ignored, which makes the concept of a replacement ratio (or indeed any proxy for retirement income adequacy for all but the youngest age cohorts) beyond the scope of this paper. Instead, the 401(k) accumulations are reported as multiples of final earnings available at age 65.

Results

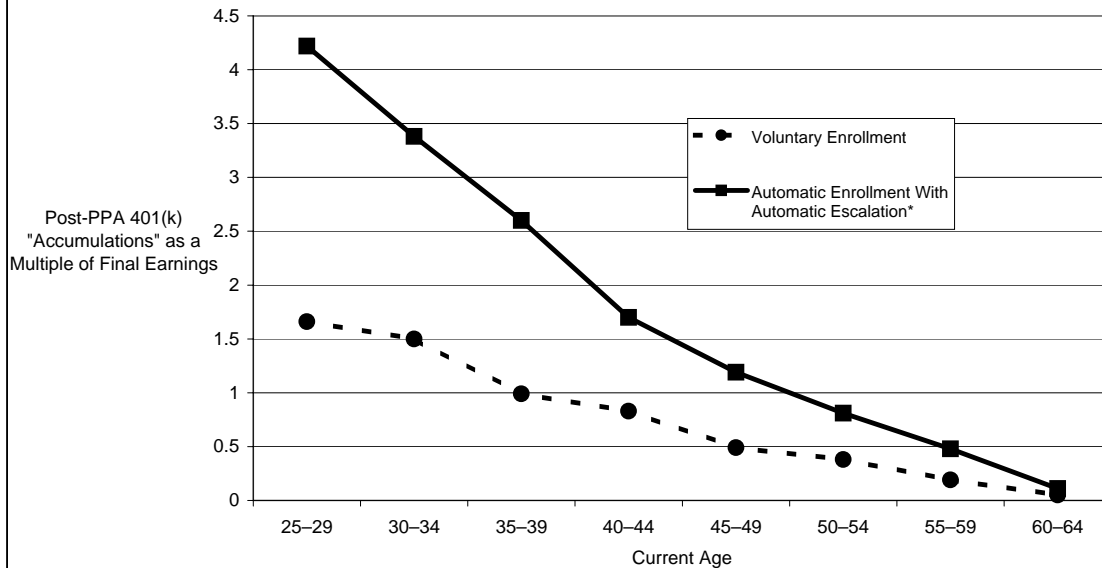
Figures 1 and 2 provide the median post-PPA 401(k) accumulations as a multiple of final earnings for both VE and AE plans with automatic escalation²⁷ as a function of current age. In both cases, the older cohort will have only minimal accumulations due to their proximity to retirement; but even for those currently in their late 50s, the median multiples are approximately twice as large for the AE plans when compared with the VE plans. Differences in type of 401(k) plan obviously have the largest impact on the youngest cohorts, who would have the most time in the work force to experience the difference. For those currently 25–29, the difference in the median multiples would be approximately 2.39 times final salary in an AE- as opposed to a VE-plan, if one assumes that future eligibility is not a function of current eligibility. This value increases to 2.56 times final salary if instead one assumes that future eligibility is related to current eligibility (under the assumptions specified earlier).

However, when one considers the 75th percentile of each age cohort (i.e., those with a multiple higher than 3 out of 4 workers their age) in Figures 3 and 4, the differences are virtually nonexistent with the exception of the very youngest cohort. The difference between the two pairs of figures (1 and 2, compared with 3 and 4) are due to some very well-known influences of automatic enrollment. While the primary benefit of increasing participation rates is extremely important for those groups with chronically low rates (the young and the low-income), there have been some well-documented limitations with respect to a significant percentage of these participants never saving more than the default contribution rates set by the employer under AE plans. Several studies have shown that under VE plans, workers who choose to participate tend to cluster around the maximum amount that the employer will match (traditionally 6 percent of compensation)²⁸ while employees in AE plans often maintain the default contribution rate (traditionally 3 percent of compensation) for a significant period of time. Holden and VanDerhei (2005) showed the likely impact of switching to AE plans as a function of salary, and in some scenarios the medians for the higher-income workers actually fell. Again, this was prior to PPA and did not include the introduction of automatic escalation, which should help to mitigate the lower relative balances for some AE participants.

The remaining analysis in this *Issue Brief* focuses on employees currently ages 25–29. This serves two purposes: (1) it indicates what the maximum impact of a change from VE to AE is likely to be in the future, and (2) it allows refinement of the results with respect to additional percentiles in the distribution analysis as well as the impact of salary and number of years participating in a 401(k) plan on the final balances.

Figure 5 compares several distribution percentiles for post-PPA 401(k) accumulations as a multiple of final earnings for workers currently ages 25–29 for automatic enrollment (without automatic escalation)

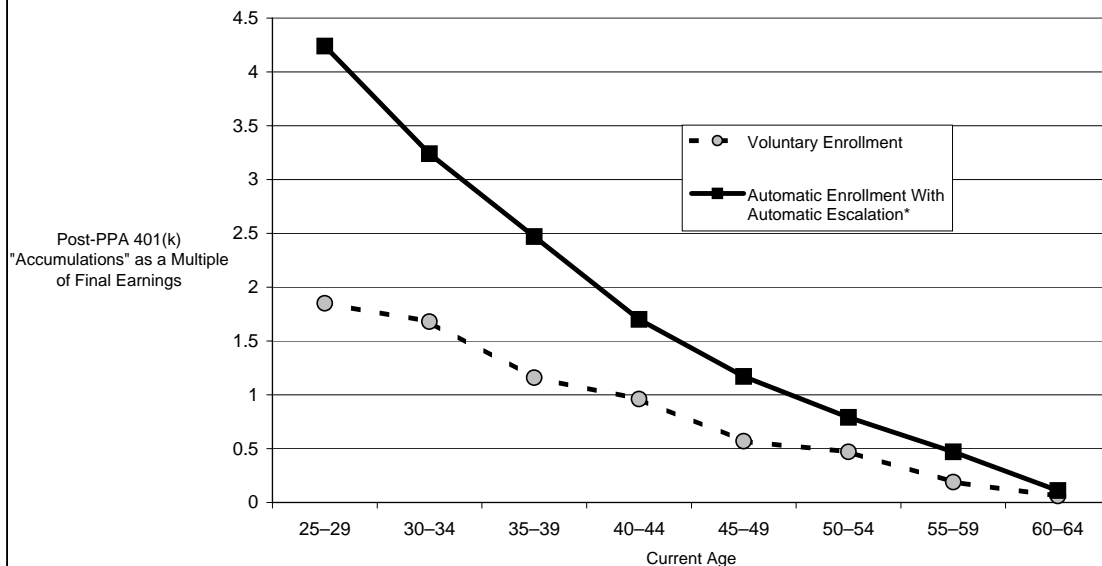
Figure 1
Auto-Enrollment With Auto-Escalation,*
vs. Voluntary Enrollment: 50th Percentiles
 (assuming future eligibility IS a function of current eligibility and historic equity returns)



Source: Author's simulations.

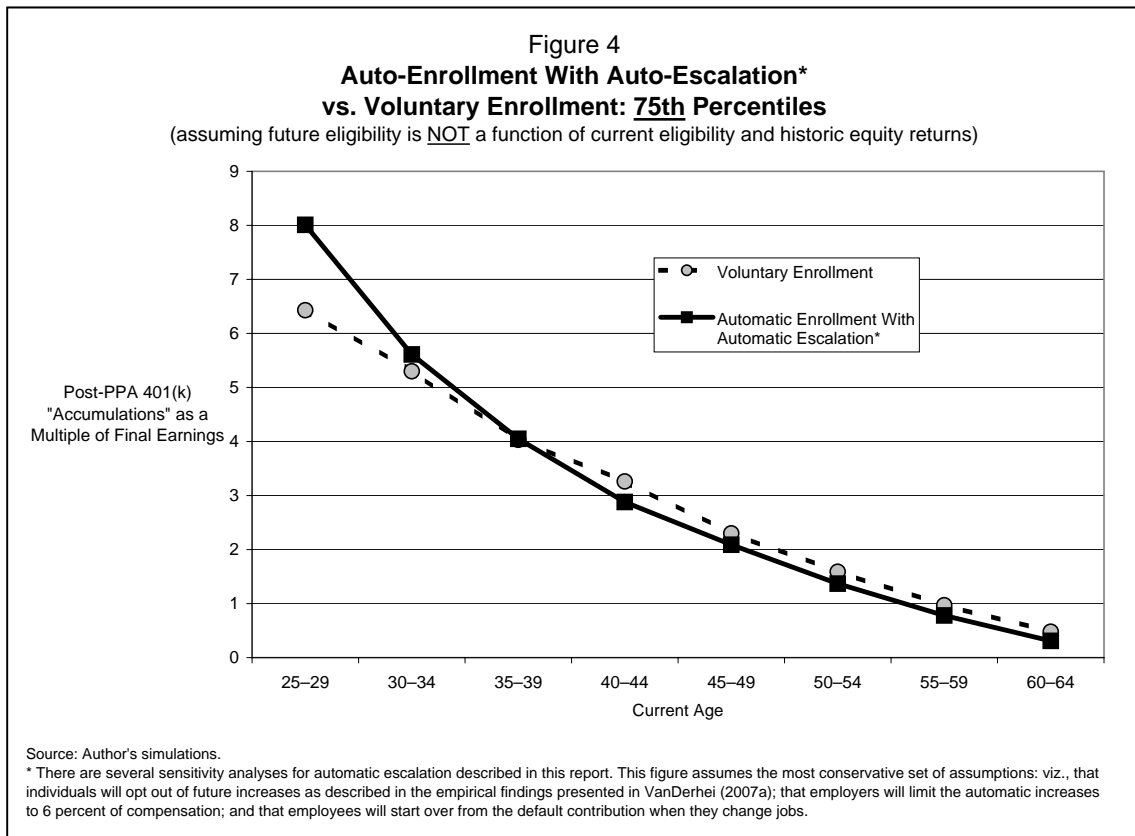
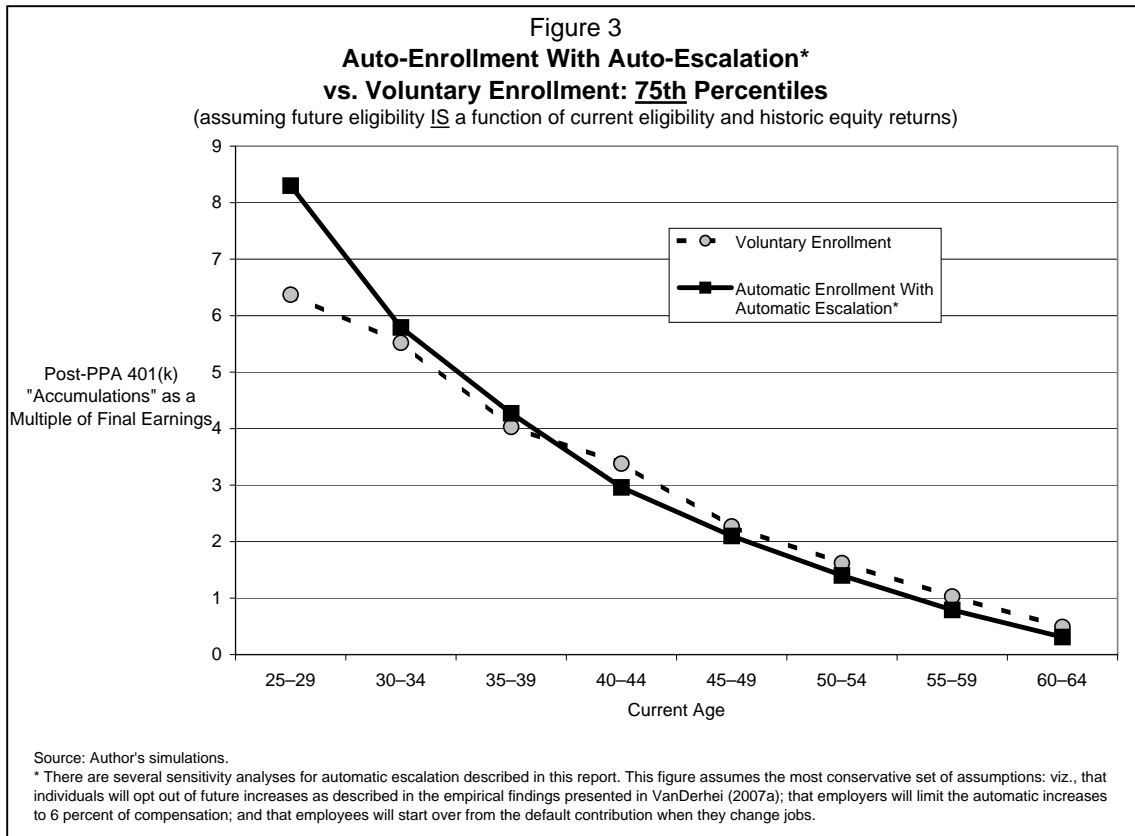
* There are several sensitivity analyses for automatic escalation described in this report. This figure assumes the most conservative set of assumptions: viz., that individuals will opt out of future increases as described in the empirical findings presented in VanDerhei (2007a); that employers will limit the automatic increases to 6 percent of compensation; and that workers will start over from the default contribution when they change jobs.

Figure 2
Auto-Enrollment With Auto-Escalation*
vs. Voluntary Enrollment: 50th Percentiles
 (assuming future eligibility is NOT a function of current eligibility and historic equity returns)



Source: Author's simulations.

* There are several sensitivity analyses for automatic escalation described in this report. This figure assumes the most conservative set of assumptions: viz., that individuals will opt out of future increases as described in the empirical findings presented in VanDerhei (2007a); that employers will limit the automatic increases to 6 percent of compensation; and that employees will start over from the default contribution when they change jobs.



versus the results expected under voluntary enrollment as a function of salary quartile. This type of analysis has the advantage of showing how well those in the upper and lower end of the distributions will do under the two types of programs, in addition to those in the middle of the distribution. The top two panels of Figure 5 compare AE with VE plans assuming future eligibility is a function of current eligibility. At the median of the two distributions, it is clear that AE dominates VE (even without the automatic escalation) but the highest salary quartile does better under VE. The same situation is found in the bottom two panels comparing AE and VE under the assumption that future eligibility is not a function of current eligibility.

At the 25th percentile, AE plans without auto-escalation dominate VE plans at all salary levels; however, at the 75th percentile, AE plans without auto-escalation are only better than VE plans for the lowest salary quartile (reflecting the fact that they are still getting the largest increase in differential participation rates).

It is interesting to compare the 10th percentile figures for the two AE plans in Figure 5 to see how the difference in the assumption for serial correlation of eligibility affects the final results. Although none of the four salary quartiles at the 10 percentile level show a 401(k) accumulation at 65, when one assumes future eligibility is a function of current eligibility in the manner assumed in this analysis, all but the lowest salary quartile has at least 90 percent of the workers accumulating (and retaining) a balance at age 65. This difference results from the lower likelihood of those not assumed to be currently eligible for a 401(k) plan having a smaller probability of eligibility in the next job under the serial correlation assumption.

Figures 6 and 7 provide a detailed distribution analysis of the difference between VE plans and AE plans with automatic escalation by salary quartile. Figure 6 provides results under the assumption of serial correlation, whereas the values in Figure 7 assume future eligibility is independent of current eligibility. In both figures, the top panel of figures pertains to the VE plans and the next five panels focus on the auto-escalation feature for AE plans under five different sets of assumptions:

1. Assuming 401(k) opt-outs, limit of safe harbor minimum, start over;
2. Assuming no opt-outs, limit of safe harbor minimum, maintain contribution rates;
3. Assuming no opt-outs, limit of safe harbor maximum, maintain contribution rates;
4. Assuming 401(k) opt-outs, limit of safe harbor maximum, maintain contribution rates;
5. Assuming 401(k) opt-outs, limit of safe harbor minimum, maintain contribution rates,

where:

- *401(k) opt-outs* denote that individuals will opt out of future increases as described in the empirical findings presented in VanDerhei (2007a);
- *No opt-outs* denotes that individuals will not opt out of future increases until they reach an employer induced constraint;
- *Safe harbor minimum* denotes that employers will limit the automatic increases to 6 percent of compensation;
- *Safe harbor maximum* denotes that employers will limit the automatic increases to 10 percent of compensation;
- *Start over* denotes that workers will start over from the default contribution when they change jobs; and
- *Maintain contribution rate* denotes that workers will retain the deferral level rate from the previous job.

Even for the most conservative set of assumptions for auto-escalation (second panel of Figures 6 and 7), the AE plans result in 401(k) accumulations at least as large as the VE plans for all four salary quartiles through and including the medians. At the 75th percentile, the AE plans have higher balances than the VE plans for all but the highest salary quartile (again reflecting the often-demonstrated empirical observation that high-salary individuals do not benefit as much from a higher participation rate under AE plans and at least some of them end up with a lower contribution rate for a time due to the inertia of keeping the default contribution rate—even though in this case it is assumed to be increasing annually to a 6 percent contribution rate). At the 90th percentile, the two lowest-salary quartiles have larger 401(k) accumulations under AE plans, but the two highest-salary quartiles do better under VE plans. At the 95th percentile, the VE plans

Figure 5
Auto-Enrollment Without Auto-Escalation vs. Voluntary Enrollment:
Post-PPA 401(k) “Accumulations” as a Multiple of Final Earnings for Those Currently Age 25–29

Voluntary Enrollment (assuming future eligibility <u>IS</u> a function of current eligibility)										
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	95th Percentile	95th Percentile	95th Percentile
1	0.0	0.0	0.0	0.1	1.8	5.9	9.2			
2	0.0	0.0	0.1	1.4	4.9	10.5	16.0			
3	0.0	0.0	0.2	2.2	7.1	14.2	18.9			
4	0.0	0.0	1.3	5.7	12.0	19.8	26.0			
Automatic Enrollment (assuming future eligibility <u>IS</u> a function of current eligibility)										
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	95th Percentile	95th Percentile	95th Percentile
1	0.0	0.0	0.1	1.2	3.3	5.7	6.8			
2	0.0	0.0	0.7	2.3	4.6	7.1	7.6			
3	0.0	0.0	1.1	2.8	5.1	7.1	8.0			
4	0.0	0.0	1.5	3.7	6.2	7.6	8.2			
Voluntary Enrollment (assuming future eligibility is <u>NOT</u> a function of current eligibility)										
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	95th Percentile	95th Percentile	95th Percentile
1	0.0	0.0	0.0	0.1	1.8	5.9	9.3			
2	0.0	0.0	0.1	1.5	4.6	9.9	13.5			
3	0.0	0.0	0.3	2.5	7.0	13.7	17.9			
4	0.0	0.0	1.8	6.0	12.0	19.8	25.7			
Automatic Enrollment (assuming future eligibility is <u>NOT</u> a function of current eligibility)										
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	95th Percentile	95th Percentile	95th Percentile
1	0.0	0.0	0.3	1.2	2.9	5.5	6.5			
2	0.0	0.1	0.8	2.0	4.4	6.7	7.6			
3	0.0	0.2	1.2	2.5	5.0	7.0	8.0			
4	0.2	0.8	1.9	3.8	6.1	7.6	8.2			

Source: Author's simulations.
 Note: Post-PPA 401(k) accumulations denote retirement money at age 65 in either a 401(k) plan or IRA rollover that originated with contributions made on or after January 1, 2008. The percentile columns represent the levels below which a certain percentage of observations fall. For example, the 75th percentile indicates the 401(k) accumulation multiple value below which fall 75 percent of all the values for an individual in that age and cohort.

Figure 6

**Auto-Enrollment With Auto-Escalation vs. Voluntary Enrollment:
Post-PPA 401(k) “Accumulations” as a Multiple of Final Earnings for Those Currently Age 25–29**
(assuming future eligibility is a function of current eligibility)

Voluntary Enrollment									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile		
1	0	0.0	0.0	0.1	1.8	5.9	9.2		
2	0	0.0	0.1	1.4	4.9	10.5	16.0		
3	0	0.0	0.2	2.2	7.1	14.2	18.9		
4	0	0.0	1.3	5.7	12.0	19.8	26.0		
Automatic Enrollment (assuming 401(k) opt-outs, limit of safe harbor minimum, start over)*									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile		
1	0	0.0	0.2	2.5	6.5	10.3	12.9		
2	0	0.0	1.0	4.0	7.6	10.9	12.5		
3	0	0.0	1.7	4.7	9.0	12.4	13.9		
4	0	0.5	3.0	6.2	9.5	12.6	13.9		
Automatic Enrollment (assuming no opt-outs, limit of safe harbor minimum, maintain contribution rates)†									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile		
1	0	0.0	0.3	2.8	7.1	11.2	13.2		
2	0	0.1	1.8	4.8	9.1	13.0	14.2		
3	0	0.4	2.6	5.9	10.2	13.2	14.6		
4	0	0.3	3.3	7.3	11.3	13.8	15.1		
Automatic Enrollment (assuming no opt-outs, limit of safe harbor maximum, maintain contribution rates)*									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile		
1	0	0.0	0.4	4.5	10.4	15.5	18.4		
2	0	0.0	2.4	6.6	12.1	16.6	18.2		
3	0	0.0	3.1	8.0	14.0	17.7	20.5		
4	0	0.9	4.9	10.0	14.7	18.1	19.8		
Automatic Enrollment (assuming 401(k) opt-outs, limit of safe harbor maximum, maintain contribution rates)†									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile		
1	0	0.0	0.3	3.4	8.4	13.5	17.0		
2	0	0.0	1.5	5.2	10.0	14.0	16.6		
3	0	0.0	2.3	6.0	12.2	16.6	18.5		
4	0	0.6	3.8	7.9	12.6	16.4	18.5		
Automatic Enrollment (assuming 401(k) opt-outs, limit of safe harbor minimum, maintain contribution rates)*									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile		
1	0	0.0	0.3	2.7	7.1	11.0	13.6		
2	0	0.0	1.2	4.4	8.2	11.7	13.2		
3	0	0.0	1.9	5.2	9.7	13.3	15.6		
4	0	0.6	3.2	6.6	10.3	13.2	14.6		

Source: Author's simulations.

* Terms: 401(k) opt-outs denotes that individuals will opt out of future increases as described in the empirical findings presented in VanDerhei (2007a). No opt-outs denotes that individuals will not opt out of future increases until they reach an employer-induced constraint. Safe harbor minimum denotes that employers will limit the automatic increases to 6 percent of compensation. Safe harbor maximum denotes that employers will limit the automatic increases to 10 percent of compensation. Start over denotes that workers will start over from the default contribution when they change jobs. Maintain contribution rate denotes that workers will retain the deferral level rate from the previous job. Note: Post-PPA 401(k) accumulations denote retirement money at age 65 in either a 401(k) plan or IRA rollover that originated with contributions made on or after January 1, 2008.

Figure 7

**Auto-Enrollment With Auto-Escalation vs. Voluntary Enrollment:
Post-PPA 401(k) “Accumulations” as a Multiple of Final Earnings for Those Currently Age 25–29**
(assuming future eligibility is NOT a function of current eligibility)

Voluntary Enrollment									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	95th Percentile	95th Percentile
1	0.0	0.0	0.0	0.1	1.8	5.9	9.3	9.3	9.3
2	0.0	0.0	0.1	1.5	4.6	9.9	13.5	13.5	13.5
3	0.0	0.0	0.3	2.5	7.0	13.7	17.9	17.9	17.9
4	0.0	0.0	1.8	6.0	12.0	19.8	25.7	25.7	25.7
Automatic Enrollment (assuming 401(k) opt-outs, limit of safe harbor minimum, start over)*									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	95th Percentile	95th Percentile
1	0.0	0.0	0.6	2.5	5.9	9.8	12.4	12.4	12.4
2	0.0	0.0	1.5	3.9	7.6	10.6	12.3	12.3	12.3
3	0.0	0.3	2.1	4.6	8.2	11.7	13.3	13.3	13.3
4	0.3	1.0	3.3	6.1	9.2	12.0	13.3	13.3	13.3
Automatic Enrollment (assuming no opt-outs, limit of safe harbor minimum, maintain contribution rates)*									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	95th Percentile	95th Percentile
1	0.0	0.0	0.9	2.8	6.8	10.4	12.5	12.5	12.5
2	0.0	0.5	1.9	5.0	8.6	12.6	13.8	13.8	13.8
3	0.1	0.5	2.6	5.5	9.9	12.6	14.6	14.6	14.6
4	0.3	1.5	4.1	7.6	11.0	13.5	14.6	14.6	14.6
Automatic Enrollment (assuming no opt-outs, limit of safe harbor maximum, maintain contribution rates)*									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	95th Percentile	95th Percentile
1	0.0	0.0	1.7	4.5	9.4	14.7	17.0	17.0	17.0
2	0.0	0.3	3.1	6.6	12.0	16.4	17.6	17.6	17.6
3	0.1	0.8	3.6	7.7	12.8	17.2	19.9	19.9	19.9
4	0.7	2.1	5.3	9.8	13.9	17.5	19.1	19.1	19.1
Automatic Enrollment (assuming 401(k) opt-outs, limit of safe harbor maximum, maintain contribution rates)*									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	95th Percentile	95th Percentile
1	0.0	0.0	1.1	3.5	7.8	12.7	16.4	16.4	16.4
2	0.0	0.0	2.0	5.1	10.0	14.5	16.4	16.4	16.4
3	0.0	0.4	2.9	6.1	11.0	15.7	17.9	17.9	17.9
4	0.5	1.4	4.1	7.6	12.1	15.5	18.3	18.3	18.3
Automatic Enrollment (assuming 401(k) opt-outs, limit of safe harbor minimum, maintain contribution rates)*									
Salary Quartile	5th Percentile	10th Percentile	25th Percentile	Median	75th Percentile	90th Percentile	95th Percentile	95th Percentile	95th Percentile
1	0.0	0.0	0.7	2.8	6.3	10.1	12.7	12.7	12.7
2	0.0	0.0	1.7	4.2	8.1	11.3	12.7	12.7	12.7
3	0.0	0.4	2.3	5.2	8.8	12.5	14.2	14.2	14.2
4	0.5	1.1	3.5	6.5	9.8	12.6	14.5	14.5	14.5

Source: Author's simulations.

* Terms: 401(k) opt-outs denotes that individuals will opt out of future increases as described in the empirical findings presented in VanDerhei (2007a). No opt-outs denotes that individuals will not opt out of future increases until they reach an employer-induced constraint. Safe harbor minimum denotes that employers will limit the automatic increases to 6 percent of compensation. Safe harbor maximum denotes that employers will limit the automatic increases to 10 percent of compensation. Start over denotes that workers will start over from the default contribution when they change jobs. Maintain contribution rate denotes that workers will retain the deferral level rate from the previous job.

Note: Post-PPA 401(k) accumulations denote retirement money at age 65 in either a 401(k) plan or IRA rollover that originated with contributions made on or after January 1, 2008.

have larger 401(k) accumulations for all but the lowest-salary quartile. For the most generous set of assumptions for auto-escalation (fourth panel of Figures 6 and 7), the AE plans result in 401(k) accumulations at least as large as the VE plans for all four salary quartiles in every case, with the exception of the highest-salary quartiles for the 90th and 95th percentiles.

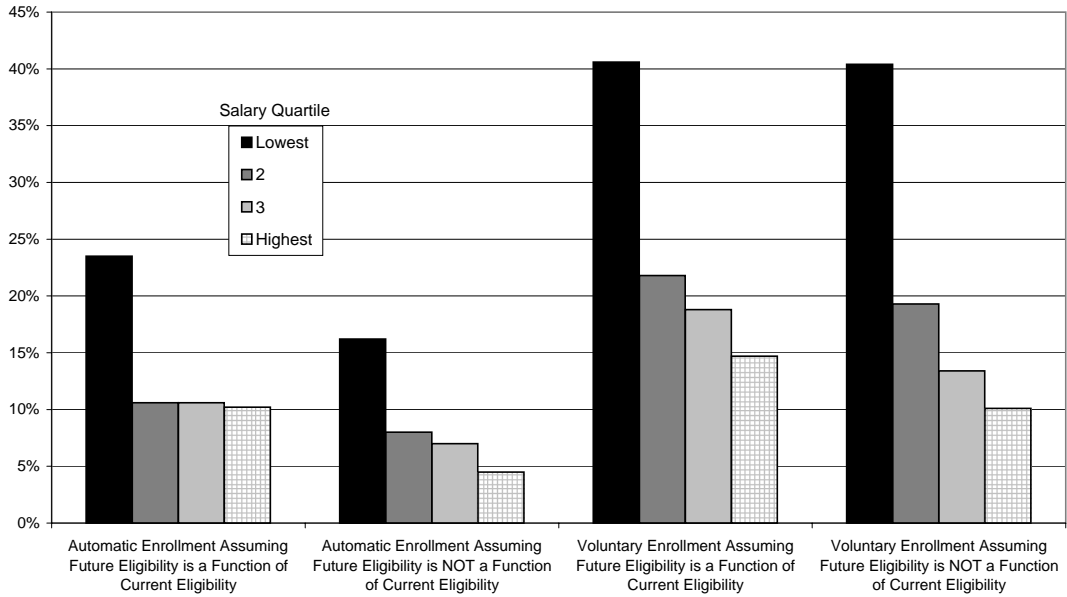
Other combinations of assumptions for auto-escalation result in intermediate results between these two extremes. Again, it will be years before researchers have enough empirical evidence to determine the relative likelihood that any of the five AE panels would be appropriate. However, the evidence presented in Figures 6 and 7 suggests that the lowest-salary quartile will always be at least as well off under AE (at least up to the 95th percentile) regardless of which set of auto-escalation assumptions proves to be correct. The same can be said of the second-lowest salary quartile through the 90th percentile and the third quartile through the 75th percentile. Even the highest-salary quartile does at least as well under AE through the median regardless of the set of auto-escalation assumptions chosen.

One public policy concern often raised, especially as the private-sector retirement system continues to evolve from defined benefit (pension) to defined contribution (401(k)-type) plans is the probability that a worker will end up with no 401(k) accumulations at retirement age. While many would argue that the 401(k) accumulations presented in Figures 6 and 7 provide more substantive evidence of the likely overall impact of PPA on retirement income from 401(k) plans, Figure 8 is included to demonstrate the likely reduction of workers with no 401(k) accumulations as a result of switching from voluntary to automatic enrollment plans. Whether one assumes serial correlation in eligibility or not, the reduction in this probability is striking, especially for the lowest-salary quartile. If future eligibility is assumed to be a function of current eligibility as parameterized in this *Issue Brief*, the probability of having no 401(k) balance for this group drops from 41 percent to 24 percent by switching from VE to AE. If serial correlation is ignored, the difference is even greater, dropping from 40 percent to 16 percent.

Figures 9, 10, and 11 present one final way of analyzing the 401(k) accumulations of VE plans versus AE plans with and without auto-escalation. Given that this version of the simulation model assumes no impact of PPA on the likelihood a worker will be eligible for a 401(k) plan, it is possible that much of the differential between these type of plans will be simply due to the “luck of the draw” as to whether one works for an employer that sponsors a 401(k) plan. Therefore the median 401(k) accumulations are analyzed not only by salary but also by the number of simulated years these individuals have been eligible to participate in a 401(k) plan (whether or not they actually choose to participate in a VE plan or opt out of participation in an AE plan). Figure 9 provides this analysis for VE plans, Figures 10 and 11 provide the analysis for AE plans (the former without auto escalation and the latter with it, albeit under the most conservative assumptions). In all cases, it is assumed that future eligibility is a function of current eligibility, as specified earlier.

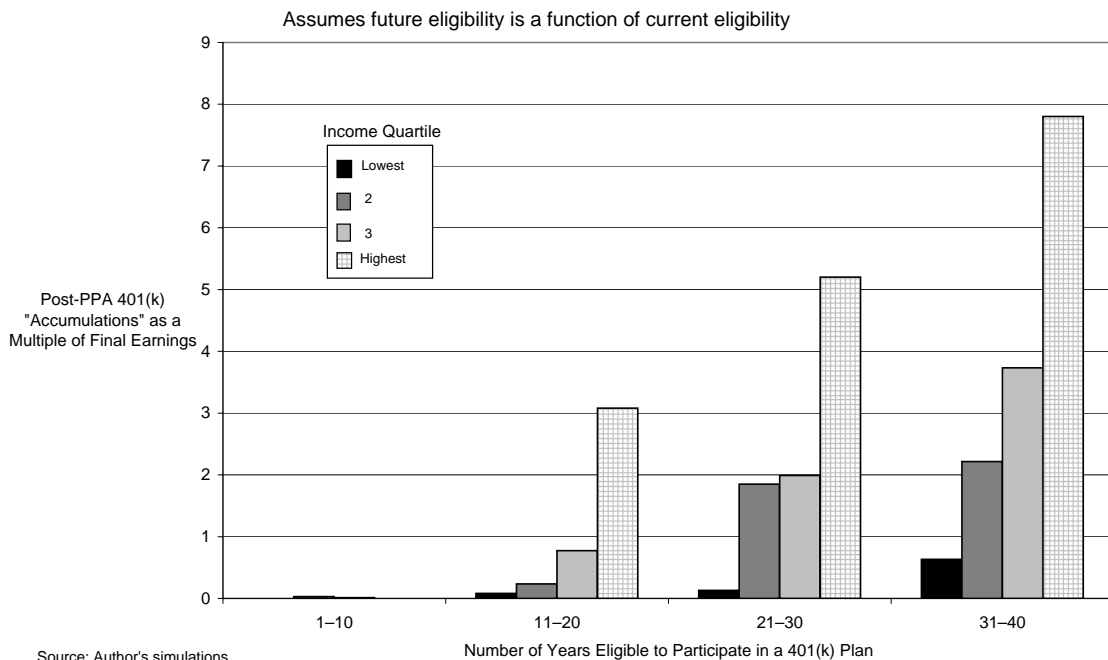
Comparing the VE plans with the AE plans with auto-escalation for the highest-salary quartiles (see Figures 9 and 11) shows that, with the exception of workers who participate for 11–20 years during their working careers, there is virtually no difference in median 401(k) accumulations. However, the same analysis for the lowest-income quartile tells a much different story. Whereas the median 401(k) accumulations for this group never exceeds two-thirds of the final year’s salary, the median 401(k) accumulations under AE with auto-escalation increases to 5.4 times final salary for those with 31–40 years of participation.

Figure 8
Employees Currently Ages 25–29:
Probability That an Employee Will End Up With No Post-PPA 401(k)
"Accumulations" at Age 65, as a Function of Salary and Type of 401(k) Plan



Source: Author's simulations.
 Note: Post-PPA 401(k) accumulations denote retirement money at age 65 in either a 401(k) plan or IRA rollover that originated with contributions made on or after January 1, 2008.

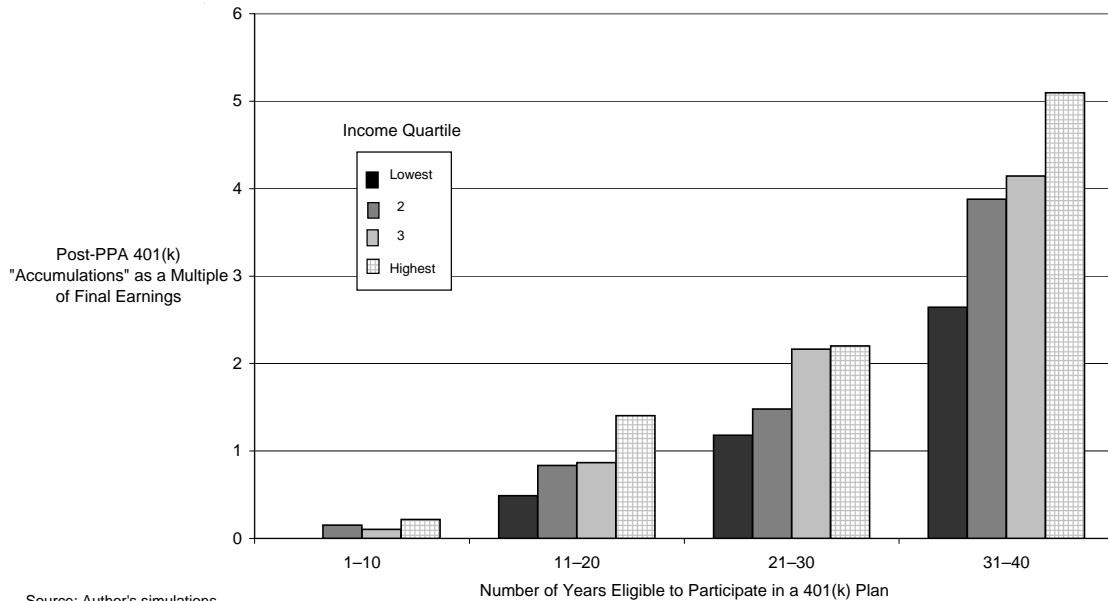
Figure 9
Employees Currently Ages 25–29:
Median 401(k) Accumulation Multiples for Voluntary Enrollment, as a
Function of Salary Quartile and Number of Years Eligible for a 401(k) Plan



Source: Author's simulations.

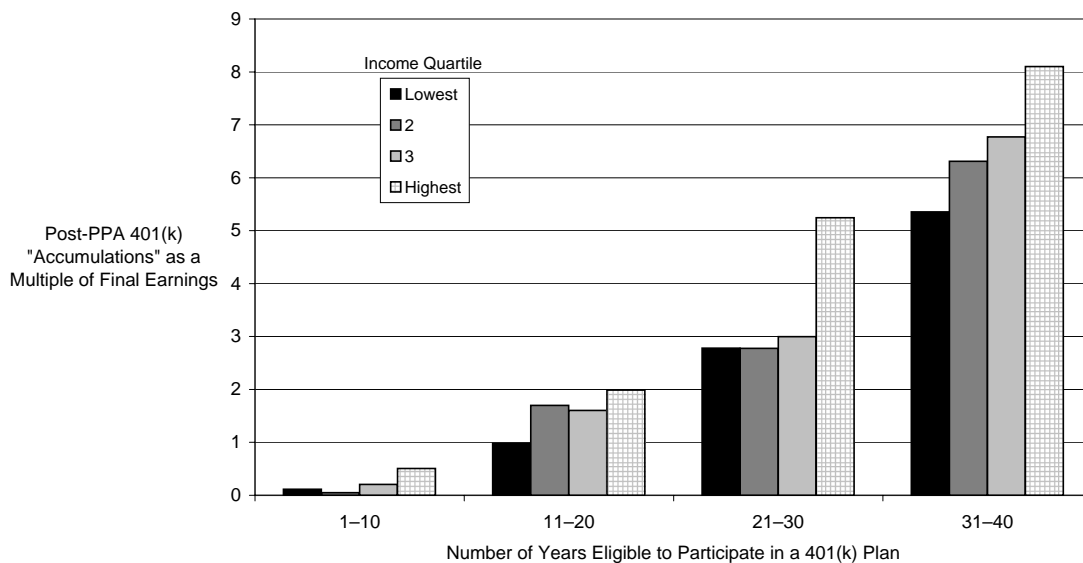
Figure 10
**Employees Currently Ages 25–29:
 Median 401(k) Accumulation Multiples for Automatic Enrollment
 Without Automatic Escalation, as a Function of Salary Quartile
 and Number of Years Eligible for a 401(k) Plan**

Assumes future eligibility is a function of current eligibility and historical equity



Source: Author's simulations.

Figure 11
**Employees Currently Ages 25–29:
 Median 401(k) Accumulation Multiples for Auto-Enrollment With Auto-Escalation,*
 as a Function of Salary Quartile and Number of Years Eligible for a 401(k) Plan**



Source: Author's simulations.

* There are several sensitivity analyses for automatic escalation described in this report. This figure assumes the most conservative set of assumptions: viz., that individuals will opt out of future increases as described in the empirical findings presented in VanDerhei (2007a); that employers will limit the automatic increases to 6 percent of compensation; and that employees will start over from the default contribution when they change jobs.

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Endnotes

¹ Holden and VanDerhei (2002).

² This literature is reviewed in Appendix II in U. S. Government Accountability Office (2007). The GAO study also provides several simulations on likely defined contribution plan accumulations under various scenarios. One of these (Panel 2 of Table 4) projects defined contribution plan savings assuming that all employees of a firm that sponsors a defined contribution plan participate immediately, rather than having to wait for eligibility or choosing not to participate. This assumption significantly raises plan participation rates among workers and average projected defined contribution savings rise by almost 40 percent. It is important to note that this is different in several important aspects from the analysis conducted in this *Issue Brief*. While the GAO scenario eliminates waiting periods for eligibility and participation among workers of firms that sponsor plans, it does not necessarily imply that workers are making a contribution to a plan each period, nor does it include the automatic escalation of contributions as discussed in a later section of this *Issue Brief*.

³ Holden and VanDerhei (2005).

⁴ VanDerhei (2006).

⁵ Technically, this assumes that future 401(k) eligibility is a function of current eligibility as defined later in the Issue Brief. Another scenario is modeled under which current and future eligibility are assumed to be independent; however, the results are very similar to those described here.

⁶ See VanDerhei and Copeland (2003).

⁷ See Holden and VanDerhei (2002).

⁸ See Holden and VanDerhei (2005).

⁹ Similar figures for the high-income quartile were 52 percent under the 3 percent contribution rate and money market investment, and 63 percent for the 6 percent contribution rate and the life-cycle investment.

¹⁰ See Helman, VanDerhei and Copeland (2007).

¹¹ See DiCenzo (2007).

¹² See Choi, Laibson, Madrian and Metrick. (2005 and 2006).

¹³ See Purcell (2006).

¹⁴ See Benartzi and Thaler (2004).

¹⁵ See Figure 2 of VanDerhei (2007) for the distribution of employee responses to the question.

¹⁶ It could be argued that the distribution of responses to this question is biased upwards given that it was only asked of employees already choosing to contribute to a 401(k) plan. Employees who would have been eligible nonparticipants in a voluntary enrollment system may indeed exhibit a less pronounced tendency to allow contributions to continue to escalate if their employer chooses to sponsor a 401(k) plan with automatic enrollment.

¹⁷ The Department of Labor issued final regulations for Qualified Default Investment Alternatives (QDIAs) on October 24, 2007 to provide, inter alia, employers who adopt automatic enrollment plans a safe harbor from fiduciary risk when selecting an investment for participants who fail to elect their own investment. Sec. 404(c)(5)(A) of ERISA provides that, for purposes of section 404(c)(1) of ERISA, a participant in an individual account plan shall be treated as exercising control over the assets in the account with respect to the amount of contributions and earnings which, in the absence of an investment election by the participant, are invested by the plan in accordance with regulations prescribed by the Secretary of Labor.

¹⁸ See VanDerhei and Copeland (2004).

¹⁹ See VanDerhei (2007b).

²⁰ For details see VanDerhei and Copeland (2003).

²¹ The 2001 Panel of the Survey of Income and Program Participation (SIPP), conducted by the U.S. Census Bureau, follows the same households for a three-year period, asking various questions on their economic and demographic status. Survey participants are interviewed at four-month intervals about a core set of demographic and economic issues. In addition, topical modules ask more specific questions about important economic issues. Topical Module 7, fielded in January–April 2003, asked questions about workers' participation in retirement and/or pension plans. For more information about the Survey of Income and Program Participation (SIPP), see www.bls.census.gov/sipp/

²² Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds. *2008 Annual Report of the Board of Trustees of the Federal Old-Age and Survivors Insurance and Disability Insurance Trust Funds.* www.ssa.gov/OACT/TR/TR08/index.html, March 25, 2008.

²³ A future *EBRI Notes* article will provide additional sensitivity analysis of assuming rates of return with a lower equity premium.

²⁴ The primary difference in our approach is the treatment of company stock. For participants assumed to be holding company stock in a particular year, we used the simulated mean for large cap stocks and the standard deviation for individual stocks in this asset class to simulate a rate of return with the same expected return but a larger standard deviation than that assigned to the diversified equity portion of the portfolio.

²⁵ See Ippolito (1997) for a detailed description of the literature.

²⁶ There is a third case, that of complete dependence, that is not used in this paper. 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.

²⁷ As will be explained later in this section, there are several sensitivity analyses for automatic escalation described in the paper. In this figure, it is assumed the most conservative set of assumptions for AE: namely, that individuals will opt out of future increases as described in the empirical findings presented in VanDerhei (2007a); that employers will limit the automatic increases to 6 percent of compensation; and that employees will start over from the default contribution when they change jobs.

²⁸ See Yakoboski and VanDerhei (1996); Choi, Laibson, Madrian, and Metrick (2005 and 2006); and Nessmith, Utkus, Young (2007).

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