PENSIM Analysis of Impact of Regulation on Defined-Contribution Default Investments

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PENSIM has been used by the Employee Benefits Security Administration of the Department of Labor (DOL) to estimate the economic impact of a proposed regulation regarding default investments for defined-contribution pensions regulated under Section 404 of ERISA. The full text of the proposed regulation and the results of DOL regulatory impact analysis will eventually appear in the *Federal Register*.

This document has been prepared to facilitate a review of the scientific methods and data used to conduct the regulatory impact analysis. Recent OMB guidelines require such a review for any regulation that has a major financial impact on society.

This document contains three sections.

The first section provides an introduction to PENSIM and points the reader to other documents that contain more detailed descriptions of model logic, data, and validation.

The second section describes the assumptions made in the PENSIM runs used in the regulatory impact analysis.

The the third section describes the nature of the output generated from the PENSIM runs and points the reader to a separate document that contains the detailed output provided to DOL for the regulatory impact analysis.

Contents

1 Nature of PENSIM

PENSIM is a dynamic microsimulation model for analysis of the retirement income implications of government policies affecting employer-sponsored pensions. Its development and testing have been funded since 1997 by the Office of Policy and Research at the Employee Benefits Security Administration of the U.S. Department of Labor.

PENSIM uses discrete event simulation methods that can generate a cohort sample of life histories that reflect the effects of both collective risks (asset return risk, inflation risk, etc.) and individual risks (mortality risk, disability risk, earnings risk, etc.). The likelihood and timing of simulated life events are represented by a variety of probability models, including hazard functions and multinomial logit models, that have been estimated using various survey data sets. Pension characteristics are imputed using a model estimated with 1996-98 establishment data from Bureau of Labor Statistics Employee Benefit Survey, which is now known as the National Compensation Survey. Simulated life histories contain information on educational attainment, disability, mortality, a complete job history that includes details on earnings and pension accumulation for each job, and a record of pension income in retirement. The simulated life histories have been subjected to a number of validation tests, the results of which suggest that samples of simulated life histories are realistic.

More information on the structure, validation, and ongoing development of PENSIM is available in *Overview of PENSIM* (Holmer et al. 2006), which begins with a two page "Introduction" and a fifteen page "Thumbnail Sketch of PENSIM" before presenting comprehensive documentation and validation results.

The pension characteristics imputation model is fully documented in *Characteristics of Pension Plans in the United States, 1996–98* (Holmer and Janney 2003), which begins with a two page introductory chapter before discussing the estimation of the imputation model in detail.

An efficient approach to learning more about PENSIM is to read the two initial sections of the *Overview* mentioned above as well as the table of contents, and then read the "Data Analysis Agenda" chapter and table of contents in the *Characteristics* report. Reading that material will provide a road map that will allow the reader to navigate which ever parts of the detailed documentation are of interest.

2 Assumptions of Regulatory Analysis

This section describes the assumptions and methods used in the PENSIM runs. Most of the data and methods used in the runs are standard and documented in *Overview of PENSIM* (Holmer et al. 2006). Only the assumptions particular to the PENSIM runs used in the regulatory analysis are described in this section.

The assumptions are discussed in two subsections. The first describes the characteristics of the PENSIM runs produced for the analysis, while the second describes the assumptions made about the impact of the proposed regulation.

The DOL approach to the impact analysis of the regulation on default investments is to analyze the effects of an increase in the prevalence of automatic-enrollment procedures in defined-contribution pension plans. The following two subsections provide details on how that analysis is conducted using PENSIM.

2.1 Characteristics of PENSIM Runs

Analysis of the effects of more plans adopting automatic-enrollment procedures is conducted using PENSIM runs that simulate a three percent sample of the 1985 birth cohort.

All the PENSIM runs use macroeconomic and macrodemographic assumptions from the 2005 OASDI Trustees Report. Using these assumptions, PENSIM life histories have been shown to produce social security projections similar to those produced by the Congressional Budget Office (Holmer et al. 2006, pages 11–12). Among these assumptions are a 2.8 percent inflation rate and a 3.0 percent real rate of return on Treasury bonds.

All the PENSIM runs assume current-law pension policy, which means that recent increases in maximum allowable pension contributions will "sunset" in 2011.

And all the PENSIM runs assume that a broad index of equity returns vary from year to year, and that the time series of equity returns is uncertain. The uncertainty is represented by variation across 1,000 Monte Carlo scenarios. The 1,000 time series of equity returns is generated assuming a lognormal distribution with no serial correlation. The lognormal mean and standard deviation of the gross return are assumed to be 0.076893 and 0.1654, which generate a sample geometric mean and standard deviation for the nominal

rate of return equal to 9.48 percent and 18.44 percent, respectively. Given the assumed inflation rate of 2.8 percent, this nominal mean translates to a real mean of 6.5 percent, which is the same value used by the SSA Office of the Chief Actuary in its analysis of social security account reforms.

Company stock, which is the employer contribution in some plans, is assumed to have a rate of return equal to the broad index plus an annual random element that is drawn from a normal distribution with a mean of zero and a standard deviation of thirty-one percent, an assumption based on 1962–1995 results reported in Table 1 of David L. Ikenberry, Richard L. Shockley, and Kent L. Womack, "Why Active Fund Managers Underperform the S&P 500: The Impact of Size and Skewness," *Journal of Private Portfolio Management*, 1:13-26, Spring 1998.

All the PENSIM runs assume a full range of individual (or idiosyncratic) risks in order to produce variation in life histories, but only the one collective (or systemic) risk of uncertain equity returns. These individual and collective risks are jointly sampled, which means that each PENSIM run consists of 1,000 small (that is, 0.003 percent) samples of the 1985 birth cohort. Each of the thousand small samples contains a different group of individuals, but each PENSIM run produces the same sample of 147,000 individuals born in 1985.

All the PENSIM runs use the same assumptions about waiting times between defined-contribution plan eligibility and participation under standard-enrollment procedures, and about waiting times between defined-contribution plan participation and active (that is, non-passive or non-default) participation under automatic-enrollment procedures. These waiting-time distributions are generated in PENSIM using hazard functions that have been calibrated to produce results that are similar to those reported in James J. Choi, David Laibson, and Bridgitte C. Madrian, "Plan Design and 401(k) Savings Outcomes," written for the *National Tax Journal* Forum on Pensions, June 2004. For more on the participation logic used in PENSIM, on the hazard functions, and on the results of a participation rate validation test, see section 2.2.2, section C.15, and section 10.1.1, respectively, in *Overview of PENSIM* (Holmer et al. 2006).

All the PENSIM runs make identical assumptions about contributions and investments among active (that is, non-passive or non-default) participants in defined-contribution plans. Active participants contribute a percent of earnings that rises with age and earnings as described in section C.16 of *Overview of PENSIM* (Holmer et al. 2006). Active participants are assumed

to invest all their plan assets (other than employer contributions made in company stock, which must be held in company stock until the employee is age 55) in a life-cycle fund. A life-cycle fund is assumed to be represented by an asset allocation in which the percent invested in Treasury bonds equals the employee age and the percent invested in the broad index of equities equals one hundred minus the employee age. In addition, all rollover account assets are invested by individuals in a life-cycle fund. For more on the rollover account, consult section 2.2.6 in *Overview of PENSIM* (Holmer et al. 2006).

All the PENSIM runs make identical assumptions about withdrawals from the pension rollover account: the whole balance is used at first withdrawal age to buy an annuity whose payments are not inflation indexed. A married individual is assumed to buy a joint-and-50%-survivor annuity, while an unmarried individual is assumed to buy a single-life annuity. The annuity provider is assumed to charge an eight percent load on annuities sold to women and a five percent load on annuities sold to men, which produces enough revenue for the annuity provider to remain solvent while making the annuity payments (assuming zero administrative costs and profits) and to avoid cross subsidies between the genders. For more on the timing of the first withdrawal from the rollover account, read section C.19 in *Overview of PENSIM* (Holmer et al. 2006).

2.2 Assumptions about Regulatory Impact

All the PENSIM runs used in the analysis share the characteristics discussed above, but differ in their assumptions about the prevalence and nature of automatic-enrollment procedures. In each run, the assumed prevalence and nature of automatic-enrollment procedures are assumed to be in effect for the complete work career of the 1985 birth cohort.

All the PENSIM runs assume that automatic-enrollment procedures are included only in savings and thrift (as defined by the Bureau of Labor Statistics in the National Compensation Survey) defined-contribution plans sponsored by private-sector employers who match employee contributions. The focus on private-sector plans is appropriate because ERISA regulations do not apply to government-sponsored plans. The focus on savings and thrift plans, which represent the vast majority of all defined-contribution plans, is appropriate because the primary focus of the regulation is on plans that require contributions from employee earnings for participation.

All the PENSIM runs assume that employee participation probabilities

in these plans are somewhat higher under automatic-enrollment procedures than under standard-enrollment procedures. The participation probability increase caused by automatic-enrollment procedures is assumed to be such that the overall participation rate would rise from 69.4 percent when none of these plans have automatic-enrollment procedures to 90.0 percent when all of these plans have automatic-enrollment procedures. This DOL assumption reflects evidence reported in James J. Choi, David Laibson, and Bridgitte C. Madrian, "Plan Design and 401(k) Savings Outcomes," written for the *National Tax Journal* Forum on Pensions, June 2004.

The PENSIM runs differ in the prevalence of automatic-enrollment procedures among employees whose employer sponsors these plans. DOL assumes that the baseline, or pre-regulation, prevalence of automatic-enrollment procedures is 25 percent of employees with these plans. The assumed prevalence rate is applied randomly across all employees with these plans, so there is no correlation between automatic-enrollment procedures and other characteristics of these employees, employers, or plans. DOL uses two assumptions about the prevalence of automatic-enrollment procedures in these plans after the regulation is implemented. Under the "low-impact" assumption, the prevalence rate rises to 35 percent, and under the "high-impact" assumption, the prevalence rate rises to 45 percent.

In addition to variation in the prevalence of automatic-enrollment procedures, the PENSIM runs use different assumptions about the default contribution rate and default investment fund under automatic-enrollment procedures. The default investment is either a life-cycle fund (as defined above) or a money-market fund, which is defined as a portfolio consisting of only Treasury bonds. The PENSIM runs produced for the DOL regulatory impact analysis are described in Table 1.

PENSIM run 411 is the baseline or pre-regulation run. The impact of the regulation is assumed by DOL to be measured by comparing the results of run 412 and run 411 (the "low-impact" case) or by comparing the results of run 414 and run 411 (the "high-impact" case). In these cases, the immediate effect of the regulation is assumed to be an increase in the prevalence of automatic-enrollment and a change in the default investment from a money-market fund to a life-cycle fund. The other five runs are used for sensitivity analysis. Runs 413 and 415 are like runs 412 and 414 except that the default investment remains the money-market fund as in run 411. Runs 431, 432, and 434 are like runs 411, 412, and 414 except that the default contribution rate is five percent instead of three percent.

Table 1: ***PENSIM Runs Produced for DOL Regulatory Impact Analysis.*** *See text for detailed explanation.*

PENSIM Run Number	Automatic-Enrollment Prevalence	Automatic-Enrollment Default	
		Contribution Rate	Investment Fund
411	25%	3%	money-market
412	35%	3%	life-cycle
413	35%	3%	money-market
414	45%	3%	life-cycle
415	45%	3%	money-market
431	25%	5%	money-market
432	35%	5%	life-cycle
434	45%	5%	life-cycle

Table 2: ***PENSIM Run Comparisons Produced for DOL Regulatory Impact Analysis.*** *MMF denotes money-market fund and LCF denotes life-cycle fund.*

Run Comparison	Auto-Enroll Prevalence	Auto-Enroll Default	
		Contribution	Investment
411 → 412	25% → 35%	3% → 3%	MMF → LCF
411 → 414	25% → 45%	3% → 3%	MMF → LCF
411 → 413	25% → 35%	3% → 3%	MMF → MMF
411 → 415	25% → 45%	3% → 3%	MMF → MMF
431 → 432	25% → 35%	5% → 5%	MMF → LCF
431 → 434	25% → 45%	5% → 5%	MMF → LCF

These PENSIM runs are used to make the six run comparisons summarized in Table 2.

3 Results of Regulatory Analysis

A standard set of statistics are tabulated for each of the six PENSIM run comparisons included in Table 2. The tabulated statistics are presented in a five-page report for each run comparison. A report for each of the six run comparisons is included in a companion document (Holmer 2006). The rest of this section explains the statistics that appear in the reports.

The first three pages in each report present aggregate pension accumulation statistics based on the results of survey conducted once for each simulated individual. Because the age at which the survey is conducted for a simulated individual varies randomly between 21.0 and 65.0, the results of the survey include information on some cohort individuals when they are young and information on other cohort individuals when they are old. The statistics gathered in this random-age survey can be aggregated to produce statistics on pension participation, contributions, account balances (with monetary amounts expressed in 2005 dollars). Note that the parenthetical "impact" statistics that appear on some lines of these pages is the sum of individual gains and the absolute value of individual losses; the net gain must be calculated by subtracting the pre from the post statistic. This net gain is decomposed into its positive and negative subtotals in the bottom panel of the page, where the sum of the "pi" and "ni" statistics is equal to the "impact" statistics (apart from rounding error).

The last two pages in each report present distributional statistics on pension income received in retirement. Statistics on pension income received from all types of pensions are tabulated for all those cohort individuals alive at age 67 (with monetary amounts expressed in 2005 dollars).

First Report Page. The first page presents the standard set of aggregate pension accumulation statistics for whole population.

Second Report Page. The second page presents the standard set of aggregate pension accumulation statistics for the subset of the population who were eligible for an automatic-enrollment plan in the post-regulation run at the time of the survey.

Third Report Page. The third page presents the standard set of aggregate pension accumulation statistics for the subset of the population who were employees at small firms (with 1–99 employees) at the time of the survey.

Fourth Report Page. This is the first of the two pages with distributional statistics on pension income in retirement. This page presents statistics on the size distribution of regulation-induced gains in pension retirement

income.

Fifth Report Page. This is the second of the two pages with distributional statistics on pension income in retirement. This page presents the average size of gains and losses in each lifetime earnings quartile. These statistics by lifetime earnings quartiles are shown for all those alive at age 67 at the top of the page. At the bottom of the page, the same statistics are presented for the subset who had at least one pension with automatic enrollment in the post-regulation run.

References

Holmer, Martin; Janney, Asa; and Cohen, Bob. *Overview of PENSIM*. Washington, DC: Policy Simulation Group, February 2006.
⟨http://www.polsim.com/overview.pdf⟩

Holmer, Martin R. and Janney, Asa M. III. *Characteristics of Pension Plans in the United States, 1996–98*. Washington, DC: Policy Simulation Group, December 2003.
⟨http://www.polsim.com/penchar.pdf⟩

Holmer, Martin R. "EBSA Automatic-Enrollment Impact Study: Final Results." Washington, DC: Policy Simulation Group, January 31, 2006.
⟨http://www.polsim.com/EBSA/AEresM.pdf⟩