April 27, 2011

Overview of the Pension Insurance Modeling System (PIMS)

What is PIMS?

- PIMS is a stochastic (i.e., random) simulation model of elements of PBGC's financial statement. In a simulation, key factors affecting PBGC are randomly selected, like lottery balls from an urn. After combining these random selections, the model assesses what effect they would have on PBGC.

- It generates thousands of 10-year projections of PBGC's future financial statements and of the factors influencing the financial statement (such as claims, premiums, interest rates, stock returns, etc.). These projections depict the broad range of potential outcomes that could happen to PBGC and show what future outcomes are most likely to occur.

- The random effects in the simulation are based on measures of the historical volatility in key factors underlying the insurance, in particular interest rates, stock market returns, and corporate bankruptcy rates.

- The results from the different scenarios are compiled to show how frequently different types of outcomes are simulated. The frequency with which an outcome is simulated (for example, that PBGC attains a surplus in the next 10 years), estimates the likelihood of that outcome's actual occurrence.

- PIMS does not predict what will happen to the future, but rather estimates probabilities over a range of possible outcomes.

- PIMS is a tool for understanding the risks insured by PBGC.

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Why did we develop PIMS?

- PBGC insurance risk has characteristics similar to those of insurances for natural disasters, what are called catastrophe insurances. That is, large claim events have a significant but relatively low likelihood of occurring. This means that historical claim experience provides a poor measure of the future probability of large claim events and even of the long-term average level of claims. The graph below, showing the annual variation in past claim experience, is illustrative of the nature of PBGC insurance risk.

PBGC Historic Claim Experience
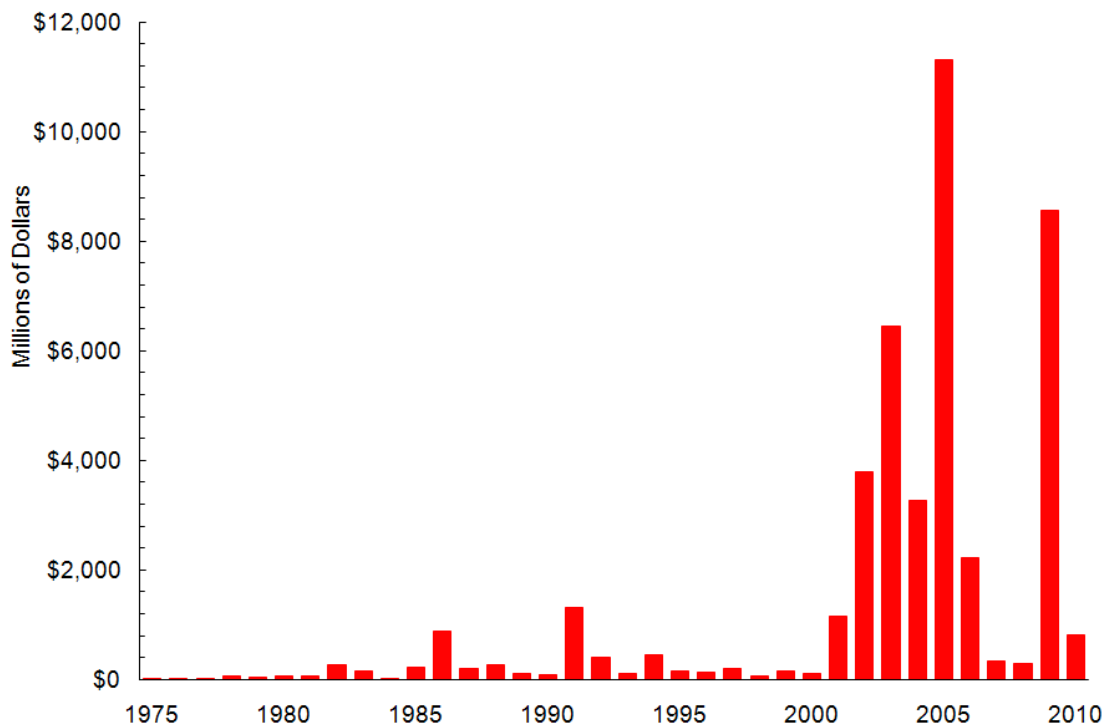
- Simulation models are useful tools for evaluating risks of this type because they can generate many years worth of possible claim experiences.

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How does PIMS work?

PIMS starts with:

- Detailed data on a representative sample of PBGC insured pensions, including benefit formulae and current plan demographics. The data is prepared from the plans' Schedule B filings and from their attachments to the Schedule B.

- Data on the current financial health of the insured plans' corporate sponsors.

- A representation of PBGC's current financial position.

In a PIMS simulation:

- 10 years of future financial market events (stock returns, interest rates) are randomly selected according to measures of historical market volatilities.

    Key Assumptions:

    Interest rates. The 30-year Treasury bond yield follows a random walk process (i.e., this year's yield equals last year's yield plus a random disturbance). Corporate bond yields are modeled to regress over time to their historic spreads over Treasury yields. The real (inflation adjusted) interest rate is set with a fixed parameter. Inflation is the difference between the Treasury bond yield and the real rate. No short term interest rates are modeled.

    Stock returns. The S&P 500 return is modeled as a strictly mean reverting process (i.e., each year's return equals 10.4% plus a random disturbance).

    Correlations. The random disturbances affecting the bond yield and stock returns are correlated according to an historical estimate. Stock returns are more likely to be high when the bond yield is falling and vice versa.

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- Pension plans are brought through the simulated financial events, experiencing the associated gains and losses. PBGC insurance premiums are assessed on plan sponsors, and plans present contribution requirements to their sponsors.

    Key Assumptions:

    Asset returns. Plan investment returns are based on historical measures of individual plan returns' correlations with S&P 500 returns and 30-year Treasury returns. Data on plans' actual investment allocations are now being reporting in 5500 filings and PIMS will soon begin using that information.

    Sponsor contributions. For projecting future claims in our baseline simulation (used for our annual report projections), sponsors are assumed to make the minimum contribution required by Internal Revenue Code. In the case of a sponsor bankruptcy, we assume sponsors fail to make their required contribution from the prior year. In calculating projected variable premium collections, a higher level of contributions is assumed in order to reflect the tendency of many sponsors to fund above the minimum in order to reduce premiums (and for other reasons). This contribution adjustment is calibrated using data from PBGC's history of premium collections.

    Plan participants. Simulated participants retire, separate, and are affected by mortality according to actuarial assumptions.   The number of active participants changes proportionally to total employment of the sponsor (see below).

    Benefit and salary levels. Flat benefits grow at the rate of inflation plus productivity growth (a fixed parameter). The average salary for a given age and service level also grows at the rate of inflation plus productivity growth. Salaries also grow with age and service to reflect merit and promotion.

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- Corporate sponsors are brought through the financial events, and also experience random shocks to their financial health according to historical measures of the volatilities. They are subjected to random chances of bankruptcy depending on their financial health measures.

  Key Assumptions:

  Financial Averages. Each firm's equity to debt and cash flow to asset ratios are affected each year by a regression to long-term averages and by random disturbances.

  Employment and equity value. Firms' employment and equity values follow random walk processes.

  Correlations. The random disturbances affecting the above variables are correlated with each other, and are also correlated to the random disturbances affecting stock returns and interest rates, according to historical estimates.

  Bankruptcy. Each firm faces a yearly random chance of bankruptcy. Individual firms have differing probabilities of bankruptcy which are based on the above financial and employment variables and also on the funding status of the plans they sponsor.

- PBGC is brought through the financial events, experiencing gains and losses accordingly. It receives insurance premiums and makes benefit payments to trusteed participants. When a sponsor experiences bankruptcy and has a sufficiently underfunded plan, PBGC receives a claim.

  Key Assumptions:

  Plan terminations. Plans sponsored by bankrupt sponsors are assumed to present a claim to PBGC if they are less than 80% funded (by PBGC termination assumptions). Otherwise a standard termination is assumed.
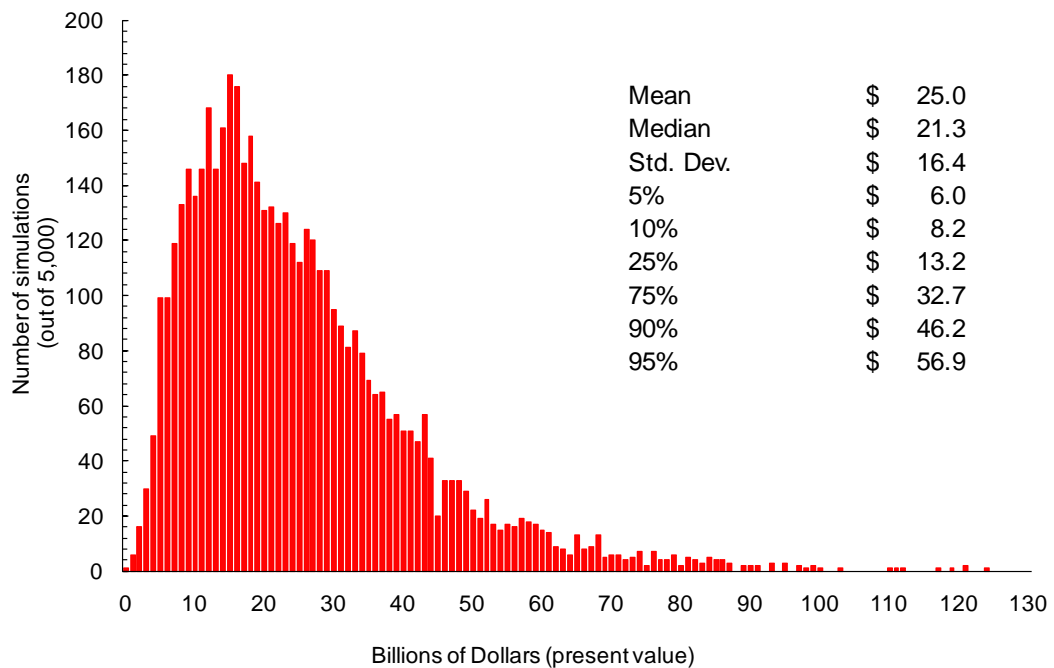
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What are the outputs of PIMS?

- A typical simulation consists of 5,000 different scenarios (500 unique economic scenarios, which PBGC and each plan and sponsor experience 10 times).

- Data that can be tracked through PIMS simulations include:

    o PBGC claims
    o Premiums
    o Plan funding levels
    o Plan contributions required by funding laws
    o Investment gains and losses

Example 1, the distribution of simulated claims over the next decade
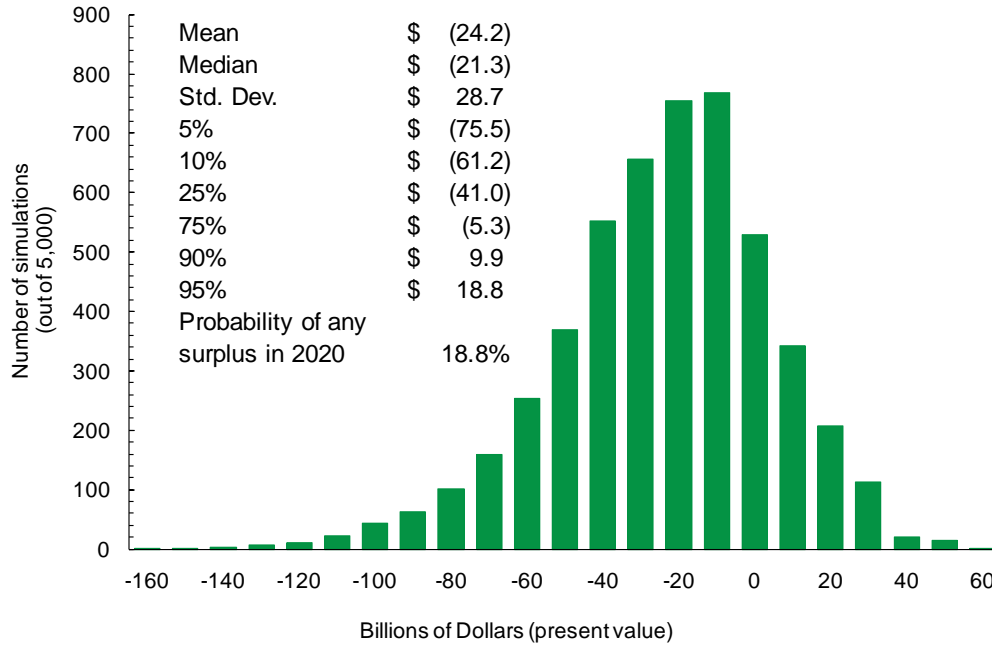
Distribution of Projected Claims 2011-2020

Mean	$	25.0
Median	$	21.3
Std. Dev.	$	16.4
5%	$	6.0
10%	$	8.2
25%	$	13.2
75%	$	32.7
90%	$	46.2
95%	$	56.9

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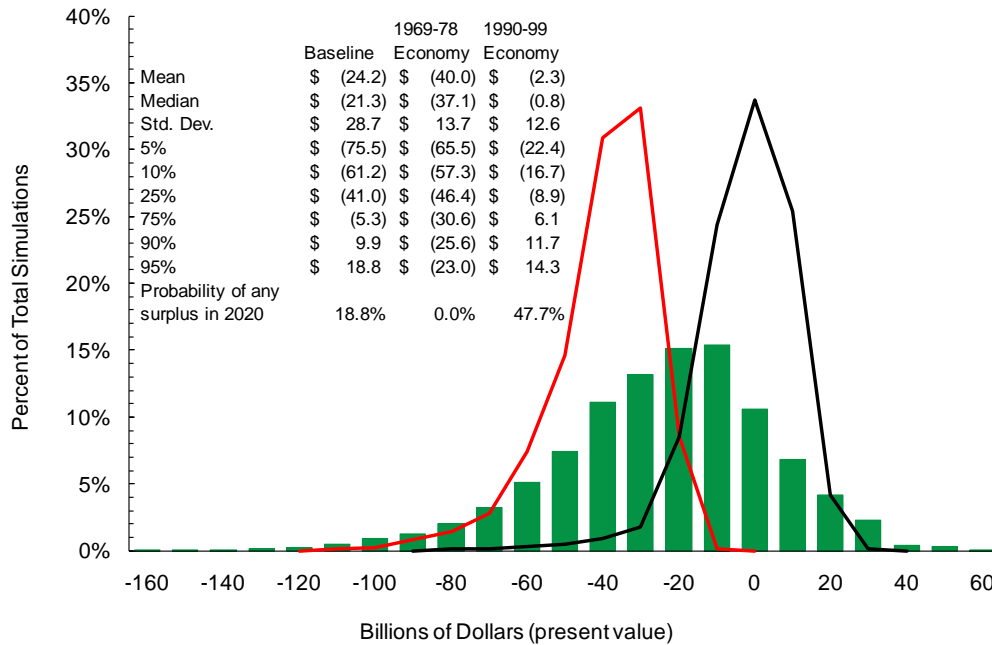
Example 2, the distribution of the PBGC's financial position after 10 years

Distribution of PBGC's Projected 2020 Financial Position

Mean	$ (24.2)
Median	$ (21.3)
Std. Dev.	$ 28.7
5%	$ (75.5)
10%	$ (61.2)
25%	$ (41.0)
75%	$ (5.3)
90%	$ 9.9
95%	$ 18.8
Probability of any surplus in 2020	18.8%

Example 3, testing the sensitivity of results to economic assumptions

Distribution of PBGC's Projected 2020 Financial Position
Baseline Stochastic Economy Compared to Two Historic Economies

	Baseline	1969-78 Economy	1990-99 Economy
Mean	$ (24.2)	$ (40.0)	$ (2.3)
Median	$ (21.3)	$ (37.1)	$ (0.8)
Std. Dev.	$ 28.7	$ 13.7	$ 12.6
5%	$ (75.5)	$ (65.5)	$ (22.4)
10%	$ (61.2)	$ (57.3)	$ (16.7)
25%	$ (41.0)	$ (46.4)	$ (8.9)
75%	$ (5.3)	$ (30.6)	$ 6.1
90%	$ 9.9	$ (25.6)	$ 11.7
95%	$ 18.8	$ (23.0)	$ 14.3
Probability of any surplus in 2020	18.8%	0.0%	47.7%

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What are applications of PIMS?

- Making financial statement projections to give the Congress a better understanding of the range of financial risks faced by PBGC.

- Measuring the effects of possible policy changes. Possible examples include:

  o Changes to the premium structure
  o Changes to funding laws
  o Changes to the interest rates used to value liabilities

- Exploring the effects of pension industry trends, such as a possible increase in standard terminations.

- Evaluation of risk management strategies.

Who else uses PIMS results?

- The Congressional Budget Office, the Joint Committee on Taxation, the Treasury, and the Office of Management and Budget to make estimates of the budgetary impact of legislative proposals.

- The Government Accountability Office to analyze and assess the condition of the pension insurance program and evaluate possible policy and legislative changes.

- Academics and think tanks to study plan characteristics.

- The Society of Actuaries is using PIMS to study defined benefit plan issues.