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Introduction

Retirement benefits are a hot button issue. While Social Security privatization is making the daily news, the safety of traditional defined benefit (DB) pensions continues to occupy public policy debates as well. Pensions received a lot of attention recently since falling interest rates and stock prices left DB plans with fewer funds than they need to cover all promised benefits. In extreme cases, pension plans were terminated, contributing to large shortfalls at the Pension Benefit Guaranty Corporation (PBGC), which insures the promised benefits for employees. To address this issue, the Bush administration recently proposed changes to funding rules. However, the proposed changes would likely make matters worse for beneficiaries, hastening the demise of pension plans. Alternative funding rules proposed below could improve the security of benefits without increasing the burden for the PBGC, while at the same time providing more certainty and stability for employers.

A closer look at pension funding and proposed rule changes shows the following:

- Current funding rules are counter-cyclical. Employers are required to contribute more to pension plans during bad economic times than during good times.
- The administration proposal would exacerbate the counter-cyclicity of pension funding and thus increase the uncertainty associated with pension plans.
- Alternative funding rules could that provide for greater leeway in averaging fluctuations in pension funding over the course of a business cycle improve the outlook for pensions. This process is called “smoothing.”
- As a result of smoothing, the burden on the PBGC would be reduced through better-funded pension plans. Employers would benefit as pension funding would become less counter-cyclical, lowering the burden during bad economic times and increasing it during good economic times, when employers are best able to contribute to their pension plans.

Pension Plans Caught in the Throes of Business Cycles

In a defined benefit (DB) pension plan, the employee is guaranteed a fixed benefit upon retirement, usually based on years of service, age and either final earnings or a benefit multiplier. Accrued benefits for private sector DB plans are insured, up to certain limits, by the Pension Benefit Guaranty Corporation (PBGC), which is funded by insurance premiums from employers with DB pensions as well as investment income and assets from terminated pension plans.

Although DB pension coverage has declined for some time, millions of employees and their families still depend on this benefit. The share of private sector workers with a DB plan has declined from 39 percent in 1975 to 21 percent in 2004 (PWBA, 1998; BLS, 2004). By 2002, the last year for which data are available, more than 34 million beneficiaries could still expect to receive some benefits from DB pensions (PBGC, 2003).

The funding of a DB plan's liabilities (promised benefits) is usually the employer's responsibility. Up until 2000, many employers could not contribute more to their plans, as their pensions were well funded due to the strong stock market performance and rising interest rates. However, after 2000, pension funds faced large shortfalls and employers sponsoring them had to contribute large amounts to their pension plans. Many large firms with pension plans have faced persistent shortfalls. PBGC (2004) estimated that the combined shortfall of all single-employer DB plans as of September 2004 was \$450 billion. Consequently, firms had to contribute new money to their plans. For instance, 90 percent of DB plans offered by companies included in the S&P 500 index showed a loss. When contributions rose, corporate earnings were often adversely affected, although some firms passed the additional costs on to consumers in the form of higher prices (Kristof, 2003). In extreme cases, the demand on employers' resources from the weak economy and pension plan underfunding contributed to corporate bankruptcies and plan terminations. The PBGC took over plans from Bethlehem Steel, LTV Steel, National Steel, TWA, U.S. Airways and Polaroid, among others. All of these terminations were among the ten largest since 1974, totaling \$8.5 billion in claims and covering 263,861 participants (PBGC, 2003).

Even though the PBGC insures benefits, it does so only within limits. By statute, PBGC's insurance is capped, currently at \$45,600 per year for a retiree at age 65 under the agency's single-employer pension insurance program. This maximum, though, is reduced for early retirement benefits. Other reductions are taken for survivorship and disability benefits and recent benefit improvements. Beneficiaries can also not accrue further benefits after the plan has been terminated. Hence, a plan termination leaves workers with less retirement security than expected.

To discuss the magnitude of recent pension plan shortfalls, it is important to understand the mechanics of pension plan funding. A plan's funding status depends on how assets compare to current liabilities. Current liabilities are the sum of payments to current retirees and of benefits that workers have already earned. In earnings-based plans,

future benefits are forecast given reasonable assumptions about life expectancy, inflation and other relevant demographic and economic variables. Based on these forecasts, pension plans determine how much in assets they need to fund benefits payable in the future. Thus, they assume how much interest they expect to earn on their assets. The higher this interest rate is, the fewer assets are needed today. It is in a plan sponsor's interest to assume a high interest rate since this would lower the amount of assets required to be set aside to pay benefits. To avoid abuse, regulators set a range of interest rates that pension plans can choose from in calculating current liability. Pension plans must choose an interest rate that is between 90 percent and 105 percent of the four-year weighted average of the 30-year Treasury bond yield.¹

A pension plan's funding status is then determined by looking at the ratio of the plan's assets to its liabilities. Plans can choose a number of options to value their assets, although many large plans use fair market valuation. Assets are evaluated at prices for which the assets could be sold on the valuation date.

By the nature of funding rules, pension plan funding is tied to changes in interest rates and stock prices. The main problem is that both of these tend to decline around the time of a recession, when corporate earnings are also declining.² From 1927 to 2001, there were a total of 12 recessions. Only in one recession, from 1973 to 1975, did interest rates not decline. The stock market is a forward looking indicator. Typically, the stock market peaks about a year before a recession starts and continues to decline in a recession. On average, stock prices are about 7 percent lower in the year after a business cycle peaks than before. That is, pension plans are losing with their assets before and during a recession, which brings additional pressures due to lower corporate earnings and lower interest rates that translate into a higher valuation of a plan's liabilities.

The recent recession posed a particular challenge since stock prices fell sharply and interest rates stayed lower, and lower longer, than in prior recessions (Weller and Baker, 2005). From the start of the recession in March 2001 to the end of 2002, the stock market fell by 25 percent. From its peak in August of 2000 to its low point in February 2003, the stock market lost 44 percent of its value. At the same time that the stock market sustained severe losses, interest rates declined more and stayed low for a longer period than on average in previous recessions (figure 1). In this recession, the treasury rate declined by 0.22 percentage points, slightly above the average of 0.19 percentage points for prior recessions. However, in the first year of a recovery, interest rates generally rise by 0.10 percentage points, whereas they fell by another 0.34 percentage points in this recovery. Thus, in this recovery employers did not see the usual help in funding their pensions that would come from rising interest rates.

¹ The Pension Funding Equity Act of 2004 required that plan sponsors use a discount rate between 90 percent and 100 percent of a 4-year weighted average of a blend of investment-grade corporate bond yields.

² Interest rates refer to the long-term treasury bond rate and total rates of return refer to the year-on-year change in the stock market plus the dividend yield. Stock market data are for the S&P500.

Figure 1: Average Change in Interest Rates

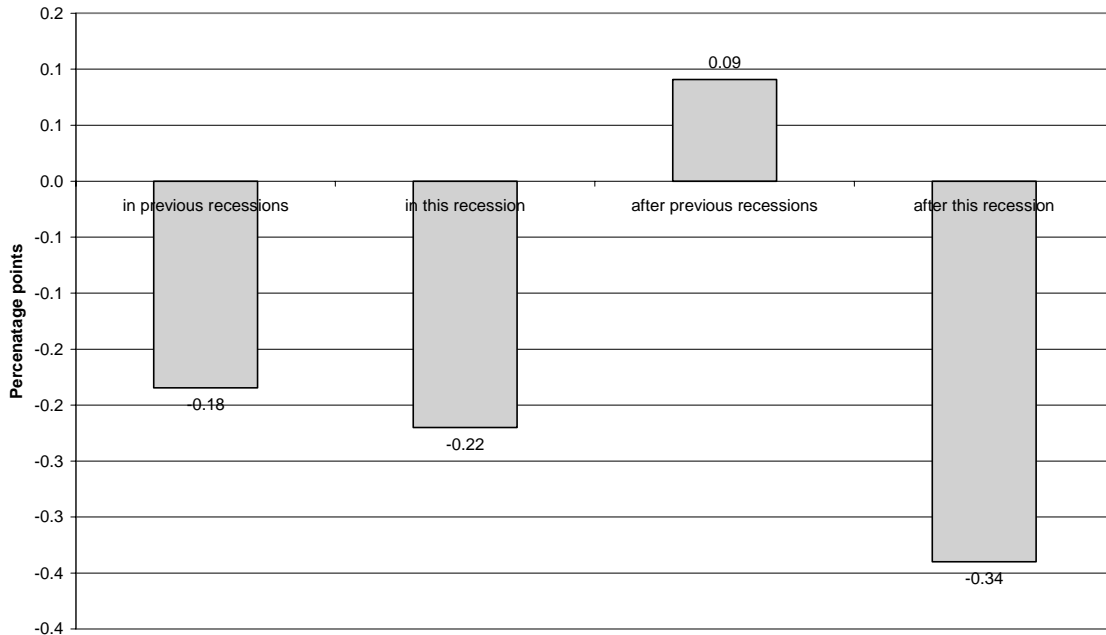


Figure 1: Average Change in Interest Rates

The problem of falling asset prices and declining interest rates in the recent recession was further exacerbated by the fact that companies had not built up more reserves during the prior expansion. This can be traced back to two aspects of the current regulatory system. First, if a pension plan reaches a certain funding threshold, the employer either no longer has to contribute or has to contribute only minimal amounts. Second, there are regulatory disincentives to contribute more to a pension plan when it is already fully funded. If pension plans are fully funded, employers face excise taxes on their contributions to the tune of 50 percent. On top of that, they can no longer deduct their pension contributions from their tax liabilities. The contribution limit beyond which further contributions are discouraged by the tax code is 100 percent of current liabilities. Thus, largely due to beneficial financial market trends – rising interest rates and higher stock prices – the average funding ratio of PBGC insured pension plans jumped from 116 percent in 1999 to 145 percent in 2000 (PBGC, 2003). However, for many plans, this reserve was insufficient to weather the crisis that followed as the stock market bubble burst and the liability discount rate sunk to and remained at historically low levels. In 2002, 74,138 new beneficiaries started receiving payments from PBGC, compared to 40,473 new beneficiaries in 2001 and only 11,091 in 2000 (PBGC, 2003).

Administration Proposal Will Exacerbate Funding Problems

The administration recently released its own proposal to reform funding rules, among other changes to the pension system (DOL, 2005). Funding burdens are already counter-cyclical, requiring employers who sponsor DB plans to contribute more during bad times than during good times. The administration's proposal could exacerbate this volatility in addition to the overall costs of some plans. First, the current rules require the use of a 4-year weighted average of the 30-year Treasury bond rate to determine current liabilities. The administration is proposing to eliminate the 4-year weighted average and to replace the single treasury rate with a range of bond rates, the so-called yield curve.³ This would mean that liabilities – future benefits – that come due at different future dates are discounted by different interest rates. For example, a benefit that is due in 10 years will be discounted by the interest rate on corporate bonds with 10-year maturity; a benefit that is due in five years will be discounted by the 5-year rate, a benefit in 15 years by the 15-year rate and so on. Second, the administration proposes that all assets be valued at fair market value, thus eliminating the current option to average stock price fluctuations over short periods of time. If these changes are enacted, plan sponsors worried about the predictability of their future contributions would have strong incentives to abandon their plans.

The administration's proposal would raise the costs of mature plans immediately. Employers who have a disproportionate number of older workers, e.g. in well established industries, will face rising costs from the administration's yield curve proposal. This is because older workers are likely to retire sooner than younger workers and their benefits will have to be paid out sooner than those for younger workers. The discount rate is tied to corporate bonds with shorter maturities. Those interest rates are lower than those for corporate bonds with longer maturities. A lower discount rate translates into a higher liability and higher cost for the employer. According to estimates by the Employment Policy Foundation (2005), the liabilities for workers 55 and older could increase by 3.5 percent and the liabilities for workers between 50 and 54 could rise by 2.0 percent. This would particularly hurt the struggling manufacturing sector.

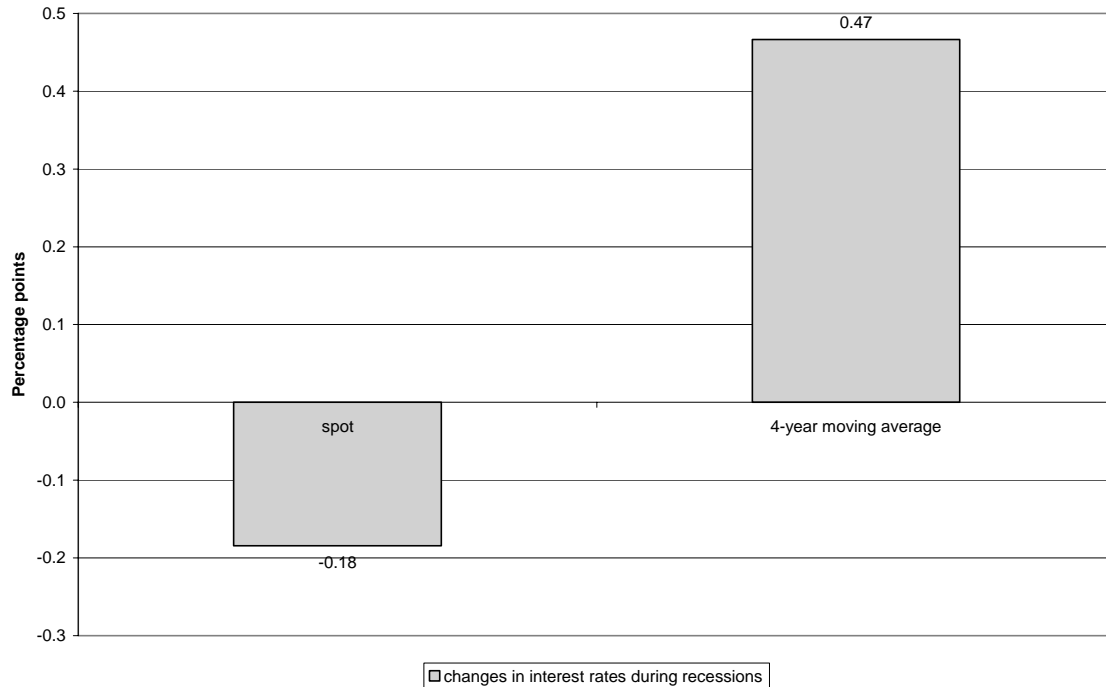
In addition to raising the costs for some plans, the administration's proposal on changes to the interest rate would exacerbate cyclical fluctuations, just like the use of fair market value for assets does, as already discussed.⁴ Employers would become more likely to see larger contributions during bad economic times, mainly because the smoothing of interest rates over even the minimal period of time of four years is eliminated. From the 1930s to the present, the spot interest rate for long-term Treasury bonds would have declined by an average of 0.18 percentage points during recessions. In comparison, though, the 4-year weighted average of the long-term Treasury bond rate would have risen by 0.47 percentage points. The fact that the discount rate is on average 0.65 percentage points higher with smoothing than without means that employers face fewer

³ Relevant bond rates would be averaged over 90 days.

⁴ Employers could theoretically insulate themselves from these fluctuations by matching assets to liabilities. However, such a "bonds only" strategy would substantially raise the costs for employers to provide this benefit and thus give another strong disincentive to abandon their plans.

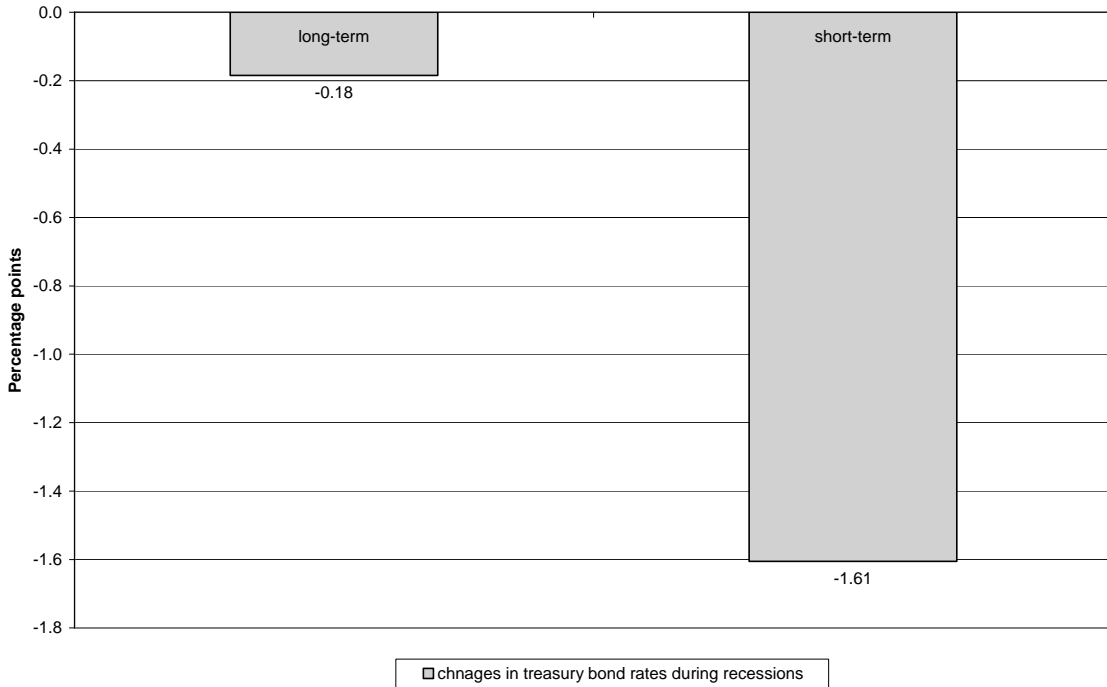
demands on their cash flow when they can least afford them. However, it also means that they face higher funding obligations during good years, when they can actually afford them.

Figure 2: Changes in Interest Rates During Recessions, With and Without Averaging



The use of a yield curve, using a variety of interest rates with different maturities for separate liabilities, would also exacerbate the funding burden during economic downturns, especially for pension plans with a more mature workforce. Specifically, the spread between short-term and long-term interest rates tends to rise during recessions, largely because short-term interest rates tend to fall faster than long-term interest rates. Short-term Treasury interest rates, in this case for 3-month bills and bonds, have typically declined by 1.6 percent during recessions (figure 3). This is an increase that is almost eight times as large as the average decline of long-term Treasury bond rates during recessions. During a recession, employers with an older labor force will see their costs rise much more rapidly than employers with a younger workforce.

Figure 3: Changes in Long-Term vs. Short-Term Treasury Bond Rates During Recessions



More Smoothing Improves Benefit Security

The problem as described above is that, under current funding rules, employers are more likely to have to make contributions to their pension plans when times are bad. When times are bad, more employers are unable to make payments to their pension plans. Therefore, pension terminations spike and the burden on the PBGC grows. The rules proposed by the administration would exacerbate this problem, while also raising the costs for employers with an older workforce. However, it is possible to change the funding rules, so that benefits are protected, employers have more certainty associated with the funding of their pension plans, and the PBGC will end up with fewer terminations.

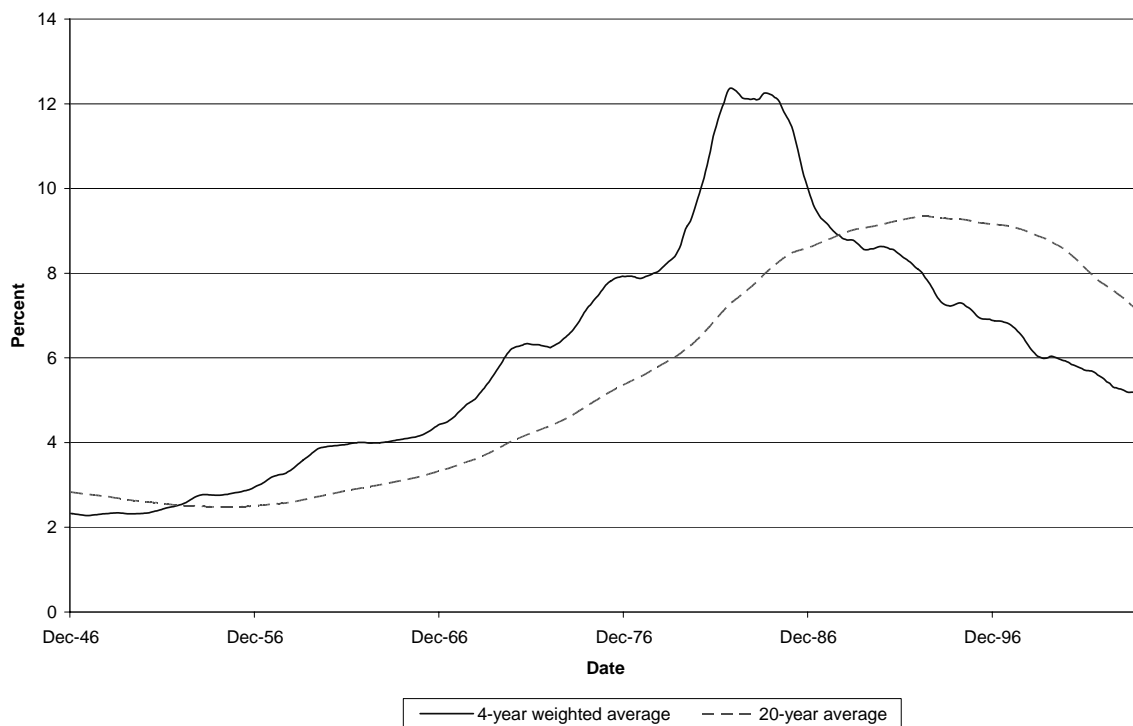
The basic premise underlying these funding rules is that they should be more pro-cyclical, allowing employers to contribute more during good times and contribute less during bad times, when they can least afford it.

Such an approach is also more consistent with the nature of a pension plan than the administration’s approach. The proposals laid out here give a clearer summary view of how well a pension plan is prepared for mastering the challenges of the medium-term future, when it is expected to pay benefits. By comparison, the administration’s proposal to move towards a process of “marking to market” provides only a snapshot of the pension plan at the time of valuation. This is a consistent and accurate view only if it is assumed that the pension plan will terminate shortly after valuation. Under all other

circumstances, the assumptions are too volatile to provide an accurate glimpse of the plan's future.

Three funding rule changes seem especially relevant. First, one way to reduce the cyclical nature of pension funding is to use a long-term average of the benchmark interest rate, e.g. a 20-year average. This would substantially reduce the volatility of calculating pension fund liabilities and it would de-couple funding requirements from the fluctuations of the business cycle, since the period over which the interest rate is averaged is longer than any business cycle. A 20-year period is also a much closer match to the average duration of pension plan liabilities. Moreover, because interest rates have recently been so low, the longer-term average would be higher than even the 4-year weighted average. Thus, switching to a longer-term average could give plan sponsors some funding relief in the immediate future, while also improving funding certainty over the long term.⁵

Figure 4: Interest Rate Averages



⁵ One of the reasons for changing pension funding rules is that the 30-year treasury bond rate is no longer an appropriate benchmark because the treasury has stopped issuing these bonds. It appears reasonable to use the 10-year Treasury bond rate instead. The benchmark rate is supposed to be risk free and reflect the long-term nature of pension liabilities. Both the 10-year and the 30-year treasury bond reflect the most secure assets. The 10-year treasury bond yield reflects the long-term nature of pension liabilities. The federal government will have outstanding debt that is likely to grow. Its financing instrument with the longest maturity is the 10-year Treasury bond. Thus, its yield reflects the long-term nature of the federal debt. Further, data on the 10-year Treasury bond rates are available since 1953 – longer than for the 30-year treasury, which was introduced in 1977.

Second, to mirror the rule change for liabilities, one can also use a 20-year smoothing for stock prices (Weller and Baker, 2005).⁶ This process essentially assumes that stocks will adjust towards a long-run average over a long enough period of time. If stock prices are above long-term averages with respect to corporate earnings, they are discounted with the assumption that the adjustment process will take 20 years. The same holds when stocks are too low.

Lastly, one of the problems associated with the recent funding crisis was that pension plans had not built up enough reserves to weather the storm that ensued after 2000. The administration has recognized this problem and has proposed that employers would be permitted to contribute to their plans even after they meet the full funding target. However, many employers already could have contributed more to their pension plans if they had wanted to during the 1990s (Ghilarducci and Sun, 2005). Hence, the lack of a cushion was to some degree the unwillingness of employers to increase the funding status of their plans, even when times were good. Therefore, a proposal to require companies to fund up to 120 percent of liabilities over a period of 30 years seems reasonable.⁷

The effects of these rule changes on a hypothetical plan can be simulated.⁸ To evaluate their effect, though, two questions should be asked. First, does the contribution pattern become less cyclical? Second, does the funding status of a plan weaken because of the rule changes? The changes in the funding status are evaluated using the ratio of assets at fair market value to current liabilities at the 4-year weighted average of the long-term Treasury rate. In addition, the probability of falling below a funding status of 75 percent is calculated.

The alternative rules would have maintained or reduced the burden on plan sponsors compared to the baseline (table 1). That is, on average, employers would have had to contribute less, especially during bad economic times. Using a smoother discount rate would have resulted in contribution holidays from 1998 to 2002 (model (2)); the alternative asset valuation method would have resulted in a contribution holiday after 1999 until 2002 (model (3)); and the requirement of contributions up to 120 percent of current liabilities would have meant no contribution holiday during this five-year period, but contributions would have been equal or less compared to the baseline model (model (4)). When all three changes are in place, the fund would have enjoyed contribution holidays for all five years (model (5)), reflecting the build-up of sufficient reserves during the preceding good years.⁹

⁶ At the same time that more smoothing is allowed, the current practice of credit balances is eliminated.

⁷ The baseline assumes normal cost contributions up to 100 percent.

⁸ The technical details of the simulation from Weller and Baker (2005) can be found in the appendix.

⁹ The easing of the funding burden during the five years from 1998 to 2002 was a result of substantial build-ups in reserves and thus did not reduce the funding adequacy and the security of benefits. The current liability (CL) funding ratio would have been higher in each case than under the baseline (table 1).

To see this, the long-term performance of the alternative funding rules is tested, using the past fifty years as an example (table 2). From 1952 to 2002, average contributions would have been approximately the same under all scenarios, or sometimes a little bit less than under the baseline.

However, plans would have built up more reserves due to the funding rule changes. In each case, the CL funding ratio would have been higher than under the baseline scenario. That is, evaluated at current rules, the security of pensions would have improved. Also, in almost all cases, the chance of the funding ratio falling below 75 percent is reduced compared to the baseline (table 2). This again highlights the improved security of pension benefits under the new set of benefits.

To test whether the proposed rules would make pension funding less counter-cyclical, contributions during recessions and non-recessions are considered. From 1952 to 2002, only the alternative asset assumptions would have lowered the contributions during the recessions compared to the baseline model. But for the period from 1980 to 2002, all models would have lowered contributions during recessions. Thus, during the past two decades, employers would have enjoyed more predictability in the funding of their pension plans.

Table 1
Funding Status of Model Pension Plan with Different Funding Rules

	Baseline model	Model (2)	Model (3)	Model (4)	Model (5)
Discount rate for liabilities	4-year weighted average of long-term Treasury bond yield	20-year average of long-term Treasury bond yield	4-year weighted average of long-term Treasury bond yield	4-year weighted average of long-term Treasury bond yield	20-year average of long-term Treasury bond yield
Asset assumptions	Fair market value	Fair market value	Adjustments for level and ROR on stocks, and long-term average interest rate for bonds	Fair market value	Adjustments for level and ROR on stocks, and long-term average interest rate for bonds
Contribution limit	100 percent	100 percent	100 percent	120 percent	120 percent
	Contribution as share of salary	Contribution as share of salary	Contribution as share of salary	Contribution as share of salary	Contribution as share of salary
	CL funding ratio	CL funding ratio	CL funding ratio	CL funding ratio	CL funding ratio
1998	0.0	100.7	119.7	137.1	243.1
1999	4.8	98.2	117.6	142.2	253.5
2000	0.0	101.9	118.7	149.7	255.2
2001	3.6	87.6	102.7	131.0	220.6
2002	6.0	76.4	87.6	113.2	188.3

Notes: All figures are in percent. Source is Weller and Baker (2005).

Table 2
Summary Measures for Different Funding Rules, 1952 to 2002

	Baseline model	Model (2)	Model (3)	Model (4)	Model (5)
Discount rate for liabilities	4-year weighted average of long-term treasury bond yield	20-year average of long-term treasury bond yield	4-year weighted average of long-term treasury bond yield	4-year weighted average of long-term treasury bond yield	20-year average of long-term treasury bond yield
Asset assumptions	Fair market value	Fair market value	Adjustments for level and ROR on stocks, and long-term average interest rate for bonds	Fair market value	Adjustments for level and ROR on stocks, and long-term average interest rate for bonds
Contribution limit	100 percent	100 percent	100 percent	120 percent	120 percent
1952-2002	Avg. cont. to salary 2.6 (2.7)	Avg. cont. to salary 2.0 (2.7)	Avg. cont. to salary 2.7 (3.0)	Avg. cont. to salary 2.4 (1.5)	Avg. cont. to salary 2.5 (3.4)
	Prob. of less than 75% 4.1	Prob. of less than 75% 3.4	Prob. of less than 75% 0.7	Prob. of less than 75% 3.0	Prob. of less than 75% 7.7
1980-2002	Ratio 3.0 (3.5)	Avg. fund. ratio 144.4 (16.9)	Avg. fund. ratio 102.6 (18.7)	Avg. fund. ratio 115.4 (23.9)	Avg. fund. ratio 176.2 (14.5)

Notes: All figures are in percent. Figures in parentheses are standard deviations.

Table 3
Contributions during Recessions and Non-Recessions

	Baseline model		Model (2)		Model (3)		Model (4)		Model (5)	
	Recession	Non-recession	Recession	Non-recession	Recession	Non-recession	Recession	Non-recession	Recession	Non-recession
1952-2002	2.2	2.8	2.5	1.8	1.7	3.2	2.6	2.2	3.4	1.8
1980-2002	2.0	3.4	0.0	0.0	0.7	3.8	1.8	1.6	0.0	0.0

Note: All figures are in percent.

There are clear benefits from implementing more smoothing in pension funding rules. Employers would gain predictability in the funding of their pension plans, while the funding status of pension plans would generally improve. Thus, employees would enjoy greater security of their benefits and the PBGC would ultimately see a reduction in the probability of plan terminations.

This proposal would also introduce funding rules that are more consistent with the going concern nature of pension plans. Using long-term averages assumes that pension funds will buy and sell securities, and that these transactions will occur at different interest rates. The time frames over which the smoothing occurs are generally consistent with the typical duration of pension liabilities. The proposals laid out here give a clearer summary view of how well a pension plan is prepared for mastering the challenges of the medium-term future, when it is expected to pay benefits.

Numerous proposals, including the administration's, have recognized the benefits and the consistency of smoothing in funding rules for the future well-being of pension plans. However, such proposals allow for more smoothing on the plan contribution side, rather than on the asset and liability valuation side (DOL, 2005; Towers Perrin, 2005). This still leaves the problem that "marking to market" does not provide an accurate view of how well the plan is prepared for the future. Furthermore, even those who propose more smoothing of contributions don't necessarily believe that it will actually work. When introducing the administration's plan, Secretary of Labor Elaine Chao was quoted as saying in the New York Times on January 30, 2005, that workers will "pressure their employer to more adequately fund the underfunded pension plans." Secretary Chao's comments indicate that the administration is counting on the large volatility of pension funding that would result from its new funding rules to scare workers into demanding more pension contributions from their employers. That is, regardless of the funding rules, employers may be forced to increase pension contributions to stave off employee dissatisfaction. However, this may only be a short-term phenomenon. Because the funding status of a pension plan would become more volatile, the contribution demands from employees at one point in time may become quickly obsolete as asset prices and interest rates change. The result would be frustration on the part of employees and large short-term pressures on employers, with the likely result that more and more employers would abandon their pension plans. Instead, the proposal laid out here would provide employees with a more accurate picture of the long-term health of their pension plans and stabilize the contribution stream of employers to their pension plans.

Conclusion

After 2000, defined benefit pension plans experienced severe underfunding. While the magnitude of the problem was unprecedented, the combination of the underlying factors was not. Employers should expect a regular recurrence of declining interest rates and asset prices during a recession. Current funding rules reflect this regularity and the administration's proposal to change these funding rules will not make the problem better, but exacerbate the counter-cyclical volatility of pension funding.

Instead of increasing the volatility of pension funding, there are rule changes that would allow for more smoothing of pension liabilities and assets and thus stabilize pension funding. Empirical results show that this would result in more stable employer contributions to pension plans and to higher average funding ratios. Employers would benefit from greater certainty about the future of their pension plans, while employees and the PBGC would benefit from greater security of pension benefits.

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Appendix: Technical Details of Pension Model

The basic simulation model referenced here is developed in Weller and Baker (2005).

Asset valuation method

First, the difference between market price and trend price is calculated:

$$\left(\frac{MP}{TP}\right)_t = \frac{MP_t}{TE_t * PE} = \frac{MP_t}{TE_{t-1} * (1+e) * PE} \quad (1)$$

where MP is the current market price (S&P 500) and TP is the trend price. The trend price is equal to the trend earnings, TE , times the long-term average price to earnings ratio, PE , since 1927. The trend earnings are equal to the trend earnings in the previous period after having grown at the average earnings growth rate, e , of 5.0 percent. Next, it is assumed that the difference between market price and trend price disappears after 20 years, generating an adjustment to stock prices of:

$$AF_t = \frac{1}{1 - r_{adj}} \quad (2)$$

where the adjustment rate, r_{adj} , is defined as:

$$r_{adj,t} = \ln\left(\frac{TP}{MP}\right)_t / 20 * 100 \quad (2')$$

such that the adjusted price, P_{adj} , is described by:

$$P_{adj,t} = MP_t * AF_t \quad (2'')$$

Since the expected rate of return to stocks is the sum of the rate of capital appreciation and the dividend yield – dividends relative to market price – the adjustment made to the price also affects the expected dividend yield:

$$DY_{adj,t} = \frac{D_t}{P_{adj,t}} \quad (3)$$

where the adjusted dividend yield, DY_{adj} , is equal to the ratio of dividends, D , to the adjusted market price, P_{adj} . We also assume that the difference between the actuarial value and fair market value disappears after 20 years, and that assets other than stocks earn the same long-term interest rate as for liabilities plus 50 basis points.

Basic pension plan design

The number of workers is assumed to have been 10,000 in 1952, equally distributed from age 20 to 65, with 80 percent of workers blue collar and 20 percent white collar, labor force growth equal to 1 percent annually, and annual wage growth equal to 3 percent. Assumed attrition is 5 percent, equally distributed, and the number of vested workers is proportional to that of job leavers. We use the age earnings profile for blue- and white-collar workers from Engen et al. (1999).

Retirement benefits are based on average final pay, with retirement benefits equaling 1 percent of the average of the last five years of earnings for each year of service, with five years of vesting, and no ancillary benefits. Current liabilities are then calculated using the unit credit method. Assets are held in stocks and bonds. From 1952 to 2002, the pension plan's asset allocation into equities is equal to the share of directly held corporate equities out of assets for all pension plans (BoG, 2003). The rate of return earned on stocks is set equal to the increase in the S&P 500 plus the dividend yield, and the rate of return on bonds is equal to the treasury rate plus 50 basis points.

About the Author

Christian E. Weller is a Senior Economist at the Center for American Progress, where he specializes in Social Security and retirement income, macroeconomics, the Federal Reserve, and international finance. Prior to joining American Progress, he was on the research staff at the Economic Policy Institute, where he remains a research associate. Dr. Weller has also worked at the Center for European Integration Studies at the University of Bonn, Germany, in the Department of Public Policy of the AFL-CIO in Washington, D.C., and in universal banking in Germany, Belgium and Poland. His publications appear in publications ranging from the *Cambridge Journal of Economics*, *the Journal of Policy Analysis and Management*, *the International Review of Applied Economics*, *the Journal of Development Studies*, and *the Journal of International Business Studies* to the *Atlanta Journal Constitution*, *USA Today*, *Detroit News*, *Challenge*, and the *American Prospect*. Dr. Weller is often cited in the press and he has been a frequent guest on news programs on ABC, NBC, CNN, MSNBC, CNBC, Fox News and Bloomberg Television. Dr. Weller holds a Ph.D. in economics from the University of Massachusetts at Amherst.

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**Center for American Progress
1333 H Street, N.W., 10th Floor
Washington, D.C. 20005
(202) 682-1611
www.americanprogress.org**