Smoothing the Waves of the Perfect Storm: Changes in Pension Funding Rules Could Reduce Cyclical Underfunding

Christian Weller
Center for American Progress

Dean Baker
Center for Economic and Policy Research

Defined-benefit plans experienced difficulties after interest rates and asset prices fell after 2000. Interest rate and asset price declines are typical for a recession, when earnings are low. Current funding rules exacerbate this regularity by directly linking the valuation of liabilities and assets to short-term fluctuations, requiring greater contributions when times are bad. We design three funding rule changes and evaluate these changes for the period 1952–2002. The results indicate that our changes would have constituted an improvement over current rules. Contributions would have been smaller and their volatility lower, required contributions during bad economic times would tend to be less, and the funding adequacy levels would generally be higher.

Introduction

Risks associated with defined-benefit (DB) pensions received much attention after 2000. Sluggish corporate earnings, rapidly rising liabilities, and tumbling assets led to some of the largest pension plan terminations in decades.

Although, after 2000, the size of the factors contributing to the underfunding of pension plans was unique, the combination of lower interest rates, falling asset prices, and declining earnings was not. In most recessions, interest rates and asset prices drop alongside corporate earnings; however, fund-

Author's address: Center for American Progress, 1333 H Street NW, 10th Floor, Washington, D.C. 20005

ing rules are linked to this regularity, such that they almost always require greater contributions when economic times are bad.

The public policy response to the underfunding crisis left the procyclicality of the existing rules untouched. Here, we consider three separate proposals to reduce cyclical fluctuations and evaluate them on the basis of their likely effects on pension plan contributions.

Pension Funding and Rule Changes

Under a DB plan, the employee is guaranteed a benefit upon retirement, usually based on years of service, age, and either final earnings or a benefit multiplier. The funding of a DB plan's liabilities (promised benefits) is usually the employer's responsibility, requiring additional contributions when assets are well below liabilities.

After 2000, the funding status of pension funds deteriorated sharply. Many of the 348 firms in the Standard and Poor's (S&P) 500 that offered a pension plan would end 2002 with a total shortfall equaling $323 billion (Blackburn 2003).

A pension plan's funding status depends on its current liabilities. These are the sum of payments to current retirees and of benefits that workers have already earned. Future benefits are forecast in light of reasonable assumptions about the relevant demographic and economic variables. On the basis of these forecasts, pension plans determine how many assets they need to fund benefits. 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.

To avoid abuse, regulators limit the interest rates that pension plans can choose. Temporary changes aside, pension plans must choose an interest rate that is between 90 percent and 105 percent of the four-year weighted average of the thirty-year Treasury bond yield. This rate dropped after 2000, resulting in more liabilities for pension plans.

Typically, interest rates fall in a recession, as do stock prices, when corporate earnings are low. Thus, the funding rules will generally result in more contributions when the ability to pay for firms is low. The decline in asset prices and interest rates was exacerbated in the recession after 2000, requiring more contributions to pension plans. These rising contributions followed a period during which many plan sponsors enjoyed a contribution holiday due to higher interest rates and rising stock prices in the 1990s.

Changes to funding rules may help to avoid a similar problem in the future. We consider three changes to funding rules. One way to reduce the countercyclicality of pension funding is to use a long-term average of the benchmark interest rate (e.g., a twenty-year average). The difference between using the

current interest rate and using a twenty-year average lies in the implicit assumptions. Use of a market rate implicitly assumes that pension plans would buy the security today and hold it until it matures. Instead, a long-term average assumes that pension funds will buy and sell securities and that these transactions will occur at different interest rates. Moving to a long-term average would have eliminated cyclical fluctuations and given firms short-term relief as the long-term average would have been higher than the current rates after 2000.

Second, to mirror our rule change for liabilities, we use a twenty-year smoothing for stock prices. First, the difference between market price and trend price is calculated as

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

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 twenty years, generating an adjustment to stock prices of

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

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

$$(2') \quad r_{adj,t} = 1n\left(\frac{TP}{MP}\right)_t / 20 * 100,$$

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

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

Because 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:

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

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 twenty years and that assets other than stocks earn the same long-term interest rate as for liabilities plus 50 basis points.

Finally, we propose to require companies to build up more reserves during good times, up to 120 percent over a period of thirty years.

The Effects of Funding Rule Changes on Pension Funds

We investigate two questions in the following simulation analysis. Do changes in funding rules reduce the volatility of contributions and does the chance of becoming severely underfunded rise after the rule changes? To evaluate the proposed funding rules, we develop a pension simulation model. 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, Gale, and Uccello (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 (Board of Governors of the Federal Reserve System 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.

The alternative rules would have maintained or reduced the burden on plan sponsors compared to the baseline (Table 1). Using an alternative discount rate would have resulted in contribution holidays through 2002 (model [2]). Our alternative asset valuation method would have resulted in a contribution holiday after 1999 (model [3]). And the requirement of contributions up to 120 percent of current liabilities would have meant no contribution holiday, 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]). Lower contributions did not come at the expense of less funding adequacy. We use two separate funding ratios: funding ratio (1) calculates the funding ratio under

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 to salary	Funding ratio (1)	Funding ratio (2)	Contribution to salary	Funding ratio (1)	Funding ratio (2)	Contribution to salary	Funding ratio (1)	Funding ratio (2)	Contribution to salary	Funding ratio (1)	Funding ratio (2)	Contribution to salary	Funding Ratio (1)	Funding Ratio (2)
1998	0.0	100.7	100.7	0.0	157.3	119.7	8.3	90.5	137.1	3.3	97.7	97.7	0.0	168.7	243.1
1999	4.8	98.2	98.2	0.0	161.1	117.6	6.7	96.6	142.2	3.1	97.8	97.8	0.0	178.6	253.5
2000	0.0	101.9	101.9	0.0	159.4	118.7	0.0	105.3	149.7	2.2	100.1	100.1	0.0	184.3	255.2
2001	3.6	87.6	87.6	0.0	135.6	102.7	0.0	109.2	131.0	3.6	87.5	87.5	0.0	182.6	220.6
2002	6.0	76.4	76.4	0.0	113.5	87.6	0.0	102.4	113.2	6.0	76.3	76.3	0.0	167.2	188.3

Notes: All figures are in percent. Funding ratio (1) denotes the ratio of actuarial assets to current liabilities evaluated at the model's rules. Funding ratio (2) denotes the funding ratio of fair market value to current liabilities evaluated at the four-year weighted average of the long-term treasury yield.

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		
	Average contribution to salary	Average funding ratio	Probability of less than 75%	Average contribution to salary	Average funding ratio	Probability of less than 75%	Average contribution to salary	Average funding ratio	Probability of less than 75%	Average contribution to salary	Average funding ratio	Probability of less than 75%	Avgerage contribution to salary	Avgerage funding ratio	Probability of less than 75%
1952–2002	2.6	98.6	4.1	2.0	116.6	6.9	2.7	101.1	3.0	2.4	109.1	3.0	2.5	137.2)	5.4
	(2.7)	(13.6)	(4.1)	(2.7)	(28.1)	(3.4)	(3.0)	(13.9)	(0.7)	(1.5)	(18.1)	(3.0)	(3.4)	(38.7)	(7.7)
1980–2002	3.0	100.3	9.5	0.0	144.4	0.0	2.8	102.6	7.0	1.7	115.4	4.6	0.0	176.2	0.0
	(3.5)	(19.3)	(9.5)	(0.0)	(16.9)	(1.6)	(3.4)	(18.7)	(0.1)	(1.6)	(23.9)	(4.6)	(0.0)	(14.5)	(0.0)

Notes: All figures are in percent. Figures in parentheses are standard deviations, except for the chance of falling below 75 percent of current liabilities, where they indicate the same probability under the ratio of the fair market value relative to current liabilities based on the four-year average treasury yield. Funding ratio refers to the ratio of actuarial assets to current liabilities evaluated at the model's rules.

TABLE 3

Contributions when Funding Problems May Arise

	Baseline Model		Model (2)		Model (3)		Model (4)		Model (5)	
	Funding ratio below 90 percent	Funding ratio above 90 percent	Funding ratio below 90 percent	Funding ratio above 90 percent	Funding ratio below 90 percent	Funding ratio above 90 percent	Funding ratio below 90 percent	Funding ratio above 90 percent	Funding ratio below 90 percent	Funding ratio above 90 percent
1952–2002	5.9	1.7	6.8	1.5	6.4	1.7	4.6	2.1	9.1	1.5
1980–2002	5.4	1.2	0.0	0.0	6.4	1.3	4.2	1.3	0.0	0.0
	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.

the respective rules since it determines contributions, and funding rule (2) evaluates assets and liabilities at current rules to make the funding ratio comparable across funding rules. Both funding ratios would have been equal to or higher than in the baseline case.

Next, we consider the long-term performance of the alternative funding rules (Table 2). From 1952 to 2002, only the change in asset valuation assumptions would have led to higher contributions. From 1980 to 2002, all changes would have resulted in lower contributions, because plans would have built up more reserves.

To test the change in cyclicality, we calculate contribution for periods when the actuarial value of assets was below and above 90 percent of liabilities (Table 3). In almost all cases, the contributions during periods when assets were below 90 percent of assets would have been higher than in the baseline scenario. In addition, we consider contributions during recessions and nonrecessions. 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. Moreover, if liabilities and assets are evaluated at current rules—funding ratio (2)—liabilities would have fallen below 75 percent of assets more frequently than under current rules only in model (5).

Conclusion

After 2000, DB pension plans experienced severe underfunding. Although the magnitude of the problem was unprecedented, the combination of the underlying factors was not. Moreover, current funding rules exacerbate this regularity. Our report addresses the counter-cyclicality of current pension funding rules by designing three rule changes. We use a pension simulation model to evaluate our three funding rule changes for the period from 1952 to 2002. Our results indicate that each change would have constituted an improvement over current rules. Contributions would have been smaller, their volatility lower, required contributions during bad economic times would tend to be less, and the funding adequacy levels would generally be higher.

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