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The Economics of \_\_\_\_\_  
Pension Insurance \_\_\_\_\_

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1989

Published for the  
Pension Research Council  
Wharton School  
University of Pennsylvania  
by

**IRWIN**

Homewood, IL 60430  
Boston, MA 02116

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University of Pennsylvania

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Project editor: Paula M. Buschman  
Production manager: Bette Ittersagen  
Compositor: TCSystems, Inc.  
Typeface: 10/12 Melior  
Printer: R. R. Donnelley & Sons Company

**Library of Congress Cataloging-in-Publication Data**

Ippolito, Richard A.

The economics of pension insurance / Richard A. Ippolito.

p. cm.

Bibliography: p.

Includes index.

ISBN 0-256-07474-7

1. Pension Benefit Guaranty Corporation 2. Insurance, Pension  
trust guaranty—United States. I. Title

HD7105.45.U6I615 1989

368.4—dc19

88-39853  
CIP

*Printed in the United States of America*

1 2 3 4 5 6 7 8 9 0 DO 6 5 4 3 2 1 0 9

**PART THREE**

**\_\_ Toward Economically Rational \_\_  
\_\_\_\_ Pension Insurance \_\_\_\_\_**

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## CHAPTER 9

# Efficiency Aspects of Pension Insurance Rules

Thus far, the discussion has generally been focused on the financial condition of the federal insurance company. Reform ideas have been judged on how successful they are in reducing claims to the PBGC in the long run. Rules constraining insurance losses on the PBGC, however, are not imposed at zero cost. To the extent that rules distort the way firms do business, there is a real resource cost to the insurance system. This chapter will discuss efficiency concepts and consider reform ideas in this context. In the next chapter, these ideas are put to work in the form of the new pension insurance system.

### ILLUSTRATION OF EFFICIENCY CONCEPTS

An example will help illustrate the idea of efficiency. Suppose there are two states in a country: a cold-weather state and a warm-weather state. The inhabitants produce and consume only two things, apples and oranges. In the cold state, workers can produce either a dozen apples or a half-dozen oranges (or any linear combination). In the warm state, workers can produce a dozen oranges or a half-dozen apples (or any linear combination).

Workers prefer a diet composed of 50 percent apples and 50 percent oranges. If the states do not trade with each other, this variety is attained if workers in each state devote twice as much time to producing the product they have the least advantage in producing; and they end up with four apples and four oranges to consume in each state.<sup>1</sup>

<sup>1</sup>Consider the cold state. It takes twice as many hours to produce an orange (*O*) compared to an apple (*A*). A total of *H* hours are available for production; they are therefore allocated according to the formula:

A better solution is for each state to produce only the product in which it has an advantage in production. Thus, overall production in the country is maximized if the cold state produces only apples and the warm state only oranges: total production equals 12 oranges and 12 apples. To retain a balanced diet, the two states can trade six apples for six oranges. Through specialization and trade, production is increased by one third.

Now suppose this country has a problem: individuals perpetuate crime then cross state lines to evade state prosecution (the states have no extradition agreement). To stop the crime problem, the government closes the only road that connects the states, so criminals cannot leave either state. The good news is that there is now less crime. The bad news is that because the road is closed, the states can no longer trade.

Now the workers in each state have a choice: to incur a *consumption inefficiency* or a *production inefficiency* (or some of both). That is, suppose the cold- and warm-weather states decide to continue producing what they produce best, all apples or all oranges. In this case, total production is unaffected by the road-closing policy, but workers in each state must eat only apples or only oranges. Because they prefer to eat some of each, they are all worse off under the road-closing policy. We can call this a *consumption inefficiency*. Consumption is inefficient because everyone would be better off if they could consume some apples and some oranges instead all one or the other.

Alternatively, suppose that to attain variety, each state devotes two thirds of its resources to production of the product in which it has the least advantage and one third to the product in which it has the most advantage. As demonstrated above, using this allocation of resources, both states produce four apples and four oranges. Workers are better off in the sense that they have attained variety in their diet. But now there is less total production. Before the road-closing policy, production totaled 24 apples and oranges; now there are only 16 apples and oranges available. We can call this a *production inefficiency*: production is one-third lower because of the road-closing policy.

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$$H = h_A A + h_O O$$

where

$h_A$  = number of hours required to produce one  
apple

$h_O$  = number of hours required to produce one  
orange

$A$  = number of apples produced

$O$  = number of oranges produced

If  $A = O$  (apple production equals orange production), then  $h_O O = (2/3)H$  (because, by definition,  $h_O = 2h_A$ ). If all resources devoted to apples yield one dozen apples, then it must be true that one-third this time yields four apples; and because  $A = O$ , they also have four oranges. A similar calculation shows the same net result for the warm state.

Clearly the policy of closing the road imposes a loss on workers in both states. This may not have been the most efficient policy to deal with crime. It may have been cheaper to let crime continue if its level was not high compared to the gains from trade; or it may have been more efficient for states to set up an extradition agreement or to devote more resources to preventing crime.

In the area of pensions, similar efficiency issues arise. Congress set up a mandatory insurance program without an appropriate pricing system. As a result, a certain level of unproductive activity is encouraged to maximize transfers available from the insurance company. This itself creates a distortion because it provides a mechanism for some financially troubled firms to force financially sound firms to help pay for pension promises in the former firms.

Efforts to fix this problem, however, are not without cost implications. Creation of nonprice solutions to help stop moral hazard in the insurance system may help reduce the problem facing the insurance company. But it may also adversely affect other pension plan sponsors and participants, leading them to engage in even more costly policies. Unless caution is used, additional layers of distortion and burden can be imposed, with a detrimental effect on the entire defined benefit plan system. These effects can be evinced in the form of either a higher cost of offering defined benefit plans (production inefficiency) or a bias toward defined contribution plans relative to defined benefit plans (consumption inefficiency).

## **PENSION INSURANCE AND EFFICIENCY**

### **Potential Problems with Market Prices**

There is no "perfect" price system for insurance coverage. In general, the more that prices reflect exposure and risk, the lower the amount of cross-subsidy characterizing the system. This tends to generate the appropriate amount of insurance coverage and moral hazard across all insureds. If measures of risk are imperfect, however, some distortions will remain.

For example, drivers under age 25 are usually rated high risks for automobile insurance. This means some young drivers who would be considered low risks in a full-information world pay large subsidies to others in the insurance pool. If there were one-risk category, these same good (but young) drivers would pay a smaller subsidy—but more other drivers would also pay subsidies. In general, the narrower the risk categories, the fewer the insureds who pay "wrong" prices; but those who are misclassified tend to pay "very wrong" prices.

Because the market will tend to establish more risk classes as long as the marginal reductions in premiums to good risks outweigh the cost

of creating new categories, the solution is efficient (the creation of more classes would not reduce prices to good risks beyond some point).<sup>2</sup> Nevertheless, the potential for risk-based price systems to badly misclassify some risks is often used as an argument for imposing a maximum premium.

### Problems with Mandatory Coverage with Market Prices

Insurance contracts invariably distort economic activities because of either moral hazards or rules designed to control these hazards. The goal is to minimize this interference and, at the same time, protect the integrity of the insurance system. One fundamental source of inefficiency in the existing pension insurance program stems from its mandatory nature: workers and firms are covered by the insurance whether or not they want to be. This problem is exacerbated by constraints on the PBGC against charging market premiums or reducing insured benefits.

As shown in Chapter 6, under the current system many firms and workers pay subsidies to poorly funded plans in high-risk firms and thus may not wish to be included in the insurance program. Mandatory coverage with inappropriate prices encourages moral hazard amongst bad risks and induces good risks to leave the system. But even if the system were characterized by free market prices and could be administered at zero cost, many firms and workers might not want to be covered by pension insurance. Thus, mandatory participation will lead to inefficiencies.

**Benefits of uninsured underfunding: An example.** In this section, I will illustrate a case where mandatory pension insurance coverage imposes economic inefficiencies. Consider a firm with a unionized labor force.<sup>3</sup> The union has some control over the financial viability of the firm: it can raise wages above competitive levels, which ultimately will lead to firm failure. Even though union members ultimately lose their jobs, they may benefit from this strategy as a group because they collect supracompetitive wages during the time it takes the firm to fail. Stockholders knowing this potential are reluctant to invest in the firm.

To solve this problem, suppose a bargain is struck giving the union a stake in the long-term viability of the firm: a large portion of

<sup>2</sup>Just because a free market system is efficient does not imply that it must generate a higher social welfare than a system that artificially regulates fewer risk categories. Because of nonlinearities, the "harm" imposed on fewer badly misclassified good risks might be greater than the lesser harm imposed on a greater number of insureds who are only mildly misclassified.

<sup>3</sup>The issues raised in this section are treated in detail in Ippolito, 1986.

compensation is paid in the form of a pension, but the pension is not funded. In the event of firm failure, the union members lose the entire value of their deferred wages in the form of valueless pensions. Thus, the union now has an incentive to help the firm remain competitive over the long run.

To illustrate, suppose the interest rate and wage growth are zero. Workers start work in the firm at age 25. The pension pays \$150 per month from age 55 until death, which I assume occurs at age 80 (that is, the monthly benefit is \$5 per year of service). The present value of the pension is \$45,000 at age 55; total compensation is \$6,500 per year during work years. Of this, workers receive \$5,000 in cash wages, and the remaining \$1,500 is deferred and returned in the form of a pension during retirement (\$1,500 per year times 30 years of work is \$45,000, exactly the value of the pension). In this example, the pension is worth 23 percent of total compensation (total compensation is \$6,500 per year times 30 years, or \$195,000).

If the funding level in the pension is zero and the firm fails, a 55-year-old worker loses \$45,000 in pension benefits; a 35-year-old worker loses \$15,000 (\$1,500 forgone wages for 10 years); a 70-year-old retiree loses \$18,000 (\$150 per month for 10 remaining years of retirement). Given these potential losses, the union has an incentive to work with the firm to ensure its long-term viability.

**Consequences of mandatory insurance.** Now suppose pension insurance is mandated. All workers have their benefits insured, and thus the incentive scheme set up by the firm is eliminated. Workers now have an incentive to raise wages: their pensions are insured, and thus no pension loss occurs on firm failure. This will create more firm failures than anticipated by the insurance company, based on historical experience prior to the creation of pension insurance. Either firms must find other, less efficient ways to control unions, or firms susceptible to a union "hold up" (notably, firms with a high intensity of specialized durable capital) will find ways to operate without unions (perhaps by transferring production to foreign countries or to other regions in the country).

Finally, firms and unions caught by the enactment of pension insurance will have incentives to transfer the extra cost created by the insurance to the PBGC. For example, firms may agree to pay union members shutdown benefits and higher monthly benefits in lieu of higher wages. Thus, instead of paying \$150 per month in benefits, they might agree to increase benefits to \$200 payable perhaps at age 50 if a plant shutdown occurs.

In short, while free market prices would substantially reduce distortions in the current single-price system, they do not ensure an absence of distortions. The mandatory nature of the system itself imposes resource costs on some firms. Given that Congress mandates

pension insurance coverage, the problem is determining the next-best solution.

### **Optimal Insurance under Mandatory Coverage: Market Prices and Benefit Reductions**

One solution that reduces the problem posed by mandatory insurance coverage is to combine a market rate premium structure with several benefit options. Free market prices (that is, prices reflecting risk and exposure) reduce cross-subsidies among different risk groups and thus reduce distortions inherent in flat price formulas. Market prices alone, however, do not eliminate market distortions. Many insureds will be required to purchase more insurance than they otherwise would if they had a free choice. This suggests that the market could be made more efficient by permitting insurance against a smaller portion of pension benefits.

For example, a low-option policy could be set at some minimal level, presumably to address congressional concerns that pension participants would have inadequate income if their pension plan were terminated. This level could be set at the plan's benefit level or at the average of all pension payments in the universe (in relation to wage and service), whichever is lower. Payments would be made starting at age 62. In this way, firms and workers who wanted less insurance could choose the low-option alternative.

In terms of the union example above, suppose guaranteed benefits were \$100 per month starting at age 62. In comparison to the \$150 benefit level payable in the plan starting at age 55, a 55-year-old worker would lose roughly 50 percent of this pension upon firm failure if the insured benefit were only \$100 payable at age 62. The guaranteed benefit for a 50-year-old worker receiving \$200 per month under a plant shutdown provision would be reduced from \$72,000 (\$200 per month for 30 years) to \$21,600 (\$100 per month for 18 years). This would reduce the moral hazard problem of firms increasing the amount of the expected transfer from the insurance company and would maintain some incentives for unions to preserve the financial viability of the firm.

In short, a pension insurance system characterized by free market premiums and an assortment of insurance protection levels would minimize the distortions inherent in mandatory insurance coverage.

### **NONPRICE/BENEFIT REFORMS**

Unfortunately, Congress has not set a pricing scheme meaningfully related to market rates (see Chapter 6). Thus, we are facing two serious congressional constraints: insurance coverage is mandatory, and premiums are essentially the same for all insureds. Given these con-

straints, a second-best solution is to reduce guaranteed benefit levels. This option minimizes the PBGC's need to distort all firms' behavior to prevent gaming by a small minority of firms against the insurance company. In short, the lower the guarantee level, the smaller the need to directly affect exposure, and the smaller the incentives for corporations to try to game the system.

Had the low-level guarantee suggested in the above paragraphs (benefits no higher than average industry benefits payable no earlier than age 62) been in effect in 1986, it is doubtful that LTV Corporation, for example, would have been in a position to make anything like a \$2 billion claim against the PBGC insurance system. As discussed in Chapter 7, "Underfunding Exposure: The Evidence," over 50 percent of the claim was attributable to shutdown and early normal retirement ages. An additional reduction would have occurred if age-62 benefits in steel industry pension plans exceeded average age-62 benefits in all insured pensions.

If all pension plans were assessed a market insurance premium, then each plan could determine whether it was willing to pay for higher benefits than these. When there are large cross-subsidies in the pricing structure, however, there is an argument for reducing these transfers to what can be considered a reasonable minimum. Otherwise, those receiving subsidies have incentives to take a larger portion of the wage package in the form of insured pension benefits. This increases the taxes on those who do not benefit from the system (encouraging them to leave) and reduces the incentive for workers to help firms remain competitive.

In short, from an efficiency perspective, the appeal of benefit reductions is that they minimize the adverse impact of the regulated price scheme. The idea is to set benefit levels to make a closer match between revenues and expected claims for all firms.

### **Outlawing Underfunding**

In the absence of meaningful changes in pricing and benefits reform, the only avenue left to control claims is to limit firms' exposure levels facing the PBGC. This can be done by enacting stricter minimum funding rules, by making it easier to attach assets in firms with underfunded pension plans, or by changing the bankruptcy laws to increase pension priorities above other creditors.

The first two solutions have the potential to interfere with optimal production and financing policies of many firms. This potential arises because the solution effectively outlaws substantial underfunding when underfunding may serve important economic functions. In fact, we know underfunding must be valuable to firms because there is a large forgone tax advantage of not fully funding a tax-free accumulation vehicle, and also because large amounts of underfunding char-

acterized defined benefit plans long before the creation of pension insurance.<sup>4</sup>

In 1986, fully one out of four plans with at least 100 participants was underfunded in a termination sense (see Table 6-1) and hence will be impacted by the new minimum funding rules. It is unlikely that 25 percent of all plans pose significant risks to the PBGC. A more likely explanation for underfunding is that overall firm productivity is higher for some firms when they operate with underfunded pension plans. Otherwise, all firms would fully fund in an ongoing sense (and thus overfund in a termination sense), thereby taking full advantage of tax-free accumulation in the pension trust. By constraining the option to underfund, some gaming potential against the PBGC is removed, but some unmeasurable productivity effect will also be imposed on other firms that operate underfunded pension plans but pose little risk to the PBGC.

The potential for interference would be reduced if funding requirements were combined with estimates of default risk. The impact of the funding rules would more likely be restricted to firms posing significant exposure to the insurance company.

This principle was partially recognized in the Pension Protection Act. This legislation did not attach assets of all firms with pension underfunding. Instead, it permitted liens to arise only when minimum contributions in excess of \$1 million were not paid to the plan. As noted in Chapter 8, because the liens arise late in the process, few assets may exist at this point that are not already subject to some other lien.<sup>5</sup> But the upside of the provision is that the lien solution tends to affect only firms with an imminent claim on the PBGC, thus reducing the overall burden of the rule.

More generally, the main ingredient of the new legislation is to require all underfunded plans, regardless of the risk they impose, to substantially increase their funding levels. The intent is to eliminate much of the exposure faced by the PBGC. The effect may be to reduce the attractiveness of defined benefit plans for some firms.

The underfunding provisions of the Pension Protection Act, however, were less intrusive than they could have been. For example,

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<sup>4</sup>ibid.

<sup>5</sup>It is not clear if the solution is more efficient if the PBGC successfully perfects its liens. A common solution to firms in financial difficulty is to use what assets are still free of lien to obtain bank loans to finance operations during reorganization. If the firm misses its pension contribution (a common occurrence prior to termination—see Chapter 7) and if the PBGC acts fast enough to attach the remaining assets, then the likelihood of a successful reorganization is reduced. That is, the likelihood is increased that the firm will ultimately enter Chapter 7 of the Bankruptcy Code, rather than structure a successful reorganization under Chapter 11. The recovery rate for the PBGC (and all other creditors) almost surely is lower in a Chapter 7 proceeding than in Chapter 11.

one easy way to eliminate most underfunding in the defined benefit system is to require all pension plans (including flat benefit plans) to project benefits to retirement ages using some wage/benefit growth assumption reasonably related to the interest rate assumption. This funding rule would be more effective in limiting the exposure facing the PBGC than the rules imposed by the Pension Protection Act because (1) it does not postpone strict funding requirements until the firm is in financial difficulty and (2) it mandates funding in the ongoing sense, thereby providing a sizable cushion for exposure in a termination sense. While this rule would have reduced exposure to the PBGC, however, it would have greatly aggravated the distortions imposed by mandatory full funding requirements because it eliminates all underfunding (not just underfunding in a termination sense).

### Bankruptcy Changes

Potential changes in bankruptcy rules are likely to be more efficient solutions than more stringent funding rules to reduce exposure. This is because bankruptcy changes work indirectly to either reduce benefits or impose market-determined insurance rates. Two potential changes include restricting the insurance event to Chapter 7 of the Bankruptcy Code and changing the pension priority in the event of either Chapter 11 or Chapter 7 of the code.

Restructuring the insurance event to Chapter 7 (dissolution) instead of Chapter 11 (reorganization) of the U.S. Bankruptcy Code eliminates the potential for ongoing firms to essentially trap the government into subsidizing their pension benefits. If some ongoing firms in an industry are successful in obtaining the subsidy, it becomes more important for other firms in the industry to follow suit; otherwise, some firms will have a competitive advantage over those who do obtain the subsidy. Restriction of the insurance only to Chapter 7 bankruptcies is an indirect way to reduce the level of benefits offered in the system: only firms in dissolution are eligible for the PBGC transfer.

In the absence of price and/or benefits flexibility, arguably the most efficient change in the law would be a change in priority claims of pensions in bankruptcy. In particular, suppose that in bankruptcy, pensions had to be paid before all other claimants (including secured creditors). The effect of this rule is that creditors would set interest rates reflecting the risk of pension default and exposure.

Just as above, however, the solution is not best because it makes insurance coverage mandatory, which might not be optimal in all cases. This solution would work better if the priority claim were limited to a minimum benefit, say, no higher than the average benefit in all pension plans, payable no earlier than age 62.

If Congress is unwilling to set market rates directly, however, it is

unlikely to change bankruptcy laws to increase the pension priority for the same reason: indirectly, a high pension-priority bankruptcy rule merely represents a "back door" free market rate system.

### Arguments for Mandatory Participation

If the insurance price structure reflects large cross-subsidies, there is an obvious need to require mandatory participation; otherwise, all the good risks would opt not to participate. Even if premiums are set to fully reflect risk and exposure (my assumption in this section), at least three arguments are used to justify it. These are selection bias, information problems (including agency costs), and catastrophic risk. None of these arguments, however, appear to be compelling.

**Selection bias.** All voluntary insurance is subject to adverse selection. Despite insurance companies' ability to collect important information, insureds usually know more about their own risk than the insurance company. Thus, when 65-year-olds apply for annuities until death, they are not a random sample from the population. They likely overrepresent a group that has a longer life expectancy. This is why defined benefit coverage is required of all workers within large groups (like blue collar or white collar) in the firm and why optional lump sums are rarely permitted.

Adverse selection is not a trivial problem in pension insurance. In this case, however, the insurance company has large amounts of available data describing a potential insured, including its financial history, the performance of its industry, and the characteristics of the plan and firm. Moreover, the insurance company can monitor audited reports of the insureds' funding levels and portfolio holdings. Just as in any kind of insurance, prices would not be perfectly set, but there are good reasons to believe that reasonably accurate prices could be attained. If so, the selection problem would appear less than paramount.

**Information problems.** A second argument is that workers may want to have their pensions insured if they possessed all the facts and had the time and ability to process the information. A related issue pertains to the incentives of the stockholders versus the workers (the so-called agency problem). Even if workers desire coverage, the firm's management decides whether coverage will be obtained.

One solution to this problem, if it exists, is to require all firms' actuaries to provide workers with an explanation of the insurance option, together with estimated premium payments required by the PBGC. On a one-time basis, all firms could be given the opportunity to opt out of the insurance. If workers are unionized, insurance coverage could be the subject of collective bargaining; otherwise, the decision would require, say, a two-thirds vote by workers in the firm (where the election would be held by, say, an actuarial or accounting firm).

**Catastrophic claims.** Perhaps the best argument for mandatory participation in a free market for pension insurance is the potential for catastrophic claims. Suppose 100 firms are covered by a pension insurance contract. All have the same small risk of making a claim (say, 1 in 100 each year), and each claim costs \$100. Ignoring the cost of operating the insurance company, the economic premium is one dollar per plan per year.

Suppose no claims occur in years one and two, and then five occur each year during years three and four. Consider the insurance company's position in year three. It has five claims totaling \$500 but only \$300 in accumulated premiums; at the end of year four, it has \$1,000 in accumulated claims and only \$400 in accumulated premiums. If it tries to raise premiums, insureds have an incentive to leave the system to insure elsewhere. Thus, the insurance company goes bankrupt, and the claimants receive only 40 percent of expected protection. This result occurs even though over a 10-year period, claims may average \$100 per year, as expected.

One way to circumvent this problem is for the insurer and the insureds to commit to a long-term contract. Effectively, a premium surcharge may be levied during the early years, say, a \$2 premium instead of \$1. During year three in the above example, \$600 in accumulated premiums would be available to pay \$500 in claims. In year four, \$300 in accumulated premiums would be available to pay part of the additional \$500 in claims in that year. The insurance company would borrow \$200 against forthcoming premiums based on its guaranteed contracts.

If in years 5 through 10 zero claims were received (consistent with the original expectation that \$1,000 in claims would occur every 10 years on average), a rebate of excess premiums during these years could be given to the insureds. This kind of industry group concept will be implemented in the pension insurance system described in Chapter 10.

The catastrophic claims problem is a good argument for the insurance carrier to mandate long-term contracts but not for the government to mandate participation of all pension plans in the agreement.

## **DISTORTION FOR OVERFUNDED PLANS**

Thus far, the discussion has been limited to the potential for distortions imposed by insurance rules on the behavior of firms with underfunded plans. The Omnibus Budget Reconciliation Act (OBRA), however, imposes a distortion on the choice of types of pension plans for firms wishing to have well-funded plans. While OBRA required underfunded plans to become better funded, it also generally required well-funded plans to become less well funded.

As discussed in Chapter 8, prior to OBRA, firms were permitted to fund up to 100 percent of ongoing liabilities. OBRA changed this limit

to 150 percent times termination liabilities. It is easy to show that for some defined benefit plans, particularly those disproportionately populated by workers (as compared to retirees), the new full funding limit is tantamount to legislating persistent underfunding in an ongoing sense. This encourages these firms to use defined contribution plans instead because the latter plans still provide for full utilization of the tax-exempt trust funds. An example will illustrate the point that OBRA essentially attaches a special excise tax against defined benefit plans.

Consider a firm's ability to fund a defined benefit plan for a worker entering the firm at age 40. For simplicity, suppose there is only one worker in the firm. This example mimics plans sponsored by new, growing firms with predominantly young workers.

Suppose the chances of this worker quitting, being laid off, or dying prior to age 65 (retirement age) are zero. At age 65, the worker will receive a lump sum pension equal to 10 percent times years of service times wage at retirement. The worker effectively pays for this pension by contributing \$1 per year (in the form of forgone wages) in real terms. That is, in the absence of the pension, the worker's salary would be \$11 per year. Assume the inflation rate, the interest rate, and wage growth are all 10 percent per year. Thus, in real terms, the present value of the worker's pension at age 65 is \$25.

### Trust Fund Balance: Pre-1988 Rules

Consider the pre-1988 funding rule: the firm is permitted to project wages by 10 percent, then discount by the 10 percent interest rate. Its ongoing liability after one year is thus \$1 (10 percent times current wage \$10, times one year of service, projected at 10 percent per year, discounted by 10 percent per year)

$$\begin{aligned} PVO(1,0) &= .10 \times 1 \text{ year} \times \$10e^{(.10 - .10)25} \\ &= \$1 \end{aligned} \tag{9-1}$$

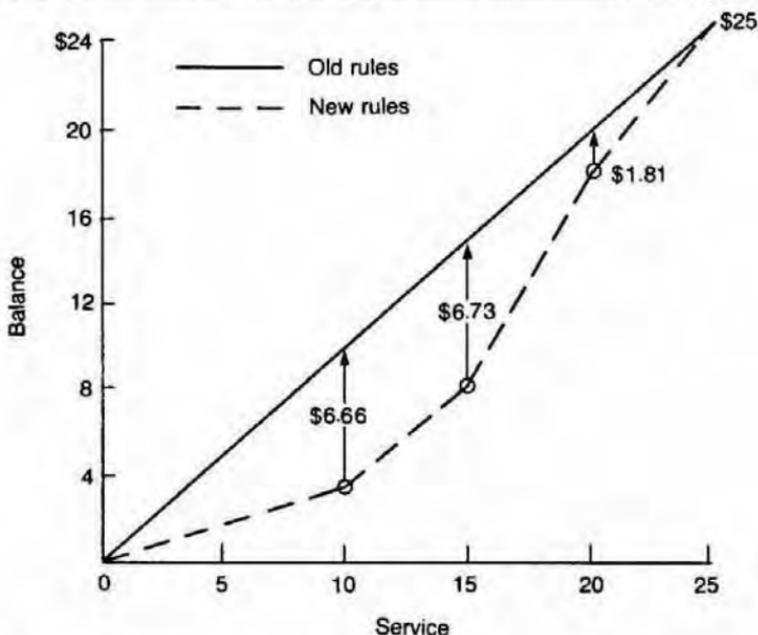
where  $PVO(1,0)$  is the present value of the ongoing pension after one year of service evaluated in year-zero dollars.

In fact, under this rule, the firm can put all subsequent worker contributions into the trust fund to accumulate at a tax-free 10 percent interest rate. For example, consider year 15 of the accumulation: the wage then is \$44.81 (\$10 accumulated at 10 percent wage growth for 10 years), service is 15 years, and there are 10 years to retirement. Thus, the ongoing benefit liability in year-15 dollars is:

$$\begin{aligned} PVO(15,15) &= .10 \times 15 \text{ years} \times \$44.81e^{(.10 - .10)10} \\ &= \$67.22 \end{aligned} \tag{9-2}$$

In year-zero dollars, this amount is discounted 15 years at the 10 percent interest rate:

**FIGURE 9-1** Trust Funding: Old and New Funding Rules



$$\begin{aligned} PVO(15,0) &= \$67.22e^{-.10(15)} \\ &= \$15 \end{aligned} \quad (9-3)$$

The firm's normal cost calculation is the difference between benefits at age 65 and current benefits, prorated over years left until retirement (see Chapter 7). Because the present value of benefits at age 65 will be \$25 in real terms the difference between this and benefits accrued at year 15 (\$15) spread over 10 years is \$1: the firm's normal contribution in year 15 is \$1 (valued in year-zero dollars).

Figure 9-1 depicts the growth of the trust fund in year-zero dollars; it is a linear schedule starting at zero and reaching \$25 in 25 years (it increases at the rate of \$1 per year). These trust fund amounts at various ages are also reflected in the first row of Table 9-1.

### Trust Balance: Post-1988 Rules

Now consider the post-1988 funding rules: the firm is restricted to maintain a trust fund with assets no more than 150 percent of the present value of terminated benefits (PVT). In year one, 150 percent of terminated benefits is 12.3 cents:

$$\begin{aligned} PVT(1,0) \times 150\% &= .10 \times 1 \text{ year} \times \$10e^{-.10(25)} \times 150\% \\ &= .123 \end{aligned} \quad (9-4)$$

**TABLE 9-1** Tax Cost of New Funding Rules: Illustration

Category	Years of Service				
	0	10	15	20	25
<b>Trust balance (\$real)</b>					
1. Old rules	\$0.00	\$10.00	\$15.00	\$20.00	\$25.00
2. New rules	\$0.00	3.34	8.27	18.19	25.00
3. Difference	0.00	6.66	6.73	1.81	0.00
4. Average difference during interval	—	3.33	6.69	4.27	.90
<b>Taxable interest</b>					
5. Average per year during interval	—	.33	.67	.42	.09
<b>Tax during interval</b>					
6. (33%) per year	—	.11	.22	.14	.03
7. Total	—	1.10	1.10	.70	.15
8. Cumulative tax	—	2.10	2.20	2.90	3.05

Note: See text for assumptions.

Termination liabilities are similar to the ongoing liabilities in Equation (9-1) except the 10 percent salary projection factor is missing in the termination calculation. This is why, even allowing for multiplication by 150 percent, the termination funding limit is only 12.3 percent of the ongoing liability limit in year one.

From the perspective of using the trust fund, the firm can contribute only 12.3 percent of the worker's implicit one-dollar contribution to the pension (in the form of forgone wages). Implicitly, the rest must be saved outside the trust. If the firm pays a tax rate of 33 percent, 87.7 percent of the implicit contribution accumulates at the 6.67 percent after-tax interest rate (10 percent, minus the 33 percent tax, times 10 percent).

In year 15, the trust fund is restricted to hold \$8.27 in real terms:

$$\begin{aligned}
 PVT(15,0) \times 150\% &= .10 \times 15 \text{ years} \times \$10e^{-.10(10)} \times 150\% \\
 &= \$8.27 \qquad (9-5)
 \end{aligned}$$

Under the old funding rules, the firm could hold \$15 in real terms in year 15 in the trust fund; thus, at the 15-year service level, the firm is saving \$6.73 outside the pension fund at the after-tax interest rate (\$15 in real contributions, minus \$8.27 in the trust fund).

The maximum amount of assets in the trust fund under the new rules is shown by the nonlinear schedule in Figure 9-1 and the second row of Table 9-1. The difference between the two requirements is the amount of pension accumulations that must be saved outside the pension fund (row three of the table, also depicted in the figure).

By year 20, the new rules permit almost the entire ongoing liability

to be reflected in trust assets. In the new scheme, \$18.19 may be held in trust (in year-zero dollars), compared to \$20 under the old rule; the gap in the two full funding rules narrows because contributions to the trust fund increase rapidly at older ages under the new rule. Between years 15 and 20, the average contribution to the trust fund is almost \$2, double the amount in the old funding scheme.<sup>6</sup>

## Tax Assessment

It is easy to obtain an estimate of the tax impact of the new rules. Over each segment of the schedule in Figure 9-1, the average difference between the two trust accounts is calculated (row four in Table 9-1). Taxable interest is 10 percent times these differences (row five of the table). The tax assessed on these interest amounts is assumed to be 33 percent times these amounts each year. Annual tax assessments on interest earned outside the trust are shown in row 6 of Table 9-1.

Row seven lists the total tax assessment during each interval. For example, during the first 10 years, 11 cents in taxes each year amounts to \$1.10 over 10 years. The last row accumulates these amounts. These numbers show that over 25 years, an additional tax is paid on savings outside the pension under the new rules amounting to approximately \$3 in real terms, which is approximately 12 percent of the value of the pension, \$25.

If, instead, the firm offers a defined contribution plan, it would be entitled to deposit the full amount of the implicit pension contributions (forgone wages) into the pension trust fund, all of which would accumulate at the pre-tax rate of interest. Thus, the new rules create a tax bias in favor of defined contribution versus defined benefit plans. Moreover, if long-term interest rates increase beyond 10 percent, the bias will become even larger.

Defined benefit plans historically have numerous inherent advantages: they permit firms to over- or underfund, to deter labor mobility, and to discourage retirement beyond normal retirement age.<sup>7</sup> In addition, they provide a vehicle that permits spreading of investment risks among worker cohorts and between workers and stockholders. The new funding rules further interfere with the first advantage. The remaining advantages are intact, except they now cost more to effect.

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<sup>6</sup>The example understates the impact of the new rule because I assume the firm can always make contributions to the fund to keep itself at the 150 percent limit. In fact, once below the limit, the pre-1988 funding rules apply (normal cost plus amortization of underfunding), and thus permitted contributions may be even less than those implied in the table.

<sup>7</sup>Defined benefit plans typically discourage retirement after normal retirement merely by not making actuarial adjustments to benefits after this age.

Given the new costs, new firms may be more likely to find other (perhaps less effective) means to control their work forces and share investment risks with workers in ways that will have more advantageous tax implications compared to defined benefit plans.

### Balanced Work Force

The use of a one-worker plan mimics the impact of the new full funding limit on new, growing firms with predominantly young workers; but it somewhat overstates the impact of the new rule in a more mature firm. This is because for older workers, 150 percent of termination liabilities typically exceeds ongoing liabilities. Because the rules are applied in the aggregate, the "surplus" amounts for older workers can be applied to the "deficit" amounts for younger workers. The net permissible trust balance is thus higher than depicted above for older firms with a mix of younger and older workers. The tax effect, however, is still significant.

To illustrate, consider a firm where each worker starts at age zero and retires at age 25. Workers never quit and are never fired. The firm is neither growing nor contracting, and thus employment is constant. For simplicity, assume there are 25 workers in the firm: one worker joins each year, and one retires each year.

The firm pays a lump-sum pension to each retiree in the amount of 10 percent per year of service, times wage. The current wage is \$10 per year.

Liabilities for the plan are obtained by adding the liability for each of 25 workers in the firm, each with a service level varying from zero to 25 years. Assuming the interest rate and the expected wage growth rate are each 10 percent, the calculation of ongoing benefits is depicted by

$$PVO = \int_0^{25} .10 \times a \text{ years} \times \$10 \, da \quad (9-6)$$

which sums benefits for workers with  $a = 0$  to 25 service years. The solution to the above expression is \$312. That is, ongoing liabilities at any given time for this firm are \$312 in real terms.

The termination value of benefits is exactly the same as in Equation (9-6), except liabilities are not projected by 10 percent salary growth. Salary growth is not permitted in a termination liability calculation. To partly offset the omission of salary growth, the new full funding limit permits termination liability to be multiplied by 150 percent. That is, the new full funding limit is expressed as follows:

$$\text{Limit} = 150\% \times \int_0^{25} .10 \times a \text{ years} \times \$10 \times e^{-.10(25-a)} da \quad (9-7)$$

The solution to this equation is \$237. In the more general model, the new 150 percent full funding limit permits 75 percent (237/312) of ongoing liabilities to be funded; the remaining 25 percent must be

saved in a tax-exposed trust. This means the interest earnings on this \$75 is subject to the corporate tax. If this tax rate is 33 percent and interest earnings are \$7.50 (10 percent interest rate times \$75), the effective tax levied against the pension savings amounts to \$2.50 per year (33 percent tax times \$7.50 in interest earnings). If we think of this tax being paid effectively by each year's retiree when he obtains the annual lump-sum payout (\$25 in real terms), then each year's retiree receives a benefit roughly 10 percent less than the benefit under the old funding limit. Since all contributions to a defined contribution plan (of equal generosity) would accumulate in the tax-exempt trust fund, the firm can evade the excise tax by switching to a defined contribution plan.

## CONCLUSION

In this chapter, an attempt was made to show the potential costs of offering pension insurance without concern for fundamental insurance principles and economic efficiency. In an ideal world, pension insurance coverage would be voluntary, the levels of insurance would be variable, and prices would be set to reflect exposure, risks, and the cost of writing insurance. By mandating insurance coverage, the government imposes costs on some firms that may operate more productively in the absence of insurance. This distortion would be minimized if firms had choices of various insurance options and if premiums were freely determined to reflect risk and exposure.

By mandating insurance coverage and effectively outlawing market pricing, the potential for inefficient outcomes increases. The system builds in a mechanism for well-funded plans with financially sound sponsors to subsidize underfunded plans with financially unsound sponsors. Because the latter firms do not pay a premium related to their risk and exposure, incentives are created for them to game the subsidizing plans, which in turn encourages those firms to evade the tax by not participating in the defined benefit system.

The distortions would be markedly reduced if the levels of mandated insurance were reduced to a basic level of protection. This would dramatically reduce the magnitude of the transfers and thus limit the long-term impact of the program. By declining to limit the program and by combining this constraint with mandatory participation and an essentially flat pricing scheme, a formula is written that virtually guarantees substantial long-term distortions in the defined benefit system. A mechanism is created for billions of dollars to be transferred from one to another set of firms sponsoring defined benefit plans.

In view of the constraints it has placed on the insurance system, Congress is left with two alternative policies: either let the system proceed unchecked, thereby facing the risk of endangering the continuation of financially sound defined benefit plans, or mandate

reduced exposure by forcing underfunded firms to become more fully funded. The latter approach was adopted in the Pension Protection Act of 1987. This policy may itself create other distortions because it requires some firms that otherwise would optimally finance internally to either engage in more external financing at higher interest rates or switch to less efficient ways to include workers in the firms' financing.<sup>8</sup>

Ironically, the new legislation may not be successful in attaining its first goal (reducing the incentives for well-funded pension plans to switch to defined contribution forms). The 1987 Omnibus Budget Reconciliation Act forced well-funded plans to offset the higher contribution (and thus higher tax deductions) used by poorly funded plans by imposing stricter funding limits on well-funded plans. At a 10 percent interest rate for a pension plan characterized by zero steady-state growth and 25-year careers by participants (with no retirees), the new full funding limit is the equivalent of assessing a 10 percent tax on the contributions to a defined benefit plan versus a defined contribution plan. For new, growing firms populated predominantly by young workers, the effective tax rate is closer to 12 percent.

The possibility that stricter funding standards may not reduce claims expectations proportionately must also be considered. Even though funding standards are stricter, potential claimants may still be successful in defunding their plans prior to termination. Efforts aimed at limiting this ability—superfast funding requirements of waivers and shutdown benefits—may ensure satisfaction of the distress criteria required to qualify for the PBGC transfer. Moreover, the integrity of the new funding constraints can be substantially affected if interest rates increase substantially and then decrease (see Chapter 8).

In addition to these problems, the PBGC insurance program has been plagued with uncertainty in benefit guarantees. Because the insurance protects nominal benefits, the guaranteed real levels vary with the interest rates and with workers' ages. It is not uncommon for a termination to cause some workers to lose 90 percent of their real expected pensions. The average loss of real pension benefits on termination can vary from 30 percent to 60 percent, depending on the level of the nominal interest rate (see Chapter 2).

In the face of these issues, it is inviting to think about an entirely new pension insurance program, one that recognizes congressional constraints for mandatory participation and a maximum premium level but pays attention to the efficiency and long-term integrity of the insurance system and defined benefit plans. This will be the subject of the last chapter of the book.

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<sup>8</sup>One alternate might be for the firm to deliberately reduce wages early in the career and to pay higher wages later. This might be a less efficient solution because it forces workers to have "too little" consumption at younger ages and "too much" at older ages.