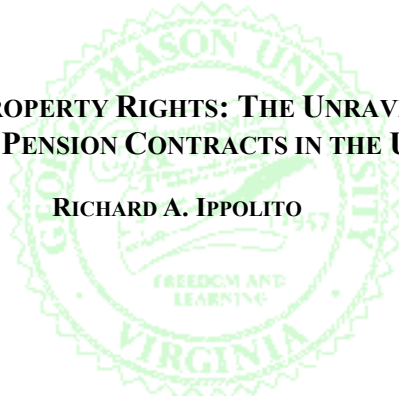


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**TENUOUS PROPERTY RIGHTS: THE UNRAVELING OF
DEFINED BENEFIT PENSION CONTRACTS IN THE UNITED STATES**

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Abstract

The private pension market in the United States has been almost completely transformed in less than 20 years. In the early 1980s, over 80 percent of all covered workers in the private sector had a classic defined benefit plan. In the year 2001, this share has fallen to less than 40 percent. In addition, approximately one in five defined benefit plans (weighted by workers) converted to a cash balance variety, which are defacto defined contribution plans.

Some of this movement is attributable to economic trends favoring the kinds of firms and industries that traditionally favored the defined contribution format, but the evidence shows a strong and persistent reduction in preferences for the defined benefit variety. I argue that the underlying reason for this trend is the adoption of a new tax policy towards terminations in the early 1980s, one that permitted terminations for reversion, which were *not* attributable to financial difficulty of the sponsoring firm. This change eliminated the mechanism that bonded the implicit pension contract, creating the possibility of unilateral termination by one party under conditions not originally contemplated in the contract.

The more firms that either terminated their plan or converted it to the cash balance variety, the more that workers still covered by defined benefit plans discounted the likelihood that their plan would survive. Since terminations and conversions confer large capital losses on workers, workers become leery of continuing to invest in the plan (in the form of foregone wages) unless it offers an extraordinary rate of return, which in turn affects the economics of offering the plan. The growing distrust of workers for firms holding up their end of the bargain creates the conditions that are ripe for the unraveling of the industry.

Following these trends, pension economics now focuses on the ability of firms to use defined contribution plans to influence productivity in the firm. Other questions arise: Absent defined benefit plans, will firms lose their ability to influence retirement ages? Will lump sums from defined contribution plans deliver comparable retirement income to future cohorts? These issues thus far remain unresolved.

Historically, pension coverage was dominated by defined benefit plans that pay annuities to workers often based on final salary and years of service. These plans have been an important source of retirement income, and feature prominently in ‘implicit pension contract’ models that help explain lower quit rates and earlier retirement ages.¹ Since the mid-1980s, however, these plans have lost substantial market share to defined contribution pensions in the private sector.² In the early 1980s, defined benefit plans covered about 85 percent of covered workers in the private sector. By 2000, this share had fallen to less than 40 percent, and reasonable extrapolations suggest that defined benefit plans will attain clear minority status over the next decade (figure 1).

They have been replaced by defined contribution plans that essentially give property rights to pension assets to workers: these assets plus investment returns usually are paid in the form of a lump sum upon leaving the firm.³ I argue that, following a change in law that undercut the basis for enforcement of the implicit pension contract that characterized defined benefit plans, defined contribution plans, which we can call ‘bonded’ pensions, are the only sustainable options in the new environment.⁴

¹ Basic data describing pension trends is found in U. S. Department of Labor (1999). Studies that include summaries of the implicit contract literature include Quinn et al. 1990; Gustman et al. 1994; Hanushek and Maritato 1996; Ippolito 1997.

² In this paper, I deal exclusively with private pension plans. Public pensions still heavily favor the defined benefit variety and evince little of the trend towards defined contribution plans observed in the private sector. See EBRI (1997). I also deal exclusively with single employer plans, and thus, ignore the minority of plans that are multiemployer plans (plans that cover unionized workers that work for any number of employers, like the Teamsters or Ladies Garment Workers). Coverage in multiemployer plans has remained primarily defined benefit.

³ Workers can roll these amounts into Individual Retirement Accounts without triggering a tax penalty.

⁴ Part of the change reflects employment shifts from traditional defined benefit firms and industries (for example, large, unionized firms in the manufacturing sector), to firms and industries that traditionally favored defined contribution plans (for example, smaller, nonunion firms in the service sector). But these studies also reveal a sharp decline in employer preferences for defined benefit plans across all portions of the private sector. Several studies have used standard statistical methods to disentangle the portion of the reduction in defined benefit market share over time (Clark and McDermed 1990, Kruse 1995, Ippolito 1997), Gustman and Steinmeier (1992). Generally, these studies conclude that about half of the reduction in defined benefit share is explained by employment shifts, and the remaining half by preference changes away from these types of plans. Most of the shift is affiliated with new plan formation and not plan termination with defined contribution replacement (Kruse 1995; Papke et al. 1996; and Ippolito and Thompson 2000). Also see [Hustead \(1990\)](#).

I. THE BASIC IDEA

Until the early 1980s, defined benefit plans terminated in conjunction with either firm failures or in the face of serious financial conditions arising with the plan sponsor (McGill 1970). I have argued that these events merely reflected the realizations of the downside of the implicit pension contract, that the imposition of pension losses on workers in failed firms is the *raison d'être* of unbonded pension plans.⁵

Beginning in the early 1980s a new kind of termination occurred, so-called terminations for reversions. In these transactions, which often were affiliated with corporate takeover events, firms unilaterally terminated the plans, took the excess assets into corporate profits, and often recreated essentially the same plan the next day. In effect, firms engaged in a pseudo-termination for the sole purpose of withdrawing pension monies. Since this two-step process accomplished what was clearly a violation of tax law in one step (plan sponsors are not permitted to take monies from the pension plan), a natural expectation is that the Internal Revenue Service (IRS) would have disallowed the transaction. They made the opposite ruling.

Supported by 'Guidelines' issued jointly by the U.S. Departments of Labor, Treasury and Commerce, the IRS ruled that such transactions were permissible.⁶ In so ruling, the IRS essentially gave up its enforcement role to the implicit pension contract. As long as terminations were allowable only in the clearly demonstrable case where the plan sponsor encountered financial difficulty, then the firm's pension promise was bonded. Once the IRS abandoned its bonding role, the property rights to pensions became more tenuous.

The Pension Benefit Guaranty Corporation, which is the federal agency that guarantees the payment of legal liabilities in the event that a plan sponsor enters bankruptcy with underfunded plans, tracked only those terminations that conferred reversions in excess of \$1 million. Starting in 1980, there were few such events. By 1985, there were 585. Through 1986, about 1,500 plans were terminated with reversions of at least \$1 million.⁷ Only about \$20 billion was taken in the form of reversions, amounting to only 2 percent of excess assets as of

⁵ See Ippolito (1985).

⁶ The Joint Implementation Guidelines essentially required all legal liabilities be satisfied upon termination; that the payouts be made in the form of annuities purchased from an insurance company; and that the discount rate used to value liabilities be no higher than one used by the Pension Benefit Guaranty Corporation. Essentially, the guidelines called for a satisfaction of legal, and not ongoing, liabilities. See 23 Tax Notes 1088 (June 4, 1984).

⁷ The Pension Benefit Guaranty Corporation tracked these totals. Summaries can be found in PBGC Annual Reports throughout the 1980s. My numbers are taken from the 1989 report.

1986, but the trend was growing.

Congress reacted by instituting the first (non-deductible) reversion tax (10%) in 1986. The tax was originally designed to recapture tax benefits embedded in reversions that flowed from the tax-exempt pension trust fund. But when the tax did not halt reversion events,⁸ the Congress increased the tax to 15% in 1988 and finally to a confiscatory 50%. The last step had an unfortunate and presumably unintended effect. Not only did the tax make further unilateral terminations uneconomic, it also made uneconomic termination under conditions envisioned in the contract in the first place.

That is to say, the plan sponsor lost its opportunity to reduce its pension obligations by terminating the pension in the event of encountering financial difficulty, *unless* it carried zero excess assets. In effect, the new tax policy increased cost of imposing default risk on employees. Firms reacted strongly: they substantially reduced excess assets, and found a way to legally circumvent termination by converting their plans to ‘cash balance’ a variety of defined benefit plans.

The cumulative effect of reversions, defunding and cash balance conversions has worked to erode the trust that forms the basis for the implicit contract. Workers’ estimate of the probability of termination depends in part on observations they make in the market. Each individual firm makes the termination decision because its workers no longer trust the firm, but this decision affects workers’ estimate of termination in other firms, making it more likely that more terminations. Effectively a lemons market develops, which makes it uneconomic for honest firms to offer defined benefit plans. The adverse economics generated by this effect are exacerbated by the impact of reversion taxes on the expected cost of exposing workers to some default risk.

⁸ About \$2 billion in reversions was taken in 1987 and again in 1988.

II. DEFAULT EXPOSURE: THE ESSENCE OF THE DEFINED BENEFIT PLANS

Contingent benefits are the core of defined benefit plans. If the plan does not terminate then workers at retirement are entitled to a benefit that is indexed to *final* wage.⁹ This is called an ‘ongoing’ benefit. But if termination occurs earlier than retirement then workers are entitled to ‘termination’ or ‘legal’ benefit, which is a payable at retirement but is indexed to the wage on the date of termination. The difference between these calculations, which can be very large, is called the contingent benefit, or default exposure.

This exposure is easy to model, but more difficult to rationalize in an employee contract. It also is non-trivial to value, owing to its peculiar loss structure and imposition of undiversified exposure on workers. Whatever price workers pay for this asset, however, they are willing to pay less, the greater their estimate that the plan will terminate prior to their retirement date.

A. Pension Capital Losses

Consider a simple model of pensions. The worker starts at the firm at age zero, retires at age R , and dies at age D . I therefore can denote age and service by a . The quit rate is zero. I assume that there is no early retirement date. The pension annuity, A , is equal to service, a , times wage, w , times some generosity factor, b ; there are no cost of living increases after retirement.¹⁰

$$(1) \quad A = b a w.$$

The termination value of the pension benefit to some worker age a , earning wage w_a , if the firm terminates the pension is:

$$(2) \quad L_a^* = b a w_a e^{-i(R-a)} \Omega, \quad \text{where } \Omega = \int_{t=0}^{(D-R)} e^{-it} dt,$$

where i is the market interest rate, and Ω is the present value of a \$1 annuity collected from during retirement, evaluated at retirement age using interest rate i . The federal government guarantees the amount in (2), regardless of funding in the plan.¹¹

⁹ In many plans, the final wage is the average of the ‘high-3’ or ‘high-5’, but in pension nomenclature, these are known as ‘final salary’ plans, and are usually modeled as though the benefit was indexed to the last wage.

¹⁰ Some plans pay flat benefits instead of indexing the pension to service and salary, but as long as the flat benefit is increased periodically, the same analysis pertains. Flat benefit plans almost always cover union workers. See U. S. Department of Labor (1999) for the distribution of defined benefit characteristics.

¹¹ Upon termination, vesting for all participants is automatic. With few reductions, the Pension Benefit Guaranty Corporation guarantees the termination benefit.

If the firm does not terminate the pension then the worker stays until age R , in which case he collects his pension indexed to his final wage. The ongoing value of the benefit based on current service evaluated at the same age a based on current service level a is:

$$(3) \quad L_a = b a w_a e^{(g-i)(R-a)} \Omega,$$

where g is the per annum wage growth (including overall increases plus within-firm merit or seniority increases).

Contingent benefits at age a , C_a , equal the difference between these two pensions:

$$(4) \quad C_a = L_a - L_a^*.$$

Making the reasonable assumption that g is on the same order of magnitude as i then contingent benefits as a percent of current wage are:

$$(5) \quad c_a = C_a/w_a = b a \Omega [1 - e^{-i(R-a)}].$$

The capital loss structure in (5) is straightforward, and a fixture in pension economics. Setting R equal to 30, the interest rate to 6.4 percent, and the generosity parameter to 1.1 percent, the value of c_a is portrayed in **figure 2**. The hill-like pattern of losses is familiar. Maximum losses are imposed on workers midstream in the contract, and gradually fall as workers approach retirement age.

B. The Economics of Default Risk in The Employee Contract

Default risk is not a ‘natural’ extension of a defined benefit plan. The firm can eliminate workers’ exposure to pension default risk by funding the plan for ongoing liabilities, and writing the contract in a way that confers pension assets up to ongoing benefits to workers. Indeed, if firms had preferred this approach then the reversion tax legislation would have had no financial and economic consequences for the firm.

Virtually all firms elect to retain the ownership of pension assets; that is, workers hold the explicit property rights to termination benefits, not the assets that back them. Firms explicitly expose workers to default risk in the event that they encounter serious financial difficulty. This is a somewhat puzzling phenomenon, and one that has received little attention. The firm can borrow unsecured credit from the market at the appropriate default premium. Since all the idiosyncratic risk in defaults can be diversified away by market investors, the firm compensates investors for interest, expected default losses, plus any compensation to investors for accepting

systematic risk.¹²

By forcing workers in effect to hold these securities, they are requiring workers to invest a substantial portion of their wealth in an undiversified portfolio; that is, one heavily laden with default risk in the firm. This means that the premium required by workers to accept this risk must be higher, and perhaps considerably higher, particularly in view of the fact that they may already be heavily invested in the firm in the form of firm-specific capital.¹³ Why does the firm choose a more expensive form of financing?

One obvious candidate is that the firm calculates that workers at risk will be less likely to pose agency risk on the firm. It is more apparent how the bond makes sense when workers are unionized, because in this instance, workers can act in concert and may find it optimal to hold up stockholders midway in the contract. I have made this argument elsewhere.¹⁴

Even if workers are not unionized, however, this does not mean that the impact on workers on long-term productivity is zero. If workers as a group have a common stake in the financial success of the firm then presumably they will create an environment where either shirking or an ‘anti management’ attitude is frowned upon by fellow workers. If exposure to risks by workers can reduce default risks sufficiently, then the risk differential must be offset by improved financial performance.

C. Contingent Benefits

The essence of the implicit pension contract is that, if the firm is successful, the plan will not be terminated, and workers receive the full value of their ongoing pension benefits. If the firm encounters sufficient financial stress, however, it may terminate the plan, and pay workers termination benefits. Summing the ongoing and termination liabilities for workers in the firm gives total contingent benefits, C :

$$(6) \quad C = L - L^*$$

These benefits are collectable by workers as long as the firm experiences favorable financial outcomes. Put differently, workers are secured bondholders in the firm up to the amount of legal pension liabilities, L^* . The

¹² In the context of the Capital Asset Pricing Model then if it is more likely for bankruptcies to occur in poor economic conditions then the beta value on these securities is positive, and thus, there is some additional compensation paid to investors to accept the risk of losses when the market portfolio is ‘down.’

¹³ This means that discounting the pension promise by the riskless interest rate is incorrect, but I not address this complication here.

amount, C , is the profit-sharing component of the pension.¹⁵

Historically, firms were allowed to fund for both termination and contingent benefits. Yet, because the firm legally owes workers only termination benefits, by convention, any assets in excess of termination benefits are referred to as ‘excess assets.’ Indeed, if the firm is fully funded for ongoing benefits, excess assets are exactly equal to contingent benefits.

The fact that the firm held the option to cancel contingent benefits did not convey ownership of the excess assets that backed these benefits in the eyes of the law. If the firm canceled contingent benefits, workers lost the contingent benefits, C . This loss represents workers’ share of downside risk in the firm. Indeed, pension terminations have occurred most frequently in firms that evince financial stress.¹⁶

Upon termination, any excess assets (a normal condition in most plans) reverts to the firm, subject to normal corporate tax treatment.¹⁷ That is, upon canceling contingent benefits, the firm automatically freed excess assets for corporate uses.

III. A NEW KIND OF TERMINATION

Plan termination traditionally signaled dire financial circumstances in the firm. Beginning in the early 1980s, sponsors discovered a new twist on termination, one seemingly designed to obtain access to excess assets for corporate profits. That is, the plan sponsor is not permitted to take pension assets. But by terminating a plan and then recreating essentially the same plan, some sponsors argued that they could effectively do just that by the two-step termination process. These events became known as ‘terminations for reversions.’

¹⁴ Ippolito (1985).

¹⁵ Perhaps, we could think of workers as either ‘super’ unsecured bondholder, in the sense that the bond can be made valueless upon the firm encountering a condition short of bankruptcy, or alternatively as workers selling a call option to the firm that comes into the money upon the firm encountering a serious financial condition.

¹⁶ See note 18.

¹⁷ Even if firms do not exercise the option to cancel contingent benefits, the existence of excess assets serves as implicit collateral for general creditors of the firm. In the event of bankruptcy, overfunded pension plans can be terminated with the excess assets distributed to the creditors. Generally, their pension funding positively influences firms’ credit ratings; see Carroll and Niehaus (1998).

A. Terminations for Reversion

In a typical event, the firm would terminate the plan, purchasing annuities for their employees equal to the present value of termination benefits, L^* , then recreate an identical pension with past service credit, which recreated the full ongoing obligation, L . So as to not to overpay workers, they stipulated that the annuities paid in the new plan were offset dollar for dollar by the annuities purchased from the insurance company upon retirement. This stipulation reduced the liabilities in the new plan to the amount C . Thus, by adding the liabilities in the new plan to the old one, the firm recreated exactly the same liabilities it had prior to the termination: $L = L^* + C$. In effect, the firm effected a reversion *without* imposing capital losses on workers.

B. Breaking the Promise

Many ‘terminations for reversion’ occurred in conjunction with corporate events during the period. For example, excess assets sometimes were used to finance a leveraged buyout. The problem that arose for the market for defined benefit plans was that firms sometimes did not recreate the plan after termination, and instead created a defined contribution plan, effectively breaking the implicit pension contract. Indeed, Shleifer and Summers (1988) advanced the theory that the premiums affiliated with leveraged buyouts were attributable to the breaking of implicit contracts, effecting large transfers from workers and other stakeholders to stock holders.

In a study of 169 LBOs over the period 1980-1987, William James and I found that these firms terminated 89 pensions within one year of the LBO. Only 22 were reestablishments; 27 had a new contribution benefit plan and 40 had no new plan. Consistent with other studies, we found that many firms in the latter group could be explained by plant closings and poor financial ratios.¹⁸ But we could not explain the defined contribution replacement events in this way, and these accounted for one in every three terminations. Moreover, in a control (non-LBO) sample, we found that one-in-four terminations resulted in a defined contribution follow on plan. It was not obvious from looking at financial data that these terminations were precipitated by financial problems (Ippolito and James 1992).

¹⁸ Most studies have shown a relation between reversion events and the financial condition of the plan sponsor. See, for example, Mitchell and Mulherin (1989), Mittelstaedt (1989), Petersen (1992), Thomas (1989), Stone (1987), and VanDerhei (1987).

C. The Internal Revenue Service Ruling

The tax rules dating to 1938 seemingly do not allow sponsors to access excess assets unless there is some evidence of errors by actuaries that cause the firm to contribute incorrect amounts to the fund.¹⁹ Presumably, the intent of the language was to ensure that the pension trust fund, which was exempt from corporate taxation, not be used for purposes other than paying pension benefits.²⁰

While many pension terminations occurred during the 1960s and 1970s, they were predominantly underfunded pensions affiliated with business failures (U.S. Congress 1976). In 1971, the IRS issued a ruling in the context of a plan that terminated for ‘business necessity.’²¹ The IRS apparently allowed excess funds beyond those required to satisfy legal obligations to be considered as though they were attributable to actuarial error and eligible for reversion to the sponsor. This ruling had little practical importance for distress terminations, because typically, firms in financial difficulty often defunded the plan of excess assets (through lower contributions) long before bankruptcy was encountered. Thus, prior to the 1980s, the law covering reversions was interpreted quite strictly, with an exception granted to firms in financial distress.

Following the initial ‘terminations for reversion’ in the early 1980s, the IRS issued a dramatically different ruling, and effectively established new tax policy for defined benefit pensions. It announced that upon any termination that fully satisfied the legal obligations of the plan, the firm could take excess assets into corporate profits. The ruling did not appear to be concerned that the tax-exempt pension trust seemingly was created by the Congress to support accumulations for the purpose of paying pension benefits.²² Moreover, the ruling made it clear that the reversions were legal even if the only purpose of the termination was to capture a reversion.

This ruling substantially altered the economics of the implicit pension contract. An implicit contract requires a bonding mechanism for both parties. Workers are bonded by virtue of the fact that if the firm

¹⁹ The common understanding about reversions stems from Section 401(a)(2) of the Internal Revenue Code, and Section 1.401-2(b) of the regulations that interpret the Code. These regulations permit “the employer to recover at termination of the plan trust and only at the termination of the trust, any balance, *which is due to erroneous actuarial computation* (my emphasis).”

²⁰ For a full history of reversion law, see Stein (1989).

²¹ See ruling 71-152.

²² See Ruling 83-52.

encounters severe financial difficulty, then they automatically absorb the downside default risk. For their part, firms were precluded from arbitrarily terminating the pension by a fairly strict tax code that prescribed the use of pension assets for the purpose of paying benefits. The new ruling, however, stripped the latter protection from the contract, and explicitly, permitted a unilateral termination of the contract, regardless of the financial condition of the sponsor.

IV. IMPLICATIONS OF REVERSION TAXES

A. Congressional Reaction

Congressional reaction to the new IRS tax policy was predictable, and it ultimately led to the enactment of a series of reversion taxes. In 1986, Congress enacted landmark legislation changing the corporate tax treatment of excess pension assets: It levied a 10 percent (non-deductible) excise tax on reversions from defined benefit plans (known as ‘the reversion tax’). While the tax rate was modest, it signaled a major alteration in Congressional interpretation on the ownership of excess pension assets, a signal that was reenforced in 1988 when the tax was increased to 15 percent. In 1990, Congress affirmed the new ownership paradigm by increasing the reversion tax to 50 percent.²³ These taxes ended the ‘termination-for-reversion’ phenomenon, but spawned an even more tumultuous period for defined benefit plans.

Ostensibly, the Congress was trying to recreate the ‘old’ environment in which reversions effectively were precluded. It did not perfectly replicate the old law. Indeed, it turns out that the taxes exacerbated the trend away from the implicit pension contract.

The reversion tax affects the value of defined benefit plans to the firm. Prior to 1986, firms could fund their plans so that pension assets covered both the termination liability and the contingent liability, but the firm held an option to cancel the contingent liability by terminating the plan and simultaneously removing the ‘excess assets’ backing the contingent liability. As a result of the reversion tax legislation, firms can continue to fund both components of the pension liability, but as long as the firm maintains excess assets in the plan, the payoff to canceling the contingent liability is severely diminished.

²³ If the sponsor gives 25 percent of the reversion to the participants (in the form of contributions to some other plan), the excise tax is reduced to 20 percent. The reversion also is subject to the normal 34 percent corporate tax, potentially leaving the firm only 16 cents for each dollar of reversion.

Effectively, the new rules mean that, to the extent that firms fund beyond termination benefits, they transform the contingent pension liability into additional secured debt, up to the amount of excess assets. Thus, if it terminates the pension, the firm now can reduce its pension debt burden by the full amount of contingent pension liabilities *only* if it maintains zero excess assets.

If the firm offers a defined benefit plan with no default risk, it can use the tax-free buildup to fund contingent benefits. If workers are exposed to default risk, the tax-free trust fund cannot be used to shelter assets that back the contingent benefits. Simply put, the cost of imposing default risk on workers is higher. The firm can reestablish the full value of its contingent pension debt by gradually reducing excess assets (through lower contributions).

B. Developments in Pension Funding

In effect, the reversion tax gave firms an opportunity to decide anew whether they wanted to continue to expose workers to default risk. If yes, then they would gradually reduce contributions until funding fell closer to termination liabilities. If no, they could forego the exposure by funding their plan closer to ongoing liabilities.²⁴ Judging by the reaction of sponsors, the vast majority decided to retain default risk. Beginning in 1986, and escalating since 1990, defunding in defined benefit plans was widespread and dramatic.

Figure 3 shows the average funding ratio for each year over the period 1980 to 1995 for a longitudinal sample of 1,900 pension plans that I studied over this period (Ippolito 2001). During the early 1980s, funding ratios generally increased, reflecting a rebounding from poor investment returns during the 1970s. But beginning in the mid-1980s, this growth noticeably flattened, and began falling significantly after 1990. In 1986, there was \$125 in pension assets for every \$100 in liabilities in the typical defined benefit plan. By 1995, there was only \$107 in assets for every \$100 liabilities.

The reduction is not explained by changing interest rates used to discount pension annuities. The funding ratios in the figure are calculated using the same 6.5 interest rate in all years. Nor is it explained by poor investment performance. The excess return for a balanced portfolio over the 1986-1995 period was 5.4 percent

²⁴ Plan sponsors face constraints in funding. It may be difficult to either reduce funding to the level of termination liabilities or to increase funding to equal ongoing liabilities, but sponsors have substantial flexibility in how well to fund their plans within pretty wide bounds.

per annum (the dashed line in the figure reflects cumulative excess returns).²⁵ The pattern of funding ratios is not suggestive of gradual changes in the retirement market, say owing to increasing maturity of pensions, but of some stimulus that plausibly explains rapid and systematic change throughout the industry over a relatively short period. Tax policy is an obvious candidate.²⁶

Cross-section distributions of funding ratios for 1986 and 1995 are shown in figure 4, where both distributions reflect liabilities for the same 1,900 longitudinal plans discounted at the same 6.5 percent rate. The bar distribution shows funding ratios in 1995. The solid-line schedule shows the distribution in 1986. The change in funding policy over this period is apparent from inspection. In 1986, funding ratios are distributed widely, reflecting, among other things, a large difference in maturity levels across plans.²⁷ By 1995, the right tail of the distribution is mostly eliminated and the mass of the distribution is shifted markedly to the left.

The dashed-line schedules show the corresponding cumulative distributions. In 1986, 55 percent of plans had funding ratios in excess of 120 percent, and 30 percent were in excess of 150 percent. By 1995, these portions had fallen to about 30 and 10 percent, respectively. Clearly, a dramatic change in pension funding occurred over the period, which predominantly affected the best-funded pensions.

New maximum full funding limits inaugurated in 1987 might explain some defunding.²⁸ That is, since 1987, sponsors have been permitted to fund their plans only if assets are less than 150 percent of terminated liabilities, whereas prior to 1986, sponsors were permitted to fund for ongoing benefits without regard to

²⁵ I use a 50-50 mix of S&P returns and the Solomon bond index returns for the years 1986 through 1994. The excess return is $r = \frac{1}{2} r_s + \frac{1}{2} r_b - r_t$, where r_s is the nominal returns on S&P stocks, r_b is the nominal return on long-term corporate bonds, and r_t is the one-year treasury bill rate. All data are from Ibbotson Associates, *Stocks, Bonds, Bills and Inflation* (1998). Since pension data reflect beginning-year values, the returns I use are lagged one year to correspond to the observations on pension funding.

²⁶ One idea we can rule out is the notion that defunding might reflect attempts by firms trying to defend themselves against a threatened takeover. The *raison d'être* of reversion taxes is to prevent the excess from being used for corporate purposes.

²⁷ Maturity refers to how many young workers are in the firm compared to older workers and retirees. Plans that have disproportionate numbers of young workers means that wage projections in ongoing benefits are important, which makes the difference between legal and ongoing benefits quite large. Since contribution rules are tied to ongoing benefits, assets in the plan normally are much higher relative to termination liabilities (the index used in figure 3), as compared to plans that have mostly older workers and retirees.

²⁸ Numerous restrictions have been made to limit the amount of overfunding in defined benefit plans. Most of these are redundant to the full funding limit of 1988. For a more complete description of all the limits, see ERISA Industry Committee (1996); also see Husted (1989).

termination liabilities. I chose the interest and mortality tables in the calculations of pension liabilities to match these limits in 1995. If the rules were binding, then funding ratios would be bunched around 150 percent. It is apparent from figure 4 that the mass of the distribution no longer is close to this limit.²⁹

I have reported more extensive results based on systematic study of pension funding elsewhere (Ippolito 2001). I estimated the impact of reversion taxes on pension funding, holding constant pension funding limits, plan maturity and other confluences of time trends, and found strong evidence in favor of the reversion-tax theory of defunding. My estimates suggest that as of 1995, excess assets in the universe of defined benefit plans had fallen by 60 percent, or about \$250 billion.³⁰

C. Emerging Trend: Cash Balance Plans

One product created by reversion taxes is the so-called cash balance plan. The cash balance plans is created by a plan amendment to the existing defined benefit plan. It has the effect of awarding each participant an individual 'account'.³¹ Typically, a worker's account is credited with the value of his or her accrued benefits (that is, the legally-mandated ERISA³² benefit) as of the date of the amendment.³³ The plan guarantees a particular

²⁹ Effective in 1988, Congress enacted a new full funding limit on defined benefit plans, which imposed the 150 percent limit. Prior to this time, they were permitted to fund for ongoing benefits. Numerous other restrictions have been made to limit the amount of overfunding in defined benefit plans. Most of these are redundant to the full funding limit of 1988. For a complete description of various interferences in pension funding and other regulations, see ERISA Industry Committee (1996).

³⁰ My estimates suggest that new full funding limits were of minor importance, once account was taken of reversion taxes, a result consistent with Gale (1994). If the reversion tax were eliminated, and sponsors reverted to their pre-reversion tax contribution behavior then the impact of the limits would become binding for many more firms, thereby leading to larger marginal effects.

³¹ The account is a bookkeeping entry, which records the opening balance, plus new contributions made by the employer plus interest, but the assets backing the accounts are still held in a pool managed by the sponsor. The earnings credited to each account typically do not reflect actual earnings in the fund, but are guaranteed the interest rate as stated in the plan document. Thus, there is some chance that the overall fund could have less money than the sum of the 'accounts.'

³² ERISA, or The Employee Retirement Income Security Act of 1974, is the basis for much regulation of private pensions; it includes oversight of fiduciary, vesting, disclosure and funding issues, and authorizes the Pension Benefit Guaranty Corporation to provide mandatory pension insurance to all defined benefit plans. Termination benefits are regulated in non-forfeiture rules.

³³ The ERISA benefit is that amount that is owed workers if the plan terminated immediately. Sometimes, the plan credits some participants' accounts with something less than this amount, but if the employee quits, he cannot receive a benefit with a value less than his accrued benefit at the time of his departure. Legally, the plan does not set up individual accounts for the participants, but instead maintains a pooled asset account that may hold investment instruments entirely different than the guaranteed return stated in the plan. But the plan reports 'account values' to participants as though they have individually owned accounts.

investment return on these monies that often is tied to a market instrument (for example, a Treasury bill rate).³⁴ This guarantee maintains the plan's legal status as 'defined benefit.' Future accruals are very much like traditional defined contribution plans; for example, the plan might award each account x percent of pay for each year of service subsequent to the date of the amendment. Importantly, at the time of the switch to cash balance, pension assets in excess of the legal benefits in the old version of the plan are used to fund future contributions.

In effect, the cash balance conversion allows a plan sponsor to terminate its defined benefit plan, and reestablish a defined contribution plan in its place, without triggering the reversion tax on the excess assets that result from the termination. The available evidence suggests that the conversions are an important part of what we label the 'defined benefit universe.' The U.S. Bureau of Labor Statistics estimates that six percent of workers covered by defined benefit plans in the private sector were in cash balance plans in 1997 (U. S. Department of Labor 1999). Moreover, this estimate is double the three percent calculation in the same survey just two years earlier (Elliot and Moore 2000). The trend continues sharply upwards. Based on preliminary data for the 1999 Form 5500 submissions, a better estimate for 1999 may be more like 20 percent.³⁵

V. A SIMPLE LEMONS MODEL

The cumulative effect of terminations for reversion, the reversion tax, defunding, and the drift towards defined contribution and cash balance plans, in combination, have increased the cost of the implicit pension contract. The essence of this idea can be demonstrated using a simple model in which two pension alternatives exist, defined contribution and defined benefit.

A. The Equivalence of Two Pensions

Consider a two-period model. Individuals are risk neutral, pay no income tax, work in period one and retire in period two. The plan sponsor faces a corporate tax rate equal to τ . Workers can take a job in a firm that offers a defined contribution plan that pays cash wage $1-\alpha$ at the start of period one. The amount α is deposited in

³⁴ When the amendment is made, the sponsor calculates the present value of legal pension liabilities; and creates individual account balances usually in these amounts. Assets beyond these amounts ('excess assets') are retained in the plan. The firm awards future contributions to each worker's account on the basis of some formula (often a percent of pay). The key feature of the cash balance plan is that it requires only an amendment to the plan, not termination, and thus, does not trigger the reversion tax on excess assets in the plan. The firm can make future contributions to employees' accounts from excess assets.

³⁵ This estimate is based on about 50 percent of records received for that year. The 1999 cycle is the first in which the questions asked whether defined benefit plans in fact are cash balance. Cash balance conversions are concentrated in larger plans.

a pension account that invests in riskless securities, and thus, accumulates with interest rate, i . The property rights to the account convey fully and immediately to the worker. Pension plans assets accumulate at the tax-free rate; that is, earnings are not subject to corporate tax).

Alternatively, workers can take a job in a firm that offers a defined benefit pension plan. These firms pay wage w at the start of period one and award a pension P payable at the start of period two. The firm fully funds the pension and invests the assets in riskless securities. In this simple model, either the firm survives or not. The firm fails with probability v , in which case the pension is worthless. In the upside state, workers gain the property rights to the defined benefit pension. For simplicity, assume that the defined benefit pension equals the cash wage in a present value sense ($P = (1+i)w$).

The expected present value of compensation in the defined benefit firm must equal the present value compensation in the defined contribution firm.

$$(7) \quad w + (1-v)w(1+i)/(1+i) = 1 - \alpha + \alpha(1+i)/(1+i),$$

which simplifies to:

$$(8) \quad w = 1 / (2 - v).$$

Workers require the wage rate, w , to just be willing to accept a job in a firm that offers a defined benefit plan. The numerator on the right hand side of (8) is total compensation in the firm offering a defined contribution plan. If default risk is zero ($v=0$) then the wage and the present value of the pension in the defined benefit firm each are $1/2$. If default risk is positive, then in order to offset the chance that the pension will be zero owing to default risk, the wage plus present value pension in the DB firm must exceed unity in the good state.³⁶

The cost for the firm to provide a defined benefit plan equals the cash wage, plus the product of the pension amount and the probability that the firm will not default:

$$(9) \quad C = w + (1-v)w(1+i)/(1+i).$$

Substituting workers' required wage from (8), then it is obvious that the expected cost of offering the defined benefit plan is the same as offering a defined contribution plan:

$$(10) \quad C = 1.$$

³⁶ The expected value of compensation in the DB firms is $(1-v)[2/(2-v)] + v/(2-v) = 1$.

If the firm does not fail then defined benefit workers collect compensation in excess of their counterparts who work in defined contribution firms, and less if their firm encounters bankruptcy. This is the risk-sharing aspect of the defined benefit pension.

B. Impact of reversion taxes and terminations

The accumulation of terminations and cash balance conversions causes workers to reevaluate the probability of termination. They do so not because they change their estimate of the firm's bankruptcy probability, but because they perceive some additional chance of termination or conversion to cash balance, independent of firm bankruptcy. They assess the probability of *contract default* as ε .

The new asking wage. I denote the new asking wage as \hat{w} . Recall my assumption that the pension equals the wage rate (that is, I assume 100 percent replacement rate). The present value of the wage (and pension) in defined benefit firms must be the equivalent to the present value of compensation in firms offering defined contribution plans:

$$(11) \quad \hat{w} + (1 - v - \varepsilon) \hat{w} (1+i)/(1+i) = 1 - \alpha + \alpha (1+i)/(1+i).$$

Simplifying, (11), the wage (and pension) in the defined benefit firm is;

$$(12) \quad \hat{w} = 1 / (2 - v - \varepsilon).$$

The prospect of contract default increases the supply wage to defined benefit plan sponsors; and in particular, the change in supply wage is:

$$(13) \quad \hat{w} - w = \varepsilon / [(2 - v)(2 - v - \varepsilon)] > 0.$$

The higher is their perception of a unilateral contract default, the less workers are willing to pay (in the form of foregone wages) for the uncertain pension.

This problem for the firm is apparent. If workers' estimation of contract default, ε , exceeds the firm's assessment, say ε^0 then a wedge develops between the value of the pension as perceived by workers, and the cost of providing the pension absorbed by the sponsor.

Add the reversion tax. We also need to take into account that, independent of the probability of termination, the effect of reversion tax policy is that firms can expose workers to default risk only by saving for the pension outside the tax-free trust fund. That is to say, earnings on deferred compensation that are subject to default and contractual risk, are now subject to the corporate income tax. The defined benefit pension therefore is

discounted inside the firm at rate $1 + i(1 - \tau)$.

The cost of offering a defined benefit plan in the new environment is therefore equal to:

$$(14) \quad \hat{C} = \hat{w} + (1 - v - \varepsilon^0) \Gamma \hat{w}, \quad \text{where } \Gamma = (1 + i)/(1 + i(1 - \tau)) > 1.$$

Substituting workers' required wage from (12) gives us:

$$(15) \quad \hat{C} = [1 + (1 - v - \varepsilon^0) \Gamma] \div (2 - v - \varepsilon).$$

Thus, using (10), the increase in cost of offering a defined benefit plan expressed as a percent of the new asking wage, is:

$$(16) \quad \Delta c = (\hat{C} - C) / \hat{w} = (1 - v)(\Gamma - 1) - \varepsilon^0 \Gamma + \varepsilon.$$

Let the workers' perception of the unilateral termination probability, ε , equal the firm's own assessment of this probability, plus some amount, δ , which can be zero, positive or negative:

$$(17) \quad \varepsilon = \varepsilon^0 + \delta.$$

Substituting (17) into (16), we have:

$$(18) \quad \Delta c = (1 - v - \varepsilon^0)(\Gamma - 1) + \delta.$$

It is apparent that the cost of offering a defined benefit plan increases for two reasons. The first term is attributable to the defacto new tax on defined benefit pensions (which makes $\Gamma > 1$). The impact of the tax is larger, the smaller the probability that the firm will default on the pension promise, either owing to bankruptcy or contract default. Apart from the direct tax effect, the cost also increases in proportion to the amount by which workers overstate the probability of the firm renegeing on the pension promise, as embodied in the term, δ .

C. The Makings of A Lemons Market

The bigger the wedge between workers' estimate and the firm's own assessment of unilateral termination, the larger is the cost of maintaining the defined benefit pension plan. Oddly, if workers *underestimate* their sponsor's likelihood of renegeing then this error works in the direction of reducing the cost of offering the defined benefit plan.

We now have the makings of a lemons market. Suppose that workers assess their employer as having average trustworthiness; that is, they set ε equal to ε_{bar} , where ε_{bar} is the overall observed probability of

³⁷ The epsilon also appears in the denominator.

reneging on the pension among all pension sponsors last period. I suppose that this average is an unbiased estimate of firms' collective perception; that is,

$$(19) \quad \varepsilon bar = (1/n) \sum_{j=1}^n \varepsilon_j^o .$$

Thus, the error made by workers in the j^{th} firm is δ_j :

$$(20) \quad \delta_j = \varepsilon bar - \varepsilon_j^o$$

For firms that are least trustworthy, that is, $\varepsilon_j^o \gg \varepsilon bar$, the cost of offering defined benefit plans is more likely to fall because workers understate the true probability of unilateral default. These are the most likely sponsors to continue offering the defined benefit plan. For firms that are most trustworthy, that is, $\varepsilon_j^o \ll \varepsilon bar$, the cost of offering their defined benefit plan increases significantly because workers overstate the true probability of unilateral termination, and therefore understate the true value of the plan. These firms are least likely to continue offering a defined benefit plan.

As the most-trustworthy firms leave, the pool gradually becomes disproportionately populated with firms more likely to renege on the contract. As this process plays out, workers covered by defined benefit plans in the aggregate increase their collective estimate of εbar , a process that pushes the market closer to a corner solution.

To a trustworthy firm, the problem manifests itself in a growing perception that the generous pension plan it is offering, at considerable cost, seems to be heavily discounted by its covered workers. Workers, it will seem, attach more value to defined contribution pensions. As this wedge grows, the net benefits of offering the defined benefit variety become smaller. Put simply, if workers act as though the firm is less trustworthy than it really is, then the only profitable option for the firm is to fulfill its workers' expectations, by simply reneging on the promise. Once the firm defaults on its implicit contract, it has only one option, namely to offer a defined contribution or cash balance plan, which effectively are bonded. In other words, if workers believe that the firm is not trustworthy, then it will be.

D. Factors that Can Preserve Some Coverage

The only way in which this process can find equilibrium with a positive share of defined benefit coverage is for plan sponsors that are trustworthy to be able to convey their unusually high trustworthiness to employees, which is problematic if other firms with similar characteristics have either terminated their plans or converted to cash balance. Additionally, even if the firm is trustworthy, the question naturally arises whether the firm will be subject to a change in corporate ownership in which case it might not be trustworthy next period (Shleifer and Summers 1988).

In the private sector, some bond is required to enforce the firm's part of the contract. This can occur if the firm is willing to forgo exposing its workers to default risk, in which case it can contract to guaranty the payment of ongoing benefits by essentially awarding the workers ownership of pension assets. Unions can maintain their pensions because they are protected by explicit collective bargaining agreements, making it costly for the firm to renege.³⁸ In the public sector, defined benefit plans could be terminated, but presumably, if sufficient numbers of voters are public employees, and if they care intensely about the pension issue, a mechanism exists to effectively bond the pension. Otherwise, it is difficult to envision the mechanism by which the lemons market does not develop.

The most effective way to create a bond is simply to use a defined contribution plan. In these plans, vesting can be immediate (and usually occurs within 2 years). Workers effectively own their accounts, which means that they own all contributions plus earnings; and often, workers are given discretion on the portfolio composition of their accounts. When they depart the firm, they usually take the lump sum in their accounts with them. Put simply, the main attribute of defined contribution plans that distinguishes them from their defined benefit counterparts is that workers own all the pension assets. In effect, defined contribution plans are the ultimate solution to the unraveling of the implicit pension contract, because they offer perfect bonding of the pension promise.

³⁸ Absent binding language, if the firm and union allow an agreement to expire, without replacing it in the interim then technically, the firm might be able to terminate the pension. Presumably, the union could react in ways that could make this action costly for the firm. These events must be exceedingly rare.

VI. CONCLUDING REMARKS

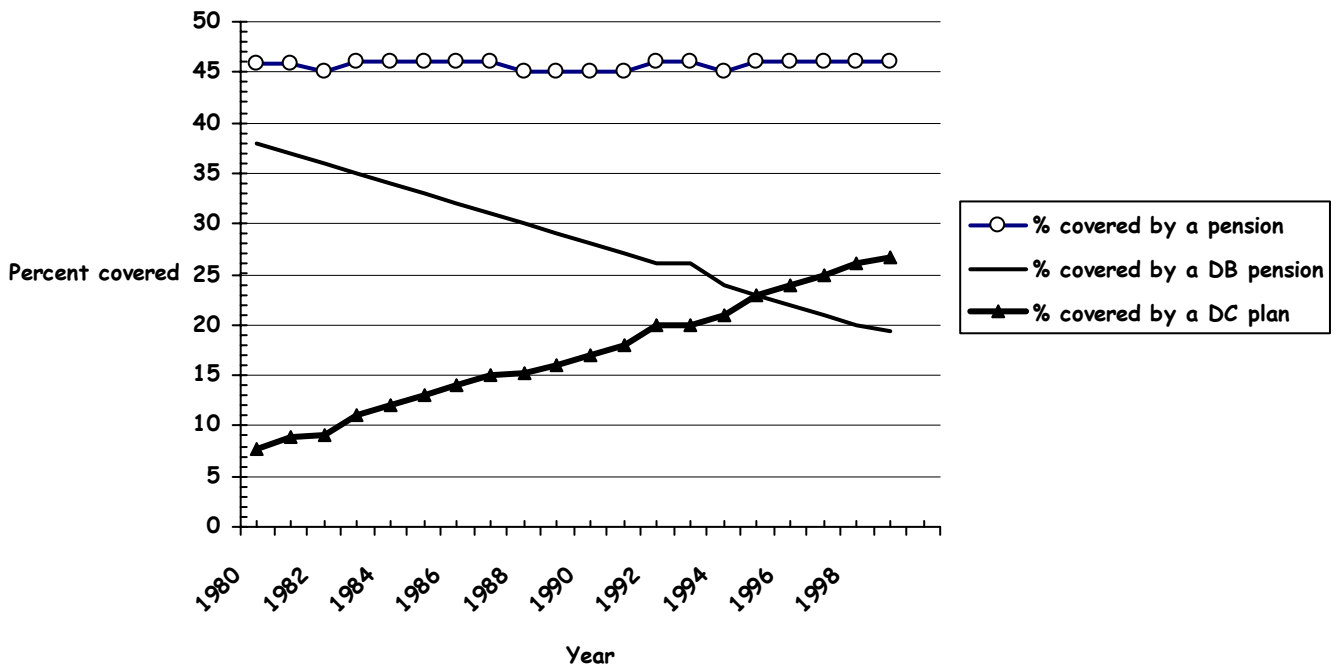
The recent history of pension plans in the United States shows the power of public policy, and the sensitivity of equilibrium to assigned property rights. Implicit contracts are by their nature tenuous. In the U.S., they were sustained largely by a tax policy that made it difficult to use pension assets for purposes other than paying pension benefits. In the event of (near) firm failure, firms typically reduced funding to limits below legal liabilities, and so, as a practical matter, the issue reversions in the context of a 'distressed firm,' was never an issue.

When the Internal Revenue Service changed its policy in 1983 to effectively allow all excess assets to revert to the plan sponsor, regardless of the nature of the termination, the pension institution began a process to find a new equilibrium. The Congress tried to rediscover the old equilibrium by instituting a series of reversions taxes. These taxes raised the cost of engaging in contract default. They also made it more costly to expose workers to financial default risk, which is a core feature of defined benefit plans. Firms reacted by engaging in widespread defunding, and converting to cash balance plans.

Without the bonding provided by the IRS, the only sustainable plans are those that have a bonding feature. Outside union plans, which are protected by explicit collectively bargaining agreements, this bonding takes the form of defined contribution plans, the property rights to which reside with the participants themselves.

The new equilibrium does not necessarily imply dramatic reductions in efficiency in the firm; nor does it necessarily imply a change in the distribution of pension wealth among participants. Defined contribution plans can reduce quitting and encourage retirement; accomplish desirable sorting (Ippolito 1997); and expose workers to financial default risk (Ippolito forthcoming). Firms must accomplish these outcomes, however, within the constraints of strictly bonded pensions.

Figure 1: Percent of Private Labor Force Covered by Type of Pension, 1980-1999



Source: U.S. Department of Labor, Private Pension Plan Bulletin: Abstract of 1995 Form 5500 Annual Reports, Pension and Welfare Benefits Administration, Number 8, Spring 1999. Participants in 401(k) plans who do not contribute are not included as pension covered in these data.

Figure 2

Pension Capital Losses From Firm Failure

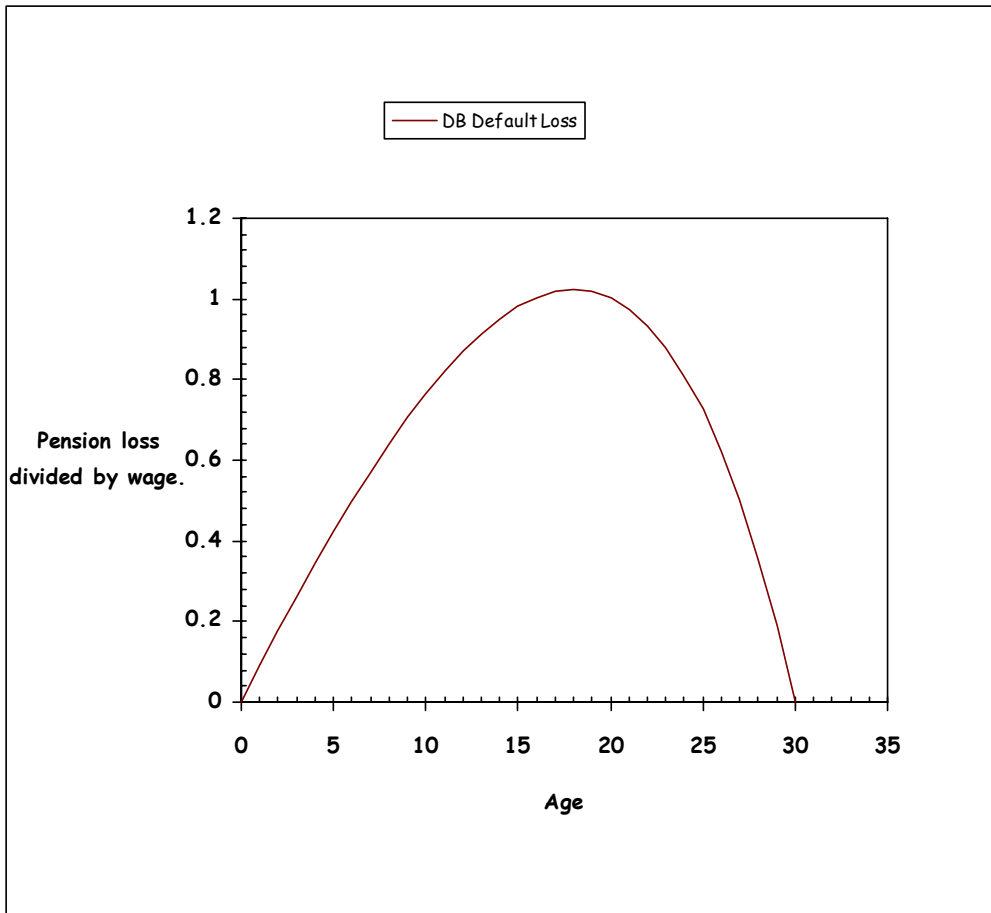
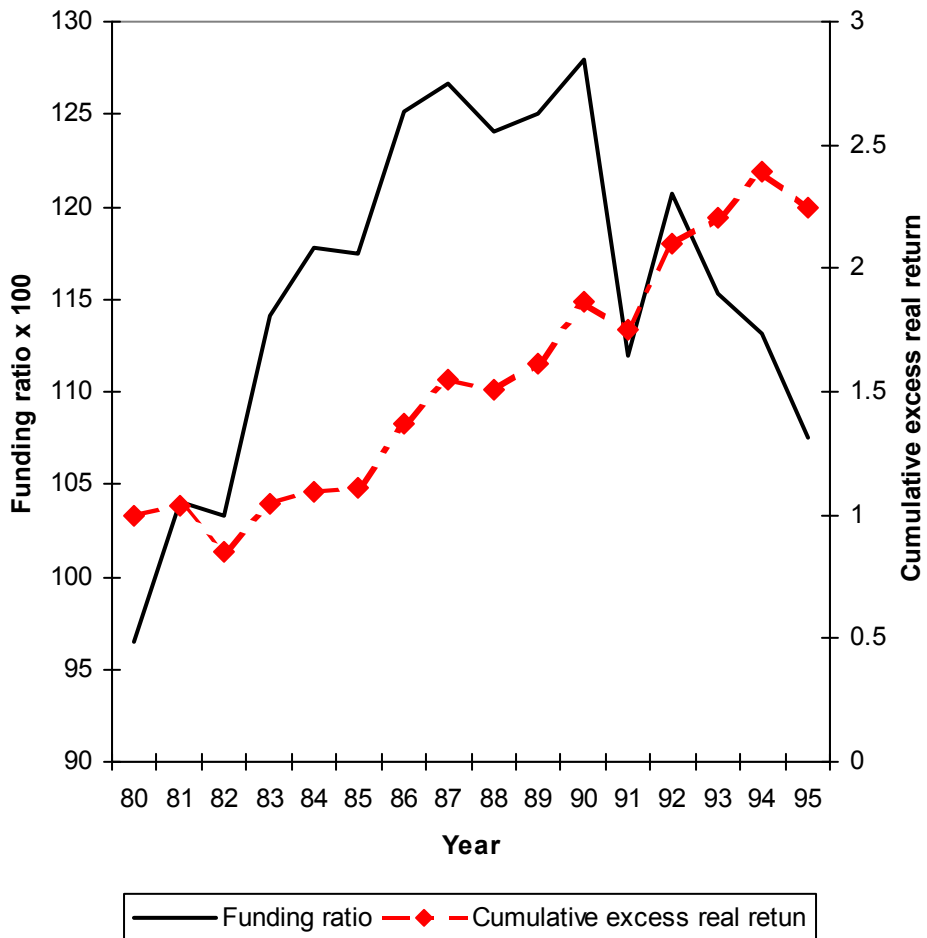
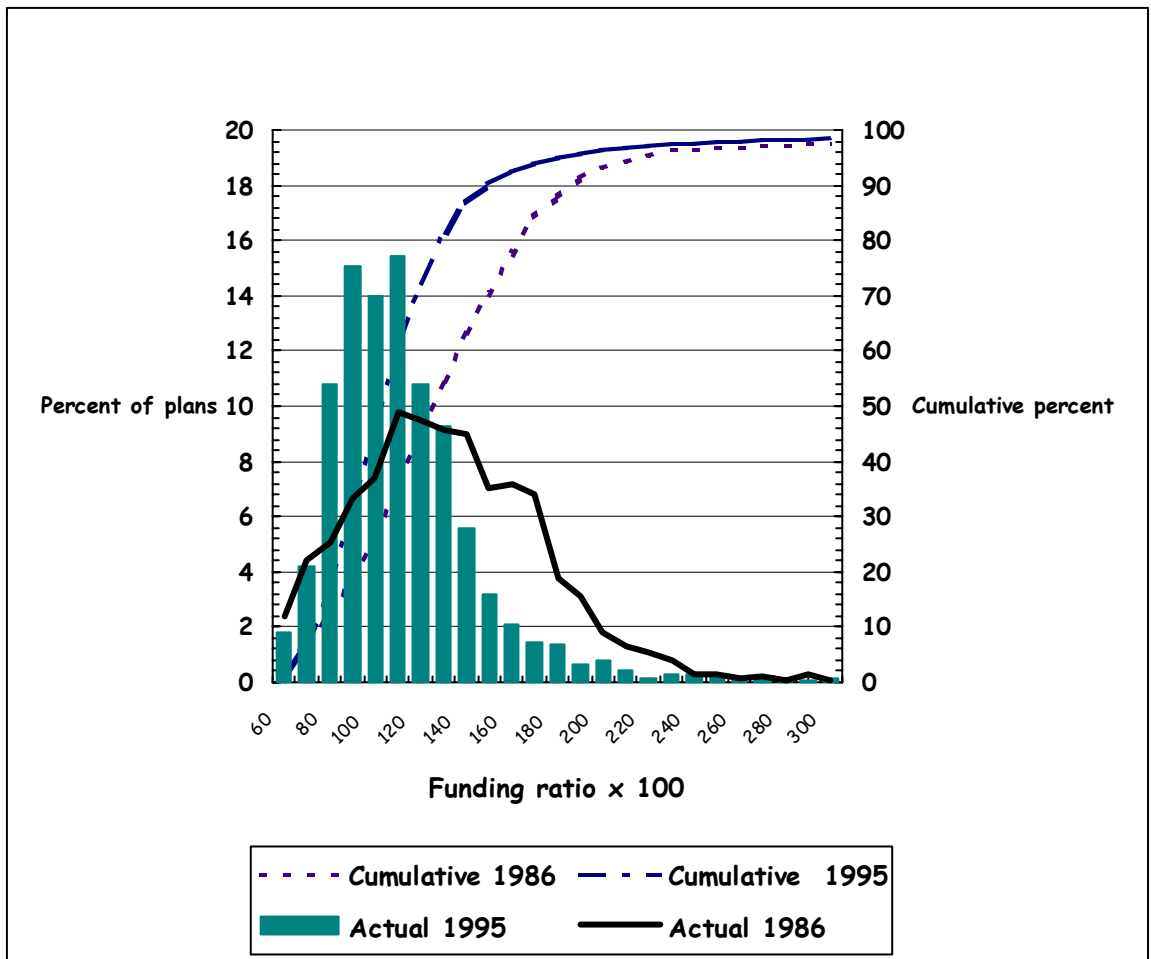


Figure 3
Funding Ratios, 1980-1995



Source: Funding ratios: Longitudinal data base, form 5500 annual pension reports. All liabilities are adjusted to a 6.5 percent interest rate and GAM 83 mortality table. . Numbers reflect beginning-year values. Excess returns are equal to the return on a 50-50 portfolio of stocks and bonds minus the one-year Treasury bill rate from Ibbotson Associates, Stocks, Bonds, Bills and Inflation 1926-1998.

Figure 4
Funding Ratios, 1986 versus 1995



Source: Longitudinal data base, form 5500 annual pension reports. All liabilities are adjusted to a 6.5 percent interest rate and GAM 83 mortality table. Numbers reflect beginning-year values Longitudinal data base.

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