

Pension Funding Rules and Sponsor Firms' Risk Taking with Defined Benefit Pension Plan Assets

Joseph Comprix,^{a,*} Karl A. Muller III^b

^a *W. P. Carey School of Business, Arizona State University, Tempe, AZ 85287, USA*

^b *Smeal College of Business, Pennsylvania State University, University Park, PA 16802, USA*

Abstract

Current ERISA and IRC funding rules for defined benefit pension plans permit sponsors of underfunded plans with funding standard account (FSA) credit balances to forgo making contributions, even for severely underfunded plans. Because such credit balances insulate sponsors from making contributions for incurred losses, sponsors of plans with large FSA credit balances may influence plan trustees to invest plan assets in riskier investments. Consistent with these incentives, we find that underfunded plans with large FSA credit balances earn higher average returns and experience higher return variance on their plan assets relative to those with small credit balances, especially as the underfunding worsens.

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*Corresponding author
Smeal College of Business
Department of Accounting
384 Business Building
The Pennsylvania State University
University Park, PA 16802
E-mail: kam23@psu.edu

“The funding rules allow contribution holidays even for seriously underfunded plans. One reason for contribution holidays is that companies build up a “credit balance” for contributions above the minimum required amount...They can then treat the credit balance as a payment of future required contributions, even if the assets in which the extra contributions were invested have lost much of their value.”

-- Testimony of Bradley D. Belt, Executive Director PBGC, before the Subcommittee on Select Revenue Measures, Committee on Ways and Means, United States House of Representatives, March 8, 2005

1. Introduction

Regulators and the financial press (e.g., Walsh 2005) have expressed concern regarding the incentives created by pension funding rules. Existing pension funding rules (i.e., Employee Retirement Income Security Act of 1974 (ERISA) and Internal Revenue Code (IRC) funding rules) for defined benefit pension plans permit firms to avoid making contributions to underfunded plans, even when they are severely underfunded. Under these rules, firms sponsoring defined benefit plans are allowed to substitute net funding standard account (FSA) credits for cash contributions.

FSA credits arise from transactions that improve plan funding—primarily employer contributions.¹ Generally as pension plans become underfunded, sponsor firms are required to make at least a minimum level of contributions to the plans. However, FSA credits can buffer firms from making further contributions, even though their pension plans have suffered large investment losses. Under current pension accounting rules, plans meet their minimum funding requirements so long as the firm has net FSA credits regardless of the actual funding level of the pension plan.

Unexpected poor investment performance does affect FSA credits, but not immediately. Instead, investment losses reduce the FSA credit gradually over time—typically five years. Congress established these rules requiring the gradual recognition of unexpected changes in

¹ Credits are also generated by amortized experience gains and interest. Credits are offset by charges, such as normal cost (annual cost of pension benefits) and amortized losses of items, which includes experience losses and increases in a plan’s benefit formula. A firm has a net credit balance when credits exceed charges. These balances can be carried forward into future years.

pension assets, as well as liabilities, in order to smooth out year-to-year fluctuations in sponsors' required contributions. A potential consequence of these smoothing rules is that defined benefit plans suffering large investment losses can remain underfunded for years without sponsor firms facing required contributions, which increases the risk of the Pension Benefits Guarantee Corporation (PBGC) assuming the liabilities of extremely underfunded plans.²

The goal of our study is to examine whether pension funding rules for defined benefit plans unintentionally encourage risk-taking with pension plan assets. Specifically, we investigate whether plan trustees are influenced by sponsor firms to increase the investment risk of the plan assets for plans with sizable net FSA credit balances. We expect such behavior due to the lower risk of unplanned contributions arising from an investment loss. For firms whose plans are underfunded (particularly for firms with extremely underfunded plans), we expect to find the highest level of investment risk since underfunded plans will lead to greater required minimum funding contributions in future years due to the eventual recognition of past charges and experience losses in minimum funding calculations.

Of course, whether sponsor firms can influence plan trustees to increase the risk of the plan assets is an open question as plan trustees must abide by ERISA standard of conduct requirements, which dictate that trustees act solely in the interests of plan participants and beneficiaries. However, prior related research provides evidence that trustees select asset allocations with higher investment risk when: (1) plans are better funded, and thus, better able to absorb investment losses (Petersen 1996 and Frank 2002); (2) sponsor firms' (non-pension) business risk is lower, and thus, are better able to meet required contributions from investment

² A recent General Accountability Office study (GAO, May, 2005) found that of the 100 largest pension plans, an average of 62.5 did not make any contribution to their pension plan in any given year from 1995-2002—largely due to FSA credits. Of more concern, even plans that ended up being terminated used FSA credits to avoid funding their plans. Both Bethlehem Steel and LTV Steel used FSA credits to avoid making cash contributions to their pension plans from 2000-2002. The PBGC eventually assumed \$3.7 billion and \$2.2 billion of unfunded pension obligations resulting from the termination of their plans, respectively.

losses (Friedman 1982; Petersen 1996; and Frank 2002); and (3) the tax benefits of investing in bonds are lower (Frank 2002). Our study extends this line of research by investigating whether trustees increase the investment risk of the plan assets due to the existence of net FSA credit balances, and whether such increases are relatively greater when plans are underfunded—especially, as the level of underfunding worsens.

Our findings are consistent with FSA credit balances encouraging greater risk taking with pension plan assets for underfunded plans (as defined by ERISA funding rules). Specifically, we find that, for underfunded plans, both the means and the variances of returns on plan assets increase with the level of the net FSA credit balance increases. In addition, we find evidence that the relatively higher investment risk for underfunded plans with net FSA credit balances becomes even more pronounced as the level of underfunding worsens. Our findings fail to support the hypothesis that FSA credit balances encourage greater risk taking with plan assets for overfunded plans. This is perhaps not surprising, as overfunded plans with FSA credit balances do not face impending minimum funding contributions. However, consistent with the findings of prior research, we do find evidence that the returns on the plan assets exhibit greater variance (but not a higher average) for overfunded plans that have higher funding levels. Also, consistent with the findings of prior research, we find that the investment risk of the plan assets increases when the sponsor firm faces lower marginal corporate tax rates, business risk and ability to generate resources internally, and when the pension plan liability duration is longer.

These findings offer a number of contributions. They suggest that the smoothing mechanisms in pension funding rules provide incentives for sponsor firms to increase the investment risk of pension plan assets. In addition, they suggest that underfunded plans behave very differently to this incentive relative to overfunded plans. While prior research provides evidence that the investment risk of plan assets increases with the level of funding, our findings suggest that, for underfunded plans with net FSA credit balances, the investment risk of plan assets *decreases* with the level of funding—especially as plans' net FSA credit balances grow.

However, consistent with prior research, our findings also suggest that, for overfunded plans, the investment risk of plan assets increases with the level of funding. Taken together, our findings suggest that plan trustees are influenced by sponsor firms to take relatively greater investment risk with the plan assets because of net FSA credit balances when the plans are least able to meet their obligations. Finally, Congress is currently debating how to revise the existing pension funding rules. The use of the funding standard account rules and the related smoothing of investment gains and losses is one of many items being considered for elimination. Whether the unintended incentive to increase the investment risk of plan assets due to the presence of net FSA credit balances outweighs the intentional benefit of reducing year-to-year fluctuations in sponsors' required contributions can only be judged by Congress.

The remainder of the study proceeds as follows. Section 2 discusses pension funding rules and develops our research hypotheses. Section 3 describes our sample selection procedures and our data. Section 4 presents our empirical results. Section 5 briefly summarizes and concludes the study.

2. Pension funding rules and hypothesis development

2.1. Pension funding rules

Private pension plans include defined contribution (e.g., 401(k) plans) and defined benefit plans. Sponsors of defined contribution plans face contractually specified contributions, but no investment risk, as the investment risk of the plan is borne solely by the participant. In contrast, sponsors of defined benefit plans must make specific payments upon participants' retirement. Typically, upon retirement, the participant receives a monthly annuity until death. Accordingly, the funding and investment risk of the defined benefit pension plan is borne by the sponsor.

The Pension Benefit Guarantee Corporation (PBGC) safeguards beneficiaries' defined benefit pension obligations up to certain limits, currently \$45,614 annually. The PBGC was established as a private government insurance corporation under the Employee Retirement

Income Security Act (ERISA) of 1974. The funding rules prescribed by ERISA and the Internal Revenue Code (IRC) of 1986, as amended, require plan sponsors to calculate whether a contribution is necessary to ensure the funding of promised pension benefits. In addition, ERISA requires plan sponsors to fund the private insurance coverage by making mandatory annual premium payments to the PBGC through a participant charge (currently \$19 per participant) and a variable-rate charge depending on the existence and level of an unfunded pension obligation.

ERISA also gives the PBGC legal remedies to safeguard and recover participants promised benefits. For terminated plans, the plan sponsor and other controlled entities are jointly and severally liable to the PBGC for the underfunded obligation. ERISA permits the PBGC to place a statutory lien on the controlled assets of the sponsor (up to 30% of their net worth) to cover unfunded pension obligations. For severely unfunded plans, the PBGC can choose to force an involuntary termination of a plan and place a lien on the sponsor's assets.

Annual required contributions by sponsor firms into defined benefit pension plans are determined by two mandatory ERISA and IRC calculations. The first, the minimum funding requirement calculation, determines the standard annual contribution for pension plans. The other, the additional funding charge (AFC) calculation, determines the possible additional contribution for severely underfunded pension plans.

The minimum funding requirement calculation is intended to ensure adequate funding of defined benefit pension obligations—i.e., that sponsors will at least make contributions that fund the pension plan's "normal cost" and the amount of amortization arising from "unfunded past service liabilities" and from "experience gains and losses." The normal cost represents the increase in pension benefits earned by participants during the year. Unfunded past service liabilities represent obligations arising from the initial plan adoption and retroactive plan amendments. Experience gains and losses represent differences between actuarial assumptions and actual gains and losses, and gains and losses arising from changes in actuarial assumptions.

The funding standard account (FSA) is the accounting mechanism by which actuaries track pension plans' minimum funding requirements under IRC Section 412. The balance of the FSA is affected by credits (transactions improving funding) and charges (transactions worsening funding). If credits equal or exceed charges, the FSA will have a net credit balance and no contribution is required to meet the minimum funding requirements, regardless of the actual funding level of the pension plan. Conversely, if charges exceed credits, the pension plan will have a net accumulated funding deficiency, which will require the sponsor to make a contribution to meet the minimum funding requirements. End-of-year credit and deficit FSA balances are carried forward to the following plan year.

Appendix 1 provides an example (abbreviated) Form 5500 for the Becton Dickinson & Co. Retirement Plan for 2002 illustrating the funding deficiency calculation. As shown in the example, credits to the FSA represent: (1) a prior year credit FSA balance, if any; (2) employer contributions; (3) amortization of credits as of the valuation date; (4) applicable interest; (5) full funding limitation credits; and (6) waived funding deficiency credits. Charges to the FSA represent: (1) a prior year funding deficiency, if any; (2) the employer's normal cost for the current plan year; (3) amortization of charges as of the valuation date; (4) applicable interest; (5) additional interest due to late quarterly contributions; and (6) the additional funding charge, if any. For the Becton Dickinson & Co. Retirement Plan, no contribution is necessary for 2002 under the minimum funding requirements because the total credits of \$219,393,475 exceed the total charges of \$62,308,302.

In addition to considering their FSA balance, sponsors must consider the additional funding charge requirement when determining whether they are required to make a contribution to their pension plans. To prevent severe underfunding of pension plans, sponsors must determine each year whether they are required to make an additional funding charge payment. When the actuarial value of assets falls between 80% and 90% of the plan's liabilities, sponsors can be liable for additional funding charges. However, sponsors are not liable if the plan was

funded at above 90% for at least two consecutive of the last three years. When the actuarial value of assets falls below 80% of the plan's liabilities, sponsors can be liable for additional funding charges regardless of the plan's prior funding history. Appendix 2 provides an example (abbreviated) Form 5500 for the Becton Dickinson & Co. Retirement Plan for 2002 illustrating the required additional funding charge calculation.

Although additional funding charges provide a disincentive for sponsors to severely underfund their pension plans, the disincentive is not strong. This occurs for two reasons. First, the funding levels employed for the additional funding charge calculations generally overstate actual funding levels. The calculations measure the current liability using the highest allowable interest rate, resulting in the lowest possible current liability measurement. As illustrated in Appendix 2, the measurement of the current liability for the Becton Dickinson & Co. Retirement plan can differ substantially when the highest possible interest rate is used. The current liability as normally estimated is \$603,552,086, whereas the liability estimated using the highest allowable rate is only \$455,898,508. Accordingly, severely underfunded plans are frequently not required to make an additional funding charge payment. The other reason is that FSA credits can be used to offset any additional funding charge. As discussed earlier, additional funding charges are included as charges to the funding standard account. Thus, to the extent that FSA credits exceed the FSA charges, firms can avoid making cash contributions, even though the plan may be severely underfunded.

2.2. Hypothesis development

The minimum funding requirements allow underfunded plans with net FSA credits to substitute such credits for cash contributions. This can allow a sponsor of an underfunded plan to avoid making cash contributions for years. This accounting artifact occurs because unfunded past service liabilities and experience gains and losses are not recognized immediately as charges and credits; instead, they are recognized only gradually through systematic amortization. The time over which these amounts can be recognized as charges and credits can be substantial. For

instance, unfunded past service liabilities can be amortized over 30 or 40 years (depending on when they were created). Experience gains and losses can be amortized over 5 to 15 years (depending on when, and how, they were created).

Although the minimum funding rules were established to reduce year-to-year fluctuations in sponsors' required contributions, they could also encourage sponsors to undertake risky investments with the pension plan assets. This could occur as sizable net FSA credit balances insulate sponsor firms from making required minimum funding requirement contributions if the plan suffers an investment loss resulting in the plan being underfunded. Under the minimum funding rules, investment losses are treated as experience losses and are amortized over 5 years. Accordingly, pension plans with large net FSA credit balances can avoid making minimum required contributions as long as the amortization of the investment loss does not result in a net FSA charge balance. In contrast, pension plans without large credit balances will face future required contributions due to recognition of the amortization of the investment loss.

The incentive for sponsor firms to undertake risky investments increases with the level of underfunding. As underfunded plans face amortization of net past charges and experience losses, sponsor firms face greater future minimum funding requirement contributions, which grows with the level of plan underfunding. This provides an incentive for sponsor firms of underfunded plans to encourage plan trustees to undertake greater investment risk with the plan assets to generate higher expected future returns and reduce future funding requirements. Again, the existence of large net FSA credit balances insulate sponsor firms from making required minimum funding requirement contributions if the plan suffers an investment loss. Thus, the incentive to increase the investment risk of the pension assets is stronger for plans with large net FSA credit balances.

Whether sponsor firms are able to take advantage of these incentives is unclear. Changing the investment risk of the plan assets requires sponsor firms to obtain the consent of

plan trustees.³ However, plan trustees should support sponsor firms' requests as long as changing the investment risk of the plan assets is in accordance with plan documents and is consistent with ERISA standard of conduct requirements. Of course, plans' trustees must be assured that sponsor firms will honor their pension obligations if pension shortfalls obtain.

In addition, prior research provides evidence that sponsor firms successfully influence trustees to select the investment risk of the plans' assets to offset their business risk and minimize their contribution risk and taxes. Friedman (1982), Petersen (1996) and Frank (2002) find that sponsor firms with higher levels of (non-pension) business risk have pension plans holding assets with lower investment risk. Moreover, Petersen (1996) and Frank (2002) find evidence that better funded pension plans (which face less risk of unplanned required contributions) hold assets with greater investment risk. Finally, Frank (2002) finds evidence that the allocation of pension plan assets into bonds relative to equities is affected by sponsor firms' potential tax benefits. We extend this line of research by investigating whether increases in the investment risk of plan assets are associated with net FSA credit balances, and whether such increases are relatively greater when plans are underfunded, especially as the level of underfunding worsens.

Based on the above discussion, we state the following research hypotheses (in alternative form):

H₁: The investment risk of the plan assets increases with the level of net FSA credit balances.

H₂: For pension plans with large net FSA credit balances, the investment risk of the plan assets is larger for underfunded plans.

H₃: For underfunded pension plans with large net FSA credit balances, the investment risk of the plan assets increases with the level of underfunding.

³ Section 404 of ERISA requires fiduciaries—which includes plan trustees—to discharge their duties with respect to pension plans (Melbinger 2005): 1) solely in the interests of participants and beneficiaries; 2) for the exclusive purpose of providing benefits to participants and beneficiaries and defraying the reasonable expenses of administering the plan; and 3) with the care, skill, prudence, and diligence under the circumstances then prevailing of a prudent person expert in such matters, and in accordance with the plan documents, insofar as such documents are consistent with ERISA. Fiduciaries are personally liable for any losses resulting from breaching ERISA standard of conduct requirements.

3. Sample selection and data description

We test our hypotheses using data from pension plans' Form 5500 filings and from COMPUSTAT. Private pension plans representing over 100 participants are required to file annually a Form 5500 with the IRS. We restrict our sample to those Form 5500 filings made by defined benefit pension plans whose sponsor firm is publicly listed (because of data requirements). In addition, we restrict our sample to sponsor firms' fiscal years ending 1996 to 2002. We are limited to these years because our data provider, Judy Diamond & Associates, currently covers these plan years. However, this time-period is advantageous to the testing of our hypotheses as no major regulatory changes were made to the funding rules for defined benefit pension plans. Our sample period begins following the enactment of the Retirement Protection Act of 1994 (RPA '94). The RPA '94 made the assumptions underlying the current liability calculation much more conservative than those previously enacted through the Omnibus Reconciliation Act of 1987 (OBRA '87). As pension plans included in sponsor firms' financial statements could relate to plan years ending some months prior to the sponsor firms' fiscal year-end, using sponsor firms' fiscal years ending in 1996 ensures that the requirements of RPA '94 were in force (RPA '94 became effective for plan years beginning in 1995). Because some of our control variables relate to characteristics of sponsor firms (e.g., sponsor firms' business risk), we also require certain data be available from COMPUSTAT. We link the sponsors of each pension plan indicated on the Form 5500 filing with firms on COMPUSTAT using the sponsor's employee identification number (EIN) following the procedures discussed by Gron and Madrian (2003).

In our study, we examine the investment risk of plan assets using the mean and variance of realized returns on the plan assets.⁴ In our univariate tests, we cross-sectionally compute the

⁴ Prior related research alternatively infers the investment risk of plan assets using plans' asset allocations (e.g., the percentage of assets invested in equities). We do not use asset allocation information due to it

variance of realized returns on the plan assets for various subsamples and make statistical comparisons across subsamples. However, in our multivariate regression analysis of the variance of realized returns, we use the variances of the returns of individual pension plans as our dependent variable. To compute the variance of realized returns for individual pension plans, we estimate the variance using between three and six observations for each plan. Because the unit of measure is at the individual pension plan level (for those having sufficient number of observations), this leads to a subsample of the available observations being used. Accordingly, we form two samples: the full sample of observations meeting all sampling requirements ($n=7,447$) and the multivariate variance of returns analysis subsample ($n=1,215$).

Table 1 provides descriptive statistics for the variables used in our univariate and multivariate analyses. Each variable is winsorized at the top and bottom 1% of observations for each variable to mitigate the impact of extreme values. The descriptive statistics are provided for both the full sample of observations (Panel A) and the multivariate variance of returns analysis subsample (Panel B). For the full sample, the realized return on the pension plan assets averages 15.31% during our sample period. The sample plans, on average, are overfunded. Plan assets average 114% of the RPA '94 current liability and 43% of plans, on average, are underfunded. The sample plans also, on average, have net FSA credit balances, with the average credit balance representing 7% of the average plan assets. In addition, the sponsor firms of the sample plans have Ohlson model (1980) scores and corporate tax rates (discussed in detail later) that average -3.74 and 0.30, respectively, which are similar in magnitude to those observed in prior studies.

being a less direct measure of the investment risk of the plan assets. We also do not use asset allocation information due to severe sample selection issues. As discussed by prior studies (e.g., Petersen 1996), detailed asset allocation information is typically unavailable for defined benefit plans. This occurs because the plan assets are commonly invested through a trust or through an insurance company, without detailed information being provided regarding how the assets held by these entities are invested. For our sample, detailed asset allocation information is unavailable for over 90 percent of our plan years. The asset allocation information for those disclosing detailed information may also suffer from a sample selection bias, as pension plans—especially those undertaking risky investments—face incentives to conceal their asset allocation information. A possible alternative to the Form 5500 asset allocation disclosures is to employ asset allocation information collected through the *Pension and Investments* survey; however, such information is only available at the sponsor firm level, not the individual plan level.

Finally, the sample plans pay, on average, 5% of the pension plan assets out as benefit payments and on average 88% of the RPA '94 current liability is vested.

For the multivariate variance of returns analysis subsample, the variance of returns across all plans averages 2.59%. The distributions for the other variables are very similar to those observed for the full sample. This is expected since the variables in the multivariate variance of returns analysis represent the average values at the plan level.

Panel A of Table 2 provides detailed information regarding the distribution of the FSA credit balances over our sample period. Again, the average balance is a net FSA credit balance of approximately 7% of the average plan assets (reported in Panel A of Table 1). However, as can be seen in Panel A of Table 2, approximately a quarter of pension plans have ending FSA balance of 0.00%, while plans in the top quartile have average FSA credit balances of at least 10%.⁵ As can further be seen in the table, the magnitude of the FSA credit balances is fairly constant across our sample period. This stability in the balances most likely occurs due to, as discussed earlier, unfunded past service liabilities and experience gains and losses being recognized only gradually as charges and credits through systematic amortization over a sizable number of years. The potential stability of these FSA credit balances over time can enable sponsor firms to undertake greater investment risk with the pension plan assets without being concerned about making a minimum funding requirement contribution. Finally, the increase in FSA credit balances during 2002 is likely attributable to sponsor firms making contributions to shore up underfunded plans.

Panel B of Table 2 provides detailed information regarding the distribution of the funding levels for our sample defined benefit pension plans. As can be seen in the table, the level of funding varies with the level of the stock market. In 1996, 42.49% of the sample pension plans were underfunded at the beginning of the plan year. In 1997, 1998 and 1999, following large increases in the stock market (as illustrated later in Figure 2), 38.07%, 29.79%, 38.04% of sample

⁵ A limited number of pension plans (63) do report net FSA debit (i.e., negative) balances. Because we use amounts after winsorizing the top and bottom 1%, these observations, which represent 0.98% of the sample, are reported in the table as 0.00%.

plans were underfunded at the beginning of the year, respectively. However, in 2000, 2001 and 2002, following large declines in the stock market, 45.17%, 55.46% and 69.32% of sample plans were underfunded at the beginning of the year, respectively. In addition, the number of sample plans severely underfunded (i.e., those plans with assets amounting to less than 80% of the RPA '94 current liability) surged to 26.75% of all defined benefit pension plans in 2002.

Figure 1 provides detailed information regarding the percentage of the sample plans making minimum funding requirement (MFR) contributions, those plans having an additional funding charge (AFC), and those plans having an AFC that also made a MFR contribution. As the figure illustrates, the number of plans making MFR contributions is relatively low, with approximately 1% of the plans facing such contributions. The relatively low number of plans facing MFR contributions is likely attributable to firms intentionally avoiding unplanned contributions, which may crowd-out firms' investment opportunities.

As the figure further illustrates, a sizable number of plans have an AFC (approximately 12% of all plans); however, the number of plans with an AFC that also make an MFR contribution is low (approximately 0.37% of all plans). Finally, the percentages of plans having MFR contributions and AFCs do not appear to exhibit any clear trend over our sample period, with the exception of the sharp drop-off of plans having AFCs in 2002. This drop-off is in large part due to the Job Creation and Worker Assistance Act of 2002 (JCWAA '02). The JCWAA '02 changed the calculation of the current liability using the highest allowable interest rate (a required AFC calculation discussed in earlier in Section II) to 120% of the assumed rate for plan years beginning in 2002. As this legislation does not directly affect the MFR contribution calculations, we choose to include 2002 plans years in our sample period.

Finally, Figure 2 provides detailed information regarding the returns earned by defined benefit pension plan assets over time. In order to have a basis for comparison, we also include in the figure the annual returns for alternative investment vehicles: the S&P 500, NASDAQ, US high yield corporate bonds, real estate, and US treasury bonds (10-year maturity). Recall that the

sample “year” is defined as the fiscal year-end of the sponsor firm. Because some pension plans have the end of the plan-year ending a few months before the sponsor firms’ fiscal year-end, the returns on the plan years do not exactly overlap in calendar time and with the other (calendar-year) benchmark returns presented in the figure. This will cause some of the returns on pension plans assets to reflect returns generated to some extent in the prior calendar year. As can be seen in the figure, the returns on the invested pension plan assets exhibit characteristics that might be expected for pension plans. Specifically, the realized returns on the pension plan assets are generally between the annual returns of the S&P 500 and those of corporate bonds. In addition, while far from constant, the realized returns earned by defined benefit pension plans in our sample do not exhibit the volatility exhibited by some types of investments—particularly, the returns earned by NASDAQ listed firms, US REITs and S&P 500 listed firms.

4. Empirical Results

This section presents empirical results of tests of our research hypotheses. First, univariate tests of the variance of realized returns and the average realized returns on plan assets are presented to determine whether underfunded plans are invested in riskier assets and whether risk-taking behavior is exacerbated when plans have large FSA credit balances. The tests of the variance of returns and of average realized returns are then repeated in multivariate tests to control for other potential determinants of defined benefit plans incentives to undertake more risky investments.

4.1. Univariate results

Panel A of Table 3 provides the variance of returns and the average and median returns for our sample defined benefit pension plans partitioned by whether the plan is underfunded and by whether the plan has a large FSA credit balance at the end of the year. Consistent with ERISA funding rule definitions, underfunded plans are defined as plans having (beginning of year) current value pension plan assets that are less than the RPA ’94 current liability. A large FSA

credit balance is defined as plans having FSA credit balances of over 10% of average pension plan assets. Again, those plans with FSA credit balances of over 10% represent plans in the top quarter of all plans' FSA credit balances.⁶

As can be seen from the table, the distribution of realized returns for our sample plans varies considerably by whether the plan is underfunded. Specifically, the variance of realized returns for underfunded plans is 4.55%, while for overfunded plans it is 2.10%. In addition, the average (median) realized return for underfunded plans is 17.59% (15.26%), while for overfunded plans it is 13.57% (15.06%). In Panel B of the table, the results of formal statistical tests indicate that the difference in these amounts are all statistically significant at less than a 1% level.

As can also be seen in the table, the distribution of realized returns for our sample plans varies considerably for plans having large FSA credit balances, especially when the plan is underfunded. For underfunded plans, the variance of realized returns for plans having large FSA credit balances is 5.37%, while for plans having small FSA credit balances it is 4.03%. In addition, the average (median) realized return for underfunded plans is 20.13% (16.68%), while for overfunded plans it is 16.17% (15.36%). In Panel B of the table, the results of formal statistical tests indicate that the difference in these amounts are all statistically significant at less than a 1% level. For overfunded plans, the variance of realized returns for plans having large FSA credit balances is 2.90%, while for plans having small FSA credit balances it is 1.94%. In addition, the average (median) realized returns for underfunded plans are 14.12% (14.55%), while for overfunded plans it is 13.46% (15.14%). In Panel B of the table, the results of formal statistical tests indicate that only the difference in the variance of returns is statistically significant at conventional levels for overfunded plans.

These univariate results do not control for other potentially important factors determining defined benefit pension plans' investment decisions. Specifically, prior research provides

⁶ In untabulated analysis, a large FSA credit balance is alternatively defined as 20% of the average pension plan assets. Our inferences that follow are insensitive to this alternative cut-off value.

evidence that the investment risk of the pension plan assets is affected by the riskiness of the sponsor firm's other assets, tax considerations and the maturity of the pension obligations. We control for these possibilities in tests conducted in the following section.

4.2. Multivariate results

We begin our multivariate analysis by establishing that our investment risk measures share similar relationships with other previously documented determinants of the investment risk of the plan assets. This leads us to our first regression specification:

$$\begin{aligned} (\sigma_{RET}^2(\%))_{ij} = & \sum_{t=1996}^{2002} \beta_{0,t} D_t + \beta_1 PercentFunded_{ij} + \beta_2 BankruptcyRisk_i \\ & + \beta_3 OperatingCashFlow_i + \beta_4 CorporateTax_i \\ & + \beta_5 BenefitsPaid_{ij} + \beta_6 PercentVested_{ij} + \epsilon_{ij} \end{aligned} \quad (1)$$

where

$(\sigma_{RET}^2(\%))_{ij}$ is the variance of the returns on the beginning pension plan assets for plan j of sponsor firm i computed using all available plan years.

D_t is an indicator variable that equals one if data from year t was used, and zero otherwise.

$PercentFunded_{ij}$ is the (beginning of year) current value of the pension plan assets divided by the RPA '94 current liability for plan j of sponsor firm i .

$BankruptcyRisk_i$ is the bankruptcy risk for sponsor firm i measured using the bankruptcy prediction score from the Ohlson (1980) model.

$OperatingCashFlow$ is cash from operating activities divided by total assets for sponsor firm i

$CorporateTax_i$ is the corporate-level tax benefit from debt less shareholder taxes on the tax benefit for sponsor firm i .

$BenefitsPaid_{ij}$ is the benefit payments made by pension plan j of sponsor firm i divided by the average pension plan assets.

$PercentVested_{ij}$ is the percentage of the RPA '94 current liability vested for plan j of sponsor firm i .

ϵ_{ij} is an error term.

As discussed earlier, we examine differences in the variances of individual pension plans computed using between three and six observations for each plan. Conceptually, we would prefer annual variance of return estimates computed using realized daily returns. Unfortunately, only annual return data for defined benefit pension plans is available. Our measure of the variance of annual returns for individual pension plans may suffer from considerable noise because of the small number of available observations underlying the variance estimates. However, as the variance of returns is the dependent variable, the noise should reduce the power of our tests but should not lead to biased estimates. In addition, while our univariate tests of the cross-sectional variances do not control for potentially important omitted factors, the tests do not suffer from such noise and serve as a basis of comparison. Our univariate and multivariate tests of the average realized returns likewise do not suffer from such noise and also serve as a basis of comparison.

Because $\sigma_{RET}^2(\%)$ is computed at the individual pension plan level using all available observations, the independent variables are computed as the average amounts over the same time period. Using average amounts has the advantage of eliminating noise by focusing on long-term behavior. However, using average amounts has the disadvantage of eliminating possibly important year-to-year deviations from long-term averages. In addition, using variables that are calculated using different numbers of sample years, potentially leads to heteroskedastic error terms. To mitigate this possibility, we estimate the model (and all subsequent models having $\sigma_{RET}^2(\%)$ as the dependent variable) using weighted-least-squares. The weighting variable is the number of sample years used to calculate each observation (see Kmenta (1986) for a detailed discussion). Further, because of differences in the level of market movements across years, we include fixed-year effects, D_t , equaling one if the data from that year was used to calculate that observation, and zero otherwise.

Petersen (1996) and Frank (2002) provide evidence that less well-funded pension plans allocate more of their pension plan assets to investments in fixed-income securities to minimize their contribution risk. We include *PercentFunded*, the beginning of year ratio of the current value of the plan assets to the RPA '94 current liability, to capture this incentive. The variable is constructed to be similar to Petersen's (1996) funding status variable, defined as the assets of the plan divided by its liabilities. To ease interpretations of interaction terms in subsequent equations, *PercentFunded* is re-centered by subtracting the minimum funding level value from all observations. We expect σ_{RET}^2 (%) and *PercentFunded* to be positively associated, consistent with prior findings of less well-funded plans taking on relatively lower investment risk with their pension plan assets.

Friedman (1982), Petersen (1996) and Frank (2002) provide evidence that sponsor firms offset their (non-pension) business risk by reducing the investment risk of the pension plan assets (i.e., firms with greater business risk invest a greater share of the pension plan assets in fixed-income securities). We include *BankruptcyRisk*, the bankruptcy prediction score from the Ohlson (1980) model, to capture this incentive.⁷ We expect σ_{RET}^2 (%) and *BankruptcyRisk* to be negatively associated, consistent with sponsor firms with greater business risk taking on relatively lower investment risk with their pension plan assets. Rather than using multiple variables (e.g., leverage and profitability) for business risk, as done by prior related research, we use a composite bankruptcy risk prediction score as we believe it is a more direct measure of business risk and to ease interpretation. We select bankruptcy prediction scores from the Ohlson (1980) model for two reasons. First, the model has been successfully used in prior research (e.g., Dichev (1998)) and exhibits similar accuracy as other bankruptcy prediction models (Beaver et al. (2005)). Second, the model does not include market-based measures as predictors. This is important

⁷ Our proxy for bankruptcy risk comes from Ohlson's (1980) bankruptcy prediction model. Ohlson models the likelihood of bankruptcy as a function of firm size, the firm's financial structure, firm performance, and current liquidity. Begley, Ming, and Watts (1996) find that Ohlson's bankruptcy prediction model outperforms Altman's (1968) model, which is another commonly used bankruptcy prediction model.

because market-based measures could (undesirably) reflect the investment risk of the pension plan assets as well as the business risk of the sponsor firm's operating assets, which would confound the interpretation of the variable.⁸

Stone (1987), Mittelstaedt (1989), Thomas (1989) and Petersen (1992) provide evidence that sponsor firms' ability to generate resources internally influences the operation of defined benefit plans—finding that sponsor firms' inability to generate resources internally result in reduced plan contributions, more favorable actuarial assumptions to reduce required cash contributions, and in extreme cases, termination of overfunded pension plans. We include *OperatingCashFlow* to capture the ability of sponsor firms to generate resources internally. In our setting, we expect σ_{RET}^2 (%) and *OperatingCashFlow* to be negatively associated, consistent with sponsor firms with lower ability to generate resources internally reducing future contribution needs by taking on relatively greater investment risk to earn higher expected investment returns with their pension plan assets.

Frank (2002) provides evidence that sponsor firms' potential tax benefits from investing in bonds affect the allocation of pension plan assets into bonds relative to equities. Specifically, sponsor firms have a potential tax arbitrage opportunity by borrowing funds through the issuance of debt and taking the tax-deduction on the interest expense, while contributing the proceeds to the pension plan and investing the funds into bonds (which grow tax-deferred). Such a strategy keeps overall firm risk constant. Black (1980) argues that the tax benefits to this integrated financing and investing strategy are increasing in the corporate marginal tax rate, denoted τ_c .⁹

⁸ In general, pension amounts represent off-balance-sheet amounts for financial reporting purposes (i.e., only the net underfunding or overfunding as determined by financial accounting rules is reported as a liability or asset, respectively).

⁹ Under different assumptions, Tepper (1981) argues that tax benefits are increasing in the difference in investors' marginal tax rates on income generated from bond and equity investments, denoted t_b and t_e , respectively. Frank (2002) finds evidence consistent with the arguments of Black (1980), but does not find evidence consistent with the arguments of Tepper (1981). Rather, Frank's variable *ITAX*, $(t_b - t_e)$, the implicit tax benefit from investing the plan assets in bonds, shares an unexpectedly negative correlation with pension plans allocations with bonds. Frank (2002) attributes the unexpected correlation to sponsor firms' dividend payouts—which is used to construct *ITAX*—being correlated with plans use of bonds for

We follow Frank (2002) and include *CorporateTax*, the corporate-level tax benefit from debt less shareholder taxes on the tax benefit ($\tau_c - \tau_b \tau_c$), where investors' marginal tax rates on income generated from bonds is τ_b . We estimate the corporate marginal tax rate, τ_c , using Graham's (1996) simulated tax rates, which are updated through 2002. We estimate investors' marginal tax rate on bond income, τ_b , as the difference between yields on taxable bonds and tax-free municipal bonds divided by the yield on taxable bonds: $\{(R_{taxable} - R_{municipal})/R_{taxable}\}$. We use the yield on the 3-year US Treasury Benchmark Bond and the 3-year Lehman Municipal Bond Composite Index as measures of these rates of return. Bond series with a 3-year maturity are selected because it represents the shortest duration available for a composite municipal bond index. Our estimates of τ_b are 25.32%, 28.57%, 22.74%, 26.82%, 25.35%, 19.24% and 15.80% for the sample years 1996-2002, respectively. We expect σ_{RET}^2 (%) and *CorporateTax* to be negatively associated, consistent with sponsor firms with higher corporate marginal tax rates investing a greater proportion of the pension plan assets in fixed-income securities (which should lead to lower variance in realized returns and lower average realized returns).

Petersen (1996) provides evidence that more mature pension plans with a greater proportion of the pension liabilities coming due in the near future invest more of the pension plan assets in bonds in order to better match the duration of the pension obligation. We follow Petersen (1996) and include as measures of the maturity of the pension plan the variables *BenefitsPaid* (the benefit payment divided by the average pension plan assets) and *PercentVested* (the fraction of the RPA '94 liability that has vested). We expect σ_{RET}^2 (%) to be negatively associated with *BenefitsPaid* and *PercentVested*, consistent with more mature pension plans investing a greater proportion of the pension plan assets in lower risk investments.

non-tax reasons. For these reasons we do not include *ITAX* in our estimations. In any event, in untabulated analyses, the inclusion of *ITAX* as an explanatory variable does not affect our inferences reported later.

The first column of Table 4 presents the results of estimating equation (1). The results are consistent with sponsor firms ability to generate resources internally and the maturity of the pension plan affecting the investment risk of the pension plan assets. Specifically, we find a negative association between the riskiness of the pension plan assets and the level of cash from operations to total assets (*OperatingCashFlow*), the proportion of the benefits paid (*BenefitsPaid*) and the proportion of the RPA '94 obligation vested (*PercentVested*). The other determinants of the riskiness of the pension plan assets are insignificant.

The lack of an association between the investment risk of the pension plan assets and the plan's funding level in equation (1) is somewhat surprising. We investigate this issue further by including variables that allow us to investigate the association between the investment risk of plan assets and funding levels conditioned on whether the plan is overfunded or underfunded. While prior research has examined funding levels using variables similar to *PercentFunded*, prior research has not separately examined funding levels for underfunded plans. As discussed earlier, because underfunded plans face a greater risk of making undesired contributions to the pension plan, especially as the plan becomes increasingly underfunded, we predict that underfunded plans are likely to behave very differently than overfunded plans. To investigate this possibility, we allow for underfunded pension plans to have a differing relation using the following regression specification:

$$\begin{aligned}
 (\sigma_{RET}^2(\%))_{ij} = & \sum_{t=1996}^{2002} \phi_{0,t} D_t + \phi_1 PercentFunded_{ij} + \phi_2 D_Underfunded_{ij} \\
 & + \phi_3 [PercentFunded_{ij} * D_Underfunded_{ij}] \\
 & + \phi_4 BankruptcyRisk_i + \phi_5 OperatingCashFlow_i \\
 & + \phi_6 CorporateTax_i + \phi_7 BenefitsPaid_{ij} + \phi_8 PercentVested_{ij} + \zeta_{ij}
 \end{aligned} \tag{2}$$

where

$D_Underfunded_{ij}$ is an indicator variable that equals one if the (beginning of year) current value of the pension plan assets is less than the RPA '94 current liability for plan j of sponsor firm i , and zero otherwise.

Because the variables are computed using all available plan years, the variable $D_Underfunded$ equals one if the average value of $PercentFunded$ over the sample period is less than one, and zero otherwise.¹⁰ As in our univariate analysis, if underfunded plans face greater risk of making undesired contributions to the pension plan, we expect that sponsors will influence trustees to invest the pension plan assets in relatively more risky investments (i.e., $\phi_2 > 0$). Also, if the risk of making undesired contributions grows as plans become increasingly underfunded, we expect that the investment risk of the pension plan assets will increase as the funding level of underfunded plans worsens (i.e., $\phi_3 < 0$). We maintain the same earlier predictions for the other variables in equation (2).

The second column of Table 4 presents the results of estimating equation (2). We find evidence consistent with underfunded plans assuming greater investment risk with the plan assets (i.e., ϕ_2 is significantly greater than zero). In addition, we find evidence consistent with the investment risk of the pension plan assets increasing as the funding level of underfunded plans worsens (i.e., ϕ_3 is significantly less than zero). Further, after allowing for differing relationships for underfunded plans, we find evidence consistent with the investment risk of the pension plan assets increasing as overfunded plans become increasingly overfunded. This result is similar to the findings of Petersen (1996). We also continue to find evidence that defined benefit pension plans with sponsors with greater ability to generate funds internally (*OperatingCashFlow*), paying out a greater proportion of benefits (*BenefitsPaid*) and having a greater proportion of the RPA '94 obligation vested (*PercentVested*) have pension plan assets with significantly lower investment risk. We now, however, find evidence that firms with greater business risk (*BankruptcyRisk*) have pension plan assets with significantly lower investment risk. The other determinants of the riskiness of the pension plan assets remain insignificant.

¹⁰ This calculation occurs before the *PercentFunded* variable is re-centered by subtracting the minimum funding value from all observations.

Next, we examine whether the pension funding rules specifying that net FSA balances be used for required funding determinations influence the chosen investment risk of the pension plan assets. We investigate this possibility using the following specification that allows the funding level variables in equation (2) to vary with the level of plans' net FSA credit balances:

$$\begin{aligned}
(\sigma_{RET}^2(\%))_{ij} = & \sum_{t=1996}^{2002} \gamma_{0,t} D_t + \gamma_1 PercentFunded_{ij} + \gamma_2 D_Underfunded_{ij} \\
& + \gamma_3 [PercentFunded_{ij} * D_Underfunded_{ij}] \\
& + \gamma_4 FSA CreditBalance_{ij} \\
& + \gamma_5 [PercentFunded_{ij} * FSA CreditBalance_{ij}] \\
& + \gamma_6 [D_Underfunded_{ij} * FSA CreditBalance_{ij}] \\
& + \gamma_7 [PercentFunded_{ij} * D_Underfunded_{ij} * FSA CreditBalance_{ij}] \\
& + \gamma_8 BankruptcyRisk_i + \gamma_9 OperatingCashFlow_i + \gamma_{10} CorporateTax_i \\
& + \gamma_{11} BenefitsPaid_{ij} + \gamma_{12} PercentVested_{ij} + \xi_{ij}
\end{aligned} \tag{3}$$

where

$FSA CreditBalance_{ij}$ is the funding standard account (FSA) credit balance divided by the average pension plan assets for plan j of sponsor firm i .

Similar to the other explanatory variables, $FSA CreditBalance$ represents the average amount over all years. For underfunded plans, if larger FSA credit balances encourage sponsor firms to increase the investment risk of the pension plan assets, then we expect $\gamma_6 > 0$. In addition, if the incentive increases as funding levels worsen for such plans, then we expect $\gamma_7 < 0$. For overfunded plans, if larger FSA credit balances encourage sponsor firms to assume greater investment risk with the pension plan assets, then we expect $\gamma_4 > 0$. In addition, if the incentive increases as funding levels are lower for such plans, then we expect $\gamma_5 < 0$. We maintain the same earlier predictions for the other variables in equation (3).

Table 5 presents the results of estimating equation (3). For underfunded plans, we find evidence consistent with net FSA credit balances encouraging greater risk taking with the pension

plan assets. Specifically, for underfunded pension plans with a zero net FSA credit balance, we fail to find evidence that such plans take on relatively greater investment risk even when their funding levels worsen (i.e., γ_2 and γ_3 are not significantly different from zero). However, we find that the investment risk of the pension plan assets increases as the level of net FSA credit balance account increases for underfunded plans (i.e., γ_6 is significantly greater than zero). In addition, we find that the riskiness of the assets in such plans increases even more as the level of underfunding worsens (i.e., γ_7 is significantly less than zero).

For overfunded plans with a zero FSA credit balance, we find evidence consistent with such plans taking on relatively greater investment risk as their funding improves (i.e., γ_1 is significantly greater than zero). However, we fail to find evidence that the investment risk of overfunded plans changes when FSA credit balances increase, even when their funding levels strengthen (i.e., γ_4 and γ_5 are insignificant). We continue to find evidence consistent with defined benefit pension plans with sponsors with greater ability to generate funds internally, plans paying out a greater proportion of benefits and plans with a greater proportion of the RPA '94 obligation being vested having plan assets with significantly lower investment risk for the pension plan assets. The other determinants of the riskiness of the pension plan assets are insignificant.

We expect that the investing of pension plan assets in riskier assets should result in higher realized returns over extended time periods. We therefore, as a further analysis, modify equation (3) by changing the dependent variable to the realized returns earned on the pension plan assets and estimate the following specification:

$$\begin{aligned}
RET(\%)_{ij} = & \sum_{t=1996}^{2002} \theta_{0,t} D_t + \theta_1 PercentFunded_{ij} + \theta_2 D_Underfunded_{ij} \\
& + \theta_3 [PercentFunded_{ij} * D_Underfunded_{ij}] \\
& + \theta_4 FSA CreditBalance_{ij} \\
& + \theta_5 [PercentFunded_{ij} * FSA CreditBalance_{ij}] \\
& + \theta_6 [D_Underfunded_{ij} * FSA CreditBalance_{ij}] \\
& + \theta_7 [PercentFunded_{ij} * D_Underfunded_{ij} * FSA CreditBalance_{ij}] \\
& + \theta_8 BankruptcyRisk_i + \theta_9 OperatingCashFlow_i + \theta_{10} CorporateTax_i \\
& + \theta_{11} BenefitsPaid_{ij} + \theta_{12} PercentVested_{ij} + \zeta_{ij}
\end{aligned} \tag{4}$$

where

$RET(\%)_{ij}$ is the realized returns on the beginning pension plan assets for plan j of sponsor firm i .

Because the realized return measure does not require using multiple years like the variance of returns measure, we use the full sample of observations to estimate equation (4). We include fixed-year effects to mitigate the impact of differing market returns across years. We also use robust standard errors, which adjust the variance estimates for correlation within each individual pension plan (see Williams (2000) for a discussion). Our predictions for the relationships between the realized returns on the pension plan assets and the explanatory variables are the same as for equation (3).

Table 6 presents the results of estimating equation (4). We find evidence very similar to that found using the variance of realized returns analyses. Specifically, we find evidence consistent with underfunded plans earning relatively higher realized returns on their plan assets (i.e., θ_2 is significantly greater than zero). In addition, we find evidence consistent with the returns earned on the pension plan assets increasing as the funding level of underfunded plans worsens (i.e., θ_3 is significantly less than zero). We also find evidence consistent with the realized returns being higher when underfunded pension plans have relatively higher FSA credit balances (i.e., θ_6 is significantly greater than zero), especially when the funding level of the underfunded plans

worsens (i.e., θ_7 is significantly less than zero). We fail to find evidence consistent with the level of funding for overfunded plans resulting in significantly different realized returns (i.e., θ_1 is insignificant)—unlike our results for the variance of realized returns. In addition, we fail to find evidence consistent with the level of the FSA credit balance for overfunded pension plans resulting in significantly different realized returns, even as the level of overfunding increases (i.e., θ_4 and θ_5 are insignificant).

We also find evidence that sponsor firms with higher corporate marginal tax rates, greater business risk, and greater ability to generate resources internally earn lower realized returns on their pension plan assets (i.e., θ_8 and θ_{10} are significantly less than zero and θ_9 is significantly greater than zero). These results are consistent with sponsor firms taking advantage of tax benefits by investing in bonds and with sponsor firms offsetting their higher business risk by reducing the risk of their pension plan assets. Finally, we find evidence consistent with defined benefit pension plans paying out a greater proportion of benefits and having a greater proportion of the RPA '94 obligation being vested earning lower realized returns on their pension plan assets (i.e., θ_{11} and θ_{12} are significantly less than zero).

5. Summary and conclusion

In this study, we investigate whether smoothing mechanisms required under pension funding rules provide incentives for sponsor firms to influence the trustees of their defined benefit pension plans to take greater risk when investing the pension plan assets. Pension funding rules promulgated by the Employee Retirement Income Security Act of 1974 (as revised) and the Internal Revenue Code permit sponsors of defined benefit pension plans with net funding standard account (FSA) credit balances to forgo making cash contributions to their underfunded plans, even if their plans are severely underfunded. Under these rules, sponsor firms have an incentive to influence plan trustees to invest the plan assets in riskier investments when sizable

net FSA credit balances exist since even if the plan assets decline in value and the plan becomes underfunded, sponsors are shielded from making otherwise required contributions. Accordingly, we investigate whether defined benefit pension plans with sizable net FSA credit balances take more risk with their pension plan assets. Due to underfunded plans facing impending contributions when past investment losses and other charges are gradually recognized in minimum funding requirement calculations, we also investigate whether this risk-taking behavior is more pronounced when defined benefit plans are underfunded and when the level of underfunding worsens.

In our empirical tests, we find large differences in the risk of the assets of defined benefit plans depending on their funding status and the availability of net FSA credit balances. Specifically, we find evidence that underfunded plans take greater risks with the plan assets than do overfunded plans, especially as plans grow increasingly underfunded. Further, consistent with pension funding rules encouraging greater risk taking, we find evidence that the relatively greater risk taking by underfunded plans is more pronounced as the level of the FSA credit balance increases, especially among plans that are the most underfunded. We also find evidence that the risk of the defined benefit plan assets increases when sponsor firms face lower marginal corporate tax rates and lower business risk, when sponsors have less ability to generate funds internally and when the pension plan obligation has a longer duration.

The results of this study provide evidence relevant for the current debate on strengthening pension funding rules. Rules that allow firms to avoid funding their pension plans increase the risk that the PBGC will be forced to take over severely underfunded plans. Since the federal government ultimately guarantees obligations of the PBGC, this raises the possibility that the federal government will be forced to bail out the PBGC. In addition, employees of many of these severely underfunded plans will ultimately be unable to recover the full value of their pensions since payouts by the PBGC are capped. Our results show that not only do current pension funding rules contribute to underfunding, they also encourage risk-taking with pension plan

assets. We feel that our results are particularly important in light of pending pension reform legislation.

Congress is currently debating a new pension bill with the stated intent of protecting promised pension benefits. However, instead of limiting smoothing mechanisms and other rules that allow companies to avoid funding their plans Congress' legislation would extend the amount of time that sponsors have to cover pension shortfalls and give sponsors more leeway in how they estimate pension liabilities. These changes would reduce corporate contributions to pension plans by an estimated \$140 to \$160 billion dollars over the next few years (Walsh 2006). In addition, these changes strengthen the effect of the incentives documented in this study.

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APPENDIX 1

2002 Becton Dickinson & Co. Retirement Plan, Abbreviated Schedule B, Form 5500: Minimum Funding Requirement Calculation

9 Funding standard account statement for this plan year:			
Charges to funding standard account:			
a	Prior year funding deficiency, if any		9(a)
b	Employer's normal cost for plan year as of valuation date		9(b) \$26,149,774
c	Amortization charges as of valuation date:	Outstanding Balance	
	(1) All bases except funding waivers	(\$ 176,697,661)	c(1) \$31,544,143
	(2) Funding waivers	(\$)	c(2)
d	Interest as applicable on lines 9a, 9b, and 9c		9d \$4,614,385
e	Additional interest charge due to late quarterly contributions, if applicable		9e
f	Additional funding charge from Part II, line 12u, if applicable <input type="checkbox"/> N/A		9f 0
g	Total charges. Add lines 9a through 9f		9g \$62,308,302
Credits to funding standard account:			
h	Prior year credit balance, if any		9h \$186,443,075
i	Employer contributions. Total from column (b) of line 3		9i \$18,000,000
		Outstanding Balance	
j	Amortization credits as of valuation date	(\$)	9j
k	Interest as applicable to end of plan year on lines 9h, 9i, 9j		9k \$14,915,461
l	Full funding limitation (FFL) and credits		
	(1) ERISA FFL (accrued liability FFL)	l(1) \$313,631,127	
	(2) "OBRA '87" FFL (155% current liability FFL)	l(2) \$803,574,079	
	(3) "RPA '94" override (90% current liability FFL)	l(3) \$12,792,184	
	(4) FFL credit before reflecting "OBRA '87" FFL		l(4)
	(5) Additional credit due to "OBRA '87" FFL		l(5)
m	(1) Waived funding deficiency		m(1)
	(2) Other credits		m(2) \$34,939
n	Total credits. Add lines 9h through 9k, 9l(4), 9l(5), 9m(1), and 9m(2)		9n \$219,393,475
o	Credit balance: If line 9n is greater than line 9g, enter the difference		9o \$157,085,173
p	Funding deficiency: If line 9g is greater than line 9n, enter the difference		9p
Reconciliation account:			
q	Current year's accumulated reconciliation account:		
	(1) Due to additional funding charges as of the beginning of the plan year	q(1)	
	(2) Due to additional interest charges as of the beginning of the plan year	q(1)	
	(3) Due to waived funding deficiencies:		
	(a) Reconciliation outstanding balance as of valuation date	q(1)	
	(b) Reconciliation amount. Line 9c(2) balance minus line 9q(3)(a)	q(1)	
	(4) Total as of valuation date		q(4)
10	Contribution necessary to avoid an accumulated funding deficiency. Enter the amount in line 9p or the amount required under the alternative funding standard account if applicable		10

APPENDIX 2

2002 Becton Dickinson & Co. Retirement Plan, Abbreviated Schedule B, Form 5500: Additional Funding Charge Calculation

1a Enter the actuarial valuation date: October 01, 2002		
b Assets		
(1) Current value of assets	b(1)	\$459,655,726
(2) Actuarial value of assets for funding standard account	b(2)	\$549,510,266
1d Information on current liabilities of the plan:		
(1) Amount excluded from current liability attributable to pre-participation service (see instructions)	d(1)	
(2) "RPA '94" information:		
(a) Current liability	d(2)(a)	\$603,552,086
(b) Expected increase in current liability due to benefits accruing during the plan year	d(2)(b)	\$33,532,613
(c) Current liability computed at highest allowable interest rate (see instructions)	d(2)(c)	\$455,898,508
(d) Expected release from "RPA '94" current liability for the plan year	d(2)(d)	
(3) "OBRA '87" information:		
(a) Current liability	d(3)(a)	\$613,942,936
(b) Expected increase in current liability due to benefits accruing during the plan year	d(3)(b)	\$34,149,987
(c) Expected release from "OBRA '87" current liability for the plan year	d(3)(c)	
(4) Expected plan disbursements for the plan year	d(4)	\$34,000,000
12 Additional required funding charge (see instructions):		
a Enter "Gateway %." Divide line 1b(2) by line 1d(2)(c) and multiply by 100. If line 12a is at least 90%, go to line 12u and enter -0-. If line 12a is less than 80%, go to line 12b. If line 12a is at least 80% (but less than 90%), see instructions and, if applicable, go to line 12u and enter -0-. Otherwise, go to line 12b	12a	120.5%
b "RPA'94" current liability. Enter line 1d(2)(a)	12b	
c Adjusted value of assets (see instructions)	12c	
d Funded current liability percentage. Divide line 12c by 12b and multiply by 100	12d	%
e Unfunded current liability. Subtract line 12c from line 12b	12e	
f Liability attributable to any unpredictable contingent event benefit	12f	
g Outstanding balance of unfunded old liability	12g	
h Unfunded new liability. Subtract the total of lines 12f and 12g from line 12e. Enter -0- if negative.	12h	
i Unfunded new liability amount (% of line 12h)	12i	
j Unfunded old liability amount	12j	
k Deficit reduction contribution. Add lines 12i, 12j, and 1d(2)(b)	12k	
l Net charges in funding standard account used to offset the deficit reduction contribution. Enter a negative number if less than zero	12l	
m Unpredictable contingent event amount:	12m	
(1) Benefits paid during year attributable to unpredictable contingent event	m(1)	0
(2) Unfunded current liability percentage. Subtract the percentage on line 12d from 100%	m(2)	
(3) Enter the product of lines 12m(1), 12m(2), and 12m(3)	m(4)	
(4) Amortization of all unpredictable contingent event liabilities	m(5)	
(5)"RPA '94" additional amount (see instructions)	m(6)	
(6)Enter the greatest of lines 12m(3), 12m(4), or 12m(5)	m(7)	
Preliminary Calculation		
n Preliminary additional funding charge: Enter the excess of line 12k over line 12l (if any), plus line 12m(6), adjusted to end of year with interest	12n	
o Contributions needed to increase current liability percentage to 100% (see instructions)	12o	
p Additional funding charge prior to adjustment: Enter the lesser of line 12n or 12o	12t	
q Adjusted additional funding charge. (% of line 12p)	12u	

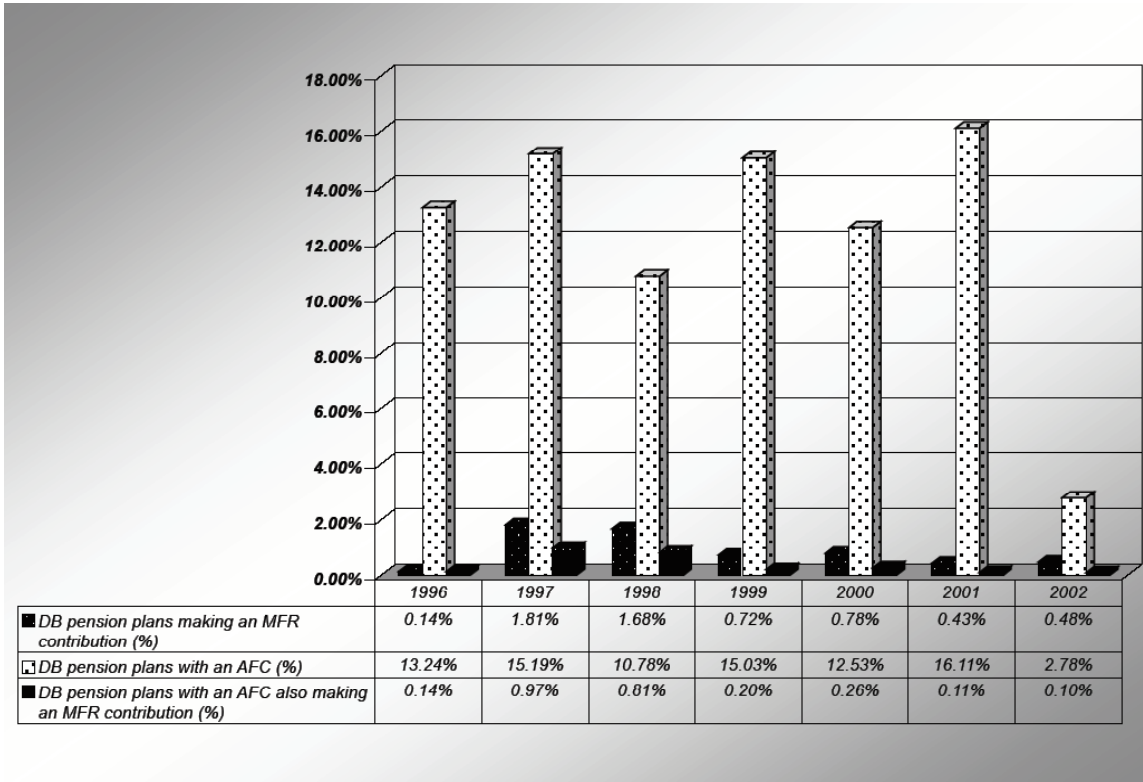


Fig. 1. Percentage of plans making MFR contributions and having an AFC. The figure provides information for the years 1996-2002 regarding the percentage of defined benefit pension plans making minimum funding requirement (MFR) contributions, those with an additional funding charge (AFC) and those making MFR contributions with an AFC. The minimum funding requirement contribution represents the required standard annual contribution for defined benefit pension plans. The additional funding charge represents a possible additional contribution for severely underfunded plans. The calculation of both amounts is determined by ERISA and the IRC funding rules.

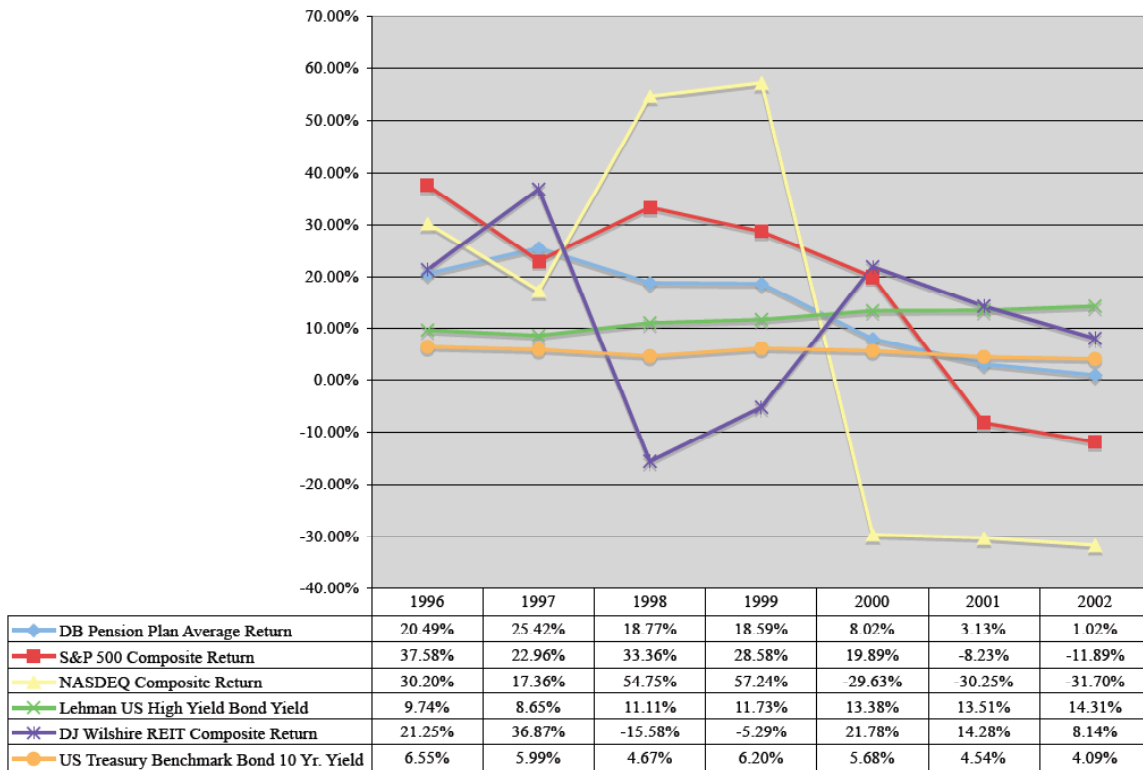


Fig 2. Annual returns on defined benefit pension plan assets relative to other benchmark annual returns. The figure provides information regarding the return on the beginning plan assets for defined benefit pension plan assets for the years 1996-2002. Benchmark returns for different asset classes are also presented for comparison purposes.

Table 1

Descriptive Statistics

This table reports the descriptive statistics for the variables used in our univariate and multivariate analyses. The full sample presented in Panel A includes all observations meeting our sample selection criteria. The multivariate variance of returns sub-sample presented in Panel B include observations averaged at the individual plan level over all available sample years (at least three). The sample period is 1996-2002.

Panel A: Descriptive Statistics for the Full Sample ($n=7,447$)

Variable	Mean	Std. Dev.	P25	P50	P75
<i>RET(%)</i>	15.31	17.89	4.84	15.33	21.80
<i>PercentFunded</i>	1.14	0.42	0.90	1.05	1.28
<i>D_Underfunded</i>	0.43	0.50	0.00	0.00	1.00
<i>FSA CreditBalance</i>	0.07	0.11	0.00	0.02	0.10
<i>BankruptcyRisk</i>	-3.74	2.79	-5.43	-4.44	-2.80
<i>OperatingCashFlow</i>	0.10	0.05	0.06	0.10	0.13
<i>CorporateTax</i>	0.30	0.08	0.32	0.33	0.33
<i>BenefitsPaid</i>	0.05	0.03	0.03	0.04	0.06
<i>PercentVested</i>	0.88	0.10	0.84	0.90	0.95

(Continued)

Table 1—Continued

Panel B: Descriptive Statistics for the Multivariate Variance of Returns Sub-Sample ($n=1,215$)

Variable	Mean	Std. Dev.	P25	P50	P75
$(\sigma_{RET}^2(\%))$	2.59	5.00	0.78	1.50	2.48
<i>PercentFunded</i>	1.14	0.38	0.91	1.04	1.27
<i>D_Underfunded</i>	0.43	0.49	0.00	0.00	1.00
<i>FSA CreditBalance</i>	0.07	0.09	0.01	0.04	0.11
<i>BankruptcyRisk</i>	-3.78	1.79	-4.97	-3.87	-2.85
<i>OperatingCashFlow</i>	0.09	0.06	0.06	0.09	0.13
<i>CorporateTax</i>	0.30	0.05	0.28	0.33	0.33
<i>BenefitsPaid</i>	0.05	0.03	0.03	0.04	0.06
<i>PercentVested</i>	0.88	0.08	0.84	0.89	0.94

Note: The variables are: $RET(\%)_{ij}$ is the realized returns on the beginning pension plan assets for plan j of sponsor firm i ; $(\sigma_{RET}^2(\%))_{ij}$ is the variance of the returns on the beginning pension plan assets for plan j of sponsor firm i computed using all available plan years; *PercentFunded* $_{ij}$ is the (beginning of year) current value of the pension plan assets divided by the RPA '94 current liability for plan j of sponsor firm i ; *D_Underfunded* $_{ij}$ is an indicator variable that equals one if the (beginning of year) current value of the pension plan assets is less than the RPA '94 current liability for plan j of sponsor firm i , and zero otherwise; *FSA CreditBalance* $_{ij}$ is the funding standard account (FSA) credit balance divided by the average pension plan assets for plan j of sponsor firm i ; *BankruptcyRisk* $_i$ is the bankruptcy risk for sponsor firm i measured using the bankruptcy prediction score from the Ohlson (1980) model; *OperatingCashFlow* is cash from operating activities divided by total assets for sponsor firm i ; *CorporateTax* $_i$ is the corporate-level tax benefit from debt less shareholder taxes on the tax benefit for sponsor firm i ; *BenefitsPaid* $_{ij}$ is the benefit payments made by pension plan j of sponsor firm i divided by the average pension plan assets; *PercentVested* $_{ij}$ is the percentage of the RPA '94 current liability vested for plan j of sponsor firm i .

Table 2

Distribution of Funding Standard Account (FSA) Credit Balances and Funding Levels by Year

This table presents annual information regarding the distribution of defined benefit pension plan's funding standard account (FSA) credit balances (Panel A) and the distribution of defined benefit pension plan's funding levels (Panel B). The sample period is 1996-2002. Defined benefit pension plans with FSA credit balances can avoid making contributions under minimum funding requirement calculations.

Panel A: Distribution of FSA Credit Balances by Year

Year	FSA Credit Balance: FSA Credit Balance Divided by Average Current Plan Asset Value				
	0.00%	0.01%-4.99%	5.00%-9.99%	10.00%-20.00%	>20.00%
1996	26.62%	43.17%	11.03%	9.93%	9.24%
1997	25.08%	41.24%	12.02%	11.64%	10.02%
1998	21.99%	42.31%	13.65%	12.46%	9.59%
1999	27.40%	39.67%	11.55%	13.09%	8.28%
2000	21.41%	42.56%	13.58%	14.36%	8.09%
2001	19.35%	39.46%	13.62%	13.41%	14.16%
2002	15.05%	30.78%	12.85%	18.79%	22.53%

(Continued)

Table 2—Continued

Panel B: Distribution of Funding Levels by Year

Percent Funded: Current Plan Asset Value Divided by RPA '94 Current Liability
(Beginning of Year Amounts)

Year	<80.00%	80.00%-99.99%	100.00-119.99%	120.00%-180.00%	>180.00%
1996	12.83%	29.66%	27.86%	26.07%	3.59%
1997	10.02%	28.05%	28.12%	27.54%	6.27%
1998	7.15%	22.64%	29.36%	33.04%	7.80%
1999	8.59%	29.45%	26.79%	27.51%	7.67%
2000	8.88%	36.29%	21.67%	27.68%	5.48%
2001	14.81%	40.65%	18.81%	20.32%	5.51%
2002	26.75%	42.57%	14.38%	12.46%	3.84%

Table 3

Pension Plan Asset Return Distribution Conditioned on Plans Funding Status and Having a Large FSA Credit Balance

The table provides univariate evidence regarding how the distribution of realized returns on pension plan assets varies by the plan's funding status and availability of funding standard account (FSA) credit balances. The sample period is 1996-2002. The return on pension plan assets is measured at the individual plan level as the income earned on the beginning pension plan assets. Consistent with ERISA funding rule definitions, underfunded plans are defined as plans having (beginning of year) current value pension plan assets less than the RPA '94 current liability. Large FSA credit balances are defined as those plans with FSA credit balances over 10% of the average pension plan assets. The symbols ** and * (## and #) denote significance at the 1% and 5% levels based on one-sided (two-sided) tests.

Panel A: Distribution of Returns on Pension Plan Assets				
Funding Status/ FSA Credit Balance	<i>N</i>	Variance of Returns	Average Returns	Median Returns
Underfunded	3,227	4.55%	17.59%	15.26%
Large FSA Credit Balance	1,162	5.37%	20.13%	16.68%
Small FSA Credit Balance	2,065	4.03%	16.17%	15.36%
Overfunded	4,220	2.10%	13.57%	15.06%
Large FSA Credit Balance	700	2.90%	14.12%	14.55%
Small FSA Credit Balance	3,520	1.94%	13.46%	15.14%

(Continued)

Table 3—Continued

Panel B: Comparisons by Funding Status and FSA Credit Balance			
Comparison	Variance of Returns (<i>F</i> -statistic)	Average Returns (<i>t</i> -statistic)	Median Returns (<i>Z</i> -statistic)
Underfunded vs. Overfunded	2.44% (2.16)**	4.02% (9.21)**	0.20% (6.12)**
Underfunded: Large vs. Small FSA Credit Balance	1.34% (1.33)**	3.97% (4.90)**	1.31% (3.89)**
Overfunded: Large vs. Small FSA Credit Balance	0.96% (1.49)**	0.96% (0.97)	-0.58% (-0.15)

Table 4

Multivariate Analysis of the Role of Underfunding on the Variance of Returns Earned by Pension Plans

This table provides the results of weighted-least-squares estimations of the determinants of the variance of returns for pension plan assets $(\sigma_{RET}^2(\%))_{ij}$. The sample period is 1996-2002. The symbols ** and * (## and #) denote significance at the 1% and 5% levels based on one-sided (two-sided) tests.

Variables	Coefficient (<i>t</i> -statistic)	Coefficient (<i>t</i> -statistic)
<i>Year Fixed Effects</i>	-	-
<i>PercentFunded</i>	-0.02 (-0.06)	1.15 (2.38) ^{##}
<i>D_Underfunded</i>		7.25 (6.14) ^{**}
<i>PercentFunded * D_Underfunded</i>		-13.72 (-5.61) ^{**}
<i>BankruptcyRisk</i>	-0.01 (-1.46)	-1.80 (-1.82) [*]
<i>OperatingCashFlow</i>	-11.67 (-3.46) ^{**}	-10.82 (-3.25) ^{**}
<i>CorporateTax</i>	2.19 (0.70)	2.58 (0.83)
<i>BenefitsPaid</i>	-18.14 (-3.24) ^{**}	-21.36 (-3.85) ^{**}
<i>PercentVested</i>	-11.40 (-4.35) ^{**}	-11.59 (-6.44) ^{**}
<i>Adjusted – R²</i>	7.12%	9.84%
<i>N</i>	1,215	1,215

(Continued)

Table 4—Continued

Note: The variables are: $(\sigma_{RET}^2(\%))_{ij}$ is the variance of the returns on the beginning pension plan assets for plan j of sponsor firm i computed using all available plan years; $PercentFunded_{ij}$ is the (beginning of year) current value of the pension plan assets divided by the RPA '94 current liability for plan j of sponsor firm i ; $D_Underfunded_{ij}$ is an indicator variable that equals one if the (beginning of year) current value of the pension plan assets is less than the RPA '94 current liability for plan j of sponsor firm i , and zero otherwise; $BankruptcyRisk_i$ is the bankruptcy risk for sponsor firm i measured using the bankruptcy prediction score from the Ohlson (1980) model; $OperatingCashFlow$ is cash from operating activities divided by total assets for sponsor firm i ; $CorporateTax_i$ is the corporate-level tax benefit from debt less shareholder taxes on the tax benefit for sponsor firm i ; $BenefitsPaid_{ij}$ is the benefit payments made by pension plan j of sponsor firm i divided by the average pension plan assets; $PercentVested_{ij}$ is the percentage of the RPA '94 current liability vested for plan j of sponsor firm i .

Table 5

Multivariate Analysis of the Role of Funding Standard Account (FSA) Credit Balances on the Variance of Returns Earned by Pension Plans

This table provides the results of a weighted-least-squares estimation of the determinants of the variance of returns for pension plan assets $(\sigma_{RET}^2(\%))_{ij}$. The sample period is 1996-2002. The symbols ** and * (## and #) denote significance at the 1% and 5% levels based on one-sided (two-sided) tests.

Variables	Coefficient (<i>t</i> -statistic)
<i>Year Fixed Effects</i>	-
<i>PercentFunded</i>	1.29 (2.23) [#]
<i>D_Underfunded</i>	1.75 (1.18)
<i>PercentFunded * D_Underfunded</i>	-2.53 (-0.81)
<i>FSA CreditBalance</i>	6.10 (0.98)
<i>PercentFunded * FSA CreditBalance</i>	0.86 (0.13)
<i>D_Underfunded * FSA CreditBalance</i>	69.01 (5.50) ^{**}
<i>PercentFunded * D_Underfunded * FSA CreditBalance</i>	-146.54 (-5.84) ^{**}
<i>BankruptcyRisk</i>	-0.05 (-0.52)
<i>OperatingCashFlow</i>	-12.47 (-3.78) ^{**}

(Continued)

Table 5—Continued

<i>CorporateTax</i>	2.84 (0.94)
<i>BenefitsPaid</i>	-20.92 (-3.85)**
<i>PercentVested</i>	-9.92 (-5.59)**
<i>Adjusted – R²</i>	15.60%
<i>N</i>	1,215

Note: The variables are: $(\sigma_{RET}^2(\%))_{ij}$ is the variance of the returns on the beginning pension plan assets for plan j of sponsor firm i computed using all available plan years; $PercentFunded_{ij}$ is the (beginning of year) current value of the pension plan assets divided by the RPA '94 current liability for plan j of sponsor firm i ; $D_Underfunded_{ij}$ is an indicator variable that equals one if the (beginning of year) current value of the pension plan assets is less than the RPA '94 current liability for plan j of sponsor firm i , and zero otherwise; $FSA\ CreditBalance_{ij}$ is the funding standard account (FSA) credit balance divided by the average pension plan assets for plan j of sponsor firm i ; $BankruptcyRisk_i$ is the bankruptcy risk for sponsor firm i measured using the bankruptcy prediction score from the Ohlson (1980) model; $OperatingCashFlow$ is cash from operating activities divided by total assets for sponsor firm i ; $CorporateTax_i$ is the corporate-level tax benefit from debt less shareholder taxes on the tax benefit for sponsor firm i ; $BenefitsPaid_{ij}$ is the benefit payments made by pension plan j of sponsor firm i divided by the average pension plan assets; $PercentVested_{ij}$ is the percentage of the RPA '94 current liability vested for plan j of sponsor firm i .

Table 6

Multivariate Analysis of the Role of Funding Standard Account (FSA) Credit Balances on the Returns Earned by Pension Plans

This table provides the results of an ordinary-least-squares estimation of the determinants of the variance of returns for pension plan assets $RET(\%)_{ij}$. The sample period is 1996-2002. The t -statistics are computed using robust standard errors. The symbols ** and * (## and #) denote significance at the 1% and 5% levels based on one-sided (two-sided) tests.

Variables	Coefficient (t -statistic)
<i>Year Fixed Effects</i>	-
<i>PercentFunded</i>	-1.41 (-1.46)
<i>D_Underfunded</i>	21.51 (8.97)**
<i>PercentFunded * D_Underfunded</i>	-41.18 (-8.37)**
<i>FSA CreditBalance</i>	1.50 (0.09)
<i>D_Underfunded * FSA CreditBalance</i>	78.98 (4.02)**
<i>PercentFunded * D_Underfunded * FSA CreditBalance</i>	-148.51 (-4.50)**
<i>PercentFunded * FSA CreditBalance</i>	12.21 (0.65)
<i>BankruptcyRisk</i>	-1.51 (-17.94)**
<i>OperatingCashFlow</i>	-26.69 (-8.38)**

(Continued)

Table 6—Continued

<i>CorporateTax</i>	-7.78 (-2.94)**
<i>BenefitsPaid</i>	-76.35 (-8.07)**
<i>PercentVested</i>	-17.50 (-5.92)**
<i>Adjusted – R²</i>	27.52%
<i>N</i>	7,447

Note: The variables are: $RET(\%)_{ij}$ is the realized returns on the beginning pension plan assets for plan j of sponsor firm i ; $PercentFunded_{ij}$ is the (beginning of year) current value of the pension plan assets divided by the RPA '94 current liability for plan j of sponsor firm i ;

$D_Underfunded_{ij}$ is an indicator variable that equals one if the (beginning of year) current value of the pension plan assets is less than the RPA '94 current liability for plan j of sponsor firm i , and zero otherwise; $FSA\ CreditBalance_{ij}$ is the funding standard account (FSA) credit balance divided by the average pension plan assets for plan j of sponsor firm i ; $BankruptcyRisk_i$ is the bankruptcy risk for sponsor firm i measured using the bankruptcy prediction score from the Ohlson (1980) model; $OperatingCashFlow$ is cash from operating activities divided by total assets for sponsor firm i ; $CorporateTax_i$ is the corporate-level tax benefit from debt less

shareholder taxes on the tax benefit for sponsor firm i ; $BenefitsPaid_{ij}$ is the benefit payments made by pension plan j of sponsor firm i divided by the average pension plan assets;

$PercentVested_{ij}$ is the percentage of the RPA '94 current liability vested for plan j of sponsor firm i .