CORPORATE TAXES AND DEFINED BENEFIT PENSION PLANS*

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The Tepper-Black arguments for tax-arbitrage opportunities from overfunding pension plans are critically examined and modifications proposed. Tax status, a function of current marginal tax rates and expected future taxable income, is predicted to determine funding policy. Tests of this modified tax benefits view suggest that 1) tax status declines are associated with pension contribution reductions, 2) reductions in contributions are related to previous excess contributions as well as non-pension tax shield increases causing the decline in tax status, and 3) cross-sectionally, tax status is related to fund levels, choice of actuarial variables, and the use of defined benefit plans.

1. Introduction

Defined benefit pension plans enjoy considerable popularity with corporate sponsors. Tax arbitrage has been suggested as the primary cause for the survival of such plans [Tepper and Affleck (1974), Black (1980), and Tepper (1981)]. Tax benefits arise from the special tax status of pension plans and from the ability to make additional contributions to the plan, in excess of any implicit or explicit obligations, that can subsequently be withdrawn. Assets for plans with defined future benefits can differ from legal or accrued liabilities.

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1See appendix A for relevant details of pension terms used here and McGill (1984, ch. 2) for additional details and for references to related tax and pension regulations. Defined benefit pension plans are plans where the ultimate benefits to be received by employees, after retirement, are stipulated in advance. These plans are different from defined contribution plans in which the periodic contributions (by the employer and/or employee) are stipulated. Friedman (1982) reported that his sample of 1836 large firms sponsored more defined benefit plans (5836 plans out of a total of 7828 plans) and these plans held substantially more assets than defined contribution plans.

representing the present value of all future benefits payable if the firm were to currently terminate the plan. The Tepper–Black view identifies broadly defined limits to overfunding, specified by tax and pension regulations, and predicts that all taxpaying firms should uniformly overfund to the maximum allowed. However, empirical investigations of pension funding conducted by Friedman (1982), Bodie et al. (1984), and Francis and Reiter (1987) observe considerable cross-sectional variation in funding levels and document a weak link between funding policy and tax status.2

Motivated by the apparent gap between the theory and practice of pension funding, this paper re-examines the link between tax status and corporate funding policy. Incorporating additional institutional constraints generates costs not considered by Tepper and Black. Introducing intertemporal changes in marginal tax rates provides an explanation for why firms fund less than the limits identified by Tepper and Black. This modified tax benefits view argues that low tax status firms (with low current marginal tax rates and/or low expected future taxable income) choose not to overfund because the costs of overfunding exceed potential tax benefits. Even firms with relatively high tax status limit overfunding to levels that can be supported by future taxable income, due to restrictions imposed by acceptable actuarial practices.

Results of empirical tests, both time-series and cross-sectional, suggest that tax status is an important determinant of pension funding. Improvements in research design and measurement of tax and pension variables are identified as potential reasons why the link between tax status and pension funding observed here is stronger than that documented by prior research. While the results are exploratory and many issues remain unresolved, the following conclusions can be drawn:

- As tax status declines, pension contributions decline.
- Cross-sectionally, this decline in contributions is related to prior overfunding and also to increases in non-pension tax shields causing the tax decline.
- Low tax status firms, identified by the presence of a tax loss carryforward, are generally funded near the level of the accrued pension liability. Firms with relatively higher tax status are frequently overfunded, relative to the accrued liability.
- Actuarial methods and assumptions are systematically less conservative (imply lower funding levels) for low tax status firms, relative to high tax status firms.
- Low tax status firms are less likely to select defined benefit plans.

2Tax status is a generic term used to describe various tax variables employed in the pension literature. While the theoretical work refers to marginal tax rates, empirical studies have used alternative measures that proxy for unobservable marginal rates. In section 2, tax status is defined as a complex function of tax attributes, including marginal tax rates and expectations of future taxable income.
The rest of this paper is organized as follows. Section 2 identifies the costs and constraints that modify the Tepper–Black tax benefits view and discusses the research design. Section 3 examines the time-series link between changes in tax status and changes in pension flows. Section 4 examines the cross-sectional relation between tax status and two measures of funding policy: funding levels and actuarial variables. This study is limited to tax effects and corporate funding policy. Non-tax effects are controlled for indirectly and pension policy relating to non-corporate organizations (local governments, partnerships, etc.) and asset allocation (among stocks, bonds, etc.) is intentionally excluded to limit complexity. In summarizing this research, section 5 speculates on the link between taxes and pension policy for state and local government units and appendix A estimates the impact of non-tax effects on pension policy.

2. Hypotheses and research design

2.1. Tax benefits of overfunding

The tax benefits view argues that pension funding consists of two separate parts that serve two different purposes: (1) a ‘base’ amount, representing funding policy that would be followed in the absence of tax benefits and (2) overfunded amounts designed to avail of tax arbitrage. Tax benefits from overfunding arise from two features of the tax code: excess contributions generate tax deductions, and income earned within the fund is tax-exempt. Firms are expected to select actuarial variables to overfund and withdraw relative to base levels, that primarily reflect pension promises to employees. Other factors affecting base funding policy include incentive effects [Ippolito (1986)], pension insurance effects [Treynor (1977)], and financial statement effects [Francis and Reiter (1986)] (see appendix A for a description of these non-tax effects).

2.1.1. Tepper–Black view

The Tepper–Black analysis can be illustrated as follows. Let $\tau_{\text{in}}$ be a firm’s current marginal tax rate when excess contributions are made, $r$ be the pre-tax annual rate of return on pension fund assets, and $\tau_{\text{out}}$ be the marginal tax rate when withdrawals take place. Marginal tax rates are defined as the expected present value of additional tax resulting from an additional unit of current taxable income. For an excess contribution of $1 the firm gets a deduction of $\tau_{\text{in}}$, which reduces the cash outlay to $(1 - \tau_{\text{in}})$. The dollar invested in the fund grows to $(1 + r)^n$ over a period of $n$ years. No taxes are due until this amount is withdrawn, and the after-tax withdrawal equals $(1 + r)^n(1 - \tau_{\text{out}})$. 

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The annual after-tax rate of return on overfunding, \( r_{of} \), is defined by

\[
(1 + r_{of})^n = \frac{(1 - \tau_{out})}{(1 - \tau_{in})} (1 + r)^n. 
\]

When \( \tau_{in} \) equals \( \tau_{out} \), the case analyzed by Tepper and Affleck (1974), Black (1980), and Tepper (1981), \( r_{of} \) equals \( r \). Firms therefore avoid corporate taxes on all income earned by excess assets held in the fund.\(^3\) In a Miller (1977) world where leverage-related tax benefits are absent, arbitrage opportunities arise from holding taxable corporate bonds in the fund, since tax-exempt pension funds are inframarginal relative to the marginal investor determining the after-tax yield on taxable bonds. Further, if leverage-related tax benefits exist [see Miller and Modigliani (1963) and DeAngelo and Masulis (1980), for example] additional benefits arise because the after-tax cost of debt, \( r(1 - \tau) \), is lower than the after-tax rate of return on overfunding, \( r \).

In any case, the funding implications of the Tepper-Black view are clear: firms should overfund to the maximum allowed. Limits to overfunding are broadly defined by regulations requiring that (1) actuarial variables selected be certified by an enrolled actuary as being acceptable and (2) any benefit increases be funded over at least ten years. Why then are all taxpaying firms not uniformly overfunded to the limits predicted by this view?\(^4\) The next subsection examines if marginal tax benefits decrease and/or marginal costs increase as funding levels increase, resulting in desired funding levels that vary across firms and that are lower than the maximum allowed.

2.1.2. Modified tax benefits view

Introducing institutional features significantly alters the Tepper-Black conclusions, primarily because property rights regarding excess assets are not well-defined [see Ippolito (1986), for example]. Sponsors are required to manage pension funds for the exclusive benefit of beneficiaries and evidence to the contrary jeopardizes the preferential tax treatment received. In principle, firms cannot overfund and withdraw at will, and excess assets do not ‘belong’

\(^3\) Note that base contributions, which are really deferred employee compensation, also create current tax deductions and generate tax-exempt income within the fund. As a result employees effectively avoid paying personal income taxes on income deferred through their pension plans [Miller and Scholes (1981)]. While defined contribution plans offer the same tax benefits for deferred compensation, they do not allow firms to overfund and avoid corporate taxes on income from excess contributions.

\(^4\) Also, why do firms hold any equity securities at all given that equity bears an implicit tax, as reflected by lower equilibrium pre-tax returns? The fact that substantial amounts of pension assets are invested in equity securities seems to contradict the Miller equilibrium. Similarly, since all income is taxed as ordinary income upon withdrawal, the tax benefits in eq. (1) are overstated for assets generating tax preferences, as such assets are expected to generate lower pre-tax returns in equilibrium.
to the sponsor. In practice, however, detection of abusive behavior is left to enrolled actuaries who typically allow a fairly wide range of funding policies as being reasonable. Therefore, while firms can overfund and withdraw within constraints imposed by their enrolled actuaries and the Internal Revenue Service (IRS), they cannot explicitly claim ownership to excess assets. The effects of these constraints on the tax benefits of overfunding, described in eq. (1), are discussed below.

First, the tax benefits are overstated since potentially significant costs of overfunding have been ignored so far. Some excess assets might be lost to the firm because of regulatory changes that restrict or eliminate withdrawals and because of disputes over asset ownership. Despite a general decline in the proportion of excess assets that courts have awarded to beneficiaries, there has been a corresponding increase in activity attempting to enact legislation that hampers, taxes or eliminates withdrawals [Ippolito (1986)]. For example, the Tax Reform Act of 1986 includes an excise tax on asset reversions from terminations of overfunded plans. Also, if the IRS obtains evidence of intentional abuse by the sponsor, the trust's qualified status can be revoked and excess contributions disallowed.5

Second, allowing for intertemporal changes in tax rates in the presence of certain funding constraints suggests that marginal tax benefits decline as overfunding increases.6 Firms are not entirely free to select contributions each period since frequent changes in funding policy would be qualified by the actuary which, in turn, could cause the IRS to invalidate all tax benefits. If firms are constrained to follow relatively stable funding policies, additional excess contributions decrease taxable income (both current and future) thereby reducing marginal tax rates. Continuing to make excess contributions during periods of reduced marginal tax rates reduces the tax benefits of overfunding, relative to when tax rates are higher.

To make explicit the assumptions underlying this conclusion, consider a firm that predicts future levels of taxable income before discretionary pension contributions. Discretionary pension contributions exclude contributions made towards base funding requirements and are positive (negative) in years when firms make excess contributions (withdrawals). Some components of taxable income are assumed exogenously determined (such as revenues and base pension contributions) while others (such as levels of debt tax shields) are

5 The costs of complying with the Employee Retirement Income Security Act of 1974 could become relevant since they are avoided if alternative forms of deferred compensation are selected. While such costs are fixed (do not vary with funding levels) and are therefore irrelevant in a marginal analysis, they are important when comparing net benefits (total benefits less total costs) across competing forms of deferred compensation.

6 Also, arbitrage opportunities caused by the tax advantages of debt financing (implied by the Tepper–Black view in a world with leverage-related tax benefits) are overstated to the extent that assets have lower debt capacity when held inside the fund, relative to outside the fund. Tepper (1984) argues that excess assets provide limited collateral because technically firms do not own excess assets.
selected endogenously. Next overlay a pension policy that calls for a stable level of excess contributions equal to the maximum allowed, creating additional tax shields over all future years until excess contributions are withdrawn. Also, if tax benefits of overfunding require that excess contributions be debt-financed, taxable income is reduced further by these additional debt tax shields. If firms do not entirely compensate for the increased level of tax deductions, by adjusting other endogenously determined components of taxable income (such as reducing debt tax shields), then taxable income, both current and future, will decline correspondingly. I assume that non-pension components of taxable income are determined by both tax and non-tax considerations and thus do not change sufficiently to completely offset the increased pension tax shields due to overfunding. This sustained reduction in taxable income is expected to reduce marginal tax rates because of progressive tax rates and because increasingly negative taxable incomes (firms carrying back and carrying forward tax losses) are expected to result in lower marginal tax rates [Scholes and Wolfson (1986)]. Continuing to make excess contributions during periods of depressed marginal tax rates ($\tau_{\text{in}}$ less than expected future values of $\tau_{\text{out}}$) reduces the expected tax benefits of overfunding, relative to the constant tax rate case. If possible, firms would withdraw previous excess contributions to benefit from the decline in tax rates ($\tau_{\text{out}}$ less than prior $\tau_{\text{in}}$). Thus, the two critical assumptions underlying the modified tax benefits view are (1) firms are not free to alter funding policy frequently and (2) firms do not, in equilibrium, completely offset an additional dollar of excess contributions by a corresponding reduction in non-pension tax shields.

The following descriptive representation of the link between taxes and pension funding emerges. If tax benefits exceed costs, then arbitrage opportunities exist and overfunded tax-paying firms exist in the economy. Desired funding levels vary cross-sectionally based on expectations of future levels of both exogenous and endogenous components of taxable income. Not all firms are expected to overfund to the maximum allowed, and some firms might choose not to overfund at all. Further, overfunded firms experiencing a decline in marginal tax rates are expected to make withdrawals to benefit from a low $\tau_{\text{out}}$.

On the other hand, firms would not overfund if costs exceed tax benefits. However, for asset portfolios typically held by pension funds (such as stocks and bonds), firms could prefer to hold such investments inside the fund, as excess assets, rather than outside the fund as direct investments. If firms intend to hold a significant amount of marketable securities over long periods of time, overfunded pension plans are a viable alternative. 7 In this no-arbi-

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7Why would firms seek to hold large amounts of marketable securities given that investors could avoid a layer of corporate tax by directly holding such investments, perhaps through tax-favored vehicles such as pension plans and life insurance contracts? Recently two explanations have been advanced for such behavior: the desire for financial slack [Myers and Majluf (1984)] and managers' reluctance to release 'free' cash flows [Jensen (1986)].
trage scenario, overfunding plays a different, and limited, role relative to that proposed by the tax-arbitrage view. Note, however, that the superiority of holding assets inside the pension fund, relative to outside the fund, is still determined by the tax benefits of overfunding. The only difference is the lower opportunity cost for funds (now equal to the after-tax return on marketable securities) and the introduction of an additional constraint (that may or may not be binding) based on the level of marketable securities desired.8

This discussion provides both a tax-based explanation for cross-sectional variation in desired funding levels, as well as a conceptual measure of tax status that is linked to desired funding levels. Conceptually, tax status is defined as the level of 'free' taxable income (after endogenously determined non-pension items but before discretionary pension contributions) available in the future to cover a sustained level of excess pension contributions without reducing marginal tax rates to a level where additional overfunding becomes undesirable (costs exceed benefits). While taxable income before discretionary contributions is not easily estimated since both pension and non-pension components of taxable income are jointly selected choice variables and current theory does not allow a separation of these joint effects, the modified tax benefits hypothesis predicts the following general link between taxes and pension funding:

*Research Hypothesis.* Desired funding levels are positively related to tax status.

A competing hypothesis is that tax status does not influence funding. This is consistent with the view that overfunding provides no net tax benefits. It is also consistent with the view that enrolled actuaries successfully prevent overfunding for tax purposes. Actuaries have long held that pension funds are separate legal entities independent of sponsors, and funding policy should not be influenced by the sponsor's tax status [McGill (1984) and Trowbridge and Farr (1976)].

2.2. *Research design*

2.2.1. *Limitations of prior studies*

Based on cross-sectional regressions of funding levels on various proxies for tax status, prior studies have observed only a weak link in the direction hypothesized by the tax benefits view [Friedman (1982), Bodie et al. (1984),

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8In the absence of data on whether benefits of overfunding exceed costs, I am unable to discriminate between these two alternative descriptions of the link between taxes and funding policy. Similarly the relation between funding policy and factors that explain why firms seek to hold marketable securities, such as financial slack and free cash flow, is not examined because of the difficulty in measuring such variables. See Francis and Reiter (1986) and Thomas (1988) for preliminary investigations of this issue.
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and Francis and Reiter (1986)]. These tests are confounded by four factors that make it difficult to isolate the presence of a tax effect. First, explanatory variables, such as profitability, leverage and risk, are often included to proxy for non-tax determinants of pension funding. The simple linear relationship assumed is probably misspecified, since evidence suggests the presence of non-linear relationships and interaction terms [see Bodie et al. (1984) and Francis and Reiter (1987)]. To the extent that tax status is correlated with these other explanatory variables and the model is misspecified, the coefficient on the tax status variable is biased. Conversely, an important non-tax effect has typically been ignored [see Finston and Mehr (1986), for example]. Firms with cost-plus or reimbursable type contracts have incentives to cover workers linked to such contracts under separate plans and overfund these plans over the duration of the contract. In such cases, even low tax status firms would overfund, thereby weakening the observed relation between tax status and funding levels.

Second, observed funding policy measures desired funding policy with error. Realized funding levels and flows are a joint product of (1) plan features, (2) actuarial variables selected by the firm, and (3) exogenous factors affecting asset values and interest rates (see appendix A). Plan features such as employee demographics and benefit formulas, assumed to be exogenous to the funding decision, narrow the range over which pension funding can be manipulated by varying the actuarial variables selected. For example, funding for plans with benefits denominated in dollar terms (instead of as a percent of future wages) and/or with older employees is less amenable to manipulation (overfunding/withdrawal). Both the strong mechanical link between plan features and funding as well as unexpected changes in discount rates and asset values influence realized funding levels and flows. Unlike changes in discount rates and asset values, plan features are expected to be systematically related to financial variables and tax status. Therefore, omitting plan features in a cross-sectional regression biases the coefficients for included explanatory variables. Also, since fund levels adjust slowly to a change in desired funding, current funding measures could reflect past funding policy.

With cost-plus contracts, the benefits of overfunding are obvious. In cases where pension contributions are reimbursed, the gains are more subtle. Firms with reimbursed pension expenses have non-tax incentives to overfund as long as (1) some employees are not covered by such contracts or (2) the firm outlives such contracts. Finston and Mehr (1986) illustrate how pervasive these non-tax incentives to overfund can be and describe the specific procedures employed.

See Bodie et al. (1984) for evidence on the cross-sectional relation between funding levels and plan features (benefit types and employee demographics).

Smith and Watts (1986) argue that the investment opportunity set determines, to a large extent, optimal financial policies. To the extent that plan features, tax status, and financial variables are all related to the underlying investment opportunity set, they are expected to be correlated with each other.
funding levels move gradually towards new desired levels, pension flows need to 'over-respond' to achieve desired funding levels.\footnote{For example, take an overfunded plan that is moving towards base funding levels (no overfunding). Pension flows need to drop below base flows during the adjustment period, to deplete prior overfunding, before increasing to base amounts in equilibrium.}

Third, tax variables used in prior studies measure tax status with considerable error. Earlier studies have used Compustat data to obtain scaled values of tax payments [Bodie et al. (1984) and Francis and Reiter (1987)] and tax expense [Friedman (1982)]. The first proxy assumes that average and marginal rates are highly correlated, i.e., higher tax payments (refunds) reflect higher (lower) marginal tax rates, while the second also assumes that average tax rates based on book and tax accounting are highly correlated. Identifying low tax firms by selecting all firms reporting positive net operating tax loss (NOL) carryforwards on Compustat [Bodie et al. (1984)] causes significant misclassification (see section 4 for evidence). Examination of tax footnote data from annual reports indicates that (1) many carryforwards relate to foreign operations or domestic subsidiaries not consolidated for tax purposes and (2) many cases with positive carryforwards are coded by Compustat as missing since the dollar amount could not be determined. The first (second) set would be incorrectly included in (excluded from) the low tax group.

Fourth, since low tax status firms are also potentially firms in financial hardship, funding levels and flows could be lower for such firms because of a 'cash constraint' or because of the pension put effect (see appendix A). The cash constraint argument assumes that such firms find it cheaper to borrow from their employees, through reduced contributions, than obtaining funds from external sources. The pension put argument predicts that firms in financial hardship seek to minimize the magnitude of the 'exposed' assets (pension assets plus 30 percent of firm equity) and maximize the variability of returns (risk) of exposed assets. Since base funding policy cannot be uniquely identified, observing that high tax firms are better funded than low tax firms is also consistent with the explanation that high tax firms are funded at base levels while low tax firms are underfunded.\footnote{Unfortunately, as explained in appendix A, available funding data is expected to be reliable only when estimating relative funding levels (across firms and over time). Estimates of absolute funding levels (overfunded or underfunded) could be associated with significant error.}

\subsection*{2.2.2. Methodology}

Given the nature and extent of these complications, no single test is expected to control adequately for all problems. Four separate tests are
employed, each controlling for individual problems to a different degree. In combination, the proposed tests benefit from a portfolio effect.

The first two tests, described in section 3, examine the time-series behavior of pension flows to determine if tax status changes cause changes in pension policy. These tests use pension flows to measure funding policy since flows are expected to exhibit larger changes, relative to fund levels, immediately after a change in tax status (see footnote 12). An important advantage of time-series tests over cross-sectional tests is that each firm serves as its own control since year-to-year changes in pension policy are analyzed. If base pension flows remain unchanged as tax status changes, the inability to identify base flows correctly is not a concern. To the extent that plan features stay constant over time, the mechanical linkage between funding and plan features is also not a concern. However, time-series tests are affected by exogenous shocks, such as changes in discount rates, that cause changes in observed pension funding. To control for this effect, the cross-sectional relation between changes in pension flows in the tax change year and the magnitude of the tax status change is analyzed.

The third and fourth tests, described in section 4, examine the cross-sectional relation between tax status and measures of funding policy. Two major advantages of the cross-sectional tests over similar regressions reported in the literature are (1) the examination of actuarial variables, in addition to fund levels, and (2) the control for plan features. Unlike funding level regressions, the relation between actuarial variables and tax status is expected to be free of any confounding due to plan features and is not affected adversely by the inability to identify base funding levels. The degree of conservatism of actuarial variables selected provides a clear signal about firms' desired funding levels. An unusual research design is offered to control for plan features and to mitigate the following data problems. First, the actuarial variables and plan features required for the tests are only reported at the plan level. Since funding policy is being examined here at the firm level, considerable hand-collection of data is required and, therefore, only a relatively small sample (180 firms) is analyzed. Second, plan features cannot simply be included as additional independent variables to the cross-sectional regressions. Some plan features are categorical and cannot easily be combined to obtain an overall value for that plan feature at the firm level (see appendix A). Further, additional analysis is necessary to model the complex empirical relation between plan features and the dependent variables measuring funding policy. Given these problems, three variables, available at the firm level, are used to proxy for plan features. Instead of modeling the effect of plan features, a non-random sampling procedure is used and plan features are excluded from the regression. Since omitting relevant variables (plan features) biases the estimates for included variables (tax status) only if they are correlated with each other, the sampling procedure is designed to reduce sample correlation between tax
status and variables proxying for plan features. All firms on Compustat are categorized into two tax status groups – high and low. Then 90 pairs of high and low tax firms are selected so that firms within each pair are matched upon variables proxying for plan features.

To measure tax status, firm-years are classified into three categories: TAXPAYER, CARRYBACK, and CARRYFORWARD. TAXPAYERS reporting positive federal tax payments are classified as high tax firms while firms reporting federal tax losses (non-payers) are low tax firms. Within the non-payer category, CARRYFORWARD firms that are carrying forward tax losses to future years are expected to have the lowest tax status, and CARRYBACK firms that are only offsetting current tax losses against prior tax payments are expected to be of intermediate tax status. Firm-years are classified into the three tax categories based on two Compustat data items as follows:

<table>
<thead>
<tr>
<th>Tax Status</th>
<th>Federal Tax Payment (data item #63)</th>
<th>NOL Carryforward (data item #52)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAXPAYER</td>
<td>&gt; 0</td>
<td>0</td>
</tr>
<tr>
<td>CARRYBACK</td>
<td>≤ 0</td>
<td>0</td>
</tr>
<tr>
<td>CARRYFORWARD</td>
<td>≤ 0</td>
<td>&gt; 0</td>
</tr>
</tbody>
</table>

Federal Tax Payment refers to the portion of tax expense that is identified, in Annual Report footnotes, as relating to federal taxes and as being currently payable (not deferred). The NOL carryforward is the amount reported in the footnotes as the Net Operating Loss being carried forward for federal tax purposes.

This simple categorical measure has a number of limitations that increase measurement error. First, it does not reflect the many features of the tax code that complicate the determination of marginal tax rates [see Scholes and Wolfson (1986), for example]. Second, the categorical measure seems relatively inefficient since no attempt is made to measure the magnitude of firms’ tax status. Finally, observed tax attributes, after discretionary pension contributions, are used to infer tax status. However, a better measure is not available given that tax status represents levels of expected future taxable income (before discretionary pension contributions), which is a complex function of exogenous and endogenous components of future taxable income that are not readily identified. Only for the second time-series test, which examines changes

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14 The magnitude of any reduction in bias (for the estimated coefficient on the tax variable) due to this procedure, relative to random sampling, cannot be estimated without a complete specification of the underlying model [Kmenta (1971)]. However, the reduction in correlation between tax status and the three proxies for plan features is reported in appendix C.
in pension flows around enactment of the Economic Recovery Tax Act (ERTA) of 1981, is a reasonable proxy available for magnitudes of tax status changes. The increase in asset-based tax shields (depreciation and investment tax credits utilized on tax returns) caused by ERTA is used as a proxy for the corresponding decline in tax status.

Two other refinements are introduced in measuring tax status. Annual reports are examined to determine the source of the carryforward, i.e., to ensure that NOL carryforwards relating to foreign and unconsolidated (for tax purposes) domestic subsidiaries are not incorrectly classified. Also, since past tax status could affect current funding levels, prior years' tax data are examined for the cross-sectional tests to identify recent changes in tax categories (TAXPAYER, etc.).

To control for the presence of non-tax incentives to overfund, certain industries are excluded from the analysis. Defense contractors are expected to receive a significant proportion of their revenues through cost-plus or reimbursable-type contracts. Similarly, public utilities could view pension expenses as reimbursable expenses due to regulations determining their cost-revenue structure. A review of the FAS-36 data tape (obtained from Columbia University) confirms that firms in these industries (even low tax firms) are systematically overfunded and use much lower discount rates on average than firms in other industries.

Both the cash constraint and pension put explanations are not easily controlled for because of the high correlation between tax status and financial hardship. The cash constraint effect is proxied for indirectly through measures of cash flows or profitability. For example, contemporaneous changes in cash flows are included as an additional explanatory variable when examining changes in pension flows associated with tax status changes. The pension put effect, however, is not controlled for here because prior studies have not succeeded in identifying a variable that explains the magnitude of this effect [see Francis and Reiter (1987) for example]. Further, since asset allocation (riskiness of pension assets) is not analyzed here, no attempt is made to determine if low tax firms invest their pension assets in high risk portfolios as predicted by the pension put explanation.

3. Results of time-series tests: Changes in pension flows and tax status

3.1. Data sources and proxies for pension flows

The sample includes all firms on the 1984 Compustat (Expanded Annual Industrial and OTC) tape with at least one year of funding data on the

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15 The improvements due to (1) using the three-category classification, instead of the magnitudes of tax payments or NOL carryforwards, and (2) also considering prior years' tax status, are explored in section 4. Section 4 also provides estimates of the improvements in NOL carryforward data obtained by examining annual reports.
FAS-36 tape. Certain industries are deleted because of contractual agreements and regulations that encourage overfunding and the increased likelihood of errors in measurement of tax and financial variables, leaving an initial sample of 677 firms.\(^{16}\) Also, since extensive pension disclosures were first made available in 1980 subsequent to Statement of Financial Accounting Standards No. 36 [FASB (1980)], only the 1980–1984 period is examined for tax rate changes. Pension flows are measured as pension expense scaled by total book value of firm assets \((P/A)\). Year-to-year changes in \(P/A\) proxy for unexpected changes in pension flows since a random walk, with no drift, provided the best expectation model for pension flows.\(^{17}\) All references to changes in pension flows correspond to \textit{proportional} changes, to enable cross-sectional comparison. Results based on changes in pension expense scaled by total employees \((P/E)\) are also presented, to confirm that the results are insensitive to the scaling variable selected. However, since the \(P/E\) and \(P/A\) results are similar, only the \(P/A\) results are discussed in the text below.

3.2. \textit{Change from taxpayers to non-payers}

The sample of 677 firms exhibits a systematic decline in tax status during the 1980–1984 period, evidenced by a sharp increase in the proportion of non-payers from 7 percent to over 25 percent. Increased tax shields from ERTA as well as the general decline in profitability of basic industries during this period are potential explanations. Pension flows also decline considerably after 1980, relative to the period before 1980.\(^{18}\) Based on the categorical tax status measure, firms changing from TAXPAYER to non-payers (CARRYBACK or CARRYFORWARD) are identified as firms with tax status declines. Given that tax status is a function of taxable income available to shelter excess pension contributions, this categorical measure is approximate. For example, some firms that remained taxpayers are also likely to experience tax

\(^{16}\)Defense contractors (SIC #3720, 3721, 3728, 3730, and 3760) and public utilities (SIC #4811, 4911, 4922, 4923, 4924, 4931, 4932, and 4940) are eliminated because of the non-tax incentives to overfund described in section 2.2. All financial institutions (SIC #6000 to 6999), such as banks, insurance firms, real estate investment trusts and lessors are eliminated because of the complex tax and financial disclosure environment in which they operate. Specifically, I expect more misclassifications of tax status for these firms and was concerned about using financial variables in cross-sectional comparisons that included firms from other industries.

\(^{17}\)See appendix B.1 for a discussion of alternative pension flow measures and expectation models. In general, since the pension variables require an extended discussion regarding measurement and limitations, all details are presented in appendix B.

\(^{18}\)Another period of large pension flow declines is around 1975, after enactment of the Employee Retirement Income Security Act of 1974 (ERISA). This decline runs counter to the general perception that ERISA caused a mandated \textit{increase} in pension flows.
status declines. An indirect proxy is used to obtain a measure of the magnitude of the tax status decline. For the subset of tax status declines that cause desired levels of overfunding to decline to zero, past levels of overfunding equal the decline in desired levels of overfunding. Therefore, an observed relation between pension flow declines and past levels of overfunding for this group of firms can be interpreted as indirect evidence supporting the tax benefits view. The actuarial practice of amortizing actuarial gains, say from an unexpected increase in pension assets, over future contributions induces a mechanical relation between pension flow reductions and prior levels of overfunding. Here, however, observing such a relation supports the tax benefits hypothesis because the decline in pension flows occurs in the same year as the tax status decline.

A sample of 102 firms is identified, representing all firms (from the initial group of 677 firms) that were TAXPAYER firms for two years prior to the change year (year 0), became non-payers in the change year, and remained non-payers for two years after year 0. The requirement that firms continue as non-payers is imposed to isolate tax status declines that cause desired overfunding levels to drop to zero. Year 0 is uniformly distributed over the five-year period 1980-1984, except for 1982 which had a slightly higher proportion of the sample (28 percent). Fig. 1, panel A graphs the time series of median changes in $P/A$ (and $P/E$) over the five-year period around year 0. Median changes in $P/A$ are constant at approximately 0 percent for years -2 and -1. In year 0, $P/A$ falls by 10 percent and continues to decline by an additional 10 percent in years +1 and +2. Non-parametric rank sum tests (not reported) indicate that median changes in $P/A$ decline significantly after the tax status decline. Comparison of mean changes in pension flows, which also reveal a significant decline similar to median changes, are not reported because of the skewness caused by a few large positive outliers (see footnote 22). The observed pension flow decline could be due to a cash constraint effect since funds from operations ($WCO/A$) also show a steep median decline of 20 percent in year 0. Funds from operations represent working capital from operations (Compustat data item #110) plus interest expense (Compustat

19 Note that changes from CARRYBACK to CARRYFORWARD are excluded from the sample. However, these firms appear in the sample with year 0 representing the change from TAXPAYER to CARRYBACK. Firms are assumed to respond around the TAXPAYER to CARRYBACK change and not wait until the second change in tax status. To the extent this assumption is incorrect, the data is less likely to reject the null hypothesis. (Including 15 changes from CARRYBACK to CARRYFORWARD in the sample slightly reduces the median year 0 changes in pension flows.) Also, note that firms with YEAR 0 being 1983 (1984) only had one (zero) year(s) after YEAR 0.

20 By examining proportional changes in funds from operations ($WCO/A$), I assume implicitly that a random walk is a reasonable expectation model for $WCO/A$. [See Bowen, Burgstahler and Daley (1986) for confirmation.]
data item #15) plus pension expense (Compustat data item #43), scaled by book value of total assets (Compustat data item #6). The scaling factor, total assets, is used to adjust for changes in the corporate entity over time (mergers and divestitures). Pension expense is added back to adjust for difference in pension policy, across firms and over time. Interest expense is added back to adjust for difference in leverage, since the denominator equals equity plus total debt. All results reported in fig. 1 and table 1 were replicated using an unadjusted measure of funds from operations (Compustat data item #110). The results remained unchanged. Interestingly, Compustat adjusts data item #110 (funds from operations) for funds statements reported on a cash basis and carries this item on a working capital basis for all firms.

Firms are deleted if (1) cash flows (WCO) for year -1 were < 0 or (2) absolute values of changes for pension flows (P/A and P/E) or cash flows (WCO/A) were > 1, leaving 93 (89) firms in the P/A (P/E) regressions.

Multicollinearity is not expected to be a problem since the collinearity diagnostics provided by SAS (see SAS Users Guide: Statistics) indicated low condition indexes (less than 7) [Belsley, Kuh and Welsch (1980)]. However, the presence of cross-sectional dependence in error terms (not estimated here for lack of sufficient time-series data) could bias downwards the ordinary least-squares standard errors used here.

The low R^2 values in panel B indicate that a large portion of the change in pension flows remains unexplained. If firms realized only late in year 0 about the impending change in tax status, their responses would be observed in year +1. Replacing year 0 changes in pension with average changes over years 0 and +1 causes R^2 values to increase to 0.12 and 0.18 for P/A and P/E, respectively, which is consistent with some firms in the sample delaying their response to year +1.
that changed from taxpayers in years $-2$ and $-1$ to non-payers in year 0 (the requirement that firms remain non-payers in years $+1$ and $+2$ is dropped), indicate results similar to those reported in fig. 1 and table 1. The slightly weaker results (smaller median pension flow declines and the coefficient on $SFL$ is significant only at the $\alpha = 0.07$ level) indicate that tax status declines are smaller and the assumption that desired overfunding levels drop to zero is less descriptive of this sample. Second, pension flows for a sample of 216 high tax firms (all firms that remained taxpayers between 1979 and 1984) drop sharply in 1981, rise slightly in 1982, and decline thereafter, relative to the stable trend observed before 1981. Cross-sectional regressions, as in panel A of table 1, reveal a weak relation ($\alpha = 0.12$) between pension flow changes and funding levels, suggesting that some firms in this sample experience tax status declines. Finally, a sample of 55 low tax firms (all firms that remained carryback or carryforward firms between 1979 and 1984) are examined. Relative to the pattern observed for high tax firms, pension flows decline to a lesser extent for this sample (and no sharp decline is observed in 1981), and no cross-sectional relation is observed between pension flow changes and funding levels. Overall, these results reduce the likelihood that the results observed in fig. 1 and table 1 are caused by omitted factors.\textsuperscript{25}

3.3. Effect of ERTA on pension flows

Here pension flows are examined for a different sample of firms experiencing a decline in tax status around the enactment of ERTA in 1981. If the only exogenous change occurring in 1981, for the ERTA sample, is a permanent increase in the amount of asset-based tax shields allowed per dollar of new investment (due to depreciation and ITC), then asset-based tax shields are expected to increase thereafter (due to both an increased level of investment as well as higher tax shields per dollar of investment, net of any add-on minimum tax effects). \textit{Ceteris paribus}, an increase in asset-based tax shields should be accompanied by a corresponding decline in endogenously selected tax shields, such as debt and pension-related tax shields. Alternatively, changes in non-pension tax shields (due to debt and depreciation) should be offset by an opposite change in pension tax shields. While it is difficult to predict \textit{ex ante} how firms trade off among these tax shields, \textit{ex post} observed changes in non-pension tax shields can be used to measure the magnitude of changes in

\textsuperscript{25}All firms with tax status \textit{increases} (changing from non-payers to taxpayers in year 0) are also examined. The sample of 19 firms exhibited a slight \textit{increase} in median changes in pension flows after the change year (starting in year $+1$). While the increase is not significantly different from zero (based on a Wilcoxon signed rank test), it is significantly higher (based on non-parametric rank sum tests) than the systematic declines exhibited by the two earlier samples with no tax status change. A cross-sectional regression between changes in pension flows and funding levels is not estimated for this sample since the tax benefits hypothesis does not predict a similar relation, given that such firms are not expected to overfund prior to year 0.
Panel A: Changes from taxpayer to non-payer (102-firm sample)

Panel B: Changes from taxpayer to non-taxpayer in 1981 (ERTA sample of 46 firms)

Fig. 1. Median change, \( (Y_t - Y_{t-1})/Y_{t-1} \), in tax and pension flows when tax status declines. \( P/A \), \( P/E \), and \( WCO/A \) correspond to pension expense/total assets, pension expense/number of employees, and funds from operations (working capital basis)/total assets, respectively. \( INT/A = \) interest expense/total assets and \( DEP/A = \) (book depreciation + 2(investment tax credits + taxes deferred on depreciation))/total assets.

Panel A: These firms changed from taxpayer to carryback/carryforward (not paying tax) in year 0 (between 1980 and 1984), and remained non-payers for years +1 and +2. Relative year denotes position relative to year 0.

Panel B: These firms changed from taxpayer to carryback/carryforward in 1981, the effective year for the Economic Recovery Tax Act (ERTA).
Determinants of pension flow changes when tax status declines.\(^a\)

<table>
<thead>
<tr>
<th>Panel A: Changes from taxpayer to non-payer (102-firm sample)(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression: ( \frac{P}{A} - \text{CHG} = \alpha + \beta_1 \frac{WCO}{A} - \text{CHG} + \beta_2 \text{SFL} )  ( R^2 = 0.07, N = 93 )</td>
</tr>
<tr>
<td>Estimate: ( \begin{array}{ccc} 0.13 &amp; 0.06 &amp; -0.15 \end{array} )</td>
</tr>
<tr>
<td>( t )-statistic: ( \begin{array}{ccc} 1.32 &amp; 0.59 &amp; -2.12 \end{array} )</td>
</tr>
<tr>
<td>(( p )-value: ( \begin{array}{ccc} (0.19) &amp; (0.56) &amp; (0.03) \end{array} )</td>
</tr>
</tbody>
</table>

| Regression: \( \frac{P}{E} - \text{CHG} = \alpha + \beta_1 \frac{WCO}{A} - \text{CHG} + \beta_2 \text{SFL} \)  \( R^2 = 0.13, N = 89 \) |
| Estimate: \( \begin{array}{ccc} 0.32 & -0.10 & -0.23 \end{array} \) |
| \( t \)-statistic: \( \begin{array}{ccc} 3.54 & -1.08 & -3.19 \end{array} \) |
| (\( p \)-value: \( \begin{array}{ccc} (0.00) & (0.28) & (0.00) \end{array} \) |

<table>
<thead>
<tr>
<th>Panel B: Changes from taxpayer to non-payer in 1981 (ERTA sample of 46 firms)(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression: ( \frac{P}{A} - \text{CHG} = \alpha + \beta_1 \frac{WCO}{A} - \text{CHG} + \beta_2 \text{SFL} + \beta_3 \text{SHL-CHG} )  ( R^2 = 0.13, N = 38 )</td>
</tr>
<tr>
<td>Estimate: ( \begin{array}{ccc} -0.12 &amp; 0.15 &amp; 0.07 &amp; -0.23 \end{array} )</td>
</tr>
<tr>
<td>( t )-statistic: ( \begin{array}{ccc} -2.38 &amp; 1.16 &amp; 1.99 &amp; -2.58 \end{array} )</td>
</tr>
<tr>
<td>(( p )-value: ( \begin{array}{ccc} (0.02) &amp; (0.24) &amp; (0.05) &amp; (0.01) \end{array} )</td>
</tr>
</tbody>
</table>

| Regression: \( \frac{P}{E} - \text{CHG} = \alpha + \beta_1 \frac{WCO}{A} - \text{CHG} + \beta_2 \text{SFL} + \beta_3 \text{SHL-CHG} \)  \( R^2 = 0.09, N = 37 \) |
| Estimate: \( \begin{array}{ccc} 0.10 & -0.05 & -0.01 & -0.26 \end{array} \) |
| \( t \)-statistic: \( \begin{array}{ccc} 1.43 & -0.36 & -0.30 & -3.23 \end{array} \) |
| (\( p \)-value: \( \begin{array}{ccc} (0.15) & (0.72) & (0.76) & (0.00) \end{array} \) |

\(^a\) \( P/A, P/E, \) and \( WCO/A \) correspond to pension expense/total assets, pension expense/number of employees, and funds from operations (working capital basis)/total assets, respectively. \( INT/A = \) interest expense/total assets. \( DEP/A = \) (book depreciation + 2(investment tax credits + taxes deferred on depreciation))/total assets. \( SHL = \) tax shields due to depreciation and interest scaled by total assets = \( INT/A + DEP/A \). \( SFL = \) standardized funding level = \( F/SAB \), where \( F \) and \( SAB \) are fund assets and accrued liabilities (adjusted for cross-sectional differences in discount rates), respectively.

\(^b\) These firms changed from taxpayer to carryback/carryforward (not paying tax) in year 0 (between 1980 and 1984), and remained non-payers for years +1 and +2. Relative year denotes position relative to year 0. The suffix \( CHG \) represents the change in year 0 = \( (Y_0 - Y_{-1})/Y_{-1} \) for the prefixed variables.

\(^c\) These firms changed from taxpayer to carryback/carryforward in 1981, the effective year for the Economic Recovery Tax Act (ERTA). The suffix \( CHG \) represents the change in 1981 = \( (Y_{81} - Y_{80})/Y_{80} \) for the prefixed variables.

\(^d\) \( t \)-statistics and \( p \)-values are computed using the White (1980) correction for heteroskedasticity.

tax status during 1981 and can be included as an additional explanatory variable to the cross-sectional regression in table 1, panel A. Note that tax status declines for the panel A sample are assumed to differ from those for the ERTA sample. Relative to the panel A sample, here the decline in tax status is assumed to be largely due to the tax law that increased asset-based tax shields, and exogenously determined future taxable income (before asset, debt, and pension tax shields) is assumed to remain unchanged.

The ERTA sample consists of all firms changing from taxpayers in 1979 and 1980 to non-payers in 1981. Since desired overfunding is not expected to drop
to zero for this sample, the requirement that years +1 and +2 be non-paying years is dropped. To expand sample size, the requirement that firms be on the SFAS-36 tape is dropped and firms from the 1984 Compustat Research tape are also included. Pension and tax shield information were hand collected from annual reports available at the University of Rochester Library. The final sample consists of 46 firms with complete data for pension flows and tax shields.  

Fig. 1, panel B plots the time series of median changes in $P/A$, $P/E$, $WCO/A$, $DEP/A$, and $INT/A$ for the five-year period around 1981 for the ERTA sample. $DEP/A$ and $INT/A$ representing asset-based tax shields (depreciation and ITC) and debt-based tax shields (interest), scaled by book value of total assets, are determined as follows:

\[
DEP/A = \frac{+2[ITC + \text{Taxes Deferred on Depreciation}]}{\text{Total Assets}},
\]

\[
INT/A = \frac{\text{Interest Expense}}{\text{Total Assets}}.
\]

Similar to the sample in panel A, as tax status declines in 1981 pension flows decline, relative to 1979 and 1980. Median changes in funds from operations ($WCO/A$) are relatively stable through the period, consistent with the sample construction procedure, indicating that tax status declines for the ERTA sample are probably caused by an increase in tax shields, rather than a decline in profitability. As expected, asset-based tax shields ($DEP/A$) increased substantially in 1981 (median increase $\approx 20$ percent). In response, both discretionary pension contributions and debt shields are expected to fall. However, debt tax shields measured by $INT/A$ increase unexpectedly in 1981 (median increase $\approx 20$ percent). The expected decline only appears in 1983, two years after the tax status change (median decrease $\approx 15$ percent in 1983). Apparently, debt was not reduced immediately in response to increases in asset-based tax shields. Alternatively, increases in interest rates during

---

26 Of the 102 firms in table 1, panel A sample (section 3.2), 19 firms changed tax status in 1981. Of these 19 firms, 10 firms are included in the ERTA sample; the rest are dropped due to incomplete tax shield data.

27 Since ITCs and deferred taxes are after-tax items, a factor of 2 (corresponding to a tax rate of 50 percent) is used to convert them to a before-tax basis. In effect, all firms in the sample are assumed to face a 50 percent marginal federal tax rate.

28 More correctly, net interest expense (less interest income) should be used. However, interest income is not reported for almost half the firms in the sample. Instead of assuming that such firms earned no interest income, I opted to ignore interest income for all firms.
1980/1981 caused increases in debt tax shields that were not offset by decreases in debt levels.

Table 1, panel B reports the results of a cross-sectional regression of changes in \( P/A \) (and \( P/E \)) on changes in \( WCO/A \), \( SHL/A \), and \( SFL \) during 1981. \( SHL/A \) represents the combined effect of asset and debt-based tax shields \( (SHL/A = INT/A + DEP/A) \). The significantly negative value of \( \beta_3 \) is consistent with the tax benefits view, since larger increases in non-pension tax shields \( (SHL/A) \) during 1981 are associated with larger declines in pension flows. \( WCO/A-CHG \) remains insignificant, as in panel A. The funding level variable \( (SFL) \) is unexpectedly positive for the \( P/A-CHG \) regression only. This is due to one firm with an unusually high value of \( SFL \) \( (= 5) \) that reported a large positive value of \( P/A-CHG \) (\( P/E-CHG \) was missing for this firm). Overall, changes in tax shields used for the ERTA sample are important in explaining changes in desired levels of overfunding. Deleting the tax shields variable \( (SHL/A-CHG) \) from the regression reduces \( R^2 \) to 0.01.

As in section 3.2, a similar analysis was conducted on other firms. The 216-firm sample that remained taxpayers over the 1979–1984 period also reported a sharp decline in pension flows in 1981, but no cross-sectional relation is observed between pension flow changes and tax shield changes during 1981, as in panel B. The 55-firm sample of firms that remained non-payers over the same period reported no change in pension flows during 1981.

---

29 Although all assets purchased in 1981 qualify for the higher depreciation and ITCs, ERTA was only enacted in August 1981. Therefore firms with fiscal years ending in 1981 might not have had enough time to respond with reduced pension contributions. To adjust for this affect, for the pension variables only, nine firms with fiscal year-ends between June and November are lagged by one year. For example, the year 0 change in \( P/A \) for such firms would correspond to the change in the year ended in 1982, while the values for changes in \( WCO/A \) and \( SHL/A \) would correspond to the change for the year ended in 1981. I assume that firms with December year-ends had enough notice and changed their pension flows in 1981. Note that for fiscal year-ends between January and May, this adjustment is not required, since Compustat lags one year anyway and classifies all data for years ended in 1982 as 1981 data. As with the panel A regressions, firms with either (1) negative 1980 values of \( WCO \) and \( SHL/A \) or (2) absolute values of changes that are greater than 1 are deleted.

30 Regression diagnostics, similar to those conducted on the panel A regression, indicate low multicollinearity (condition indexes less than 6). Again, no effort is made to adjust for cross-sectional dependences in error terms.

31 Firms could have increased investments in fixed assets subsequent to ERTA and financed these investments through reduced pension flows – consistent with the cash constraint hypothesis. To check for this effect, two other measures of changes in cash flows are examined. The first measure adjusts \( WCO \) to include sales of and investments in fixed assets (Compustat \#107 and 128, respectively). The second measure, also considers issues and repurchases of debt (Compustat items \#111 and 114), issues and repurchases of equity (Compustat items \#108 and 115), and cash dividends (Compustat item \#127). Changes in cash flow under both alternative measures remained unrelated, at conventional significance levels, to changes in pension flows during 1981. Interestingly, investments in fixed assets for this sample remained fairly stable between 1979 and 1981, before dropping sharply in 1982 and 1983.
1981 and exhibited no panel B type cross-sectional relation between pension flow changes and tax shield changes.

The results in fig. 1 suggest that tax status declines cause reductions in pension flows. Two separate cross-sectional relationships are hypothesized and observed in table 1. The panel A results benefit from a larger sample size and cross-sectional dispersion in event dates. The panel B sample results, on the other hand, are based on more detailed hand-collected data, specifically examine the effect of changes in expected taxable income, and are less likely to have been contaminated by a cash constraint effect.

4. Results of cross-sectional tests: Tax status and funding policy

4.1. Data sources and sample selection

Information regarding tax and financial variables and funding levels is obtained from footnotes to annual reports. Information regarding actuarial variables and plan features is obtained from the FORM 5500 reports that are filed by each plan with the IRS. Annual reports relate to the consolidated corporate entity whereas the pension reports relate to each individual plan. As each consolidated corporation could have a number of subsidiaries and each parent or subsidiary could sponsor a number of plans, a considerable amount of data collection and aggregation is required to relate pension information to the corresponding financial entity. Fortunately, Friedman (1982) laid the groundwork by creating a data base consisting of 1892 firms from the 1977 Compustat Annual Industrial tape. Firms not in Friedman’s sample are deleted to avoid the laborious process of identifying their subsidiaries and divisions.

Computer-readable information, from FORM 5500 reports, for plan years ending on or after December 31, 1980 are made available through the Department of Labor (DOL). Given the systematic decline in pension funding subsequent to ERTA in 1981, only 1980 data is examined. Since pension disclosures in annual reports are typically based on information available at the beginning of the fiscal year, funding levels are obtained from the 1981 (fiscal year ending in) annual reports to ensure comparability with 1980 plan data from the Form 5500 reports. If the 1981 annual report was not available or if the footnotes indicated that pension disclosures were based on year-end valuations, the 1980 annual report is used. To obtain plan-level information Friedman’s list of subsidiaries was updated by comparing the 1977 and 1981 editions of the Directory of Corporate Affiliations [NRPC (1977, 1981)], and then all plans relating to a consolidated entity are located from over a million plans on the DOL tapes.

Firms are classified into two groups based on the expected effect of tax status on current (1980) funding levels. Since the smoothing process followed
by actuarial methods links current funding levels to prior years' tax status, firms that are CARRYFORWARD firms in 1980, or have been CARRYFORWARD firms in any year during five prior years (1975 to 1979), are expected to have the lowest funding levels.\textsuperscript{32} Conversely, firms that remained TAXPAYERS over the six-year period are expected to have the highest funding levels. To obtain a dichotomous tax status measure, the CARRYFORWARD group is designated the low tax (LOSS) group and all other firms with available data are included in the high tax (TAX) group.\textsuperscript{33} To the extent that firms are misclassified by this procedure, the likelihood of observing a tax effect (rejecting the null hypothesis) is lowered.

The three proxies for plan features, employed for matching, are: (1) four-digit Standard Industry Classification (SIC) code, (2) size, measured by book value of total assets, (3) capital to labor ratio, measured by the ratio of book value of total assets to total employees. The industry match is used since plan features, such as benefit formulae and age profiles of beneficiaries, are expected to be relatively homogeneous within industries. The size match is designed to reduce intra-industry differences in plan features that are a function of size of the firm (or workforce). The third factor, representing capital employed per employee, proxies for production technology. Matching along this ratio is relevant to the extent that labor-intensive firms are characterized by a different set of employer–employee relationships and face different plan features than capital-intensive firms in the same industry.

Appendix C details the process resulting in the final sample of 90 pairs of TAX and LOSS firms. For these 180 firms, a total of 1673 plans are identified from the DOL tapes. Some salient features of the matching procedure are presented below:

- Similar to the samples in section 3, firm-years are initially classified into TAXPAYER, CARRYBACK, and CARRYFORWARD based on CompuStat current federal tax payments and NOL carryforwards. All NOL carryforwards are rechecked in annual reports to delete those relating to foreign or unconsolidated (for tax) subsidiaries.
- Unlike section 3, only firms in Friedman's data base are used. To compensate for this reduction in sample size, firm-years with missing tax data

\textsuperscript{32}The number of prior years that are relevant for current funding levels is not known \textit{a priori}, and I arbitrarily selected five years.

\textsuperscript{33}An alternative procedure is to classify the TAXPAYER group as high tax firms and all others, or only CARRYFORWARD firms, as low tax firms. Empirically, given the matching criteria used, the only firms that were reasonably similar to the CARRYFORWARD firms were firms with some CARRYBACK firm-years during the six-year window. To maximize sample size these firms of intermediate tax status had to be included in the high tax group.
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(0n Compustat) are included in the sample for further analysis of annual reports.

- The potential for error in the measurement of \(NOL\) carryforwards is large. Relative to a simpler procedure that selected all firms with current \(NOL\) carryforwards, as in Bodie et al. (1984), more than half the LOSS firms in this sample would be misclassified. In addition, approximately one quarter of the firms with \(NOL\) carryforwards on Compustat are really TAX firms.\(^{34}\)

- The 90 pairs are well matched along size and assets per employee. A number of plan features obtained from the FORM 5500 data, such as the mix of benefit types, proportion of employees covered by defined benefit plans and the proportion of active to retired beneficiaries, were also examined and revealed no systematic differences between matched pairs.\(^{35}\)

Various financial ratios are examined in appendix C and two variables, profitability and leverage, are significantly different between the matched pairs. Consistent with the results of prior studies [for example, Francis and Reiter (1987)], TAX firms are more profitable and employ less leverage. If these variables affect base funding policy, omitting them from the regressions could bias the coefficient on the tax status variable. Therefore both variables are included as additional explanatory factors.\(^{36}\) Note that non-tax determinants of pension funding (see appendix A) are being controlled for indirectly. The matching procedure should control for proportion of unionized labor, which is the variable identified by Ippolito (1986) as proxying for the pension incentive effect. Similarly the financial variables identified in prior studies as proxying for financial statement effects are either used for matching (size) or included as covariates (leverage and profitability). Finally the profitability measure is used to proxy for the cash constraint effect.

4.2. Univariate comparisons of matched pairs

Before estimating cross-sectional regressions, three pension policy variables are compared for the 90 matched pairs of TAX and LOSS firms.

\(^{34}\) This does not include the LOSS firms that are excluded because of potential non-tax incentives to overfund, namely the defense contractors and public utilities.

\(^{35}\) However, there are major differences in these variables across industries, underlying the importance of an industry match. No systematic intra-industry differences in plan features are discerned based on differences in size and assets per employee – the other two matching variables.

\(^{36}\) Cross-sectional regressions on a larger sample of approximately 500 firms indicate that a number of other variables proxying for growth opportunities, financial slack, and risk are also significantly related to funding levels. However, unlike profitability and leverage which had a systematic effect, the effect of these other variables is sensitive to the definition employed. Since the objective here is to identify a tax effect while maintaining a reasonable degree of control for potential omitted correlated variables, only leverage and profitability are included as covariates.
Table 2

Comparisons of funding policy variables for TAX and LOSS matched pairs (matched on industry, total assets and assets per employee).

<table>
<thead>
<tr>
<th>Sample</th>
<th>Mean</th>
<th>t-stat.²</th>
<th>p-value²</th>
<th>Median/Range</th>
<th>lt: gr (N)³</th>
<th>p-value³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Panel A: Standardized funding level (SFL = F/SAB)⁴</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAX</td>
<td>1.44</td>
<td>7.28</td>
<td>0.00</td>
<td>1.30/0.42 to 3.28</td>
<td>15:75 (90)</td>
<td>0.00</td>
</tr>
<tr>
<td>LOSS</td>
<td>1.09</td>
<td>1.81</td>
<td>0.07</td>
<td>1.05/0.31 to 2.82</td>
<td>38:51 (89)</td>
<td>0.25</td>
</tr>
<tr>
<td>Difference</td>
<td>0.35</td>
<td>5.04</td>
<td>0.00</td>
<td>0.30/−1.15 to 2.01</td>
<td>23:66 (89)</td>
<td>0.00</td>
</tr>
</tbody>
</table>

| Panel B: Conservatism of actuarial method (AM)⁵ |
| TAX    | 1.00/0.0 to 1.0 | 8:0 (82) | n.a. |
| LOSS   | 1.00/0.0 to 1.0 | 24:0 (81) | n.a. |
| Difference  | 0.00/−1.0 to 1.0 | 7:24 (74) | 0.00 |

| Panel C: Interest rates for funding (FR)⁶ |
| TAX    | 6.44 | n.a. | n.a. | 6.50/4.0 to 8.0 | n.a. (81) | n.a. |
| LOSS   | 6.97 | n.a. | n.a. | 7.00/5.0 to 10.0 | n.a. (80) | n.a. |
| Difference  | −0.54 | −3.57 | 0.00 | −0.75/−3.0 to 3.0 | 44:18 (72) | 0.00 |

²F and SAB are the fund assets and standardized accrued liabilities, respectively. SAB = AB × R/S, where AB is the reported accrued liability and R and S are the reported and standard (PBGC) interest rates, respectively.

³t-stat. and p-value refer to t-tests of the null hypothesis that the mean = 1 (0) for the TAX and LOSS (Difference) rows. The tests are one-tailed for the Difference row.

⁴(N) equals the number of observations. lt: gr are the number less than one (zero): greater than one (zero), and p-value refers to the signed rank test of the null hypothesis that the median = 1 (0) for the TAX and LOSS (Difference) rows. The tests are one-tailed for the Difference row.

⁵AM measures conservatism of actuarial method employed, and is coded as 0 for plans that follow the unit credit method (least conservative) and 1 for all other plans (more conservative). Plan AM values are averaged, weighted by plan assets, to obtain an AM value for the firm.

⁶FR is the discount rate, reported in the Form 5500 reports, used by individual plans for actuarial determination of funding. Plan FR values are averaged, weighted by plan assets, to obtain an FR value for the firm.

4.2.1. Comparison of funding levels

Table 2, panel A reports distributions for standardized funding levels (SFL) for TAX and LOSS firms and compares SFL values for matched pairs (see appendix B.2 for computation of SFL and appendix A for potential limitations). As many as 75 of 90 TAX firms are overfunded (SFL greater than one). Mean and median funding levels are 1.44 and 1.30, respectively, both significantly different from one. On the other hand, mean and median funding levels for the LOSS group are 1.09 and 1.05, which are significantly different from one only at the 7 and 25 percent levels, respectively. This evidence is weakly supportive of the view that accrued/legal liabilities represent base funding
levels. The matched pairs comparison indicates that 66 TAX firms are better funded than their LOSS counterparts and the mean (median) difference between matched pairs is 0.35 (0.30), both significantly different from zero. Interestingly, using reported funding levels (see appendix B.2), instead of standardized funding levels, generates a smaller mean (median) difference of 0.18 (0.11) between TAX and LOSS firms. This indicates a systematic bias in reported discount rates; while both sets of firms use discount rates lower than the standard, TAX firms use lower discount rates than LOSS firms.37

4.2.2. **Comparison of actuarial variables**

Actuarial variables are examined to identify the method employed to attain such funding differences and also to verify that funding level differences are not caused entirely by differences in plan features (which the matching process was unable to control for). The tax benefits view predicts that overfunding could be achieved by (1) using a conservative actuarial method, or (2) using a discount rate for funding purposes that is unusually low, or (3) using a salary growth rate that is unusually high, or (4) taking a ‘conservative’ position on other actuarial variables, such as accelerated amortization of prior period costs, not adjusting asset values to reflect increased market values and slow amortization of experience gains (overfunding resulting from estimates that are too conservative, *ex post*).

While all of these variables are reported in Schedule B of Form 5500, the DOL tape only reports the first two variables, namely the actuarial method ($AM$) and the discount rate for funding ($FR$).38 Due to data limitations, described in appendix B.3, plans using the least conservative method (unit credit) are coded as $AM = 0$ and all other plans are assigned a value of one. For each consolidated entity, average values of $AM$ and $FR$ values are computed – weighted by the assets in each plan. The tax benefits view predicts that

$$AM_{TAX} > AM_{LOSS} \quad \text{and} \quad FR_{TAX} < FR_{LOSS}.$$  

Panels B and C in table 2 report univariate comparisons for $AM$ and $FR$, respectively. Examination of $AM$ distributions (not reported) indicate a bimodal distribution with a large cluster around $AM = 1$ and a smaller cluster around $AM = 0$. The bimodal distribution rules out a parametric t-test, and

37Comparison of standard and reported discount rates reveal a mean (median) difference of 1.85 (2.0) percent for the TAX group and only 1.17 (1.0) percent for the LOSS group.

38Note that $FR$, the discount rate for funding purposes need not be the same as $R$, the reported discount rate used to compute the accrued liability for purposes of disclosure in accounting reports. In 86 plans, or 18 percent of the 480 plans in the sample that reported both amounts, the two rates are different. In these 86 plans, $R$ is higher than $FR$ in all but four cases.
even the non-parametric signed-rank tests reported are not reliable because of
the asymmetric distribution. However, there are obvious differences in the two
samples. Only 8 of 82 TAX firms had any plan that followed the unit credit
method (i.e., weighted AM less than 1), while 26 of 81 LOSS firms had at least
one plan based on the unit credit method. The matched pair differences in the
third row show that in 24 pairs the difference is positive (the TAX firm
reported a higher AM value) versus only seven pairs with a negative differ-
ence.

In panel C, the link between actuarial variables and tax status is more
evident. TAX firms employ a mean (median) discount rate for funding
purposes (FR) of 6.44 (6.5) percent, while LOSS firms employ a higher mean
(median) discount rate of 6.97 (7.0) percent. The mean (median) differences
between the matched pairs are -0.54 (-0.75), both highly significant, with
TAX firms using lower rates. While the differences do not seem substantial in
absolute value, it should be noted that even small differences in FR have a
large impact on funding. For example, a 1 percent change in this rate can
reduce funding (based on actuarial liabilities, not accrued liabilities) for a
typical plan by 25 percent [McGill (1984)].

Despite the lack of precision in measuring AM and the inability to analyze
other actuarial variables, the matched pairs comparisons support the tax
benefits hypothesis, since TAX firms use more conservative actuarial methods
and lower interest rates for funding to achieve the higher funding levels
observed in panel A. Given the correlation between actuarial variables (AM
and FR) and standardized funding levels (SFL), the univariate comparisons
reported should only be considered as being illustrative of differences in
funding policy. The three sets of tests are not independent, and p-values
should more correctly be based on multivariate test of the three variables.

4.3. Regression of funding policy variables on tax status

Funding levels (SFL) and discount rate for funding (FR) are regressed on
tax status, profitability and leverage for the 180-firm sample. Actuarial method,
AM, is excluded because of its asymmetric and bimodal distribution. These
tests are different from regressions on the full sample (before matching) to the
extent that the non-random sampling procedure reduces the correlation be-
 tween tax status and plan features; therefore reducing the bias caused by
omitting plan features from the regression.

The regression results in table 3 confirm the descriptive comparisons in table
2. Tax status, represented by the TAX DUMMY (equals 0 for LOSS firms and

39The impact on contributions of a change in FR depends on other factors such as plan
demographics and GR. Hewitt Associates (1983) provides additional data on the effect of such
changes on pension contributions.
Table 3

Cross-sectional determinants of funding levels and interest rates for funding (180-firm sample that controls for industry, total assets and assets per employee).

<table>
<thead>
<tr>
<th>Panel A: Regression of funding levels (SFL) on tax status and other variablesa</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression:</td>
<td>$SFL = \alpha + \beta_1 PM + \beta_2 DEBT/A + \beta_3 TAX DUMMY$ R$^2 = 0.19, N = 179$</td>
</tr>
<tr>
<td>Estimate</td>
<td>0.34 2.67 0.76 0.29</td>
</tr>
<tr>
<td>t-statisticb</td>
<td>(0.09) (0.00) (0.01) (0.00)</td>
</tr>
<tr>
<td>(p-value)b</td>
<td>(0.09) (0.00) (0.01) (0.00)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Panel B: Regression of interest rates for funding (FR) on tax status and other variablesa</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression:</td>
<td>$FR = \alpha + \beta_1 PM + \beta_2 DEBT/A + \beta_3 TAX DUMMY$ R$^2 = 0.07, N = 161$</td>
</tr>
<tr>
<td>Estimate</td>
<td>7.17 0.20 -0.36 -0.59</td>
</tr>
<tr>
<td>t-statisticb</td>
<td>(0.00) (0.89) (0.55) (0.00)</td>
</tr>
<tr>
<td>(p-value)b</td>
<td>(0.00) (0.89) (0.55) (0.00)</td>
</tr>
</tbody>
</table>

aThe variables employed and their sources are as follows:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Symbol</th>
<th>Source</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total debt</td>
<td>$DEBT$</td>
<td>Compustat #5 + #9 + #75</td>
<td>1980</td>
</tr>
<tr>
<td>Operating income before depreciation and taxes</td>
<td>$OI$</td>
<td>Compustat #13</td>
<td>1975–1981</td>
</tr>
</tbody>
</table>

$SFL = F/SAB$, where $SAB = AB(R/S)$, $AB =$ reported accrued liability and $R =$ reported discount rate from annual reports, $S =$ standard discount rate from the PBGC. $FR =$ interest rate used for funding purposes from Form 5500 reports. $TAX DUMMY = 0$ if firm had at least one carryforward year between 1975 and 1981, = 1 otherwise. $PM =$ average profitability $= \sum(OI)/\sum(A)$, where $\sum = \sum_{1975}^{1981}$ = sum over the seven-year period 1975 to 1981.

b$t$-statistics and $p$-values are computed using the White (1980) correction for heteroskedasticity.

1 for TAX firms), is highly significant in both the funding level ($SFL$) and discount rate for funding ($FR$) regressions reported in panels A and B, respectively.40 The coefficient values ($\beta_3$) are of the same sign and of similar magnitude to the matched pairs differences reported in panels A and C of table 2, despite the additional controls for profitability and leverage. While profitability and leverage are significant in the funding level regression, they are unrelated to the discount rate for funding ($FR$). Further, the coefficient on the leverage variable in panel A is positive, which is contrary to the effect typically noted in the literature. The insignificant coefficients on leverage and profitability in Panel B and the unexpected positive sign of the leverage coefficient in panel A suggest that financial attributes do not directly affect funding levels. Perhaps, they are intricately linked with more fundamental firm

40While tax status is related to profitability and leverage, multicollinearity is unlikely to be a severe problem since the condition indexes are low (less than 14). Again, the effect of cross-sectional dependences is not analyzed.
attributes, such as the investment opportunity set, that also determine plan features. Since funding levels are mechanically linked to plan features, profitability and leverage are also related to funding levels.

Replacing the dichotomous tax status variable used here with other measures of tax status used in prior studies provides an estimate of the potential for error in measuring tax status. Both regressions in table 3 are re-estimated using the following measures of current tax status (prior years’ tax status is ignored): (1) federal tax payments scaled by total assets, (2) NOL carryforwards, as reported by Compustat, scaled by total assets, and (3) presence or absence of an NOL carryforward, as reported by Compustat. For the funding level regressions (panel A), $R^2$ values drop to below 0.10 and the tax status variable is no longer significant, even at the 10 percent level. Similarly, for the panel B regressions, the $R^2$ values drop to 0.02 and tax status is no longer significantly related to the discount rate used for funding. These results confirm the importance of carefully specifying tax status both at the conceptual and empirical levels.

4.4. Additional test

A final test is motivated by the observation that a large proportion of low tax (LOSS) firms do not sponsor defined benefit plans (see appendix C). If the tax benefits of overfunding are reduced significantly for LOSS firms, they should select other forms of deferred compensation instead of sponsoring a defined benefit plan and not overfunding it. For example, as suggested by Scholes and Wolfson (1984), emerging firms often faced with substantial tax loss carryforwards might systematically opt for forms of deferred compensation other than defined benefit plans.

Evidence on this issue is obtained by examining the 2438 firms on the 1981 Compustat tape. Based on the LOSS sample selection process (see appendix C), 481 firms are classified as LOSS firms and 106 firms are deleted, since annual reports for the LOSS year could not be obtained. The remaining 1851 firms are classified as TAX firms. These 2332 TAX and LOSS firms are classified as either sponsoring a defined benefit plan, or not, based on the existence of a reported pension and retirement expense (item #43 on Compustat) for 1980.41 Both classifications are approximate and therefore the results are exploratory. This procedure shows that 182 of 481 LOSS firms (38%)

41While all firms sponsoring defined benefit plans report a pension expense, some firms with only defined contribution plans also report a pension expense. The extent of error in this regard can be gauged by analyzing a sample of 299 LOSS firms that (1) reported a pension expense in 1980 and (2) had available annual reports. Examination of their annual reports revealed that 54 firms (18%) did not sponsor defined benefit plans; the pension expense related to a defined contribution plan. While important in magnitude, this error is not expected to be systematically different between LOSS and TAX groups and should not bias the results.
reported no pension and retirement expense and were classified as not sponsoring defined benefit plans, while only 408 of 1851 TAX firms (22%) reported no pension and retirement expense. A chi-square test of independence indicates a significant difference (at well below the 5 percent level) between the proportions of firms in each group sponsoring defined benefit plans. The tests are repeated for each one-digit SIC Industry subgroup and the pattern persists for each subgroup; LOSS firms are always less likely to sponsor defined benefit plans.\(^42\) This significant association between a firm's tax status and the presence or absence of a defined benefit plan is consistent with the argument that the tax benefits of overfunding defined benefit plans are a major motivation for sponsoring such plans.

5. Summary

The results reject the view that pension funding and tax status are unrelated. While this evidence is consistent with the tax benefits of overfunding, many issues remain unresolved. What is the extent of tax arbitrage possible? How do firms trade off pension and non-pension tax shields? More generally, numerous predictions can be made regarding the growth and popularity of pensions. First, pension plans of any kind are attractive only if personal tax benefits from deferring compensation exist. This requires high personal tax rates and other tax incentives such as the exemption of tax on pension fund income. Second, the popularity of defined benefit plans should be positively related to corporate tax rates and the absence of constraints to overfund or withdraw. Finally, tax-exempt institutions should not prefer defined benefit plans.

Thomas (1984) conducts some preliminary investigation relating the popularity of pensions and defined benefit plans to changes in U.S. tax laws and finds evidence consistent with these predictions. Similarly, the relative popularity of defined benefit plans across different countries indicates that tax rates and property rights regarding excess assets seem to explain some of this variation. Only the use of defined benefit plans by local governments, which are tax-exempt, seems to contradict the tax benefits arguments. Two possible ad hoc explanations for this anomaly exist, depending on whether the relevant liabilities for such plans are economic or accrued liabilities (see appendix A). Kotlikoff and Smith (1983) report that, while most state and local government plans are underfunded relative to economic liabilities, many such plans are overfunded relative to accrued liabilities. Under the economic liability assumption, the incentive effects suggested by Ippolito (1986) could motivate the use of defined benefit plans. Unlike corporate plans, which are covered by ERISA, these plans can remain underfunded and can be used to post a 'performance

\(^{42}\) Only for two, out of seven, industry subgroups (1000 to 1999 and 7000 to 7999) are the differences not significant at the 5 percent level.
Under the accrued liability assumption, tax-exempt institutions could be engaged in tax arbitrage (and the IRS allows this) by borrowing funds at after-tax rates and investing them at pre-tax rates. Future research on these issues, as well as the impact of non-tax factors on funding, will hopefully clarify the relation between taxes and pension policy.

Appendix A: Pension terms and definitions

Benefit formulae are of three general types: (1) flat benefits (say $1000/month), (2) fixed benefits (say 50% of salary), and (3) unit benefits (say $35 times years of service, or 2% of salary times years of service). While the third category is the most frequent, the proportions of the first two categories increase for certain industries and for blue collar employee groups [see Kotlikoff and Smith (1983)]. At any point in time, the accrued benefits, or nominal future benefits payable based on past service, are known. These future benefits are based on plan features such as benefit formulas, demographics of beneficiaries, past service and current wages. The present value of these benefits, discounted at the risk-free interest rate, is termed the standardized accrued liability (SAB). The SAB, a legal liability, represents the amount firms owe their employees if the plan were currently terminated. Bulow (1982) argues that this accrued/legal liability is the only relevant liability. Ippolito (1986) and others argue that current pension liabilities are determined by an economic liability which uses projected wage levels at retirement, not current wages. Finally, for funding purposes, firms use a third liability measure termed the actuarial liability, typically higher than both the accrued and economic liabilities, which is determined both by plan features as well as by endogenous actuarial variables selected by the sponsoring firm.

Three actuarial variables that significantly affect actuarial liabilities are (1) the actuarial cost method (AM), (2) the interest rate for discounting future benefit payments (FR) and (3) the expected salary growth rate (GR). The least conservative actuarial method, the unit credit method, accepts the accrued/legal liability representation. The modified unit credit method is based on the economic liability, and all other methods (all belonging to the cost allocation class) call for current funding of benefits to be ‘earned’ in the future and thereby generate much higher liabilities. To illustrate the prefund-

43Numerous complications, such as the portion of accrued benefits that are vested and the portion of vested benefits that are guaranteed (by the PBGC), are ignored here to focus on conceptual issues.

44I assume that plan features are exogenous to the funding decision. In other words, firms do not adjust plan features to manipulate funding. Even benefit types (flat/fixed/unit) are assumed to be determined separately. This is reasonable if benefit types are generally set by industry practices. Alternatively, changes in benefit types (designed to facilitate funding changes) might generally be unacceptable due to unintended wealth transfers among workers.

45Sharpe (1976) points out that the appropriate rate for discounting these future benefit payments is the risk-free rate, rather than the rate of return expected to be earned on assets in the fund, since there is typically a very high probability (no risk) of making such payments.
ing called for by these more conservative methods, take a plan that pays $30 per month of benefits for each year of service. Although each additional year's service increases future benefits by a constant amount of $30, the present values of these constant increments are lower (higher) for junior (senior) workers. Conservative (cost allocation) methods, however, require constant dollar contributions into the fund over the worker's tenure. Also, low discount rates and high salary growth rates (for salary based benefits) increase the actuarial liability further. Fund levels resulting from contributions based on actuarial liabilities often significantly exceed standardized accrued liabilities (and even economic liabilities).

Similar to the treatment of depreciation, pension accounting in financial statements is not constrained to follow the methods employed for tax purposes, and the annual pension expense \( P \) could be different from cash contributions. Footnote disclosures under SFAS-36 [FASB (1980)] report the current value of fund assets \( F \) and an accrued liability \( AB \) based on a reported discount rate \( R \). The tax/actuarial statements, as mentioned earlier, are based on actuarial procedures selected by the firm. Note that the discount rate, \( R \), reported in the financial statements can be different from the discount rate, \( FR \), used for funding in the actuarial statement.

For empirical tests, the only liability measure reported is the accrued liability \( AB \). There is considerable cross-sectional variation in reported discount rates \( R \), with values varying from 4 to 14.5 percent for the firms analyzed here. To enable cross-sectional comparison, standardized accrued liabilities are computed using a common standard discount rate \( S \), as described in appendix B.2. Since the choice of \( S \) and the standardization procedure used are both \emph{ad hoc}, the standardized funding levels computed are not reliable measures of \emph{absolute} funding levels, i.e., determination of over-funding and underfunding is approximate and should be used with caution. However, as an empirical matter, they are fairly robust measures of \emph{relative} funding levels. Alternative standardization procedures and measures of \( S \) generate funding level measures that are highly correlated across firms [Francis and Reiter (1987)].

These standardized accrued liabilities are also assumed to represent 'base' funding levels, i.e., levels at which firms would fund in the absence of tax-related incentives to overfund. The pensions literature offers three arguments for alternative base funding policies. First Ippolito (1986) suggests that accrued liabilities are irrelevant since employers and employees contract on the basis of economic liabilities (based on retirement wages) and fund at levels lower than the economic liability for incentive reasons. Second, Treynor (1977) argues that firms attempting to maximize the value of insurance (labelled the pension put) offered by the Pension Benefits Guarantee Corporation (PBGC)

46A variation of this method requires that the present values of future benefit increases be a constant \emph{proportion} of current salary, rather than a constant dollar amount.
have incentives to fund below the accrued liability. Finally, Francis and Reiter (1987) offer the perspective that firms have incentives to manipulate pension policy in order to alter financial statement numbers that impact on political visibility and are important for contracting (debt covenants and management compensation).

An analysis of these arguments indicates that their impact on base levels is expected to be low. Since workers cannot claim assets in excess of the accrued liability, Ippolito points out that firms need to fund below the accrued liability in order to create the pension bond. Ippolito admits that the passage of the Employee Retirement Income Security Act of 1974 (ERISA) created a floor (approximately equal to the SAB) below which firms could not underfund for incentive reasons. In other words, base fund levels would move up to SAB subsequent to ERISA. Similarly, Thomas (1984) argues that the incentives to underfund created by the PBGC guarantees are minimal because of the minimum funding requirements of ERISA. Essentially firms could fund below the SAB only after obtaining approval from the IRS and PBGC on the grounds that making normal contributions would jeopardize the future of the firms. Only very few firms in financial distress (less than 1/2 percent of Friedman’s sample of Compustat firms) were able to obtain such approvals. Finally, while financial statement effects could influence pension policy, they are important to the extent that firms constrain themselves (for unknown reasons) to use the same policies for their tax/actuarial statements and financial statements.

Appendix B: Variables measuring funding policy

Three sets of dependent variables are defined and their limitations discussed.

B.1. Pension flows: To determine if tax rate changes had the hypothesized effect on pension flows, realized pension flows need to be compared with an ‘expected’ value that would have obtained in the absence of a tax rate change. Since no theoretical model is available to predict pension flows, I searched for a simple model that best fit the data. Given that ERISA, enacted in 1974, was expected to have significantly affected pension funding [Ippolito (1986)], only the 1974–1984 period is analyzed. Random walk models, allowing for drift, and simple regressions of pension flows on prior year’s pension flows are fitted to identify models with the lowest error (scaled by actual pension flows) over the event period, 1980–1984. To remove any effects caused by changes in tax status, all models are fitted on a sample of 302 firms that reported positive federal tax payments over the entire period. The variables used for pension flows included unscaled pension expense \( P \) and pension expense scaled by total assets of the firm \( P/A \), total number of employees \( P/E \), and total labor expense \( P/L \). Pension expense \( P \), total assets \( A \), total employees
(E) and labor expenses (L) are obtained from Compustat data items #43, #6, #29, and #42, respectively.

While the simple regression models had the lowest forecast errors for 1980, their performance declined for subsequent years, indicating a structural shift after 1980. Random walk models, without drift, for P/A and P/L were the best models over the entire period. Since most firm-years did not report total labor expense, P/L was dropped. The P/E series exhibited some drift, with the amount of drift varying over the period. Therefore annual changes in P/A, representing deviations from expectation, are used to measure unexpected pension flow changes.

There are three possible sources of error in these measures of pension flows. First, pension expense does not always equal pension contributions. As many as 10 percent of firm-years show some (typically very small) difference between these amounts [Francis and Reiter (1986)]. Second, occasionally the pension expense reported by Compustat also includes flows relating to defined contribution plans. Third, the number of employees (E) relates to total employees not all of whom are covered by defined benefit plans. The first error causes a bias that makes it more difficult to detect the hypothesized effect. Typically in such cases, firms making reduced contributions reduce the expense by a smaller amount. The last two errors, on the other hand, would not cause any bias, as long as the relative importance of defined benefit plans remains constant over time for each firm.

R 2. Funding levels: Funding levels (FL) are computed by comparing pension assets (F) against accrued liabilities (AB) as follows:

\[ FL = \frac{F}{AB} \]

The accrued liability values (AB) are reported based on a variety of discount rates (R) and are strictly not comparable across firms. One heuristic procedure assumes a simple inverse relationship between present values of future benefits and discount rates employed and standardizes reported accrued liabilities as follows:

\[ SAB = AB\left(\frac{R}{S}\right) \quad \text{and} \quad SFL = \frac{F}{SAB}, \]

47 The extent of error caused by this standardization procedure cannot be determined. Are present values of future benefits inversely proportional to discount rates, as assumed here, or are they a more complex function of discount rates? Data obtained from the footnotes of five annual reports where accrued liabilities (AB1 and AB2) had been reported for two different discount rates (R1 and R2) allowed some sensitivity analysis. Various functional forms were fitted to the data. The best fit resulted from plots of

\[ \frac{AB_1}{AB_2} \text{ vs } R_2/R_1 \quad \text{and} \quad \frac{AB_1}{AB_2} \text{ vs } \frac{\ln(1 + R_2)}{\ln(1 + R_1)}. \]

Therefore, the simple inverse relationship (between AB and R) assumed here is not expected to cause any serious bias.
where $SAB$ is the standardized accrued liability, $SFL$ is the standard funding level, and $S$ equals the standard interest rate. An overfunded (underfunded) firm would have values of $SFL$ greater (less) than one. Although Sharpe (1976) recommends use of the risk-free interest rate for standardization, there is little agreement in the pension literature about the appropriate empirical proxy for this standard rate for discounting purposes. The rate selected here is the Pension Benefit Guaranty Corporation (PBGC) rate published monthly, which is used to determine accrued liabilities by the PBGC for plans terminated by sponsors.48

B.3. Actuarial variables: Firms select a number of actuarial variables, subject to approval by the enrolled actuary, that determine actuarial liabilities and funding levels and flows. Both variables analyzed here possess certain limitations in cross-sectional comparisons. The actuarial method ($AM$) is coded as being one of eight categories. The only ranking possible is that seven of the eight methods belong to the cost allocation group (see appendix A) and therefore prefund for future benefits yet to be earned. These seven methods coded as $AM = 1$ are more conservative than the last method (unit credit), which determines funding based on the accrued liability and is coded as $AM = 0$. Similarly the discount rate for funding ($FR$) is typically set in conjunction with the salary growth rate ($GR$). Plans employing low $FR$ are not always more conservative than plans using higher $FR$ – it depends on the corresponding $GR$ values selected. Given that $FR$ and $GR$ are set in conjunction (high $FR$ values imply high $GR$ values, etc.) and that a 1 percent change in $FR$ has a larger impact on funding than a 1 percent change in $GR$ (an $FR/GR$ combination of 6/4 percent is more conservative than an 8/6 combination), low values of $FR$ are assumed to be more conservative than higher $FR$ values in the absence of data on $GR$.

Average values are computed for $AM$ and $FR$ for all plans sponsored by each firm. Asset values are used as weights. For some firms, all plans sponsored by the consolidated entity could not be identified from the DOL tape. Therefore, for purposes of computing $AM$ and $FR$, plans holding at least 75 percent of the total assets reported by the consolidated entity and reporting values of $AM/FR$ had to be identified before weighted average values for these two variables are computed; the remaining firms are assigned missing values of $AM/FR$.

48 This rate changes over time and allows the comparison of funding levels based on valuations of $AB$ that are not contemporaneous. The PBGC rate is a conservative (lower bound) estimate of the applicable discount rate if the sponsor approached an insurance company to buy guaranteed annuity contracts for current accrued benefits.
Appendix C: Sample selection for cross-sectional tests

This appendix details the procedure employed to select the 90 pairs of matched low tax (LOSS) and high tax (TAX) firms analyzed in section 4. All 2438 firms on the 1981 Compustat tape (Annual Industrial) are examined to determine if current federal tax payments (data item #63) or NOL carryforwards (data item #52) during 1975 to 1980 indicate the presence of a carryforward year. Table 4 summarizes the three sets of firms that are matched for analysis.

Table 4
Selection of LOSS and TAX samples.

<table>
<thead>
<tr>
<th>Tax status group</th>
<th>Set 1</th>
<th>Set 2</th>
<th>Set 3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAX LOSS CFWD</td>
<td>&gt; 0</td>
<td>&gt; 0</td>
<td>missing</td>
<td></td>
</tr>
<tr>
<td>CUR FED TAX c</td>
<td>≤ 0</td>
<td>&gt; 0</td>
<td>≤ 0</td>
<td></td>
</tr>
</tbody>
</table>

Firms obtained
410 219 155 784

Less: Annual reports not available for LOSS year
— (72) (34) (106)

Less: Not LOSS firms after examining tax footnotes in LOSS year
(102) d  (95)  (197)

Firms remaining
410 45 26 481

Starting LOSS sample = 481 firms

Panel B: Selection of final sample

<table>
<thead>
<tr>
<th>Reason for deletion</th>
<th>Firms deleted</th>
<th>Firms remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industries deleted</td>
<td>(68)</td>
<td>413</td>
</tr>
<tr>
<td>Not on Friedman data base</td>
<td>(211)</td>
<td>202</td>
</tr>
<tr>
<td>1980/81 annual reports not available</td>
<td>(20)</td>
<td>182</td>
</tr>
<tr>
<td>Did not sponsor defined benefit plan</td>
<td>(46)</td>
<td>136</td>
</tr>
<tr>
<td>Examined set 1 firms for LOSS status</td>
<td>(12)</td>
<td>124</td>
</tr>
<tr>
<td>Matched with TAX firms</td>
<td>(34)</td>
<td>90</td>
</tr>
</tbody>
</table>

Final sample = 90 pairs of LOSS and TAX firms

*aFirms in set 1 have the highest probability of being LOSS firms, based on Compustat data alone, with at least one year of net operating loss (NOL) carryforwards for federal taxes. In panel A, they are assumed to be LOSS firms. Later in panel B, when a smaller number of set 1 firms remain, annual reports are examined for the loss year for confirmation. Set 2 needs further examination, since they paid taxes despite reporting a NOL. Set 3 also needs further examination as the NOL data was missing on Compustat.

bTAX LOSS CFWD is the tax loss carryforward reported in the LOSS year between 1975 and 1980 (Compustat item #52).

CCUR FED TAX is the current portion of federal tax expense (Compustat item #63) reported in the LOSS year between 1975 and 1980.

dThe loss carryforward was specifically linked to foreign subsidiaries and unconsolidated (for tax) domestic subsidiaries in 26 cases and 15 cases, respectively.
obtained. A total of 784 firms are identified as potential candidates. The annual reports of all firms in sets 2 and 3 are examined for the appropriate year to determine if the firm is in fact a LOSS firm. Set 1 firms are assumed to be LOSS firms and their annual reports are examined at a later stage, when a smaller sample remained, to confirm that they are LOSS firms. A starting sample of 481 LOSS firms is obtained.

An additional 68 firms had to be deleted because of the requirement to exclude certain industries. While 211 firms not in Friedman's sample are deleted, most of these firms would have subsequently been deleted because they did not sponsor defined benefit plans. Apparently, firms not sponsoring defined benefit plans are unlikely to be on Friedman's data base. The remaining 202 firms' 1980/81 annual reports are examined to obtain information about fund assets ($F$), reported accrued liabilities ($A$), and discount rates ($R$). For 20 firms the annual reports were not available at the University of Rochester library, and 46 firms are deleted because they did not sponsor defined benefit plans. An additional 12 firms (all set 1 firms) are excluded after detailed examination of their tax footnotes indicated that they were actually TAX firms, to obtain 124 LOSS firms.

The population of high tax firms (TAX) consisted of firms in Friedman's sample that are excluded from the initial LOSS sample. 106 firms with insufficient tax data to determine if they had a CARRYFORWARD year between 1975 and 1981 are dropped. The remaining firms are scanned to obtain matches for the 124 LOSS firms. The three proxies for plan features, employed for matching, are (1) four-digit Standard Industry Classification (SIC) code, (2) size ($A$) measured by total assets in 1980 (Compustat item #6), and (3) capital to labor ratio ($A/EMP$) measured by the ratio of total assets to total employees (Compustat item #29) in 1980. The matching criteria employed is as follows. The ratio of each control variable ($A$ and $A/EMP$) for the two firms in the match had to lie between 0.5 and 2.0. In other words, for each pair the TAX firms $A$ and $A/EMP$ is more than half and less than double the LOSS firm's $A$ and $A/EMP$, respectively. There is no justification for these limits other than the objective of producing a reasonable sample size. An additional 34 LOSS firms are deleted at this stage to generate a final list of 90 matched pairs of LOSS and TAX firms.

The 90 pairs are examined to ascertain the degree of similarity in plan features between the pairs. First, the two proxies, size and assets per employee, are examined to ensure that no systematic differences resulted from the matching procedures. Table 5 reports that the mean and median differences between matched pairs for both matching variables are small and not significantly different from zero. Various financial ratios are examined and generally the firms seemed well-matched. However, two variables, profitability ($PM$) and leverage ($DEBT/A$), were significantly different between the matched
Table 5
Descriptive statistics on LOSS and TAX matched pairs (N = 90 pairs).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>TAX sample</th>
<th>LOSS sample</th>
<th>Mean (p-value)</th>
<th>Median (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total assets</td>
<td>—</td>
<td>653.09 / 233.29</td>
<td>701.78 / 179.34</td>
<td>-48.69 (0.5365)</td>
<td>9.83 (0.5093)</td>
</tr>
<tr>
<td>Assets/employee</td>
<td>A / EMP</td>
<td>66.93 / 40.15</td>
<td>62.42 / 42.15</td>
<td>4.62 (0.2520)</td>
<td>-2.91 (0.7434)</td>
</tr>
<tr>
<td>Total sales</td>
<td>—</td>
<td>851.85 / 361.09</td>
<td>930.00 / 305.62</td>
<td>-68.57 (0.5256)</td>
<td>3.52 (0.6945)</td>
</tr>
<tr>
<td>Debt ratio</td>
<td>DEBT / A</td>
<td>0.4792 / 0.4896</td>
<td>0.5993 / 0.6114</td>
<td>-0.1200 (0.0001)</td>
<td>-0.1160 (0.0001)</td>
</tr>
<tr>
<td>Profitability measure (PM)</td>
<td>OI / A</td>
<td>0.1684 / 0.1519</td>
<td>0.1085 / 0.1055</td>
<td>0.0598 (0.0001)</td>
<td>0.0642 (0.0001)</td>
</tr>
</tbody>
</table>

*The variables employed and their sources are as follows:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Symbol</th>
<th>Source</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees</td>
<td>EMP</td>
<td>Compustat #29</td>
<td>1980</td>
</tr>
<tr>
<td>Total sales</td>
<td>SL</td>
<td>Compustat #12</td>
<td>1980</td>
</tr>
<tr>
<td>Total debt</td>
<td>DEBT</td>
<td>Compustat #5 + #9 + #75</td>
<td>1980</td>
</tr>
<tr>
<td>Operating income before depreciation and taxes</td>
<td>OI</td>
<td>Compustat #13</td>
<td>1975–1981</td>
</tr>
</tbody>
</table>

PM = average profitability = \[\frac{\sumOi}{\sumA}\], where \[\sumOi = \sum_{1975}^{1981}\] sum over seven-year period 1975 to 1981.

*b p-values refer to tests of the null hypothesis that the means (medians) of the two samples are equal using a two-tailed t-test (Wilcoxon signed rank test).
pairs. Numerous other measures of profitability and leverage confirmed these differences.

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