Do Mandatory Pension Contributions Lead to Increases in Firms' Cost of Debt?

John L. Campbell
Eller College of Management, University of Arizona
Tucson, AZ 85721-0108
johnc@email.arizona.edu

Dan S. Dhaliwal
Eller College of Management, University of Arizona
Tucson, AZ 85721-0108
dhaliwal@eller.arizona.edu

William C. Schwartz, Jr.*
Eller College of Management, University of Arizona
Tucson, AZ 85721-0108
Phone: 520.621.4830
Fax: 520.621.3742
schwartz@eller.arizona.edu

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*Corresponding author. We thank the University of Arizona doctoral student workshop for helpful comments and suggestions.

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Abstract:

Using a sample of 2,012 new debt issues, we investigate the relation between mandatory pension contributions and firms' cost of debt. Recent research documents a negative association between firms' mandatory pension contributions and capital expenditures (Rauh 2006), as well as negative abnormal returns for capital intensive firms when funding regulations increase mandatory pension contributions (Campbell, Dhaliwal and Schwartz 2009). However, these studies are silent as to the mechanism linking increased mandatory pension contributions with reduced levels of investment. After controlling for the funded status of firms' pension plans and the traditional determinants of cost of debt, we document a positive association between mandatory pension contributions and firms' cost of debt for our full sample. However, we then present evidence that the relation between cost of debt and mandatory pension contributions is concentrated in firms facing external financing constraints (i.e. non-investment grade debt issuers). Finally, we show that Moody's credit ratings are not statistically associated with mandatory pension contributions. The final result is not surprising considering that Moody's believes that financing pension liabilities with debt is a credit neutral event (Moody's 2006).

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1. Introduction

Defined benefit pension plans have recently received increasing attention in the business press as well as from Congress and the Financial Accounting Standards Board (FASB). The issue is also the subject of contemporaneous accounting research (Rauh 2006; Franzoni and Marin 2006; Hann, Heflin and Subramanyam 2007; Shaw 2008; Campbell, Dhaliwal and Schwartz 2009). Campbell et al. show the projected benefit obligation (PBO) of U.S. firms is nearly three trillion dollars in 2005. They also document that firms have become increasingly underfunded in recent years.[1] The underfunding reached a maximum in 2004 with an aggregate level of underfunding of over $500 billion. The massive level of underfunding, as well as several high profile bankruptcies, threaten the fiscal viability of the Pension Benefit Guarantee Corporation (PBGC).[2] Congress recently enacted the Pension Protection Act of 2006 (PPA 2006) which requires firms to fully fund their pension plans in seven years. Prior to the PPA 2006, firms were allowed 30 years to fund their pension plans. Additionally, in 2006 the FASB adopted FASB Statement No. 158 (FAS 158) (FASB 2006) which requires firms to recognize the difference between PBO and the fair value of plan assets (FVPA) on the balance sheet effective for fiscal years ending 2006.[3] The cumulative effect of the PPA 2006 and FAS 158 is to draw attention to the funded status of firms' pension plans and to increase firms' annual mandatory pension contributions.

[1] Funded status is calculated using information in firms' financial statements under generally accepted accounting principles (GAAP). Specifically, funded status is the PBO minus the fair value of pension assets (FVPA).

[2] The PBGC was created in 1974 to protect the pensions of American workers and retirees. When a company terminates its pension plan, the PBGC takes responsibility for the plan. The PBGC is largely funded by insurance premiums paid by US firms with defined benefit plans. The director of the PBGC reports directly to the U.S. Secretary of Labor.

[3] The PPA 2006 and FAS 158 are more fully discussed in section 3 of the paper.

Rauh (2006) examines the effects of mandatory pension contributions on capital expenditures as well as other forms of corporate investment. He notes that financial disclosures relating to total pension contributions under GAAP are not sufficient to determine the minimum required pension contribution. Rauh uses a unique data set of firms filing Internal Revenue Service (IRS) Form 5500. This data set allows him to calculate the minimum contribution required under Employee Retirement Income Security Act (ERISA) of 1974. Rauh (2006) documents a negative and significant association between capital expenditures and mandatory pension contributions. The effects are especially strong for cash constrained firms, young firms and low dividend paying firms. These results suggest that mandatory pension contributions limit a firm's ability to invest in desired projects. Campbell, Dhaliwal and Schwartz (2009) extend Rauh's (2006) research to examine the relationship between capital expenditures and abnormal returns surrounding key dates in the legislative process that lead to the adoption of the PPA 2006. Campbell et al. (2009) document a negative and significant association between capital expenditures and abnormal returns. The results documented in Campbell et al. (2009) are consistent with the view that capital markets believe that increases in mandatory pension contributions will require firms to forgo investments in positive NPV projects.

While the prior literature documents a significant negative relation between capital expenditures and mandatory pension contributions, it is silent as to the mechanism which links the two. In this study, we examine whether regulatory-imposed mandatory pension contributions affect firms' cost of capital. Specifically, we examine two research questions. First, are mandatory pension contributions positively associated with firms' cost of debt? Second, is the association between mandatory pension contributions and cost of debt stronger for firms facing external financing constraints?

On the one hand, the negative association between mandatory pension contributions and capital investment may be due to exogenously imposed cash outflows (i.e. mandatory pension

contributions) leading to increased risk to the firms' bondholders. Covenants exist in debt contracts to protect bondholders from adverse changes in the firm which would increase bankruptcy risk and accordingly increase the risk that bondholders would not be repaid (Smith and Warner 1979; Smith 1993). Managers and shareholders willingly submit to restrictive covenants in order to reduce borrowing costs (Jensen and Meckling 1976; Myers 1977). If increases in mandatory pension contributions increase bondholder risk (i.e. push firms closer to debt covenant constraints), then higher mandatory pension contributions should be associated with higher costs of debt.

On the other hand, Moody's (2006) argues that mandatory pension contributions may not lead to an increase in firms' cost of debt. They argue that an increase in mandatory pension contributions is a "credit neutral" event. Moody's rationale is that "companies that borrow to fund their pension obligations are exchanging one form of debt for another" and the rating agency historically adjusts firms' balance sheets to reflect a liability equal to the pension obligation.[4] Consequently, Moody's argues that increases in mandatory pension contributions will not affect credit ratings and by implication would not increase the cost of debt. Moody's notes, however, that the final effect on credit ratings (and ultimately firms' cost of debt) depends on traditional determinants such as the terms, conditions and maturity profile of any new borrowings.[5] A third possibility examined in this paper is that mandatory pension contributions are associated with higher cost of debt for some but not all firms.

[4] When developing its credit ratings, Moody's historically considered a firm's pension liability using the projected benefit obligation (PBO) even though the FASB did not require firms to record the liability using the PBO on their balance sheets until FAS 158 in 2006.

[5] In addition to testing whether mandatory pension contributions affect firms' cost of debt, we also test whether there is a statistical relationship between mandatory pension contributions and Moody's credit ratings in section 4.6 and Table 8.

GAAP does not require firms to disclose mandatory pension contribution levels.[6] As an alternative, debt rating agencies have developed measures for mandatory pension contributions using data from 10-K disclosures. In this study, we use two proxies for mandatory pension contributions which are based on these measures. Our first proxy uses pension expense while our second proxy is based on Moody's definition of pension contributions.[7] We first present evidence that our proxies capture the mandatory pension contributions disclosed on IRS Form 5500 filings by replicating Rauh's (2006) finding that mandatory pension contributions are associated with lower investment levels. Consistent with Rauh (2006), both of our proxies are negatively associated with capital expenditures. Additionally, both the magnitude and significance of the primary control variables in Rauh's specification are quantitatively and qualitatively similar.

Our sample period spans the years 1991 through 2007 and includes 2,012 firm-year observations. Our empirical analyses yield three main results. First, for our full sample we document a significant and positive association between mandatory pension contributions and firms' cost of debt. This result is robust to controlling for the funded status of firms' pension plans and the traditional determinants of cost of debt.[8] This evidence suggests that mandatory pension contributions increase the incremental cost of borrowing. However, we then present evidence that the relation between cost of debt and mandatory pension contributions is concentrated in firms

[6] The GAAP disclosure requirements for defined benefit pension plans are governed by FAS 132R (FASB 2003). FAS 132R requires firms to disclose total pension contributions. Firms are not required to disaggregate total contributions into mandatory and discretionary portions. Rauh (2006) documents that total pension contributions are not statistically associated with pension firms' capital expenditures.

[7] Specifically, our first measure is defined as pension expense scaled by beginning of year total assets if the pension plan is underfund (FVPA<PBO) and zero elsewhere. Our second measure is defined as [service cost + (ABO-FVPA)/30] scaled by beginning of year total assets if the pension plan is underfunded and zero elsewhere. Each measure is more fully discussed in section 4.1 of the paper.

[8] Consistent with existing research, we measure each firm's cost of debt as the difference between yields on the corporate issue and a U.S. Treasury Security issue of similar maturity (MacKie-Mason 1990; Dhaliwal, Erickson and Krull 2007; Dhaliwal, Gleason, Melendrez and Heitzman 2008). Additionally, we control for firm and issue specific characteristics that associated with the cost of debt (Sengupta 1998; Reeb, Mansi, and Alee 2001; Anderson, Mansi and Reeb 2003; Bhojraj and Sengupta 2003; Shi 2003; Mansi, Maxwell and Miller 2004; and Dhaliwal, Gleason, Heitzman and Melendrez 2008).

facing external financing constraints. Specifically, we document that the association between cost of debt and mandatory pension contributions is positive and significant for firms with non-investment grade debt but is not statistically different from zero for firms with investment grade debt. These results suggest that mandatory pension contributions increase the cost of debt for firms that face external financing constraints but not for other firms. Finally, we show that Moody's credit ratings are not statistically associated with mandatory pension contributions. The final result is not surprising considering that Moody's believes that financing pension liabilities with debt is a credit neutral event.

Our research makes several significant contributions. First, our study is the first to examine the relationship between the incremental cost of borrowing and mandatory pension contributions. Our evidence suggests that part of the reason for the negative association between capital investments and mandatory pension contributions documented in the prior literature is due to some firms experiencing an incremental increase in their cost of borrowing (Rauh 2006; Campbell et al. 2009). Specifically, mandatory pension contributions lead to an increase in the incremental cost of borrowing for firms facing external financing constraints (i.e. firms with non-investment grade debt). As a result, the reduction in capital expenditures experienced by firms facing external financing constraints likely represents permanently foregone positive NPV projects. In combination with Rauh (2006), our results suggest that there is little reduction in capital expenditures due to mandatory pension contributions for investment grade issuers, as these firms are better able to borrow funds to replenish any temporary shortfall in investment levels.

Second, our results have important implications for rating agencies. Moody's (2006) states that they do not currently consider the relation between mandatory pension contributions and firms' credit ratings. Our evidence suggests that this is appropriate for investment grade issuers. However, our results suggest that debt markets use mandatory pension contributions when pricing

the risk of non-investment grade debt issuers, beyond the traditional determinants of the cost of debt.

Third, our results have policy implications for accounting/pension funding regulators. Specifically, our results suggest that these groups should incorporate the notion that the relationship between mandatory pension contributions and the cost of debt differs across debt markets. That is, it is important for legislators and accounting standard setters to realize that their policies are likely to have stronger effects on firms with non-investment grade debt.

Finally, the FASB currently has a pension project on its agenda. Rauh (2006) argues that mandatory pension contributions, rather than total pension contributions, are most relevant to corporate investment decisions. Our results suggest that mandatory pension contributions are priced in debt markets. In our study, it was necessary to proxy for mandatory pension contributions because the data is not available in publicly filed documents in a timely manner. Consequently, one issue the FASB may want to consider in their deliberations is the merits of disaggregating pension contribution disclosures into mandatory and discretionary portions.

The remainder of the paper is organized as follows. Section 2 discusses the institutional setting by detailing accounting and legislative regulation of corporate pension plans over the last several decades. The section then describes how regulation would affect firms' cost of debt. Section 3 reviews the relevant academic literature and develops the hypotheses tested in the paper. Section 4 explains our research design and presents empirical results. Section 5 offers concluding remarks.

2. Background and motivation

2.1 The relationship between accounting and government pension regulation

The political cost hypothesis predicts that certain firms are vulnerable by virtue of their visibility to political costs such as litigation, regulation and taxation (Watts 1977; Watts and

Zimmerman 1978; and Zimmerman 1983). If managers face the possibility of politically-imposed wealth transfers (i.e. taxes, government subsidies, tarrifs, etc.), they will choose accounting procedures that reduce the expected value of the transfer, through reducing its size, its likelihood or both. The prior literature has generally assumed that large firms are more visible than small firms, and would thus choose accounting procedures that would minimize their visibility (Watts and Zimmerman 1978).

Prior literature presents evidence that managers choose pension accounting and funding procedures in order to reduce visibility. For instance, Francis and Reiter (1987) find that managers increase pension funding levels, and therefore reduce the size of their pension obligations, in order to decrease income during highly profitable periods. Asthana (1999) finds that managers manipulate pension actuarial assumptions in order to reduce the size of their pension funding obligations when they are significantly underfunded. Additionally, Bergstresser, Desai and Rauh (2006) present evidence that managers manipulate pension actuarial assumptions in order to meet earnings benchmarks during periods where pre-managed earnings are close to critical earnings thresholds.[9] In all, the prior literature is consistent with managers of firms with defined benefit pension plans choosing accounting procedures and assumptions which reduce visibility, and therefore reduce the expected value of politically-imposed wealth transfers.

Managers of defined benefit pension firms have good reason to be concerned about political scrutiny. Requiring firms to fund their pension plans more quickly represents a potential transfer of wealth from pension firms to those firms' current and future retirees. This transfer of wealth is politically imposed, since Congress has regulated pension funding ever since it passed the Employee Retirement Income Security Act (ERISA) of 1974. Under ERISA, firms were allowed

[9] Bergstresser et al. (2006) examine the return on pension plan assets assumption. Specifically, they examine three earnings thresholds: (1) previous year EPS, (2) median analyst forecasts for industry earnings growth of EPS, and (3) zero EPS. Additionally, they find that managers are more likely to manage earnings through actuarial assumption changes when they prepare to acquire other firms and when their managers exercise stock options. The assumption changes are usually followed by changes in pension plan asset allocations, in order to justify the change in expected return assumption.

30 years to fund their underfunded pension liabilities. ERISA also created the Pension Benefit Guarantee Corporation (PBGC), which was established to protect the pensions of American workers and retirees and is managed by the U.S. Department of Labor. When a company terminates its pension plan, the PBGC takes responsibility for the plan. Consequently, the fiscal viability of the government-led PBGC depends on firms' ability to pay their promised pension obligations to retirees.

Ever since Congress enacted ERISA and created the PBGC, every significant pension accounting framework change by the FASB has been associated with a significant pension funding law change from Congress. In 1974, Accounting Principles Board Opinion No. 8 (APB 8) (APB 1966) was the authoritative guidance for pension accounting. APB 8 was known as a "legal form" pension accounting framework, since the liability owed to current and future retirees legally belongs to the pension trust. That is, the cash contributions from the firm are made to the pension trust and not to retirees directly. Consequently, the pension liability was not considered to be a liability of the firm. Therefore, firms did not recognize a pension liability on their balance sheets, and only recognized pension expense whenever they made contributions to the pension trust.

In 1985, the Financial Accounting Standards Board (FASB) moved to an "economic substance" pension accounting framework with the adoption of FASB Statement No. 87 (FAS 87) (FASB 1985). The FASB passed FAS 87 in December 1985 and FAS 87 became effective for fiscal years ending in 1986. Under FAS 87, firms recognized the fair value of net pension obligations as balance sheet liabilities based on the plan's accumulated benefit obligation (ABO). The ABO is the estimated net present value of pension obligations assuming that all employees maintain their current salary levels. In order to avoid significant fluctuations in pension expense, the changes to record the net liability at fair value were recorded to shareholders' equity instead of directly to the income statement. The shareholders' equity balances were then amortized to the

income statement using a straight-line method, which created a relatively smooth pension expense level.[10]

In 1987, and less than two years after the FASB passed FAS 87, Congress enacted the Pension Protection Act of 1987 (PPA 1987). The goal of the PPA 1987 was to require better overall funding of pension plans by creating "catch-up" contributions for severely underfunded firms. Specifically, severely underfunded firms were required to contribute between 13.75% and 30% of their unfunded pension obligation within five years. As with other pension firms, severely underfunded firms were allowed 30 years to contribute the remaining portion of their unfunded pension obligations. In sum, the PPA 1987 resulted in increased mandatory pension contributions for severely underfunded firms.

The FASB substantially changed the pension accounting framework again in 2006 with the adoption of FAS 158 (FASB 2006). The FASB passed FAS 158 in September 2006 and FAS 158 became effective for fiscal years ending in 2006. Under FAS 158, firms recognize the fair value of net pension obligations as balance sheet liabilities based on the plan's projected benefit obligation (PBO) rather than the ABO. The PBO includes estimated salary increases up to the retirement date, while the ABO uses the salary level as of the current balance sheet date. Firms were required to disclose the PBO in footnote disclosures prior to FAS 158. Additionally, the income statement smoothing provisions of FAS 87 were not affected. By passing FAS 158 in September 2006, the FASB decided that disclosure of the PBO was not an adequate substitution for recognition on firms' balance sheets.

[10] Income statement smoothing occurs in order to prevent fluctuations in current period income which may ultimately adjust in the other direction. Specifically, significant fluctuations in the difference between actual return on pension plans assets and expected return on pension plan assets are held in accumulated other comprehensive income (AOCI). Additionally, the effects of changes in actuarial assumptions such as the assumed discount rate, salary rate increases, or projections of future employee service are also held in AOCI. Amounts are amortized from AOCI to the income statement when the cumulative AOCI balance reaches significant levels.

At the same time, Congress passed the Pension Protection Act of 2006 (PPA 2006). The PPA 2006 substantially impacted firms with defined benefit pension plans in two significant ways. First, while the legislation did not change the total cash outflows associated with funding the pension plan, the legislation dramatically accelerated near term cash outflows for many firms because firms are now required to fully fund their pension plans within seven years. Formerly, firms were allowed 30 years to fund 90 percent of their pension plan. Second, the PPA 2006 increased the level of contributions qualifying for tax deductibility.[11] Specifically, in the past, contributions were deductible up to the point the pension plan was fully funded.[12] The PPA 2006 increased the level of deductibility to 150 percent of the PBO. That is, contributions became deductible up to the point of 50 percent overfunding of the plan. In sum, the PPA 2006 resulted in increased mandatory pension contributions for all underfunded pension firms.

2.2 Regulation, debt covenants and the cost of debt

Both the PPA 1987 and the PPA 2006 increased mandatory pension contributions for pension firms. It seems likely that these increases in mandatory pension contributions could impact firms' existing nexus of contracts. Specifically, firms' debt contracts may have restrictions which would be affected by increases in mandatory pension contributions. Dichev and Skinner (2002) find that the most widely used covenant in debt contracting is the cash coverage ratio (CCR), which is

[11] The PPA 2006 had other significant provisions. Specifically, firms that were less than 65% funded (i.e. FVPA / PBO < 0.65) were targeted for even more aggressive acceleration of pension contributions. Additionally, the PPA 2006 provides special provisions for firms in some industries that will be particularly affected by the accelerated pension contribution requirement. Airline firms that have frozen their pension plans get an additional 10 years to fully fund their plans while airline firms that have not frozen their plans will get an additional three years to meet the funding requirements. Defense contractors and auto manufacturers received transition assistance to minimize the effect of the 30 to 7 year acceleration. See Moody's (2006) for a more complete understanding of the PPA 2006.

[12] According to the PPA 2006, percent funded is calculated as the fair value of plan assets divided by the plan's funding target level, which is based on annual guidance from the Department of Labor and the Internal Revenue Service. According to Moody's (2006), the projected benefit obligation calculated under generally accepted accounting principles (GAAP) is a good proxy for the plan's funding target level.

defined as debt divided by cash flows. Using a sample of 3,319 private lending agreements, they find that 91% of firms in their sample have lending agreements which have debt covenants that contain a CCR.[13] Additionally, Smith (1993) documents that the CCR is among the covenants most frequently violated.

Covenants exist in debt contracts to protect bondholders from adverse changes in the firm which would increase bankruptcy risk and accordingly increase the risk that bondholders would not be repaid (Smith and Warner 1979; Smith 1993). Additionally, managers and shareholders willingly submit to restrictive covenants in order to reduce borrowing costs (Jensen and Meckling 1976; Myers 1977). If increases in mandatory pension contributions result in a higher cash coverage ratio (CCR), then the tighter debt covenants signal an increase in firm risk to the firm's creditors. If the increase in firm risk is large enough, an increase in CCR should manifest itself in a higher cost of debt.

On the other hand, Moody's (2006) argues that mandatory pension contributions may not lead to an increase in firms' cost of debt. They argue that an increase in mandatory pension contributions is a "credit neutral" event. Moody's rationale is that "companies that borrow to fund their pension obligations are exchanging one form of debt for another" and the rating agency historically adjusts firms' balance sheets to reflect a liability equal to the pension obligation.[14] Consequently, Moody's argues that increases in mandatory pension contributions will not affect credit ratings. Moody's notes, however, that the final effect on credit ratings (and ultimately firms' cost of debt) depends on traditional determinants such as the terms, conditions and maturity profile of any new borrowings. The above discussions suggest that the cash coverage ratio is

[13] According to Dichev and Skinner (2002), the debt to cash flow covenant is defined in several variations. Specifically, "debt" may mean total debt, funded debt, or funded debt less cash, while "cash flow" may mean cash from operations, EBIT, EBITDA, among other things.

[14] When developing its credit ratings, Moody's has historically considered a firm's pension liability using the projected benefit obligation (PBO) even though the FASB did not require firms to record the liability using the PBO on their balance sheets until FAS 158 in 2006.

generally considered to be an important determinant of default risk and presumably of debt ratings and firms' cost of debt. Accordingly, whether mandatory pension contributions, after controlling for other known determinants, are associated with increases in firms' cost of debt is an empirical question.

3. Relevant academic literature and hypotheses development

3.1 Pension funding effects on firms' investment levels

Rauh (2006) examines the effects of required pension contributions on corporate expenditures. Rauh exploits an interesting data set that allows him to isolate the effect of required contributions. Specifically, he points out that disclosures in a firm's 10-K regarding pension plan contributions do not reveal the required portion of the pension contribution but rather the aggregate contribution (which may be greater than the required contribution). Rauh uses a unique data set of firms filing Internal Revenue Service (IRS) Form 5500. This data set allows him to calculate the minimum contribution required under ERISA. Data in Rauh's study was available from the U.S. Department of Labor from 1990 through 1998. Rauh (2006) documents a negative and significant association between capital expenditures and required pension contributions. The effects are especially strong for firms that face external financing constraints. These results suggest that required pension contributions limit a firm's ability to invest in positive NPV projects.

Campbell, Dhaliwal and Schwartz (2009) use the Pension Protection Act of 2006 (PPA 2006) as a natural experiment in which to better understand market reaction to increased mandatory pension contributions. The PPA 2006 made two significant changes to existing pension funding requirements. First, the PPA 2006 required pension firms to dramatically accelerate near term cash outflows by requiring firms to fully fund their pension plans within seven years. This accelerated funding requirement became effective as of 2008. Formerly, firms were allowed 30

years to fund 90 percent of their pension plan. Second, the PPA 2006 increased the level of contributions qualifying for tax deductibility from 100 percent of the projected benefit obligation to 150 percent of the projected benefit obligation. This increased deductibility became effective in 2006. Campbell et al. (2009) document a negative and significant association between capital expenditures and abnormal returns around key dates in the legislative process leading to the adoption of the PPA 2006. The negative market reaction to increased mandatory pension contributions documented in their study is consistent with the view that the market believes that increases in mandatory pension contributions will require firms to forgo investments in positive NPV projects.

While prior literature finds a negative association between mandatory pension contributions and capital expenditures, it is silent as to the mechanism which links the two. One explanation would be that mandatory pension contributions impact firms' cost of capital. Given that mandatory pension contributions reduce the cash available to service debt, it is likely that firms' cost of debt will increase. By testing whether the pension firms' cost of debt is the intervening link, we examine whether the previously documented reduction in investment levels is likely to represent permanently foregone capital expenditures.

3.2 Pension funding effects on firms' cost of debt

A review of firms' pension footnote disclosures provides anecdotal evidence that mandatory pension contributions impact debt financing, and ultimately firm investment decisions. For instance, in the 2006 Form 10-K Milacron, Inc. states that "failure to fund the pension plan as required by law would be a breach of the terms of our debt agreements and therefore a default." Additionally, it is clear that firms have a choice to fund the contributions with internally generated funds or to borrow externally. For example, Twin Disc, Inc.'s Form 10-K states that they "intend to meet any pension funding requirements using cash from operations and, if necessary, from

available borrowings under existing credit facilities." Other firms prefer to issue new debt. When describing the use of proceeds from a 2006 debt offering, Hershey Company states that "proceeds from…debt issuances…may be used for…funding contributions to our pension plans." Finally, disclosures suggest that mandatory pension contributions could reduce firm investment. In its 2006 Form 10-K, Calgon Carbon Corporation states that mandatory pension contributions "will have an adverse effect on our cash flow and could require us to reduce or delay our capital expenditures." The above quotes imply that mandatory pension contributions affect firms' (1) debt covenants, (2) cash outflows, and (3) financing and investment decisions, since they must be financed with either internal funds or external debt. To the extent that additional mandatory pension contributions reduce firms' operating cash flows available for servicing debt and/or increase the level of borrowings, it is likely to increase the cost of debt.

Using a sample of 3,319 private lending agreements, Dichev and Skinner (2002) document that the most widely used covenant in debt contracts is the cash coverage ratio (CCR): total debt / cash flow. Specifically, they find that the CCR is used in 91% of the lending agreements within their sample. An increase in the CCR implies that firms' debt covenants more tightly constrain the firm. Since debt covenants are designed to protect bondholders from default risk (Smith and Warner 1979, Smith 1993), tighter debt covenants signal increased firm risk. If the increase in firm risk is large enough, an increase in CCR should manifest itself in a higher cost of debt capital. Therefore, we use the CCR as a proxy for cost of debt in the following illustrative example.

Consider the case of a firm that sponsors a corporate pension plan for its employees and is subject to accounting and legislative regulation which affects its pension funding requirements. Assume the firm has total debt (including pension obligations) of $D > 0$, annual pre-pension contribution operating cash flows of C, and annual mandatory pension contributions of $P > 0$. The firm's cash coverage ratio (CCR) is:

$$CCR = \frac{D - P}{C - P} \quad (1)$$

Equation (1) assumes that firms use internal funds to finance its mandatory pension contributions. If firms have more debt *D* than annual operating cash flows *C*, then *CCR* will increase when firms pay mandatory pension contributions.[15]

On the other hand, suppose the firm replaces *P* by issuing external debt. In the process, the firm incurs net costs of αP, where α = [interest rate on new debt] – [rate of return earned by pension plan assets]. The firm's cash coverage ratio becomes:

$$CCR = \frac{D - P + P}{C - P + (P - \alpha P)} \quad (2)$$

which simplifies to:

$$CCR = \frac{D}{C - \alpha P} \quad (3)$$

If the interest rate on the new external debt is higher than the rate of return earned by pension plan assets (i.e., $\alpha > 0$), then *CCR* will increase. As previously mentioned, Moody's (2006) predicts that increases in mandatory pension contributions do not affect firms' credit ratings. In the context of our example, Moody's argument implies that the difference between firms' incremental borrowing rate and the return on the assets of their pension funds is, on average, less than or equal to zero (i.e., $\alpha \leq 0$). We expect that, on average, the interest rate on funds owed to parties outside of the firm is higher than the rate of return on pension plan assets. Accordingly, our first hypothesis is:

HYPOTHESIS 1: *Mandatory pension contributions are positively associated with firms' cost of debt.*

[15] Subtracting the same amount from both the numerator and denominator results in a higher value than the original fraction, so long as the original fraction is greater than 1.

3.3 Pension funding effects on firms' cost of debt when facing external financing constraints

Rauh (2006) finds that the negative association between mandatory pension contributions and firm investment levels is particularly evident among firms that face external financing constraints. He partitions his sample based on firms' credit ratings and tests whether the sensitivity of investment to mandatory pension contributions is stronger for firms with lower credit ratings.[16] He finds that firms with no credit rating or weak credit ratings adjust investment downward in response to mandatory pension contributions. There is no statistical association between investment and mandatory pension contributions for firms with strong credit ratings. Rauh concludes that the effect of mandatory pension contributions on reduced investment is particularly evident among firms that face external financing constraints.

Rauh's (2006) findings highlight that the association between investment and mandatory pension contributions varies across firms. Specifically, the association is stronger for firms facing external financing constraints as evidenced by weak credit ratings. This is consistent with the notion that non-investment grade issuers are likely to face larger incremental borrowing rates than investment grade issuers, and thus are likely to incur larger net costs when borrowing to fund mandatory pension contributions. Accordingly, our second hypothesis is:

HYPOTHESIS 2: *The association between mandatory pension contributions and cost of debt will be stronger for firms with non-investment grade bond issues.*

[16] Specifically, Rauh (2006) partitions his sample firms into (1) firms with no credit rating, (2) firms with S&P credit ratings worse than A- and (3) firms with S&P credit ratings of A- or above. He finds that firms with credit ratings of A- or above do not adjust investment levels in response to increased mandatory pension contributions. The other two partitions negatively adjust investment.

4. Research design and Empirical Results

4.1 Marginal cost of debt specification

Firms will accept investment projects if the investment's "return is less than the marginal cost of capital to the firm" (p.264, Modigliani and Miller 1958). Holding constant the expected returns from available investment projects, firms will be forced to reject positive NPV projects if their marginal cost of capital increases. Prior literature uses the cost of incremental financing as a proxy for marginal cost of capital (MacKie-Mason 1990, Dhaliwal, Erickson and Krull 2007, Dhaliwal, Gleason, Melendrez and Heitzman 2008). Consistent with this literature, we measure each firm's cost of debt using yields on the first corporate debt issue subsequent to year-end.

To examine the relation between mandatory pension contributions and the cost of debt, we follow prior literature and model the cost of debt as a function of firm and issue-specific characteristics (Sengupta 1998; Reeb, Mansi, and Alee 2001; Anderson, Mansi and Reeb 2003; Bhojraj and Sengupta 2003; Shi 2003; Mansi, Maxwell and Miller 2004; and Dhaliwal, Gleason, Heitzman and Melendrez 2008). We then extend this model to include mandatory pension contributions and the existing funded status of firms' pension plans:

$$\begin{aligned} TSPREAD = {} & \beta_0 + \beta_1 MC + \beta_2 FUNDSTATUS + \beta_3 ROA + \beta_4 LEV + \beta_5 LnMVE + \beta_6 BTM \\ & + \beta_7 STDRET + \beta_8 RATING + \beta_9 LnPrin + \beta_{10} LnMAT + \beta_{11} SENDUM \\ & + \beta_{12} PUBLIC + \varepsilon \end{aligned} \quad (4)$$

Where the variables are defined as follows:

TSPREAD	The yield on the first bond issue in year *t* less the yield on a corresponding Treasury security of similar maturity (as reported in the *SDC New Issues* database)
MC	One of two measures of mandatory pension contributions: 1) *MC_PENSEXP* = aggregate pension expense divided by total firm assets as of year t – 1, if aggregate pension plans are underfunded; and zero otherwise. 2) *MC_MOODYS* = service cost plus (ABO – FVPA / 30), all divided by total firm assets as of year t – 1, if ABO > FVPA); and zero otherwise.
FUNDSTATUS	Fair value of pension plan assets minus the projected benefit obligation all divided by the market value of equity as of year t – 1

ROA	Income before extraordinary items divided by total assets at the end of year $t - 1$
LEV	Long-term debt divided by total assets at the end of year $t - 1$
LnMVE	The natural log of market value of equity reported by CRSP at the end of year $t - 1$
BTM	Book value of equity at end of year $t - 1$ divided by market value of equity, winsorized at 0 and 3.
STDRET	Standard deviation of monthly stock returns for the 24 months through the end of the last month of year $t - 1$
RATING	Moody's Credit Rating in year *t* converted to a numerical equivalent where 1 is assigned to bonds with an Aaa rating and 19 is assigned to bonds with a C rating (as reported in the *SDC New Issues* database)
LnPRIN	The natural log of the total amount of proceeds received from the issue
LnMAT	The natural log of the number of years until maturity of the issue
SENDUM	An indicator variable equal to 1 if the debt issue is senior, 0 otherwise
PUBLIC	An indicator variable equal to 1 if the debt is publicly traded debt, 0 if issued under Rule 144a

Consistent with existing research, we measure each firm's cost of debt as the difference between yields on the corporate issue and a U.S. Treasury Security issue of similar maturity. MC represents a measure of a firm's mandatory pension contributions as required under pension funding regulations. The coefficient on MC is expected to be positive ($\beta_1 > 0$) if mandatory pension contributions are positively associated with firms' cost of debt.

We use two measures as proxies for mandatory pension contributions. Consistent with Rauh (2006), both of our measures incorporate the fact that firms with overfunded pension plans are not required to contribute to their pension plans. First, we estimate mandatory pension contributions using MC_PENSEXP, which is equal to firms' pension expense scaled by total assets if the firm's pension plan is underfunded (the PBO is greater than the fair value of pension plan assets (FVPA)) and zero otherwise. MC_PENSEXP uses data which is publicly available from required accounting disclosures, specifically pension expense divided by total assets if the firm's pension plan is underfunded and zero otherwise.

Second, we estimate mandatory pension contributions using MC_MOODYS, which is equal to sum of (1) the portion of pension expense earned by employees during the current period (i.e.

service cost) and (2) the amortization of any funding shortfall, which according to Moody's (2006) is (ABO – FVPA) / 30.[17,18] MC_MOODYS uses data which is publicly available from required accounting disclosures and is Moody's formula for determining mandatory pension contributions (Moody's 2006). Rauh (2006) obtained Form 5500 data from the Department of Labor for his tests. However, Form 5500 data is not available for a substantial portion of our sample.[19] Additionally, it is not possible for the initial pricing on debt to incorporate Form 5500 data, as it is generally only available from the Department of Labor on a five-year lag (Soto and Buessing 2006). As a construct validity check for our measures, we replicate Rauh's (2006) findings in Section 4.3 and Table 4.

Our control variables are based on the aforementioned cost of debt literature, as well as the pension contribution literature (Rauh 2006). Pension firms are less likely to have underfunded plans when the firms are financially strong and able to make voluntary pension contributions that adequately fund the plan. Additionally, firms that are less financially sound may intentionally underfund their pension plans in order to maintain liquidity or otherwise conserve cash outflows. In addition to controls for firm profitability and credit worthiness, we follow prior literature and also include firms' funded status as a control variable. Rauh (2006) argues that including FUNDSTATUS in a model with mandatory pension contributions, the inferences with respect to

[17] The thirty year amortization period is consistent throughout our time period. As previously mentioned, the PPA 2006 accelerated this amortization from 30 to 7 years beginning in 2008.

[18] Moody's (2006) uses the accumulated benefit obligation (ABO) instead of the PBO when calculating the funding shortfall. The primary difference between these two measures is that the ABO relates to employee service performed through the current balance sheet and does not include estimates for future service. This calculation is consistent with the methodology used on Schedule B of Form 5500.

[19] Specifically, there is a significant time lag in the release of Form 5500 data for public consumption. Firms have ten months after year-end to file the forms, and then the data must be compiled, cleaned and tabulated. For example, as of early 2006, official tabulations were only available up to 2000 (Soto and Buessing 2006). See section 4.3 for additional details.

mandatory pension contributions are less subject to endogeneity concerns.[20] The coefficient on FUNDSTATUS is expected to be negative if underfunded pension firms have higher default risk and incur a higher cost of borrowing.

Our model also incorporates financial statement-based measures of profitability and leverage in order to capture accounting information which would be relevant to bondholders in pricing a firm's debt. We expect the coefficient on ROA (β_3) to be negative if more profitable firms have lower default risk and benefit from a lower cost of borrowing. We expect the coefficient on LEV (β_4) to be positive if leverage increases the expected default costs and the yield demanded by bondholders.

Additionally, our model incorporates other issuer characteristics consistent with prior research. We expect the natural log of the market value of equity, LnMVE, (β_5) to be inversely related to the cost of debt because large firms are expected to have lower default risk. BTM (β_6) controls for growth opportunities. Prior research has found mixed evidence on the relation between BTM and cost of debt. Accordingly, we make no prediction on the coefficient sign for BTM. We include STDRET (β_7) as a proxy for the overall risk of the firm, and it should be positively related to the cost of debt. Finally, our model incorporates RATING (β_8), which is a numerical conversion of Moody's bond ratings to a discrete variable, where 1 represents an Aaa-rated bond and 19 represents a C-rated bond). Prior research documents a strong positive association between bond rating and the cost of debt. Including a measure of bond rating allows us to test for the incremental association of mandatory pension contributions with the cost of debt after controlling for other firm-specific risk characteristics included in the bond rating, including firms' funded status.

[20] Rauh (2006) argues that the relationship between FUNDSTATUS and cost of debt does not have the same asymmetry as the relationship between FUNDSTATUS and mandatory pension contributions. Unlike with mandatory pension contributions, cost of debt has no reason to make a discrete jump where firms' FUNDSTATUS changes from underfunded to overfunded, nor is cost of debt likely to be correlated with FUNDSTATUS for underfunded plans but not overfunded plans.

Our model also incorporates control variables for issue-specific characteristics. We measure the amount borrowed as the natural log of the proceeds, LnPRIN (β_9). The magnitude of the bond issue could affect the cost of debt in two ways. On the one hand, LnPRIN is negatively related to the cost of debt due to economies of scale in underwriting. On the other hand, the size of the issue is mechanically related to cost of debt in a positive direction due to the fact that it increases firm leverage. Consequently, we make no prediction on the sign of the coefficient of LnPRIN. Bonds with longer maturities expose bondholders to greater liquidity risk. If interest rates are increasing over the life of the bond, the bond's value is discounted by the market until its yield is equal to the market rate of interest. Therefore, term risk is captured in Treasury yields, which are deducted from the total yield to obtain our cost of capital measure (TSPREAD). Nevertheless, our model includes LnMAT (β_{10}) to capture any remaining effects of duration, and this value is expected to be positively related to cost of debt. Senior debt issues (SENDUM) take priority in liquidation, reduce bondholder risk, and generally result in a lower cost of borrowing. As a result, the coefficient on SENDUM (β_{11}) should be negative.

Finally, our model incorporates Rule 144a debt issues. Although all the firms in our sample are publicly traded, the Rule 144a bonds are only issued to, and tradable among, qualified institutional investors. These bonds do not require registration with the Securities Exchange Commission (SEC), and as a result have less stringent disclosure and reporting requirements. Not surprisingly, Rule 144a issues typically have higher yields relative to their SEC-registered counterparts. To control for differences in issuance type, we include the dummy variable PUBLIC, which equals 1 for publicly-issued bonds and 0 otherwise. We expect PUBLIC (β_{12}) to be negatively related to firms' cost of debt. Consistent with prior research, our model incorporates industry and year dummy variables.

4.2 Sample and descriptive statistics

We initially identify 15,492 public and Rule 144a bond issues and their characteristics from the *SDC Global New Issues* database during 1991 through 2007. We use firm-level financial information from the most recent fiscal year ending before the bond was issued. We selected this time period to coincide with Rauh (2006), whose study begins in 1990, and we continue to the latest available year for which financial statement data is available in Legacy Compustat.

We obtain data on mandatory pension contributions and pension plan funded status from Compustat, and data for the standard deviation of historical stock returns from the Center for Research in Security Prices (CRSP). Panel A of Table 1 summarizes our sample selection process. We eliminate 11,262 observations without sufficient Compustat data for pensions and 279 observations without sufficient CRSP data for historical stock returns. To reduce the effect of cross-sectional correlation in the error terms, we limit our sample to the first bond per firm issued after fiscal year end. This restriction eliminates an additional 1,939 observations, resulting in a final sample of 2,012.

Panel B of Table 1 presents a breakdown of our sample firms by year. Year concentration does not appear to be a concern as no single year comprises more than 10 percent of the sample. Panel C of Table 1 presents an industry breakdown of our sample firms into 48 industry groupings (see Fama and French 1997). Consistent with prior studies, industry concentration does appear to be an issue. Specifically, the utilities industry represents a disproportionate group of debt issuers (17.8%) relative to other industries.[21] Consequently, our models include both industry and year fixed effects in order to reduce the effects of industry or year concentration.[22]

[21] Using a sample from the *SDC Global New Issues* database of debt issuers from 2001 through 2003, Dhaliwal, Gleason, Melendrez and Heitzman (2008) find that 18.1% of their sample is comprised of the utilities industry.

[22] Many studies do not report industry concentration. However, most of the cost of debt studies which we cite utilize both industry and year fixed effects.

We present descriptive data for the sample in Panel A of Table 2. We winsorize all data at the top and bottom 1 percent to mitigate the influence of outliers. The distributions of our mandatory pension contribution measures (MC_PENSEXP and MC_MOODYS) appear to be quite similar. The mean values (0.004 and 0.006, respectively) are larger than their corresponding median values (0.001 for both) because mandatory pension contributions are censored at zero and consequently skewed right. This finding is consistent with the data presented in Rauh (2006). The average yield spread (*TSPREAD*) is 161 basis points, and is slightly lower than the spread of 193 basis points reported by Klock, Mansi, and Maxwell (2005) for the 1990-2000 period. This is likely due to the inclusion of the 2001 – 2007 period when interest rates were generally lower. The average and median return on assets is five percent. The mean (median) level of debt is 30% (28%) of assets. The mean (median) firm in our sample has market value of equity of $12.8 billion ($3.8 billion), while the mean (median) book-to-market ratio for the sample is 0.47 (0.40). Additionally, 80 percent of the bond issues in our sample have investment-grade ratings. As indicated above, we include Rule 144a private bond issues for publicly traded firms. These issues represent 18 percent of the sample.

Panels B and C of Table 2 highlight the differences between firms that issue non-investment grade debt and the rest of the sample. At the mean, non-investment grade issuers have larger mandatory pension contributions (MC_PENSEXP and MC_MOODYS) and have pension plans which are more underfunded (FUNDSTATUS) as compared to the rest of the sample. Additionally, these firms have larger costs of debt (TSPREAD). As expected, non-investment grade issuers are reliably smaller (MVE), less profitable (ROA), more risky (STDRET) and have greater leverage (LEV).

Table 3 presents Pearson correlation coefficients. The correlations between our two measures for mandatory pension contributions (MC_PENSEXP and MC_MOODYS) is quite high (correlation = 0.70, *p*-value = <0.001). This suggests that our two measures for mandatory pension

contributions are capturing the same underlying construct. We also present correlations among our dependent variable, TSPREAD and control variables. Consistent with existing debt literature, TSPREAD has a strong positive correlation with LEV, STDRET, and RATING. We also find an expected negative relation between TSPREAD and FUNDSTATUS, ROA, LnMVE, LnMAT, SENDUM, and PUBLIC.

4.3 Estimation of mandatory pension contributions

Rauh (2006) used a data set of firms filing Internal Revenue Service (IRS) Form 5500 to obtain mandatory pension contributions. This data set allows him to calculate the minimum contribution required using specific Employee Retirement Income Security Act (ERISA) of 1974 calculations. Rauh points out that total pension contributions from a firm's 10-K do not reveal the required portion of the pension contribution but rather the aggregate contribution (which may be greater than the required contribution). However, we develop two proxies for mandatory pension contributions which use data from 10-K disclosures in order to estimate the mandatory portion of total pension contributions.

There is a significant time lag before Form 5500 data becomes available. Firms have ten months after year end to file the forms, and then the data must be compiled, cleaned and tabulated by the Department of Labor before it is released to the general public. This process typically takes five years (Soto and Buessing 2006). In fact, as of February 2006, the earliest year for which this data was available was 2000. Therefore, we do not use Form 5500 data in our mandatory pension contribution measures for two reasons. First, the data is not available for a substantial portion of our sample. Second, the significant time lag before the data is available precludes it from being used by bondholders in their initial pricing of debt issues.

As an alternative, debt rating agencies have developed measures for mandatory pension contributions using data from 10-K disclosures. These measures are the basis for our two proxies for mandatory pension contributions (MC_PENSEXP and MC_MOODYS). It is likely that bondholders would use similar calculations when determining what, if any, impact mandatory pension contributions should have on debt pricing.

As a construct validity check on our two measures, we replicate Rauh's (2006) finding that mandatory pension contributions are associated with lower investment levels for pension firms from 1990 to 1998.[23] The results are presented in Table 4. Consistent with Rauh, both MC_PENSEXP and MC_MOODYS are negatively associated with capital expenditures. Additionally, both the magnitude and significance of the primary control variables in Rauh's specification are quantitatively and qualitatively similar to results using our two measures.

Table 4 also provides descriptive statistics and implied economic significance of our measures relative to Rauh's measure. Interestingly, the mean and standard deviation of our measures have similar relationships relative to Rauh's measure. Further, the coefficient estimates for our measures lead to similar economic impacts on investment relative to Rauh's measure. In sum, the evidence in Table 4 suggests that both of our measures for mandatory pension contributions are substantially similar to the data available in Form 5500.

4.4 Results on pension funding effects on firms' cost of debt

Our first hypothesis predicts that mandatory pension contributions are positively associated with pension firms' cost of debt ($\beta_1 > 0$). We test H1 with our multivariate model set forth in equation (4) and our two measures of mandatory pension contributions (MC_PENSEXP and

[23] Specifically, we replicate Table 2, regressions (1C) and (2C) from Rauh (2006). We identify 10,490 sample firms compared to Rauh's 8,030. To estimate firms that would file Form 5500, we only include US-based firms with pension expense greater than zero. The difference in observations is likely due, in part, to our inability to identify firms with pension plans having fewer than 200 employees, which are not required to file Form 5500.

MC_MOODYS). Results regarding H1 using MC_PENSEXP as our proxy for mandatory pension contributions are presented in Table 5. Estimating our multivariate model across all sample firms, we find a positive and significant association between MC_PENSEXP and TSPREAD (β_1 = 921.34, *t*-statistic = 2.51). The signs on all statistically significant control variables are consistent with prior debt research (Sengupta 1998; Reeb, Mansi, and Alee 2001; Anderson, Mansi and Reeb 2003; Bhojraj and Sengupta 2003; Shi 2003; Mansi, Maxwell and Miller 2004; and Dhaliwal, Gleason, Heitzman and Melendrez 2008).

Results regarding H1 using MC_MOODYS as our proxy for mandatory pension contributions are presented in Table 6. Again, estimating our multivariate model across all sample firms, we find a positive and significant association between MC_MOODYS and TSPREAD (β_1 = 1,317.26, *t*-statistic = 2.01). As with the MC_PENSEXP specification, the sign on all statistically significant control variables are consistent with prior research. In sum, the evidence presented in Tables 5 and 6 supports our first hypothesis that increasing mandatory pension contributions are associated with a higher cost of debt.

4.5 Results on pension funding effects on firms' cost of debt when facing financing constraints

Our second hypothesis predicts that the association between mandatory pension contributions and pension firms' cost of debt is stronger for firms facing external financing constraints (i.e. non-investment grade debt issuers). We test H2 in two ways. First, we partition the sample based on whether firms issue debt with an investment grade credit rating and then we re-estimate equation (4) for each partition. We expect the association between mandatory pension contributions and cost of debt to be stronger for the sample firms with non-investment grade debt issues.

Results from estimating equation (4) separately for firms which issue non-investment grade debt and firms which issue investment grade debt are presented in Tables 5 and 6 using MC_PENSEXP and MC_MOODYS, respectively, as our proxies for mandatory pension

contributions. In Table 5, we find that the association between mandatory pension contributions (MC_PENSEXP) and firms' cost of debt for non-investment grade debt issues (β_1 = 3,267.62, *t*-statistic = 2.78) is positive and the magnitude of the coefficient is larger than the association for all sample firms (β_1 = 921.34, *t*-statistic = 2.51). Additionally, we find no statistical association between mandatory pension contributions and firms' cost of debt for investment grade debt issues. The results in Table 6 are consistent when using MC_MOODYS as our measure for mandatory pension contributions. Taken together, the results in Tables 5 and 6 provide support for our second hypothesis. The results suggest that the positive association between mandatory pension contributions and firms' cost of debt is concentrated in firms facing external financing constraints. However, there does not appear to be a statistical association between mandatory pension contributions and firms' cost of debt for firms which issue investment grade debt.

The second way in which we test H2 is by modifying our multivariate model. We modify equation (4) by interacting mandatory pension contributions and firms' pension funding status with IGRADE, a dummy variable equal to 1 if the debt issue is investment grade and zero otherwise:

$$\begin{aligned} TSPREAD = {} & \beta_0 + \beta_1 MC + \beta_2 MC*IGRADE + \beta_3 FUNDSTATUS + \\ & \beta_4 FUNDSTATUS*IGRADE + \beta_i Controls + \varepsilon \end{aligned} \quad (5)$$

The control variables in equation (5) are identical to equation (4), except we exclude RATING since it is the basis for the partitioning variable IGRADE. If the association between mandatory pension contributions and cost of debt is stronger for firms which issue non-investment grade debt, then we expect that $\beta_1 > 0$ and either (1) $\beta_2 < 0$, if the effect of mandatory pension contributions on cost of debt is weaker for firms which issue investment grade debt, or (2) $\beta_1 + \beta_2 = 0$, if there is no association between mandatory pension contributions on cost of debt for firms which issue investment grade debt.

Results from our multivariate interaction model (equation 8) are presented in Table 7. Consistent with the evidence from the partition regressions, we find that mandatory pension contributions are positively associated with firms' cost of debt for non-investment grade debt issues. Specifically, β_1 is positive and significant (β_1 = 3,429.39, *t*-statistic = 4.78) using MC_PENSEXP as our proxy for mandatory pension contributions, and is also positive and significant (β_1 = 3,242.66, *t*-statistic = 2.47) using MC_MOODYS as our proxy for mandatory pension contributions.

We find no association between mandatory pension contributions and firms' cost of debt for firms which issue investment grade debt. Specifically, the F-test statistic for the null hypothesis that $\beta_1 + \beta_2 = 0$ is is insignificant for both MC_PENSEXP ($\beta_1 + \beta_2$ = 338.53, F-statistic = 0.68) and MC_MOODYS ($\beta_1 + \beta_2$ = 785.32, F-statistic = 1.17). As before with the partition regressions, we again fail to reject the null that after controlling for the traditional determinants of the cost of debt, there is no association between mandatory pension contributions and firms' cost of debt for firms which issue investment grade debt.

Overall, the collective evidence from Tables 5 through 8 supports two main conclusions regarding the effect of mandatory pension contributions on firms' cost of debt. First, mandatory pension contributions are positively associated with firms' cost of debt after controlling for the funded status of the pension plan and the traditional determinants of the cost of debt. Second, the positive association is concentrated in the firms which issue non-investment grade debt, which suggests that firms facing external financing constraints experience the largest increase in cost of debt when mandatory pension contributions are high.

These results are consistent with Rauh's (2006) finding that the reduction in investment due to mandatory pension contributions is more pronounced in financially constrained firms. Additionally, our results suggest that the higher mandatory pension contributions are likely to lead to permanently forgone capital expenditures. Finally, the findings for investment grade debt issues

are consistent with Moody's claim that companies that borrow to fund their pension obligations are exchanging one form of debt for another and such borrowing is a "credit neutral" event.

4.6 Exploratory evidence on whether mandatory pension contributions affect credit ratings

As previously mentioned, Moody's (2006) argues that increases in mandatory pension contributions should not negatively affect credit ratings. Our results suggest that this argument is valid for firms which issue investment grade debt. However, our results suggest that firms which issue non-investment grade debt experience higher costs of capital, and should consequently receive lower credit ratings.

This leads to an interesting question: is there a statistical relationship between mandatory pension contributions and Moody's credit ratings? If Moody's credit ratings reflect its argument, we should find no relationship between mandatory pension contributions and credit ratings for any partition of sample firms. Table 8 presents evidence for this question. Consistent with Moody's (2006) claims, we are unable to document a statistical relationship between mandatory pension contributions and Moody's credit ratings. Additionally, there continues to be no association even when partitioning the sample on firms which issue non-investment grade debt. This finding is particularly interesting in conjunction with our previous finding that debt markets reflect the effects of mandatory pension contributions when pricing non-investment grade debt. Specifically, the results suggest that Moody's beliefs about the effect of mandatory pension contributions on firms' default risk are inconsistent with the pricing of new debt offerings by credit markets.

5. Conclusions

This study documents the association between mandatory pension contributions and firms' cost of debt. Our empirical analyses yield three main results. First, for our full sample we document a significant and positive association between mandatory pension contributions and

firms' cost of debt. This result is robust to controlling for the funded status of firms' pension plans and the traditional determinants of cost of debt. This evidence suggests that mandatory pension contributions increase the incremental cost of borrowing. However, we then present evidence that the relation between cost of debt and mandatory pension contributions is concentrated in firms facing external financing constraints (i.e. non-investment grade issuers). Specifically, we document that the association between cost of debt and mandatory pension contributions is positive and significant for firms with non-investment grade debt but is not statistically different from zero for firms with investment grade debt. These results suggest that mandatory pension contributions increase the cost of debt for firms that face external financing constraints but not for other firms. Finally, we show that Moody's credit ratings are not statistically associated with mandatory pension contributions. The final result is not surprising considering that Moody's believes that financing pension liabilities with debt is a credit neutral event.

Once sufficient data becomes available in the post-PPA 2006 regime, future research could use the PPA 2006 as a natural experiment in which to test the cost of debt and corporate investment implications of mandatory pension contributions. Additionally, Franzoni and Marin (2006) present evidence that capital markets do not fully anticipate the impact of the pension liability on future earnings and cash flows. Future research could investigate whether the market inefficiency documented in Franzoni and Marin (2006) remains (or gets larger) after FAS 158 and the PPA 2006 or if investors become better able to efficiently price pension accounting information.

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TABLE 1
Industry and Market Classification for 2,012 bonds issued between 1991 and 2007

Number of bond issues from non-financial firms in SDC Global New Issues Database	15,492
Issuing firm not in Compustat or missing a pension plan	(11,262)
Missing CRSP data	(279)
Issues following first issue of year	(1,939)
Final Sample	2,012

Panel B: Distribution by year

	Frequency	Percentage
1991	98	4.9%
1992	114	5.7%
1993	120	6.0%
1994	65	3.2%
1995	92	4.6%
1996	90	4.5%
1997	104	5.2%
1998	160	8.0%
1999	132	6.6%
2000	75	3.7%
2001	189	9.4%
2002	150	7.5%
2003	190	9.4%
2004	94	4.7%
2005	107	5.3%
2006	98	4.9%
2007	134	6.7%
	2,012	

(continued)

TABLE 1, Continued
Industry and Market Classification for 2,012 bonds issued between 1991 and 2007

Panel C: Industry Classification (Fama and French 1997)

	Number	Percent
Utilities	359	17.8%
Petroleum and Natural Gas	124	6.2%
Chemicals	121	6.0%
Transportation	99	4.9%
Retail	98	4.9%
Communication	87	4.3%
Business Supplies	81	4.0%
Machinery	74	3.7%
Food Products	72	3.6%
Pharmaceutical Products	67	3.3%
Wholesale	63	3.1%
Consumer Goods	62	3.1%
Automobiles and Trucks	56	2.8%
Business Services	54	2.7%
Construction Materials	52	2.6%
Steel Works	46	2.3%
Electronic Equipment	46	2.3%
Printing and Publishing	43	2.1%
Computers	42	2.1%
Aircraft	40	2.0%
Beer & Liquor	35	1.7%
Electrical Equipment	28	1.4%
Other	28	1.4%
Restaurants, Hotels, Motels	25	1.2%
Medical Equipment	24	1.2%
Shipping Containers	22	1.1%
Industries less than 1% of sample	164	8.2%
	2,012	

TABLE 2
Descriptive Statistics for 2,012 bonds issued between 1991 and 2007

Panel A: All sample firms

	Obs.	Mean	Standard Deviation	25%	Median	75%
MC_PENSEXP	2012	0.004	0.006	0.000	0.001	0.006
MC_MOODYS	2012	0.006	0.020	0.000	0.001	0.004
FUNDSTATUS	2012	-0.008	0.122	-0.022	-0.003	0.016
TSPREAD	2012	161.03	141.89	71.00	110.00	199.50
ROA	2012	0.05	0.05	0.02	0.05	0.08
LEV	2012	0.30	0.19	0.18	0.28	0.38
MVE	2012	12,832.7	27,545.5	1,408.3	3,805.2	11,792.4
BTM	2012	0.469	0.361	0.228	0.404	0.620
STDRET	2012	0.086	0.044	0.058	0.075	0.102
PRIN	2012	425.86	639.59	148.70	249.20	475.10
MAT	2012	11.40	8.49	6.00	10.00	10.00
SENDUM	2012	0.944	0.230	1.000	1.000	1.000
IGRADE	2012	0.796	0.403	1.000	1.000	1.000
RATING	2012	8.13	3.44	6.00	8.00	10.00
PUBLIC	2012	0.823	0.382	1.00	1.00	1.00

(continued)

TABLE 2, continued
Descriptive Statistics for 2,012 bonds issued between 1991 and 2007

Panel B: Investment grade bond issues

	Obs.	Mean	Standard Deviation	25%	Median	75%
MC_PENSEXP	1601	0.003	0.006	0.000	0.000	0.005
MC_MOODYS	1601	0.004	0.013	0.000	0.000	0.003
FUNDSTATUS	1601	0.002	0.092	-0.017	-0.001	0.020
TSPREAD	1601	111.22	81.19	65.00	95.00	137.00
ROA	1601	0.06	0.05	0.03	0.05	0.09
LEV	1601	0.27	0.15	0.17	0.26	0.34
MVE	1601	15,524.5	30,248.1	2,078.7	5,357.0	15,320.4
BTM	1601	0.436	0.283	0.228	0.383	0.583
STDRET	1601	0.076	0.030	0.055	0.070	0.092
PRIN	1601	438.98	669.54	124.80	249.30	497.00
MAT	1601	12.00	9.23	5.00	10.00	12.00
SENDUM	1601	0.998	0.050	1.000	1.000	1.000
RATING	1601	6.76	2.22	5.00	7.00	9.00
PUBLIC	1601	0.93	0.26	1.00	1.00	1.00

(continued)

TABLE 2, continued
Descriptive Statistics for 2,012 bonds issued between 1991 and 2007

Panel C: Non-investment grade bond issues

	Obs.	Mean		Standard Deviation	25%	Median		75%
MC_PENSEXP	411	0.005	***	0.006	0.001	0.003	***	0.007
MC_MOODYS	411	0.002	*	0.003	0.000	0.001	***	0.003
FUNDSTATUS	411	-0.045	***	0.197	-0.056	-0.014	***	0.000
TSPREAD	411	355.08	***	159.96	235.00	338.00	***	435.00
ROA	411	0.02	***	0.07	0.00	0.03	***	0.05
LEV	411	0.43	***	0.27	0.27	0.38	***	0.54
MVE	411	2,347.1	***	3,544.3	470.2	1,098.6	***	2,602.8
BTM	411	0.597	***	0.553	0.227	0.465	***	0.794
STDRET	411	0.124	***	0.064	0.083	0.109	***	0.151
PRIN	411	374.75	**	503.79	150.00	248.40		400.00
MAT	411	9.06	***	3.81	7.00	10.00	***	10.00
SENDUM	411	0.735	***	0.442	0.000	1.000	***	1.000
RATING	411	13.48	***	1.65	12.00	13.00	***	15.00
PUBLIC	411	0.42	***	0.49	0.00	0.00	***	1.00

(continued)

TABLE 2, continued
Descriptive Statistics for 2,012 bonds issued between 1991 and 2007

All variables are winsorized at 1% and 99% to avoid the influence of outliers on statistical inference. Panel A provides descriptive statistics for all firms in the sample. Panel B provides descriptive statistics for firms where bond issues were considered investment grade, using the IGRADE variable as defined below, while Panel C provides descriptive statistics for firms where bond issues were non-investment grade. Data definitions are as follows:

MC_PENSEXP	If aggregate pension plans are underfunded, then equals the aggregate pension expense divided by total firm assets as of year t – 1; if aggregate pension plans are overfunded, then equals zero
MC_MOODYS	Estimate of mandatory pension contributions according to Moody's (2006). If (ABO > FVPA), then equals the service cost plus (ABO – FVPA / 30), all divided by total firm assets as of year t – 1; if (ABO < FVPA), then equals zero
FUNDSTATUS	Fair value of pension plan assets minus the projected benefit obligation all divided by the market value of equity as of year t – 1
TSPREAD	The yield on the first bond issue in year t less the yield on a corresponding Treasury security of similar maturity (as reported in the *SDC New Issues* database)
ROA	Income before extraordinary items divided by total assets at the end of year *t* – 1
LEV	Long-term debt divided by total assets at the end of year *t* – 1
MVE	Market value of equity reported by CRSP at the end of year *t* – 1
BTM	Book value of equity at end year *t* – 1 divided by market value of equity (measured in fiscal year-end month), winsorized at 0 and 3.
STDRET	Standard deviation of monthly stock returns for the 24 months through the end of the last month of in year *t* – 1
PRIN	The total amount of proceeds received from the issue
MAT	The number of years until maturity of the issue
SENDUM	An indicator variable equal to 1 if the debt issue is senior, 0 otherwise
IGRADE	Indicator variable equal to 1 if the firm's Moody's Credit Rating in year t (as reported in the *SDC New Issues* database) is Baa3 or better
RATING	Moody's Credit Rating in year *t* converted to a numerical equivalent where 1 is assigned to bonds with an Aaa rating and 19 is assigned to bonds with a C rating (as reported in the *SDC New Issues* database)
PUBLIC	Indicator variable equal to 1 if the debt is publicly traded and 0 if it is a Rule 144a bond issue

[a] *MVE*, *PRIN*, and *MAT* information is provided only for sample characteristics. In the regressions, the natural log of these values (*LnMVE*, *LnPRIN*, and *LnMAT*) are used.

*, ** and *** next to the mean (median) indicate a 10%, 5% and 1%, respectively, significant difference between investment grade issues and non-investment grade issues using a two-tailed test.

TABLE 3
Pearson correlations between sample variables

	MC_PENSEXP	MC_MOODYS	FUNDSTATUS	ROA	LEV	LN_MVE	BTM	STDRET	LN_PRIN	LN_MAT	SENDUM	RATING	PUBLIC
TSPREAD	0.104	0.004	-0.195	-0.341	0.317	-0.464	0.294	0.577	0.070	-0.010	-0.350	0.725	-0.528
	<0.001	*0.840*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*0.002*	*0.645*	*<0.001*	*<0.001*	*<0.001*
MC_PENSEXP		0.703	-0.404	-0.036	-0.082	-0.038	-0.022	0.095	0.019	0.015	-0.043	0.113	-0.066
		<0.001	*<0.001*	*0.098*	*<0.001*	*0.084*	*0.308*	*<0.001*	*0.383*	*0.485*	*0.053*	*<0.001*	*0.003*
MC_MOODYS			-0.345	-0.027	-0.135	0.054	-0.059	-0.015	0.035	0.027	-0.003	0.033	0.013
			<0.001	*0.221*	*<0.001*	*0.015*	*0.007*	*0.505*	*0.108*	*0.215*	*0.893*	*0.132*	*0.559*
FUNDSTATUS				0.166	-0.031	0.045	-0.148	-0.236	-0.055	-0.033	0.000	-0.175	0.074
				<0.001	*0.153*	*0.040*	*<0.001*	*<0.001*	*0.013*	*0.136*	*0.989*	*<0.001*	*0.001*
ROA					-0.223	0.358	-0.484	-0.277	0.059	-0.044	0.079	-0.391	0.148
					<0.001	*<0.001*	*<0.001*	*<0.001*	*0.007*	*0.047*	*<0.001*	*<0.001*	*<0.001*
LEV						-0.297	-0.034	0.197	-0.024	0.008	-0.290	0.420	-0.190
						<0.001	*0.123*	*<0.001*	*0.267*	*0.724*	*<0.001*	*<0.001*	*<0.001*
LN_MVE							-0.405	-0.267	0.450	-0.086	0.279	-0.543	0.278
							<0.001	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*	*<0.001*
BTM								0.223	-0.069	0.051	-0.005	0.247	-0.134
								<0.001	*0.002*	*0.021*	*0.829*	*<0.001*	*<0.001*
STDRET									0.130	-0.091	-0.178	0.477	-0.380
									<0.001	*<0.001*	*<0.001*	*<0.001*	*<0.001*
LN_PRIN										-0.090	0.031	0.050	-0.087
										<0.001	*0.160*	*0.025*	*<0.001*
LN_MAT											-0.029	-0.081	0.101
											0.195	*<0.001*	*<0.001*
SENDUM												-0.439	0.282
												<0.001	*<0.001*
RATING													-0.504
													<0.001

(continued)

TABLE 3, continued
Pearson correlation between sample variables

The Pearson correlation coefficients between variables are presented, and two-tailed *p*-values for testing whether the correlation coefficient is different from zero are reported. Variables are defined as follows: TSPREAD is the yield on the first bond issue in year t less the yield on a corresponding Treasury security of similar maturity (as reported in the *SDC New Issues* database). If aggregate pension plans are underfunded, then MC_PENSEXP equals the aggregate pension expense divided by total firm assets as of year t – 1; if aggregate pension plans are overfunded, then MC_PENSEXP equals zero. If (ABO > FVPA), then equals the service cost plus (ABO – FVPA / 30), all divided by total firm assets as of year t – 1; if (ABO < FVPA), then equals zero. FUNDSTATUS is the fair value of pension plan assets minus the projected benefit obligation all divided by total firm assets as of year t – 1. ROA is income before extraordinary items divided by total assets at the end of year *t* – 1. LEV is long-term debt divided by total assets at the end of year *t* – 1. LN_MVE is the natural log of the market value of equity reported by CRSP at the end of year *t* – 1. BTM is the book value of equity at end year *t* – 1 divided by market value of equity (measured in fiscal year-end month), winsorized at 0 and 3. STDRET is the standard deviation of monthly stock returns for the 24 months through the end of the last month of in year *t* – 1. LN_PRIN is the natural log of the total amount of proceeds received from the issue. LN_MAT is the natural log of the number of years until maturity of the issue. SENDUM is an indicator variable equal to 1 if the debt issue is senior, 0 otherwise. RATING is Moody's Credit Rating in year *t* converted to a numerical equivalent where 1 is assigned to bonds with an Aaa rating and 19 is assigned to bonds with a C rating (as reported in the *SDC New Issues*).

TABLE 4
Construct Validity Check of Mandatory Pension Contribution Proxy Variables

Model: $Capital\_Expenditures_{i,t} = \alpha_0 + \beta_1 MC_{i,t} + \beta_i CONTROLS_{i,t} + \varepsilon_{i,t}$.

		Rauh (2006)		MC_PENSEXP		MC_MOODYS	
RAUH_MEASURE	(-)	-0.830***	-0.738***				
		(0.289)	(0.284)				
MC_PENSEXP	(-)			-15.81**	-12.225**		
				(7.25)	(7.23)		
MC_MOODYS	(-)					-0.713***	-0.519***
						(0.168)	(0.178)
NONPENSIONCF	(+)	0.112***	0.111***	0.114***	0.114***	0.112***	0.112***
		(0.012)	(0.012)	(0.009)	(0.009)	(0.009)	(0.009)
TOBINSQ	(+)	0.019***	0.019***	0.017***	0.016***	0.016***	0.016***
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
FUNDSTATUS	(-)		0.026		0.088***		0.075***
			(0.023)		(0.024)		(0.026)
Firm Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
R2		0.609	0.610	0.682	0.683	0.682	0.683
Nobs		8030	8030	10490	10490	10490	10490

(continued)

TABLE 4, continued
Construct Validity Check of Mandatory Pension Contribution Proxy Variables

	Mean	Median	Std	Economic Significance (1)	Economic Significance (2)
RAUH_MEASURE	0.001	0.000	0.003	-0.0008	-0.0007
MC_PENSEXP	0.00005	0.00000	0.00016	-0.0008	-0.0006
MC_MOODYS	0.002	0.000	0.003	-0.0014	-0.0010

The first table presents regression results replicating Rauh (2006). Using Form 5500 data from the Department of Labor available through 1998, Rauh calculated actual mandatory pension contributions for a sample of firms from 1990 to 1998, which we defined as RAUH_MEASURE. The dependent variable is Capital Expenditures, and the regression is estimated with firm and year fixed effects with firm level cluster-robust standard errors. The first column presents Rauh's regression (1C) and (2C) from Table 1, as presented in Rauh (2006). The coefficient estimate is presented with the standard error beneath it. The second column presents the MC_PENSEXP proxy in the same models, while the third column presents the MC_MOODYS proxy in the same models. MC_PENSEXP and MC_MOODYS are as defined in Table 2.

The second table provides descriptive information of MC_PENSEXP and MC_MOODYS as compared to RAUH_MEASURE. Economic significance columns are calculated by multiplying the mean value of the variable with the regression coefficient obtained. Column (1) is calculated based upon Rauh (2006), Table 2 regression (1C) and column (2) is calculated based upon Rauh (2006), Table 2 regression (2C).

TABLE 5
Multivariate Regression of the Cost of Debt on
Mandatory Pension Contribution Levels using Pension Expense Proxy

Model: $TSPREAD_{i,t} = \alpha_0 + \beta_1 MC\_PENSEXP_{i,t} + \beta_2 FUNDSTATUS_{i,t} + \beta_i CONTROLS_{i,t} + \varepsilon_{i,t}$.

	Predict	All Firms		Non-Investment Grade		Investment Grade	
MC_PENSEXP	(+)	1,264.56	921.34	3,332.77	3,267.62	623.62	285.63
		(3.64)***	(2.51)***	(3.09)***	(2.78)***	(2.01)**	(0.88)
FUNDSTATUS	(-)		-51.84		-5.56		-68.12
			(-2.87)***		(-0.14)		(-3.28)***
ROA	(-)	-62.71	-60.58	-167.11	-167.33	-133.27	-123.62
		(-1.40)	(-1.35)	(-1.53)	(-1.53)	(-2.94)***	(-2.73)***
LEV	(+)	11.13	10.33	10.34	10.04	34.07	33.04
		(0.94)	(0.87)	(0.39)	(0.38)	(2.72)***	(2.65)***
LN_MVE	(-)	-12.09	-12.49	-51.95	-51.98	-12.52	-12.97
		(-6.07)***	(-6.27)***	(-7.53)***	(-7.52)***	(-7.52)***	(-7.79)***
BTM	(?)	30.38	28.82	-1.22	-1.42	35.82	35.34
		(4.50)***	(4.27)***	(-0.09)	(-0.10)	(4.43)***	(4.38)***
STDRET	(+)	534.13	505.80	425.11	422.30	559.85	525.74
		(9.13)***	(8.54)***	(3.52)***	(3.45)***	(7.50)***	(7.00)***
LN_PRIN	(?)	2.08	2.12	19.71	19.69	4.46	4.45
		(0.99)	(1.02)	(2.44)**	(2.44)**	(2.53)**	(2.53)**
LN_MAT	(+)	22.11	22.07	-62.14	-62.20	18.05	18.11
		(7.56)***	(7.57)***	(-3.04)***	(-3.04)***	(7.83)***	(7.88)***
RATING	(+)	19.16	19.02				
		(20.13)***	(19.99)***				
SENDUM	(-)	-13.11	-13.94	6.69	6.69		
		(-1.43)	(-1.52)	(0.43)	(0.43)		
PUBLIC	(-)	-44.62	-45.32	-29.75	-29.93	-21.12	-22.95
		(-7.56)***	(-7.68)***	(-1.79)*	(-1.79)*	(-3.35)***	(-3.56)***
Industry Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
R2		0.6951	0.6964	0.5774	0.5774	0.4515	0.4553
Nobs		2012	2012	411	411	1601	1601

(continued)

TABLE 5, continued
Multivariate Regression of the Cost of Debt on
Mandatory Pension Contribution Levels using Pension Expense Proxy

Variables are defined as follows: TSPREAD is the yield on the first bond issue in year t less the yield on a corresponding Treasury security of similar maturity (as reported in the *SDC New Issues* database). If aggregate pension plans are underfunded, then MC_PENSEXP equals the aggregate pension expense divided by total firm assets as of year t – 1; if aggregate pension plans are overfunded, then MC_PENSEXP equals zero. FUNDSTATUS is the fair value of pension plan assets minus the projected benefit obligation all divided by total firm assets as of year t – 1. ROA is income before extraordinary items divided by total assets at the end of year *t* – 1. LEV is long-term debt divided by total assets at the end of year *t* – 1. LN_MVE is the natural log of the market value of equity reported by CRSP at the end of year *t* – 1. BTM is the book value of equity at end year *t* – 1 divided by market value of equity (measured in fiscal year-end month), winsorized at 0 and 3. STDRET is the standard deviation of monthly stock returns for the 24 months through the end of the last month of in year *t* – 1. LN_PRIN is the natural log of the total amount of proceeds received from the issue. LN_MAT is the natural log of the number of years until maturity of the issue. SENDUM is an indicator variable equal to 1 if the debt issue is senior, 0 otherwise. RATING is Moody's Credit Rating in year *t* converted to a numerical equivalent where 1 is assigned to bonds with an Aaa rating and 19 is assigned to bonds with a C rating (as reported in the *SDC New Issues*). Investment grade bond issues are identified using the IGRADE indicator variable, which equals one if the firm's Moody's Credit Rating in year t (as reported in the *SDC New Issues* database) is Baa3 or better. If IGRADE equals zero, then the issue is considered a non-investment grade issue. *, ** and *** next to the *t*-statistic indicate a 10%, 5% and 1%, respectively, significance level using a one- (two-) tailed test for hypothesized (control) variables.

TABLE 6
Multivariate Regression of the Cost of Debt on
Mandatory Pension Contribution Levels using Moodys' Proxy

Model: $TSPREAD_{i,t} = \alpha_0 + \beta_1 MC\_MOODYS_{i,t} + \beta_2 FUNDSTATUS_{i,t} + \beta_i CONTROLS_{i,t} + \varepsilon_{i,t}$.

	Predict	All Firms		Non-Investment Grade		Investment Grade	
MC_MOODYS	(+)	1,902.87	1,317.26	6,025.46	5,805.95	781.14	221.09
		(3.02)***	(2.01)**	(2.97)***	(2.66)***	(1.41)*	(0.38)
FUNDSTATUS	(-)		-56.52		-10.71		-71.68
			(-3.17)***		(-0.28)		(-3.49)***
ROA	(-)	-59.90	-58.48	-174.76	-174.86	-130.04	-122.13
		(-1.33)	(-1.31)	(-1.60)	(-1.60)	(-2.86)***	(-2.69)***
LEV	(+)	10.42	9.72	12.95	12.28	33.26	32.46
		(0.88)	(0.82)	(0.49)	(0.46)	(2.66)***	(2.60)***
LN_MVE	(-)	-12.52	-12.83	-53.32	-53.32	-12.74	-13.10
		(-6.30)***	(-6.47)***	(-7.75)***	(-7.74)***	(-7.68)***	(-7.91)***
BTM	(?)	30.15	28.51	-0.15	-0.56	35.55	35.10
		(4.47)***	(4.22)***	(-0.01)	(-0.04)	(4.39)***	(4.35)***
STDRET	(+)	542.34	509.13	432.53	426.84	569.99	529.53
		(9.27)***	(8.59)***	(3.58)***	(3.48)***	(7.67)***	(7.06)***
LN_PRIN	(?)	1.91	2.01	19.38	19.36	4.40	4.41
		(0.91)	(0.96)	(2.40)**	(2.39)**	(2.49)**	(2.51)**
LN_MAT	(+)	22.03	22.01	-62.75	-62.85	18.00	18.08
		(7.53)***	(7.54)***	(-3.07)***	(-3.07)***	(7.80)***	(7.87)***
RATING	(+)	19.19	19.03				
		(20.14)***	(19.99)***				
SENDUM	(-)	-12.45	-13.54	7.59	7.56		
		(-1.35)	(-1.48)	(0.49)	(0.49)		
PUBLIC	(-)	-44.87	-45.55	-31.90	-32.15	-21.19	-23.11
		(-7.59)***	(-7.72)***	(-1.91)*	(-1.92)*	(-3.39)***	(-3.66)***
Industry Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
R2		0.6945	0.6960	0.5766	0.5767	0.4508	0.4551
Nobs		2012	2012	411	411	1601	1601

(continued)

TABLE 6, continued
Multivariate Regression of the Cost of Debt on
Mandatory Pension Contribution Levels using Moodys' Proxy

Variables are defined as follows: TSPREAD is the yield on the first bond issue in year t less the yield on a corresponding Treasury security of similar maturity (as reported in the *SDC New Issues* database). If (ABO > FVPA), then MC_MOODYS equals the service cost plus (ABO – FVPA / 30), all divided by total firm assets as of year t – 1; if (ABO < FVPA), then MC_MOODYS equals zero. FUNDSTATUS is the fair value of pension plan assets minus the projected benefit obligation all divided by total firm assets as of year t – 1. ROA is income before extraordinary items divided by total assets at the end of year *t* – 1. LEV is long-term debt divided by total assets at the end of year *t* – 1. LN_MVE is the natural log of the market value of equity reported by CRSP at the end of year *t* – 1. BTM is the book value of equity at end year *t* – 1 divided by market value of equity (measured in fiscal year-end month), winsorized at 0 and 3. STDRET is the standard deviation of monthly stock returns for the 24 months through the end of the last month of in year *t* – 1. LN_PRIN is the natural log of the total amount of proceeds received from the issue. LN_MAT is the natural log of the number of years until maturity of the issue. SENDUM is an indicator variable equal to 1 if the debt issue is senior, 0 otherwise. RATING is Moody's Credit Rating in year *t* converted to a numerical equivalent where 1 is assigned to bonds with an Aaa rating and 19 is assigned to bonds with a C rating (as reported in the *SDC New Issues*). Investment grade bond issues are identified using the IGRADE indicator variable, which equals one if the firm's Moody's Credit Rating in year t (as reported in the *SDC New Issues* database) is Baa3 or better. If IGRADE equals zero, then the issue is considered a non-investment grade issue. *, ** and *** next to the *t*-statistic indicate a 10%, 5% and 1%, respectively, significance level using a one- (two-) tailed test for hypothesized (control) variables.

TABLE 7
Multivariate Regression of the Cost of Debt on
Mandatory Pension Contribution Levels from 1991 to 2007

Model: $TSPREAD_{i,t} = \alpha_0 + \beta_1 IGRADE_{i,t} + \beta_2 MC_{i,t} + \beta_3 MC*IGRADE_{i,t} + \beta_4 FUNDSTATUS_{i,t} + \beta_5 FUNDSTATUS*IGRADE_{i,t} + \beta_i CONTROLS_{i,t} + \varepsilon_{i,t}$

		MC_PENSEXP		MC_MOODYS	
IGRADE	(-)	-125.70	-124.74	-132.45	-132.40
		(-16.83)***	(-16.61)***	(-18.06)***	(-18.05)***
MC_PENSEXP	(+)	3,516.03	3,429.39		
		(5.44)***	(4.78)***		
MC_PENSEXP*IGRADE	(-)	-2,823.61	-3,090.86		
		(-3.91)***	(-3.85)***		
MC_MOODYS	(+)			4,019.01	3,242.66
				(3.28)***	(2.47)***
MC_MOODYS*IGRADE	(-)			-2,724.09	-2,457.34
				(-2.02)**	(-1.69)**
FUNDSTATUS	(-)		-11.04		-39.56
			(-0.46)		(-1.71)**
FUNDSTATUS*IGRADE	(-)		-55.90		-24.85
			(-1.67)**		(-0.76)
ROA	(-)	-128.93	-123.03	-134.19	-131.30
		(-2.93)***	(-2.80)***	(-3.04)***	(-2.98)***
LEV	(+)	32.20	31.21	30.89	29.76
		(2.80)***	(2.71)***	(2.67)***	(2.75)***
LN_MVE	(-)	-20.34	-20.68	-20.92	-21.19
		(-11.02)***	(-11.19)***	(-11.33)***	(-11.48)***
BTM	(?)	30.19	29.84	30.06	28.87
		(4.51)***	(4.44)***	(4.47)***	(4.27)***
STDRET	(+)	547.20	535.06	558.18	531.53
		(9.45)***	(9.09)***	(9.62)***	(9.00)***

(continued)

TABLE 7, continued
Multivariate Regression of the Cost of Debt Capital on Mandatory Pension Contribution Levels from 1991 to 2007

		MC_PENSEXP		MC_MOODYS	
LN_PRIN	(?)	6.22	6.21	5.93	5.97
		(3.02)***	(3.02)***	(2.87)***	(2.89)***
LN_MAT	(+)	15.95	15.93	15.84	15.84
		(5.56)***	(5.57)***	(5.50)***	(5.51)***
SENDUM	(-)	-9.69	-9.09	-9.10	-9.52
		(-1.06)	(-0.99)	(-0.99)	(-1.03)
PUBLIC	(-)	-31.52	-32.48	-32.36	-33.13
		(-5.23)***	(-5.39)***	(-5.33)***	(-5.46)***
Industry Fixed Effects		Yes	Yes	Yes	Yes
Year Fixed Effects		Yes	Yes	Yes	Yes
R2		0.8641	0.8644	0.8628	0.8633
Nobs		2012	2012	2012	2012
F test:					
	$\beta_2 + \beta_3$:	692.42	338.53	1294.92	785.32
	F-test	(3.19)**	(0.68)	(3.47)**	(1.17)
	$\beta_4 + \beta_5$:		-66.94		-64.41
	F-test		(6.74)***		(6.37)***

Variables are defined as follows: TSPREAD is the yield on the first bond issue in year t less the yield on a corresponding Treasury security of similar maturity (as reported in the *SDC New Issues* database). If aggregate pension plans are underfunded, then MC_PENSEXP equals the aggregate pension expense divided by total firm assets as of year t – 1; if aggregate pension plans are overfunded, then MC_PENSEXP equals zero. If (ABO > FVPA), then MC_MOODYS equals the service cost plus (ABO – FVPA / 30), all divided by total firm assets as of year t – 1; if (ABO < FVPA), then MC_MOODYS equals zero. FUNDSTATUS is the fair value of pension plan assets minus the projected benefit obligation all divided by total firm assets as of year t – 1. ROA is income before extraordinary items divided by total assets at the end of year *t* – 1. LEV is long-term debt divided by total assets at the end of year *t* – 1. LN_MVE is the natural log of the market value of equity reported by CRSP at the end of year *t* – 1. BTM is the book value of equity at end year *t* – 1 divided by market value of equity (measured in fiscal year-end month), winsorized at 0 and 3. STDRET is the standard deviation of monthly stock returns for the 24 months through the end of the last month of in year *t* – 1. LN_PRIN is the natural log of the total amount of proceeds received from the issue. LN_MAT is the natural log of the number of years until maturity of the issue. SENDUM is an indicator variable equal to 1 if the debt issue is senior, 0 otherwise. RATING is Moody's Credit Rating in year *t* converted to a numerical

(continued)

TABLE 7, continued
Multivariate Regression of the Cost of Debt Capital on Mandatory Pension Contribution Levels from 1991 to 2007

equivalent where 1 is assigned to bonds with an Aaa rating and 19 is assigned to bonds with a C rating (as reported in the *SDC New Issues*). Investment grade bond issues are identified using the IGRADE indicator variable, which equals one if the firm's Moody's Credit Rating in year t (as reported in the *SDC New Issues* database) is Baa3 or better. If IGRADE equals zero, then the issue is considered a non-investment grade issue. *, ** and *** next to the *t*-statistic indicate a 10%, 5% and 1%, respectively, significance level using a one- (two-) tailed test for hypothesized (control) variables.

TABLE 8
Multivariate Regression of Credit Ratings on Mandatory Pension Contribution Levels

Model: $RATING_{i,t} = \alpha_0 + \beta_1 MC_{i,t} + \beta_2 FUNDSTATUS_{i,t} + \beta_i CONTROLS_{i,t} + \varepsilon_{i,t}$.

	Predict	All Firms		Non-Investment Grade		Investment Grade	
MC_PENSEXP	(+)	-7.60		10.89		-5.73	
		(-0.87)		(0.84)		(-0.66)	
MC_MOODYS	(+)		-19.20		11.13		-19.56
			(-1.28)		(0.46)		(-1.29)
FUNDSTATUS	(-)	-1.01	-1.04	-0.90	-0.97	-0.96	-1.05
		(-2.31)**	(-2.42)**	(-2.08)**	(-2.27)**	(-1.70)**	(-1.88)**
ROA	(-)	-9.48	-9.52	-2.30	-2.35	-8.69	-8.76
		(-9.07)***	(-9.10)***	(-1.91)*	(-1.95)*	(-7.29)***	(-7.35)***
LEV	(+)	3.33	3.32	0.52	0.51	3.20	3.19
		(12.28)***	(12.25)***	(1.77)*	(1.74)*	(9.75)***	(9.73)***
LN_MVE	(-)	-0.86	-0.85	-0.29	-0.29	-0.68	-0.68
		(-19.76)***	(-19.80)***	(-3.80)***	(-3.89)***	(-15.48)***	(-15.55)***
BTM	(?)	0.11	0.10	-0.16	-0.16	0.21	0.20
		(0.66)	(0.64)	(-1.04)	(-1.04)	(1.00)	(0.96)
STDRET	(+)	13.92	13.89	6.14	6.13	11.13	11.12
		(10.10)***	(10.08)***	(4.56)***	(4.55)***	(5.63)***	(5.64)***
LN_PRIN	(?)	0.31	0.31	0.03	0.02	0.27	0.27
		(6.24)***	(6.26)***	(0.30)	(0.28)	(5.94)***	(5.94)***
LN_MAT	(+)	-0.50	-0.50	-0.40	-0.41	-0.40	-0.40
		(-7.33)***	(-7.33)***	(-1.80)	(-1.82)	(-6.65)***	(-6.65)***
SENDUM	(-)	-2.63	-2.64	-1.13	-1.13		
		(-12.50)***	(-12.53)***	(-6.64)***	(-6.62)***		
PUBLIC	(-)	-1.29	-1.29	-0.80	-0.80	-0.34	-0.34
		(-9.36)***	(-9.35)***	(-4.35)***	(-4.37)***	(-2.05)**	(-2.08)**
Industry Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects		Yes	Yes	Yes	Yes	Yes	Yes
R2		0.7061	0.7062	0.5239	0.5232	0.4987	0.4992
Nobs		2012	2012	411	411	1601	1601

(continued)

TABLE 8, continued
Multivariate Regression of Credit Ratings on
Mandatory Pension Contribution Levels

Variables are defined as follows: RATING is Moody's Credit Rating in year *t* converted to a numerical equivalent where 1 is assigned to bonds with an Aaa rating and 19 is assigned to bonds with a C rating (as reported in the *SDC New Issues*). If (ABO > FVPA), then MC_MOODYS equals the service cost plus (ABO – FVPA / 30), all divided by total firm assets as of year t – 1; if (ABO < FVPA), then MC_MOODYS equals zero. FUNDSTATUS is the fair value of pension plan assets minus the projected benefit obligation all divided by total firm assets as of year t – 1. ROA is income before extraordinary items divided by total assets at the end of year *t* – 1. LEV is long-term debt divided by total assets at the end of year *t* – 1. LN_MVE is the natural log of the market value of equity reported by CRSP at the end of year *t* – 1. BTM is the book value of equity at end year *t* – 1 divided by market value of equity (measured in fiscal year-end month), winsorized at 0 and 3. STDRET is the standard deviation of monthly stock returns for the 24 months through the end of the last month of in year *t* – 1. LN_PRIN is the natural log of the total amount of proceeds received from the issue. LN_MAT is the natural log of the number of years until maturity of the issue. SENDUM is an indicator variable equal to 1 if the debt issue is senior, 0 otherwise. Investment grade bond issues are identified using the IGRADE indicator variable, which equals one if the firm's Moody's Credit Rating in year t (as reported in the *SDC New Issues* database) is Baa3 or better. If IGRADE equals zero, then the issue is considered a non-investment grade issue. *, ** and *** next to the *t*-statistic indicate a 10%, 5% and 1%, respectively, significance level using a one- (two-) tailed test for hypothesized (control) variables.