ESSAY ON UNEXPECTED MANDATORY PENSION CONTRIBUTIONS IN DEFINED BENEFIT PENSION PLANS

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Abstract:

Corporate sponsors of defined benefit (DB) pension plans in the US are legally required (if underfunded) to make mandatory pension contribution (MPC) as a non-linear function of the funding status of the pension plan. Prior literature finds that sponsor firms react to unexpected MPC by reducing capital expenditures. This study builds upon this framework to determine if a symmetric pattern exists in the response of capital expenditures to whether unexpected MPC is unfavorable (additional cash contributions) or favorable (less cash contributions). We find additional cash contributions or expense have a significant negative impact on investments of cash-constrained sponsor firms (whose capital expenditure exceeds their cash flow frequently). However, reduced cash contributions or saving do not exhibit a significant relationship with investments, thus, indicating an asymmetric relationship of capital investments with saving and expense.

Previous findings observe an increased prevalence of risk shifting tendencies among sponsors with well-funded plans and better credit ratings. Consistent with this style of risk-shifting, this study finds a higher probability of unexpected MPC (both saving and expense) for high-rated sponsors that opt for greater risk (equity) in their pension asset allocation. Results also indicate that plans opting for increased equity allocation face a significantly greater incidence of additional contributions - an explanation to why weakly-funded plans or low-rated firms are less inclined toward risky allocations in their pension investment strategies.

Additionally, I document a positive relationship of unexpected MPC (and expense) with cash flow volatility of the firm and expect this to translate into a higher cost of debt for the firm. However, my findings do not support a positive relationship between unexpected MPC (and expense) and borrowing costs. There is evidence that unexpected savings lead to a lower cost of debt in case of non-investment grade bonds for the Pension & Investments data sample but this result could be sensitive to the sample size and needs further validation.

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CHAPTER I

INTRODUCTION

Corporate sponsors of defined benefit (DB) pension plans are legally required (if underfunded) to make mandatory pension contribution (MPC) as a function of the funding status of the pension plan. Rauh (2006) and Campbell, Dhaliwal, and Schwartz (2012) document the adverse impact of MPC on sponsoring firms, such that an increase in MPC (cash outflow) reduces capital expenditures especially for financially constrained firms. Furthermore, Factset and Citi report pension contributions in 2012 comprised 11% of the EBITDA for median industrial firms in the S&P 500 that sponsored a DB plan (Kimyagarov & Shivdasani, 2013). This evidence suggests a significant impact that pension contributions can have on corporate activities of the sponsor firm.

Rauh (2006) distinguishes between expected and unexpected MPC and finds the effect of unexpected MPC on capital investment is akin to that of total MPC on investment. The crux of my study lies with this distinction between expected and unexpected MPC to be able to address the role of unexpected MPC in the corporate framework. The rationale behind this exercise lies in the identification strategy of Rauh (2006) wherein MPC (and unexpected MPC) is proposed as an exogenous financial constraint to overcome endogeneity issues arising from the association of earlier proxies with the firm's investment opportunities. Additionally, my study proposes a further decomposition of unexpected MPC to be able to identify a more refined version of the financial constraint. The justification for such a decomposition is that unexpected MPC is not a smooth function, but in reality comprises two segments that underfunded sponsor firms could belong to in any pension year –

unfavorable unexpected MPC, implying increased cash demands (due to actual MPC being greater than expected MPC), and favorable unexpected MPC suggesting implicit cash savings (due to actual MPC being less than expected MPC)[1]. This study proposes a proxy for unexpected MPC using the SEC filings that constitute an easy source of information to investors and other stakeholders compared with the Form 5500 filings filed with the Department of Labor[2].

The purpose of MPC is to fund currently accruing benefits as well as reduce the pension funding deficit. Since accruing benefits can be reasonably predicted, it is an expected MPC. However, reducing the pension funding deficit (when pension obligations exceed pension assets) depends in part on achieving an expected rate of return on pension assets. If there is a return shortfall (surplus), there will be less (more) pension assets than expected and the pension deficit rises (reduces), causing the MPC to increase (decrease). This shortfall (surplus), and risk of shortfall (surplus), is considered to be the unexpected MPC (the difference between actual MPC and the expected MPC)[3]. Since these shortfalls or surpluses are unexpected, they translate into a source of cash volatility for DB sponsors. Therefore, it is pertinent to understand the plan and sponsor characteristics that are associated with a greater incidence of this unexpected MPC. More specifically, the impact of the risk profile of pension asset investments (asset allocation) and therefore, of the expected rate of return on these assets on the probability of unexpected MPC needs to be identified if firms wish to contain any possible volatility in MPC and in its cash flow requirements.

Campbell et al. (2012) identify cost of capital as the key link between MPC and capital expenditure for financially constrained firms - a significantly positive relationship being evidence of market friction associated with external financing. However, they do not distinguish between expected and unexpected MPC and, there is no evidence in prior literature to whether incremental cost of capital is attributable to expected or unexpected MPC or both. A plausible argument is expected MPC is not a

[1] A zero unexpected MPC is possible only if both actual and expected MPC are zero.
[2] Form 5500 filings are available for public use with a significant time-lag of around 10 months owing to statutory deadlines. In contrast, Form 10-k data are relatively more timely and user-friendly.
[3] Refer to Section 4 for detailed calculations of MPC, expected MPC and unexpected MPC.

cash shock and therefore, is not to be a reason for outside financing and any subsequent change in the cost of debt of the sponsor firm. Whether the debt market correctly prices unexpected MPC as a source of cash flow volatility or not is open to empirical investigation. If the volatility of MPC manifested through these unexpected MPCs is embedded in the cost of debt, it might be useful to address the causes that trigger these unexpected MPCs. A lower volatility in MPC would imply enhanced financial flexibility and incremental debt capacity (Kimyagarov & Shivdasani, 2013).

The purpose of this study is twofold. First, the study will test whether unexpected MPC (using the proxies constructed with the SEC filings) is an investment constraint for the firm and the role a financial constraint plays in light of the MPC decomposition. Secondly, the study will determine if the pension asset allocation affects the unexpected MPC. Evidence of both outcomes implies that pension asset allocation impacts investment decisions, either as an investment constraint or a financing constraint.

My study uses three different proxies for unexpected MPC – a theoretical proxy following Rauh (2006), the second using Pension & Investments survey data on pension asset allocation and the third using allocation data available from 10-K filings. The first part of my analysis, intended to validate unexpected MPC and its components as a finer version of a financial constraint, demonstrates cash-constrained plan sponsors have to forego investments as a result of unexpected MPC (additional contributions/expense). No significant association however, is observed between investments and unexpected MPC (reduced contributions/saving) implying an asymmetric effect between capital expenditure and both components (saving and expense) of unexpected MPC.

Results indicate equity allocation significantly increases the probability of additional contributions (expense). Further, plan sponsors that have superior ratings and opt for higher equity allocation are found to have a greater incidence of unexpected MPC in terms of both saving and expense. Such evidence is consistent with prior findings that well-funded and highly-rated sponsors firms tend to be more inclined toward risky pension investment strategies and greater risk in pension investments should manifest as greater fluctuations in the MPC of the sponsor firm.

Thereafter, I document a significant positive association between cash flow volatility and unexpected MPC (expense) for non-investment grade firms. This positive link however, does not translate into a positive relationship between unexpected MPC and cost of debt. Instead, the results imply a negative impact of unexpected MPC (and expense) on cost of debt which is contrary to logic. The proxy based on the P&I sample does however, indicate that savings significantly reduces the cost of debt for below-Baa3 (Moody's rating) bond issues but the size of this sample of bonds is significantly small (63 bonds) to be able to make an assertive conclusion. It is to be noted the relationship of cost of debt with unexpected MPC, though in the opposite direction, is stronger than that with expected MPC for non-investment grade issues. In addition, I investigate how bond rating behaves in response to unexpected MPC or its components and results again suggest a negative relationship between rating and unexpected MPC (and expense) for non-investment grade firms. Thus, the relationship of unexpected MPC (and expense) with both cost of debt and bond rating appear to be contradictory to expectations and prior literature.

CHAPTER II

DEFINED BENEFIT PLANS

A. Introduction

A pension plan is an employee benefit scheme maintained by an employer for accrual of retirement benefits to be distributed to plan beneficiaries at retirement or at termination of covered employment or beyond. Pension plans in the U.S. are broadly classified into defined benefit and defined contribution plans. A defined benefit (DB) pension plan bears semblance to the debt instrument - plan beneficiaries are promised a steady stream of retirement benefits based on employee age, salary/wage and tenure. The discounted value of the total retirement benefits makes up the pension liability while the market value of the assets that pension plan funds are invested in comprises the pension plan assets.

The pension liability can be thought of in different forms, the broadest form being the present value of benefits (PVB) that takes into account all accrued benefits as well as all 'future expected benefit payments' (Novy-Marx, 2013). This form of economic liability is attributable to both additional years of service and potential wage increases. A narrower version is the projected benefit obligation (PBO) which accounts for all accrued benefits as well as future benefits attributable to future salary increases, but not to future years of service. The narrowest version however, is the accumulated benefit obligation (ABO). The sponsor is legally obliged to honor this liability in case of termination of the DB plan and therefore, this liability is also referred to as termination liability. This definition recognizes benefits accrued for services rendered till date and estimates the same based on current and past wage history with no consideration of potential wage increases as in case of PBO. In

financial accounting, the firm must fund the projected benefit obligation (PBO) (the funded status on the balance sheet of a sponsor firm is the difference between the pension assets and the PBO), but funded status under the PBGC and IRS is determined in relation to the current liability (similar to the ABO).

If the market value of the pension assets falls below (rises above) the discounted value of the pension obligations, the plan is referred to as underfunded (overfunded). The plan sponsor, responsible for funding adequacy of the plan, makes regular contributions to the plan and bears all investment and mortality risk associated with these plans. Sponsors of overfunded DB plans need not make additional pension contributions, but have the incentive to make voluntary contributions to avail of favorable tax treatments up to a specified limit. The Pension Protection Act, 2006, one of the recent landmark pension legislations, had in fact enhanced the tax deductibility provisions from 100% to 150% of the pension obligations. Underfunded plan sponsors on the other hand, are legally obliged to make mandatory pension contributions, to cover newly accrued liabilities as well as a deficit reduction contribution. Apart from employer protection and collateral in terms of pension assets, these DB plans are also entitled to another layer of protection from the Pension Benefit Guaranty Corporation (PBGC), a federal agency established under the aegis of the Employee Retirement Income Security Act (ERISA), 1974, to insure and guarantee pension benefits up to a statutory maximum amount. Underfunded pension plans are subject to higher premiums than fully funded plans, which incurs additional costs to the plan sponsor.

Defined contribution (DC) plans on the other hand, offer retirement benefits that are typically a function of the level and timing of plan contributions and investment performance of the assets in the individual employee account. In these plans, contributions are made by the employer and the employee or both; however, both investment risk and longevity risk are borne by the participant/beneficiary. The sponsor is not responsible for any guaranteed retirement security to its

employees and thus, remains absolved of future fund commitments toward vested or unvested pension liabilities as is the case with DB plans.

B. Regulatory Background

Prior to 1974, there was little legal protection offered to pension plans. A reform legislation was introduced in 1967 through the efforts of late Senator Jacob Javits of New York, following the termination of the pension plan at Studebaker in 1963 that had resulted in the loss of retirement benefits of more than 4,000 workers.[4]

The Employee Retirement Income Security Act (ERISA) of 1974 was the first major governing legislation for all private DB pension plans in the US to ensure plan participants receive their promised benefits. ERISA[5] requires all underfunded pension plans to make minimum funding contributions (MFC), comprised of the current year service cost (the present value of the future retirement benefits accruing to the plan participant for services rendered in the current year) and an amortized installment of prior unfunded obligations. It had allowed sponsors up to 30 years to amortize their unfunded pension obligations which implied they could conveniently spread the pension burden across extended periods of time. This was presumed to have considerably weakened the funding status of many corporate pension plans. A remarkable feature of this legislation was the establishment of the Pension Benefit Guaranty Corporation (PBGC) to insure retirement benefits of employees covered by private defined benefit pension plans. The PBGC receives its finances through insurance premiums from DB sponsors, liquidation of pension assets that are taken over along with plan liabilities during insolvency of the insured sponsor, income from investments and bankruptcy recoveries. A flat-rate premium determined by the number of plan participants is required of both single-employer and multi-employer plans. However, underfunded single-employer plans are further

[4] http://www.pbgc.gov/about/who-we-are/pg/history-of-pbgc.html
[5] Refer to Munnell and Soto (2003) for a detailed discussion

subject to a variable-rate premium defined by the amount of underfunded vested retirement benefits.[6] A criticism of the PBGC is the premiums charged do not fully cover the cost of covering liabilities in the case of bankruptcy or default of the plan sponsor. This mismatch between the price of risk protection and the insurance premiums charged apparently incentivize sponsor firms to take more risk with their sponsor assets (Lin, Liu, & Yu, 2014). VanDerhei (1990) provides a methodology to estimate more realistic risk-related premiums based on the possible exposure as well as the probability of bankruptcy of an underfunded plan sponsor. The current variable-rate premium structure accounts for the plan's 'potential severity' but is lacking in its consideration of the probabilities of sponsor bankruptcy. Another criticism is pension beneficiaries may receive less than their promised retirement benefits from the PBGC in case of plan termination or sponsor bankruptcy. This cap on maximum benefits payable does not work in favor of employees despite the presence of PBGC that stands to insure such retirement benefits.

Another important piece of legislation was the Pension Protection Act of 1987, introduced with the objective of improving the funding scenario. This legislation initiated deficit reduction contributions (DRC), which were essentially 'catch-up' contributions targeted toward extremely underfunded sponsors, and reduced amortization periods for unfunded pension obligations. Subsequent significant legislations include the Retirement Protection Act (RPA) of 1994 and the Pension Protection Act (PPA) of 2006. The RPA, 1994, instituted additional funding requirements for plans that were severely underfunded (refer to Rauh (2006) for a detailed review). The major provisions of PPA, 2006, on the other hand, mandated a more direct relationship between the funded status of the pension plans and mandatory pension contributions (MPC), an increase in tax-deductibility limits for pension contributions from 100% to 150% of the pension liability, and a requirement for plan sponsors to fully fund their DB plans within seven years[7]. Many firms opted to making more than the minimum

[6] http://www.pbgc.gov/about/factsheets/page/premiums.html

[7] The tax deductibility provisions came into effect in 2006 while the accelerated pension contributions to achieve full funding within seven years came into effect in 2008.

pension contribution around 2006 and 2007 to avail of the tax provisions as well as to avoid being labelled as an "underfunded" or "at-risk" firm and consequently, be subject to more restrictive provisions (Campbell & Schwartz Jr, 2011). The PPA, 2006, was intended to boost the funded status of corporate DB plans as well as the financial health of the PBGC by reducing the risk exposure of this federal agency to underfunded plans.[8]

[8] Refer to LaMonte (2006) for a detailed review of the PPA 2006.

CHAPTER III

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

A. Framework of Corporate Pension Policy

Two major perspectives delineate pension fund studies in academic literature - the traditional versus the corporate. The traditional perspective looks at the pension fund as an entity separate from the sponsor and its shareholders. In this framework, all pension plan decisions, be it funding or asset allocation, are a function of pension variables and beneficiary interests, with no consideration of corporate variables or sponsor/shareholder interests. Under such an approach, there is however no clear answer to what would be the ideal asset allocation for the plan beneficiaries (Bodie, Light, & Morck, 1987). This perspective might have been more relevant when pension assets and liabilities were off the firm balance-sheet. In recent times, however, pension accounting rules have undergone major revisions and plan sponsors are required to report the funded status of their plans on their balance-sheets.

The corporate finance approach on the other hand, supports an integrated balance-sheet that extends beyond traditional firm assets and liabilities to include pension assets and liabilities. This economic approach suggests pension management in alignment with shareholder interests rather than beneficiary interests alone. Bodie et al. (1987) refer to these corporate pension decisions a game between the plan sponsor and the different government agencies and interests, the possible elements of this game being the tax effect, the pension put effect and the financial slack effect.

In the pension put framework, given the extra latitude for risk-taking offered by the PBGC, the DB pension contract between the plan sponsors and the plan beneficiaries is regarded as a put option

written on pension assets and exercisable by the plan sponsor in case of its bankruptcy at a strike price equal to the value of the pension obligations (Sharpe, 1976; Treynor, 1977). The protection offered by the PBGC has led to moral hazard issues - basically a mini-max strategy whereby financially distressed DB sponsors fund pension plans to the minimal possible extent, and take maximum possible risk with its pension assets. Any upside from this risk is gained by firm shareholders while any downside from this risk (fall in the value of pension assets and consequent bankruptcy of sponsor) becomes the onus of the PBGC in that it provides plan beneficiaries with annual pensions up to a statutory amount. As Petersen (1996) puts it, the shareholders gain at the expense of the plan participants (employees) or in case of federal protection from the PBGC, at the expense of the federal agency (Marcus, 1987), or essentially the taxpayers of the country. Legislative conditions were however imposed in the late eighties to restrict the unwarranted use of this 'PBGC put'.

The tax effect on the other hand, refers to a max-min strategy where plan sponsors keep the pension plan funded to the maximum limit specified by the Internal Revenue Service (IRS) and invest plan assets in heavily taxed instruments, such as bonds, in order to capitalize on the value of the tax-shelter to the firm's shareholders (Black, 1980; Tepper, 1981). In fact, the tax savings from pension contributions cannot be ignored with tax shields from pension contributions being almost one-third of that from interest payments for DB pension sponsors (Shivdasani & Stefanescu, 2010). However, the best strategy for the sponsor firm to exploit tax-arbitrage opportunities would be to sell off equity investments in the pension fund and invest in corporate bonds and on the other hand, issue debt and repurchases its own shares - this allows the firm to borrow at the after-tax rate but lend at the pre-tax rate since interest paid on bonds issued by the firm is tax-deductible while income from pension fund assets is not taxable (Black, 1980). In addition, increased allocation of pension assets to fixed investments would help reduce volatility in the value of pension assets and therefore, in pension contributions.

Another element in the corporate finance framework is the financial slack effect that regards the pension fund as a repository for excess corporate short-term funds. Such slack could provide a hedge against unfavorable times (Bodie et al., 1987) but such a strategy is limited due to legal restrictions on the maximum tax-deductible contributions and hefty excise taxes in case of reversion of pension assets to the firm (An, Huang, & Zhang, 2013).[9] However, the shareholders of the firm can still benefit from excess pension assets through decreased pension contributions in the future (Petersen, 1996).

The traditional perspective which advocates taking pension decisions with no consideration to firm objectives finds little support among industry personnel as well as academic literature. Friedman (1983), one of the earliest studies to explore the interrelationships between corporate financial management and pension management, finds evidence that management of pension assets and liabilities is not separated from the management of corporate assets and liabilities. The same study, as well as Petersen (1996), observe these pension-firm interrelationships however, do not seem to offer support to the conventional hypotheses such as the put effect or the tax effect. A similar observation that the insurance or put effect (minimum funding) and the tax effect (maximum funding) need not be the optimal solutions for corporate pension management is proposed in Bicksler and Chen (1985) as well. Rauh (2009) perceives the traditional style as a possibility only in very inefficient firms and has, in fact, noted the involvement of the sponsor firm's board and managers in pension investment decisions as well as in the process of selecting investment managers to implement these decisions.

Albeit these different theoretical hypotheses regarding pension asset allocation and funding within the corporate finance framework do not seem to be consistent with empirical findings, yet the theoretical framework of an integrated economic approach cannot be rejected. Most pension literature adopts this

[9] Reversion of pension assets to employer upon plan termination is subject to an excise tax of 20 percent provided the employer establishes/maintains a qualified replacement plan or provides certain benefit increases to plan participants of the terminating plan; else, the excise tax rate is 50 percent.

structure to empirically test different questions of pension management. Thus, this study also will assume the corporate finance perspective as the theoretical construct for testing different hypotheses about the pension fund and the corporate sponsor.

In the context of this corporate finance framework, the lack of perfect substitutability of pension assets and liabilities with the traditional ones needs to be acknowledged. Though Shivdasani and Stefanescu (2010) observe a significant increase in firm leverage when pension assets and liabilities are combined with traditional balance sheet components which in turn explains a part of the debt conservatism of US firms (Graham, 2000), there are several differences between both categories of assets and liabilities. A major difference is the inexpensive nature of pension liabilities relative to outside liabilities. The cost of borrowing from employees by underfunding pension plans is substantially less than the cost of outside debt due to various reasons that include information asymmetry problems (Akerlof, 1970; Myers & Majluf, 1984), agency and incentive problems (Jensen & Meckling, 1976), or tax issues (Poterba & Summers, 1984). Further, the guarantee by the PBGC, albeit up to a specified amount, of plan benefits to plan participants and the favorable tax provisions for pension plans (tax deductibility for pension contributions as well as for income from pension assets) allow the plan sponsor substantial leeway in decision-making which is not available with ordinary debt liabilities. Of course, such flexibility is contained to some extent since plan sponsors cannot easily access pension assets to meet ordinary firm obligations without the accompanying excise-tax penalty. In a more direct contrast, the flexibility in the timing of the pension contributions versus debt interest payments, and the explicit placement of traditional assets and liabilities versus only the pension funding status (pension assets less pension liabilities) on the firm's balance sheet (Friedman, 1983; Shivdasani & Stefanescu, 2010) bring to light the non-synonymous nature of both these liabilities.

B. Theoretical background

Within the framework of an integrated approach, attempts to explore the interrelationships between pension finance and corporate finance of a corporate sponsor inevitably begins with the Modigliani-Miller capital structure irrelevance theorems (Miller & Modigliani, 1961; Modigliani & Miller, 1958), the seminal works in investment and capital structure theory. These theories underlie the irrelevance of the firm's financial policy in firm valuation or wealth of shareholders, absent market frictions. In the pension framework, the equivalent interpretation suggests pension asset allocation has no impact on shareholder wealth or employee stake (Petersen, 1996). However, in the presence of differential costs of internal and external financing owing to market frictions, the irrelevance of pension asset allocation to shareholder wealth no longer holds. Increased volatility in pension fund assets through greater allocation to common stock or alternative investments would translate into increased volatility in the sponsor's pension contributions and therefore, in the value of the firm (Black, 1980). Greater variability in pension contributions and in the firm's cash flows would suggest greater risk to the bondholders of the firm, too. One would therefore, expect this risk to manifest in higher costs of debt for the sponsor firm.

A caveat here is cash flow variability would not prove expensive if the sponsor firm's operating cash flows are high when investment opportunities are also high and vice-versa (Petersen, 1996). With no financial hedge in place, however, a firm with greater pension allocation to stocks and therefore, greater pension contributions during market downswings might seek external financing to avoid foregoing positive NPV projects. In an imperfect capital market, lenders would presume that only financially unhealthy firms choose to raise external capital and therefore, would impose a penalty in the form of higher costs of debt, especially true for firms with increased capital constraints (Campbell et al., 2012). Additionally, as Campbell et al. (2012) elaborates, negative cash shocks from mandatory pension contributions could bias a firm toward greater leverage which means an increase in financial

risk, costs of equity and in turn, possibly cost of debt too, following Modigliani and Miller (1958) Proposition II.

The above theoretical arguments could be extended to examine the debt market reaction beyond mandatory pension contribution to the expected and the unexpected portion of mandatory pension contributions. Assuming a one-year horizon given the firm's ability to effect pension assets through pension contributions made in the prior year and pension obligations by setting appropriate benefit levels (Rauh, 2006), the expected MPC could be gauged based on expected return on pension fund investments, expected change in interest rates used to compute pension liabilities, normal costs and funding credits.

An ex-ante knowledge of the expected MPC allows the firm sufficient time to plan the expenditure, and logically, such expenditure should not prove to be a significant cash flow shock or a financial constraint to the firm (Rauh, 2006). A financial shock, if any, would arise due to unexpected MPCs caused by deviations in the actual MPC from the expected MPC. Theoretically, this unexpected MPC should therefore, be a better representative of financial constraint (Rauh, 2006). However, this unexpected component could either entail a cash outflow (if actual exceeds the expected, implying additional cash contributions) or an implicit cash inflow (if actual is less than the expected, implying less cash contributions than expected). Additional cash expenditure attributable to unexpected MPC could therefore be deemed a more refined proxy of an exogenous financial constraint.

It should be noted that the process of estimating expected MPC is not bias-free. Expected MPC is a function of expected pension assets, expected pension liabilities, normal costs and funding credits. All except the first determinant can be determined ex-ante fairly accurately and therefore, do not entail substantial errors-in-estimation. Expected assets on the other hand, is subject to potential biases embedded in the firm's expectation of market returns. In fact, deviations of actual asset returns and interest rates from expectations could very well aggravate due to unrealistic return expectations

or due to the riskiness of pension assets. Assuming a firm makes fairly realistic return assumptions, it is the risk of the pension portfolio that would then essentially trigger unexpected MPCs. In other words, the magnitude of this unexpected component will vary with fluctuations in the fair value of pension assets implying a more volatile pension asset portfolio translates into greater unexpected MPCs. It thus follows that the unexpected MPC should bear a high correlation with the risk profile of pension assets or the pension beta (Jin, Merton, & Bodie, 2006).

Further, the greater the probability of this unexpected component, the greater the cash flow risk involved. Such cash flow risk should apparently be factored in and priced by an informationally efficient debt market. A similar reaction might seem unreasonable to assume in the equity market since individual equity investors generally lack the investment sophistication visible amongst debt market investors who are mostly institutional investors. Institutional players tend to display greater price efficiency (Boehmer & Kelley, 2009; Gujarathi, Gupta, & Raman, 2010; Ronen & Zhou, 2013) and therefore, are expected to react to a greater incidence of unexpected MPCs. The findings in Campbell et al. (2012) endorse this fact since the magnitude and significance of mandatory pension contributions are higher in case of cost of debt vis-à-vis cost of equity as a function of mandatory pension contribution of the sponsor firm.

C. Empirical Background

i. Mandatory Pension Contributions as Financing Constraints

The problem of identifying an appropriate measure of financial constraint to study the impact of these constraints on firm capital expenditure has spawned many empirical models. The cash flow variable happens to be one of the many proxies suggested, and (Fazzari, Hubbard, Petersen, Blinder, & Poterba, 1988) report a positive coefficient for cash flow that increases in magnitude in case of a sample of low-dividend paying firms (assumed to be representing financially constrained firms). However, many contradictory arguments have been put forth since then, one major concern being the inadequacy of Tobin's Q to capture investment opportunities (Erickson & Whited, 2000; Poterba,

1988) - the positive association between cash flow and capital expenditure could actually be representing the unaccounted for profitable growth opportunities. Further conflicting evidence comes along in the positive association between cash flow and capital expenditure in a sample of financially unconstrained firms observed by Kaplan and Zingales (1997).

A key to this measurement problem in the financial constraint-investment model has been offered by Rauh (2006) who introduces mandatory pension contribution as an exogenous financial shock, in the presence of other control variables. Apart from firm and year fixed effects, the author includes non-pension cash flows and funding status to control for the effect of unaccounted investment opportunities. The most pertinent feature in that model is that the relationship between funding status and capital expenditure does not exhibit the non-linearity that exists, by law, in the relationship between funding status and mandatory pension contributions. Therefore, all impact, if any, of variations in MPC on capital expenditure, would be deemed exogenous.

The identification strategy in Rauh (2006) treats mandatory contributions at the point of underfunding as threshold events required to identify causality between mandatory contributions (a proxy for financial constraint) and investments. Such a methodology in the generic regression framework however, cannot be deemed an exact application of the research discontinuity design (RDD). As Bakke and Whited (2012) put it, RDD has 'strong local validity but weak external validity' and therefore, offer sound conclusions for only observations that lie in close proximity to the threshold event.

Rauh (2006) finds capital expenditures decline with mandatory contributions to DB pension plans, especially for financially constrained firms. Bakke and Whited (2012) attribute the findings in Rauh (2006) to a set of severely underfunded plan sponsors with characteristics that are markedly different from the rest of the sample firms. Not surprisingly, Campbell et al. (2012) subsequently note a positive relationship between MPC and cost of debt for these cash-crunched firms. Such firms seek

external financing to avoid missing out on capital opportunities but simultaneously face the brunt of higher borrowing costs because the market traces the firm's borrowing stance to financial adversities. It is therefore, pertinent to effectively assess and manage DB pension risks in order to contain the possibility of frequent unexpected mandatory contributions, and to this end, sponsors can focus on three areas: funding strategy, investment strategy and risk management strategy (Bauer, Fletcher, Halfon, & Scapino, 2013).

ii. Funding Strategy

Designing an appropriate funding strategy for DB plans involves consideration of the plan's existing funded status, pension assets and liabilities, the financial health of the firm and the rules related to contributions and tax treatment that govern private DB plans.

Voluntary pension contributions can improve the funding status of pension sponsors, but Rauh (2006) observes sponsors generally tend to make only the required contribution. Many sponsors also resort to in-kind (non-cash) contributions due to several reasons such as preservation of cash and potential of the in-kind contribution for capital growth (Mangiero, 2013), reduction in funding deficits along with reduced earnings fluctuations and increased financial flexibility (Cohen & Levine, 2012). Of course, an added incentive to keep pension plans sufficiently overfunded is that such sponsors are not required to pay variable insurance premiums to the PBGC (Rauh, 2006).

Underfunding could also be a deliberate outcome while strategizing between pension contributions and other corporate activities. Bauer et al. (2013) trace the choice of allocating free funds toward corporate investments rather than pension plans to the assumption that such corporate investments could bolster the financial strength of the sponsor and enable it to meet future pension obligations better. This allocation of funds towards more optimal corporate activities implies that the pension plan will remain either underfunded or unfunded for some time (the authors call it 'inexpensive borrowing') but the same will enable the sponsor to 'grow out of the pension problem'. However, this

'inexpensive borrowing' from employees could have considerable repercussions once pension deficits become severe.

A severe pension underfunding naturally escalates the amount of mandatory pension contributions required of the sponsor. Borrowing to meet these required contributions is regarded by certain market factions (eg. Moody's) as a mutual interchange of debt with no credit impact (LaMonte, 2006). Campbell et al. (2012) suggest this assessment is more applicable in case of investment-grade pension sponsors since debt markets do incorporate these mandatory contributions while pricing debt issued by below investment-grade firms. In extreme circumstances, sponsor firms may also choose to freeze their DB pension plans to ease the stress on liquidity (Phan & Hegde, 2013b). In fact, in a related vein, Peterson (1994) observes firms with greater cash flow variability and costs of financial distress tend to sponsor a DC plan rather than a DB plan owing to the inherent flexibility of DC plans.

Different pension assumptions such as the assumed rate of return on pension assets, the discount rate for pension liabilities, and the salary inflation rate also offer significant leeway to sponsors while deciding on a suitable funding strategy. Bergstresser, Desai, and Rauh (2006) note the substantial incentives possible through manipulation of pension assumptions when a firm's earnings are highly sensitive to such assumptions and how these opportunistic mechanisms prove *convenient* during deteriorating operating earnings, impending acquisition activities, managerial option exercise activities or while determining pension plan asset allocations. This manipulative context has been observed by Amir and Benartzi (1998) who note the expected rate of return (ERR) on pension assets (an assumption based on 'prior experience and performance expectations' and used to smoothen the impact of pension expenses on the income statement) fails to explain future returns in the short-term as well as the long-term windows. In the context of UK sponsor firms, Li and Klumpes (2012) find firms subject to significant revisions in pension accounting regulations opportunistically increased the ERR on pension assets when they were closer to default on debt covenants, and used ERR and salary growth rate (SGR) jointly to manipulate the leverage appearing on their balance-sheets.

The assumed rate of return on pension assets becomes redundant in the computation of the MPC since the latter is determined as a non-linear function of the plan funded status. The impact of assumptions on MPC is mostly limited to the discount rate used to determine the ABO of the pension plan. Amir and Benartzi (1998) additionally find the percentage of equity investment demonstrates a positive relationship with the future returns earned on pension assets. This result is not surprising and reflects the amount of risk in the pension portfolio dictates the return on the portfolio which in turn determines the funded status of the plan and MPC. More risky investments would imply volatile asset returns (a volatile funded status) and therefore, volatile MPC.

Owadally (2003) proposes the *ideal* situation that does not favor prolonged surpluses and deficits irrespective of the conservative or optimistic estimates of pension accounting assumptions and in fact, argues plan surpluses hinder the sponsor's ability to negotiate when plan beneficiaries demand additional benefits.

In sum, the funding gap is impacted through voluntary pension contributions, modifications in employment and plan contracts, changes in the value of pension investments through market fluctuations and of pension obligations through interest rate movements (Bakke & Whited, 2012). The first two alternatives are a function of the sponsor characteristics. The ability to effect changes in actuarial assumptions is limited by legal mandates while the market fluctuations are beyond the sponsor's control. One way therefore, to influence or remedy the funding gap and subsequently, the scope for mandatory contributions lay in the choice of pension asset allocation.

iii. Investment Strategy and Risk Management

In the practical setting, pension sponsors have little room for flexibility in so far as pension liabilities are concerned, given the legal environment, labor market and/or industry practices. Friedman (1983) also observes that if basic pension liabilities are already fixed as part of corporate decision-making, then all reference to pension liabilities essentially refers to the underfunded obligations of the plan.

Consequently, all decisions pertaining to pension liabilities essentially reduce to decisions about the pension assets of the firm.

However, a coordinated approach to both the plan asset portfolio and the plan liability structure would be recommended for firms with underfunded plans. Sponsor firms could face increased pension contributions if the asset portfolio is managed independent of the present value of the pension obligations and of the change in these liabilities owing to interest rate fluctuations (Ryan & Fabozzi, 2002). Apart from increased contributions, such mismanagement can lead to worsening funding ratios and in extreme situations, plan freeze or termination and firm bankruptcy.

A balanced pension asset allocation of both equity and bonds is one way to mitigate the transfer of wealth accruing from corporate level investments to the pension fund, especially for highly levered and financially constrained firms (Alderson & Seitz, 2013). However, a high incidence of risky investments by pension funds is common despite the contrasting need for controlling cash flow volatility - possibly a manifestation of the different characteristics of plan sponsors operating at different points of the spectrum. In fact, the Milliman 2014 Pension Funding Study that focusses on the 100 U.S. public companies with the largest defined benefit pension plans assets (amounting to more than $1.3 trillion at the end of 2013) reveals that 2013 witnessed significant improvement in the funded status of plans with the highest equity allocation (Ehrhardt, Perry, & Wadia, 2014).[10] The authors attributed it to decreasing plan liabilities due to growing interest rates, and increasing plan asset values owing to a remarkable return on plan investments.

Apparently, an investment bias toward fixed income instruments deprives the sponsor of an opportunity to enhance pension fund income through equity investments but such a strategy can reduce the amount of wealth transfer from the sponsor to the pension fund. Such de-risking strategies seem especially unattractive to US companies given their ability to impact their earnings with the

[10] http://us.milliman.com/Solutions/Products/Corporate-Pension-Funding-Study/

expected rate of return on plan assets assumed while reporting net periodic pension expense on the income statement (Kimyagarov & Shivdasani, 2013).

As a function of plan-level characteristics, investment decisions primarily depend on the funded status and the maturity of pension obligations (Petersen, 1996). Evidence of a negative relationship between risky investments and shorter maturity pension obligations is documented in Petersen (1996) as well as Rauh (2009). There are firm-level characteristics that can influence the investment policy of DB sponsors such as financial strength/profitability, risk quotient, tax paying status of the sponsor.

Rauh (2009) examines risk-shifting versus risk-management strategies of DB plan sponsors in pension investments and finds that risk-management strategies are more common among financially constrained firms with a greater proximity to bankruptcy while risk-shifting strategies are mostly adopted by financially healthy sponsors with superior credit ratings. Risk-management becomes important to firms when challenged with mandatory contributions that can significantly strain their cash resources and cause them to lose favorable capital investment opportunities. Risk shifting, on the other hand, finds considerable motivation as outlined in prior studies: the PBGC put effect (Sharpe, 1976; Treynor, 1977), the scope for earnings manipulation (Bergstresser et al., 2006), increased pension benefit demands from employee unions, hedging risks of benefit increases arising from wage increases using equity investments (Lucas & Zeldes, 2006) among other reasons. The findings in Rauh (2009) are in line with the evidence in Petersen (1996) who argues that profitable firms can afford the volatility associated with risky investments. Therefore, sponsors that do not find a volatile pension portfolio and volatile pension contributions conducive to their operations generally opt for a low-risk pension portfolio.

On the other hand, Addoum, van Binsbergen, and Brandt (2010) exploit the kinks (exogenously regulated) in the mandatory contribution function to find that firms, when faced with mandatory contributions, tend to reallocate pension investments and take on more risk in a bid to increase the

chances of being above the kink points (effect stronger in case of the 20% rather than the 0% underfunding kink) - the authors call it ‘gambling for resurrection’.

An et al. (2013) take an integrated approach and examine several risk-taking hypotheses (risk-shifting, risk management, tax benefit, financial slack, accounting effect, risk synchronicity and labor union hypotheses) to determine risk-taking in corporate pension funds. Similar to Rauh (2009), they find risk management strategies generally rule the scene for sponsors with low funding levels and high default risks. But a non-linear relationship is observed between default risk and pension investment strategies with risk-shifting strategies dominating sponsors that are financially distressed or have the highest risk of bankruptcy. Another layer to pension risk-taking is that firms with superior corporate governance (external and internal) are more inclined to take risk (Phan & Hegde, 2013a).

If volatile contributions prompt a firm to rethink their investment and risk strategies it is rational to expect that such investment decisions could be deemed a precursor to volatility in MPC (or unexpected MPC).

iv. Market Reaction to DB Pension Funds

Franzoni and Marín (2006) offer empirical evidence of market overvaluation of acutely underfunded pension sponsors, and the subsequent low stock returns for up to five years once pension liabilities begin to adversely affect the sponsors’ earnings and cash flows (through amortization loss and contributions). They attribute this delayed market response to sponsor decisions on pension contributions, and amortization, accounting and fiscal provisions and more importantly, the institutional/legal (ERISA) environment that allows plan sponsors considerable time to bridge funding deficits. Further, these negative stock returns following the emergence of a severe pension deficit are more pronounced for financially constrained firms since liquidity shocks from mandatory pension contributions cause such firms to forego favorable investments, which in turn hurt shareholder interests (Franzoni, 2009).

Further, Picconi (2006) notes certain pension information, such as changes in pension parameters, though available in the 10-k disclosures of pension firms are progressively discounted by investors and analysts as their impact starts to manifest in the subsequent quarterly earnings of the firm. In addition, the study finds investors evaluate on-balance-sheet component of the funded status more accurately rather than the off-balance-sheet component and the PBO; the latter two elements therefore, can significantly predict up to five-year returns. The author suggests the complex nature of pension disclosures and the accompanying efforts and costs of interpreting such information as possible reasons for the lagged incorporation of otherwise readily available information in prices and forecasts.

The impact of pension underfunding on sponsors is also observed in the debt market. The decline in credit ratings owing to underfunded pension liabilities is greater than the possible upgrade in these ratings (engendered by excess pension assets) probably due to the restrictions and costs associated with accessing surplus pension assets (Carroll & Niehaus, 1998). The same study also finds that the effect of pension underfunding on credit ratings appears to be greater than that of leverage; the authors attribute it to the higher priority of pension debt over long-term debt (leverage) as a likely reason. Cardinale (2007) goes a step further to confirm unfunded pension obligations are reflected in credit spreads also, more strongly in case of high-yield bonds than investment-grade bonds. Similar to the asymmetric findings of Carroll and Niehaus (1998), the author finds the bond market reaction in terms of a higher credit spread is stronger for pension liabilities than for traditional long-term debt, and that pension overfunding does not narrow credit spreads as much as pension deficits tend to increase spreads. In a related context, Shaw (2008), while examining the possible impact of the Statement of Financial Accounting Standards No. 158[11] on cost of debt, concludes that the debt market discounts both balance sheet and footnote information in the pricing of new debt issuances

[11] SFAS 158, released in 2006, required firms sponsoring defined benefit pension and other postretirement plans to report the funded status (the fair value of their pension assets *less* the projected pension obligations) on their balance sheets. This shifted unrecognized pension information (prior gains or losses and prior service costs) from the footnote (disclosure required under SFAS 87) to the balance sheet.

and a positive association exists between the size of pension liabilities and yield spreads on such issues.

So far as mandatory pension contributions are concerned, they constitute a negative cash shock and push a firm toward external borrowings. As a consequence of market imperfections, these financially constrained firms that seek external financing are subject to a penalty in the form of an increased cost of capital (Campbell et al., 2012).

Market participants in fact, incorporate the economic significance of pension risk too. Jin et al. (2006) find empirical evidence that US capital markets incorporate the systematic risk of a firm's DB pension plan (measured via the betas of pension assets and pension liabilities) in the firm's equity betas despite the complicated nature of pension accounting and the off-balance sheet placement of certain pension accounting items. Likewise, a positive relationship has been observed between pension beta and debt ratings (McKillop & Pogue, 2009).

Given the unique characteristics of the corporate pension framework, shareholders of a sponsor firm are able to accommodate extra risk, if necessary, to handle an increase in pension obligations. However, creditors would then penalize such risky strategies with a greater cost of long-term debt. Lin et al. (2014) accordingly empirically documents a positive association between short-term debt and the size of pension obligations (ABO) and argues, on the lines of Jensen and Meckling (1976) and Myers (1977), an optimal level of short-term debt as a mechanism to attenuate agency costs of debt attributable to pension liabilities. Further supporting the findings in Campbell et al. (2012), the study documents a positive association of cost of debt with pension liabilities/ accumulated benefit obligations (ABO) - an indicator of the increased risk and agency problems pension liabilities could entail; and of cost of debt with volatility of pension assets – a signal that creditors rationally price the risk embedded in pension assets. Interestingly, the study does not find a significant relationship cost of debt with projected benefit obligations (PBO), another measure for pension liabilities, which the

authors attribute to the greater uncertainty associated with the estimation of PBO. There is a considerable scope for accounting manipulation in the estimation of PBO compared to none in case of ABO (Rauh, 2006).

It is to be noted that the stock market does not appear to immediately process changes in the magnitude of pension liabilities (PBO) as well as the long-term impact of such change on cash-flow and earnings of the firm (Picconi, 2006). On the other hand, Lin et al. (2014) find a positive relationship between corporate bond yield spreads and the size of the pension liabilities (ABO) (not with PBO). Whether this difference in reactions of the stock market and the debt market to the size of pension liabilities is traceable to the difference in the definition of pension liabilities in both the studies (ABO vs. PBO) or to the level of information efficiency of each market is not certain. It could be interesting to explore if changes in pension size could still continue to predict future returns in Picconi (2006) using the ABO definition. One would expect a less significant impact given that ABO is less vulnerable to choice of assumptions regarding compensation rate and other manipulations.

CHAPTER IV

HYPOTHESIS DEVELOPMENT

Mandatory pension contributions (MPC) of DB plans adversely affect sponsors, such that an increase in the mandatory contribution (cash outflow) reduces capital expenditures (Rauh, 2006). The same study also documents unexpected MPC to be a more significant and stronger factor than expected MPC in explaining the variations in capital expenditure under a pooled specification setting.

This study attempts to decompose this unexpected MPC (UMPC) into a favorable versus an unfavorable cash shock depending on whether the actual MPC is less or greater than the expected MPC. This helps to examine the response of firm investments to a more refined definition of the financial constraint. An unfavorable cash shock (actual greater than expected) suggests additional cash outflow which can adversely impact the capital investments of the firm. A favorable (actual less than expected) cash shock would imply an implicit cash inflow. This unexpected inflow could be used toward increasing the contribution to the plan in excess of the actual MPC or could be allocated to capital expenditures and other corporate activities, with a firm only making the actual MPC. Formally, the hypotheses are:

$H1a_0$: *All else constant, both components of UMPC exhibit the same impact on the sponsor's capital investments.*

$H1a_1$: *All else constant, each component of UMPC does not exhibit equal impact on the sponsor's capital investments.*

$H1a_2$: *All else constant, the unfavorable component (additional cash outflow) of UMPC exhibits a negative association with the sponsor's capital investments.*

$H1a_3$: *All else constant, the favorable component (implicit cash savings) of UMPC exhibits a non-negative association with the sponsor's capital investments.*

The inverse relationship of MPC with capital expenditure in Rauh (2006) is more dominant in financially constrained firms as evidenced by parameters such as credit ratings, dividend ratios, cash *less* debt ratios and if capital expenditures exceed cash flow. As aforesaid, Rauh (2006) also documents UMPC exercising an impact similar to that of MPC on capital investments, of course, with appropriate controls for funding status. Further, the positive relationship of cost of capital with MPC suggested in Campbell et al. (2012) as the underlying mechanism for the findings in Rauh (2006) also appears pronounced only for non-investment grade sponsor firms.

Against this backdrop that reinforces the role of financial constraints, it would be interesting to examine if the negative relationship of UMPC with investments persists or disappears when UMPC is broken down unto favorable (saving) and unfavorable (expense) shocks in the presence of financial constraints. Firstly, it is possible that UMPC, though a cash shock per definition, is not a significant influence on the investment expenditure of a financially unconstrained firm. Secondly, for a financially constrained firm, one would expect the negative relationship of investments to persist with unfavorable UMPC but disappear with favorable UMPC.

$H1b_0$: *All else constant, UMPC has the same effect on capital investments for both financially constrained and unconstrained firms.*

$H1b_1$: *All else constant, UMPC does not have the same effect on capital investments for both financially constrained and unconstrained firms.*

$H1b_2$: *All else constant, UMPC (unfavorable) has a negative effect on capital investments for financially constrained firms only.*

H1b$_{3:}$ *All else constant, UMPC (favorable) has a non-negative effect on capital investments for financially constrained firms only.*

Whether it is favorable or unfavorable UMPC in question, UMPC inherently is a direct contributor to the cash volatility of the pension sponsor and therefore, on the capital investments of the sponsor firm. Though Rauh (2006) finds the impact of MPC and of UMPC on capital expenditure to be similar, a major distinction between both variables is that MPC is a direct function of the plan funded status whereas UMPC is a direct consequence of the vulnerability of pension asset investments to market risk. UMPC may or may not engender greater MPC. It would be erroneous to expect sponsor firms facing a greater MPC to also experience a higher incidence of UMPC. It is therefore, necessary to understand the characteristics of firms with a greater exposure to UMPC and consequently, to greater cash flow volatility.

Before identifying the characteristics of sponsor firms with a greater incidence of UMPC, it is important to define the reasons that lead to UMPC. Apparently, a more aggressive asset allocation increases the market risk exposure of pension assets which in turn impacts the magnitude of MPC. The nature or direction of this impact is uncertain since market shifts could be either favorable or unfavorable. UMPC measures this uncertainty or, the vulnerability of pension assets to market volatility - greater the proportion of equity (and alternative) investments, greater the probability of unexpected MPC. Following Amir and Benartzi (1998), this study uses the percentage of equity investments in the pension asset portfolio as a proxy for risk. Accordingly,

H2a$_0$: *All else constant, there is no association between the probability of unexpected MPC and the risk profile of pension assets of the sponsor firm.*

H2a$_1$: *All else constant, there is a positive association between the probability of unexpected MPC and the risk profile of pension assets of the sponsor firm.*

The next pertinent issue is to identify sponsor firms that are more likely to face UMPC. If UMPC is traceable to the amount of risk in the pension asset portfolio, it is logical to conclude that sponsors opting for higher risk in their pension investments would face a greater probability of UMPC. Generally, the risk quotient in the pension investment policy of a sponsor firm is a function of both sponsor characteristics and plan characteristics – sponsors with weak funded status and credit ratings adopt the risk management approach whereas their counterparts with strong funded status and credit ratings opt for a risk shifting approach (Rauh, 2009). Apparently, as Petersen (1996) puts it, financially healthy sponsors can afford the risk that accompanies equity investments. A logical association is therefore, expected between the probability of UMPC and different sponsor characteristics and plan characteristics. Following Rauh (2009), sponsor characteristics shall include firm rating, firm size, probability of bankruptcy represented by Altman's Z-score, volatility of operating cash flows and cash flow to assets ratio. Plan characteristics and controls would include the size of pension assets relative to firm assets, pension liabilities relative to firm assets, firm employees and lagged investment return on the plan assets. Data for active employee coverage used in Rauh (2006) is not available in Compustat and therefore, this study uses the total employees of the firm for lack of a better proxy.

$H2b_0$: *All else constant, there is no association between the probability of UMPC and the plan characteristics of the sponsor firm.*

$H2b_1$: *All else constant, there is an association between the probability of UMPC and the plan characteristics of the sponsor firm.*

$H2c_0$: *All else constant, there is no association between the probability of UMPC and the characteristics of the sponsor firm.*

$H2c_1$: *All else constant, there is an association between the probability of UMPC and the characteristics of the sponsor firm.*

The above mentioned hypotheses would be further examined in the light of the two components of UMPC to understand whether the influence of sponsor and plan characteristics on the incidence of UMPC varies when favorable UMPC versus unfavorable UMPC are considered rather than total UMPC.

The previous hypotheses explored the reasons for UMPC as well as the sponsor and plan characteristics that could be associated with a higher incidence of UMPC. The next logical extension is to identify the influence of UMPC in possible directions.

Gujarathi et al. (2010) explain a significantly positive association between the assumed rate of return (the assumption used to compute pension expense in the income statement and is based on the return the corporate sponsor expects from the pension investment portfolio – a risky portfolio would be designated a higher rate of return) and the cost of debt for underfunded firms thus: a higher assumed rate needs to be justified using riskier investment portfolios (Bergstresser et al., 2006) which implies higher chances of pension deficits and therefore, higher cash flow volatility. This magnifies the probability of default on corporate debt which consequently increases the cost of debt. Interestingly, cost of debt is found to be weakly related with the actual rate of return (placed in the footnotes) which accurately quantifies the actual performance of the pension investments. The use of the assumed rate of return versus the actual rate is mainly to smoothen the impact of pension earnings on the income statement. Deviations between both the rates are taken into account through 'unrecognized gain or loss' based on the corridor approach that requires sponsors to amortize this unrecognized amount if it exceeds 10 percent of the greater of projected benefit obligation or the fair value of pension assets[12].

In light of Gujarathi et al. (2010), this study thus identifies UMPC as the bridge variable that connects cash flow volatility with cost of debt. Thus, this study seeks to empirically show UMPC connects the risk in pension investments to cash flow volatility and therefore, to the cost of debt of the sponsor

[12] Actuarial gains and losses arising from either changes in assumptions about the PBO or deviations in the actual return from the expected return on pension assets are reported in the statement of comprehensive income as other comprehensive income (OCI)(Spiceland, Sepe, & Nelson, 2011)

firm. A positive relationship between UMPC and cash flow volatility would imply the risk in pension investments translates into risk in the cash flow of the firm. Accordingly,

$H3a_0$: *All else constant, there is no association between UMPC and cash flow volatility of the sponsor firm.*

$H3a_1$: *All else constant, there is a positive association between UMPC and cash flow volatility of the sponsor firm.*

Additionally, this positive relationship is expected to be more dominant in case of financially constrained firms that do not have access to sufficient cash resources that could buffer cash shocks. Thus,

$H3a_2$: *All else constant, the positive association between UMPC and cash flow volatility of the sponsor firm is stronger in case of financially constrained firms than unconstrained firms.*

Any impact of UMPC on the cash flow volatility shall heighten the risk of default of the firm and it needs to be examined if this implies a higher incremental cost of debt to the plan sponsors. Campbell et al. (2012) confirm Rauh's findings that MPC is an investment constraint, but then trace the intervening mechanism to the firm's cost of capital by showing a positive relationship between MPC and cost of capital of the sponsor firm; the relationship is significant though, only for financially constrained firms. Their study treats MPC as a proxy for internal capital constraints, and uses the rationale that external funds raised to offset liquidity shocks from MPC would be costlier than internal resources owing to market frictions. Apparently, MPC is then expected to bear a positive association with cost of capital (and with costs of debt and equity each).

This study builds on Campbell et al. (2012) and hypothesizes that UMPC has a separate effect than the expected component on the incremental cost of debt measured through the yields on the first corporate bond issue of the sponsor in that year. The expected component of MPC should not constitute a surprise, and sponsor firms should be relatively prepared to fund this portion of the mandatory contribution. Specifically, this amount is not a financial constraint and firms should

logically not be driven to seek external financing to meet this expected expenditure. No incremental change in the cost of capital should therefore, be observed.

The unexpected component on the other hand, arises due to market movements and is aggravated by aggressive pension asset allocation. This unexpected component could imply either additional contributions (losses) or gains to the pension fund. While surprise gains fit well with shareholder interests, a prolonged incidence of UMPC in terms of additional contributions would not reflect well on the financial judgment and risk of the firm. This unexpected component, a reason for potential cash flow volatility, can lead to higher costs of debt. This study thus, seeks to show that the positive relation between mandatory contribution and cost of debt in Campbell et al. (2012) shall be stronger in case of the unexpected component than the expected component of MPC.

It needs to be noted that if expected MPC appears to have a significant relationship with the firm's cost of debt, it suggests that the debt market assumes that this expected amount could unfavorably impact the firm's risk. In other words, it reflects the assessment of the firm by the debt market in so far as the ability/preparedness of the firm to meet its expected obligations are concerned (Rauh, 2006).

$H3b_0$: *All else constant, both expected and unexpected MPC should bear a similar relationship with the cost of debt of the sponsor firm.*

$H3b_1$: *All else constant, unexpected MPC (UMPC) should bear a stronger relationship than the expected MPC with the cost of debt of the sponsor firm.*

There might be questions as to how the debt market quantifies UMPC. This could be through various channels including analyst forecasts that discount the impact of UMPC, or debt market investors, comprising mostly institutional investors, who are sophisticated enough to assess the risk that comes with UMPC. In fact, several sponsor firms actually report the expected pension contributions as part of their SEC filings. Additionally, if UMPC is positively associated with the

cash flow volatility of the firm but not with the cost of debt, this reflects upon the information efficiency of the debt market. It could be attributable to the complicated nature of pension accounting and the complex nature of pension information. In such a situation, the proxy used in this study could be a useful tool to measure the impact of risky pension investments on the cash flow of the sponsor firm.

Campbell et al. (2012) show MPC only has an effect on financially constrained firms, but not on those that have access to external debt markets. Drawing the inferences further, the effect of UMPC on capital investments also are expected to be aggravated in case of firms with greater external financing costs (i.e., firms with non-investment grade debt). As Petersen (1996) rationalizes, financially healthy firms can afford the risk of an aggressive pension investment policy. Consequently, they are expected to be better prepared to face the cash volatility that accompanies the incidence of UMPC and the debt market might not penalize such firms with a higher cost of debt. Accordingly, it can be hypothesized that:

$H3c_{0:}$ *All else constant, the (stronger) relationship of cost of debt with unexpected MPC than with expected MPC shall hold for both financially constrained and unconstrained sponsor firms.*

$H3c_{1:}$ *All else constant, the (stronger) relationship of cost of debt with unexpected MPC than with expected MPC shall be more pronounced for financially constrained than unconstrained sponsor firms.*

CHAPTER V

DATA AND METHODOLOGY

The main variable of interest in all the above hypotheses is the unexpected MPC (UMPC). The reason for this UMPC is a difference between mandatory contributions for year t as expected in year (t-1) and actual mandatory contributions in year t. A naïve approach would look at the difference between expected total contribution in year (t-1) and actual total contribution in year t instead of looking at the difference between actual and expected mandatory contributions. So, before delving further into expected and unexpected mandatory contributions, the implications of examining mandatory pension contributions versus total pension contributions need to be discussed. It would be worthwhile here to reiterate the arguments proposed in Rauh (2006) and Campbell et al. (2012) that mandatory contributions are an exogenous shock to the internal financial resources of a firm. This contribution is independent of the firm's growth opportunities and overall operating framework in the presence of appropriate control variables. The impact of this contribution (exogenous shock) are in addition to the control variables in Rauh (2006) which include Tobin's Q and internal cash flows of the firm as proxies for the profitability of investment opportunities of the firm; and firm and year fixed effects and most importantly, the funding status of the firm to account for variations in mandatory contributions that might correlate with the firm's investment opportunities. The presence of funding status is the key aspect that serves to purge the estimated mandatory contributions of endogeneity issues.

In contrast, the voluntary component of total contributions (that includes both mandatory and voluntary contributions) is correlated with several other variables including funding status, cash

flows, investment opportunities, financial health of the firm and so forth. Consequently, total contributions, an aggregate of mandatory, voluntary and noncash contributions, cannot be treated as an exogenous financial constraint. MPC therefore, is the right proxy to be used in the current empirical setting and therefore, this study considers the difference between total MPC and expected MPC (UMPC) rather than the difference between total contribution and expected contribution in any pension year.

IRS Form 5500 filings, available from the Department of Labor, contain information on plan level information of DB sponsors in the US. Rauh (2006) uses this source for the period from 1990 to 1998 for data regarding funding status and normal cost required to compute MPC. MPC is computed as the maximum of the minimum funding contribution (MFC) and the deficit reduction contribution (DRC). The MFC is the amount of contribution required of underfunded plan sponsors under ERISA and is computed as (normal cost + 10% of ERISA underfunding) where underfunding, in the context of ERISA, is defined as that portion of projected benefit obligations that neither are backed by pension plan assets nor will be covered by projected normal costs contributions. The DRC on the other hand, is the contribution aimed at severely underfunded DB plans. DRC, expressed as a percentage of firm funding, is defined as min [0.30, [0.30 - 0.25*(funding status – 0.35)]] for the period 1987-1994 and as min [0.30, [0.30 - 0.40*(funding status – 0.60)]] for 1995 and later. Initially, plan sponsors were required to reduce the underfunding over a 30-year period, but the Pension Protection Act (2006) now requires the funding deficit to be eliminated over a 7-year period.

A later study by Campbell et al. (2012), following Moody's estimate outlined in LaMonte (2006), proposes a new proxy for MPC using 10-k filings that are definitely more timely and user-friendly compared to the Form 5500 filings. This proxy is estimated thus: if the fair value of pension assets (FVPA) is less than the projected benefit obligation (PBO), then MPC is equal to [normal cost plus (ABO – FVPA)/30 scaled by total firm assets]; else if FVPA is equal or greater than PBO, then MPC

equals zero. ABO here refers to accumulated benefit obligations based on current salaries versus PBO that is based on future salaries.

Campbell et al. (2012) validates Moody's proxy by replicating the findings in Table II (1c and 2c) in Rauh (2006). In order for the sample to be consistent with firms that file Form 5500, Campbell et al. (2012) include only domestic firms that report a positive pension expense; the remaining mismatch in sample size being attributed to not being able to identify sponsor firms that have less than 200 employees and are not needed to file Form 5500 This study uses the following definition to arrive at MPC in year t:

$$MPC_t = \text{Service cost}_t + (ABO_{(t-1)} - FVPA_{(t-1)}) / (30(\text{if pre-2008}) \text{ or } 7(\text{if 2008 and after}))^{13}$$

The rationale for the slight modification in the formula is because MPC is a function of the current service cost and an amortized portion of the underfunding at the beginning of the plan year. The funding gap at the start of the plan year needs to be determined by the difference between lagged pension assets and liabilities rather than contemporaneous pension assets and liabilities. This slight modification is in line with Rauh (2006) where total pension assets are defined as the current value of pension assets at the beginning of the plan year in Form 5500 filings while total pension liabilities are the current liabilities (ABO) available from Schedule B of the Form 5500 filings.

It is expected that sponsor firms will have a fair estimate (at the beginning of year t-1) of the MPC required of them at the beginning of year t. Rauh (2006) develops a measure for expected mandatory contributions attributable to the firm's potential to exert a one-year influence on pension assets through contributions in the prior year and on pension liabilities through benefit accruals for the same period. Rauh (2006) expresses mandatory contribution thus:

$$\text{Mandatory Contribution}_{i,t,k} = M(y_{i,t,k})$$

[13] The amortization period was changed from thirty years to seven years under the Pension Protection Act of 2006.

where $y_{i,t,k}$ is a vector comprising pension assets($PA_{i,t,k}$), pension liabilities($PL_{i,t,k}$), normal cost($NC_{i,t,k}$), and funding credits($FC_{i,t,k}$) for plan k of firm i at time t.

Thereafter, following Rauh (2006), expected MPC is deducted from the actual MPC to arrive at unexpected mandatory contributions.

$$\text{Unexpected } MPC_{i,t,k} = \text{Actual } MPC_{i,t,k} - \text{Expected } MPC_{i,t,k}$$

$$= M(y_{i,t,k}) - M(E_{t-1}[y_{i,t,k}])$$

$$= M(PA_{i,t,k}, PL_{i,t,k}, NC_{i,t,k}, FC_{i,t,k}) - M(E_{t-1}[PA_{i,t,k}], E_{t-1}[PL_{i,t,k}], NC_{i,t,k}, FC_{i,t,k}) \quad (1)$$

In (1) above, normal cost (NC) and funding credit (FC) are generally known beforehand. The expected pension liabilities are computed as actual liabilities, with a correction for the change in the 30-year Treasury rate. The expected pension assets are determined by applying the expected rate of return $R^{e}_{i,t,k}$to lagged pension assets i.e,

$$E_{t-1}[PA_{i,t,k}] = (1 + R^{e}_{i,t,k})PA_{i,t-1,k} \quad (2)$$

To determine $R^{e}_{i,t,k}$, Rauh (2006) assumes that the firm invests in only large-cap corporate equity and intermediate-term government bonds such that for each plan,

$$R^{e}_{i,t,k} = \hat{s}_{i,t,k}[\overline{R}^{S}] + (1 - \hat{s}_{i,t,k})[\overline{R}^{B}] \quad (3)$$

where $\hat{s}_{i,t,k}$ is the implied share of the pension assets invested in stock while $\overline{R}^{S}$ is the large-cap corporate equity return averaged over 1926-1990 and $\overline{R}^{B}$is the intermediate-term government bond return averaged over the same period. Both averages are available from Ibbotson Associates (2003) time series database.

Rauh (2006) then uses each plan's actual returns[14] [$R_{i,t,k} = \text{Investment Income}_{i,t,k}/PA_{i,t-1,k}$] and the time series returns of the two investment possibilities from Ibbotson Associates (R_t^S for stock returns and R_t^B for bond returns) to approximate $\hat{s}_{i,t,k}$.

$$R_{i,t,k} = \hat{s}_{i,t,k} R_t^S + (1 - \hat{s}_{i,t,k}) R_t^B \quad (4)$$

The $\hat{s}_{i,t,k}$ computed from (4) is plugged back into equation (3) to arrive at $R_{i,t,k}^e$ which in turn is used to compute $E_{t-1}[PA_{i,t,k}]$ in equation (2).

The approach in this study shall follow Campbell et al. (2012) to arrive at MPC (and expected MPC); it then modifies Campbell et al. (2012) methods to decompose the MPC into expected and unexpected components using the methodology in Rauh (2006) described above. It is to be noted, in the context of pension variables, that this study uses firm-level data (directly available from Compustat) while Rauh (2006) uses plan-level data (from Form 5500 filings) aggregated to the firm-level. Further, to overcome the limitation of assuming a two-investment portfolio in (3), this study suggests an alternative methodology to estimate the expected fair value of pension assets - the use of actual asset allocation data at the beginning of each period available from Pensions & Investments (P&I) survey and from Compustat (10-K filings) in conjunction with standard indices to compute the returns on different asset classes[15] and directly arrive at the expected rate of return for that period. The expected fair value of pension assets at the end of year (t-1) would be a product of this expected rate of return and the fair value of pension assets as at the beginning of period (t-1) or end of period (t-2).

$$\text{Expected FVPA}_{(t-1)} = \text{Expected Rate of Return}_{(t-1)} * \text{FVPA}_{(t-2)}$$

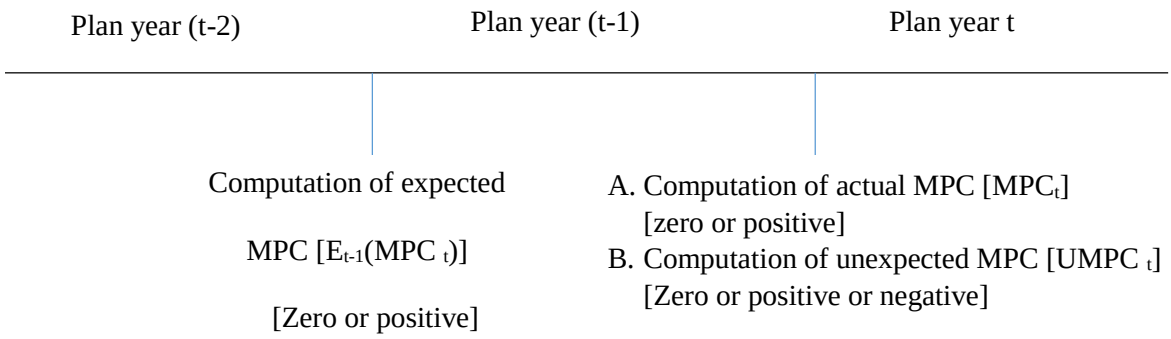
[14] The actual dollar returns for pension plans is reported by Compusat as Pension Plans Expected Return on Plan Assets (PPRPA) till 1997 and as Pension Actual Return on Plan Assets (PBARAT) from 1998 onward. The variable PPRPA is coded as negative in case of positive returns and as positive in case of negative returns. This needs to be taken into consideration in future studies.

[15] The *Others* asset category in both the Compustat and P&I sample are assumed to be invested in equity to arrive at the rate of return expected on pension assets for each pension sponsor. It should be noted that both the number of sponsors who report investment in this category and the magnitude of allocation in this category are not substantial relative to other categories.

Once the expected fair value of assets is computed, Moody's proxy will be modified to arrive at expected MPC:

$$\text{Expected MPC}_t = \text{Service cost}_t + (\text{Expected ABO}_{(t-1)} - \text{Expected FVPA}_{(t-1)})/\ 30(\text{if pre-2008}) \text{ or } 7(\text{if 2008 and after})$$

The following timeline illustrates the points at which MPC, expected MPC and UMPC are determined:



This study accesses multiple sources of data for the sample period from 1990 to 2010. Firm-level information for all firms with DB assets are obtained from the Compustat Fundamentals (annual) file while firm-level data on pension contributions (MPC) as well as funded status of DB plans are obtained from Compustat Pensions (annual)[16]. Data on new bond issues are gathered from the SDC Global New Issues Database. This study uses asset allocation data available in Compustat (from 2003) and from the Pension & Investments (P&I) survey data as well for validating the conclusions arrived at using the theoretical construct described above. The allocation data in P&I survey pertains to DB sponsors with the largest amount of pension assets in the economy and offers a finer classification (ten asset categories: Equity - Domestic and International, Debt- Domestic and

[16] It is not possible to distinguish between domestic and foreign pension liabilities using Compustat data and hence, the pension assets and liabilities data used in this study are inclusive of both. Of course, appropriate filters are used to retain only firms registered in the US in the sample.

International, Cash, Private Equity, Real Estate, Mortgage, Alternative Assets and Others) compared to that in Compustat (limited to four categories viz. Equity, Debt, Real Estate and Others). The firms on P&I survey data have been hand-matched with Compustat Annuals by company name and efforts have been made to trace all possible changes in names due to mergers and acquisitions to ensure the best match. The return indices used for each of the asset categories while computing unexpected MPC are specified in the appendix (Appendix II). The number of DB sponsors covered in P&I allocation data prior to 1997 is limited. Though this study attempts to use the P&I data from 1997 onward, the unexpected MPC variable yields a substantially low number of observations till 2000. Hence, most analyses in this study that employs P&I data would be confined to 2000 and onward.

The baseline specification for the investment-financial constraint modelling (hypotheses 1a and 1b) is borrowed from Rauh (2006) and modified to validate the proxies for MPC and UMPC used in this study. Model (A) incorporates the impact of the favorable and unfavorable components of UMPC on capital expenditures.

$$Capital\ Expenditure_{i,t} = Expected\ MPC_{i,t} + Unexpected\ MPC(Saving\ /\ Expense)_{i,t} + Tobin'sQ_{i,t-1} + Nonpension\ Cashflow_{i,t} + Plan\ Funded\ Status_{i,t-1} + Year\ Fixed\ effects + \varepsilon_{i,t} \quad \text{---------- (A)}$$

The baseline model is going to be augmented with squared and cubed powers of funded status as stringent controls for firm heterogeneity, financing cash flows and leverage to consider possible sources of funds that cannot be accounted for by nonpension cash flow, and a dummy for 2008 when the economic recession took place and important funding provisions of the Pension Protection Act of 2006 went into effect.

Theoretically, expected MPC should not bear a significant relationship with capital expenditure of the firm since it is an anticipated cash flow and sponsor firms would generally plan for

such expenditures. Rauh (2006) attributes the significance of this predicted MPC in his fixed effects specifications to the inappropriateness of the specification relative to the pooled specification. The latter contains the first three powers of the firm's funding status that not only account for the funding status per se but also serve to account for the heterogeneity across sponsor firms. Apparently, expected MPC is not significant in the latter framework. As an alternative rationale, Rauh (2006) adds that a significant relationship between expected MPC and investments could be a reflection of the sponsor's short-term investment planning horizon or a context where such contributions could not be predicted sufficiently ahead of time for financing to adjust accordingly. The latter situation would be aggravated in the presence of long-term constraints that cause capital investments to be increasingly reliant on internal funds of the firm. Given that the pooled specification is a stringent specification with aggressive controls, most of the models used to examine the relationship of unexpected MPC and capital investments would contain year fixed effects only.

Tobin's Q, a proxy for unobserved investment opportunities, as well as non-pension cash flow are expected to be positively associated with the capital investments of the firm. Non-pension cash flow constructed as net income *plus* depreciation and amortization *plus* pension expenses, takes care of the possible conceptual inadequacy of Tobin's Q and thus, controls for investment profit opportunities (Rauh, 2006). In other words, it absorbs shocks from asset performance in prior periods that could otherwise effect a relationship between investments and MPC in subsequent periods, especially for financially constrained firms. Further, any time-invariant factors that could impact the relationship between investments and MPC of the firm are accounted for by year fixed effects. The most important feature of this empirical specification however, is the presence of the funded status of the firm's pension plans. The expected positive relationship of funded status with capital expenditure is a function of the internal funds and the investment opportunities of the firm. Any impact of MPC on capital expenditure would therefore, be deemed an internal cash shock cleansed off any endogeneity problems.

Rauh (2006) also finds UMPC has a negative and significant coefficient with a magnitude similar to that of total MPC, endorsing that UMPC proxies MPC close enough to measure investment sensitivity to internal cash constraints of the firm. In the current framework, the decomposition of UMPC into favorable and unfavorable MPC yields a more refined version of this internal cash constraint, and consequently, the negative association should persist in the case of unfavorable UMPC only. The association in case of favorable UMPC (implicit cash inflow) should be non-negative since the sponsor firm could decide to continue with its expected pension payments or direct the cash savings to productive investments – in either case, no diversion of funds from capital investments to MPC takes place.

Following Rauh (2006) and Campbell et al. (2012), these specifications are further extended to include credit ratings and a cash constraint measure (based on how frequently capital investments exceed the cash flow of the firm) as an indicator of financial strength of the sponsor firm. This would help examine the relationship of each of the two components of UMPC with investments in the presence of financial constraints. The negative (non-negative) association between unfavorable (favorable) UMPC and cash investments should hold only for cash constrained firms; such relationships should not prove significant for unconstrained firms.

The next set of specifications attempt to trace the cause of UMPC and also identify the firm and plan characteristics associated with the incidence of UMPC (hypotheses 2a through 2c). The proportion of equity in the pension portfolio, a proxy for the riskiness of the pension portfolio, determines the incidence of UMPC and a positive relationship is therefore, expected between both variables. Further, Rauh (2009) examines pension fund asset allocation as a function of plan and sponsor characteristics. Since UMPC is a function of the risk quotient of the plan asset allocation, the empirical model in Rauh (2009) is modified to examine the plan characteristics associated with a greater probability of UMPC.

In probit specification (B) (that tests hypotheses 2a and 2b), pension assets (liabilities) are expected to be positively (negatively) related to the dependent variable following prior findings that firms with well-funded plans are more inclined to invest in equities while those with weakly funded plans tend toward risk-management strategies (Petersen, 1996; Rauh, 2009). The same studies also find that a greater proportion of active employees, indicative of a longer maturity of pension obligations, is a significant driver for greater risk-taking in pension investments. Since the data on active share of employees for each plan in not available in Compustat, the next best alternative is to consider total employees as a proxy for the former. Following Rauh (2009), all variables are lagged since UMPC, by construction, is a function of their lagged rather than contemporaneous impact. Year fixed effects are further incorporated in the model for all year specific characteristics that could impact the incidence of UMPC. A dummy for 2008 is introduced to account for the financial crisis of 2008 and the funding provisions of the Pension Protection Act, 2006, that went into effect from 2008 onward.

$$Probability\ of\ UMPC_{i,t} = \%\ Equity_{i,t-1} + Total\ employees_{i,t-1} + Pension\ Assets_{i,t-1} + Pension\ Liabilities_{i,t-1} + Plan\ investment\ return_{i,t-1} + Dummy_{2008} + Year\ Fixed\ Effects + \varepsilon_{i,t} \quad \text{---------- (B)}$$

Again, in line with Rauh (2009), probit specification (C) examines the characteristics of sponsor firms that could be associated with greater risk-taking in pension assets and therefore, with the recurrence of unexpected MPC (hypothesis 2c). For reasons discussed above, a financially healthy sponsor would be expected to take on more risk – a positive relationship is therefore, expected between cash flow to assets/ Z-score/ operating assets and the probability of UMPC. The numerical equivalent of S&P rating is such that AAA equals 1 (=22/22) and D equals 1/22; thus, this rating variable should bear a positive association with the probability of UMPC. With regard to the volatility of operating cash flow, it is possible that firms could choose to contain operating risk through safer pension investments and thereby, face a lower probability of UMPC. A negative relationship could thus, be

predicted between this cash flow risk and the incidence of UMPC. On the other hand, this variable could be representative of risky firms that are willing to take on risk in their pension allocation and could end up with a higher probability of UMPC.

$$Probability\ of\ UMPC_{i,t} = S\&P\ credit\ rating_{i,t} + Firm\ assets_{i,t-1} + Z-score_{i,t-1} + Cash\ flow\ volatility_{i,t-1} + Cash\ flow\ to\ assets\ ratio_{i,t-1} + Pension\ assets_{i,t-1} + Pension\ Liabilities_{i,t-1} + Dummy_{2008} + Year\ Fixed\ Effects + \varepsilon_{i,t} \quad \text{---------- (C)}$$

To examine the influence of sponsor and plan characteristics on the incidence of favorable versus unfavorable UMPC, the dependent variable in (B) and (C) will be modified accordingly.

Hypothesis (3a) that examines the relationship of UMPC with cash flow volatility is tested with specification (D) which is similar to the one employed in Gujarathi et al. (2010). The premise in Gujarathi et al. (2010) is that higher cash flow volatility will be followed by a higher stock return volatility and therefore, their study uses standard deviation of returns as a proxy for cash flow volatility in their specification. This study assesses the impact of UMPC directly on a five-year cash flow volatility to judge if UMPC poses a risk to the cash flows of the firm and therefore, to the debt holders of the firm. Sponsor firms with high levels of UMPC as well as higher levels of financial leverage/ earnings volatility/no rating experience a greater volatility in its cash flows. On the other hand, larger and more profitable firms are generally characterized by stable cash flows; hence a negative association would be expected between cash flow risk and total assets/ return on assets. S&P credit rating (numerical equivalent implies a high score for high rated firms and vice-versa) should bear a negative relationship with cash flow volatility since high-rated firms are exposed to less cash flow risk. A high book-to-market ratio could be representative of either a distressed or a value firm while a low ratio could imply a growth firm. It is difficult to predict the association between this ratio and the cash flow risk of the firm.

$$Cash\ flow\ volatility_{i,t} = \ UMPC(Saving/\ Expense)_{i,t} + Expected\ MPC_{i,t} +$$
$$Plan\ Funded\ Status_{i,t} + S\&P\ credit\ rating_{i,t} + Ln(Firm\ assets)_{i,t} + \ Leverage_{i,t} +$$
$$Return\ on\ Assets_{i,t} + Income\ Volatility_{i,t} + Book\ to\ market_{i,t} + Dummy_{2008} +$$
$$Firm\ Fixed\ Effects + Year\ Fixed\ Effects + \ \varepsilon_{i,t} \qquad \text{---------- (D)}$$

Finally, the association of unexpected MPC and cost of debt (hypothesis 3b and 3c) will be tested using the empirical design (specification (E)) proposed in Campbell et al. (2012). The positive association between MPC and cost of debt in Campbell et al. (2012) is evidence that MPC is a financial constraint that forces sponsor firms to seek outside financing that, in conjunction with market frictions, in turn cause an increase in the cost of borrowing of the firm. The decomposition of MPC allows the distinction of this financial constraint into an expected and unexpected component. The expected component could be a financial constraint for cash-crunched firms but the unexpected component by definition should prove to be the more persistent internal resource constraint. So, this study proposes that the positive relationship between UMPC and cost of debt is stronger than that between expected MPC and cost of debt.

Funded status is included in the model since it is closely related to the financial strength of the firm. Underfunded firms generally represent firms that are cash-constrained and therefore, unable to fully fund their pension plans. Owing to the risk attached with such firms, debt markets impose a penalty on such firms in terms of a higher cost of debt, thus implying a negative relationship between the funded firms and the cost of debt. Amongst firm-level characteristics, larger and more profitable firms would be considered less risky and therefore, subject to lower costs of borrowing. Accordingly, a negative relationship is predicted between cost of debt and market value of equity/ return on assets. Higher leverage/ stock return volatility would increase the risk of the sponsor firm and therefore, the cost of debt. As aforementioned, the relationship between book-to-market and the risk of the firm is difficult to predict.

The issue-level characteristics definitely affect the cost of debt. The yield spread should exhibit a positive association with the proceeds and maturity of the issue since larger issues imply greater default risk while longer-maturity means greater liquidity premium. Credit-rating, where one stands for an Aaa Moody-rated bond while twenty represents a Ca bond, is predicted to bear a positive association with borrowing costs. Further, owing to the priority accorded to senior-debt issues, the yield spread is expected to be lower for such issues. Following Campbell et al. (2012), the public debt indicator is incorporated in the model specification to distinguish between a typical public issue and a Rule 144a debt issue (equals zero if Rule 144a issue and one otherwise). This distinction is necessary since the market for Rule 144a debt issues is restricted to certain institutional investors and such issues are also subject to fewer regulations than a typical public issue. Lower liquidity, greater information asymmetry and less investor protection engender a higher yield spread for such issues. A negative relationship is subsequently predicted between cost of borrowing and the public debt indicator. Year-specific effects (that impact all firms in any particular year) and industry-specific effects (that affect variations in cost of debt of the firm typically over time) are included in the specification.

$$Cost\ of\ debt\ less\ treasury\ rate_{i,t} = Expected\ MPC_{i,t} + Unexpected\ MPC\ (Saving/Expense)_{i,t} + Plan\ funded\ status_{i,t} + Return\ on\ assets_{i,t} + Leverage_{i,t} + \text{Log}(Market\ value\ of\ equity)_{i,t} + Book\ to\ market\ equity_{i,t} + Stock\ return\ volatility_{i,t} + \text{Log}(Proceeds\ from\ debt\ issue)_{i,t} + \text{Log}(\#of\ years\ to\ maturity)_{i,t} + Credit\ rating_{i,t} + Senior\ debt\ indicator_{i,t} + Public\ debt\ indicator_{i,t} + Dummy_{2008} + Industry\ fixed\ effects + Year\ Fixed\ effects + \varepsilon_{i,t} \quad \text{---------- (E)}$$

The above empirical model would be re-estimated with a sample partition based on whether the firm issues investment-grade bonds or not (Campbell et al., 2012) to investigate the impact of financial constraints on the association between UMPC and cost of debt (hypothesis 3c).

CHAPTER VI

FINDINGS

Summary statistics for variables (relevant for hypotheses 1 and 2) are presented in Table 1. Unless specified otherwise, all variables are winsorized at the 1st and 99th percentiles of their distribution and scaled by lagged firm assets.

[INSERT TABLE 1]

The average capital expenditure is 5.7 percent of firm assets, with a range of 0.1% to 28.8% of firm assets for the sample firms. Non-pension cash flow, constructed as net income plus depreciation and amortization plus pension expense following Rauh (2006), has a mean and median of 9.5% and 9.2% of firm assets. Pension expense and depreciation and amortization are non-cash items on the income statement and therefore, added back to net income. Financing cash flow is representative of all cash flows related to financing activities and is available from Compustat. It is negative up to the 50^{th} percentile and only positive for firms in the 75^{th} percentile and upward. These negative financing cash flows cannot be deemed an indicator of a financially weak firm (unlike in the case of non-pension cash flows) since such negative cash flows could be attributable to sale or retirement of debt, payment of dividends, change in current debt etc.

Funded status, the difference between pension assets and accumulated pension obligations (does not assume potential salary increases), is averaged at 3.1% of firm assets with 50^{th} and 75^{th} percentile values at 0.7% and 4.2%. This suggests the sample is positively skewed toward well-funded firms. A

caveat to this is the definition of the funded status variable. If funded status is defined instead as the difference between pension assets and projected benefit obligations (assumes potential salary increases) as per ERISA requirements, the funded status of plan sponsors would worsen, thus, leading to greater MPC and consequently, a greater impact on capital expenditure and other financing variables. However, this study uses the ABO-based definition following Bodie (1990) and Rauh (2006). Bodie (1990) argues sponsor firms do not regard PBO as the target measure of benefits in their pension investment policies as evident from their tendency to invest more in equities rather than inflation-protected investment avenues. Equities are not exactly the apparent choice of investment for investors wanting to hedge against inflation risk.

The distribution of mandatory pension contribution (MPC) with a mean of 0.2 % of assets and a standard deviation of 0.4% is not very different from that in Rauh (2006) with a mean of 0.1% and a standard deviation of 0.3% of firm assets. It is to be noted that unexpected MPC using the methodology in Rauh (2006) (referred to as theoretical methodology from hereon), the actual data allocation in Pension & Investments (P&I) survey data and in 10-K Filings (available from Compustat) are distributed very similarly, despite the difference in time periods: 1991-2010 for the theoretical methodology, 2000-2010 for P&I allocation data and 2003-2010 for Compustat allocation data. Figure 1 presents the trend in the three types of unexpected MPC for the period 2003 to 2010 which is common to each of the three proxies. Unexpected MPC (theoretical) bears a high correlation (pairwise) of 96.36% and 95.89% with unexpected MPC constructed with P&I and Compustat data respectively. The correlation between unexpected MPC as per P&I data and as per the Compustat data is high at 99.46% as expected.

[INSERT FIGURE 1]

Similarly, the percentage invested in equity which are actual percentage allocations in case of the P&I and Compustat data but is a computed number in case of the theoretical methodology, follow a

similar distribution in all three cases. The variation is however, higher with the theoretical methodology. This could be due to the fact that certain equity allocation percentages in this set-up are less than negative one and greater than positive one in cases where the pension investment return of the bond and equity portfolio in any year falls outside the range of return on the bond and equity indices. This study does not exclude these allocation figures (outliers) in order to retain the variation in equity allocation dictated by the methodology. It does however, exclude lagged expected return on pension assets (106 firm-year observations from a sample of greater than 20,000 firm-year observations) that lie outside the range of positive and negative one.

The equity allocation data from P&I survey bears a correlation of 50.14% with that from Compustat which alleviates the concern to some extent that the asset allocation data from P&I survey pertains to September 30 of each year while the allocation data on Compustat pertains to fiscal year-end. The equity allocation figures according to the theoretical construct has a correlation of around 14.79 % and 9.26% respectively with that from Compustat allocation data and P&I allocation data.

The average age of firms in the sample is 29 years and most firms are rated BBB or BBB-on average. This suggests that the sample is slightly skewed towards higher-rated firms (each rating is scaled by 22 such that the numerical equivalent of AAA is one and of D is 1/22 or 0.045 at the limits while of BB at the middle of the spectrum is 0.5).

Table 2 contains results from columns 3 and 6 of Table V in Rauh (2006) and the corresponding results for the theoretical construct of unexpected MPC. The results in this table are intended to validate my theoretical proxy for unexpected MPC. It is to be noted that Rauh (2006), as a justification for the significance of predictable MPC in his study, comments that the fixed effects specification may not be a correct specification for a framework with expected and unexpected elements since these variables are 'averaged within firms' through time. Consequently, the impact of the expected and the unexpected components could get washed off. The pooled specification

containing the first three powers of the funded status is a more 'aggressive control' for funded status and therefore, for firm heterogeneity. Further, since MPC (and unexpected MPC) is proposed as an exogenous financial constraint in light of the distinctive non-linearity in the relationship between MPC (and unexpected MPC) and funded status (a feature absent in the relationship between funded status and capital investment), it would be more appropriate to require powers of the funded status in the model specifications. The fact that the theoretical proxy does not replicate the original fixed effect specification therefore, is not of major concern in this study. In the pooled setting, the coefficient for unexpected MPC is significantly negative as in Rauh (2006).

My study also augments the baseline model by introducing financing cash flows and leverage to further control for possible sources funds. There are several items in the sources and uses of funds framework that are not accounted for in non-pension cash flow since the latter mostly focusses on operating cash flows and not financing cash flows. In the augmented model, the coefficient for unexpected MPC is significant at 5% and expected or predictable MPC is not significant as observed in Rauh (2006). Given the pooled specification yields results as hypothesized and is more justified in the predictable and unexpected framework, all further analyses to examine the impact of unexpected MPC (and savings versus expenditure) on investments would be undertaken in the pooled specification setting. In Table 2 (pooled specification), funded status is negative but not significant; however at higher values of funded status (squared funded status), the negative impact on capital investments is magnified. The cubed funded status variable is positive and insignificant. Drawing on Rauh (2009) where funded status is deemed an indicator for the financial health of the sponsor, it would be fair to conclude that at lower values of funded status, there is a negative relationship between funded status and capital investments but at higher values, the rate of decrease in investments decreases significantly.

[INSERT TABLE 2]

Having validated the theoretical proxy for unexpected MPC, Table 3 (Panel A) now examines the impact of unexpected MPC on capital investments from 1991 to 2010. The coefficient for unexpected MPC is negative and significant at 5% for the entire period (Table 3, column 3) versus at 1% in the 1990-98 period for the baseline model (Table 2, column 4). In the augmented model, the explanatory power of unexpected MPC as an exogenous financial constraint is no longer significant (Table 3, column 6) relative to being significant at 5% in the 1991-98 period (Table 2, column 5).

In an effort to identify if there is a structural break in the explanatory power of unexpected MPC after the financial crisis, the baseline and the augmented models are re-examined for the 1991-2007 period. Results in Panel B of Table 3 indicate unexpected MPC continues to remain significant at 1% with a negative coefficient of 0.649 and at 5% with a coefficient of -0.469 for the baseline and augmented models respectively. Expected MPC is negative and significant at 10% in the basic model but insignificant in the augmented model for the same period.

[INSERT TABLE 3]

The fact that the negative impact of unexpected MPC does not hold after 2007 requires further deliberation. Figure 2 clearly confirms the drop in average investments around 2008-09 while Figure 3 displays the sharp movements (in opposite directions) of both capital investments and unexpected MPC around 2008-09. Figure 3 apparently implies a significant inverse relationship between both these variables. However, a lack of a significant relationship in the augmented specification for the 1991-2010 period in Panel A of Table 3 suggests the decrease in investments around 2008-09 is not induced by the spike in unexpected MPC and could in fact, be an overall shift in corporate spending policy given the economic recession. Campello, Graham, and Harvey (2010) in their survey of Chief Financial Officers (CFOs) across the US, Europe and Asia document 86% of the CFOs of financially constrained firms in the US reporting a cut-back in their capital investment projects owing to tightening credit conditions. Similarly, Duchin, Ozbas, and Sensoy (2010) finds the sub-prime crisis

of 2008 led to a decline in investments especially for financially constrained firms or firms with a significant dependence on external sources of finance. Thus, it appears there was a substantial cutback in capital investments around 2008 independent of the increase in unexpected MPC. It needs to be noted that rigorous funding provisions introduced by the Pension Protection Act of 2006 came into effect from 2008. The interplay of the financial crisis and attempts by firm to meet the revised funding regulations could also be responsible for the changed dynamics of the relationship between capital investments and unexpected MPC.

[INSERT FIGURE 2]

[INSERT FIGURE 3]

My first set of hypotheses (hypotheses $H1a_1$ through $H1a_3$) aims to examine the magnitude and direction of impact of both the components of unexpected MPC on capital investments. Table 4 reports the responses of capital expenditure to unexpected MPC when the latter is broken down into favorable UMPC (savings due to actual MPC being less than expected MPC) and unfavorable UMPC (expense or additional contributions due to actual MPC being more than expected MPC). If a negative cash shock leads to a decrease in capital expenditure, it makes an interesting question whether a positive cash shock arising due to a reduced actual MPC leads to a symmetric increase in capital expenditure. The 1991-98 period saw investments of sponsor firms exhibit a significant negative reaction (at 5% significance level) to unfavorable unexpected UMPC but not to favorable unexpected UMPC (Table 4, column 3). Additional contributions (expense) implies cash flow from the firm to the pension fund which leads to a cut-back on capital investments. However, reduced contributions (saving) implies less than expected cash flow from the firm to the pension fund and this does not appear to be an incentive for firms to increase the level of investments. A similar analysis for the 1991-2010 period reveals savings remain insignificant but expense also cannot explain variations in capital investments. The difference in the coefficients of savings and expense is

significant at 10% for the 1991-1998 period but not so for the 1991-2010 period. A significant negative relationship is observed between unfavorable cash shocks (expense) and capital investments in the early part of the sample period (1991-98) but not for the entire period (1991-2010), while no significant relationship is observed between favorable cash shocks (savings) and capital investments in either period, indicative of the asymmetric impact of savings and expense on capital investments.

[INSERT TABLE 4]

Table 5 reports the differential impact of unexpected MPC (and of savings and expense) on investments based on S&P credit ratings and on the amount of external financing required by firms depending on how frequently their capital expenditure exceeds their cash flow (hypotheses $H1b_1$ through $H1b_3$). The first criterion is a direct measure of financial constraint. For the latter criterion, as Rauh (2006) points out, firms that frequently face a shortfall of cash flow to meet their investment plans would need to resort to external finance more often and consequently, the capital investments of these firms should be more vulnerable to MPC (or unexpected MPC) or such shifts in internal funds. In Table 5, the first tercile for ratings (column 1) comprises firms with no ratings and could be representative of either financially sound firms with no need to access debt markets or financially weak firms that cannot afford the costs of accessing external financing. The non-investment grade firms as well as the investment-grade firms exhibit negative but not significant relationships with investments. On the other hand, the firms for which capital investments never exceed their cash flow or exceed for less than $1/3^{rd}$ of the years tend to have a positive relationship with capital investments. This is akin to overfunded firms exhibiting a positive relationship between MPC and investments in Rauh (2006). Firms that do not face cash shortfall very frequently could be suggestive of firms with easy access to cash (external financing) - cash sourced through external funds to meet additional contributions could incentivize greater capital expenditure as well. In fact, the impact of financing cash flows does monotonically increase from the least cash-crunch to the most cash-crunched. It is to be noted that the capital investments for the most cash-crunched firms respond negatively and in fact,

more strongly to expected MPC rather than to unexpected MPC. One could argue on similar lines as in Rauh (2006) that these contributions labelled as predictable are not actually predictable for these firms, or their planning horizon is not long enough to accommodate expected MPC.

[INSERT TABLE 5]

Table 6 repeats the analyses in Table 5 to examine the behavior of capital investments in response to the two components of unexpected MPC - saving and expense, in the sub-sample framework. No explanatory power is observed for the variables of interest in the rating sub-samples. In case of the cash-constraint sub-samples (based on how frequently capital expenditure exceeds the cash flow of the firm), expense leads to a significant reduction in capital expenditure of the most cash-constrained firms (whose capital expenditure exceeds cash flow for more than one-third of the firm-year observations). Apparently, these are the firms that are most vulnerable to a cash shock and should be more dependent on external financing. However, savings fail to exhibit a significant relationship with the capital investments for this same set of firms, thereby, confirming an asymmetric relationship in the response of capital expenditure to favorable (saving) and unfavorable (expense) unexpected MPC of the sponsor firm. Interestingly, expected MPC remains negative and significant at a 10% significance level for the most cash-constrained firms.

[INSERT TABLE 6]

In order to ensure the proxy for unexpected MPC constructed using the methodology in Rauh (2006), I report the sample statistics and the major regression analyses using the two proxies constructed using actual allocation data from P&I survey and from Compustat for the period 2003-10 (this period is common to all the three proxies). The sample is filtered to firms that are common to each of the three sources – theoretical construct, P&I survey (referred to as P&I sample hereon) and Compustat (referred to as Compustat sample hereon). The reason for filtering a common sample thus is that the

asset classification data in the P&I sample is the most comprehensive relative to that of the theoretical sample or the Compustat sample.

The summary statistics reported in Table 7 are indicative of the typical profile of the firms in this common sample or the P&I sample (versus the profile of the entire sample of firms in Table 1) – larger (mean firm assets of $40 billion in this sample versus $5 billion in the entire sample) and older (mean age of 46 years in this sample versus 20 years in the entire sample). The mean pension assets and liabilities in this sample are, as expected, much bigger than that in the entire sample. Interestingly, the mean funded status of these firms (0.023) is weaker than that of the entire sample (0.032). This could be because the effects of the financial crisis dominate this sample period of eight years in a more pronounced manner versus the original sample period of 20 years.

[INSERT TABLE 7]

In the regression specifications for this common sample, the coefficient for unexpected MPC using the theoretical methodology (-0.090) is almost the same as that of unexpected MPC using P&I survey data (-0.091) and is not very different from that of unexpected MPC using Compustat data (-0.255). The similarity in coefficient for the P&I sample and the theoretical sample implies the findings reported in Tables 2 through 6 using the theoretical construct are valid. Further, since all three proxies for unexpected MPC are negative but insignificant in this common sample, it allows us to infer the capital expenditures of these larger and older firms are more planned and not sensitive to negative cash shocks. Since larger and aged firms are generally representative of financially unconstrained firms, these findings are in line with Rauh (2006) who finds MPC is not a significant shock for the financially unconstrained firms.

[INSERT TABLE 8]

Table 9 similarly reports the impact of favorable and unfavorable components of unexpected MPC on investments for this common sample. The coefficients for unfavorable MPC is negative throughout,

as expected, and insignificant in each category except in the Compustat sample (significant at 10%). The lack of a strong significant relationship is not a surprise since this set of firms constitute DB sponsors with the largest pension plans and generally classify as large and old firms.

[INSERT TABLE 9]

If unexpected MPC is a stronger and more refined proxy of an exogenous financial constraint than MPC (and expected MPC) based on Rauh (2006) and the findings above, especially for the 1991-2007 period (Table 3 Panel B), it is pertinent to identify the firms and plans that are more vulnerable to these financial shocks. In line with hypotheses H2a and H2b, I now examine if the risk profile of pension assets and plan characteristics affect the incidence of unexpected MPC. In Table 10, the risk profile of pension assets is proxied using the percentage of equity allocation in the pension investment portfolio while plan characteristics include the amount of pension assets and pension liabilities (as a percentage of firm assets), the log of firm employees (the data for active employees is not available) and the investment return on plan assets.

The results in Table 10 do not offer evidence of a positive relationship as hypothesized between the probability of unexpected MPC and a greater allocation of pension assets to equity, at least for the theoretical sample and the P&I sample. The fact that the coefficient is instead negative (though not significant because of the use of one-tailed hypothesis test) in both these samples despite the difference in sample sizes and the sample periods is supportive of a negative relationship between equity investment and the probability of unexpected MPC. However, this negative relationship goes against the expected positive relationship between both variables – logically, a greater equity allocation implies greater vulnerability to market movements and therefore, a greater probability of unexpected MPC. The positive sign before equity allocation in the Compustat sample does conform to my hypothesized relationship but further analysis is needed to conform or reject the hypothesized relationship.

Further, in line with earlier literature, well-funded plans are expected to be more risky (greater equity allocation) in their investment policies (Rauh, 2009). This suggests an increase in pension assets (liabilities) should increase (lower) the probability of unexpected MPC. Each of pension assets and pension liabilities exhibit signs contrary to the hypothesized relationship but consistent with the relationship between equity allocation and probability of unexpected MPC. Though not significant in the directional hypothesis framework, an increase in pension assets (liabilities) tends to lower (increase) the probability of unexpected MPC.

The number of employees of the firm is an imperfect proxy for the number of active employees in the plan which has been found to have a positive relationship with the level of risk in pension investment strategy in prior studies. More active employees implies a greater duration of the pension obligations (Rauh, 2009). Despite being an inadequate representation of the number of plan participants, log of employees exhibits a positive sign as expected. Lagged investment returns, included in the specification as a control variable, seem to reduce the probability of unexpected MPC. The dummy, introduced to account for the effects of the 2008 financial crisis and the funding provisions under the Pension Protection Act, 2006, that came into effect in 2008, exhibits a positive relationship with the occurrence of unexpected cash shocks as well. This could be traced to the significant shocks in the equity market around the financial crisis.

[INSERT TABLE 10]

The negative relationship (albeit not significant under the one-tailed hypothesis test) observed between equity allocation and the incidence of unexpected MPC is puzzling. One could argue all three methodologies (the theoretical proxy, the P&I proxy and the Compustat proxy) use a long-run return on assets in the process of calculating expected pension assets and this levels out fluctuations in the MPCs. The alternative is to assume a short-term average to estimate the expected value of pension assets but such assumptions are firm-level choices and it is difficult to determine which

assumption would be the best. In fact, a more recent average could introduce further biases and thereby, induce greater unexpected MPC but this study chooses a long-term average that would reduce the scope for any bias.

The results in Table 11 assess the relationship between the incidence of unexpected MPC and the risk profile of pension assets in the light of decomposition of unexpected MPC into saving and expense. The dependent variables in the regression analyses in Table 11 are the probability of savings and expense (via reduced MPC and additional MPC respectively). The theoretical sample comprises the largest sample and contains both financially healthy and unhealthy firms over the period 1991-2010. The Compustat sample contains similar firms but over a shorter time-frame i.e., 2003-10 while the P&I sample firms are corporate DB plan sponsors with the largest pension assets analyzed over the 2001-10 period. It is interesting a greater percentage of equity investment reduces the probability of savings in all three samples (the relationship is insignificant owing to the one-tailed test). Risky allocation however, significantly increases the chances of additional contributions in only the theoretical sample. The response of probability of expense to equity allocation is positive but not significant in the Compustat sample. The positive (negative) relationship between the probability of greater expense (saving) and equity allocation is the reason why financially weak firms choose not to invest in equity – they might not be able to afford the additional contributions or chances of reduced savings resulting from aggressive allocation of pension assets.

The log of employees, though not the perfect proxy for active share of employees (Rauh, 2009), affects the sponsor's investment policy and therefore, the probability of unexpected MPC positively in most of the specifications. Plans with larger asset base (and therefore, relatively better-funded and more inclined toward a relatively riskier asset allocation) witness a strong (though not significant) reduction in the probability of added contributions in all the samples and the probability of savings in case of the Compustat sample. This could also be indicative of very well-funded plans with no legal requirement for MPC and a lesser scope for unexpected MPC (saving and expense) as well. Again,

plans with relatively greater pension obligations face increased chances of unexpected MPC (both savings and expense) for all the samples. One could reckon, with reference to the coefficients for both pension assets and pension liabilities, that well-funded plans are less exposed to unexpected MPC (both saving and expense). The lagged actual return on pension investments exhibits the expected sign and significantly impacts the incidence of unexpected MPC with an increase (decrease) in the probability of savings (expense).

[INSERT TABLE 11]

The relationship between firm characteristics and the probability of unexpected MPC, as posited in hypotheses H2c, is explored in Table 12. The hypothesized relationship predicted a positive association between financially healthy firms and the occurrence of unexpected MPC - this category of firms chooses riskier pension investments and therefore, should be more vulnerable to market volatility. However, I find a negative relationship (not significant because of the one-tailed hypothesis test) instead which implies firms with sound credit standing face a lesser incidence of unexpected MPC. This could be attributable to the fact that well-funded plans bear little or no MPC obligation and therefore, minimal scope for unexpected MPC or that their investment choices involve risk in the right direction. Equity investment is riskier than debt investment (or cash) but there is the question of choosing the right level and type of risk within the equity portfolio too.

[INSERT TABLE 12]

A further break-down of unexpected MPC into favorable and unfavorable components in Table 13 reveals highly rated firms are less prone (not significant in the one-tailed framework) to facing unexpected MPC, whether it be in the form of savings or additional expense (contributions). This could be, as aforesaid, indicative of very well-funded plan sponsors with no significant obligation to pay MPC (and therefore, no significant unexpected MPC). The alternative reason could be superior investment management styles of these high-rated firms that help them contain additional

contributions. However, this explanation would have held more appeal if these firms exhibited a positive relationship with the probability of savings.

[INSERT TABLE 13]

The evidence in Table 11 suggests greater equity allocation reduces the chances of savings but increases the chances of expense while Table 13 suggests high rating is associated with lesser chances of both savings and expense. Table 14 and Table 15 present all the firm and plan parameters in an integrated framework and further incorporate an interaction variable (Ratings * % Equity Allocation) to assess the joint impact of rating and equity allocation – do high-rated firms that opt for greater equity allocation face greater unexpected MPC?

In Table 14, the coefficients for rating remain strongly (though not significantly due to the one-sided nature of the hypothesis tested) negative especially for the P&I and the theoretical samples. Equity Allocation remains strongly negative only in case of the P&I sample suggesting equity investments does reduce the probability of unexpected MPC. Interestingly, the interaction variable is positive and significant in the P&I sample which suggests increase in equity allocation by high-rated firms increases the chances of unexpected MPC. This is in line with the hypothesized relationship – highly-rated firms should be more vulnerable to unexpected MPC since these firms tend to invest in riskier portfolios than financially weaker firms do. The negative relationship between equity allocation and the percentage of unexpected MPC remains puzzling though and therefore, it is pertinent to understand how the probability of saving and expense (rather than only unexpected MPC) responds to equity allocation under the full model specification.

[INSERT TABLE 14]

Table 15 examines the response of the probability of saving and of expense to rating, equity allocation and the interaction term of both, in an integrated framework that contains both firm and plan parameters. High-rated firms are less exposed to unexpected MPC (both saving and expense) in

most of the sample specifications. Equity allocation reduces the incidence of unexpected savings in both the theoretical and the P&I samples. However, it exhibits a significantly positive relationship with the probability of expense (at a 1% significance level) in the theoretical sample and a negative one (again not significant due the one-sided nature of the hypothesis tested) in the P&I sample. Again, the significant and positive coefficient of the interaction variable of rating and equity allocation, suggests high-rated firms that increase equity allocation has a positive relationship with the probability of both savings and expense in the P&I sample.

[INSERT TABLE 15]

To summarize, the probability of unexpected MPC is greater for plans with lesser equity allocation, less (more) pension assets (liabilities) and weaker firms (with low ratings). This goes against the positive relationship I had posited for each of equity allocation, funded status and firm ratings with the incidence of unexpected MPC. A further decomposition of unexpected MPC reveals the probability of saving (expense) significantly reduces (increases) with greater equity allocation which is partially in line with what I had expected (a positive association between percentage equity and probability of savings and expense). The probability of saving and expense are generally lower for firms with superior ratings, which could be reflective of the over-funded plans of these sponsors that are not legally required to pay mandatory contributions. The results in the integrated specification (most stringent) with both firm and plan parameters reveal that highly rated firms that increase equity allocation face a significant chance of unexpected MPC (increased probability of saving and expense in the P&I sample). The results are not very strong or consistent with the theoretical and Compustat samples. Since the P&I sample offers the most accurate asset classification data, there is reason to believe that the results for this sample would be deemed more sound compared to the theoretical or the Compustat sample.

As per the results above, the impact of unexpected MPC (additional contributions) is significant on the capital investments of the sponsor firm, especially for cash-crunched firms. I have also observed the probability of unexpected MPC is higher for low-rated firms as well. Given this background, it is pertinent to understand if the incidence of unexpected MPC translates into higher cash flow volatility for the plan sponsor, especially in case of financially constrained firms (Hypothesis 3a). If such an association is identified, it would be logical to assume that the debt market could potentially penalize the firm for the added risk accruing from unexpected MPC. In fact, Minton and Schrand (1999) document that cash flow volatility is positively associated with cost of external financing.

Interestingly, Table 16 documents a positive significant association with the cash flow volatility of the firm for the theoretical sample for the period 1991-2010. Further examination reveals expense (additional contribution) appears to significantly increase (at a 5% significance level) the fluctuations in the cash flow of the firm while savings does not.

[INSERT TABLE 16]

Table 17 contains results for the P&I sample for the 2000-2010 period and no significant impact of unexpected MPC or either of its components on cash flow volatility is observed for this sample. This insulation from cash shocks could be attributable to the very nature (larger and older) of the firms in these sample.

[INSERT TABLE 17]

In the Compustat sample for the 2003-2010 period, unexpected MPC (and expense) can significantly explain variations in the cash flow volatility of the firm. Unexpected savings does not seem to have any significant explanatory power in any of the model specifications.

[INSERT TABLE 18]

Table 19 contains the full model specification (with both saving and expense) for each sample but divided into sub-samples based on investment and non-investment grade S&P firm ratings. Expense (unexpected additional contributions) exerts a strong positive impact on cash flow volatility for both the non-investment and investment-grade firms for the theoretical sample at 5% significance level. Surprisingly, savings tend to reduce the cash flow fluctuations for the investment grade firms in the theoretical sample with a 10% significance level.

For the P&I firms (deemed to be generally financially healthy as apparent from the skew in the sample size: only 96 firms belong to the non-investment grade while 286 firms pertain to the investment grade), unexpected expense significantly increases the volatility of cash flows while unexpected savings serve to significantly attenuate the cash flow volatility for the non-investment category.

In the Compustat sample, the results are similar to the theoretical sample with unexpected expense significantly increasing the fluctuations in the cash flow of the DB sponsors in the non-investment category.

[INSERT TABLE 19]

The above results demonstrate unexpected MPC (expense) serves to increase the cash flow volatility of DB pension sponsors, especially for non-investment grade sponsors. It now remains to be seen if this volatility is penalized by the debt market in the form of an increased cost of debt. I hypothesize the positive relationship between MPC and cost of debt documented in earlier literature is stronger in case of unexpected MPC rather than expected MPC (Hypothesis 3b) and that this stronger relationship should be more pronounced in case of financially constrained firms (Hypothesis 3c). To investigate this hypothesis, I consider 2,509 bonds that have been issued between 1991 and 2010.

Table 20 contains the descriptive statistics for these 2,309 bonds in Panel A. The average spread for these bonds, the difference between the cost of debt and the corresponding treasury spread, is 188

basis points. The spread reported in Klock, Mansi, and Maxwell (2005) is 193 basis points for 1,877 bond issues for the 1990-2000, while in Campbell et al. (2012) is 161 basis points for 2,012 bonds for the period 1991-2007. The spread in this study is apparently higher than that in Campbell et al. (2012) owing to the increase in cost of borrowing during the financial crisis. The stark contrast in the spread variations between the investment-grade (0.142) and the non-investment grade (0.385) issues is apparent in Panel B and Panel C. The unexpected and expected MPC seem to follow a similar distribution in both Panel B and Panel C while the funded status is slightly stronger for the investment grade issues. It is to be noted that the non-investment grade issues comprise 23% of the total sample consistent with the average rating of Baa1 for the entire sample in Panel A.

[INSERT TABLE 20]

Table 21 investigates the relationship between unexpected MPC (and its favorable and unfavorable components) and cost of debt. Prior literature documents a positive relationship between MPC and cost of borrowing, suggestive of the mechanism underlying the negative relationship between MPC and investments – non-investment grade issuers choose to forego positive capital investments rather than access the debt market for expensive financing. In line with that finding, I expect to find a stronger relationship of cost of debt with unexpected MPC than with expected MPC since the former is a more refined proxy of a financial constraint. However, I find neither a significant nor a positive relationship between MPC and cost of debt in this study. More importantly, this negative relationship between both the variables persists (not significantly due to the one-sided hypothesis test) for both unexpected and expected MPC for non-investment grade firms in the theoretical sample. Further when unexpected MPC is decomposed into saving (reduced contributions implying a favorable cash shock) and expense (additional contributions implying an unfavorable cash shock), expense tends to have a strong negative relationship with borrowing costs. Further, unexpected MPC seems a stronger determinant of cost of debt than expected MPC is for the non-investment grade issues; however, the sign is opposite to what I had expected.

[INSERT TABLE 21]

Contrary to the hypothesized relationship, unexpected MPC has no significant impact on the cost of debt while expected MPC has a significant positive association with cost of debt for the non-investment grade issues. The latter relationship, though significant, does not appear logical. On the other hand, the finding that stands out in Table 22 is the significantly negative coefficient for saving for the non-investment grade bond issues in the P&I sample. This implies an increase in favorable unexpected MPC tends to reduce the cost of debt of the sponsor firm. Further, the association of unexpected MPC (saving) with cost of debt is stronger than that of expected MPC with cost of debt. This conforms to the relationship hypothesized in 3(c).

[INSERT TABLE 22]

The results in Table 23 for the Compustat sample are similar to that of the theoretical sample. Additional contribution (expense) appears to have a strong (though not significant) negative impact on the cost of debt for the non-investment grade bonds, and the relationship of cost of debt is stronger with unexpected MPC than with expected MPC. Though the direction of this relationship contradicts logic, the strength of the relationship is in line with my hypothesis that unexpected MPC, being a cash shock or a more refined proxy of a financial constraint, should have greater explanatory power than expected MPC.

[INSERT TABLE 23]

In the above analyses, most of the control variables, barring a few, appear to bear the expected signs. In the theoretical sample (Table 21), the log of years to maturity exhibits a negative (even if not significant) relationship with the yields for the non-investment grade and a significantly positive relationship with the yields for the investment grade issues. This is contrary to logic since a longer duration should be penalized with a higher cost of debt especially for below-investment grade bonds. Again, in the theoretical sample (Table 21, columns 2 and 3), the plan funded status, representative of

the firm's financial health, appears to have an inverse relationship (as expected) with the dependent variable in the entire sample. The dummy introduced to account for the financial crisis of 2008 and the funding provisions of the Pension Protection Act of 2006 seems to be positively related with borrowing costs for the entire sample in case of the theoretical construct (Table 21, column 1) and for the non-investment grade firms in the Compustat sample (Table 23, column 4 and 5). This positive relationship could be suggestive of the impact of the financial crisis characterized by increased information uncertainty and market volatility.

In order to confirm if the reverse causal directions suggested in Tables 21, 22 and 23 persist with the debt issue ratings by Moody's (instead of cost of debt), I carry out regression analyses for each sample again. LaMonte (2006) argue MPC should not result in increased cost of debt since funds simply flow from the firm to the pension fund. The findings in Campbell et al. (2012) also do not support a significant relationship between Moody's ratings and MPC. I examine if the absence of a significant relationship holds in case of unexpected MPC and expected MPC as well or whether the relationships are significant but with reversed signs. Tables 24 through 26 document the relationships of each of MPC, unexpected MPC (saving and expense) and expected MPC with Moody's rating for each of the three samples. The numerical equivalent of the rating variable is defined such that higher values of the dependent variable imply lower ratings and vice versa (Aaa equals 1 and Ca equals 20). In Campbell et al. (2012), the coefficient for MPC is negative and significant in the entire sample.

In the theoretical sample (Table 24), the coefficient for MPC is negative and insignificant. However, non-investment grade issues exhibit a strong negative relationship between unexpected MPC (and expense) with rating, suggesting unexpected cash shocks lead to better ratings. Therefore, the impact of saving and expense on rating are examined separately to mesh out a more precise (and conceptually correct) directional relationship. The negative relationship between unexpected MPC and rating persists between expense and rating as well (again, not significantly owing to the one-tailed nature of the hypothesis tested) – greater expense leads to enhanced ratings. A negative

relationship is observed for expected MPC as well for the non-investment grade bonds (column 4). Interestingly, the sign before funded status is negative as expected – a more funded plan is reflective of a financially healthier firm and therefore, calls for better ratings. The strong negative relationship between unexpected MPC (and expense) and rating, though contrary to logic, seems to suggest ratings do not account for MPC but do account for unexpected MPC, a proxy for cash shocks.

[INSERT TABLE 24]

Results for the P&I sample in Table 25 do not exhibit a significant relationship between MPC or unexpected MPC (and its components) and credit rating. This could be possibly because these firms are financially more robust and are less prone to unexpected MPCs unless of course, they opt for greater equity allocations (as observed in Tables 14 and 15).

[INSERT TABLE 25]

In the Compustat sample, the negative association between unexpected MPC and ratings holds in the entire sample but not for the sub-samples. Surprisingly, MPC also exhibits a negative relationship with Moody's rating while pension funded status which has been significant in the theoretical and the P&I samples is not significant in this sample.

[INSERT TABLE 26]

Overall, the results that unexpected MPC (or expense) leads to an improvement in ratings, even if not significantly owing to the one-sided nature of the hypotheses, are contrary to logic. The obvious question that follows is if Moody's ratings have started to consider the risk of MPC in the post-crisis/the Pension Protection Act, 2006 period.

CHAPTER VII

CONCLUSIONS

This study examines the relationship of pension asset allocation risk with capital investments, cash flow volatility and cost of debt of the firm. The effect of pension investment risk is captured through unexpected mandatory pension contribution (MPC) using three different proxies – one based on the methodology in Rauh (2006), the second based on actual asset allocation data available from Pension & Investments (P&I) survey data and the third using pension allocation data reported in 10-K filings available from Compustat. All three proxies follow the methodology proposed in Campbell et al. (2012) to construct a proxy for MPC using 10-K filings rather than Form 5500 filings. The former proves to be more user-friendly and timely relative to the Form 5500 filings available from the Department of Labor. I also decompose unexpected MPC into two components – favorable (saving owing to actual contribution being less than the expected) and unfavorable (expense owing to actual MPC being greater than expected MPC) to derive a more refined definition of a financial constraint in all my analyses.

First, I find unexpected MPC (or its components) bears no significant impact on capital investments for the 1991-2010 period in my augmented model specification. However, I do observe a significant negative relationship between unexpected MPC and capital investments for the 1991-2007 period at a 5% significance level that leads us to suspect a structural break in the pattern post-2008. I conjecture the decline in capital investments in 2008 and thereafter is more than what MPC (or unexpected MPC) could significantly explain. Interestingly though, sub-sample analyses for the 1991-2010

period based on a cash-constraint measure (how frequently capital expenditure of firms exceed their cash flows) indicate a significant negative relationship between investments and unexpected MPC (and expense) in case of the most cash-crunched firms. No significant relationship is however, observed in case of saving, implying an asymmetric pattern in the response of investments to saving and expense. To ensure the validity of these results that use the theoretical construct, I repeat the major analyses using firms from the P&I sample that are also present in the other two samples (theoretical and Compustat) as well. Albeit no significant relationships are observed, the analyses do serve to confirm the validity of the theoretical construct – the coefficients for the theoretical proxy is very similar to that of the P&I proxy. The reason for the absence of a significant negative relationship could be attributable to the older and larger nature of the firms in this common sample - such firms are expected to have more planned investments and thus, be less affected by unexpected cash shocks.

Second, contrary to what I expected, I find the percentage of equity allocation used to represent investment risk does not lead to a higher probability of unexpected MPC. However, the decomposition of unexpected MPC reveals that the percent of equity allocation bears a significant positive relationship with the incidence of additional unexpected contributions (expense) for the theoretical proxy and a negative relationship (not significant due to the one-sided nature of the hypothesis being tested) with the incidence of reduced contributions (implicit cash savings) for each of the three proxies. This could be a reason why weakly funded plans or firms with low ratings tend to keep away from equity investments. Similarly, I find firms with high ratings are less exposed to the probability of unexpected MPC (and of expense and saving as well) for each of the three proxies. However, in a comprehensive framework with both plan and firm parameters, I find high-rated firms (in the P&I sample) that tend to increase the percentage of equity allocation face a significantly greater probability of unexpected MPC, and of saving and expense as well. Since this result holds for the P&I proxy that builds on the most refined asset classification categories relative to the other two

proxies, it would be justified to infer that firms with superior ratings do face a higher risk of unexpected MPC when they increase the risk in their pension investment strategies.

Given unexpected MPC is a financial constraint to firms, and earlier studies that document a positive relationship of MPC and cost of debt, I propose a similar positive relationship of cost of debt with unexpected MPC. I posit the positive relationship between the two would be stronger than that between cost of debt and expected MPC and that this stronger nature of the relationship should persist mostly among the financially constrained firms. Before moving to explore this hypothesis, I attempt to identify a relationship of this unexpected cash shock with the cash flow volatility of the firm. My premise is that an association between this unexpected cash shock and cash flow volatility is what would be penalized by the lenders of the firm through a higher cost of borrowing. In line with my expectations, I find a positive relationship of cash flow fluctuations with unexpected MPC (and of expense) for the theoretical as well as the Compustat sample. The results in the P&I sample are not significant but are in the predicted direction for unexpected MPC as well as for saving and expense. Further sub-sample analyses suggest a significant positive relationship between expense and cash flow volatility for non-investment grade firms in case of all the three proxies.

Having documented the positive impact these unexpected pension cash obligations could have on the cash flow risk of the firm, I now examine if this translates into a higher cost of debt as well. I do not find support for a positive association between cost of debt and unexpected MPC (and expense) in both the theoretical as well as the Compustat samples for non-investment grade issues. The main finding that conforms to my expectations is the significant negative relationship observed for unexpected saving and cost of debt for the below-investment grade issues in the P&I sample – increase in favorable cash shocks (saving) leads to an decrease in the borrowing costs of the firm. Additional contribution (expense) exhibits a positive relationship with cost of debt for this P&I sample but the relationship is not significant. It is to be noted that this sample comprises 63 observations and it is possible the results are sensitive to the sample size. Overall, though most of the

main relationships are in conflicting directions, it is observed unexpected MPC (saving or expense) has a stronger impact than expected MPC for the non-investment grade issues.

As a robustness test, I carry out these cost of debt specifications with Moody's bond ratings (numerical equivalent defined such that high rating implies high risk and vice-versa). I again fail to find a positive relationship between rating and unexpected MPC (and expense) for non-investment grade issues in the theoretical sample and for the entire sample in the Compustat sample. Each of these relationships that suggest unfavorable cash shocks leads to better bond ratings contradicts my arguments. The negative relationship (albeit not significant due to the one-sided nature of the hypothesis being tested) of rating with MPC in the P&I as well the Compustat sample leads to an obvious question of whether there has been a change in the considerations of Moody's policy for bond ratings in the context of pension contributions.

My research therefore, has identified, by employing a more refined version of a financial constraint using the two components of unexpected MPC, an association of pension asset risk with capital investments and cash flow volatility of the firm. My attempt to identify a significant relationship of unexpected MPC with cost of debt or bond ratings needs to be validated further – one way could be to examine if unexpected MPC constructed using Form 5500 filings exhibits a relationship with cost of debt (bond ratings) similar to that documented in this study.

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APPENDICES

Appendix I: Data Definitions

Age	Number of years a firm is in Compustat
Altman's Z-score	(3.3*EBIT/Operating Assets)+(Sales/Operating Assets)+1.4*(Retained Earnings/Operating Assets)+1.2*(Net Operating Capital/Operating Assets)
Capital Expenditure	Capital investments of the firm
Book-to-market equity	Book value of equity divided by market value of equity
Cash flow to asset ratio	Non pension cash flow to firm assets
Cash flow volatility	Standard deviation of yearly cash flow for the preceding five years where cash flow = net income plus depreciation & amortization plus pension expense
Expected MPC	If lagged expected funded status is less than zero, expected MPC= service cost plus (lagged expected ABO less lagged expected FVPA)/30. For years 2008 and after, the funding gap is divided by 7 instead of 30. If lagged expected funded status is greater than equal to zero, expected MPC=0.
Financing cash flow	Cash paid or received for all transactions classified as financing activities (available in Compustat)
Firm assets	Total firm assets
Investment grade indicator	A dummy variable equal to one if the credit rating is Baa3 or higher
Leverage	Long-term debt of the firm
Mandatory Pension Contributions (MPC)	If lagged funded status is less than zero, MPC= service cost plus (lagged ABO less lagged FVPA)/30. For years 2008 and after, the funding gap is divided by 7 instead of 30. If lagged funded status is greater than equal to zero, MPC=0 [FVPA= fair value of pension assets, ABO= Accumulated Benefit Obligations, PBO= Projected Benefit Obligations]

Market Value of Equity	Shares outstanding times market price per share
Moody's Rating	The bond issue's rating from Moody's at the time of offering (available from SDC). Ratings range from Aaa (the most credit worthy) to Ca (the least credit worthy) and have been converted to its equivalent such that Aaa equals 1 and Ca equals 20
Non pension cash flow	Net Income plus depreciation & amortization plus pension expense, divided by lagged firm assets
Pension assets	Total pension assets of each plan, aggregated at the firm-level
Pension liabilities	Total pension liabilities(PBO) of each plan, aggregated at the firm-level
Number of years to debt maturity	Years remaining to maturity of the new bond issue
% Equity	% of pension assets invested in equity
Plan Funded Status (expected)	FVPA (expected) *less* ABO (expected)
Plan Investment Return	Lagged return on pension assets
Proceeds from debt issue	Total proceeds from the new bond issue
Public debt indicator	A dummy variable equal to one if the new bond issue is a publicly issue debt else equal to zero if it is a Rule 144a issue
Return on assets	Income before extraordinary items divided by lagged firm assets
Senior debt indicator	A dummy variable equal to one if the new bond issue is a senior bond issue else equal to zero
S&P credit rating	S&P issuer credit rating converted to its numerical equivalent thus: AAA equals 21 while D equals one
Stock return volatility	Standard deviation of monthly stock returns for twenty four months ending the last month of previous year
Spread or Cost of debt less treasury rate	Yield on the first bond issue in year t less yield on a corresponding Treasury instrument of similar maturity (as per the SDC *New Issues* Database, and then divided by 1000)
Tobin's Q	Market Value of Equity plus total assets less book value of common equity less deferred taxes, all divided by firm assets.
Total employees	Number of employees employed by the firm and its consolidated

	subsidiaries
Unexpected MPC (UMPC)	Actual MPC *less* Expected MPC
UMPC(savings)	If Expected MPC> Actual MPC, Savings = Expected MPC – Actual MPC
UMPC(expense)	If Expected MPC < Actual MPC, Expense = Actual MPC – Expected MPC
Volatility of earnings	Standard deviation of yearly net income for the preceding five years

Appendix II: Standard Indices used for each asset category to compute Expected Return on Pension Assets for the P&I and Compustat Sample Firms

1. Equity (Domestic) – Ibbotson Large-Cap Company Index Return
2. Equity (International) – MSCI World Ex-Us Equity Index Return
3. Bond (Domestic) – Ibbotson Long-Term Corporate Bond Index Return
4. Bond (International)- Citi Government Bond Index
5. Treasury Bill – Ibbotson Treasury Bills Rate
6. Real Estate – FTSE NAREIT US all-REITs Total Return
7. Mortgage – Barclays US MBS Index Return
8. Alternatives – Morningstar Diversified Alternatives Index Return
9. Others – Same as Equity(Domestic)

Table 1 Descriptive statistics for the period 1991-2010

Variables	Count	Mean	Standard Deviation	Percentile			Minimum	Maximum
				25th	50th	75th		
Capital Expenditure$_t$/ Assets$_{(t-1)}$	20157	0.057	0.051	0.023	0.044	0.076	0.001	0.288
Nonpension CashFlow$_t$ / Assets$_{(t-1)}$	20157	0.095	0.083	0.053	0.092	0.140	-0.206	0.346
Lagged Tobin's Q $_{(t-1)}$	20157	1.518	0.789	1.037	1.255	1.714	0.698	5.259
Financing Cashflow$_t$/ Assets$_{(t-1)}$	20157	-0.005	0.111	-0.057	-0.018	0.023	-0.261	0.543
Leverage$_t$ / Assets$_{(t-1)}$	20136	0.242	0.199	0.089	0.217	0.342	0.000	1.004
Funded Status$_{(t-1)}$/ Assets$_{(t-1)}$	20157	0.032	0.084	-0.004	0.007	0.042	-0.135	0.446
Age$_t$ (Years)	20064	29.025	16.234	14.000	29.000	43.000	4.000	60.000
Firm Assets$_t$ ($millions)	20157	5820.82	15151.88	301.38	1068.00	3852.60	14.69	111148.00
Pension Assets$_t$ ($millions)	20157	611.90	1701.52	15.34	73.90	330.70	0.17	11769.60
Projected Pension Liabilities$_t$ ($millions)	20157	686.41	1879.88	18.68	85.65	380.03	0.39	12845.00
Accumulated Pension Liabilities$_t$ ($millions)	20157	477.69	1504.35	0.00	25.94	199.27	0.00	10558.00
Mandatory Pension Contribution$_t$ (MPC)/ Assets$_{(t-1)}$	20157	0.002	0.004	0.000	0.000	0.002	0.000	0.020
Unexpected MPC$_t$ (Rauh Methodology) / Assets$_{(t-1)}$	16208	0.001	0.004	0.000	0.000	0.000	-0.016	0.017
Unexpected MPC$_t$(P&I data)*/ Assets$_{(t-1)}$	2099	0.001	0.006	0.000	0.000	0.001	-0.022	0.022
Unexpected MPC$_t$ (10-k filings-Compustat)**/ Assets$_{(t-1)}$	5899	0.001	0.006	0.000	0.000	0.002	-0.026	0.024
Equity Allocation$_{(t-1)}$(Rauh Methodology)	16208	0.677	1.720	0.248	0.589	0.882	-6.856	10.467
Equity Allocation$_{(t-1)}$(P&I Data)*	1969	0.595	0.164	0.559	0.630	0.690	0.000	0.848
Equity Allocation$_{(t-1)}$(10-k filings-Compustat)**	5972	0.596	0.157	0.540	0.620	0.690	0.000	0.960
Rating$_t$	10096	0.629	0.157	0.500	0.636	0.773	0.045	1.000

All variable definitions are provided in Appendix I

* Pertains to period 2000-10 and ** pertains to period 2003-10

Table 2 Validation of the proxy for Unexpected MPC using Moody's definition and Rauh (2006)

Model: $Capital\ Expenditure_{i,t} = Unexpected\ MPC_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

	Fixed Effect Specification		Pooled Specification		
VARIABLES	**Rauh (2006) - Table V Col (3) (1990-98)**	**Moody's version (1991-1998)**	**Rauh (2006) - Table V Col(6) (1990-98)**	**Moody's version (1991-1998)**	**Moody's version (1991-1998)**
Unexpected MPC (Theoretical)	-0.665**	-0.033	-0.863**	-0.995***	-0.659**
	(0.315)	(0.285)	(0.428)	(0.335)	(0.319)
Expected MPC (Theoretical)	-0.779**	0.072	-0.593	-0.917**	-0.565
	(0.381)	(0.311)	(0.518)	(0.389)	(0.376)
Nonpension cash flow	0.111***	0.125***	0.244**	0.241***	0.254***
	(0.012)	(0.012)	(0.015)	(0.016)	(0.015)
Lagged Tobin's Q	0.019***	0.018***	0.001	0.000	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Lagged funded status		0.035		-0.059	-0.007
		(0.030)		(0.036)	(0.034)
Lagged funded status^2				-0.249**	-0.289**
				(0.101)	(0.126)
Lagged funded status^3				0.592	0.422
				(0.552)	(0.543)
Financing cash flow					0.121***
					(0.011)
Leverage					0.021***
					(0.006)
Constant		-0.018		0.023***	0.017**
		(0.027)		(0.007)	(0.008)
Observations	8,030	6,682	8,030	6,682	6,680
Number of groups	1,522	1,438			
Year FE	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	No	No	No

Rauh (2006)uses Form 5500 filings to compute an estimate of MPC while Campbell et al. (2012) uses Form 10-k filings (available from Compustat) to construct Moody's proxy for MPC (LaMonte, 2006). Columns I and III report the original coefficients and standard errors as in Rauh (2006). This study follows Campbell et al. (2012) in construction of the MPC variable with a slight modification for the period 1991-2010. The unexpected MPC variable is constructed using Rauh (2006) and Campbell et al. (2012). *, ** and *** represent significance at 1%, 5% and 10% levels respectively. As indicated, the regression models (columns 1 and 2) are estimated with firm and year fixed effects while the models in columns 3, 4 and 5 contain year fixed effects only. Heteroskedasticity-robust standard errors are reported in parentheses. All variables are defined in Appendix A

Table 3 Regression Analysis of Capital expenditure on Unexpected and Expected MPC

Model: $Capital\ Expenditure_{i,t} = Unexpected\ MPC_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{it}$

	Predict	Panel A (1991-2010)					
Capital Expenditure		**Basic Model**			**Augmented Model**		
Unexpected MPC (Theoretical)	(-)	-0.170**		-0.364**	-0.102		-0.232
		(-1.931)		(-1.739)	(-1.157)		(-1.145)
Expected MPC (Theoretical)	(-)		-0.052	-0.313		-0.044	-0.211
			(-0.426)	(-1.269)		(-0.379)	(-0.893)
Nonpension cash flow	(+)	0.244***	0.244***	0.245***	0.256***	0.256***	0.257***
		(16.962)	(16.836)	(16.677)	(18.585)	(18.453)	(18.231)
Lagged Tobin's Q	(+)	-0.003	-0.003	-0.003	-0.001	-0.001	-0.001
		(-2.018)	(-2.017)	(-2.002)	(-1.001)	(-0.998)	(-0.988)
Lagged funded status	(+)	-0.016	-0.013	-0.028	0.000	0.001	-0.008
		(-1.261)	(-1.059)	(-1.580)	(0.011)	(0.093)	(-0.473)
Lagged funded status^2	(-)	-0.262***	-0.266***	-0.218***	-0.272***	-0.273***	-0.242***
		(-5.499)	(-5.694)	(-4.996)	(-4.915)	(-5.040)	(-4.397)
Lagged funded status^3	(?)	0.530***	0.529***	0.488***	0.517***	0.515***	0.489***
		(4.095)	(4.168)	(4.227)	(3.875)	(3.937)	(3.952)
Financing cash flow	(+)				0.098***	0.098***	0.098***
					(12.957)	(12.981)	(13.001)
Leverage	(+)				0.026***	0.026***	0.026***
					(6.636)	(6.647)	(6.657)
Dummy for 2008	(-)	-0.006	-0.005	-0.005	-0.004	-0.003	-0.003
		(-0.906)	(-0.736)	(-0.705)	(-0.477)	(-0.366)	(-0.350)
Constant		0.026***	0.026***	0.026***	0.016**	0.016**	0.016**
		(3.712)	(3.745)	(3.708)	(2.212)	(2.217)	(2.209)
Observations		16,208	16,208	16,208	16,190	16,190	16,190
Year FE		Yes	Yes	Yes	Yes	Yes	Yes

Robust t-statistics are in parentheses and standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 3 (continued)

	Predict	Panel B (1991-2007)	
Capital Expenditure		**Basic Model**	**Augmented Model**
Unexpected MPC (Theoretical)	(-)	-0.649***	-0.469**
		(-2.759)	(-2.055)
Expected MPC (Theoretical)	(-)	-0.512**	-0.331
		(-1.727)	(-1.175)
Nonpension cash flow	(+)	0.253***	0.267***
		(16.033)	(17.688)
Lagged Tobin's Q	(+)	-0.002	-0.001
		(-1.656)	(-0.803)
Lagged funded status	(+)	-0.034	-0.010
		(-1.786)	(-0.543)
Lagged funded status^2	(-)	-0.223***	-0.272***
		(-4.063)	(-3.987)
Lagged funded status^3	(?)	0.539***	0.576***
		(4.200)	(4.108)
Financing cash flow	(+)		0.098***
			(12.346)
Leverage	(+)		0.024***
			(5.540)
Constant		0.025***	0.017**
		(3.549)	(2.236)
Observations		13,370	13,360
Year FE		Yes	Yes

Robust t-statistics are in parentheses and standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 4 Regression Analysis of Capital Expenditure on Unexpected (Saving & Expense) and Expected MPC

Model: $Capital\ Expenditure_{i,t} = Unexpected\ MPC(Saving\ /Expense)_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

		(1)	(2)	(3)	(4)	(5)	(6)
Capital Expenditure	**Predict**		**1991-98**			**1991-2010**	
Unexpected MPC - Saving (Theoretical)	(?)	0.513		0.642	0.037		0.095
		(1.126)		(1.362)	(0.127)		(0.308)
Unexpected MPC- Expense(Theoretical)	(-)		-0.612**	-0.666**		-0.259	-0.265
			(-1.788)	(-1.893)		(-1.258)	(-1.245)
Expected MPC (Theoretical)	(-)	-0.374	-0.238	-0.558*	-0.062	-0.107	-0.154
		(-1.121)	(-0.886)	(-1.448)	(-0.299)	(-0.709)	(-0.609)
Non-pension cash flow	(+)	0.253***	0.253***	0.254***	0.256***	0.257***	0.257***
		(16.634)	(16.640)	(16.632)	(18.454)	(18.213)	(18.207)
Lagged Tobin's Q	(+)	0.002	0.002	0.002	-0.001	-0.001	-0.001
		(0.912)	(0.915)	(0.915)	(-0.998)	(-0.990)	(-0.989)
Lagged funded status	(+)	0.013	0.002	-0.007	0.001	-0.007	-0.008
		(0.450)	(0.074)	(-0.195)	(0.066)	(-0.450)	(-0.474)
Lagged funded status^2	(-)	-0.329***	-0.314***	-0.289**	-0.272***	-0.245***	-0.242***
		(-2.684)	(-2.645)	(-2.297)	(-4.974)	(-4.645)	(-4.420)
Lagged funded status^3	(?)	0.348	0.404	0.423	0.514***	0.491***	0.489***
		(0.644)	(0.760)	(0.779)	(3.941)	(3.973)	(3.964)
Financing cash flow	(+)	0.121***	0.121***	0.121***	0.098***	0.098***	0.098***
		(11.347)	(11.349)	(11.341)	(12.979)	(13.010)	(13.007)
Leverage	(+)	0.022***	0.021***	0.021***	0.026***	0.026***	0.026***
		(3.629)	(3.582)	(3.567)	(6.648)	(6.661)	(6.662)
Dummy for 2008	(-)				-0.003	-0.002	-0.002
					(-0.371)	(-0.311)	(-0.324)
Constant		0.016**	0.017**	0.017**	0.016**	0.016**	0.016**
		(2.116)	(2.169)	(2.156)	(2.216)	(2.218)	(2.215)
Observations		6,680	6,680	6,680	16,190	16,190	16,190
Year FE		Yes	Yes	Yes	Yes	Yes	Yes
F-stat(Savings & Expense)				**3.84***			**0.67**

Robust t-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 5 Sub-sample Regression Analysis of Capital Expenditure on Unexpected and Expected MPC for 1991-2010

Model: $Capital\ Expenditure_{i,t} = Unexpected\ MPC_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

		Rating			Capital investment minus Cash flow>0		
Capital Expenditure	**Predict**	**No rating**	**Non-investment grade(BB+ to D)**	**Investment grade (BBB- & above)**	**Never**	**Less than 1/3rd of years**	**Greater than 1/3rd of years**
Unexpected MPC (Theoretical)	(-)	-0.133	-0.458	-0.235	0.193	0.488	-0.974**
		(-0.475)	(-1.006)	(-1.076)	(0.942)	(1.773)	(-1.988)
Expected MPC (Theoretical)	(-)	-0.138	-0.654	-0.175	0.325	0.593	-1.370**
		(-0.449)	(-1.199)	(-0.703)	(1.429)	(1.918)	(-2.294)
Non-pension cash flow	(+)	0.231***	0.189***	0.272***	0.311***	0.275***	0.334***
		(13.544)	(6.902)	(17.352)	(17.079)	(15.235)	(15.022)
Lagged Tobin's Q	(+)	0.002	0.006*	-0.002	-0.004	0.003*	0.011***
		(1.205)	(1.404)	(-1.417)	(-3.237)	(1.526)	(3.854)
Lagged funded status	(+)	-0.007	-0.056	-0.001	0.039**	0.061***	-0.017
		(-0.281)	(-1.625)	(-0.040)	(2.108)	(2.878)	(-0.434)
Lagged funded status^2	(-)	-0.264***	-0.199***	-0.279***	-0.157**	-0.252***	-0.485***
		(-3.270)	(-2.684)	(-4.015)	(-1.824)	(-3.294)	(-2.992)
Lagged funded status^3	(?)	0.446**	0.886***	0.492***	0.154	0.116	1.073***
		(2.526)	(3.255)	(3.386)	(0.871)	(0.805)	(2.868)
Financing cash flow	(+)	0.110***	0.102***	0.098***	0.024***	0.064***	0.170***
		(10.989)	(6.618)	(11.579)	(3.627)	(6.953)	(12.081)
Leverage	(+)	0.025***	-0.007	0.038***	0.016***	0.013***	0.008
		(4.348)	(-0.796)	(7.222)	(3.357)	(2.492)	(1.109)
Dummy for 2008	(-)	0.017	-0.014***	0.013	-0.021***	0.004	0.001
		(5.120)	(-3.189)	(1.676)	(-9.276)	(0.519)	(0.291)
Constant		-0.006*	0.037***	-0.001	0.019***	0.003	0.025***
		(-1.851)	(6.656)	(-0.177)	(7.432)	(0.372)	(5.927)
Observations		7,652	2,724	13,466	4,476	6,086	4,628
Year FE		Yes	Yes	Yes	Yes	Yes	Yes

Robust t-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 6 Sub-Sample Regression Analysis of Capital Expenditure on Unexpected (Saving & Expense) and Expected MPC

Model: $Capital\ Expenditure_{i,t} = Unexpected\ MPC(Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

		Rating (1991-2010)			(Capital investment *minus* Cash)>0 (1991-2010)		
Capital Expenditure	**Predict**	**No rating**	**Non-investment grade(BB+ to D)**	**Investment grade (BBB- & above)**	**Never**	**Less than 1/3rd of years**	**Greater than 1/3rd of years**
Unexpected MPC - Saving	(?)	-0.078	0.435	0.073	0.242	-0.226	0.237
(Theoretical)		(-0.185)	(0.547)	(0.229)	(0.642)	(-0.618)	(0.263)
Unexpected MPC – Expense	(-)	-0.189	-0.464	-0.272	0.271	0.430	-1.176**
(Theoretical)		(-0.628)	(-1.053)	(-1.170)	(1.286)	(1.641)	(-2.304)
Expected MPC (Theoretical)	(-)	-0.055	-0.646	-0.105	0.119	0.427	-1.111*
		(-0.169)	(-1.033)	(-0.406)	(0.427)	(1.489)	(-1.612)
Non-pension cash flow	(+)	0.231***	0.189***	0.272***	0.310***	0.266***	0.334***
		(13.536)	(6.886)	(17.339)	(17.032)	(15.486)	(15.027)
Lagged Tobin's Q	(+)	0.002	0.006*	-0.002	-0.004	0.001	0.011***
		(1.204)	(1.404)	(-1.420)	(-3.209)	(0.737)	(3.833)
Lagged Funded status	(+)	-0.007	-0.056	-0.001	0.040**	0.045***	-0.019
		(-0.284)	(-1.636)	(-0.037)	(2.137)	(2.406)	(-0.471)
Lagged Funded status^2	(-)	-0.264***	-0.198***	-0.279***	-0.163**	-0.238***	-0.481***
		(-3.294)	(-2.724)	(-4.040)	(-1.911)	(-3.965)	(-3.035)
Lagged Funded status^3	(?)	0.446**	0.886***	0.492***	0.168	0.166	1.071***
		(2.536)	(3.259)	(3.400)	(0.951)	(1.335)	(2.908)
Financing cash flow	(+)	0.110***	0.102***	0.098***	0.024***	0.061***	0.170***
		(10.990)	(6.629)	(11.580)	(3.650)	(6.637)	(12.091)
Leverage	(+)	0.025***	-0.007	0.038***	0.016***	0.011**	0.008
		(4.348)	(-0.799)	(7.225)	(3.347)	(2.275)	(1.107)
Dummy for 2008	(-)	0.017	-0.014***	0.013	-0.021***	0.003	0.002
		(5.141)	(-3.119)	(1.705)	(-9.520)	(0.424)	(0.548)
Constant		-0.006*	0.037***	-0.001	0.019***	0.005	0.025***
		(-1.820)	(6.654)	(-0.174)	(7.439)	(0.746)	(6.038)
Observations		7,652	2,724	13,466	4,476	7,086	4,628
Year FE		Yes	Yes	Yes	Yes	Yes	Yes
F-stat (Savings-Expense)		**0.04**	**0.68**	**0.57**	**0.00**	**1.64**	**1.52**

Robust t-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 7 Descriptive Statistics for the Pension & Investments (P&I) Sample (2003-2010)

Variables	Count	Mean	Standard Deviation	Percentile			Minimum	Maximum
				25th	50th	75th		
Capital Expenditure$_t$/ Assets$_{(t-1)}$	1209	0.047	0.033	0.025	0.040	0.063	0.001	0.181
Nonpension CashFlow$_t$ / Assets$_{(t-1)}$	1209	0.104	0.068	0.061	0.101	0.144	-0.113	0.279
Lagged Tobin's Q $_{(t-1)}$	1209	1.657	0.758	1.116	1.399	1.937	0.820	6.074
Financing Cashflow$_t$/ Assets$_{(t-1)}$	1209	-0.035	0.072	-0.075	-0.035	-0.001	-0.228	0.246
Leverage$_t$ / Assets$_{(t-1)}$	1208	0.231	0.133	0.135	0.219	0.308	0.000	0.648
Funded Status$_{(t-1)}$/ Assets$_{(t-1)}$	1209	0.023	0.113	-0.023	0.000	0.025	-0.163	0.716
Age$_t$ (Years)	1208	46.341	15.289	42.000	54.000	57.000	7.000	61.000
Firm Assets$_t$ ($millions)	1209	40927.87	109479.30	5158.43	13029.10	32609.00	1330.70	795337.00
Pension Assets$_t$ ($millions)	1209	4064.59	7803.20	737.90	1493.90	3479.00	179.22	49252.00
Projected Pension Liabilities$_t$ ($millions)	1209	4633.62	8363.29	896.00	1800.00	4097.00	194.88	51428.00
Accumulated Pension Liabilities$_t$ ($millions)	1209	4013.09	7621.69	673.50	1458.00	3598.40	0.00	47416.00
Mandatory Pension Contribution$_t$ (MPC)/ Assets$_{(t-1)}$	1209	0.004	0.006	0.000	0.000	0.007	0.000	0.023
Unexpected MPC$_t$ (Rauh Methodology)	936	0.002	0.007	0.000	0.000	0.003	-0.024	0.022
Unexpected MPCt(P&I data)	1000	0.002	0.006	0.000	0.000	0.002	-0.024	0.020
Unexpected MPC$_t$ (10-k filings-Compustat)	757	0.002	0.007	0.000	0.000	0.004	-0.030	0.023
Equity Allocation$_{(t-1)}$(Rauh Methodology)	936	0.850	0.785	0.552	0.724	0.999	-1.142	3.636
Equity Allocation$_{(t-1)}$(10-k filings-Compustat)	765	0.632	0.110	0.580	0.650	0.700	0.270	0.870
Equity Allocation$_{(t-1)}$(P&I Data)	946	0.602	0.155	0.560	0.630	0.690	0.000	0.850
Rating$_t$	1155	0.682	0.140	0.591	0.682	0.773	0.136	1.000

All variable definitions are provided in Appendix I

Table 8 Regression Analysis of Capital Expenditure on Unexpected and Expected MPC for the P&I Sample firms

Model: $Capital\ Expenditure_{i,t} = Unexpected\ MPC_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

		Pooled Specification(2003-10)		
Capital Expenditure	**Predict**	**Theoretical**	**P&I Sample**	**Compustat Sample**
Unexpected MPC (Theoretical)	(-)	-0.090		
		(-0.189)		
Expected MPC (Theoretical)	(-)	-0.254		
		(-0.454)		
Unexpected MPC (P&I Allocation)	(-)		-0.091	
			(-0.197)	
Expected MPC (P&I Allocation)	(-)		-0.177	
			(-0.312)	
Unexpected MPC (Compustat Allocation)	(-)			-0.255
				(-0.600)
Expected MPC (Compustat Allocation)	(-)			-0.281
				(-0.603)
Nonpension cash flow	(+)	0.301***	0.302***	0.319***
		(9.227)	(9.475)	(9.103)
Lagged Tobin's Q	(+)	-0.010	-0.010	-0.013
		(-3.645)	(-3.618)	(-3.812)
Lagged funded status	(+)	0.002	0.003	0.004
		(0.051)	(0.091)	(0.131)
Lagged funded status^2	(-)	-0.275***	-0.252***	-0.193*
		(-2.390)	(-2.410)	(-1.561)
Lagged funded status^3	(?)	0.352***	0.315***	0.215
		(2.654)	(2.668)	(1.362)
Financing cash flow	(+)	0.077***	0.074***	0.077***
		(3.507)	(3.493)	(3.256)
Leverage	(+)	0.035***	0.037***	0.030**
		(2.920)	(3.135)	(2.236)
Dummy for 2008	(-)	-0.003	-0.015*	-0.009
		(-0.413)	(-1.573)	(-0.700)
Constant		0.030***	0.040***	0.038***
		(4.954)	(4.334)	(2.862)
Observations		935	1,010	756
Year FE		Yes	Yes	Yes

Robust t-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 9 Regression Analysis of Capital Expenditure on Unexpected (Saving & Expense) and Expected MPC for the P&I Sample firms (2003-2010)

Model: $Capital\ Expenditure_{i,t} = Unexpected\ MPC(Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

		Pooled Specification(2003-10)		
Capital Expenditure		**Theoretical**	**P&I Sample**	**Compustat Sample**
Unexpected MPC- Saving (Theoretical)	(?)	-1.113		
		(-1.088)		
Unexpected MPC- Expense (Theoretical)	(-)	-0.285		
		(-0.685)		
Expected MPC(Theoretical)	(-)	0.249		
		(0.337)		
Unexpected MPC- Saving (P&I Allocation)	(?)		-1.150	
			(-1.157)	
Unexpected MPC- Expense (P&I Allocation)	(-)		-0.319	
			(-0.796)	
Expected MPC(P&I Allocation)	(-)		0.311	
			(0.432)	
Unexpected MPC- Saving(Compustat Allocation)	(?)			-1.351
				(-1.299)
Unexpected MPC- Expense (Compustat Allocation)	(-)			-0.510*
				(-1.409)
Expected MPC(Compustat Allocation)	(-)			0.401
				(0.595)
Nonpension cash flow	(+)	0.303***	0.303***	0.322***
		(9.220)	(9.469)	(9.191)
Lagged Tobin's Q	(+)	-0.010	-0.010	-0.013
		(-3.664)	(-3.692)	(-3.859)
Lagged funded status	(+)	0.003	0.003	0.010
		(0.114)	(0.122)	(0.307)
Lagged funded status^2	(-)	-0.283***	-0.249***	-0.194*
		(-2.502)	(-2.443)	(-1.611)
Lagged funded status^3	(?)	0.361***	0.309***	0.207
		(2.724)	(2.637)	(1.325)
Financing cash flow	(+)	0.076***	0.072***	0.076***
		(3.530)	(3.437)	(3.271)
Leverage	(+)	0.034***	0.035***	0.028**
		(2.860)	(3.023)	(2.123)
Crisis	(-)	0.002	0.001	-0.007
		(0.267)	(0.167)	(-0.486)
Constant		0.030***	0.029***	0.041***
		(4.969)	(5.115)	(2.675)
Observations		935	999	756
Year FE		Yes	Yes	Yes

Robust t-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 10 Regression Analysis of Probability of Unexpected MPC on Pension Plan Characteristics

Model: $Probability\ of\ UMPC_{i,t} = \%\ Equity_{i,t-1} + Total\ employees_{i,t-1} + Pension\ Assets_{i,t-1} + Pension\ Liabilities_{i,t-1} + Pension\ Plan\ investment\ return_{i,t-1} + Dummy_{2008} + Year\ Fixed\ Effects + \varepsilon_{i,t}$

Probability of Unexpected MPC		**Theoretical**	**P&I Sample**	**Compustat Sample**
	Predict	**1991-2010**	**2000-2010**	**2003-2010**
Lagged %Equity(Theoretical)	(+)	-0.065		
		(-10.463)		
Lagged %Equity(P&I Allocation)	(+)		-0.409	
			(-1.368)	
Lagged % Equity(Compustat Allocation)	(+)			0.125
				(0.653)
Lagged employees(log)	(+)	0.209***	0.041	0.147***
		(10.062)	(0.604)	(4.984)
Lagged pension assets(log)	(+)	-0.217	-0.189	-0.100
		(-11.968)	(-2.549)	(-3.760)
Lagged pension liabilities(as % of firm assets)	(-)	1.277	1.109	0.932
		(7.773)	(3.735)	(4.183)
Lagged investment return on pension assets	(?)	-0.468**	-0.917	-0.817***
		(-2.475)	(-1.275)	(-3.120)
Dummy for 2008	(+)	1.056*	3.061***	0.717**
		(1.499)	(10.848)	(1.734)
Constant		0.696	-0.298	0.575
		(0.988)	(-0.656)	(1.378)
Observations		16,017	1,815	5,673
Year FE		Yes	Yes	Yes

Robust z-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the z-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 11 Regression Analysis of Probability of Unexpected MPC (Saving & Expense) on Plan Characteristics

Model: $Probability\ of\ UMPC(Saving/Expense)_{i,t} = \%\ Equity_{i,t-1} + Total\ employees_{i,t-1} + Pension\ Assets_{i,t-1} + Pension\ Liabilities_{i,t-1} + Pension\ Plan\ investment\ return_{i,t-1} + Dummy_{2008} + Year\ Fixed\ Effects + \varepsilon_{i,t}$

		Probability of Saving				Probability of Expense		
		Theoretical	**P&I Sample**	**Compustat Sample**		**Theoretical**	**P&I Sample**	**Compustat Sample**
Probability of Unexpected MPC	**Predict**	1991-2010	2000-2010	2003-2010	**Predict**	1991-2010	2000-2010	2003-2010
Lagged %Equity (Theoretical)	(+)	-0.510			(+)	0.085***		
		(-18.955)				(12.199)		
Lagged %Equity (P&I Allocation)	(+)		-0.619		(+)		-0.251	
			(-1.871)				(-0.876)	
Lagged % Equity (Compustat Allocation)	(+)			-0.339	(+)			0.197
				(-2.128)				(1.173)
Lagged employees (log)	(+)	0.119***	-0.058	0.005	(+)	0.178***	0.063	0.158***
		(6.919)	(-0.902)	(0.252)		(10.160)	(0.958)	(6.249)
Lagged pension assets (log)	(+)	-0.155	-0.078	-0.033	(+)	-0.171	-0.178	-0.098
		(-10.358)	(-0.914)	(-1.616)		(-11.088)	(-2.696)	(-4.313)
Lagged pension liabilities (as % of firm assets)	(-)	0.620	0.373	0.010	(-)	1.134	1.013	0.980
		(4.906)	(1.379)	(0.071)		(8.130)	(3.536)	(5.298)
Lagged investment return on pension assets	(+)	4.130***	3.215**	4.038***	(-)	-2.052***	-2.086***	-3.213***
		(13.799)	(2.252)	(11.121)		(-10.981)	(-2.763)	(-11.617)
Dummy for 2008	(-)	2.231	2.458	0.895	(+)	-0.520	-0.843	-0.699
		(2.177)	(9.077)	(12.787)		(-1.022)	(-4.162)	(-1.692)
Constant		-1.627	-1.071**	-0.746***		0.252	0.934**	0.247
		(-1.590)	(-2.017)	(-6.095)		(0.497)	(2.415)	(0.595)
Observations		15,397	1,008	5,661		15,582	1,695	5,673
Year FE		Yes	Yes	Yes		Yes	Yes	Yes

Robust z-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the z-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 12 Regression Analysis of Probability of Unexpected MPC on Firm Characteristics

Model: $Probability\ of\ UMPC_{i,t} = S\&P\ credit\ rating_{i,t} + Firm\ assets_{i,t-1} + Pension\ assets_{i,t-1} + Z\text{-}score_{i,t-1} + Cash\ flow\ volatility_{i,t-1} + Cash\ flow\ to\ assets\ ratio_{i,t-1} + Pension\ Liabilities_{i,t-1} + Dummy_{2008} + Year\ Fixed\ Effects + \varepsilon_{i,t}$

		Theoretical	P&I Sample	Compustat Sample
Probability of Unexpected MPC	**Predict**	**(1991-2010)**	**(2000-2010)**	**(2003-2010)**
Rating	(+)	-1.888	-2.270	-1.478
		(-7.521)	(-4.242)	(-4.097)
Lagged assets (log)	(+)	0.296***	0.278**	0.076
		(5.511)	(2.334)	(1.191)
Lagged pension assets (log)	(+)	-0.271	-0.265	-0.090
		(-5.583)	(-1.965)	(-1.523)
Lagged Altman Z-score	(+)	0.026	-0.012	-0.001
		(0.727)	(-0.162)	(-0.026)
Lagged cash flow volatility	(?)	-0.471	1.045	-0.912
		(-0.655)	(0.776)	(-1.039)
Lagged pension liabilities(as % of firm assets)	(-)	1.628	1.123	0.589
		(4.741)	(2.067)	(1.671)
Lagged cash flow to asset ratio	(+)	0.088	1.302	0.186
		(0.189)	(1.252)	(0.313)
Dummy for 2008	(+)	1.787***	3.012***	0.562
		(2.769)	(9.585)	(1.120)
Constant		-0.589	-1.372**	1.394**
		(-0.814)	(-2.057)	(2.316)
Observations		7,624	1,690	3,011
Year FE		Yes	Yes	Yes

Robust z-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the z-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 13 Regression Analysis of Probability of Unexpected MPC (Saving & Expense) on Firm Characteristics

Model: $Probability\ of\ UMPC\ (Saving\ /\ Expense\ )_{i,t} = S\&P\ Credit\ rating_{i,t} + Firm\ assets_{i,t-1} + Z-score_{i,t-1} + Cash\ flow\ volatility_{i,t-1} + Cash\ flow\ to\ assets\ ratio_{i,t-1} + Pension\ assets_{i,t-1} + Pension\ Liabilities_{i,t-1} + Year\ Fixed\ Effects + Dummy_{2008} + \varepsilon_{i,t}$

		Probability of UMPC(Saving)			Probability of UMPC(Expense)		
Probability of UMPC (Saving/Expense)	**Predict**	**Theoretical (1991-2010)**	**P&I Sample (2000-2010)**	**Compustat (2003-2010)**	**Theoretical (1991-2010)**	**P&I Sample (2000-2010)**	**Compustat (2003-2010)**
Rating	(+)	-1.402	-1.648	-0.892	-1.363	-1.719	-0.927
		(-6.558)	(-2.592)	(-3.093)	(-6.045)	(-3.290)	(-3.058)
Lagged assets(log)	(+)	0.222***	0.031	0.071*	0.183***	0.283***	0.030
		(6.240)	(0.297)	(1.513)	(4.175)	(2.538)	(0.562)
Lagged pension assets(log)	(+)	-0.171	0.003	-0.051	-0.186	-0.289	-0.055
		(-5.600)	(0.022)	(-1.160)	(-4.859)	(-2.471)	(-1.134)
Lagged Altman Z-score	(+)	-0.002	0.032	-0.041	0.052	-0.026	0.031
		(-0.094)	(0.436)	(-1.151)	(1.619)	(-0.352)	(0.775)
Lagged cash flow volatility	(?)	0.459	2.946*	1.203	-0.784	-0.048	-1.469**
		(0.752)	(1.659)	(1.536)	(-1.246)	(-0.042)	(-1.974)
Lagged pension liabilities(% of firm assets)	(-)	0.739	-0.346	-0.293	1.241	1.294	0.618
		(3.431)	(-0.775)	(-1.059)	(4.513)	(2.521)	(2.012)
Lagged cash flow to asset ratio	(+)	1.008**	1.306	1.549***	-0.504	0.782	-0.603
		(2.355)	(1.046)	(2.644)	(-1.139)	(0.756)	(-1.133)
Dummy for 2008	(-,+)	1.234	2.685	1.208	-0.545	-0.991	-1.494
		(12.192)	(9.038)	(11.707)	(-0.767)	(-4.559)	(-2.938)
Constant		-0.942***	-1.318*	-0.511**	-0.232	-0.010	1.195**
		(-4.289)	(-1.952)	(-1.991)	(-0.307)	(-0.016)	(2.057)
Observations		7,294	887	3,004	7,332	1,575	3,011
Year FE		Yes	Yes	Yes	Yes	Yes	Yes

Robust z-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the z-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 14 Regression Analysis of Probability of Unexpected MPC on Firm and Plan Characteristics

Model: $Probability\ of\ UMPC_{i,t} = Credit\ rating_{i,t} + \%Equity_{i,t-1} + Credit\ rating_{i,t} * Equity_{i,t-1} + Control\ Variables_{i,t-1} + Year\ Fixed\ Effects + Dummy_{2008} + \varepsilon_{i,t}$

Probability of Unexpected MPC	Predict	Theoretical (1991-2010)	P&I Sample (2000-2010)	Compustat Sample (2003-2010)
Rating	(+)	-1.763	-8.425	-1.214
		(-6.855)	(-3.944)	(-0.88)
Lagged %Equity (Theoretical)	(+)	-0.015		
		(-0.332)		
Rating*Lagged % Equity (Theoretical)	(+)	-0.085		
		(-1.259)		
Lagged %Equity (P&I)	(+)		-6.957	
			(-3.071)	
Rating*Lagged % Equity (P&I)	(+)		9.428***	
			(2.866)	
Lagged % Equity (Compustat)	(+)			0.388
				(0.320)
Rating*Lagged %Equity (Compustat)	(+)			-0.404
				(-0.193)
Lagged assets (log)	(+)	0.230***	0.188*	0.028
		(3.576)	(1.295)	(0.362)
Lagged pension assets (log)	(+)	-0.274	-0.230	-0.081
		(-5.579)	(-1.319)	(-1.338)
Lagged Altman Z-score	(+)	-0.025	-0.051	-0.030
		(-0.584)	(-0.578)	(-0.539)
Lagged cash flow volatility	(?)	-0.632	-0.062	-1.024
		(-0.871)	(-0.038)	(-1.141)
Lagged pension liabilities (as % of firm assets)	(-)	1.524	0.860	0.505
		(4.393)	(1.402)	(1.368)
Lagged cash flow to asset ratio	(+)	0.232	1.296	0.364
		(0.498)	(1.103)	(0.591)

Table 14 (continued)

Probability of Unexpected MPC	**Predict**	**Theoretical (1991-2010)**	**P&I Sample (2000-2010)**	**Compustat Sample (2003-2010)**
Lagged employees(log)	(+)	0.082**	0.105	0.050
		(2.070)	(1.235)	(0.941)
Lagged investment return on pension assets	(?)	-0.751**	-0.883	-1.521***
		(-2.369)	(-1.127)	(-3.266)
Dummy for 2008	(+)	2.136***	3.140***	1.082**
		(3.086)	(9.378)	(1.955)
Constant		-0.359	3.652**	1.179
		(-0.461)	(2.340)	(1.539)
Observations		7,584	1,569	2,921
Year FE		Yes	Yes	Yes

Robust z-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the z-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 15 Regression Analysis of Probability of Unexpected MPC (Saving / Expense) on Firm and Plan Characteristics

Model: $Probability\ of\ UMPC(Saving/Expense)_{i,t} = Credit\ rating_{i,t} + \%Equity_{i,t-1} + Credit\ rating_{i,t} * Equity_{i,t-1} + Control\ Variables_{i,t-1} + Year\ Fixed\ Effects + Dummy_{2008} + \varepsilon_{i,t}$

		Probability of Saving			Probability of Expense		
Probability of Saving/Expense	**Predict**	**Theoretical (1991-2010)**	**P&I Sample (2000-2010)**	**Compustat Sample (2003-2010)**	**Theoretical (1991-2010)**	**P&I Sample (2000-2010)**	**Compustat Sample (2003-2010)**
Rating	(+)	-1.522	-3.785	0.302	-1.296	-4.224	-1.231
		(-6.537)	(-2.572)	(0.287)	(-5.502)	(-2.393)	(-1.087)
Lagged %Equity (Theoretical)	(+)	-0.632			0.162***		
		(-7.303)			(2.972)		
Rating*Lagged % Equity (Theoretical)	(+)	0.053			-0.092		
		(0.502)			(-1.176)		
Lagged %Equity (P&I)	(+)		-2.677			-2.834	
			(-1.806)			(-1.540)	
Rating*Lagged % Equity (P&I)	(+)		3.490*			3.745*	
			(1.522)			(1.361)	
Lagged % Equity (Compustat)	(+)			0.815			-0.095
				(0.839)			(-0.097)
Rating*Lagged %Equity (Compustat)	(+)			-1.958			0.491
				(-1.181)			(0.280)
Lagged assets (log)	(+)	0.213***	-0.037	0.089*	0.130***	0.167	-0.029
		(4.672)	(-0.292)	(1.587)	(2.448)	(1.268)	(-0.448)
Lagged pension assets (log)	(+)	-0.197	0.081	-0.048	-0.174	-0.225	-0.046
		(-5.784)	(0.518)	(-1.007)	(-4.516)	(-1.598)	(-0.911)
Lagged Altman Z-score	(+)	-0.029	0.055	-0.007	0.013	-0.084	-0.014
		(-0.810)	(0.631)	(-0.162)	(0.325)	(-0.916)	(-0.301)
Lagged cash flow volatility	(?)	0.191	2.986	1.005	-0.828	-1.010	-1.531*
		(0.295)	(1.448)	(1.271)	(-1.304)	(-0.776)	(-1.886)
Lagged pension liabilities (% of firm assets)	(-)	0.757	-0.514	-0.191	1.145	0.906	0.509
		(3.208)	(-0.994)	(-0.661)	(4.101)	(1.657)	(1.565)

Table 15(continued)

Probability of Saving/Expense	Predict	Probability of Saving			Probability of Expense		
		Theoretical (1991-2010)	**P&I Sample (2000-2010)**	**Compustat Sample (2003-2010)**	**Theoretical (1991-2010)**	**P&I Sample (2000-2010)**	**Compustat Sample (2003-2010)**
Lagged cash flow to asset ratio	(+)	1.080***	1.306	1.509***	-0.308	0.985	-0.396
		(2.431)	(1.040)	(2.610)	(-0.689)	(0.842)	(-0.716)
Lagged employees (log)	(+)	0.036	-0.037	-0.052*	0.065*	0.107*	0.076**
		(1.075)	(-0.451)	(-1.390)	(1.905)	(1.329)	(1.746)
Lagged investment return on pension assets	(?)	4.408***	3.538**	3.564***	-2.434***	-2.070**	-3.552***
		(9.224)	(2.296)	(6.333)	(-7.786)	(-2.434)	(-7.883)
Dummy for 2008	(-,+)	1.042	2.647	1.039	-0.693	-0.942	-0.516
		(10.195)	(8.250)	(9.705)	(-1.094)	(-4.254)	(-0.924)
Constant		-0.788***	0.001	-1.520**	0.451	2.585**	1.157
		(-2.676)	(0.001)	(-2.402)	(0.646)	(2.016)	(1.331)
Observations		7,259	864	2,915	7,295	1,463	2,921
Year FE		Yes	Yes	Yes	Yes	Yes	Yes

Robust z-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the z-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 16 Regression Analysis of Cash Flow Volatility on Unexpected MPC (Saving/Expense) for the Theoretical Sample

Model: $Cash\ flow\ volatility_{i,t} = UMPC\ (Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

Cash flow volatility	Predict	(1)	(2)	(3)	(4)
		Theoretical Sample (1991-2010)			
Unexpected MPC	(+)	0.072*			
		(1.523)			
Unexpected MPC (Expense)	(+)		0.092**		0.091**
			(2.211)		(2.093)
Unexpected MPC (Saving)	(?)			0.029	0.011
				(0.280)	(0.105)
Expected MPC	(+)	0.076*	0.046	0.002	0.041
		(1.338)	(1.251)	(0.035)	(0.552)
Plan funded status	(-)	0.003	0.003	0.002	0.003
		(1.194)	(1.243)	(0.742)	(1.241)
Rating	(-)	-0.005**	-0.005**	-0.005**	-0.005**
		(-1.874)	(-1.893)	(-1.931)	(-1.889)
Log of firm assets	(-)	0.001	0.001	0.001	0.001
		(1.016)	(1.050)	(0.942)	(1.051)
Leverage	(+)	0.004***	0.004***	0.004***	0.004***
		(2.888)	(2.880)	(2.961)	(2.878)
Return on assets	(-)	0.028	0.028	0.028	0.028
		(9.368)	(9.366)	(9.369)	(9.363)
Income volatility	(+)	0.959***	0.959***	0.959***	0.959***
		(124.210)	(124.194)	(123.635)	(123.896)
Book-to-market	(?)	-0.001**	-0.001**	-0.001**	-0.001**
		(-2.069)	(-2.074)	(-2.061)	(-2.072)
Dummy for 2008	(+)	-0.003	-0.003	-0.003	-0.004
		(-1.175)	(-1.229)	(-1.115)	(-1.236)
Constant		0.001	0.001	0.001	0.001
		(0.143)	(0.121)	(0.240)	(0.122)
Observations		8,509	8,509	8,509	8,509
Number of Firms		1,126	1,126	1,126	1,126
Year FE		Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes

Robust t-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 17 Regression Analysis of Cash Flow Volatility on Unexpected MPC (Saving & Expense) for the P&I Sample

Model: $Cash\ flow\ volatility_{i,t} = UMPC(Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

Cash flow volatility	**Predict**	**P&I Sample(2000-2010)**			
Unexpected MPC	(+)	0.069			
		(0.837)			
Unexpected MPC (Expense)	(+)		0.040		0.053
			(0.613)		(0.716)
Unexpected MPC (Saving)	(?)			-0.174	-0.192
				(-0.946)	(-0.959)
Expected MPC	(+)	0.035	-0.006	0.058	0.084
		(0.336)	(-0.100)	(0.492)	(0.581)
Plan funded status	(-)	0.001	0.001	0.001	0.001
		(0.437)	(0.278)	(0.208)	(0.438)
Rating	(-)	-0.001	-0.001	-0.001	-0.001
		(-0.169)	(-0.213)	(-0.233)	(-0.169)
Log of firm assets	(-)	-0.001	-0.001	-0.001	-0.001
		(-0.876)	(-0.887)	(-0.907)	(-0.886)
Leverage	(+)	0.006**	0.007**	0.006**	0.006**
		(2.195)	(2.200)	(2.173)	(2.180)
Return on Assets	(-)	0.028	0.028	0.028	0.028
		(4.307)	(4.322)	(4.262)	(4.272)
Income volatility	(+)	0.963***	0.963***	0.964***	0.963***
		(63.478)	(63.247)	(63.280)	(63.383)
Book-to-market	(?)	-0.002*	-0.002*	-0.002*	-0.002*
		(-1.869)	(-1.855)	(-1.888)	(-1.893)
Dummy for 2008	(+)	-0.003	-0.003	-0.003	-0.003
		(-1.802)	(-1.763)	(-1.787)	(-1.752)
Constant		0.017	0.017	0.017	0.017
		(1.087)	(1.119)	(1.159)	(1.082)
Observations		1,860	1,860	1,860	1,860
Number of Firms		335	335	335	335
Year FE		Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes

Robust t-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 18 Regression Analysis of Cash Flow Volatility on Unexpected MPC (Saving & Expense) for the Compustat Sample

Model: $Cash\ flow\ volatility_{i,t} = UMPC\ (Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

Cash flow volatility	Predict	Compustat Sample(2003-2010)			
Unexpected MPC	(+)	0.097***			
		(2.455)			
Unexpected MPC (Expense)	(+)		0.114***		0.111***
			(2.925)		(2.748)
Unexpected MPC (Saving)	(?)			0.092	0.029
				(0.983)	(0.298)
Expected MPC	(+)	0.092**	0.044*	-0.045	0.026
		(1.847)	(1.404)	(-0.768)	(0.385)
Plan funded status	(-)	0.004	0.005	0.003	0.005
		(1.057)	(1.102)	(0.714)	(1.086)
Rating	(-)	-0.000	-0.000	-0.000	-0.000
		(-0.030)	(-0.025)	(-0.058)	(-0.026)
Log of firm assets	(-)	-0.000	-0.000	-0.001	-0.000
		(-0.244)	(-0.219)	(-0.303)	(-0.218)
Leverage	(+)	0.004**	0.004**	0.005**	0.004**
		(1.809)	(1.787)	(1.891)	(1.794)
Return on assets	(-)	0.022	0.022	0.022	0.022
		(6.220)	(6.174)	(6.218)	(6.163)
Income volatility	(+)	0.970***	0.970***	0.971***	0.970***
		(104.751)	(104.580)	(103.914)	(104.864)
Book-to-market	(?)	-0.000	-0.000	-0.000	-0.000
		(-0.315)	(-0.269)	(-0.267)	(-0.256)
Dummy for 2008	(+)	-0.002	-0.002	-0.002	-0.002
		(-1.598)	(-1.542)	(-1.329)	(-1.489)
Constant		0.005	0.004	0.006	0.004
		(0.342)	(0.306)	(0.411)	(0.304)
Observations		3,464	3,464	3,464	3,464
Number of Firms		740	740	740	740
Year FE		Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes

Robust t-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 19 Sub-Sample Regression Analysis of Cash Flow Volatility on Unexpected MPC (Saving & Expense) based on S&P Ratings
Model: $Cash\ flow\ volatility_{i,t} = UMPC(Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

		Theoretical Sample (1991-2010)		P&I Sample (2000-2010)		Compustat Sample (2003-2010)	
Cash flow volatility	**Predict**	**Non-investment Grade**	**Investment Grade**	**Non-investment Grade**	**Investment Grade**	**Non-investment Grade**	**Investment Grade**
Unexpected MPC (Expense) (Theoretical)	(+)	0.173**	0.078**				
		(1.994)	(1.977)				
Unexpected MPC (Saving)(Theoretical)	(?)	0.239	-0.197*				
		(1.217)	(-1.770)				
Unexpected MPC (Expense) (P&I)	(+)			0.322*	-0.010		
				(1.395)	(-0.214)		
Unexpected MPC (Saving)(P&I)	(?)			-0.717**	-0.161		
				(-2.243)	(-1.235)		
Unexpected MPC (Expense) (Compustat)	(+)					0.249***	0.033
						(2.712)	(0.843)
Unexpected MPC (Saving)(Compustat)	(?)					0.129	-0.066
						(0.842)	(-0.586)
Expected MPC (Theoretical)	(+)	0.050	0.126*				
		(0.438)	(1.506)				
Expected MPC (P&I)	(+)			0.469***	0.060		
				(2.376)	(0.663)		
Expected MPC(Compustat)	(+)					0.075	0.029
						(0.649)	(0.373)
Control Variables		Yes	Yes	Yes	Yes	Yes	Yes
Observations		2,707	5,802	332	1,527	1,284	2,180
Number of Firms		561	746	95	283	343	474
Year FE		Yes	Yes	Yes	Yes	Yes	Yes
Firm FE		Yes	Yes	Yes	Yes	Yes	Yes

Robust t-statistics are in parentheses and heteroskedasticity-robust standard errors are clustered by firm. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 20 Descriptive Statistics for Bonds issued between 1991 and 2010

Panel A: Entire sample

Variables	Obs.	Mean	Standard Deviation	25%	Median	75%
Spread	2509	0.188	0.158	0.080	0.130	0.238
Unexpected MPC (Theoretical)	2156	0.000	0.004	0.000	0.000	0.000
Unexpected MPC (P&I)	751	0.001	0.005	0.000	0.000	0.000
Unexpected MPC (Compustat)	820	0.001	0.007	0.000	0.000	0.002
Expected MPC (Theoretical)	2156	0.001	0.004	0.000	0.000	0.000
Expected MPC (P&I)	751	0.001	0.005	0.000	0.000	0.000
Expected MPC (Compustat)	820	0.003	0.007	0.000	0.000	0.001
Funded status	2509	0.032	0.091	-0.004	0.004	0.037
Return on assets	2509	0.043	0.050	0.012	0.035	0.071
Leverage	2509	0.287	0.192	0.147	0.266	0.372
Market value of equity	2509	16895.480	30645.690	1847.843	5616.875	16654.600
Book to market equity	2509	0.509	0.359	0.284	0.473	0.670
Stock return volatility	2509	0.089	0.048	0.057	0.077	0.105
Proceeds from debt maturity	2509	491.798	664.174	149.292	250.000	499.525
Years to debt maturity	2509	12.143	9.241	7.083	10.144	10.208
Senior debt indicator	2509	0.906	0.291	1.000	1.000	1.000
Investment grade indicator	2509	0.811	0.392	1.000	1.000	1.000
Credit rating	2509	8.038	3.378	6.000	8.000	10.000
Public debt indicator	2509	0.861	0.347	1.000	1.000	1.000

Table 20 (continued)

Panel B: Investment-grade bonds issued

Variables	Obs.	Mean	Std Deviation	25%	Median	75%
Spread	2035	0.142	0.113	0.072	0.108	0.167
Unexpected MPC (Theoretical)	1765	0.000	0.004	0.000	0.000	0.000
Unexpected MPC (P&I)	686	0.001	0.005	0.000	0.000	0.000
Unexpected MPC (Compustat)	679	0.001	0.007	0.000	0.000	0.002
Expected MPC (Theoretical)	1765	0.001	0.004	0.000	0.000	0.000
Expected MPC (P&I)	686	0.001	0.005	0.000	0.000	0.000
Expected MPC (Compustat)	679	0.003	0.007	0.000	0.000	0.001
Funded status	2035	0.034	0.090	-0.003	0.004	0.038

Panel C: Non-investment grade bonds issued

Variables	Obs.	Mean	Std Deviation	25%	Median	75%
Spread	474	0.385	0.170	0.261	0.367	0.495
Unexpected MPC (Theoretical)	391	0.001	0.005	0.000	0.000	0.000
Unexpected MPC (P&I)	65	0.003	0.005	0.000	0.000	0.003
Unexpected MPC (Compustat)	141	0.001	0.008	0.000	0.000	0.003
Expected MPC (Theoretical)	391	0.002	0.005	0.000	0.000	0.000
Expected MPC (P&I)	65	0.001	0.005	0.000	0.000	0.000
Expected MPC (Compustat)	141	0.004	0.009	0.000	0.000	0.003
Funded status	474	0.025	0.095	-0.014	0.004	0.034

All variables defined in Appendix I

Table 21 Regression Analysis of Cost of Debt on Unexpected MPC (Saving & Expense) for the Theoretical Sample (1991-2010)

Model: $Cost\ of\ debt\ less\ treasury\ rate_{i,t} = Unexpected\ MPC\ (Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Plan\ funded\ status_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

Cost of Debt	Predict	All firms			Non-investment grade		Investment grade	
Mandatory Pension Contribution (MPC)	(+)	-0.349						
		(-0.520)						
Unexpected MPC	(+)		-0.788		-5.557		0.091	
			(-1.008)		(-2.227)		(0.113)	
Unexpected MPC - Saving	(-)			1.000		2.423		0.504
				(0.482)		(0.420)		(0.236)
Unexpected MPC - Expense	(+)			-0.760		-6.079		0.169
				(-0.923)		(-2.298)		(0.201)
Expected MPC	(+)		-1.243	-1.349	-4.405	-2.919	-0.248	-0.551
			(-1.448)	(-1.048)	(-1.716)	(-0.819)	(-0.284)	(-0.413)
Pension Plan Funded Status	(-)	-0.013	-0.051*	-0.051*	-0.121	-0.116	-0.030	-0.029
		(-0.451)	(-1.591)	(-1.586)	(-1.020)	(-0.974)	(-0.928)	(-0.915)
Return on Assets	(-)	-0.282***	-0.260***	-0.260***	-0.546***	-0.549***	-0.090*	-0.090*
		(-5.742)	(-4.778)	(-4.777)	(-3.533)	(-3.546)	(-1.538)	(-1.546)
Leverage	(+)	0.033**	0.049***	0.049***	0.128***	0.126***	0.015	0.015
		(2.314)	(3.037)	(3.038)	(3.167)	(3.089)	(0.828)	(0.834)
Log(Market Value of Equity)	(-)	-0.006***	-0.005**	-0.005**	-0.051***	-0.051***	-0.015***	-0.015***
		(-2.343)	(-2.021)	(-2.022)	(-4.998)	(-4.949)	(-6.053)	(-6.056)
Book to market equity	(?)	0.016**	0.014*	0.014*	-0.019	-0.020	0.047***	0.047***
		(2.460)	(1.907)	(1.908)	(-1.057)	(-1.085)	(5.146)	(5.146)
Stock return volatility	(+)	0.659***	0.684***	0.685***	0.215	0.221*	0.639***	0.640***
		(11.962)	(11.371)	(11.355)	(1.272)	(1.302)	(9.540)	(9.537)
Log(Proceeds from debt issue)	(?)	0.002	0.003	0.003	0.019*	0.019*	0.003	0.003
		(0.780)	(1.103)	(1.101)	(1.832)	(1.871)	(1.069)	(1.071)

Table 21 (continued)

Cost of Debt	Predict	All firms			Non-investment grade		Investment grade	
Log(# of years to debt maturity)	(+)	0.011***	0.009***	0.009***	-0.064	-0.064	0.013***	0.013***
		(3.633)	(2.884)	(2.876)	(-2.306)	(-2.293)	(4.703)	(4.680)
Moody's Credit Rating(Issue)	(+)	0.021***	0.021***	0.021***				
		(19.918)	(18.074)	(18.063)				
Senior Debt Indicator	(-)	-0.002	0.002	0.002	0.020	0.020		
		(-0.249)	(0.227)	(0.228)	(1.023)	(1.029)		
Public Debt Indicator	(-)	-0.037***	-0.033***	-0.033***	-0.010	-0.010	-0.022***	-0.022***
		(-5.547)	(-4.583)	(-4.582)	(-0.510)	(-0.502)	(-2.422)	(-2.423)
$Dummy_{2008}$	(+)	0.030**	-0.035	-0.035	0.154	0.158	0.040	0.040
		(1.877)	(-0.516)	(-0.519)	(1.149)	(1.176)	(0.512)	(0.505)
Constant		-0.029	0.025	0.025	0.679***	0.674***	0.136*	0.136*
		(-0.958)	(0.335)	(0.335)	(4.366)	(4.318)	(1.672)	(1.672)
Observations		2,509	2,151	2,151	390	390	1,761	1,761
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes

T-statistics are reported in parentheses. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 22 Regression Analysis of Cost of Debt on Unexpected MPC (Saving & Expense) for the P&I Sample (2000-2010)

Model: $Cost\ of\ debt\ less\ treasury\ rate_{i,t} = Unexpected\ MPC\ (Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Plan\ funded\ status_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

Cost of Debt	Predict	All firms			Non-investment grade		Investment grade	
Mandatory Pension Contribution (MPC)	(+)	-0.404						
		(-0.433)						
Unexpected MPC	(+)		-1.347		14.594		-0.684	
			(-0.990)		(1.172)		(-0.497)	
Unexpected MPC - Saving	(-)			2.547		-53.143**		3.079
				(0.674)		(-1.848)		(0.797)
Unexpected MPC - Expense	(+)			-1.253		14.594		-0.486
				(-0.903)		(1.172)		(-0.345)
Expected MPC	(+)		-0.639	-1.217	27.532**	27.532**	-0.254	-1.444
			(-0.433)	(-0.541)	(1.800)	(1.800)	(-0.168)	(-0.616)
Pension Plan Funded Status	(-)	0.019	0.078	0.077	0.514	0.514	-0.004	-0.005
		(0.413)	(1.297)	(1.285)	(1.286)	(1.286)	(-0.060)	(-0.076)
Return on Assets	(-)	-0.350***	-0.430***	-0.433***	1.683	1.683	-0.367***	-0.372***
		(-4.474)	(-3.348)	(-3.358)	(1.098)	(1.098)	(-2.665)	(-2.695)
Leverage	(+)	0.044**	-0.001	-0.001	0.349*	0.349*	0.015	0.016
		(1.844)	(-0.027)	(-0.017)	(1.529)	(1.529)	(0.313)	(0.331)
Log(Market Value of Equity)	(-)	-0.006	-0.000	-0.000	-0.007	-0.007	-0.013**	-0.012**
		(-1.556)	(-0.021)	(-0.008)	(-0.129)	(-0.129)	(-1.974)	(-1.945)
Book to market equity	(?)	0.024**	0.035**	0.035**	-0.033	-0.033	0.077***	0.077***
		(2.446)	(2.344)	(2.346)	(-0.433)	(-0.433)	(4.395)	(4.404)
Stock return volatility	(+)	0.565***	0.593***	0.596***	0.313	0.313	0.635***	0.643***
		(7.355)	(4.630)	(4.639)	(0.458)	(0.458)	(4.600)	(4.637)
Log(Proceeds from debt issue)	(?)	0.002	0.003	0.003	-0.028	-0.028	0.001	0.001
		(0.509)	(0.504)	(0.505)	(-0.394)	(-0.394)	(0.137)	(0.140)

Table 22 (continued)

Cost of Debt	Predict	All firms			Non-investment grade		Investment grade	
Log(# of years to debt maturity)	(+)	0.007*	0.010*	0.010*	0.015	0.015	0.016***	0.016***
		(1.487)	(1.529)	(1.494)	(0.149)	(0.149)	(2.606)	(2.533)
Moody's Credit Rating(Issue)	(+)	0.024***	0.024***	0.024***				
		(14.777)	(9.291)	(9.286)				
Senior Debt Indicator	(-)	0.002	-0.034	-0.034				
		(0.194)	(-1.395)	(-1.393)				
Public Debt Indicator	(-)	-0.024***	-0.032**	-0.032**	0.029	0.029	-0.037**	-0.037**
		(-2.637)	(-2.218)	(-2.217)	(0.488)	(0.488)	(-2.239)	(-2.243)
$Dummy_{2008}$	(+)	-0.033	-0.049	-0.051	-0.559	0.062	-0.038	-0.040
		(-1.922)	(-1.727)	(-1.757)	(-1.333)	(0.415)	(-1.279)	(-1.355)
Constant		0.007	-0.013	-0.015	0.380	0.370	0.196***	0.193***
		(0.155)	(-0.169)	(-0.184)	(0.634)	(0.618)	(2.869)	(2.827)
Observations		1,482	705	705	63	63	642	642
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes

T-statistics are reported in parentheses. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 23 Regression Analysis of Cost of Debt on Unexpected MPC (Saving & Expense) for the Compustat Sample (2003-2010)

Model: $Cost\ of\ debt\ less\ treasury\ rate_{i,t} = Unexpected\ MPC\ (Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Plan\ funded\ status_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

Cost of Debt	Predict	All firms			Non-investment grade		Investment grade	
Mandatory Pension Contribution (MPC)	(+)	-0.882						
		(-0.858)						
Unexpected MPC	(+)		-0.417		-8.909		-0.750	
			(-0.343)		(-1.856)		(-0.545)	
Unexpected MPC - Saving	(-)			2.771		4.423		3.286
				(0.899)		(0.458)		(0.937)
Unexpected MPC - Expense	(+)			-0.188		-8.875		-0.435
				(-0.151)		(-1.833)		(-0.304)
Expected MPC	(+)		0.362	-1.019	-7.692	-5.175	-0.361	-1.857
			(0.282)	(-0.485)	(-1.740)	(-0.800)	(-0.246)	(-0.773)
Pension Plan Funded Status	(-)	-0.047	0.153	0.144	-0.280	-0.249	0.069	0.058
		(-0.573)	(1.177)	(1.103)	(-0.590)	(-0.517)	(0.440)	(0.370)
Return on Assets	(-)	-0.285***	-0.182*	-0.182*	-0.105	-0.106	-0.037	-0.038
		(-3.084)	(-1.616)	(-1.607)	(-0.363)	(-0.363)	(-0.253)	(-0.256)
Leverage	(+)	0.058**	0.017	0.019	0.062	0.052	0.002	0.003
		(1.937)	(0.423)	(0.469)	(0.593)	(0.483)	(0.045)	(0.052)
Log(Market Value of Equity)	(-)	-0.004	-0.004	-0.004	-0.061**	-0.061**	-0.017***	-0.017***
		(-0.818)	(-0.626)	(-0.626)	(-2.118)	(-2.069)	(-2.886)	(-2.875)
Book to market equity	(?)	0.031**	0.044***	0.045***	0.119*	0.120*	0.082***	0.082***
		(2.311)	(2.790)	(2.819)	(1.908)	(1.897)	(4.444)	(4.463)
Stock return volatility	(+)	0.610***	0.466***	0.472***	0.335	0.390	0.506***	0.516***
		(6.669)	(4.218)	(4.262)	(0.741)	(0.835)	(4.087)	(4.144)
Log(Proceeds from debt issue)	(?)	0.001	0.004	0.004	0.040	0.040	0.002	0.002
		(0.294)	(0.658)	(0.636)	(1.437)	(1.425)	(0.283)	(0.259)

Table 23 (continued)

Cost of Debt	Predict	All firms			Non-investment grade		Investment grade	
Log(# of years to debt maturity)	(+)	0.006	0.006	0.005	-0.098	-0.099	0.008	0.007
		(1.129)	(0.837)	(0.739)	(-1.642)	(-1.636)	(1.165)	(1.076)
Moody's Credit Rating(Issue)	(+)	0.023***	0.023***	0.023***				
		(10.920)	(8.395)	(8.382)				
Senior Debt Indicator	(-)	0.004	-0.007	-0.007	0.013	0.014		
		(0.246)	(-0.397)	(-0.397)	(0.204)	(0.208)		
Public Debt Indicator	(-)	-0.012	-0.012	-0.012	0.006	0.007	-0.056***	-0.056***
		(-1.044)	(-0.716)	(-0.726)	(0.152)	(0.173)	(-2.362)	(-2.352)
$Dummy_{2008}$	(+)	-0.002	-0.037	-0.026	0.114**	0.118**	-0.031	-0.019
		(-0.148)	(-0.344)	(-0.244)	(1.748)	(1.780)	(-0.283)	(-0.171)
Constant		-0.053	-0.019	-0.029	0.677***	0.668***	0.275**	0.261**
		(-0.958)	(-0.148)	(-0.230)	(3.105)	(3.030)	(2.285)	(2.156)
Observations		1,143	820	820	141	141	679	679
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes

T-statistics are reported in parentheses. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 24 Regression Analysis of Credit Rating on Unexpected MPC(Saving & Expense) for the Theoretical Sample (1991-2010)

Model:$Moody's\ Credit\ Rating_{i,t} = UMPC\ (Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Plan\ funded\ status_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

Moody's Rating (Issue)	**Predict**	**All Firms**			**Non-investment grade**		**Investment grade**	
Mandatory Pension Contribution (MPC)	(+)	-6.310						
		(-0.466)						
Unexpected MPC	(+)		-11.294		-74.599		15.516	
			(-0.724)		(-2.602)		(1.005)	
Unexpected MPC - Saving	(-)			44.742		83.954		-0.052
				(1.083)		(1.264)		(-0.001)
Unexpected MPC - Expense	(+)			-6.831		-73.042		17.556
				(-0.416)		(-2.401)		(1.080)
Expected MPC	(+)		0.527	-16.169	-39.872	-44.309	14.196	6.329
			(0.031)	(-0.630)	(-1.352)	(-1.081)	(0.843)	(0.246)
Pension Plan Funded Status	(-)	-2.168***	-2.592***	-2.573***	-1.945*	-1.960*	-1.226**	-1.216**
		(-3.847)	(-4.086)	(-4.055)	(-1.423)	(-1.427)	(-1.985)	(-1.966)
Return on Assets	(-)	-3.879***	-3.517***	-3.530***	-1.306	-1.297	-2.819***	-2.833***
		(-3.922)	(-3.246)	(-3.257)	(-0.735)	(-0.728)	(-2.502)	(-2.513)
Leverage	(+)	2.496***	2.667***	2.678***	0.801**	0.808**	1.438***	1.441***
		(8.736)	(8.482)	(8.509)	(1.719)	(1.722)	(4.012)	(4.019)
Log(Market Value of Equity)	(-)	-0.977***	-0.991***	-0.991***	-0.417***	-0.418***	-0.889***	-0.890***
		(-22.290)	(-20.655)	(-20.659)	(-3.528)	(-3.524)	(-19.171)	(-19.170)
Book to market equity	(?)	-0.281**	-0.410***	-0.408***	-0.168	-0.166	-0.133	-0.132
		(-2.106)	(-2.723)	(-2.705)	(-0.803)	(-0.792)	(-0.751)	(-0.749)
Stock return volatility	(+)	12.648***	12.675***	12.730***	3.556**	3.539**	8.732***	8.766***
		(11.711)	(10.891)	(10.921)	(1.831)	(1.815)	(6.759)	(6.770)
Log(Proceeds from debt issue)	(?)	0.061	0.039	0.039	0.026	0.024	0.062	0.062
		(1.273)	(0.772)	(0.760)	(0.218)	(0.204)	(1.316)	(1.318)

Table 24 (continued)

Moody's Rating (Issue)	**Predict**	**All Firms**			**Non-investment grade**		**Investment grade**	
Log(# of years to debt maturity)	(+)	-0.309	-0.325	-0.327	-1.121	-1.122	-0.014	-0.016
		(-5.212)	(-5.118)	(-5.151)	(-3.518)	(-3.513)	(-0.262)	(-0.282)
Senior Debt Indicator	(-)	-1.800***	-1.768***	-1.764***	-1.085***	-1.085***		
		(-12.329)	(-10.920)	(-10.896)	(-4.868)	(-4.859)		
Public Debt Indicator	(-)	-1.167***	-1.182***	-1.181***	-0.624***	-0.624***	-0.312**	-0.312**
		(-8.924)	(-8.292)	(-8.289)	(-2.696)	(-2.692)	(-1.807)	(-1.809)
$Dummy_{2008}$	(?)	2.994***	1.264	1.230	0.793	0.781	1.951	1.939
		(9.373)	(0.935)	(0.910)	(0.516)	(0.507)	(1.280)	(1.272)
Constant		16.092***	17.959***	17.959***	18.927***	18.943***	12.964***	12.965***
		(32.425)	(12.732)	(12.732)	(10.587)	(10.555)	(8.254)	(8.252)
Observations		2,504	2,151	2,151	390	390	1,761	1,761
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes

T-statistics are reported in parentheses. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 25 Regression Analysis of Credit Rating on Unexpected MPC (Saving & Expense) for the P&I Sample (2000-2010)

Model: $Moody's\ Credit\ Rating_{i,t} = UMPC\ (Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Plan\ funded\ status_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

Moody's Rating (Issue)	**Predict**	**All Firms**			**Non-investment grade**		**Investment grade**	
Mandatory Pension Contribution (MPC)	(+)	-24.479						
		(-1.540)						
Unexpected MPC	(+)		3.474		-91.705		15.196	
			(0.154)		(-0.782)		(0.753)	
Unexpected MPC – Saving	(-)			-11.047		-0.314		6.842
				(-0.177)		(-0.001)		(0.121)
Unexpected MPC – Expense	(+)			2.885		-91.705		17.021
				(0.125)		(-0.782)		(0.823)
Expected MPC	(+)		6.837	10.480	-40.520	-40.520	17.011	6.053
			(0.279)	(0.281)	(-0.281)	(-0.281)	(0.768)	(0.176)
Pension Plan Funded Status	(-)	-3.537***	-2.946***	-2.942***	-5.445*	-5.445*	-2.350***	-2.358***
		(-4.584)	(-2.999)	(-2.990)	(-1.445)	(-1.445)	(-2.587)	(-2.594)
Return on Assets	(-)	-3.006***	-2.461	-2.447	5.958	5.958	-1.500	-1.545
		(-2.256)	(-1.158)	(-1.149)	(0.413)	(0.413)	(-0.743)	(-0.764)
Leverage	(+)	3.133***	3.893***	3.890***	-3.183	-3.183	3.911***	3.919***
		(7.897)	(5.382)	(5.370)	(-1.481)	(-1.481)	(5.687)	(5.692)
Log(Market Value of Equity)	(-)	-0.945***	-0.888***	-0.888***	-0.174	-0.174	-0.804***	-0.802***
		(-15.702)	(-8.801)	(-8.792)	(-0.367)	(-0.367)	(-8.636)	(-8.605)
Book to market equity	(?)	-0.256	-0.327	-0.327	0.256	0.256	0.052	0.054
		(-1.511)	(-1.318)	(-1.318)	(0.359)	(0.359)	(0.204)	(0.211)
Stock return volatility	(+)	10.958***	11.698***	11.676***	4.970	4.970	8.009***	8.079***
		(8.584)	(5.675)	(5.640)	(0.774)	(0.774)	(3.958)	(3.976)
Log(Proceeds from debt issue)	(?)	0.006	-0.123	-0.123	1.798***	1.798***	-0.104	-0.103
		(0.092)	(-1.280)	(-1.280)	(2.713)	(2.713)	(-1.223)	(-1.220)

Table 25 (continued)

Moody's Rating (Issue)	**Predict**	**All Firms**			**Non-investment grade**		**Investment grade**	
Log(# of years to debt maturity)	(+)	-0.339	-0.114	-0.113	-0.043	-0.043	0.059	0.056
		(-4.163)	(-1.050)	(-1.035)	(-0.045)	(-0.045)	(0.651)	(0.610)
Senior Debt Indicator	(-)	-1.383***	-0.559*	-0.560*				
		(-6.725)	(-1.396)	(-1.395)				
Public Debt Indicator	(-)	-1.116***	-1.147***	-1.147***	-1.441***	-1.441***	-0.373*	-0.374*
		(-7.321)	(-4.896)	(-4.891)	(-2.616)	(-2.616)	(-1.545)	(-1.547)
$Dummy_{2008}$	(?)	1.713***	1.067**	1.076**	-1.260	0.222	1.235***	1.210***
		(5.973)	(2.264)	(2.255)	(-0.319)	(0.158)	(2.867)	(2.784)
Constant		16.955***	15.880***	15.887***	4.176	4.153	12.958***	12.936***
		(27.242)	(13.949)	(13.926)	(0.741)	(0.738)	(12.971)	(12.918)
Observations		1,482	705	705	63	63	642	642
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes

T-statistics are reported in parentheses. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

Table 26 Regression Analysis of Credit Rating on Unexpected MPC (Saving & Expense) for the Compustat Sample (2003-2010)

Model: $Moody's\ Credit\ Rating_{i,t} = UMPC\ (Saving/Expense)_{i,t} + Expected\ MPC_{i,t} + Plan\ funded\ status_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t}$

Moody's Rating (Issue)	**Predict**	**All Firms**			**Non-investment grade**		**Investment grade**	
Mandatory Pension Contribution (MPC)	(+)	-29.225						
		(-1.839)						
Unexpected MPC	(+)		-35.573		-72.655		-10.370	
			(-1.997)		(-1.224)		(-0.589)	
Unexpected MPC - Saving	(-)			48.464		66.964		9.363
				(1.070)		(0.560)		(0.208)
Unexpected MPC - Expense	(+)			-34.316		-72.611		-10.494
				(-1.877)		(-1.209)		(-0.571)
Expected MPC	(+)		-23.096	-30.659	-70.388	-67.195	-5.678	-5.084
			(-1.227)	(-0.994)	(-1.288)	(-0.838)	(-0.303)	(-0.165)
Pension Plan Funded Status	(-)	-0.869	1.906	1.857	3.165	3.204	1.310	1.314
		(-0.690)	(0.999)	(0.969)	(0.539)	(0.535)	(0.655)	(0.654)
Return on Assets	(-)	-3.246**	-1.501	-1.496	-1.182	-1.183	-0.880	-0.880
		(-2.271)	(-0.905)	(-0.901)	(-0.330)	(-0.326)	(-0.466)	(-0.465)
Leverage	(+)	2.988***	4.477***	4.487***	1.633	1.620	3.104***	3.104***
		(6.591)	(7.924)	(7.924)	(1.258)	(1.213)	(4.665)	(4.660)
Log(Market Value of Equity)	(-)	-1.014***	-0.953***	-0.953***	-0.224	-0.223	-0.847***	-0.847***
		(-15.538)	(-11.993)	(-11.982)	(-0.625)	(-0.614)	(-11.272)	(-11.261)
Book to market equity	(?)	0.001	0.197	0.200	-0.322	-0.322	0.513**	0.513**
		(0.003)	(0.850)	(0.860)	(-0.417)	(-0.411)	(2.175)	(2.171)

Table 26 (continued)

Moody's Rating (Issue)	**Predict**		**All Firms**		**Non-investment grade**		**Investment grade**	
Stock return volatility	(+)	12.363***	11.409***	11.440***	7.569*	7.638*	7.631***	7.627***
		(9.105)	(7.312)	(7.312)	(1.354)	(1.317)	(4.810)	(4.779)
Log(Proceeds from debt issue)	(?)	0.105	0.045	0.044	0.194	0.194	-0.074	-0.074
		(1.433)	(0.487)	(0.478)	(0.567)	(0.560)	(-0.855)	(-0.853)
Log(# of years to debt maturity)	(+)	-0.405	-0.380	-0.383	-2.181	-2.181	-0.131	-0.131
		(-4.633)	(-3.735)	(-3.744)	(-2.946)	(-2.911)	(-1.497)	(-1.484)
Senior Debt Indicator	(-)	-1.362***	-1.053***	-1.053***	-1.838**	-1.838**		
		(-6.017)	(-3.953)	(-3.949)	(-2.293)	(-2.265)		
Public Debt Indicator	(-)	-1.264***	-1.488***	-1.489***	-0.738*	-0.737*	-0.353	-0.353
		(-7.225)	(-6.315)	(-6.313)	(-1.597)	(-1.574)	(-1.154)	(-1.153)
$Dummy_{2008}$	(?)	0.648***	0.010	0.068	0.381	0.385	0.464	0.459
		(3.145)	(0.006)	(0.043)	(0.471)	(0.469)	(0.336)	(0.329)
Constant		18.055***	17.813***	17.752***	19.857***	19.846***	14.402***	14.408***
		(29.064)	(10.294)	(10.187)	(7.368)	(7.256)	(9.365)	(9.271)
Observations		1,143	820	820	141	141	679	679
Year FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes

T-statistics are reported in parentheses. Variables are defined in Appendix I and ***, ** and * next to the t-statistic indicate significance at 1%, 5% and 10% respectively using a one-tailed test for variables with signs as predicted and a two-tailed test otherwise.

FIGURES

Figure 1 Unexpected MPC using the Theoretical construct, P&I survey and Compustat data

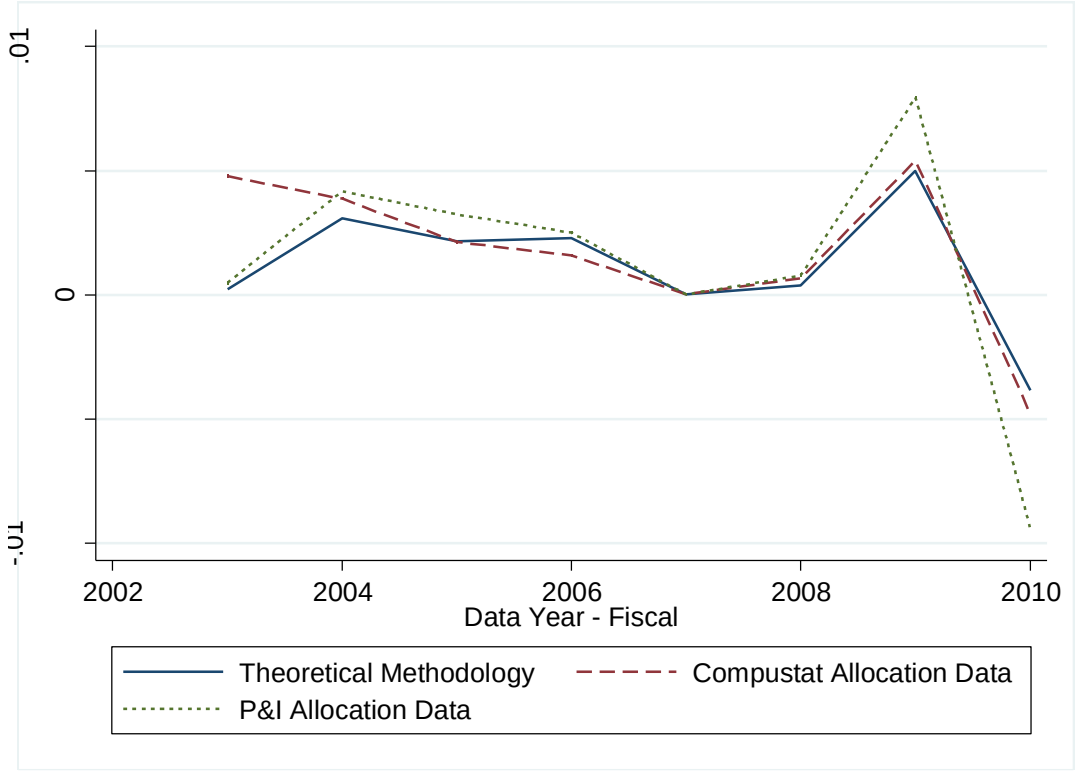


Figure 2 Trend in Capital Investments

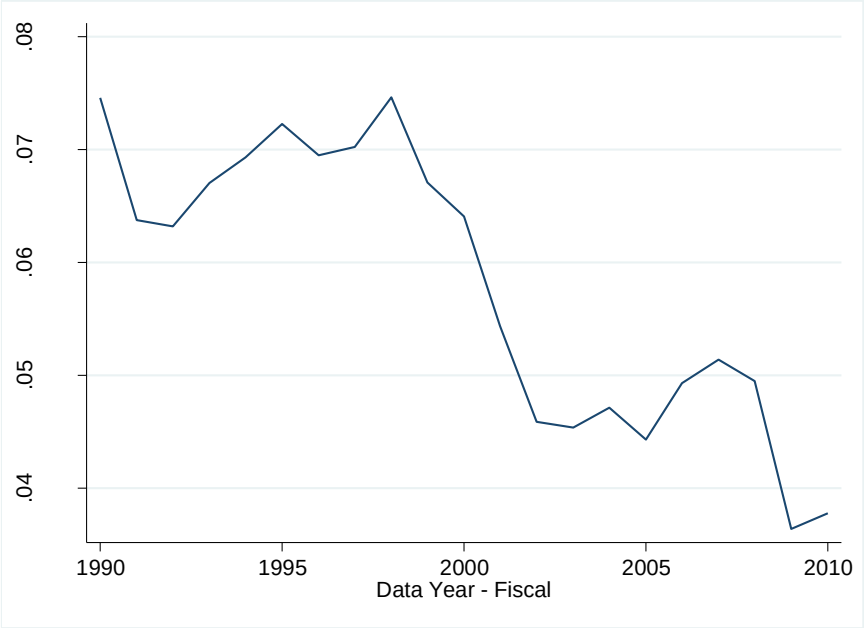
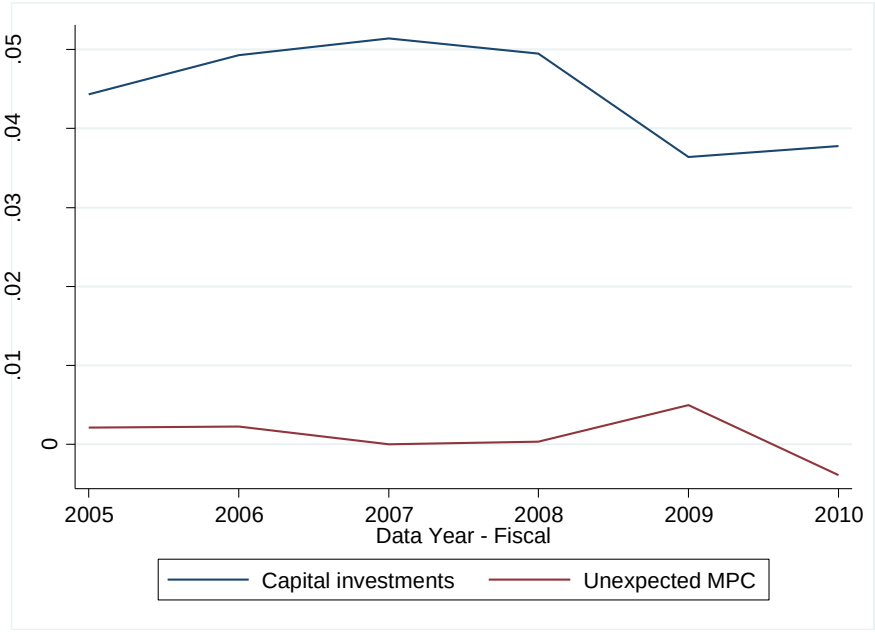


Figure 3 Comparison of Capital Investments versus Unexpected MPC (Theoretical)



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