Corporate pension funding levels, firm performance and dividend payout ratios*

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July 2022

* I am grateful to Zenon Taoushianis, Athanasios Sakkas, Antonios Kalyvas, several anonymous referees and seminar participants for useful feedback and comments. Remaining errors are my own.

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Abstract

I employ a large sample of defined-benefit (DB) pension plans, sponsored by publicly traded US corporations over the period 1998-2016, and explore the impact of the level of pension funding on firm performance and dividend payout policy. Using panel regression analysis, I find evidence of significant positive association between the level of pension funding and both firm performance and dividend payout. The results have a number of important implications that should be cause of concern for policy makers and a wide range of stakeholders including investors, pensioners, employees and managers.

*JEL classification***:** G18, G28, G32, G35

Keywords: defined-benefit pensions, pension-funding, underfunding, firm-performance, dividend policy

1. Introduction

It is a well-known fact that the defined-benefit (DB) is the most common pension scheme offered by the United States (US) federal, state and local governments (i.e. the public sector). Many scholars have been attracted to study the characteristics of this type of pension plans, due to the uniqueness of the accounting standards followed in the public sector, allowing the manipulation of the true value of the pension liabilities (Mohan and Zhang, 2014; Novy-Marx and Rauh, 2009; Novy-Marx and Rauh, 2011). In contrast, the accounting standards followed by corporations (i.e. the private sector) do not allow for such manipulations.[2] As a consequence, the gap separating the pension assets and the pension liabilities (i.e. the pension deficit) is usually much more pronounced in the case of private corporations.

The US pension law requires that corporate DB pension plans must be kept adequately funded. As such, corporations sponsoring this type of pension plans must make frequent fund contributions towards their plans to cover the benefits participants accumulate over time. The amount of contributions further increases for underfunded plans, as there is also the requirement to gradually eliminate the funding deficits. This naturally raises the question of whether the funding level of corporate DB pension plans can be used to predict the financial performance of sponsoring corporations. Further, what is the impact on dividend policy? To answer these questions, I take a large sample of DB pension plans sponsored by publicly-traded US corporations over the period 1998-2016. I employ panel regression analysis and, in line with expectations, I find that underfunded DB pension plans are associated with reduced firm performance (measured by Return on Assets – ROA) and dividend payout ratios (proportion of profits used to pay dividends and repurchase shares). Furthermore, the results are statistically and economically significant and are robust to several controls such as firm and

[2] Additional discussion on the accounting standard differences between the public and the private sector is provided in Cocco (2014).

plan characteristics, the quality of corporate governance, and the quality of audit in the plan-sponsoring firm. As further robustness, I repeat the analysis after removing the most recent financial crisis years from the sample, and I also employ alternative measures for pension funding and firm financial constraints. Under all circumstances, the results remain qualitatively the same.

This paper is related to, and extends the insights of, studies that investigate the consequences on corporations sponsoring underfunded DB pension plans. Webb (2007) develops a two-horizon model predicting under (risky) corporate investment when the present (future) DB pension liability is high. Rauh (2006) and Campbell et al. (2012) find that firms sponsoring DB pension plans with large deficits substantially reduce capital expenditures. Given this finding, one can also speculate that the reduction in capital expenditures and productive resources could possibly open up a route to decreased firm performance. Under perfect markets, an adverse shock to the sponsoring firms' internal funding should have no effect on future performance since the firms can perfectly substitute the amounts contributed (in the pension plan) by external funding at no extra cost. However, in the presence of asymmetric information, agency costs and transaction costs, external funding may be difficult or costlier to obtain, which could mean that the firm has to forgo profitable investment opportunities and consequently compromise future performance. On the other hand, capital expenditures and future firm performance are not always fully aligned and this is a point of differentiation of this paper. That is because a firm can be profitable and have low capital expenditures, which is the case for firms that choose to pay out their profits as dividends or use their profits for stock buybacks.

An et al. (2013) find that DB pension plan sponsors on the verge of bankruptcy and sponsors with severely underfunded plans alter their pension asset allocation policies, taking higher risks with their pension funds. On the other hand, Rauh (2009) finds that firms with

poorly funded pension plans and weaker credit ratings allocate a greater share of pension assets to safer securities. Cocco (2014) states that the mixed evidence in the literature regarding the pension asset allocation policies of financially distressed firms may be a result of these papers' focus on the probability of distress while not considering the costs of financial distress, which are also important.

Franzoni (2009) investigates the relevance of the financial conditions of DB pension plan sponsors in determining the firms' share prices, immediately after transferring funds towards their plans. The author finds that the share prices of more financially constrained firms drop significantly more strongly when such contributions occur. Further, Franzoni and Marin (2006) find that the market significantly overvalues firms with severely underfunded pension plans and undervalues firms with pension surpluses. They attribute this result to investor under-reaction to pension plan information.[3] This paper differs from this literature as well, as it explores the relationship between pension underfunding and firm performance, which is not the same as stock market returns. That is because stock market returns are a reflection of how investors perceive the performance of a firm, including future growth potential. Firm performance, as measured by ROA, is an assessment of managerial ability to generate profits and is a more direct firm performance measure compared to stock market returns. In addition, firm performance is not always positively followed by positive stock market returns; in fact, returns can be negative if profits fall short of investor expectations.

This paper also contributes to the extant literature that tries to relate firm performance and dividend payout using a range of factors. These factors include firm-specific information and corporate governance characteristics. [See for instance Agrawal and Knoeber (1996), Bhagat and Bolton, (2008), Denis and Osobov (2008), Guest (2009), Liu et al. (2015) and Kang

[3] Similarly, Gallagher and McKillop (2010) suggest that unfunded pension liabilities are not as aggressively priced as traditional leverage in corporate bond spreads while Wang and Zhang (2014) postulate that corporate bond ratings do not fully capture pension underfunding risk.

et al. (2018), among others]. I contend that such studies trying to identify the determinants of firm performance and dividend payout should also consider the funding level of pension liabilities in their specifications, a measure that is easy to find from the sponsoring firms' balance sheets. Finally, I assert that to the best of my knowledge, this is the first study to consider the relation between funding levels of DB pension plans and dividend payouts of the respective sponsoring firms in the US.[4]

The remainder of this paper is structured as follows. In Section 2, I discuss the regulatory framework and develop the hypotheses. In Section 3, I describe the sample of data and in Section 4 I talk about the methodology. In Section 5, I present the results, in Section 6, I conduct robustness testing and I conclude the paper in Section 7.

2. Regulatory framework and hypotheses

2.1. Is the funding level of DB pension plans related to the sponsoring firm's performance?

Current regulations require defined-benefit (DB) pension plan sponsors to ensure that their plans remain adequately funded. Thus, the sponsors need to frequently contribute funds towards their plans to cover the benefits that plan participants accumulate and gradually amortize funding deficits, if any. Moreover, the Pension Protection Act (voted into law in 2006 but with the first provisions being enforced in 2008) stipulates additional funding requirements for DB pension plans, thus increasing the amount of minimum required contributions that sponsors are required to make towards their pension plans.

In order to understand the rationale behind the additional contribution requirements, it is essential to discuss in further detail the framework within which firms sponsoring DB pension plans operate. Figure 1, which I adapt from Cocco (2014), depicts that while the

[4] There have been several studies exploring the relationship between pension funding levels, pension contributions and dividends payments, for UK-based firms, finding mixed results (Armitage and Gallagher, 2019; Bunn and Trivedi, 2005, Bunn et al. 2018; Liu and Tonks, 2013 and references therein).

balance sheets of sponsoring firms and their respective plans are separate, the pension deficit, that is essentially the difference between the fair value of pension assets and liabilities, is regarded as a liability (debt) on the sponsoring firms' balance sheets. Therefore, firms need to make additional contributions in their DB pension plans (similar to periodic debt repayments), particularly since 2008 when the Pension Protection Act (PPA) was enforced, to gradually eradicate deficits. These contributions are reported as expenses on the sponsoring firms' balance sheets and, as such, they are negatively correlated to accounting profits. This informs the first hypothesis.

Hypothesis 1: Among all defined-benefit pension plan-sponsoring firms those that sponsor underfunded plans will exhibit decreased performance, *ceteris paribus*.

[INSERT FIGURE 1 HERE]

2.2. Is the funding level of DB pension plans related to the dividend policy the sponsoring firm would likely follow?

The fact that firms sponsoring underfunded DB pension plans exhibit reduced profitability raises the question of whether the same relation holds between pension funding levels and the level of dividends paid out by the sponsoring firms. Naturally one would expect that, if a firm is sponsoring an underfunded DB pension plan, it would reduce dividends as a response to the requirement of additional fund contributions to keep its plan well-funded. Furthermore, I find it reasonable that sponsors of underfunded DB pension plans would revise their dividend payout ratios downwards, as they do with capital expenditures, to maintain a reasonable level of fund liquidity which is necessary to finance the ongoing running costs in their firms. This informs the second hypothesis.

Hypothesis 2: Among all defined-benefit (DB) pension plan-sponsoring firms those which sponsor underfunded plans will revise their dividend payout ratios downwards, *ceteris paribus.*

3. Data and sample selection

For the final dataset, I combine data from three different databases. The first is Compustat, from where I take variables related to the sponsoring firm and pension-related data. Second, I use CRSP to obtain data for estimating firm age and third, I use corporate governance and audit-related data from MSCI (formerly KLD and GMI Ratings). All three databases are provided by Wharton Research Data Services (WRDS).[5] The final dataset consists of 42,633 firm-year observations, spanning 1998-2016, and is formed after combining data from the three databases and filtering out entries of non-defined benefit (DB) pension plans. I list the dependent and independent variables, used in the econometric models, in Table 1.

[INSERT TABLE 1 HERE]

3.1. Dependent variables

For firm performance, I employ two widely-used measures from the corporate finance literature, Return on Assets *(ROA)* and *Tobin's Q* ratio (Lang et al., 1989; Bharadwaj et al., 1999; Short and Keasey, 1999; Frijns et al., 2016; Hauser, 2018). *ROA* is the ratio of firm Net Income over Total Assets while *Tobin's Q* is the ratio of total firm market value (Market Value of Equity and Total Liabilities) over the total value of firm assets. While *ROA* is a backward-looking form of performance, as it shows how effectively the firm uses its resources to generate profits, *Tobin's Q* is a forward-looking form, because it reflects the firm's prospects as viewed by the stock market. Both measures have similarities with stock market performance (i.e. stock returns) but there are also notable differences.[6] This is a point of differentiation of this paper from prior literature (e.g., Franzoni and Marin, 2006; Franzoni, 2009), proxying for firm performance with stock market returns.

[5] WRDS data require user registration and can be accessed via https://wrds-www.wharton.upenn.edu/.
[6] For instance, a firm can be profitable but generate negative stock market returns. This may happen if profits fall short of expectations and in such a case ROA will be positive but the stock market price will decline. In the same example the Q ratio may be greater than unity (1), indicating that the market firm-value is greater than the book firm-value, if the long-term expectations of the stock market in the firm remain positive.

The third dependent variable I use is the payout ratio *(Payout)*, measured as the proportion of the annual Net Income that the firm pays out to shareholders in the form of dividends and share repurchases.

3.2. Firm performance explanatory variables

In principle, the explanatory variable of interest would be additional required contributions, which are needed when DB pension plans lose their fully funded status. However, this information is not available since only total contributions are reported in the financial statements. As such I proxy for it with the level of funding of pension liabilities ($Plan\_Fund$) that I discuss below.

3.2.1. Pension plan funding

Pension plan funding is defined as the ratio of pension assets over projected benefit obligations and the formula of estimation is given in Equation (1).

$$Plan\_Fund = \frac{Pension\ Assets}{Projected\ Benefit\ Obligations} \quad (1)$$

When this ratio is above a stipulated threshold, the corresponding pension plan is considered well-funded. When it drops to values below the stipulated threshold the pension plan is considered underfunded, and at that point additional mandatory contributions are required by law.[7] The extent of the underfunding determines the amount of additional contributions needed, meaning that the closer pension plan funding ratio gets to zero, the higher the contributions sponsors have to make.

[7] Prior to 2008, a DB pension plan was considered fully funded if the funding ratio was 90% or above. Since 2008, when the Pension Protection Act was enforced, this threshold changed to 92% in 2008, 94% in 2009, 96% in 2010 and 100% in 2011 onwards.

3.2.2. Firm and pension plan variables

I expect the size of a pension plan (*Plan_Size*), defined as the natural logarithm of unity (1) added to total pension assets, to be negatively correlated with firm profitability. All other factors being the same, large pension plans would require large amounts of a firm's income to remain well-funded, which in turn reduces profitability. On the other hand, larger values of this variable may indicate a larger firm[8]; prior studies find that such firms achieve economies of scale in monitoring top management (Himmelberg et al., 1999). I control for terminated or frozen (*Frozen*) DB pension plans since, for such plans, the accumulation of future benefits is significantly slowed down and, in some cases, even completely halted. As such less funds will need to be contributed by sponsors in their pension plans implying higher firm profitability. I also control for *Leverage*, defined as total debt divided by shareholders' equity. *Leverage* may act as a monitoring mechanism for managers to achieve higher performance, therefore reducing agency costs. [See, for instance, Jensen and Meckling (1976), Jensen (1986) and Berger and Bonaccorsi di Platti (2006) among others.] Bartram (2015) finds that DB pension plan-sponsoring firms exhibit higher leverages and may be associated with higher performance. On the other hand, higher leverages increase the variability of earnings (Li et al., 2015) and hence bear higher likelihood of bankruptcy.

The next two control variables are based on the principle that firms with financial difficulties will be less profitable. The first variable is cash flows from operations (*CFO*); this accounts for the financial constraints a firm may be facing and which can impact its profitability.[9] I also control for financial distress by using an indicator variable that equals one (1), if Altman's Z-score is smaller than 1.81 (*Low_Z*) and zero (0) otherwise. This measure has

[8] The in-sample correlation of pension plan size, given by the logarithm of unity added to the fair value of pension assets, and firm (plan-sponsor) size, given by the logarithm of unity added to total value of firm assets, is estimated at 0.7312. Because this number is high, I make the assumption that large pension plans proxy for large firms and as such I only control for pension plan size.

[9] It is also important to highlight the findings in Hadlock and Pierce (2010), that firm age and size are excellent proxies for financial constraints.

also been used in Kang et al. (2018) and it is based on the Z-score measure developed by Altman (1968).

Further, I control for firm age (*Age*), measured as the logarithm of the number of years a firm has equity data available in CRSP. Prior literature finds that more mature firms may face lower growth opportunities and have increased difficulties in achieving competitive financial performance, if compared to younger firms (Li et al., 2015).

3.2.3. Additional variables

Finally, I control for other characteristics that can affect firm performance. In this instance, two variables are considered: (a) board independence (*Board_Ind*) and (b) the auditing firm the plan sponsor buys services from (*Audit_Big4*). The first variable is defined as the proportion of board directors that are not firm employees. Outside directors can act in favor of shareholders' interests by independently monitoring top management, reducing therefore agency costs (Cocco and Volpin, 2007; Linck et al., 2008; Li et al., 2015) but are less informed about a firm's constraints and opportunities (Linck et al., 2008). In addition, Vafeas and Vlittis (2016) find a positive link between the proportion of outside directors on the board and DB pension plan funding levels. The second variable is an indicator variable that takes the value one (1) if a plan sponsor uses services from one of the Big4 audit firms (PwC, Deloitte, Ernst & Young and KPMG). I consider this variable to account for prior literature findings that larger auditors provide services of higher standards and are thus more likely to avoid professional misconduct (Francis and Yu, 2009).

3.3. Dividend payout explanatory variables

As in the case with firm performance, the main variable of interest is pension plan funding ($Plan\_Fund$). I expect that firms sponsoring DB pension plans with low levels of funding to cut down a significant amount of their profits, which would otherwise be invested

or distributed to shareholders as dividends, in order to meet the increased requirements for pension contributions.

I control for liquidity, measured as Cash Flows from Operations (CFO) since it can impair the ability of a firm to pay dividends. Several studies use equity beta as a measure of market risk (e.g., Rozeff, 1982; Lloyd et al., 1985). In this paper, I use a measure of financial distress (Low_Z) based on the Z-score of Altman (1968) to control for that. Next, I control for $Leverage$. Higher levels of leverage may be associated with lower dividend distributions due to higher interest payments which reduce the cash availability. On the other hand, depending on the capital structure policy of the firm, higher levels of leverage may be associated with higher dividend distributions to attract more shareholders, thus re-balancing the capital structure of the firm. I additionally control for the size of the pension plan ($Plan\_Size$), which is also indicative of the size of the firm. Prior literature finds that smaller firms face higher financing costs, translating into lower dividend distributions (Alli et al., 1993). I also control for terminated or frozen (*Frozen*) plans since sponsors of such plans save considerable amounts of money from cash contributions they would otherwise have to make towards their plans, due to the increasing benefits of the plan participants. These saved amounts are additional profit which can be distributed to shareholders as dividends. I further control for the age of sponsoring firms (Age), since mature firms may have excess reserves due to lower investment opportunities and fewer capital expenditures (Grullon et al., 2002); thus, they may be able to pay higher dividends.

Finally, I control for the quality of corporate governance and audit within the sponsoring firm, with a variable that measures board independence ($Board\_Ind$) and an indicator variable ($Audit\_Big4$) that takes the value one (1) if the sponsoring firm is buying services from one of the Big4 audit firms.

4. Research design

I employ panel regression models to exploit the panel character of my dataset (i.e. cross-sectional, time-series). The main advantages of panel regression analysis include controlling for unobservable time-invariant factors, which can potentially affect the dependent variable, by taking fixed effects. Panel regression analysis also allows controlling for correlation of the regression errors at the group level, leading to robust estimates of standard errors and the t-statistics (Hoechle, 2007; Colin Cameron, and Miller, 2015).

I use the panel regression model, given in Equation (2), to test Hypotheses 1 and 2 which state that firms sponsoring DB pension plans that are underfunded exhibit reduced performance (profitability) and pay lower dividends. The dependent variable ($Y_{i,t+1}$), which stands for sponsoring firm's "i" profitability (ROA or Tobin's Q) and dividend payout, is taken one year ahead of the independent variables as means of preventing endogeneity / simultaneity bias. The main independent variable ($Plan\_fund_{i,t}$) represents the sponsoring firm's "i" pension funding level. FE stands for Fixed Effects taken at the firm level. Finally, $\boldsymbol{\varepsilon_{i,t}}$ represents the regression error. All remaining variable definitions are provided in Table 1.

$$Y_{i,t+1} = \beta_0 + \beta_1 * Plan_{Fund_{i,t}} + \beta_2 * Plan_{Size_{i,t}} + \beta_3 * Frozen_{i,t} + \beta_4 * Low_{Z_{i,t}} + \beta_5 * Leverage_{i,t} + \beta_6 * CFO_{i,t} + \beta_7 * Age_{i,t} + \beta_8 * Board\_Ind_{i,t} + \beta_9 * Audit\_big4_{i,t} + Year\ Indicators + FE + \varepsilon_{i,t} \quad (2)$$

5. Results

Table 2 presents descriptive statistics of the dependent and explanatory variables over the period 1998-2016.

[INSERT TABLE 2 HERE]

5.1. Dependent Variables Descriptive Statistics

ROA, which I use as proxy for firm profitability, has mean (median) value equal to 0.0247 (0.0283). Volatility is higher, with a standard deviation of 0.0865, suggesting that negative values (annual losses) are common. *Tobin's Q* mean value is estimated at 1.5113 and the median at 1.2436. The Q's standard deviation is estimated at 0.7885. Finally, the mean (median) of *Payout Ratio* is estimated at 0.5095 (0.3274) with 1.1895 standard deviation.

5.2. Main explanatory variable descriptive statistics

Pension plan funding *(Plan_Fund)*, has a mean (median) value of 0.7917 (0.8083) and a standard deviation of 0.3131. These numbers suggest that the average plan in the sample has significant funding deficiencies in place, something that should be cause for concern to investors and policy makers.

5.3. Does the DB pension plan underfunding reduce the sponsoring firm's performance?

In order to test Hypothesis 1, I estimate Equation (2), using Return on Assets *(ROA)* as the dependent variable and report the results in Table 3. Overall, firm performance, as measured by *ROA*, is highly associated with the pension funding level *(Plan_Fund)*. The estimated coefficients, which range from 0.0110 to 0.0199 depending on the model specification, are both statistically and economically significant. The results suggest that a 1% drop in pension plan funding level can induce a drop to *ROA* ranging 1.1 to 1.99 basis points. Taking into consideration the in-sample median fair value of firm total assets[10], estimated at 2,308 million USD, the reduction in firm profitability from a 1% decline in the *Plan_Fund*, ranges from 0.2539 to 0.4593 million USD *ceteris paribus*. Overall, the results provide support to Hypothesis 1.

[10] I consider the median of the sorted sample, instead of the average (mean) value, because the distribution of firm total assets is highly skewed to the right. Descriptive statistics for firm total assets remain untabulated but can be provided upon request.

[INSERT TABLE 3 HERE]

5.4. Does the funding level of DB pension plans influence the growth of the sponsoring firm?

In Table 4, I present results of estimating Equation (2) with the Tobin's Q ratio as the dependent variable. The estimated coefficients of $Plan\_Fund$ are not statistically significant but are positive as expected. This finding has important implications because unlike ROA, which is a backward-looking measure, the Q ratio is forward-looking, reflecting investors' perspectives and expectations in the firm over the long run. The non-significant coefficient estimates suggest that investors do not take the pension funding level of the sponsoring firm into consideration when evaluating it. This finding is in line with prior literature (Franzoni and Marin, 2006, p.1) finding that "investors do not anticipate the impact of the pension liability on future earnings, and they are surprised when the negative implications of underfunding ultimately materialize".

[INSERT TABLE 4 HERE]

5.5. Does the funding level of DB pension plans affect dividend payouts of sponsoring firms?

In Table 5, I present the results of estimating Equation (2) with the payout ratio as the dependent variable. The results evince a significant positive association between $Payout$ and pension plan funding ($Plan\_Fund$) with the estimated coefficients ranging from 0.122 to 0.373. These numbers suggest, for instance, that a 1% drop in the pension funding level would sever dividend payouts by 0.122%-0.373%, *ceteris paribus*. Considering that the median net income (profit) of all the sponsoring firms in the sample is 52.98 million USD, then a 1% drop in the pension funding level would induce an expected reduction in the payout (dividends and stock repurchases) of 0.064-0.198 million USD. In a similar manner, a 5% drop in pension funding level would reduce dividends by 0.323-0.988 million USD. Overall, the results suggest

that firms cut down dividend distributions as a response to the contributions they have to make towards their underfunded DB pension plans, a finding that lends support to Hypothesis 2.

[INSERT TABLE 5 HERE]

6. Additional analysis and robustness tests

6.1. Removing the effect of the crisis years

To test the robustness of the main results (Tables 3-5) I remove data from the recent crisis years from the sample. As the crisis is an exogenous event that can potentially impact the pension funding levels as well as the firm profitability and payouts, I isolate it by creating a "crisis-free" dataset. Then I repeat the regression analysis, to test if the main results remain significant. In particular, for this test, I exclude data from the period 2007-2008 and then re-estimate Equation (2) for ROA, Tobin's Q and Payout as dependent variables. Overall, the results, given in Appendix A, stay in the same direction and retain their statistical and economic significance, with the inference remaining unchanged.

6.2. Alternative measure for pension funding

To further test the robustness of the main results (Tables 3-5), I use an alternative measure to proxy for pension funding level, an indicator variable that takes the value of one (1) if a pension plan is stipulated as $Underfunded$ according to the US pension law. Based on the Employee Retirement Income Security Act (ERISA), the first comprehensive US federal pension law for private pension plans enacted in 1974, a single employer-defined benefit pension plan is considered $Underfunded$ if its pension funding level ($Plan\_Fund$) is below 90%. Since 2008, when the Pension Protection Act (PPA)[11] was enforced, this threshold was

[11] PPA is the first major reform of ERISA and was voted into law in 2006 by the Bush administration. The reform was deemed as necessary to tackle the deteriorating funding levels of private pension plans in the US and its first provisions were enforced in 2008. For more info visit, https://www.govinfo.gov/content/pkg/PLAW-109publ280/pdf/PLAW-109publ280.pdf.

subsequently changed to 92% in 2008, 94% in 2009, 96% in 2010 and 100% in 2011 onwards.[12] In the light of this information I estimate the regression model given in Equation (3).

$$Y_{i,t+1} = \beta_0 + \beta_1 * Underfunded_{i,t} + \beta_2 * Plan_{Size\,i,t} + \beta_3 * Frozen_{i,t} + \beta_4 * Low_{Z\,i,t} + \beta_5 * Leverage_{i,t} + \beta_6 * CFO_{i,t} + \beta_7 * Age_{i,t} + \beta_8 * Board\_Ind_{i,t} + \beta_9 * Audit\_big4_{i,t} + Year\ Indicators + FE + \varepsilon_{i,t} \quad (3)$$

The difference between the regression models of Equations (2) and (3) is the main independent variable, being $Underfunded$ in Equation (3) instead of $Plan\_Fund$ in Equation (2). Everything else remains the same. Estimating Equation (3) yields the results in Appendix B; these results are similar to the main results, suggesting that underfunded pension plans are associated with lower firm performance and dividend payouts. Overall, the main results of the paper remain robust to this test.[13]

6.3. Additional controls for firm financial constraints

In this paper I control for financial constraints in both regression models [Equations (2) and (3)] with cash flows from operations (CFO). Although CFO is sufficient in itself, there are several other established proxies for financial constraints that have been developed in prior literature; for example, the measures developed by Cleary (1999) and Kaplan and Zingales (1997). To account for these alternative measures, I re-estimate the main results (Tables 3-5) using the Cleary index, instead of the CFO, and report results in Appendix C. The new results are qualitatively the same, even slightly stronger, compared to the main ones.

As further noted, Hadlock and Pierce (2010) evaluate several well-established measures for firm financial constraints and find that these measures are not always the most appropriate choice. The authors further find that firm age and size, both of which I control for in the

[12] Underfunded plans (Underfunded) comprise on average 0.716 (71.6%) of the sample (further summary statistics are provided in Table 2).

[13] Note that the statistical significance of the $Underfunded$ estimated coefficients is relatively smaller (compared to those of $Plan\_Fund$), but this is expected as an indicator variable cannot be as informative as a variable taking the full range of pension funding values.

regression models (Equations (2) and (3)), are particularly strong predictors of financial constraint levels.

As a consequence, I postulate that the results in this paper are robust to firm financial constraints.

6.4. The FASB Statement No. 158

In September 2006 the Financial Accounting Standards Board (FASB), an independent organization responsible for establishing accounting and financial reporting standards in the United States, has released statement no. 158 which, among other things, required single-employer DB pension plan sponsors to recognize the underfunded (overfunded) status of their plans as liability (asset) on their financial statements. The provisions of Statement No. 158 were enforced for fiscal years ending after the 15th of December 2006 (15th June 2007) for publicly traded (private) firms.[14] In this paper I use data from single-employer publicly trader firms sponsoring DB pension plans. Thus, to test whether the increased transparency, from adhering to the provisions of Statement No. 158, had any effect on firm profitability and dividend payout, I split the sample period to pre-2006 (1998-2005) and post-2006 (2006-2016) and re-estimate the main results for both subsamples. For the pre-2006 period all the results are statistically insignificant and thus remain untabulated. For the post-2006 period the results are reported in Appendix D and suggest that DB pension funding does not have a significant effect on firm profitabity (ROA and Tobin's Q). In contrast, DB pension funding has a strong positive association with dividend payout and is consistent with the main results reported in Table 5.

[14] For more information visit, https://www.fasb.org/page/PageContent?pageId=/reference-library/superseded-standards/summary-of-statement-no-158.html&bcpath=tff.

7. Summary and Conclusions

In this paper I employ a large sample of defined-benefit (DB) pension plans from publicly-traded US corporations over the period 1998-2016, and explore the impact of pension funding levels on firm performance and dividend policy. I employ panel regression analysis and find evidence that sponsors of underfunded DB plans exhibit significantly reduced firm performance and also pay smaller amounts in dividends. The results are robust to several settings, including removing the impact of the 2007-2008 global financial crisis on the US economy, considering an alternative measure for pension funding, controlling for financial constraints of the plan sponsoring firms and more. The findings of this paper should be cause for concern to a wide range of stakeholders, including investors, pensioners, employees and managers whose wealth, pensions, jobs, salaries, and bonuses are linked to the corporate characteristics that pension funding levels can impact.

As a further remark, I advise investors to take the pension funding levels of DB pension plan sponsoring firms into careful consideration, if they consider purchasing their shares. That is because they bear the risk of losing considerable amounts of wealth if the firms they invest in are facing severe pension deficits. Furthermore, since the current pension law allows pension underfunding to be smoothed out over a long horizon of years, corporations are given the option to underfund their pension plans in order to report higher profitability and pay larger dividends in the short run, which might suit equity investors, but is a cause of concern for pensioners. It is my view that policy makers should intervene by imposing stringent pension regulations and higher financial penalties (e.g. via amending the pension law) to stop such practices because once the pension underfunding settles in, it might be difficult to reverse.

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Tables and Figures

Table 1

Variable definitions

This table provides the definitions, sources of data and formulae used to compute the variables used in Equations (2) and (3). The first column provides the full name and the second column, the symbol (shortened name: used in the equations) of every variable. Finally, the third column contains the formula estimating each variable and the source of data.

Dependent Variables	**Symbol**	**Definition & Source**
Return on Assets	ROA	[Firm Profit After Tax (Compustat item NI)/Total Firm Assets (Compustat item AT)]
Tobin's Q Ratio	Tobin's Q	[Total Firm Assets (Compustat Item AT) + Market Value of Equity (Compustat Item CSHO * Compustat item PRCC_F) – Common Equity (Compustat Item CEQ)]/Total Firm Assets (Compustat Item AT).
Dividends Payout Ratio	Payout	[Common and Preferred Dividends Paid (Compustat item DVC + Compustat item DVP) + Amount for repurchasing Common and Preferred Stocks (Compustat item PRSTKC)]/Income Before Extraordinary Items (Compustat item IB).
Independent Variables	**Symbol**	**Definition & Source**
Pension Plan Funding	Plan_Fund	Fair Value of Pension Assets (Compustat item PPLAO)/Projected Benefit Obligations (Compustat item PBPRO).
Underfunded Status Indicator	Underfunded	Indicator variable set to 1 if funding level is below 0.9 for years preceding 2008, 0.92 for 2008, 0.94 for 2009, 0.96 for 2010 and 1 for 2011 or later. Set to 0 otherwise.
Size of Pension Plan	Plan_Size	Natural logarithm of [1 + Total Plan Assets (Compustat item PPLAO)]

Table 1 (Continued)

Independent Variables	Symbol	Definition & Source
Terminated or Frozen Pension Plan	Frozen	Indicator variable that takes the value one (1) if the present value of expected future pension payments (Compustat item PPSC) is equal to zero.
Firm Leverage Ratio	Leverage	Long-term debt (Compustat item DLTT) + Debt in current liabilities (Compustat item DLC)/Shareholders' Equity (Compustat item SEQ).
Cash Flows from Operations	CFO	[Cash Flows from Operations (Compustat item OANCF)/Total Firm Assets (Compustat item AT)].
Firm Age	Age	Natural logarithm of [Current Year – Year on which Equity Data becomes available for the first time (CRSP item BEGDATE)].
Board Independence	Board_Ind	Number of Board of Directors that are not firm employees (MSCI item DIRECTORSOUTSIDE)/Total Number of members in Board of Directors (MSCI item DIRECTORSTOTAL).
Big4 Auditor Indicator	Audit_Big4	Indicator variable that takes the value one (1) if a plan sponsor uses services from one of the Big4 audit firms (PwC, Deloitte, Ernst & Young and KPMG). Set to zero (0) otherwise.
Low Z Score Indicator	Low_Z	Indicator variable set to 1 if the Altman Z Score for the plan sponsor (firm) is below the 1.81 threshold; set to 0 otherwise. Altman Z Score is estimated by 1.2 * [Current Firm Assets (Compustat item ACT) – Current Firm Liabilities (Compustat item LCT)]/Total Firms Assets (Compustat item AT) + 1.4 * Retained Earnings (Compustat item RE)/Total Firm Assets (Compustat item AT) + 3.3 * Operating Income After Depreciation (Compustat item OIADP) / Total Firm Assets (Compustat item AT) + 0.6 * [Firm Stock Price (Compustat item PRCC_F) * Number of Shares Outstanding (Compustat item CSHO)] / [Debt in Current Liabilities (Compustat item DLC) + Long Term Debt (Compustat item DLTT)] + Total Sales (Compustat item SALE) / Total Firm Assets (Compustat item AT).

Table 2

Descriptive Statistics (1998-2016)

This table reports descriptive statistics of the dependent and independent variables used in Equations (2) and (3), with the data spanning 1998-2016. All variables are winsorized at 1% and 99% levels to remove outliers. Variable definitions are provided in Table 1.

Dependent Variables	**Observations**	**Mean**	**Standard Deviation**	**p25**	**p50**	**p75**
ROA	38494	0.0248	0.0863	0.0061	0.0283	0.0613
Tobin's Q	33978	1.5126	0.7903	1.0400	1.2444	1.6887
Payout	35976	0.5095	1.1895	0.0000	0.3274	0.7485
Independent Variables	**Observations**	**Mean**	**Standard Deviation**	**p25**	**p50**	**p75**
Plan_Fund	40128	0.7914	0.3131	0.6610	0.8083	0.9530
Underfunded	40128	0.7175	0.4502	0.0000	1.0000	1.0000
Plan_Size	41046	4.6032	2.5443	2.7874	4.6967	6.4478
Frozen	40908	0.1072	0.3094	0.0000	0.0000	0.0000
Low_Z	27844	0.2288	0.4201	0.0000	0.0000	0.0000
Leverage	42945	1.0960	3.0761	0.2541	0.6909	1.3654
CFO	41570	0.0749	0.0717	0.0304	0.0717	0.1135
Age	31539	2.8368	1.0189	2.1972	2.9957	3.6109
Board_Ind	13341	0.7394	0.1573	0.6667	0.7778	0.8750
Audit_Big4	13354	0.9171	0.2757	1.0000	1.0000	1.0000

Table 3

Panel regressions (ROA & Plan Funding, 1998-2016)

ROA is given by the ratio of net profits over the total value of firm assets. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using a dataset spanning 1998-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1) ROA	(2) ROA	(3) ROA
Plan_Fund	0.0160***	0.00922*	0.0164*
	(0.00557)	(0.00545)	(0.00894)
Plan_Size	-0.00760***	-0.00656***	-0.00885***
	(0.00162)	(0.00176)	(0.00235)
Frozen	0.00293	0.00582	-0.00206
	(0.00471)	(0.00460)	(0.00659)
Low_Z	-0.0225***	-0.0209***	-0.0113***
	(0.00260)	(0.00282)	(0.00414)
Leverage	-0.000699***	-0.000398	0.000236
	(0.000260)	(0.000261)	(0.000321)
CFO	0.312***	0.325***	0.286***
	(0.0168)	(0.0182)	(0.0249)
Age		0.00394*	0.0130***
		(0.00234)	(0.00435)
Board_Ind			-0.0193**
			(0.00777)
Audit_Big4			0.00463
			(0.00597)
Constant	0.0400***	0.0321***	-0.00710
	(0.00712)	(0.00892)	(0.0175)
Observations	23799	19793	9305
Adj. R-Square	0.0935	0.0997	0.0959
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Table 4

Panel regressions (Tobin's Q & Plan Funding, 1998-2016)

Tobin's Q is given by the ratio of the total market value of liabilities and equity over the total value of assets. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using a dataset spanning 1998-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	Tobin's Q	Tobin's Q	Tobin's Q
Plan_Fund	0.0234	0.0463	0.115
	(0.0500)	(0.0552)	(0.0905)
Plan_Size	-0.0733***	-0.0809***	-0.0899***
	(0.0141)	(0.0163)	(0.0246)
Frozen	0.0433	0.0320	-0.0384
	(0.0361)	(0.0373)	(0.0412)
Low_Z	-0.0642***	-0.0644***	-0.0747***
	(0.0174)	(0.0203)	(0.0222)
Leverage	-0.00497***	-0.00460**	-0.000773
	(0.00180)	(0.00191)	(0.00263)
CFO	1.615***	1.650***	1.760***
	(0.116)	(0.135)	(0.181)
Age		0.0205	0.0750*
		(0.0264)	(0.0397)
Board_Ind			-0.171***
			(0.0578)
Audit_Big4			0.0672*
			(0.0384)
Constant	1.802***	1.779***	1.648***
	(0.0688)	(0.0930)	(0.153)
Observations	23658	19754	9305
Adj. R-Square	0.100	0.103	0.148
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5

Panel regressions (Payout & Plan Funding, 1998-2016)

Payout is the proportion of firm profits paid out to shareholders in the form of dividends and stock repurchases. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using a dataset spanning 1998-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	PayOut	PayOut	PayOut
Plan_Fund	0.152**	0.191**	0.411***
	(0.0748)	(0.0821)	(0.128)
Plan_Size	-0.0204	-0.0300	-0.0880**
	(0.0208)	(0.0231)	(0.0360)
Frozen	-0.0832	-0.0727	-0.110
	(0.0583)	(0.0619)	(0.0992)
Low_Z	-0.209***	-0.163***	-0.205***
	(0.0372)	(0.0402)	(0.0582)
Leverage	0.00127	0.00166	0.00394
	(0.00339)	(0.00364)	(0.00420)
CFO	0.765***	0.663***	0.899***
	(0.161)	(0.175)	(0.273)
Age		0.0777**	0.160***
		(0.0333)	(0.0610)
Board_Ind			0.0423
			(0.111)
Audit_Big4			-0.104
			(0.0858)
Constant	0.466***	0.324***	-0.00710
	(0.0944)	(0.120)	(0.221)
Observations	22896	19032	9086
Adj. R-Square	0.0113	0.0110	0.0189
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

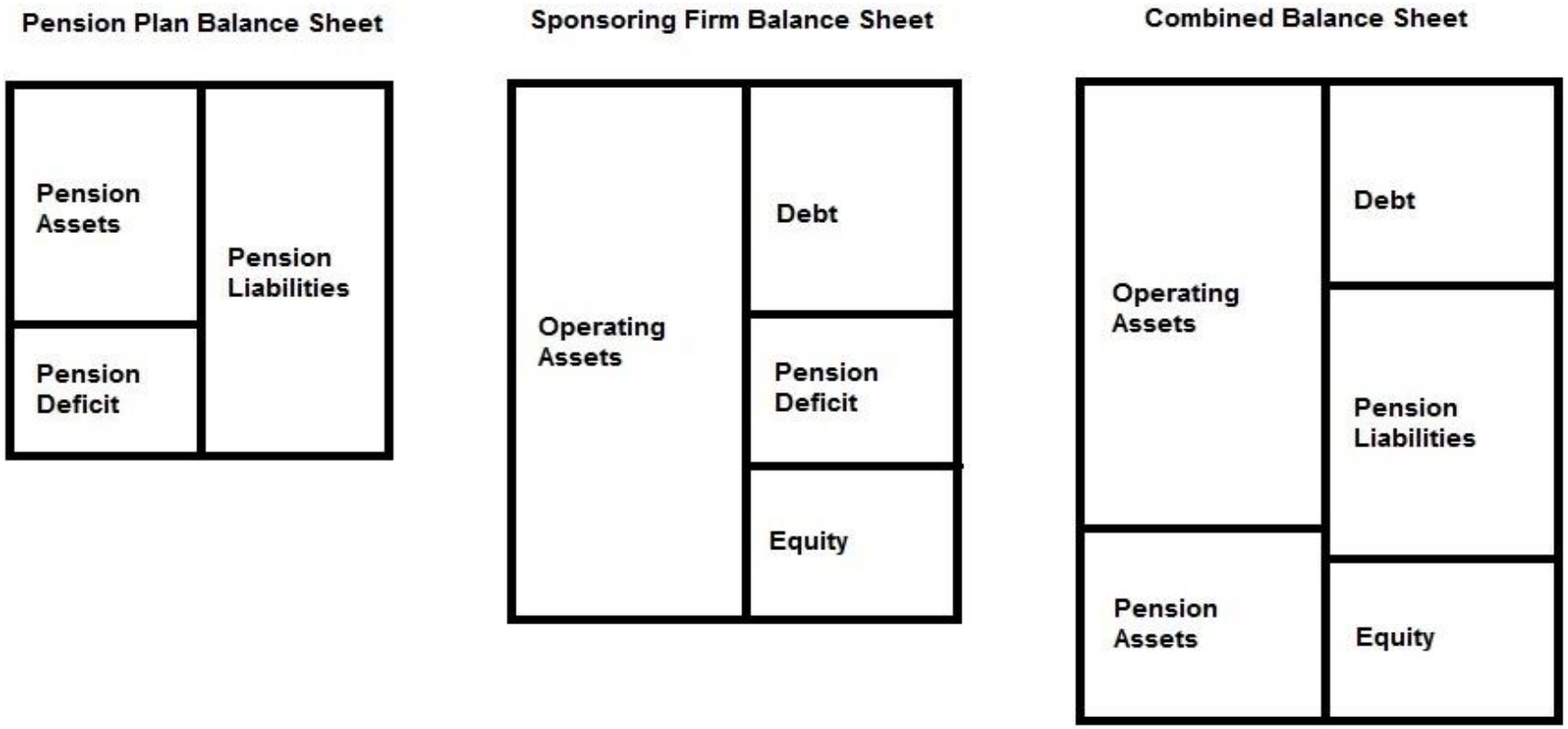

Figure 1

Plan, Firm and Combined Balance Sheet[+++]

+++ Note: Adapted from Cocco, J. (2014). Corporate Pension Plans. Annual Review of Financial Economics, Volume 6, Pages 163-184.

Appendix A

Table A1

Panel regressions (ROA & Plan Funding, 1998-2007 & 2010-2016)

ROA is given by the ratio of net profits over the total value of firm assets. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using data in 1998-2007 & 2010-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1) ROA	(2) ROA	(3) ROA
Plan_Fund	0.0169***	0.0110**	0.0241**
	(0.00574)	(0.00557)	(0.00942)
Plan_Size	-0.00760***	-0.00636***	-0.00897***
	(0.00166)	(0.00178)	(0.00260)
Frozen	0.00277	0.00602	-0.00326
	(0.00501)	(0.00481)	(0.00694)
Low_Z	-0.0248***	-0.0224***	-0.0153***
	(0.00295)	(0.00318)	(0.00466)
Leverage	-0.000656**	-0.000455	0.000366
	(0.000284)	(0.000284)	(0.000371)
CFO	0.334***	0.346***	0.330***
	(0.0182)	(0.0197)	(0.0283)
Age		0.00309	0.0112**
		(0.00242)	(0.00459)
Board_Ind			-0.0208***
			(0.00776)
Audit_Big4			0.00125
			(0.00591)
Constant	0.0374***	0.0296***	-0.00746
	(0.00729)	(0.00917)	(0.0190)
Observations	21164	17614	7881
Adj. R-Square	0.100	0.106	0.110
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Table A2

Panel regressions (Tobin's Q & Plan Funding, 1998-2007 & 2010-2016)

Tobin's Q is given by the ratio of the total market value of liabilities and equity over the total value of assets. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using data in 1998-2007 & 2010-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	Tobin's Q	Tobin's Q	Tobin's Q
Plan_Fund	0.0402	0.0646	0.147
	(0.0532)	(0.0585)	(0.102)
Plan_Size	-0.0777***	-0.0838***	-0.0942***
	(0.0145)	(0.0166)	(0.0262)
Frozen	0.0435	0.0290	-0.0595
	(0.0394)	(0.0401)	(0.0466)
Low_Z	-0.0694***	-0.0712***	-0.0941***
	(0.0189)	(0.0222)	(0.0249)
Leverage	-0.00495**	-0.00503**	-0.00106
	(0.00199)	(0.00211)	(0.00296)
CFO	1.702***	1.738***	2.130***
	(0.128)	(0.148)	(0.223)
Age		0.0130	0.0808*
		(0.0277)	(0.0431)
Board_Ind			-0.173***
			(0.0621)
Audit_Big4			0.0607
			(0.0410)
Constant	1.798***	1.785***	1.601***
	(0.0714)	(0.0973)	(0.167)
Observations	21037	17581	7881
Adj. R-Square	0.103	0.106	0.161
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Table A3

Panel regressions (Payout & Plan Funding, 1998-2007 & 2010-2016)

Payout is the proportion of firm profits paid out to shareholders in the form of dividends and stock repurchases. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using data in 1998-2007 & 2010-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	PayOut	PayOut	PayOut
Plan_Fund	0.132*	0.189**	0.450***
	(0.0795)	(0.0872)	(0.143)
Plan_Size	-0.0207	-0.0288	-0.0896**
	(0.0218)	(0.0243)	(0.0394)
Frozen	-0.102	-0.101	-0.119
	(0.0623)	(0.0666)	(0.115)
Low_Z	-0.221***	-0.164***	-0.207***
	(0.0391)	(0.0415)	(0.0637)
Leverage	0.00187	0.00253	0.00468
	(0.00355)	(0.00390)	(0.00490)
CFO	0.865***	0.738***	1.089***
	(0.181)	(0.194)	(0.325)
Age		0.0880**	0.195***
		(0.0351)	(0.0628)
Board_Ind			0.0470
			(0.118)
Audit_Big4			-0.101
			(0.0877)
Constant	0.480***	0.291**	-0.157
	(0.0979)	(0.125)	(0.226)
Observations	20318	16898	7690
Adj. R-Square	0.0106	0.00962	0.0141
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix B

Table B1

Panel regressions (ROA & Underfunded, 1998-2016)

ROA is given by the ratio of net profits over the total value of firm assets. *Underfunded* is an indicator variable set to 1 if *Plan_Fund* is below 0.9 for years preceding 2008, 0.92 for 2008, 0.94 for 2009, 0.96 for 2010 and 1 for 2011 or later. Set to 0 otherwise. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using a dataset spanning 1998-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	ROA	ROA	ROA
Underfunded	-0.00528***	-0.00281	-0.00427
	(0.00191)	(0.00197)	(0.00275)
Plan_Size	-0.00608***	-0.00566***	-0.00694***
	(0.00144)	(0.00160)	(0.00197)
Frozen	0.00336	0.00617	-0.00128
	(0.00465)	(0.00457)	(0.00640)
Low_Z	-0.0227***	-0.0210***	-0.0115***
	(0.00259)	(0.00282)	(0.00412)
Leverage	-0.000709***	-0.000404	0.000226
	(0.000259)	(0.000261)	(0.000320)
CFO	0.312***	0.325***	0.287***
	(0.0168)	(0.0182)	(0.0249)
Age		0.00398*	0.0132***
		(0.00235)	(0.00437)
Board_Ind			-0.0193**
			(0.00778)
Audit_Big4			0.00470
			(0.00598)
Constant	0.0504***	0.0378***	-0.000733
	(0.00728)	(0.00907)	(0.0177)
Observations	23799	19793	9305
Adj. R-Square	0.0932	0.0996	0.0956
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B2

Panel regressions (Tobin's Q & Underfunded, 1998-2016)

Tobin's Q is given by the ratio of the total market value of liabilities and equity over the total value of assets. *Underfunded* is an indicator variable set to 1 if *Plan_Fund* is below 0.9 for years preceding 2008, 0.92 for 2008, 0.94 for 2009, 0.96 for 2010 and 1 for 2011 or later. Set to 0 otherwise. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using a dataset spanning 1998-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1) Tobin's Q	(2) Tobin's Q	(3) Tobin's Q
Underfunded	-0.00196	-0.00569	0.0122
	(0.0141)	(0.0156)	(0.0207)
Plan_Size	-0.0706***	-0.0757***	-0.0725***
	(0.0128)	(0.0148)	(0.0185)
Frozen	0.0445	0.0346	-0.0282
	(0.0360)	(0.0372)	(0.0408)
Low_Z	-0.0646***	-0.0653***	-0.0778***
	(0.0174)	(0.0203)	(0.0221)
Leverage	-0.00498***	-0.00463**	-0.000916
	(0.00180)	(0.00191)	(0.00263)
CFO	1.616***	1.652***	1.769***
	(0.116)	(0.135)	(0.181)
Age		0.0211	0.0780**
		(0.0264)	(0.0397)
Board_Ind			-0.171***
			(0.0577)
Audit_Big4			0.0678*
			(0.0385)
Constant	1.813***	1.801***	1.648***
	(0.0649)	(0.0907)	(0.153)
Observations	23658	19754	9305
Adj. R-Square	0.100	0.103	0.147
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B3

Panel regressions (Payout & Underfunded, 1998-2016)

Payout is the proportion of firm profits paid out to shareholders in the form of dividends and stock repurchases. *Underfunded* is an indicator variable set to 1 if *Plan_Fund* is below 0.9 for years preceding 2008, 0.92 for 2008, 0.94 for 2009, 0.96 for 2010 and 1 for 2011 or later. Set to 0 otherwise. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using a dataset spanning 1998-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	PayOut	PayOut	PayOut
Underfunded	-0.0478**	-0.0512**	-0.0782**
	(0.0225)	(0.0239)	(0.0324)
Plan_Size	-0.00769	-0.0130	-0.0435
	(0.0181)	(0.0200)	(0.0309)
Frozen	-0.0765	-0.0625	-0.0887
	(0.0582)	(0.0619)	(0.0999)
Low_Z	-0.209***	-0.165***	-0.210***
	(0.0372)	(0.0403)	(0.0582)
Leverage	0.00125	0.00163	0.00382
	(0.00338)	(0.00364)	(0.00420)
CFO	0.769***	0.668***	0.916***
	(0.161)	(0.175)	(0.273)
Age		0.0806**	0.168***
		(0.0335)	(0.0614)
Board_Ind			0.0412
			(0.111)
Audit_Big4			-0.100
			(0.0856)
Constant	0.567***	0.437***	0.134
	(0.0924)	(0.119)	(0.228)
Observations	22896	19032	9086
Adj. R-Square	0.0112	0.0108	0.0182
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Appendix C

Table C1

Panel regressions (ROA & Cleary Index, 1998-2016)

ROA is given by the ratio of net profits over the total value of firm assets. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. *Cleary index* is a proxy for firm (plan sponsor) financial constraints developed in Cleary (1999). Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using a dataset spanning 1998-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	ROA	ROA	ROA
Plan_Fund	0.0179***	0.0115**	0.0195**
	(0.00577)	(0.00572)	(0.00904)
Plan_Size	-0.00906***	-0.00808***	-0.0100***
	(0.00169)	(0.00179)	(0.00232)
Frozen	0.00191	0.00471	-0.000704
	(0.00496)	(0.00484)	(0.00656)
Low_Z	-0.0270***	-0.0248***	-0.0126***
	(0.00275)	(0.00298)	(0.00408)
Leverage	-0.000783***	-0.000428	0.000303
	(0.000266)	(0.000269)	(0.000331)
Cleary Index	0.0273***	0.0327***	0.0323***
	(0.00390)	(0.00401)	(0.00506)
Age		0.00540**	0.0156***
		(0.00249)	(0.00449)
Board_Ind			-0.0222***
			(0.00769)
Audit_Big4			0.00512
			(0.00608)
Constant	0.0841***	0.0766***	0.0329*
	(0.00722)	(0.00895)	(0.0175)
Observations	23627	19637	9245
Adj. R-Square	0.0590	0.0638	0.0701
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table C2

Panel regressions (Tobin's Q & Cleary Index, 1998-2016)

Tobin's Q is given by the ratio of the total market value of liabilities and equity over the total value of assets. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. *Cleary index* is a proxy for firm (plan sponsor) financial constraints developed in Cleary (1999). Remaining variable definitions are provided in Table 1. Firm (Plan sponsor) fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using a dataset spanning 1998-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	Tobin's Q	Tobin's Q	Tobin's Q
Plan_Fund	0.0368	0.0592	0.142
	(0.0515)	(0.0568)	(0.0943)
Plan_Size	-0.0795***	-0.0875***	-0.0994***
	(0.0147)	(0.0169)	(0.0260)
Frozen	0.0379	0.0261	-0.0399
	(0.0378)	(0.0390)	(0.0441)
Low_Z	-0.110***	-0.105***	-0.106***
	(0.0185)	(0.0208)	(0.0229)
Leverage	-0.00572***	-0.00513**	-0.00112
	(0.00190)	(0.00202)	(0.00274)
Cleary Index	0.0400*	0.0737***	0.0820**
	(0.0237)	(0.0244)	(0.0346)
Age		0.0300	0.0835**
		(0.0276)	(0.0421)
Board_Ind			-0.185***
			(0.0601)
Audit_Big4			0.0676*
			(0.0398)
Constant	1.988***	1.966***	1.877***
	(0.0734)	(0.0973)	(0.160)
Observations	23478	19599	9245
Adj. R-Square	0.0713	0.0764	0.117
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Table C3

Panel regressions (Payout & Cleary Index, 1998-2016)

Payout is the proportion of firm profits paid out to shareholders in the form of dividends and stock repurchases. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. *Cleary index* is a proxy for firm (plan sponsor) financial constraints developed in Cleary (1999). Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using a dataset spanning 1998-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	PayOut	PayOut	PayOut
Plan_Fund	0.153**	0.200**	0.410***
	(0.0746)	(0.0819)	(0.126)
Plan_Size	-0.0252	-0.0361	-0.0927***
	(0.0206)	(0.0228)	(0.0351)
Frozen	-0.0824	-0.0755	-0.106
	(0.0585)	(0.0622)	(0.0999)
Low_Z	-0.199***	-0.141***	-0.161***
	(0.0366)	(0.0386)	(0.0559)
Leverage	0.00181	0.00257	0.00392
	(0.00332)	(0.00357)	(0.00422)
Cleary Index	0.166***	0.211***	0.251***
	(0.0360)	(0.0441)	(0.0701)
Age		0.0836**	0.170***
		(0.0334)	(0.0612)
Board_Ind			0.0412
			(0.111)
Audit_Big4			-0.105
			(0.0862)
Constant	0.619***	0.474***	0.164
	(0.0942)	(0.119)	(0.218)
Observations	22734	18889	9037
Adj. R-Square	0.0117	0.0127	0.0202
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Appendix D

Table D1

Panel regressions (ROA & Plan Funding, 2006-2016)

ROA is given by the ratio of net profits over the total value of firm assets. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using data in 2006-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	ROA	ROA	ROA
Plan_Fund	-0.00724	-0.0133	0.00289
	(0.00820)	(0.00849)	(0.0114)
Plan_Size	-0.00426**	-0.00590***	-0.00594**
	(0.00211)	(0.00226)	(0.00280)
Frozen	0.00695	0.00498	0.00246
	(0.00599)	(0.00628)	(0.00725)
Low_Z	-0.0223***	-0.0192***	-0.00999*
	(0.00359)	(0.00413)	(0.00535)
Leverage	-0.000624*	-0.000198	0.000237
	(0.000334)	(0.000344)	(0.000362)
CFO	0.251***	0.258***	0.251***
	(0.0213)	(0.0232)	(0.0277)
Age		0.00741	0.0132**
		(0.00454)	(0.00592)
Board_Ind			-0.0303***
			(0.0104)
Audit_Big4			0.0351**
			(0.0149)
Constant	0.0617***	0.0561***	0.0170
	(0.00976)	(0.0161)	(0.0254)
Observations	13171	10963	6893
Adj. R-Square	0.0693	0.0708	0.0751
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Table D2

Panel regressions (Tobin's Q & Plan Funding, 2006-2016)

Tobin's Q is given by the ratio of the total market value of liabilities and equity over the total value of assets. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using data in 2006-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	Tobin's Q	Tobin's Q	Tobin's Q
Plan_Fund	-0.0772	-0.0745	0.0224
	(0.0734)	(0.0855)	(0.0947)
Plan_Size	-0.0417**	-0.0468**	-0.0471**
	(0.0181)	(0.0211)	(0.0212)
Frozen	0.0232	0.0146	-0.0305
	(0.0349)	(0.0383)	(0.0449)
Low_Z	-0.0745***	-0.0765***	-0.0663***
	(0.0190)	(0.0203)	(0.0246)
Leverage	-0.00121	-0.000400	0.00285
	(0.00210)	(0.00236)	(0.00257)
CFO	1.538***	1.547***	1.476***
	(0.129)	(0.150)	(0.167)
Age		-0.0403	0.0242
		(0.0330)	(0.0410)
Board_Ind			-0.160***
			(0.0572)
Audit_Big4			0.0841
			(0.0556)
Constant	1.880***	2.042***	1.858***
	(0.0737)	(0.119)	(0.154)
Observations	13088	10943	6893
Adj. R-Square	0.140	0.145	0.162
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Table D3

Panel regressions (Payout & Plan Funding, 2006-2016)

Payout is the proportion of firm profits paid out to shareholders in the form of dividends and stock repurchases. *Plan_Fund* is defined as the ratio of the fair value of pension assets over projected benefit obligations. Remaining variable definitions are provided in Table 1. Firm (Plan sponsor)-fixed effects, year indicators and cluster-heteroscedasticity robust standard errors are used. Estimation was performed using data in 2006-2016. All variables are winsorized at the 1% and the 99% levels to remove outliers.

	(1)	(2)	(3)
	PayOut	PayOut	PayOut
Plan_Fund	0.298**	0.318**	0.505***
	(0.117)	(0.130)	(0.177)
Plan_Size	-0.0185	-0.0312	-0.118***
	(0.0290)	(0.0314)	(0.0443)
Frozen	-0.0667	-0.0146	-0.0960
	(0.0788)	(0.0827)	(0.114)
Low_Z	-0.234***	-0.182***	-0.128*
	(0.0514)	(0.0550)	(0.0730)
Leverage	0.00135	0.00204	0.00536
	(0.00415)	(0.00440)	(0.00504)
CFO	1.218***	1.005***	1.217***
	(0.228)	(0.237)	(0.305)
Age		0.0936	0.145*
		(0.0639)	(0.0820)
Board_Ind			-0.0485
			(0.140)
Audit_Big4			-0.289
			(0.251)
Constant	0.346**	0.186	0.665*
	(0.146)	(0.217)	(0.386)
Observations	12595	10481	6740
Adj. R-Square	0.0121	0.0117	0.0198
Fixed Effects	Firm	Firm	Firm
Year Indicators	Yes	Yes	Yes

Notes:
Standard errors in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01