Corporate Governance and Pension De-Risking Strategies: Evidence from the UK

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First draft 11 October 2016

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Abstract

This research investigates the influence of corporate governance on capital structure using data from FTSE All-share firms for the period 2005-2014. The findings suggest that corporate governance measured by board size and independence is negatively related to debt level, while ownership concentration measured by institutional and insider ownership is positively related to debt level. Bodie et al. (1987) suggest that the pension assets and obligations have generally been regarded as corporate assets and liabilities. This study further examines how corporate governance may influence pension de-risking strategies, defined as the changes in pension asset allocations, switches from defined benefit (DB) to defined contribution (DC) pension plans, and pension buy-in and buyout transactions. The finding suggest that firms with large and more independent boards are more likely to invest their pension assets in bonds, whereas firms with higher institutional and insider ownership are more likely to invest their pension assets in equities. In addition, firms with more independent boards are more likely to retain their DB pension plans, while firms with greater institutional ownership are more likely to switch from DB to DC pension plans. Overall, pension de-risking strategies and capital structure are found to be influenced by corporate governance.

Keywords: Capital Structure; Pension De-risking Strategies; Defined Benefit Pension; Corporate Governance.

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1. Introduction

Corporate governance plays a key role in determining a firm's capital structure. Agency theory describes the problems that may arise as a result of conflicts interest between shareholders and managers, and both theoretical and empirical studies have sought to address agency problems by improving corporate governance in the US. A key role of boards is to monitor, assess and control the top management (Adams et al., 2010). However, some evidence suggests that UK boards play a weak monitoring role with regard to UK corporate governance regulations (Guest, 2008). In addition, Erkens et al. (2012) find that firms with more independent boards encourage riskier investments. Ownership concentration of a firm, indicating firm's corporate governance, has been established a link to the structure of capital. Empirical evidence (Demsetz and Lehn, 1985; Shleifer and Vishny, 1997; Berger et al., 1997; Burkart et al., 1997) suggests that highly concentrated ownership structures relate to high debt levels, indicating that ownership concentration plays a role in monitoring managers. Overall, the previous literature (Whitehead, 2015; Ivashina et al., 2009; Stulz, 1990) suggests a significant relationship between corporate governance characteristics and debt levels. Differences in institutional setting between the UK and the US draw particular attention to the influence of board composition on capital structure (Aguilera et al., 2006).

In this research study, the focus is on UK DB pension plans. Lane Clark and Peacock (2016) report that, at the end of July 2016, FTSE 100 firms had pension liabilities of £628 billion, compared with pension assets of £582 billion, and that pension deficit had increased by £21 billion to £46 billion since 2015. Under a DC plan, employees do not undertake any risks of shortfall in pension investments, whereas for DB plans, firms are responsible for shortfall of

investments in order to meet the future pension benefits. Thus, DB pension plans pose a higher level of risk and uncertainty relating to pension fund investments, and many firms with DB pension plans have embarked on pension de-risking strategies in order to reduce their firm risk. Recent statistics show that, since the 2000s, FTSE 100 companies have been closing their DB pension plans due to rising uncertainty over pension asset investments. For example, in 2015, HSBC, Severn Trent and Standard Life announced the closure of their DB pension plans to new employees. Moreover, it is expected that FTSE 100 firms' allocations of pension assets will continue to move from equities to bonds. This indicates that firms are investing in safer assets so as to lower their pension fund risk. Lane Clark and Peacock (2014) expect the pension buy-in and buyout market to grow in the coming years. Among the strategies used by firms to de-risk their pension plans, this study examines changes in pension asset allocations, switches from DB to DC pension plans and pension buy-in and buyout transactions.

Pension trustees are responsible to manage and make investment decisions on pension fund. Given there is conflict interests between employers and pension beneficiaries in pension investment strategies, the role of pension trustees is the key to deal with different stakeholders' risk attitudes. However, Myners's (2001) review suggests that UK pension trustees may make poor decisions on pension investments. Monk (2009) indicates that there is poor corporate governance in the UK trustees. Thus, sponsor firms can insert significant influences in determining pension investment strategies. This research is motivated to focus on corporate governance of sponsor firms to explore its influence on pension investment strategies when firms need to de-risk their DB pension schemes.

Most of the extant literature focuses on the relationship between corporate governance and pension asset allocations. Cocco and Volpin (2007) find that UK firms with more executive directors acting as DB pension fund trustees tend to allocate more pension assets to risky investments. Shivdasani and Stefanescu (2009) incorporate pension assets and liabilities into the capital structure of sponsor firms to explore the extent to which corporate governance influences firms' capital structure. Phan and Hegde (2013) suggest that good external and internal governance drive pension asset allocations toward equities rather than bonds. In addition, shareholders may influence the behaviour of CFOs by changing their compensation plans.

Anantharaman and Lee (2014) suggest that CFOs whose risk preferences align more closely with those of the stakeholders tend to allocate more pension assets to risky investments. Similarly, Yu-Thompson et al. (2015) find that CEO insider debt holding has a positive influence on the level of pension funding and helps reduce pension risk. The current research expands on this to examine the extent to which corporate governance may influence pension de-risking strategies. Few existing studies indicate any relationship between corporate governance and switches from DB to DC pension schemes. To our knowledge, this research appears to be the first to explore the relationship between corporate governance and pension buy-in and buyout decisions.

The sample for this study consisted of 1,617 firm-year observations for the FTSE All-share firms for the period 2005-2014. A sub-sample exploring the influence of corporate governance on pension de-risking strategies included UK firms with DB pension plans, with 1,418 firm-year observations for the same period. This research adopts Harford et al.'s (2012) method for measuring a

firm's corporate governance and then splitting the corporate governance measures into board composition and ownership concentration.

Board composition uses the size and percentage of independent directors on the board to measure corporate governance, while insider and institutional ownership are used to represent ownership concentration. The pension asset allocation proxy is the percentage of pension assets allocated to equities. Information on FTSE 100 firms' switches from DB to DC pension plans was hand-collected from their annual reports, and pension buy-in and buyout information was drawn from Lane Clark and Peacock (2014).

Empirical tests reveal different influences of board composition and ownership concentration on firm leverage. These differences may be driven by the weak monitoring role of UK boards. Additionally, this could indicate a substitutional relationship between board composition and debt (Bathala and Rao, 1995). In taking pension de-risking strategies into consideration, it is found that firms with large and more independent boards are more likely to allocate pension assets to fixed income securities. This implies that firms with large and more independent boards engage in less risky investments in managing their pension funds. However, firms with high institutional ownership and insider ownership are more likely to invest their pension assets in higher risky equities. This supports the finding of the existing literature that corporate governance structure may influence the riskiness of pension asset investments.

The results also show that firms with more independent boards are more likely to keep their DB pension plans open, while firms with high institutional ownership tend to switch from DB to DC pension plans. Interestingly, firms' leverage levels may determine the negative or positive influence of corporate

governance measures on allocations of pension assets and switches from DB to DC pension schemes. Since limited data were available on pension buy-ins and buyouts, the tests produce mixed evidence regarding the influence of corporate governance proxies on pension buy-in and buyout decisions.

This research contributes to the extant literature on corporate governance and capital structure. Most existing studies have focused on the effects of corporate governance on the capital structure of US firms. Aguilera et al. (2006) argue that there are some national differences in corporate governance between US and UK firms with respect to board structure, ownership and corporate regulations. This research draws on a UK-based sample of companies, providing empirical evidence that differentiates the results from the US literature.

This study also contributes to the literature on corporate governance and pension de-risking strategies. Anecdotal evidence shows that firms have been widely using pension de-risking strategies to reduce pension risk. This research explores how firms with different corporate governance characteristics apply pension de-risking strategies to limit the risks to pension fund sponsors. It extends the previous literature (Cocco and Volpin, 2007) on the effect of corporate governance on pension asset allocations to changes in pension schemes and pension buy-in and buyout decisions. Given that the UK pension trustees appear to have weaker monitoring role than those in US, this research contributes to provide UK evidence to existing pension de-risking literature. The development of UK bulk annuity market can be mirrored for other countries.

Finally, this research has real policy implications for the risk management of corporate pension funds. Of particular relevance to investors is that board composition and ownership concentration may have different influence on

pension de-risking strategies and risk taking with regard to pension fund management.

The remainder of this research is structured as follows. Section 2 starts with a discussion of the previous literature and the development of hypotheses, and Section 3 discusses the research design and methodology. Section 4 summarizes the sample and data, and Section 5 presents some descriptive statistics. The main tests and results are discussed in section 6, and robustness checks are presented in Section 7. The final section provides the conclusions.

2. Related literature and hypothesis development

2.1 Association between corporate governance and capital structure

Following Jensen and Meckling (1976), an extensive body of literature has explored various financial structures and agency problems. In order to address agency problems, companies tend to improve corporate governance to motivate managers to work in shareholders' interests. Jensen and Meckling (1976) raise the role of debt in corporate governance. Their study reveals that debt may act as a constraint on managerial discretion. Another study by Jensen (1986b) supports the argument that debt may provide a more effective bond for managers' promises to pay out future free cash flows. This research confirms the monitoring role of debt.

In addition, Berger et al. (1997) indicate that firms with entrenched managerial characteristics tend to have lower leverage. This implies that managers do not make optimal use of leverage when there are conflicts interest between shareholders and agents. Jung et al. (1996) find that firms issuing equity and

lacking valuable investments are regarded unfavourably, as these factors enhance managerial discretion. Berger et al. (1997) provide empirical evidence that firms with CEOs who are not strongly monitored by the board of directors are more likely to hold lower levels of debt. They use events that change entrenchment levels to clarify the causal relationship between corporate governance and debt levels. Harford et al. (2012) indicate that corporate governance mechanisms, measured by multiple corporate governance proxies, may drive cash holding levels.

2.1.1 Board composition and ownership concentration

Corporate governance can be measured by the size and independence of the board. The role of directors is to monitor and evaluate top management. Most US literature focuses on whether board characteristics correlate with corporate governance. Harris and Raviv (2008) suggest that there is an optimal board size for playing an effective monitoring role. Raheja (2005) explores the effectiveness of insider and outsider boards. Peasnell et al. (2005) find that a high proportion of independent directors on the board may constrain income-increasing earnings management in UK firms.

Long-standing debate over whether independent boards correlate with better firm performance is discussed in the previous literature (Baysinger and Butler, 1985; Hermalin and Weisbach, 1991; Byrd and Hickman, 1992). Tanna et al. (2011) suggest that a high proportion of independent directors on the board relates positively to measures of firms' efficiency in the UK banking industry. However, Erkens et al. (2012) find that firms with more independent boards take greater risks during financial crises. Although there is mixed evidence on the relationship between board independence and firm performance, Byrd and

Hickman (1992) find that independent boards may influence board decisions on different tasks.

Boone et al. (2007) study of US IPO firms in the oil industry from 1988 to 1992 provides consistent evidence that board size is negatively related to the cost of monitoring. However, Yermack (1996) argues that firms with small boards are more effective. His research supports that reducing board size may improve boards' communications and decision-making processes. Overall, the vast majority of US research shows that board characteristics may relate to corporate governance, and may consequently affect firm performance.

Alternatively, ownership concentration may determine firm corporate governance. Jensen and Meckling (1976) indicate that managers who have discretion to act as agents for stakeholders' benefit may pursue their own interests at the expense of stakeholders'. Therefore, increasing managerial ownership may address agency problems and improve corporate governance. Brealey et al. (1977) and Ross (1977) suggest that managerial incentive schemes may provide market signals about firm's and reduce asymmetries of information between managers and investors. However, the relationship between insider ownership and firm characteristics is non-linear. Morck et al.'s (1988) study of Fortune 500 firms explores the association between board ownership and firm performance. They find a non-linear relationship between the two. In a positive relationship, insider ownership may promote the interests of both managers and shareholders, while a negative relationship represents managerial entrenchment. A similar finding is provided by McConnell and Servaes (1990) examination of two sample firms for 1976 and 1986. Han and Suk (1998) find that insider ownership and institutional ownership are positively

related to stock returns, but excessive insider ownership is negatively related. McConnell et al. (2008) study of US firms from 1994 to 1999 reveals that increases in insider ownership may increase share prices up to a point, but these may fall back after a while. Anderson and Reeb (2003) treat family ownership as insider ownership and find consistent evidence that the organisational structure of firms under family ownership is as effective as that of non-family-owned firms.

Moreover, institutional ownership is regarded as an effective tool to address agency problems. Shleifer and Vishny (1986) suggest that large shareholders are concerned with monitoring companies' management. They note that large shareholders favour value-increasing takeovers. Coffee (1991) states that institutional owners are becoming increasingly active in monitoring management. This confirms that the role of institutional ownership is to improve corporate governance.

2.1.2 Substitutional relationship between the corporate governance mechanisms

Debt may be used as a device for monitoring top management (Fama and Jensen, 1983), and the corporate governance literature (McKnight and Weir, 2009) suggests that debt is a corporate governance mechanism that mitigates agency problems. Bathala and Rao (1995) investigate the determinants of board composition and find an inverse relationship between levels of debt and board size. This indicates that firms tend to increase the number of directors to improve corporate governance, rather than increasing the level of debt to reduce managerial discretion. Agrawal and Knoeber (1996) explore four alternative corporate control mechanisms and conclude that the strengths of

different corporate governance methods are interrelated. This also support the view that other governance mechanisms may act as substitutions for debt (Setia- Atmaja et al., 2009).

The previous literature (Moh'd et al., 1998; Grier and Zychowicz, 1994; Crutchley et al., 1999) also explores the substitution relationship between corporate debt and institutional ownership, and finds that firms with higher institutional ownership tend to have less leverage. This explains that firms that place greater reliance on external monitoring tend to reduce internal monitoring devices by reducing their use of debt (Bathala et al., 1994).

2.1.3 Different institutional settings of UK and US firms

The dominant literature focuses on the effects of US rather than UK board composition. Although there are similarities in board functions between the UK and the US, legal requirements, a low proportion of independent directors and low financial incentives for monitoring may make UK boards function less effectively than those in the US (Black et al., 2005; Cosh and Hughes, 1987; Franks et al., 2001; Higgs, 2003; Ozkan, 2007). Guest (2008) provides no evidence of any relationship between monitoring factors and board structure, measured by size and independence of the board, and concludes that UK boards have a weak monitoring role. Although adoption of the recommendations of UK's Combined Code was expected to improve board effectiveness, McKnight and Weir (2009) find that changes to board structure have no effect in lowering agency costs. A less effective board composition may reduce firm performance.

Further evidence provided by Guest (2009) confirms that increasing the number of directors and proportion of independent directors leads to reduction in

profitability, Tobin's Q and share returns. Weir and Laing (2001) find no evidence of any relationship between UK corporate structure and firm performance. Empirical research finds that board structure is not effective in the UK.

However, in contrast to the UK's relatively weak board structure, ownership concentration appears to be stronger in the UK than in the US (Short and Keasey, 1999). British institutional investors are encouraged to monitor firms' business strategy and investment decisions closely (Cadbury, 1992; Myners, 2002). Short and Keasey (1999) provide empirical evidence supporting a non-linear relationship between managerial ownership and firm performance for UK companies. Overall, institutional ownership concentration in the UK is expected to be positively related to leverage levels.

The above discussion of the influence of corporate governance on firm's capital structure suggests that levels of debt may be driven by firms' corporate governance. Thus, the following hypothesis is developed.

Hypothesis 1: Corporate governance may influence firms' leverage levels.

2.2 Corporate governance and pension de-risking strategies

Since the main focus of this study is on DB pension plans, pension liabilities and pension assets are incorporated into the previous empirical setting. Landsman (1986) explores the market pricing of off-balance sheet pension assets and pension liabilities for a sample of US firms with DB pension schemes from 1979 to 1981. They find that investors value pension assets and liabilities as corporate assets and liabilities. Feldstein and Seligman (1981) suggest that unfunded pension benefits reported off balance sheet are similar to

corporate debt and are reflected in share prices. Dhaliwal (1986) confirms that unfunded pensions, viewed as corporate debt, are incorporated into firms' risk. Pension obligations are therefore similar to debt in influencing firms' risk. Although the market seems to incorporate the valuation of pension obligations, Landsman and Ohlson (1990) point out that it appears to under-react to information on pensions. Gopalakrishnan and Sugrue (1993) conclude that pension assets and projected benefit obligations should be part of the financial structure, and that the accounting standards regulator should bring pensions information back onto the balance sheet.

Some research focuses on DB pension schemes outside the US. Interestingly, Wiedman and Wier (2004) find that the pension deficits of Canadian firms are recognized as liabilities, while surpluses in the pension fund are not regarded as assets. This suggests that Canadian pension regulations have influenced the valuation of pensions. In contrast, Wiedman and Wier (2004) and Salah et al. (2015) appear to disagree that market participants view pension surpluses as corporate assets. Jin et al. (2006) suggest that firms should incorporate pension risk into firm risk, although the US PBGC complicates the correlation between the two. Similarly, Bodie et al. (1987) emphasise the corporate financial view of pension plans. However, they seem to suggest that companies with small pension plans view pension assets and liabilities as an integral part of the corporate financial structure, while firms with large pension plans cannot treat them as entirely corporate property. This is because large pension plans are protected by the PBGC. The current research supports the corporate financial view of pension plans, incorporating pension obligations and assets into firms' capital structure.

As most surveys (Lane Clark and Peacock, 2016; Lane Clark and Peacock, 2014) show that UK firms are experiencing high pressure from DB pension schemes, pension de-risking strategies must be applied to reduce firm risk. In this research, pension de-risking strategies are defined as changes in pension asset allocations, switches from DB to DC pension plans, and pension buy-ins and buyouts.

2.2.1 Corporate governance and pension asset allocations

Pension asset allocations may be changed to reduce pension risk. The adoption of International Accounting Standard (IAS) 19 and Statement of Financial Accounting Standards (SFAS) 158, issued by the Financial Accounting Standard Board (FASB), has introduced greater volatility into pension assets and liabilities on the balance sheet of UK and US firms respectively (Stone and Sweeting, 2005). Amir et al. (2010) investigate the effect of a new pension accounting standard on pension asset allocations and find that firms tend to change pension asset allocations from equities to bonds in order to reduce volatility in the figure reported on the balance sheet. Similarly, Amir and Benartzi (1999) provide consistent evidence that the purpose of changing pension asset allocations is to reduce the volatility of the balance sheet. Brownlee and Marsha (1994) suggest that firms may benefit from Black's (1980) proposed tax arbitrage strategy to invest pension assets in fixed income securities. Thus, reductions in financial reporting risk and tax arbitrage encourage switches of pension asset allocations to fixed income securities. In terms of tax benefits, Black (1980) and Tepper (1981) strongly support that the view that pension assets should be entirely invested in fixed income securities, which are safer than investing in the stock market. In addition to tax benefit

concerns, Amir and Benartzi (1999) point out that firms change their pension asset allocations to match their pension assets and obligations in order to meet future pension contributions. They suggest that firms with longer investment horizons tend to invest pension assets in equities, while firms that need to hedge interest rate fluctuations tend to invest in bonds. Moreover, firms may change their pension asset allocations to reduce firm risk. Friedman (1982) suggests a negative relationship between pension assets invested in equities and firm risk measured by income variability.

Most of the literature favours the view that firms should invest pension assets in the fixed income securities to lower the volatility of pension contributions, to benefit from tax reductions and to reduce firm risk. However, higher returns from the equity market may be an incentive for managers to invest pension assets in equities. Bodie (1990) identifies three reasons why firms tend to invest pension assets in equities. First, managers believe that it is worth taking risks on the stock market to benefit employees; second, successful investments in equities may reduce pension contributions, and third, managers hope to hedge inflation by investing pension assets in the equity market. In addition, other research (Amir and Benartzi, 1999; Bodie et al., 1987) suggests that firms invest pension assets in equities to increase the value of the put option provided by the PBGC. Liu and Tonks (2013) find that pension contributions are negatively related to dividend payments. This implies that, in order to maintain regular dividend payments, managers pursue higher returns from pension asset investments. Similarly, Lane Clark and Peacock (2014) report that some FTSE 100 firms are increasing their pension asset allocations to equities, explaining that firms tend to put pension de-risking strategies on hold and pursue higher equity returns when bonds are too expensive. Therefore, trade-off decisions

between investing pension assets in equities or bonds may be determined by firm and pension plan characteristics and financial market conditions.

This research incorporates pension assets and liabilities in exploring the influence of corporate governance on changes in pension asset allocations. Although UK board structures may be less effective than in the US, Cocco and Volpin (2007) find the percentage of board directors in UK pension fund trustees has a significant influence on the pension asset allocation decisions. Phan and Hegde (2013) measure the internal and external corporate governance of US firms using the G-index and E-index to explore the influence of corporate governance on risk taking in pension asset allocations. The empirical evidence confirms that firms with high G-index and E-index scores tend to allocate more pension assets to equities. This indicates that these risk-increasing strategies are driven primarily by a desire to achieve better pension plan funding levels and reduce future pension contributions. However, the E-index and G-index are aggregated numbers for measuring the level of corporate governance, and may easily ignore the effect of individual corporate governance characteristics. In addition, they are only representative and available for US companies.

Anantharaman and Lee (2014) and Yu-Thompson et al. (2015) find that executive compensation is related to pension fund risk taking. Anantharaman and Lee (2014) suggest that a top management with compensation structure based on wealth-risk sensitivity tends to allocate more pension assets to equities, while risk-shifting behaviour is weaker with wealth-price sensitivity. Risk taking in pension asset allocations appears to be driven by the interests of top management. Yu-Thompson et al. (2015) find that CEOs with more insider debt compensation are likely to ensure better funded pension fund and are less

likely to engage in pension risk shifting. Therefore, the previous literature supports the view that corporate governance structure may influence risk taking in pension asset allocations.

Other corporate governance literature also indicates a relationship between board composition and corporate risk taking. Pathan (2009) studies the influence of US banks' corporate structure on risk taking and finds that firms with small boards are more likely to make excessively risky investments. In contrast, he finds that firms with more independent boards take less risk. This suggests that independent directors may play a role in balancing the interests of different shareholders. Similarly, Wang (2012) finds consistent evidence that smaller boards force CEOs to take more risk and invest more heavily in risky assets. Eling and Marek (2014) provide evidence from UK and German insurance companies that firms with more independent boards are associated with lower risk taking. However, boards with greater independence may encourage firms to raise more equity capital during financial crises (Erkens et al., 2012).

In contrast to the influence of board composition on risk taking, institutional concentration is found to be positively related to risk taking (Chen and Steiner, 1999; Erkens et al., 2012; Wright et al., 1996; 2002). Managerial ownership acts as an incentive to align the interests of managers and shareholders. This equity held by the managers is regarded as a call option for the firm (Black and Scholes, 1973; Galai and Masulis, 1976). Greater firm variance or risk will increase the value of this call option; thus, managers with higher equity incentives may undertake riskier business strategies. Chen and Steiner (1999) provide evidence that managerial ownership increases corporate risk taking,

and Wright et al. (1996) confirm that high levels of insider ownership may induce managers to take excessive risks. They also find that institutional ownership positively influences risk taking. Similarly, their empirical findings suggest that stock ownership has a positive impact on firm risk taking (Wright et al., 2002). Erkens et al. (2012) find that firms with higher institutional ownership tend to take greater risks prior to financial crises, resulting in significant losses. Therefore, firms with high insider ownership and institutional ownership are expected to engage in more risky investment strategies.

Hypothesis 2: Corporate governance may influence the risk taking of firms' pension asset allocations.

Following the above discussion, firms with large and more independent boards are expected to be less likely to make risky pension asset investments. This suggests that higher pension asset allocations to fixed income securities are correlated with larger and more independent boards. However, higher insider ownership and institutional ownership induce firms to take greater risks. Pension asset allocations to equities are expected to be positively related to insider ownership and institutional ownership.

2.2.2 Corporate governance and switches from DB to DC pension plans

Given that firms with DB pension plans appear to take greater risks than firms with DC pension plans, many studies have tried to identify why firms terminate or freeze their DB pension plans. Munnell et al. (2007) explore motives for freezing DB pension plans. These include cutting employees' compensation, cutting health-care costs and avoiding the risks of accounting and regulatory changes. Since switching from a DB to a DC pension plan is a pension de-

risking strategy, Atanasova and Hrazdil (2010) find that firms froze their DB pension plans between 2002 and 2006 experienced greater equity returns and a lower probability of credit rating downgrades. They explain that closing a DB pension plan allows wealth to be transferred from pension beneficiaries to shareholders. In contrast, Choy et al. (2014) argue that firms tend to take more risks after freezing a DB pension plan. This finding confirms that firms increase their equity and credit risks after freezing their DB pension plans, as pension obligations act as inside debt, changing managerial incentives.

Overall, corporate governance characteristics are regarded as determinants of firms' decisions to switch from DB to DC pension plans.

Hypothesis 3: Corporate governance may influence firms' decisions to switch from DB to DC pension plans.

2.2.3 Corporate governance and pension buy-ins and buyouts

In pension buy-ins and buyouts, a premium is paid to transfer pension liabilities to a life insurer or insurance company. Insurance companies must estimate pension liabilities based on assumptions of mortality, interest rates, inflation rates to calculate the present value of pension obligations. If a pension fund is in deficit, the firm must pay the insurance company the difference between the estimated pension liabilities and the fair value of pension assets in order to buy-in or buyout their pension assets and obligations. Lane Clark and Peacock (2015) report that the pension buy-in and buyout market reached £13.2 billion in 2014, an increase of £5.7 billion on 2013. Pension buy-in and buyout transactions have become increasingly popular as a pension de-risking strategy since 2006. Lane Clark and Peacock (2015) report that the pricing of pension buy-ins stabilised in 2015, so it is expected that more employers will choose to

engage in pension buy-ins in order to off-load significant pension obligations from their balance sheets. The other reason for emergence of the pensions buy-in and buyout market is that insurers appear to be better able to forecast and manage pension risk and beat market returns on pension investments (Biffis and Blake, 2009). In addition, Monk (2009) indicates that the UK pension buy-in and buyout market grew significantly to transactional volumes of £8 billion in 2008 (£2.9 billion in 2007). Prior to 2008, this market was small (around £1-2 billion turnover per year). The emergence of the pension buy-in and buyout market was driven by the Pension Act 2005 and new accounting standards (Monk, 2009). Compared with the UK, US pension buy-in and buyout market has experienced modest growth (Monk, 2009). Thus, there is little empirical literature focusing on pension buy-ins and buyouts, as the market is relatively new and data on transactions are limited. Lin et al. (2015) focus on the costs of pension buy-ins and buyouts and what other pension de-risking strategies may be deployed to implement them effectively. Other research (Blake et al., 2008; Biffis and Blake, 2009) explores pension buy-ins and buyouts to investigate how employers transfer the mortality risk to insurance companies. This research explores the influence of corporate governance on pension buy-in and buyout decisions.

Hypothesis 4: Corporate governance may influence firms' engagement in pension buy-ins and buyouts.

3. Research design

This section describes the measures used for firms' capital structure, corporate governance and pension de-risking strategies. Ordinary least squares (OLS) estimation was employed to examine the influence of corporate governance on

capital structure and changes in pension asset allocations. However, since the nature of the dependent variables for switches from DB to DC pension plans and pension buy-ins and buyouts was different from the other dependent variables, the Cox proportional model was applied to handle the censoring of observations.

3.1 Leverage

The book value of leverage (*LVG_BOOK*) and market value of leverage (*LVG_MARKET*) were used to measure firms' capital structure. The leverage proxies were calculated following Berger et al. (1997), as these are the most common measurements of firms' leverage in literature.

$$Book\ Value\ Leverage\ = \frac{Book\ Value\ of\ Total\ Debt}{Book\ Value\ of\ Total\ Assets}$$

$$Market\ Value\ Leverage$$

$$= \frac{Book\ Value\ of\ Total\ Debt}{Book\ Value\ of\ Total\ Debt + Market\ Value\ of\ Equity}$$

3.2 Measures of Corporate governance

Following Harford et al. (2012) construct, two sets of proxies were used to measure corporate governance. Harris and Raviv (2008); Boone et al. (2007) propose that increasing board size may reduce monitoring costs. In addition, Baysinger and Butler (1985) suggest that board independence may improve firm performance. In contrast, Yermack (1996) finds that small boards are more effective than large boards, and Raheja (2005) argues that independent boards may be less informed than insider-boards. This study measures board size (*BOARD*) as the number of directors on the board divided by the log of total

assets. Board independence (*BOARD_INDEPENDENCE*) was calculated as the percentage of independent directors on the board.

The other corporate governance measurement is ownership concentration. Han and Suk (1998) find that insider ownership and institutional ownership are positively related to stock returns. Anderson and Reeb (2003) suggest that insider ownership may be an effective organizational structure, as in family-owned companies. However, a curvilinear relationship between insider ownership and firm performance implies that excessive insider ownership may have an adverse influence on corporate governance, and may consequently lead to lower share prices (McConnell and Servaes, 1990; McConnell et al., 2008). A positive relationship between corporate governance and institutional ownership is supported by Shleifer and Vishny (1986). Since large shareholders are interested in companies' management, increasing institutional ownership may reduce agency problems.

This research measures insider ownership (*INSIDER_OWNERSHIP*) as the number of shares held by insiders scaled by total shares outstanding. Institutional ownership (*INSTITUTIONAL_OWNERSHIP*) was measured as the ratio of shares owned by institutions divided by total shares outstanding.

3.3 Measures of pension de-risking strategies

Pension asset allocations were measured as the percentage of pension assets allocated to equities (*EQUITY*). Switches from DB to DC pension plans were measured as a dummy variable, taking a value of 0 if a firm did note close its DB pension plan, and 1 if it partially or fully closed its DB pension plan. Date on pension buy-in and buyout transactions were collected from 2008 to 2014, available from Lane Clark and Peacock (2015). Since buy-in and buyout data

were limited, all buy-in and buyout transactions were combined, and coded as 1 if they occurred and 0 otherwise. Although there are different types of pension buy-ins and buyouts, these were not differentiated, as the main interest of this study was all the pension buy-in and buyout transactions.

3.4 Empirical models and control variables

3.4.1 Relationship between corporate governance and capital structure

In order to examine Hypothesis 1, OLS regression was used to test the relationship between corporate governance proxies and levels of leverage. Control variables were constructed to develop the empirical model. Following Berger et al. (1997), control variables were chosen that were expected to influence the level of leverage. Firms' profitability was controlled by including the return on assets (*ROA*) calculated as earnings before interest and tax divided by total assets at the fiscal year end. Firms with high profitability were expected to have low leverage levels. Lang et al. (1996) suggest that firms' investments are negatively related to leverage. The collateral value of assets (*ASSET_COLLATERAL_VALUE*) was included to measure firms' investments, calculated as net property, plant, and equipment plus inventory over total assets. Since Schwartz and Van Tassel (1950) indicate that large firms tend to have higher leverage, firm size (*SIZE*) was measured as the log of total assets. Firms with high future growth opportunities tend to have low leverage (Hall, 1992). Two measurements were included for uniqueness of assets to control for leverage. *ASSET_UNIQUENESS1* is research and development (*R&D*) divided by total sales. *ASSET_UNIQUENESS2* is selling, general, and administrative (*SGA*) expenses divided by total sales. The use of *SGA* to measure product

specialization is supported by Berger et al. (1997). DeAngelo and Masulis (1980) suggest that a non-debt tax shield may influence debt policy. Following Titman and Wessels (1988), the non-debt tax effect (*NON_DEBT_TAX*) was measured as deprecation divided by total assets. The above control variables were used to construct the following model.

$$LVG\_BOOK_{it}(orLVG\_MARKET_{it}) = \alpha_0 + \beta_1 BOARD_{it}(orINSTITUTIONAL\_OWNERSHIP_{it}) + \beta_2 BOARD\_INDEPENDENCE_{it}(orINSIDER\_OWNERSHIP_{it}) + \beta_3 ROA_{it} + \beta_4 ASSET\_COLLATERAL\_VALUE_{it} + \beta_5 SIZE_{it} + \beta_6 ASSET\_UNIQUENESS1_{it} + \beta_7 ASSET\_UNIQUENESS2_{it} + \beta_8 NONDEBT\_TAX_{it} + YearF.E + IndustryF.E + \varepsilon_{it} \quad (1)$$

3.4.2 Relationship between corporate governance and pension de-risking strategies

Since the dependent variables for pension de-risking strategies differ in nature, different models were employed to examine Hypotheses 3 and 4. An OLS model was used to test the relationship between corporate governance and pension asset allocations, as the proxy for pension asset allocations is a continuous variable. A Cox proportional hazard model was used to investigate the relationship between corporate governance and switching from DB to DC pension plans, as well as decisions to adopt pension buy-ins and buyouts.

Control variables were chosen following previous research (Amir et al., 2010). Bader and Leibowitz (1988) find an inverted-U relationship between funding levels and pension asset allocations. *FUND* and *FUND_SQUARE* were used to capture this nonlinear relationship. *FUND* was calculated as the fair value of pension assets divided by projected benefit obligations. According to Amir and Benartzi (1999), firms with more young employees invest more pension assets

in equities than firms with more mature employees. This is based on asset- and liability-matching strategies to meet future pension contributions. The investment horizon (HOR) was measured as the log of projected benefit obligations divided by service costs. Since debt contracts influence pension asset allocations, the leverage ratio (*LEV*) was included in the model, measured by long-term debt divided by long-term debt plus the market value of equity. Liu and Tonks (2013) indicate that funding levels crowd out dividend payments. Dividend payments were expected to be negatively related to equity allocations and were measured by the dividend pay-out ratio (*DIVP*), being the dividend per share divided by the earnings per share. The effective tax rate (*TAXR*) was measured as tax expenses divided by pre-tax income. It was expected that firms would allocate more pensions to bonds under higher effective tax rates. The relationship between operating cash flows and pension asset allocations is examined by Friedman (1982) and Bodie et al. (1985). Firms with lower operating cash flows tend to invest more pension assets in bonds to avoid volatility in pension contributions. The volatility of operating cash flows (*SDCF*) was calculated as the standard deviation of operating cash flows over the current and past four years. Firm size (*SIZE2*) was measured as the log of total market capitalization to control the effect of on pension asset allocations. As previously discussed, the introduction of the MFR will probably have influenced pension obligation changes, so a dummy variable indicating the introduction of the MFR from 2005 might have been added to the controls. However, since the sample period did not cover the years before 2005, the influence of the MFR on pension obligations was not examined. In addition to the control variables for pension asset allocations, an interaction term between book value of leverage (market value of leverage) and corporate governance proxies was included. The

level of leverage not only represents the firm's capital structure but may also be regarded as an alternative external corporate control mechanism. Crutchley et al. (1999) suggest that firms may reduce expensive internal monitoring devices when external monitoring is available. The monitoring role of debt is supported by Jensen (1986a). This enables exploration of whether different corporate governance methods and levels of leverage jointly determine pension asset allocations.

$$
\begin{aligned}
&EQUITY_{it} = \alpha_0 + \beta_1 BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it}) \\
&+ \beta_2 BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it}) + \beta_3 FUND_{it} \\
&+ \beta_4 FUND\_SQUARE_{it} + \beta_5 HOR_{it} + \beta_6 LEV_{it} + \beta_7 DIVP_{it} + \beta_8 TAXR_{it} + \beta_9 SDCF_{it} + \beta_{10} SIZE2_{it} \\
&+ \beta_{10} BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it}) \times LVG\_BOOK_{it}(or LVG\_MARKET_{it}) \\
&+ \beta_{11} BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it}) \\
&\times LVG\_BOOK_{it}(or LVG\_MARKET_{it}) + \beta_{12} LVG\_BOOK_{it}(or LVG\_MARKET_{it}) \\
&+ YearF.E + IndustryF.E + \varepsilon_{it}
\end{aligned}
\tag{2}
$$

The same controls variables were used to test Hypotheses 3 and 4, following previous research (Choy et al., 2014). Switches from DB to DC pension plans and pension buy-in and buyout transactions were treated as events. *UNDERFUND* is a dummy variable representing whether a pension fund was under- or over-funded, coded as 1 if the fair value of pension assets was less than the projected benefit obligations, and 0 otherwise. *FUND* was used as a control variable in this model to capture funding level. Pension plan size (*PLAN_SIZE*) was measured as projected benefit obligations divided by total assets. Operating cash flows (*OP_CF*) were calculated as operating cash flows scaled by total assets.

Whether or not the firms suffered losses may have influenced them to switch from a DB to a DC pension plan. The indicator variable, *LOSS*, was coded as 1

if firms reported losses at the fiscal year end, and 0 otherwise. Some changes in firms' financial characteristics were included to control for their influence on decisions to shift DB to DC pension plans, as well as changes in sales (*delta_SALE*), dividends (*delta_DIV*), leverage (*delta_LEV*), research and development expenses (*delta_RD*) and capital expenditure (*delta_CAPEX*). In the model of pension buy-ins and buyouts, a variable indicating switches from DB to DC pension plans (*SWITCH*) was included as a control. Although previous research (Choy et al., 2014) suggests the inclusion of an indicator variable representing whether a firm's DB plans are subject to collective-bargaining power, this variable was excluded, as labour unions have little power and unlikely to be involved in negotiations on switching from DB to DC pension plans in the UK. Again, the corporate governance proxies were interacted with the book value of leverage (market value of leverage) to explore the joint effects of corporate governance methods on switches from DB to DC pension plans and pension buy-ins and buyouts.

$$
\begin{aligned}
SWITCH_{it} &= \alpha_0 + \beta_1 BOARD_{it}(orINSTITUTIONAL\_OWNERSHIP_{it}) \\
&+ \beta_2 BOARD\_INDEPENDENCE_{it}(orINSIDER\_OWNERSHIP_{it}) + \beta_3 UNDERFUND_{it} \\
&+ \beta_4 FUND_{it} + \beta_5 PLAN\_SIZE_{it} + \beta_6 OP\_CF_{it} + \beta_7 LOSS_{it} + \beta_8 delta\_DIV_{it} + \beta_9 delta\_LEV_{it} \\
&+ \beta_{10} delta\_RD_{it} + \beta_{11} delta\_CAPEX_{it} + \beta_{12} delta\_SALE_{it} \\
&+ \beta_{13} BOARD_{it}(orINSTITUTIONAL\_OWNERSHIP_{it}) \times LVG\_BOOK_{it}(orLVG\_MARKET_{it}) \\
&+ \beta_{14} BOARD\_INDEPENDENCE_{it}(orINSIDER\_OWNERSHIP_{it}) \\
&\times LVG\_BOOK_{it}(orLVG\_MARKET_{it}) + \beta_{15} VG\_BOOK_{it}(orLVG\_MARKET_{it}) + \varepsilon_{it}
\end{aligned}
\tag{3}
$$

$$BUYOUT_{it} = \alpha_0 + \beta_1 BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it})$$
$$+ \beta_2 BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it}) + \beta_3 UNDERFUND_{it}$$
$$+ \beta_4 FUND_{it} + \beta_5 PLAN\_SIZE_{it} + \beta_6 OP\_CF_{it} + \beta_7 LOSS_{it} + \beta_8 delta\_DIV_{it} + \beta_9 delta\_LEV_{it}$$
$$+ \beta_{10} delta\_RD_{it} + \beta_{11} delta\_CAPEX_{it} + \beta_{12} delta\_SALE_{it} + \beta_{13} SWITCH_{it}$$
$$+ \beta_{13} BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it}) \times LVG\_BOOK_{it}(or LVG\_MARKET_{it})$$
$$+ \beta_{14} BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it})$$
$$\times LVG\_BOOK_{it}(or LVG\_MARKET_{it}) + \beta_{15} LVG\_BOOK_{it}(or LVG\_MARKET_{it}) + \varepsilon_{it} \quad (4)$$

4. Sample and data

The recent accounting standard change and the financial crisis have created a unique empirical setting to UK companies, which are experiencing high pressure from DB pension plans. Lane Clark and Peacock (2016) report that DB pension plan closures have become a main trend in the UK. IAS 19 created high volatility in pension obligations reported in financial statements. In addition, the emerging market for pension buy-ins and buyouts has created opportunities for companies to transfer their pension obligations to insurance companies. The pension buy-in and buyout market is expected to continue to grow. The availability of data on pension buy-ins and buyouts enabled empirical tests to be conducted to explore the determinants of pension buy-in and buyout transactions.

The sample selection process is shown in Table 1. First, data were downloaded from the Bloomberg for all UK All-share firms between 2002 and 2014. The primary sample comprised 8,434 firm-year observations. Corporate governance information and some accounting information were collected from the Bloomberg database. Other accounting information, including pension asset allocations information, was collected from the Thomson One Banker database. Data on switches from DB to DC pension plans were hand-collected from

annual reports, and pension buy-ins and buyout information was collected from Lane Clark and Peacock (2015) report.

Firstly, the data from the Bloomberg database and the Thomson One Banker databases were merged. Thus, all the accounting and corporate governance information was amalgamated. Financial firms with Standard Industrial Classification (SIC) codes 6000 to 6999 were excluded, as firms in these industries have different leverage and corporate governance structures from other firms. Firms for which corporate governance information was unavailable were excluded. This resulted in 1,617 firm-year observations for the years 2005 to 2014.

Since data on switches from DB to DC pension plans and pension buy-ins and buyouts were limited, a sub-sample was established to explore the empirical questions. The sub-sample for investigating pension asset allocations comprised 1,418 firm-year observations from 2005 to 2014. The separate dataset for switches from DB to DC pension plans contained 4,800 firm-year observations for FTSE 100 firms from 2000 to 2014. The sample for pension buy-ins and buyouts only had 510 firm-year observations. After merging the data for switches from DB to DC pension plans and pension buy-in and buyout data with the corporate governance data, 354 and 112 firm-year observations remained respectively. All continuous variables were winsorized at 1% and 99% in order to deal with the influence of outliers for each variable.

5. Univariate results

Panel A of Table 2 reports the leverage levels in the sample firms based on two proxies, market value of leverage and book value of leverage. The average

book value of leverage was 0.19 and the average market value of leverage was 0.33. It is consistent to prior literature that the market value of leverage is higher than the book value of leverage (Berger et al., 1997). Two measures of leverage were used to enable to best estimate of the value of leverage based on accounting numbers and market valuations. For the full sample, firms had an average of 8.7 directors on the board. Since information on institutional and insider ownership were only available for 2010-2014, the number of firm-year observations was reduced to 1,201 for regression tests including these two variables. Descriptive data for pension de-risking strategies are shown in Panels B and C. The sub-sample for pension asset allocation analysis reveals that firms allocated an average 47.97 percent of pension assets to equities. The average funding level was 87 percent funded. This suggests that companies in the sample tended to be underfunded. Panel C shows that firms in the sub-sample tended to switch from DB to DC pension plans, as the average of *SWITCH* is far from zero.

A correlation matrix is given in Table 3. Panel A in the correlation matrix indicates that the book value of leverage (*LVG_BOOK*) is significantly positive related to the market value of leverage (*LVG_MARKET*) and is close to 1. The number of directors on the board (*BOARD*) seems to be negatively related to leverage level. Firms with lower profitability tended to have higher leverage, as the *ROA* is negatively related to leverage. The correlations between *ASSET_UNIQUENESS1* and *LVG_BOOK* reveal that firms with more growth opportunities had lower leverage levels. Firm size (*SIZE*) is positively related to leverage. Firms with higher effective interest rates (*NONDEBT_TAX*) tended to have higher leverage to gain tax benefits. It should be noted that board size (*BOARD*) appears to be unrelated to pension asset allocations (see in Panel B),

while the percentage of independent directors (*BOARD_INDEPENDENCE*) is negatively related to pension assets allocated to equities. The correlations between pension assets allocated to equities and other pension fund characteristics support the previous literature (Amir and Benartzi, 1999).

In Panel C, board independence (*BOARD_INDEPENDENCE*) is positively related to switches from DB to DC pension plans (*SWITCH*). It is worth noting that operating cash flow (*OP_CF*) levels are significantly positive related to *SWITCH*, which is not consistent with Choy et al. (2014) study. *PLAN_SIZE* shows that firms with small pension plans tended to switch from DB to DC pension plans. This may imply that it is easier for small pensions than for large pensions to switch from DB to DC pension plans. The correlation between pension buy-in and buyout transactions and other firm and pension fund characteristics can be seen in Panel D. This suggests that firms with small boards are more likely to make pension buy-in and buyout decisions.

6. Multivariate analysis

6.1 Corporate governance and leverage levels

The relationship between corporate governance and capital structure was examined using an industry and year fixed effects model. Table 4 provides empirical evidence for this relationship. The results in Column 1 suggest that firms with high number of directors tended to have lower leverage levels. The proxy for the number of directors on the board (*BOARD*) is negatively related to the book value of leverage (*LVG_BOOK*) at the 1% significance level. The results for the other measure of board composition, board independence (*BOARD_INDEPENDENCE*), indicates that firms with more independent

directors were more likely to have lower leverage levels. There is consistent evidence of using the market value of leverage to measure a firm's capital structure, as shown in Column 4. Clearly, board size (*BOARD*) is negatively related to the market value of leverage (*MARKET_LVG*) at the 1% significance level, although the significance level for board independence (*BOARD_INDEPENDENCE*) is lower, at the 10% level. Overall, the corporate governance characteristics measured by board composition are negatively related to firms' leverage levels.

Columns 2 and 5 of Table 4 present the relationship between firms' ownership concentration and leverage levels. The positive relationship between the percentage of institutional ownership (*INSTITUTIONAL_OWNERSHIP*) and the book value of leverage (*BOOK_LVG*) suggests that firms with more shares owned by institutions tended to have high leverage. However, insider ownership (*INSIDER_OWNERSHIP*) is negatively related to leverage level at the 5% significance level (see Model 3), but becomes statistically insignificant when the market value of leverage is used to measure capital structure. Thus, there is weak confirmation that firms with higher insider ownership tended to have lower leverage. This weak evidence is not consistent with the expectation that firms sharing ownership with managers can align the interests of managers and shareholders. This finding on ownership concentration shows that different corporate governance characteristics may influence debt levels in different ways.

Columns 3 and 6 include both board composition and ownership concentration variables in the model. The significance levels for board independence, institutional ownership and insider ownership are weaker, but the signs are consistent with the results in the Column 3. This provides consistent support for

the previous results. The regression tests provide mixed evidence regarding the relationship between different corporate governance measures and firm leverage. A negative relationship between board composition and firm leverage supports the finding of previous literature (Black et al., 2005; Cosh and Hughes, 1987; Franks et al., 2001; Higgs, 2003; Ozkan, 2007) that UK board structures are less effective than in the US. This is consistent with the view of McKnight and Weir (2009) and Guest (2008) that increasing board size and independence does not reduce agency costs. The evidence reveals differences between UK and US board structures in terms of their influence on firm leverage. Another interpretation is that using debt and changing board composition are alternative methods to improve corporate governance. Similarly, Bathala and Rao (1995) find an inverse relationship between board composition and debt levels. Thus, these results may indicate a substitution relationship between board composition and leverage levels (Setia- Atmaja et al., 2009). This suggests that firms may choose to improve their board structure rather than using debt to constrain the managerial discretion. Overall, the findings suggest that corporate governance measures may influence leverage levels, resulting in the changes to firms' capital structure.

6.2 Corporate governance and pension asset allocations

Since the above empirical evidence confirms that corporate governance may influence firms' capital structure, it is expected also to affect changes in pension asset allocations, which are a pension de-risking strategy. Table 5 presents analysis of the relationship between the corporate governance proxies and pension asset allocations, measured by the percentage of pension assets allocated to equities. An industry and year fixed effects model was used to

conduct the regression. Columns 1 and 2 of Table 5 show that firms with larger boards tended to allocate less pension assets to equities, as did firms with more independent boards. Board size (*BOARD*) and board independence (*BOARD_INDEPENDENCE*) are negatively related to pension asset allocations to equities (*SWITCH*) at the 5% and 1% significance levels respectively. The results in Columns 3 and 4 show that firms with higher institutional ownership tended to allocate more pension assets to equities. This is inconsistent with the results of using board composition to measure corporate governance. The relationship between levels of insider ownership (*INSIDER_OWNERSHIP*) and levels of equity investment (*SWITCH*) is positive. This suggests that firms with higher insider ownership were more likely to allocate pension assets to equities.

An interaction term between the value of leverage and corporate governance measures was added to explore the extent to which the level of leverage and corporate governance jointly influence pension asset allocations. In Columns 1 and 2 show that the interaction between the book (market) value of leverage and board independence are statistically positively significant with regard to pension asset allocations to equities (*EQUITY*). This indicates that the negative relationship between board independence and pension assets allocated to equities was more significant for firms with higher levels of leverage. The alternative use of the market value of leverage in Column 2 provides consistent evidence. In contrast, lower leverage tended to enhance the positive relationship between ownership concentration (*INSTITUTIONAL_OWNERSHIP*, *INSIDER_OWNERSHIP*) and pension asset allocations to equities (*EQUITY*). Overall, the results provide mixed evidence on the influence of corporate governance measures on pension asset allocations. The board composition measures suggest that board size and independence are negatively related to

pension assets invested in equities, while the ownership measures suggest a positive relationship.

These findings support the expectation that different corporate governance methods create different incentives for risk taking in pension asset allocations. Smaller boards have incentives to force managers to take greater investment risks (Wang, 2012). Thus, large boards are less likely to invest pension funds in a risky asset class, such as equities. The negative relationship between board size and pension asset allocations to equities is consistent with the previous literature (Phan and Hegde, 2013). In addition, since the previous literature confirms that a key role of independent directors is to balance the interests of different shareholders, more independent boards likely to make less risky investments. Therefore, the evidence of this study supports the view that firms with more independent boards tend to invest more pension assets in fixed income securities. The results on board composition suggest that firms with larger and more independent boards prefer to allocate pension assets to safer investments such as fixed income securities.

The positive relationship between ownership concentration and pension asset allocations is also consistent with the findings of previous literature (Chen and Steiner, 1999; Erkens et al., 2012; Wright et al., 1996; Wright et al., 2002) that higher ownership concentration promotes excessive risk taking in investments. This excessive risk-taking behaviour is explained by Black and Scholes (1973); Galai and Masulis (1976) by the fact that managerial ownership is regarded as a call option. Higher firm variance and risk may increase the value of the call option; thus, firms with higher institutional ownership and higher insider

ownership tend to make risker pension asset allocations and invest pension assets more heavily in equities.

The interaction term may reveal that, for firms with high leverage, those with greater board independence are more likely to allocate pension assets to bonds, while higher institutional ownership and insider ownership are less likely to influence pension asset allocations. However, for firms with low leverage, the influence of institutional ownership and insider ownership on pension asset investments in equities is greater than for high leverage firms. Increasing institutional ownership and insider ownership may cause increases in pension asset allocations to equities. This suggests that firm leverage plays a key role in influencing corporate governance regarding pension asset allocations.

Previous research (Bathala et al., 1994) indicates that debt may be used as an alternative method of corporate governance. In addition, the previous literature (Crutchley et al., 1999) indicates a substitutional relationship between external and internal monitoring as debt use is treated as internal monitoring. This may imply that corporate governance measures drive pension asset allocations to fixed income securities when external monitoring is high, and to risky investments when external monitoring is low. Therefore, the findings reveal that increases in board size and board independence may cause pension asset allocations to bonds, while increases in institutional ownership and insider ownership encourage pension asset allocations to equities. The influence of corporate governance on pension asset allocations may vary according to different levels of leverage, representing an external monitoring device.

The relationships between pension asset allocations and several control variables are consistent with the prior literature (Amir et al., 2010). Funding level

(*FUND*) is positive related to equity investments. This indicates that firms with higher funding levels allocate more pension assets to equities to pursue higher returns on investments in the stock market. The negative coefficient between *FUND_SQUARE* and *EQUITY* implies that there is an optimal level of pension asset allocations to equities. This finding is consistent with a nonlinear relationship between funding level and pension asset allocations. Moreover, the negative sign of pension fund investment horizon (*HOR*) suggests that firms with longer investment horizons tend to allocate less pension assets to equities. However, this is inconsistent with the research by Amir et al. (2010). There is weak support for a relationship between firm size and pension asset allocations, indicating that large firms tend to allocate more pension assets to bonds than equities, with a negative relationship between *SIZE2* and *EQUITY*.

6.3 Corporate governance and switches from DB to DC pension plans

To examine the influence of corporate governance on switches from DB to DC pension plans, the Cox proportional hazard model was used. Coefficients and hazard ratios are reported in Table 6. The dependent variable is *SWITCH*, representing the time taken to switch from DB to DC pension plans. Board independence (*BOARD_INDEPENDENCE*) is negatively and significantly related to switching from DB to DC pension plans (*SWITCH*). This means that a higher number of independent directors on the board was associated with a slower switch from DB to DC pension plans at the 1% significance level. The hazard rate of *BOARD_INDEPENDENCE* indicates that an increase of one unit in board independence cause around 97% lower hazard rates. This suggests

that firms with more independent boards were more likely to retain their DB pension plans.

To examine whether a firm's leverage level affects the influence of corporate governance on switching from DB to DC pension plans, the book and market value of leverage were interacted with board size (*BOARD*) and independence (*BOARD_INDEPENDENCE*) variables. As shown in Columns 1 and 3, the coefficient of the interaction term suggests that in firms with higher levels of leverage, the influence of board independence on switching from DB to DC pension plans was greater. However, board size was not related to changes in pension plans as the results are not statistically significant.

The results for alternative measures of corporate governance are shown in Columns 5 and 7 of Table 6. The findings reveal that firms with higher institutional ownership were more likely to switch from DB to DC pension plans. Insider ownership was unrelated to switching from DB to DC pension plans. The interaction term between ownership concentration and leverage value reveals no influence of leverage on the ownership measures. The interaction term is not statistically significant in the regression. In general, the results confirm that institutional ownership was positively related to switching from DB to DC pension plans, regardless of the effect of firm leverage.

The negative sign of *PLAN_SIZE* shows that smaller pension plans were more likely to switch, which is consistent with previous research (Choy et al., 2014; Comprix and Muller, 2011). Interestingly, in the sample of this study, firms with large operating cash flows tended to switch from DB pension plans. As is apparent from the positive sign of *delta_RD*, firms with high growth tended to switch from DB to DC pension plans. Changes in sales (*delta_SALE*) are

positively related to changes in pension plans. The results show that firms with increases in sales were more likely to switch from DB to DC pension plans at the 5% significance level. According to the control variables in the regression tests, it appears that a firm's current financial constraints may not have been the key reason for switching from DB to DC pension plans. Previous research (Ippolito, 1985) confirms that healthy firms terminate their pension plans even if their DB pension plans are sufficiently funded. Overall, the influence of board composition on pension asset allocations was greater for firms with high leverage.

6.4 Corporate governance and pension buy-ins and buyout

Pension buy-in and buyout transactions help firms transfer large pension obligations to insurance companies. Following the above tests, the relationship between corporate governance and pension buy-in and buyout decisions was investigated. The results in Table 7 support a relationship between board composition and pension buy-in and buyout transactions. Board size (*BOARD*) is positively related to pension buy-ins and buyouts (*BUYOUT*) at the 5% significance level, as shown in Columns 1 and 3. This suggests that firms with larger boards were more likely to engage in pension buy-in and buyout transactions. Although the coefficient of board independence shows that board independence (*BOARD_INDEPENDENCE*) is significantly negatively related to pension buy-ins and buyouts (*BUYOUT*), the hazard ratio is close to zero. Thus, board independence was unlikely to influence pension buy-in and buyout decisions. The two proxies (*LVG_BOOK* and *LVG_MARKET*) for leverage value interacting with board (*BOARD*) and board independence (*BOARD_INDEPENDENCE*) indicate that leverage may enhance the negative

(positive) influence of board composition on pension buy-in and buyout decisions. In other words, for firms with low leverage, increasing board size may have caused firms to engage more quickly in pension buy-ins and buyouts than firms with high leverage. Columns 5 and 7 provide weak support that institutional ownership may influence pension buy-in and buyout transactions, as it is only statistically significant at 10% level, and the hazard ratio is close to zero. Insider ownership (*INSIDER_OWNERSHIP*) is shown to be positively related to pension buy-ins and buyouts (*BUYOUT*). This suggests that firms with higher insider ownership were more likely to pursue pension buy-ins and buyouts to transfer their pension obligations. In addition, the interaction between value of leverage and insider ownership shows that lower leverage may create greater incentives for the influence of insider ownership on pension buy-ins and buyouts.

In summary, the evidence on the relationship between corporate governance and pension buy-in and buyout decisions establishes that firms with larger boards and more insider ownership were more likely to conduct pension buy-ins and buyouts. However, owing to the limited availability of data on pension buy-in and buyout transactions, the results are inconclusive.

7. Robustness checks

7.1 Endogeneity correction

Although the control variables were constructed to account fully for the other effects of capital structure and pension de-risking strategies, OLS regressions may not reveal potential endogeneity problems. The causal relationship among capital structure, pension de-risking strategies and corporate governance may

be problematic if capital structure influences corporate governance or pension de-risking strategies affect governance quality. Therefore, it was important to employ an estimation to support the causal relationship.

The two-stage least squares (2SLS) method is commonly used to support causal relationship arguments. However, since corporate governance shared the same controls as leverage, it is difficult to find valid instrumental variables for a 2SLS estimation. Thus, an alternative method was used to examine whether corporate governance influences capital structure or leverage levels. This provides empirical evidence for the influence of corporate governance measures on capital structure. Although this method may be less strong than 2SLS, it was implemented by lagging all the corporate governance and control variables. The lagged variables represented historical information on corporate governance, controlling for endogeneity problems. Consistent results support the causal relationship between corporate governance and capital structure shown in Table 8.

Endogeneity problems between corporate governance and pension de-risking strategies are arguably less likely. Pension funds are managed directly by trustees rather than sponsoring firms, and pension de-risking strategies are unlikely to cause changes to sponsor firm's corporate governance structure. Thus, the finding supports a causal relationship between corporate governance and pension de-risking strategies.

7.2 Alternative model

The prior literature (Choy et al., 2014; Comprix and Muller, 2011) relating to the termination of DB pension plans suggests using a probit model to examine the research questions. However, in this study, the Cox proportional hazard model

was used to investigate the relationship between corporate governance and switching from DB to DC pension plans. In order to examine the robustness of the results, a probit model was used to conduct the same regression using the same group of dependent and independent variables. In Table 9, Columns 1 and 2 show that board independence (*BOARD_INDEPENDENCE*) is negatively associated with switching from DB to DC pension plans (*SWITCH*). This is consistent to our results of the Cox proportional hazard model. Similarly, the coefficients of the interaction term between leverage and board independence are statistically significant at the 1% level. This strongly supports that leverage enhances the negative relationship between board independence and switches from DB to DC pension plans. This leads to the same conclusion, that firms with greater board independence are more likely to retain their DB pension plans. Similarly, Columns 3 and 4 provide evidence that firms with higher institutional ownership are more likely to switch from DB to DC pension plans. In addition, there is weak evidence that, for firms with lower leverage, the influence of institutional ownership on switching from DB to DC pension plans is greater at the 10% significance level. Overall, the results derived from the probit model support the finding of the Cox proportional hazard model regarding the effect of corporate governance on switching from DB pension plans.

Table 10 provides no evidence to support the previous finding. The limited availability of pension buy-in and buyout data may have been a significant factor leading to a different conclusion from the previous results. Moreover, the data limits the study to conducting a test with a probit model to explore the relationship between ownership concentration and pension buy-in and buyout decisions. Thus, it can only be concluded that there is a significant relationship between corporate governance proxies and pension buy-in and buyout

transactions. However, it is uncertain how corporate governance may influence pension buy-in and buyout decisions.

8. Conclusions

This study adopted Berger et al.'s (1997) method to examine the effect of corporate governance on firms' capital structure. In the sample of FTSE All-share companies for the period 2005-2014, it has been observed that corporate governance had a mixed influence on leverage levels. The book and market values of leverage were used to measure firms' capital structure. The findings suggest that board size and independence are negatively related to leverage levels. However, firms with high institutional ownership tend to have high levels of leverage. The study provides weak support for a negative relationship between insider ownership and levels of leverage. Overall, the results suggest that leverage levels are affected by different corporate governance measures in different ways. This is caused by the institutional setting of UK boards, which play a weak monitoring role. The finding that debt may be used as an external monitoring device to reduce agency costs is consistent with the finding of prior literature of a substitution relationship between board composition and debt (Setia‐Atmaja et al., 2009; Grier and Zychowicz, 1994).

This study has also investigated the effect of corporate governance on each pension de-risking strategy. A fixed effects model was applied to explore the relationship between corporate governance and pension asset allocations, controlling for industry-year fixed effects. The findings reveal that the influence of corporate composition on pension de-risking strategies differs from the influence of ownership concentration. Firms with larger and more independent boards tend to invest less pension assets in equities. However, higher

institutional and insider ownership tend to cause greater investments of pension assets in equities. This evidence supports the finding of prior literature that larger and more independent boards promote less risk taking in pension investments (Pathan, 2009; Wang, 2012; Eling and Marek, 2014), while higher institutional ownership and insider ownership increase a firm's risk taking (Chen and Steiner, 1999; Erkens et al., 2012; Wright et al., 1996; Wright et al., 2002). Leverage levels exert a significant influence on corporate governance in determining pension asset allocations.

In addition, the Cox proportional hazard model was used to explore the relationship between corporate governance and decisions to switch from DB to DC pension plans. The results suggest that firms with more independent directors on the board are more likely to retain their DB pension plans, while firms with more shares owned by institutions are more likely to switch from DB to DC pension plans. The findings suggest that different corporate governance measures influence decisions to switch from DB to DC pension plans differently. Finally, limited data on pension buy-in and buyout transactions were used to explore the association between corporate governance and pension buy-ins and buyouts. However, the results may have been affected by the limitations of the data.

This research enhances UK regulators' and investors' understanding that different corporate governance structures may influence pension de-risking strategies and capital structure differently. Specifically, board composition has a negative influence on risk taking in pension asset allocations. This should encourage firms to have larger and more independent boards in order to avoid allocating excessive pension assets to equities and prevent aggressive pension

investment strategies. This research also reveals that firms may change their managerial ownership structure to minimize pension fund risk, as higher insider ownership may increase pension asset allocations to risky assets. In addition, it informs investors that corporate governance structures may affect whether or not firms take decisions to switch from DB to DC pension plans.

Future research should focus on alternative corporate governance measures that may influence pension de-risking strategies.

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Appendix I: Variable Definitions

Variable	Definition
ASSET_COLLATERAL_VALUE	Net property, plant and equipment plus inventory over total assets for firm *i* at time *t*.
ASSET_UNIQUENESS1	Research and development expenses divided by total assets for firm *i* at time *t*.
ASSET_UNIQUENESS2	Selling, general and administrative expenses divided by total assets for firm *i* at time *t*.
BOARD	Number of directors on the board divided by log of total assets for firm *i* at time *t*.
BOARD_INDEPENDENCE	Number of independent directors on the board divided by total number of directors on the board for firm *i* at time *t*.
BUY-OUT	1 if firm *i* at time *t* engaged in pension buy-in or buy-out transactions, and 0 otherwise.
delta_CAPEX	Difference between capital expenditure for firm *i* at time *t* and capital expenditure for firm *i* at time *t*-1.
delta_DIV	Difference between dividends for firm *i* at time *t* and dividend for firm *i* at time *t*-1.
delta_LEV	Difference between leverage for firm *i* at time *t* and leverage for firm i at time *t*-1.
delta_RD	Difference between research and development expenses for firm *i* at time *t* and research and development expenses for firm *i* at time *t*-1.
delta_SALE	Difference between sales for firm *i* at time *t* and sales for firm *i* at time *t*-1.
DIVP	Dividend per share divided by earnings per share for firm *i* at time *t*.
EQUITY	Pension assets allocated to equities divided by total pension assets for firm *i* at time *t*.
FUND	Fair value of pension assets divided by projected benefit obligations for firm *i* at time *t*.
FUND_SQUARE	Square of fair value of pension assets divided by projected benefit obligations for firm *i* at time *t*.
INSTITUTIONAL_OWNERSHIP	Number of shares owned by institutions divided by total shares outstanding for firm *i* at time *t*.
INSIDER_OWNERSHIP	Number of shares owned by insiders divided by total shares outstanding for firm *i* at time *t*.
HOR	Log of projected benefit obligations divided by service costs for firm *i* at time *t*.
LEV	Long-term debt divided by the sum of long-term debt and market value of equity for firm *i* at time *t*.
LOSS	1 if firm *i* at time *t* reported a loss, and 0 otherwise.
LVG_BOOK	Book value of total debt divided by book value of total assets for firm *i* at time *t*.
LVG_MARKET	Book value of total debt divided by sum of book value of total assets and market value of equity for firm *i* at time *t*.
NONDEBT_TAX	Depreciation divided by total assets for firm *i* at time

	t.
OP_CF	Operating cash flow divided by total assets for firm *i* at time *t*.
PLAN_SIZE	Projected benefit obligations divided by total assets for firm *i* at time *t*.
ROA	Earnings before interest and tax divided by total assets for firm *i* at time *t*.
SDCF	Standard deviation of operating cash flow for firm *i* over times *t-4*, *t-3*, *t-2, t-1* and *t*.
SIZE	Log of total assets for firm *i* at time *t*.
SIZE2	Log of total market capitalisation for firm *i* at time *t*.
SWITCH	1 if firm *i* at time *t* had partially or fully closed a DB pension plan, and 0 otherwise.
TAXR	Income tax expenses divided by pre-tax income for firm i at time t.
UNDERFUND	1 if firm i at time t had a fair value of pension assets less projected benefit obligations, and 0 otherwise.

Table 1: Sample selection

Data	Firm-Year Observations	Unique Firms
Data set from Bloomberg and Thomson One Banker database for the period 2002-2014	8,434	1,186
Less observations without corporate governance data	(4,610)	(552)
Firm with corporate governance data for period 2005-2014	3,824	634
Less observations with missing data for calculating variables, and financial firms with SIC 6000 to 6999	(1,412)	(350)
Sample available for corporate governance and capital structure analysis	**1,617**	**284**
Less observations with missing pension asset allocation data	(199)	(55)
Sample available for corporate governance and pension asset allocations	**1,418**	**229**
Less observations without information on switches from DB to DC pension plans	(1,003)	(162)
Sample available for corporate governance and switches from DB to DC pension plans	**415**	**67**
Less observations without pension buy-in and buyout data	(357)	(59)
Sample available for corporate governance and pension buy-ins and buyouts	**58**	**8**

Table 2:
Descriptive statistics on corporate governance, pension de-risking strategies and firm characteristics

This table reports descriptive statistics for corporate governance, pension de-risking strategies and firm characteristics for FTSE All-share companies from 2005 to 2014. Corporate governance information was derived from the Bloomberg database, accounting information was collected from Thomson One Banker and pension information was collected from annual reports. Firm leverage is measured by *LVG_BOOK* and *LVG_MARKET*. Corporate governance measures include *SIZE_BOARD*, *BOARD_INDEPENDENCE*, *INSTITUTIONAL_OWNERSHIP* and *INSIDER_OWNERSHIP*. Pension de-risking strategy measures include EQUITY, SWITCH and BUYOUT. Panel A reports the control variables in equation 1: *ROA*; *ASSET_UNIQUENESS1*, *ASSET_UNIQUENESS2* and *NONDEBT_TAX*. Panel B reports the control variables in equation 2: *FUND*; *FUND_SQUARE*, *HOR*; *LEV*, *DIVP*, *TAXR*, *SDCF* and *SIZE2*. Panel C reports the control variables in equations 3 and 4: *UNDERFUND*, *PLAN_SIZE*, *OP_CF*, *LOSS*, *delta_LEV*, *delta_RD*, *delta_CAPEX* and *delta_SALE*.

Panel A: Descriptive statistics for frim leverage and board composition

	N	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
LVG_BOOK	1,617	0.19	0.16	0.00	0.72	0.06	0.18	0.28
LVG_MARKET	1,617	0.33	0.28	0.00	1.59	0.11	0.31	0.48
SIZE_BOARD	1,617	8.70	2.38	5.00	19.00	7.00	8.00	10.00
BOARD_INDEPENDENCE	1,617	0.56	0.12	0.25	0.82	0.50	0.57	0.67
ROA	1,617	0.13	0.10	-0.28	0.43	0.08	0.12	0.17
ASSET_COLLATERAL_VALUE	1,617	0.35	0.23	0.01	0.93	0.17	0.33	0.48
SIZE	1,617	7.26	1.67	3.80	11.85	6.08	7.00	8.18
ASSET_UNIQUENESS1	1,617	0.03	0.09	0.00	0.88	0.00	0.00	0.02
ASSET_UNIQUENESS2	1,617	0.24	0.25	0.01	2.51	0.08	0.18	0.33
NONDEBT_TAX	1,617	0.03	0.03	0.00	0.13	0.01	0.02	0.04

Panel B: Descriptive statistics for leverage and ownership concentration

	N	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
LVG_BOOK	1,201	0.18	0.15	0.00	0.72	0.05	0.16	0.26
LVG_MARKET	1,201	0.31	0.28	0.00	1.59	0.09	0.27	0.44
INSTITUTIONAL_OWNERSHIP	1,201	0.99	0.81	0.09	9.58	0.75	0.98	1.14
INSIDER_OWNERSHIP	1,201	0.07	0.08	0.00	0.44	0.01	0.04	0.08
ROA	1,201	0.12	0.10	-0.28	0.43	0.07	0.11	0.17
ASSET_COLLATERAL_VALUE	1,201	0.34	0.24	0.01	0.93	0.14	0.32	0.48
SIZE	1,201	7.00	1.66	3.80	11.85	5.78	6.82	7.99
ASSET_UNIQUENESS1	1,201	0.03	0.10	0.00	0.88	0.00	0.00	0.01
ASSET_UNIQUENESS2	1,201	0.27	0.30	0.01	2.51	0.08	0.20	0.33
NONDEBT_TAX	1,201	0.03	0.03	0.00	0.13	0.01	0.02	0.04

Panel C: Descriptive statistics for pension asset allocations

	N	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
EQUITY	1,418	0.48	0.19	0.05	0.93	0.35	0.49	0.61
SIZE_BOARD	1,418	9.22	2.46	5.00	19.00	7.00	9.00	10.00
BOARD_INDEPENDENCE	1,418	0.57	0.12	0.25	0.82	0.50	0.57	0.67
FUND	1,418	0.87	0.13	0.41	1.16	0.80	0.88	0.96
FUND_SQUARE	1,418	0.78	0.22	0.17	1.35	0.64	0.77	0.92
HOR	1,418	4.34	1.01	1.63	7.84	3.71	4.23	4.83
LEV	1,418	0.21	0.17	0.00	0.80	0.09	0.18	0.30
DIVP	1,418	0.68	0.99	0.00	7.76	0.33	0.47	0.65
TAXR	1,418	0.27	0.31	-1.28	2.38	0.19	0.27	0.32
SDCF	1,418	0.75	2.70	0.01	17.02	0.05	0.09	0.20
SIZE2	1,418	7.57	1.54	3.79	11.09	6.53	7.37	8.45

Panel D: Descriptive statistics for switches from DB to DC pension plans

	N	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
SWITCH	415	0.74	0.44	0.00	1.00	0.00	1.00	1.00
SIZE_BOARD	415	10.36	2.33	6.00	17.00	9.00	10.00	12.00
BOARD_INDEPENDENCE	415	0.62	0.11	0.30	0.82	0.55	0.64	0.71
UNDERFUND	415	0.85	0.36	0.00	1.00	1.00	1.00	1.00
FUND	415	0.90	0.11	0.56	1.16	0.83	0.90	0.97
PLAN_SIZE	415	0.41	0.41	0.00	2.36	0.15	0.27	0.53
OP_CF	415	0.11	0.05	-0.01	0.33	0.08	0.10	0.13
LOSS	415	0.00	0.05	0.00	1.00	0.00	0.00	0.00
delta_DIV	415	0.02	1.01	-6.26	5.83	-0.08	0.01	0.11
delta_LEV	415	-0.00	0.05	-0.20	0.24	-0.03	-0.01	0.02
delta_RD	415	8.32	46.45	-88.00	182.00	0.00	0.00	5.20
delta_CAPEX	415	-0.00	0.02	-0.10	0.09	-0.01	-0.00	0.00
delta_SALE	415	0.04	0.14	-0.97	0.58	-0.00	0.05	0.11

Panel E: Descriptive statistics for pension buy-ins and buyouts

	N	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
BUYOUT	58	0.62	0.49	0.00	1.00	0.00	1.00	1.00
SIZE_BOARD	58	9.78	2.13	6.00	15.00	9.00	9.00	10.00
BOARD_INDEPENDENCE	58	0.67	0.10	0.50	0.82	0.57	0.68	0.75
UNDERFUND	58	0.90	0.31	0.00	1.00	1.00	1.00	1.00
FUND	58	0.91	0.08	0.68	1.12	0.87	0.89	0.94
PLAN_SIZE	58	0.39	0.27	0.13	1.13	0.23	0.28	0.41
OP_CF	58	0.13	0.07	0.00	0.33	0.09	0.11	0.16
LOSS	58	0.00	0.00	0.00	0.00	0.00	0.00	0.00
delta_DIV	58	0.09	0.55	-1.30	3.28	-0.08	0.01	0.11
delta_LEV1	58	0.01	0.06	-0.10	0.24	-0.02	-0.00	0.03
delta_RD	58	14.63	56.24	-88.00	182.00	0.00	2.00	10.00
delta_CAPEX	58	0.00	0.01	-0.02	0.05	-0.00	-0.00	0.01
delta_SALE	58	0.05	0.08	-0.15	0.29	0.00	0.04	0.10
SWITCH	58	0.88	0.33	0.00	1.00	1.00	1.00	1.00

Table 3:

Correlation matrix

Panel A's diagonal describes correlations between measures of leverage and all variables. Panel B describes correlations between pension asset allocations and all variables. Panel C describes correlations between switches from DB to DC pension plans and all variables. Panel D describes correlations between pension buy-in and buyout transactions and all variables. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. All variable definitions are reported in Appendix I.

Panel A: Correlation between Leverage, corporate governance measures and financial characteristics (N=1,617)

	LVG_BOOK	*LVG_MARKET*	*BOARD*	*BOARD_INDEPENDENCE*	*ROA*	*ASSET_COLLATERAL_VALUE*	*SIZE*	*ASSET_UNIQUENESS1*	*ASSET_UNIQUENESS2*	*NONDEBT_TAX*
LVG_BOOK	1									
LVG_MARKET	0.873***	1								
	(0.000)									
BOARD	-0.153***	-0.131***	1							
	(0.000)	(0.000)								
BOARD_INDEPENDENCE	0.055*	0.088***	-0.308***	1						
	(0.028)	(0.000)	(0.000)							
ROA	-0.057*	-0.126***	0.158***	-0.144***	1					
	(0.023)	(0.000)	(0.000)	(0.000)						
ASSET_COLLATERAL_VALUE	0.116***	0.041	-0.140***	-0.031	0.197***	1				
	(0.000)	(0.099)	(0.000)	(0.217)	(0.000)					
SIZE	0.198***	0.221***	-0.267***	0.405***	-0.244***	0.021	1			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.410)				
ASSET_UNIQUENESS1	-0.220***	-0.206***	0.119***	-0.005	-0.095***	-0.281***	-0.176***	1		
	(0.000)	(0.000)	(0.000)	(0.854)	(0.000)	(0.000)	(0.000)			
ASSET_UNIQUENESS2	-0.092***	-0.176***	0.125***	-0.030	0.167***	-0.090***	-0.217***	0.347***	1	
	(0.000)	(0.000)	(0.000)	(0.223)	(0.000)	(0.000)	(0.000)	(0.000)		
NONDEBT_TAX	0.120***	0.086***	0.018	-0.088***	0.203***	0.426***	-0.070**	-0.156***	-0.068**	1
	(0.000)	(0.001)	(0.463)	(0.000)	(0.000)	(0.000)	(0.005)	(0.000)	(0.006)	

Panel B: Correlation between pension asset allocations, corporate governance measures and financial characteristics (N=1,418)

	EQUITY	*BOARD*	*BOARD_INDEPENDENCE*	*FUND*	*FUND_SQUARE*	*HOR*	*LEV*	*DIVP*	*TAXR*	*SDCF*	*SIZE2*
EQUITY	1										
BOARD	0.040	1									
	(0.129)										
BOARD_INDEPENDENCE	-0.275***	-0.274***	1								
	(0.000)	(0.000)									
FUND	-0.083**	0.010	0.108***	1							
	(0.002)	(0.720)	(0.000)								
FUND_SQUARE	-0.095***	0.017	0.097***	0.992***	1						
	(0.000)	(0.524)	(0.000)	(0.000)							
HOR	-0.283***	-0.093***	0.066*	0.129***	0.110***	1					
	(0.000)	(0.000)	(0.013)	(0.000)	(0.000)						
LEV	0.018	-0.157***	-0.052	0.012	0.020	0.048	1				
	(0.509)	(0.000)	(0.051)	(0.645)	(0.443)	(0.069)					
DIVP	0.021	-0.073**	0.068*	0.010	0.013	0.027	0.085**	1			
	(0.424)	(0.006)	(0.011)	(0.698)	(0.628)	(0.302)	(0.001)				
TAXR	0.049	-0.037	0.089***	-0.064*	-0.062*	-0.139***	-0.058*	0.139***	1		
	(0.064)	(0.165)	(0.001)	(0.016)	(0.019)	(0.000)	(0.030)	(0.000)			
SDCF	0.055*	0.046	0.004	0.064*	0.068*	-0.020	0.043	0.011	0.011	1	
	(0.039)	(0.083)	(0.890)	(0.017)	(0.011)	(0.460)	(0.104)	(0.671)	(0.681)		
SIZE2	-0.091***	-0.052	0.368***	0.065*	0.056*	-0.248***	-0.087**	-0.005	0.180***	-0.048	1
	(0.001)	(0.050)	(0.000)	(0.015)	(0.034)	(0.000)	(0.001)	(0.854)	(0.000)	(0.070)	

Panel C: Correlation between switches from DB to DC pension plans, corporate governance measures and financial characteristics (N=415)

	SWITCH	*BOARD*	*BOARD_INDEPENDENCE*	*UNDERFUND*	*FUND*	*PLAN_SIZE*	*OP_CF*	*LOSS*	*delta_DIV*	*delta_LEV*	*delta_RD*	*delta_CAPEX*	*delta_SALE*
SWITCH	1												
BOARD	0.076	1											
	(0.122)												
BOARD_INDEPENDENCE	0.198***	-0.217***	1										
	(0.000)	(0.000)											
UNDERFUND	-0.040	-0.162***	0.096	1									
	(0.412)	(0.001)	(0.051)										
FUND	0.053	0.103*	0.000	-0.667***	1								
	(0.278)	(0.036)	(0.992)	(0.000)									
PLAN_SIZE	-0.179***	0.101*	-0.103*	-0.009	0.104*	1							
	(0.000)	(0.040)	(0.035)	(0.857)	(0.034)								
OP_CF	0.257***	0.230***	0.041	-0.137**	0.117*	-0.122*	1						
	(0.000)	(0.000)	(0.409)	(0.005)	(0.017)	(0.013)							
LOSS	-0.083	-0.031	0.019	0.021	0.002	0.005	-0.027	1					
	(0.092)	(0.523)	(0.702)	(0.670)	(0.973)	(0.918)	(0.590)						
delta_DIV	-0.007	0.019	-0.008	-0.008	-0.030	-0.012	-0.062	-0.001	1				
	(0.893)	(0.698)	(0.864)	(0.866)	(0.541)	(0.827)	(0.207)	(0.977)					
delta_LEV	-0.007	-0.067	0.056	0.006	0.015	-0.087	-0.135**	-0.046	0.080	1			
	(0.888)	(0.175)	(0.252)	(0.903)	(0.759)	(0.076)	(0.006)	(0.353)	(0.103)				
delta_RD	0.007	0.080	-0.022	-0.046	0.013	-0.016	0.146**	-0.012	-0.011	0.066	1		
	(0.888)	(0.103)	(0.661)	(0.350)	(0.791)	(0.745)	(0.003)	(0.808)	(0.820)	(0.182)			
delta_CAPEX	-0.036	0.016	0.061	0.013	-0.003	0.026	-0.060	0.073	-0.007	0.038	-0.094	1	
	(0.459)	(0.748)	(0.218)	(0.787)	(0.945)	(0.591)	(0.224)	(0.138)	(0.892)	(0.44)	(0.056)		
delta_SALE	-0.040	0.031	-0.178***	0.017	-0.053	-0.029	0.036	0.004	0.023	0.071	0.143**	-0.109*	1
	(0.415)	(0.531)	(0.000)	(0.727)	(0.280)	(0.552)	(0.467)	(0.937)	(0.648)	(0.146)	(0.004)	(0.026)	

Panel D: Correlation between pension buy-ins and buyouts, corporate governance measures and financial characteristics (N=58)

	BUYOUT	*BOARD*	*BOARD_INDEPENDENCE*	*UNDERFUND*	*FUND*	*PLAN_SIZE*	*OP_CF*	*LOSS*	*delta_DIV*	*delta_LEV*	*delta_RD*	*delta_CAPEX*	*delta_SALE*
BUYOUT	1												
BOARD	-0.237*	1											
	(0.012)												
BOARD_INDEPENDENCE	0.133	0.029	1										
	(0.161)	(0.761)											
UNDERFUND	-0.155	0.114	0.148	1									
	(0.101)	(0.230)	(0.117)										
FUND	0.150	-0.089	-0.197*	-0.760***	1								
	(0.113)	(0.349)	(0.037)	(0.000)									
PLAN_SIZE	0.043	0.247**	-0.040	0.220*	-0.130	1							
	(0.654)	(0.008)	(0.672)	(0.019)	(0.169)								
OP_CF	0.089	0.216*	0.210*	-0.046	-0.002	-0.197*	1						
	(0.346)	(0.022)	(0.026)	(0.633)	(0.986)	(0.036)							
LOSS	-0.121	0.011	-0.048	0.047	0.035	-0.069	-0.000	1					
	(0.203)	(0.908)	(0.613)	(0.625)	(0.713)	(0.467)	(0.996)						
delta_DIV	0.227*	0.074	0.181	0.122	-0.183	-0.130	0.196*	-0.048	1				
	(0.015)	(0.436)	(0.055)	(0.198)	(0.052)	(0.171)	(0.038)	(0.617)					
delta_LEV1	-0.038	-0.035	-0.045	0.006	0.108	-0.064	-0.252**	0.165	0.026	1			
	(0.691)	(0.710)	(0.634)	(0.948)	(0.256)	(0.498)	(0.007)	(0.081)	(0.789)				
delta_RD	-0.203*	0.051	0.093	0.089	-0.119	-0.082	0.246**	-0.021	0.091	-0.036	1		
	(0.031)	(0.592)	(0.325)	(0.347)	(0.210)	(0.390)	(0.009)	(0.828)	(0.336)	(0.705)			
delta_CAPEX	-0.096	-0.046	0.014	-0.058	0.079	0.078	0.048	-0.261**	-0.032	0.116	0.048	1	
	(0.310)	(0.626)	(0.883)	(0.540)	(0.408)	(0.412)	(0.614)	(0.005)	(0.736)	(0.222)	(0.611)		
delta_SALE	0.059	-0.035	-0.112	-0.114	0.008	-0.144	0.007	-0.488***	0.294**	0.147	0.119	0.142	1
	(0.533)	(0.714)	(0.238)	(0.230)	(0.933)	(0.129)	(0.941)	(0.000)	(0.002)	(0.120)	(0.210)	(0.133)	

Table 4:

Influence of corporate governance on firms' leverage

$$LVG\_BOOK_{it}(orLVG\_MARKET_{it}) = \alpha_0 + \beta_1 BOARD_{it}(orINSTITUTIONAL\_OWNERSHIP_{it})$$
$$+ \beta_2 BOARD\_INDEPENDENCE_{it}(orINSIDER\_OWNERSHIP_{it}) + \beta_3 ROA_{it}$$
$$+ \beta_4 ASSET\_COLLATERAL\_VALUE_{it} + \beta_5 SIZE_{it} + \beta_6 ASSET\_UNIQUENESS1_{it}$$
$$+ \beta_7 ASSET\_UNIQUENESS2_{it} + \beta_8 NONDEBT\_TAX_{it} + YearF.E + IndustryF.E + \varepsilon_{it}$$

Dependent Variable		*BOOK_LVG (Book Value of Leverage)*			*MARKET_LVG (Market Value of Leverage)*		
		(1)	(2)	(3)	(4)	(5)	(6)
	Exp. sign	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*
BOARD	+	-0.051***		-0.051***	-0.075***		-0.067*
		(0.01)		(0.02)	(0.03)		(0.04)
BOARD_INDEPENDENCE	+	-0.068**		-0.037	-0.099*		-0.001
		(0.03)		(0.04)	(0.06)		(0.07)
INSTITUTIONAL_OWNERSHIP	+		0.029***	0.014*		0.025**	0.006
			(0.01)	(0.01)		(0.01)	(0.02)
INSIDER_OWNERSHIP	+		-0.161**	-0.160*		-0.004	-0.094
			(0.08)	(0.09)		(0.15)	(0.18)
ROA_w	-	-0.163***	-0.080*	-0.068	-0.428***	-0.259***	-0.226**
		(0.04)	(0.04)	(0.05)	(0.07)	(0.09)	(0.10)
ASSET_COLLATERAL_VALUE	-	0.027	0.001	-0.032	-0.041	-0.128**	-0.150**
		(0.03)	(0.03)	(0.04)	(0.06)	(0.06)	(0.07)
SIZE	+	0.019***	0.020***	0.017***	0.037***	0.034***	0.030***
		(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
ASSET_UNIQUENESS1	-	-0.271***	-0.216***	-0.283***	-0.422***	-0.242**	-0.394***
		(0.05)	(0.05)	(0.06)	(0.09)	(0.10)	(0.11)
ASSET_UNIQUENESS2	+	0.015	0.015	0.010	-0.067**	-0.069**	-0.091***
		(0.01)	(0.01)	(0.02)	(0.03)	(0.03)	(0.03)
NONDEBT_TAX	+	0.487**	0.844***	0.612**	1.000**	1.918***	1.220**
		(0.21)	(0.22)	(0.26)	(0.40)	(0.45)	(0.49)
Constant		0.162***	0.009	0.137***	0.325***	0.089	0.243***
		(0.04)	(0.03)	(0.04)	(0.07)	(0.06)	(0.09)
Observations		1,617	1,201	1,004	1,617	1,201	1,004
R-squared		0.097	0.119	0.097	0.103	0.092	0.100
Number of SIC		157	176	150	157	176	150
Industry FE		YES	YES	YES	YES	YES	YES
Year FE		YES	YES	YES	YES	YES	YES

This table reports fixed-effects results using two alternative measures of firm leverage for 2005–2014. Less data was available for institutional ownership and insider ownership so when the models include these two variables, the sample only covers 2010 to 2014. Industry variables are based on 4-digit (CRSP) SIC codes. Standard errors are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Appendix I.

Table 5:

Influence of corporate governance on pension asset allocations Association

$$EQUITY_{it} = \alpha_0 + \beta_1 BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it})$$
$$+ \beta_2 BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it}) + \beta_3 FUND_{it}$$
$$+ \beta_4 FUND\_SQUARE_{it} + \beta_5 HOR_{it} + \beta_6 LEV_{it} + \beta_7 DIVP_{it} + \beta_8 TAXR_{it} + \beta_9 SDCF_{it} + \beta_{10} SIZE2_{it}$$
$$+ \beta_{10} BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it}) \times LVG\_BOOK_{it}(or LVG\_MARKET_{it})$$
$$+ \beta_{11} BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it})$$
$$\times LVG\_BOOK_{it}(or LVG\_MARKET_{it}) + \beta_{12} LVG\_BOOK_{it}(or LVG\_MARKET_{it})$$
$$+ YearF.E + IndustryF.E + \varepsilon_{it}$$

Dependent Variable		*EQUITY*			
	Exp. Sign	(1) *Fixed Effects*	(2) *Fixed Effects*	(3) *Fixed Effects*	(4) *Fixed Effects*
BOARD	+	-0.071**	-0.082**		
		(0.03)	(0.03)		
BOARD_INDEPENDENCE	+	-0.278***	-0.274***		
		(0.07)	(0.07)		
INSTITUTIONAL_OWNERSHIP	+			0.047**	0.072***
				(0.02)	(0.03)
INSIDER_OWNERSHIP	+			0.959***	0.926***
				(0.14)	(0.15)
LVG_BOOK	+	-0.337		0.155	
		(0.21)		(0.10)	
LVG_MARKET	+		-0.234*		0.188***
			(0.12)		(0.06)
*BOARD*LVG_BOOK*	?	0.101			
		(0.10)			
*BOARD_INDEPENDENCE*LVG_BOOK*	?	0.551**			
		(0.23)			
*BOARD*LVG_MARKET*	?		0.079		
			(0.06)		
*BOARD_INDEPENDENCE*LVG_MARKET*	?		0.291**		
			(0.13)		
*INSTITUTIONAL_OWNERSHIP*LVG_BOOK*	?			-0.093**	
				(0.05)	
*INSIDER_OWNERSHIP*LVG_BOOK*	?			-1.865***	
				(0.61)	
*INSTITUTIONAL_OWNERSHIP*LVG_MARKET*	?				-11.900***
					(3.64)
*INSIDER_OWNERSHIP*LVG_MARKET*	?				-82.580**
					(33.33)
FUND	+	1.241***	1.191***	1.222***	1.268***
		(0.26)	(0.26)	(0.35)	(0.35)
FUND_SQUARE	-	-0.788***	-0.761***	-0.874***	-0.899***
		(0.15)	(0.15)	(0.21)	(0.21)
HOR	+	-0.029***	-0.029***	-0.012	-0.012*

Dependent Variable		*EQUITY*			
		(0.01)	(0.01)	(0.01)	(0.01)
LEV	+	-0.002	0.026	0.079	0.031
		(0.05)	(0.04)	(0.07)	(0.06)
DIVP	+	0.002	0.002	0.001	0.002
		(0.00)	(0.00)	(0.00)	(0.01)
TAXR	+	-0.012	-0.011	-0.014	-0.011
		(0.01)	(0.01)	(0.02)	(0.02)
SDCF	+	0.003*	0.003	0.002	0.000
		(0.00)	(0.00)	(0.00)	(0.00)
SIZE2	-	-0.010**	-0.009*	-0.001	-0.002
		(0.01)	(0.00)	(0.01)	(0.01)
Constant		0.575***	0.602***	0.036	-0.004
		(0.12)	(0.12)	(0.15)	(0.15)
Observations		1,417	1,417	817	817
R-squared		0.348	0.347	0.250	0.248
Number of SIC		144	144	150	150
Industry FE		YES	YES	YES	YES
Year FE		Yes	Yes	Yes	Yes

This table reports fixed-effects results using pension asset allocation measured by the percentage of pension assets allocated to equities for 2005–2014. Industry variables are based on 4-digit (CRSP) SIC codes. Standard errors are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Appendix I.

Table 6:

Influence of corporate governance on switches from DB to DC pension plans

$$SWITCH_{it} = \alpha_0 + \beta_1 BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it})$$
$$+ \beta_2 BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it}) + \beta_3 UNDERFUND_{it}$$
$$+ \beta_4 FUND_{it} + \beta_5 PLAN\_SIZE_{it} + \beta_6 OP\_CF_{it} + \beta_7 LOSS_{it} + \beta_8 delta\_DIV_{it} + \beta_9 delta\_LEV_{it}$$
$$+ \beta_{10} delta\_RD_{it} + \beta_{11} delta\_CAPEX_{it} + \beta_{12} delta\_SALE_{it}$$
$$+ \beta_{13} BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it}) \times LVG\_BOOK_{it}(or LVG\_MARKET_{it})$$
$$+ \beta_{14} BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it})$$
$$\times LVG\_BOOK_{it}(or LVG\_MARKET_{it}) + \beta_{15} VG\_BOOK_{it}(or LVG\_MARKET_{it}) + \varepsilon_{it}$$

Dependent Variable		*SWITCH*							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Exp. sign	*Coefficient*	*hazard ratio*	*Coefficient*	*hazard ratio*	*Coefficient*	*hazard ratio*	*Coefficient*	*hazard ratio*
_t									
BOARD	+	0.185	1.204	-0.437	0.646				
		(0.66)	(0.79)	(0.63)	(0.41)				
BOARD_INDEPENDENCE	+	-3.581***	0.028***	-4.243***	0.014***				
		(1.24)	(0.04)	(1.28)	(0.02)				
INSTITUTIONAL_OWNERSHIP	+					1.434**	4.195**	1.064	2.899
						(0.66)	(2.76)	(0.66)	(1.92)
INSIDER_OWNERSHIP	+					4.515	91.340	1.035	2.816
						(7.97)	(727.60)	(7.49)	(21.09)
LVG_BOOK	+	-6.569*	0.001*			4.044*	57.080*		
		(3.84)	(0.01)			(2.43)	(138.50)		
LVG_MARKET	+			-6.573***	0.001***			1.213	3.364
				(2.34)	(0.00)			(1.49)	(5.02)
*BOARD*LVG_BOOK*	?	0.799	2.223						
		(2.41)	(5.35)						
*BOARD_INDEPENDENCE*LVG_BOOK*	?	10.04**	22,820**						
		(4.05)	(92,487)						
*BOARD*LVG_MARKET*	?			2.040	7.694				
				(1.25)	(9.62)				
*BOARD_INDEPENDENCE*LVG_MARKET*	?			7.257***	1,418***				
				(2.42)	(3,428)				
*INSTITUTIONAL_OWNERSHIP*LVG_BOOK*	?					-3.047	0.048		
						(2.27)	(0.11)		
*INSIDER_OWNERSHIP*LVG_BOOK*	?					-31.240	0.000		
						(32.52)	(0.00)		
*INSTITUTIONAL_OWNERSHIP*LVG_MARKET*	?							-0.946	0.388
								(1.40)	(0.55)
*INSIDER_OWNERSHIP*LVG_MARKET*	?							-10.050	4.3e-05
								(17.68)	(0.00)
UNDERFUND	+	0.118	1.126	0.094	1.099	0.053	1.054	0.055	1.057
		(0.23)	(0.25)	(0.23)	(0.25)	(0.28)	(0.30)	(0.28)	(0.30)
FUND	-	-0.383	0.682	-0.470	0.625	-0.659	0.517	-0.661	0.516
		(0.74)	(0.50)	(0.75)	(0.47)	(0.95)	(0.49)	(0.97)	(0.50)
PLAN_SIZE	-	-0.330*	0.719*	-0.356**	0.700**	-0.262	0.770	-0.274	0.760
		(0.17)	(0.13)	(0.18)	(0.13)	(0.20)	(0.15)	(0.21)	(0.16)
OP_CF	-	2.706**	14.970**	2.674**	14.500**	3.522**	33.850**	3.559**	35.130**
		(1.17)	(17.48)	(1.20)	(17.41)	(1.62)	(54.83)	(1.69)	(59.38)
LOSS	+	-33.940	0.000	-31.860	0.000				
		(4.9e+07)	(0.00)	(1.8e+07)	(0.00)				
delta_DIV	+	-0.050	0.952	-0.048	0.953	-0.030	0.971	-0.031	0.969

Dependent Variable		*SWITCH*							
		(0.06)	(0.06)	(0.06)	(0.06)	(0.08)	(0.08)	(0.09)	(0.08)
delta_LEV	+	-1.716	0.180	-1.695	0.184	-3.419*	0.0327*	-3.302*	0.037*
		(1.27)	(0.23)	(1.29)	(0.24)	(1.75)	(0.06)	(1.79)	(0.07)
delta_RD	-	0.003**	1.003**	0.003**	1.003**	0.001	1.001	0.000	1.000
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
delta_CAPEX	+	-3.942	0.019	-3.628	0.027	-6.656	0.001	-6.867*	0.001*
		(3.16)	(0.06)	(3.18)	(0.08)	(4.11)	(0.01)	(4.08)	(0.00)
delta_SALE	+	1.237**	3.446**	1.218**	3.381**	1.520**	4.572**	1.510**	4.528**
		-0.05	0.95	-0.05	0.95	-0.03	0.97	-0.03	0.97
Observations		415	415	415	415	250	250	250	250

This table reports Cox proportional hazard model results using switches from DB to DC pension plans in the period 2005–2014. *SWITCH* is coded as 1 if a firm partially or fully closed its DB pension plan and 0 otherwise. Standard errors are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Appendix I.

Table 7:

Influence of corporate governance on pension buy-in and buyout transactions

$$BUYOUT_{it} = \alpha_0 + \beta_1 BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it})$$
$$+ \beta_2 BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it}) + \beta_3 UNDERFUND_{it}$$
$$+ \beta_4 FUND_{it} + \beta_5 PLAN\_SIZE_{it} + \beta_6 OP\_CF_{it} + \beta_7 LOSS_{it} + \beta_8 delta\_DIV_{it} + \beta_9 delta\_LEV_{it}$$
$$+ \beta_{10} delta\_RD_{it} + \beta_{11} delta\_CAPEX_{it} + \beta_{12} delta\_SALE_{it} + \beta_{13} SWITCH_{it}$$
$$+ \beta_{13} BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it}) \times LVG\_BOOK_{it}(or LVG\_MARKET_{it})$$
$$+ \beta_{14} BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it})$$
$$\times LVG\_BOOK_{it}(or LVG\_MARKET_{it}) + \beta_{15} LVG\_BOOK_{it}(or LVG\_MARKET_{it}) + \varepsilon_{it}$$

Dependent Variable		*BUYOUT*							
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Exp. Sign	*Coefficient*	*Hazard ratio*	*Coefficient*	*hazard ratio*	*Coefficient*	*Hazard ratio*	*Coefficient*	*hazard ratio*
_t									
BOARD	+	9.052**	8,534**	8.125**	3,377**				
		(3.97)	(33,839)	(3.73)	(12,604)				
BOARD_INDEPENDENCE	+	-21.610**	0.000**	-19.220**	0.000**				
		(9.00)	(0.00)	(8.01)	(0.00)				
INSTITUTIONAL_OWNERSHIP	+					-5.188	0.006	-10.93*	0.000*
						(7.49)	(0.04)	(6.50)	(0.00)
INSIDER_OWNERSHIP	+					163.800**	1.3e+71**	154.900**	1.8e+67**
						(70.61)	(9.2e+72)	(64.61)	(1.2e+69)
LVG_BOOK	+	-18.480	0.000			5.910	368.900		
		(17.34)	(0.00)			(16.88)	(6,227)		
LVG_MARKET	+			-6.980	0.001			-8.530	0.000197
				(10.30)	(0.01)			(9.839)	(0.00194)
*BOARD*LVG_BOOK*	?	-33.120**	0.000**						
		(14.03)	(0.00)						
*BOARD_INDEPENDENCE*LVG_BOOK*	?	84.700**	6.1e+36**						
		(34.39)	(2.1e+38)						
*BOARD*LVG_MARKET*	?			-18.83**	6.7e-09**				
				(7.80)	(5.2e-08)				
*BOARD_INDEPENDENCE*LVG_MARKET*	?			45.1**	4.0e+19**				
				(18.89)	(7.5e+20)				
*INSTITUTIONAL_OWNERSHIP*LVG_BOOK*	?					17.17	2.9e+07		
						(23.13)	(6.6e+08)		
*INSIDER_OWNERSHIP*LVG_BOOK*	?					-549.400**	0.000**		
						(232.80)	(0.00)		
*INSTITUTIONAL_OWNERSHIP*LVG_MARKET*	?							24.590*	4.8e+10*
								(12.86)	(6.2e+11)
*INSIDER_OWNERSHIP*LVG_MARKET*	?							-345.800**	0.000**
								(147.40)	(0.00)
UNDERFUND	+	-1.067	0.344	-1.161	0.313	-2.703	0.067	-1.072	0.342
		(2.09)	(0.72)	(2.19)	(0.69)	(3.90)	(0.26)	(5.49)	(1.88)
FUND	-	3.677	39.53	5.930	376.0	-1.797	0.166	1.878	6.539
		(5.71)	(225.60)	(5.82)	(2,19)	(8.73)	(1.45)	(9.10)	(59.49)
PLAN_SIZE	-	-0.041	0.960	-0.563	0.569	-0.133	0.876	0.657	1.930
		(0.98)	(0.94)	(1.02)	(0.58)	(1.00)	(0.88)	(1.17)	(2.26)
OP_CF	-	-0.239	0.787	-1.089	0.337	-7.341	0.001	-0.914	0.401
		(7.12)	(5.61)	(8.33)	(2.80)	(12.43)	(0.01)	(15.00)	(6.01)
delta_DIV	+	-0.572	0.564	-0.442	0.643	-1.058**	0.347**	-0.666	0.514
		(0.43)	(0.24)	(0.40)	(0.26)	(0.52)	(0.18)	(0.50)	(0.26)

Dependent Variable		*BUYOUT*							
delta_LEV	+	-7.741	0.000435	-9.273*	9.4e-05*	-4.341	0.013	-3.704	0.025
		(5.33)	(0.00)	(5.43)	(0.00)	(6.97)	(0.09)	(7.76)	(0.19)
delta_RD	-	0.001	1.001	0.004	1.004	0.021**	1.021**	0.016**	1.016**
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
delta_CAPEX	+	15.940	8.4e+06	21.860	3.1e+09	12.840	377,205	14.190	1.5e+06
		(17.63)	(1.5e+08)	(17.28)	(5.4e+10)	(24.87)	(9.4e+06)	(24.78)	(3.6e+07)
delta_SALE	+	9.988***	21,772***	9.511**	13,506**	6.687*	802.000*	10.790***	48,724***
		(3.73)	(81,218)	(3.72)	(50,239)	(3.75)	(3,004)	(4.10)	(199,984)
SWITCH	-	-1.797*	0.166*	-1.918*	0.147*	-4.984*	0.007*	-6.208**	0.002**
		(0.99)	(0.16)	(0.98)	(0.14)	(2.77)	(0.02)	(2.49)	(0.01)
Observations		58	58	58	58	36	36	36	36

This table reports Cox proportional hazard model results using pension buy-in and buyout data for the period 2008–2014. All the buy-ins and buyouts are treated as the same events and coded as 1, or 0 otherwise. Types of pension buy-in and buyout transactions are not differentiated. Standard errors are reported in parentheses. *, **, and *** represent significance level of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Appendix I.

Table 8:

Influence of corporate governance on capital structure in robustness tests

$$LVG\_BOOK_{it}(orLVG\_MARKET_{it}) = \alpha_0 + \beta_1 BOARD_{it-1}(orINSTITUTIONAL\_OWNERSHIP_{it-1}) + \beta_2 BOARD\_INDEPENDENCE_{it-1}(orINSIDER\_OWNERSHIP_{it-1}) + \beta_3 ROA_{it-1} + \beta_4 ASSET\_COLLATERAL\_VALUE_{it-1} + \beta_5 SIZE_{it-1} + \beta_6 ASSET\_UNIQUENESS1_{it-1} + \beta_7 ASSET\_UNIQUENESS2_{it-1} + \beta_8 NONDEBT\_TAX_{it-1} + YearF.E + IndustryF.E + \varepsilon_{it-1}$$

Dependent Variable	*BOOK_LVG (Book Value of Leverage)*			*MARKET_LVG (Market Value of Leverage)*		
	(1)	(2)	(3)	(4)	(5)	(6)
	Fixed Effects	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*
lagBOARD	-0.063***		-0.059***	-0.082***		-0.084**
	(0.02)		(0.02)	(0.03)		(0.04)
lagBOARD_INDEPENDENCE	-0.055*		-0.061	-0.077		-0.026
	(0.03)		(0.04)	(0.06)		(0.08)
lagINSTITUTIONAL_OWNERSHIP		0.031***	0.019		0.025*	-0.005
		(0.01)	(0.01)		(0.01)	(0.02)
lagINSIDER_OWNERSHIP		-0.186**	-0.182*		-0.031	-0.084
		(0.08)	(0.10)		(0.17)	(0.20)
lagROA	-0.056	0.067	0.095	-0.272***	-0.034	-0.036
	(0.04)	(0.06)	(0.06)	(0.08)	(0.11)	(0.12)
lagASSET_COLLATERAL_VALUE	0.042	0.026	-0.014	-0.043	-0.099	-0.166**
	(0.03)	(0.04)	(0.04)	(0.06)	(0.07)	(0.08)
lagSIZE	0.017***	0.018***	0.017***	0.034***	0.031***	0.028***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)
lagASSET_UNIQUENESS1	-0.238***	-0.161***	-0.248***	-0.394***	-0.183	-0.363***
	(0.05)	(0.06)	(0.06)	(0.09)	(0.11)	(0.12)
lagASSET_UNIQUENESS2	-0.007	-0.003	0.002	-0.081***	-0.088***	-0.082**
	(0.01)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)
lagNONDEBT_TAX	0.456**	0.829***	0.557*	1.041**	1.724***	1.357**
	(0.22)	(0.26)	(0.29)	(0.44)	(0.51)	(0.56)
Constant	0.162***	-0.014	0.128**	0.295***	0.073	0.278***
	(0.04)	(0.03)	(0.05)	(0.08)	(0.07)	(0.10)
Observations	1,357	896	759	1,357	896	759
R-squared	0.101	0.127	0.112	0.098	0.087	0.097
Number of SIC	151	156	138	151	156	138
Industry FE	YES	YES	YES	YES	YES	YES
Year FE	Yes	YES	YES	YES	YES	YES

This table reports robustness tests with fixed-effects regression using two alternative measures of firm leverage for the period 2005–2014. All independent variables are lagged by one year. This regression addresses endogeneity problems. Since less data was available for institutional ownership and insider ownership, when the model includes these two variables, the sample only covers 2010 to 2014. Industry variables are based on 4-digit (CRSP) SIC codes. Standard errors are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Appendix I.

Table 9:

Influence of corporate governance on switches from DB to DC pension plans in probit model

$$SWITCH_{it} = \alpha_0 + \beta_1 BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it})$$
$$+ \beta_2 BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it}) + \beta_3 UNDERFUND_{it}$$
$$+ \beta_4 FUND_{it} + \beta_5 PLAN\_SIZE_{it} + \beta_6 OP\_CF_{it} + \beta_7 LOSS_{it} + \beta_8 delta\_DIV_{it} + \beta_9 delta\_LEV_{it}$$
$$+ \beta_{10} delta\_RD_{it} + \beta_{11} delta\_CAPEX_{it} + \beta_{12} delta\_SALE_{it}$$
$$+ \beta_{13} BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it}) \times LVG\_BOOK_{it}(or LVG\_MARKET_{it})$$
$$+ \beta_{14} BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it})$$
$$\times LVG\_BOOK_{it}(or LVG\_MARKET_{it}) + \beta_{15} VG\_BOOK_{it}(or LVG\_MARKET_{it}) + \varepsilon_{it}$$

Dependent Variable	*SWITCH*			
	(1) *Probit coefficient*	(2) *Probit coefficient*	(3) *Probit coefficient*	(4) *Probit coefficient*
BOARD	-0.025	-0.606		
	(1.51)	(1.73)		
BOARD_INDEPENDENCE	-5.355*	-6.068*		
	(2.88)	(3.19)		
INSTITUTIONAL_OWNERSHIP			3.595**	2.604*
			(1.56)	(1.56)
INSIDER_OWNERSHIP			33.260	42.760
			(23.89)	(27.38)
LVG_BOOK	-20.690*		11.410**	
	(10.82)		(5.157)	
LVG_MARKET		-14.990**		4.775
		(7.16)		(3.45)
*BOARD*LVG_BOOK*	5.110			
	(5.97)			
*BOARD_INDEPENDENCE*LVG_BOOK*	27.000***			
	(10.06)			
*BOARD*LVG_MARKET*		4.464		
		(3.81)		
*BOARD_INDEPENDENCE*LVG_MARKET*		17.060***		
		(6.21)		
*INSTITUTIONAL_OWNERSHIP*LVG_BOOK*			-10.180*	
			(5.91)	
*INSIDER_OWNERSHIP*LVG_BOOK*			-99.270	
			(93.89)	
*INSTITUTIONAL_OWNERSHIP*LVG_MARKET*				-3.325
				(3.53)
*INSIDER_OWNERSHIP*LVG_MARKET*				-86.160
				(65.81)
UNDERFUND	0.009	0.008	-0.222	-0.148
	(0.30)	(0.31)	(0.43)	(0.42)

Dependent Variable	*SWITCH*			
FUND	0.780	0.784	1.302	1.551
	(1.51)	(1.50)	(1.78)	(1.85)
PLAN_SIZE	-0.554**	-0.526*	-0.678	-0.613
	(0.28)	(0.29)	(0.47)	(0.47)
OP_CF	8.195***	8.330***	13.010***	11.390***
	(2.71)	(2.60)	(3.68)	(3.48)
delta_DIV	-0.019	-0.021	0.025	0.037
	(0.04)	(0.04)	(0.05)	(0.05)
delta_LEV1	-0.348	-0.155	-0.639	-1.422
	(1.36)	(1.42)	(2.21)	(2.29)
delta_RD	-0.001	-0.001	0.003**	0.003*
	(0.00)	(0.00)	(0.00)	(0.00)
delta_CAPEX	-5.743	-5.474	3.474	2.398
	(3.73)	(3.99)	(6.01)	(5.86)
delta_SALE	0.227	0.201	-1.265	-1.073
	(0.58)	(0.56)	(1.16)	(1.12)
Constant	1.275	2.458	-5.416**	-4.788*
	(3.44)	(3.89)	(2.38)	(2.62)
Observations	414	414	250	250

This table reports probit model results using switches from DB to DC pension plans for the period 2005–2014. *SWITCH* is coded as 1 if a firm partially or fully closed its DB pension plan, and 0 otherwise. Standard errors are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Appendix I.

Table 10:

Influence of corporate governance on pension buy-in and buyout in probit model

$$BUYOUT_{it} = \alpha_0 + \beta_1 BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it})$$
$$+ \beta_2 BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it}) + \beta_3 UNDERFUND_{it}$$
$$+ \beta_4 FUND_{it} + \beta_5 PLAN\_SIZE_{it} + \beta_6 OP\_CF_{it} + \beta_7 LOSS_{it} + \beta_8 delta\_DIV_{it} + \beta_9 delta\_LEV_{it}$$
$$+ \beta_{10} delta\_RD_{it} + \beta_{11} delta\_CAPEX_{it} + \beta_{12} delta\_SALE_{it} + \beta_{13} SWITCH_{it}$$
$$+ \beta_{13} BOARD_{it}(or INSTITUTIONAL\_OWNERSHIP_{it}) \times LVG\_BOOK_{it}(or LVG\_MARKET_{it})$$
$$+ \beta_{14} BOARD\_INDEPENDENCE_{it}(or INSIDER\_OWNERSHIP_{it})$$
$$\times LVG\_BOOK_{it}(or LVG\_MARKET_{it}) + \beta_{15} LVG\_BOOK_{it}(or LVG\_MARKET_{it}) + \varepsilon_{it}$$

Dependent Variable	*BUYOUT*	
	(1) *Probit coefficient*	(2) *Probit coefficient*
BOARD	-10.580 (6.45)	-17.930*** (4.24)
BOARD_INDEPENDENCE	9.054* (5.25)	22.540** (9.33)
LVG_BOOK	-43.810** (21.09)	
LVG_MARKET		-30.920** (12.34)
*BOARD*LVG_BOOK*	25.320 (17.32)	
*BOARD_INDEPENDENCE*LVG_BOOK*	12.320 (21.14)	
*BOARD*LVG_MARKET*		32.380*** (4.45)
*BOARD_INDEPENDENCE*LVG_MARKET*		-19.010 (18.81)
UNDERFUND	3.833*** (1.34)	4.334*** (1.62)
FUND	32.670*** (6.75)	37.240*** (9.97)
PLAN_SIZE	3.126 (2.1214)	5.417*** (1.34)
OP_CF	16.660*** (3.44)	22.740*** (5.88)
delta_DIV	1.733*** (0.65)	1.889** (0.78)
delta_LEV	10.150*** (3.29)	16.100** (7.73)
delta_RD	-0.016** (0.01)	-0.017** (0.01)
delta_CAPEX	-71.760**	-68.880***

Dependent Variable	*BUYOUT*	
	(32.54)	(26.62)
delta_SALE	2.048	2.960
	(5.13)	(4.48)
SWITCH	1.822	3.264**
	(1.59)	(1.28)
Constant	-29.400***	-36.420***
	(5.94)	(13.72)
Observations	58	58

This table reports probit model results using pension buy-in and buyout data for the period 2008–2014. All the buy-ins and buyouts are treated as the same events and coded as 1, and 0 otherwise. Types of pension buy-in and buyout transactions are not differentiated. Standard errors are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Appendix I.