Essays on Pension De-risking Strategies

Submitted by Zezeng Li to the University of Exeter as a thesis for the degree of Doctor of Philosophy in Accountancy

I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

(Signature) ……

Abstract

This thesis includes three empirical chapters exploring how a sample of UK firms with different financial and non-financial characteristics adopt pension de-risking strategies. These chapters address firms' hedging needs, financial flexibility and governance, and treat the assets and liabilities of defined benefit (DB) pension plan as corporate assets and liabilities. Three pension de-risking strategies are considered: the reallocation of plan assets, the switch from DB to defined contribution (DC) plans, and the use of buy-ins and buy-outs.

The first chapter of the thesis provides an introduction about the risks of DB pension plan and institutional background information. The second and third chapters examine how firms adjust their financial characteristics to target credit ratings in the period 2004-2013. The second chapter explores the influence of hedging needs on trade-off decisions between increasing cash holdings and reducing outstanding debt in order to achieve target credit ratings. Following Acharya, Almeida and Campello (2007), firms' hedging needs are measured as the correlation between cash flows and future investment opportunties. Collectively, the findings suggest that firms' hedging needs may correlate to decisions on capital structure and pension de-risking strategies.

The third chapter focuses on how firms' desire to maintain financial flexibility relates to capital structure decisions. It explores whether firms with different financial flexibility may affect trade-off decisions between increasing cash holdings and reducing debt in order to target credit ratings. Given that Byoun (2011) suggests that firms with different financial flexibility may make decision on capital structure differently, , the UK sample firms are categorised as developing firms with LFF, growth firms with MFF and mature firms with HFF. Dividend pay-out ratio is used as a proxy for financial flexibility (DeAngelo and DeAngelo, 2007). The results demonstrate that that a desire for the firm to maintain its financial flexibility relates to pension de-risking strategies used.

Berger, Ofek and Yermack (1997) suggest that corporate governance affects a firm's debt level. In this context, the fourth chapter of the thesis examines the relationship between corporate governance and capital structure using a sample of FTSE All-share firms for the period 2005-2014. The findings suggest that corporate governance measured by board size, independence and insider ownership are negatively related to debt level, while institutional ownership is positively related to debt level. This study further examines the relationship between corporate governance and pension de-risking strategies. The finding suggests 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 related to corporate governance.

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Table of Contents

List of Tables and Figures

Abbreviations

ACCA	Association of Chartered Certified Accountants
CEO	Chief Executive Officer
CFO	Chief Financial Officer
CRAs	Credit rating agencies
DB	Defined benefit
DC	Defined contribution
ERISA	Employee Retirement Income Security Act
FTSE	Financial Times Stock Exchange
FRS	Financial Reporting Standard
HFF	High Financial Flexibility
HHNs	High Hedging Needs
IAS	International Accounting Standard
LDI	Liability-Driven-Investment
LFF	Low Financial Flexibility
LHNs	Low Hedging Needs
MFF	Moderate Financial Flexibility
MFR	Minimum Funding Requirement
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary least square
OPEB	Other post-employment benefits
OPRA	Occupational Pensions Regulatory Authority
PBGC	Pension Benefit Guaranty Corporation
PPF	Pension Protection Fund
SFAS	Statement of Financial Accounting Standards
SIC	Standard Industrial Classification
SOA	American Society of Actuaries
tPR	the Pensions Regulator
2SLS	two-stage least squares

Chapter 1: Introduction

1.1 Motivation and Contributions

Defined benefit (DB) pension plans are significant in the UK. With DB pension plans, employers promise to offer fixed pension benefits to their employees, usually based on final or average salary. However, firms with DB pension plans face a variety of risks posed by changes in financial conditions, demographics, accounting standards and government policies. Global financial crises lower the value of pension funds and returns on pension investments. The Organization for Economic Cooperation and Development (OECD) reported a drop of $5.4 trillion in the value of global pension assets at the end of 2008 (Yermo and Severinson, 2010). The UK's EU referendum sparked an immediate market reaction and an increase in pension deficits by over £500 billion (JLT, 2016). In addition, low interest rates limit returns on pension assets and pose a significant challenge to firms. Thus, with poor returns on investment, firms struggle to meet pension contributions and, in the midst of global financial crises, start to look for higher yields from alternative investments (OECD, 2015).

Firms with DB pension plans are exposed to mortality risk. Mortality assumptions are used to estimate firms' projected benefit obligations and calculate the value of future benefits for pension plan members. With improvements in life expectancy, mortality levels have been underestimated and members are living longer than expected, raising longevity risk and creating uncertainty for firms with DB pension plans. In addition, adoption of the revised version of International Accounting Standard (IAS) 19 is producing more volatile reported funding levels than the previous accounting standard (Amir, Guan and Oswald, 2010), which may significantly influence firms' reported financial

performance. Moreover, firms are facing pressure from pension regulations. The Pensions Act 2004 introduced a Minimum Funding Requirement (MFR) to maintain a safe level of funding.

Firms seek to mitigate these risks by adopting pension de-risking strategies. The research in the thesis focuses on three pension de-risking strategies: changes in pension asset allocations, switches from DB to DC pension plans and pension buy-in and buy-out transactions. Pension de-risking strategies are the actions that are being taken by pension trustees and sponsors to reduce the risks, including the mismatching of pension asset allocations, and increase in the liabilities and deficits in DB pension plans. The main purpose of changing pension asset allocations is to match pension assets with the duration of pension liabilities in order to reduce the volatility of pension contributions. Wise (1984) suggests that the ideal investment policy is to invest pension assets in fixed interest-rate investments with a term to maturity matching the duration of pension liabilities. The prior literature (Amir et al., 2010; Lane Clark and Peacock, 2016b) suggests that a key trend in pension asset investment is to move pension assets to fixed income securities, away from equities, in order to reduce the volatility in pension contributions. Thus, changes in pension asset allocations may be used to reduce pension risk.

DB pension plans were developed to attract and retain workers by providing competitive compensation. However, the factors described above have increased these risks and the costs of DB pension plans for companies, and re-design of pension plans may be a solution. DC pension plans place most of the burden of pension risk on employees. Therefore, companies may transfer their risks to employees partially or completely by switching from DB to DC pension

plans. Previous evidence (Munnell, Golub-Sass, Soto and Vitagliano, 2007) confirms that switching DB pension plans reduces firms' costs and can be used as a pension de-risking strategy.

In addition to passing pension risk to employees, firms may also transfer pension risk to third-party institutions such as insurance companies. Pension buy-ins and buy-outs allow firms to transfer all or some of their pension obligations to such institutions in exchange for a premium. The UK pension buy-in and buy-out market reached a volume of £10 billion in 2015 (Lane Clark and Peacock, 2015), which implies that pension buy-ins and buy-outs are being widely accepted as a pension de-risking strategy. Lin, MacMinn and Tian (2015) treat pension buy-ins and buy-outs as hedging strategies and demonstrate that hedging costs may influence such decisions. Overall, changes in pension asset allocations, switches from DB to DC pension plans, and pension buy-ins and buy-outs are empirically and theoretically supported as pension de-risking strategies.

The motive of this thesis is to explore how firms' financial and non-financial characteristics correlate with decisions to adopt pension de-risking strategies. This thesis contributes to the pension de-risking literature by providing empirical evidence that adopting pension de-risking strategies relates to firms' financial characteristics. First, this thesis adopts the view of Landsman (1986) that pension assets and liabilities are an integral part of corporate assets and liabilities. Thus, managers take account the pension assets and liabilities to determine the capital structure. This thesis examines the relationship between firms' hedging motives and trade-off decisions on changes in capital structure when firms are targeting credit ratings. Thus, this thesis not only contributes to

the hedging literature (Acharya et al., 2007), but also supports target credit-rating behaviour (Alissa, Bonsall, Koharki and Penn, 2013). Second, this thesis contributes to understanding the relationship among firms with different levels of financial flexibility, pension de-risking strategies and capital structure. The previous literature indicates that managers seek to retain firms' financial flexibility by changing capital structures (Graham and Harvey, 2001). In this context, this thesis explores the relationship between firms with different levels of financial flexibility and each pension de-risking strategy separately. Third, this thesis contributes to the corporate governance literature by investigating the extent to which corporate governance characteristics are related to the adoption of pension de-risking strategies. This is motivated by Berger et al.'s (1997) finding that there is a relationship between corporate governance and capital structure decisions. In summary, this thesis explores whether firms' behaviour in adopting pension de-risking strategies is related to hedging motives, financial flexibility or corporate governance characteristics.

1.1.1 Firms' hedging needs and pension de-risking strategies

Firms target credit ratings by changing their financial characteristics (Hovakimian, Kayhan and Titman, 2009; Kisgen, 2009). Credit rating agencies (CRAs), such as Standard and Poor's, Moody's and Fitch, determine credit ratings by estimating firms' credit risk. Credit ratings act as financial constraints on companies, as firms with higher credit ratings are likely to have lower borrowing costs and easier access to external financing than those with lower credit ratings.

Chapter 2 studies the extent to which hedging needs relates to trade-off decisions between increase cash holding and reduce debts when firms are

targeting credit ratings. It presents empirical evidence of the relationship between hedging needs and these decisions. Previous research indicates that, in the absence of financial constraints, there is a substitution relationship between reserving cash flows and paying down debt (Opler, Pinkowitz, Stulz and Williamson, 1999). However, when firms are targeting credit ratings, increasing cash holdings differs from using cash flows to pay down outstanding debt. Acharya et al. (2007) suggest that firms' hedging needs may be a major driver of trade-off decisions between accumulating cash flow and using cash flow to pay down debt. Hedging needs are measured by the correlation between cash flow and future investment opportunities. Thus, the sample of UK firms was divided to high hedging needs (HHN) and low hedging needs (LHN). Measuring hedging needs also gives an indication of firms' expected future cash flow. Firms that expect to suffer from future cash flow shortages are more likely to accumulate cash flows, while firms that expect to have sufficient cash flows for future investments are more likely to pay down debt.

The findings suggest that firms with HHNs tend to increase cash holdings to target credit ratings, whereas firms with LHNs tend to reduce outstanding debt. These results are consistent with the finding of prior literature (Acharya et al., 2007) that firms accumulate cash flows when they expect a cash flow shortage for future investments.

In addition, the prior literature suggests a strong relationship between credit ratings and pension obligations (Martin and Henderson, 1983; Bodie, Light, Morck and Taggart, 1985; Maher, 1987; McKillop and Pogue, 2009). Anecdotal evidence also indicates that firms pursue pension de-risking strategies to achieve targeted credit ratings (Lane Clark and Peacock, 2005; NISA, 2013). In

this context, the study presented in Chapter 2 investigates whether firms' hedging needs relate to pension de-risking strategies. The findings reveal that firms with HHNs are more likely to target credit ratings, which they do by reducing pension risk: changing pension asset allocations from bonds to equities and switching from DB to DC pension plans. This suggests that firms pursue higher returns on pension assets when they expect a shortage of cash flows for future investments, as indicated by HHNs. Firms switch from DB to DC pension plans if they anticipate a lack of cash flows to contribute to DB pension plans.

Chapter 2 contributes to the literature on the relationship between debt capacity and cash holdings. The findings reveal that firms' hedging needs is related to their choice between increasing cash holdings and reducing outstanding debt to target credit ratings differently. This chapter documents that increasing cash holdings is not equivalent to reducing debt when firms are under financial constraints, and also confirms the behaviours adopted by firms targeting credit ratings. It also contributes to the literature on pension de-risking strategies. The evidence suggests that when firms are concerned about their hedging needs, they use pension de-risking strategies to target credit ratings. The implication of this research is that firms take into account expected future cash flows and investment needs when considering pension de-risking strategies.

1.1.2 Firms' financial flexibility and pension de-risking strategies

Graham and Harvey (2001) highlight that firms' financial flexibility may determine their capital structure. Financial flexibility is defined as firms' ability to respond to a lack of funding under financial constraints. Prior research (Mittoo, Bancel and Mittoo, 2011) provides evidence from a European context that

capital structure is driven by firms' concerns for financial flexibility. Therefore, the study presented in Chapter 3 examines the relationship among firms with different levels of financial flexibility, capital structure and pension de-risking strategies. Firms' financial flexibility is measured by dividend pay-out ratios and changes in dividends. Most of the literature (Lintner, 1956; Jensen, 1986; Fazzari, Hubbard, Petersen, Blinder and Poterba, 1988; DeAngelo and DeAngelo, 2007) suggests that a stable dividend pay-out policy signals a firm's strong financial flexibility. In addition, using changes in dividends as an alternative measure for financial flexibility is supported by Grullon, Michaely and Swaminathan (2002) and Benartzi, Michaely and Thaler (1997), as positive and negative changes in dividends provide financial information about the firm.

Following the finding of Chapter 2 that firms adjust their financial characteristics to target credit ratings, Chapter 3 first explores the extent to which managers take into account firms' financial flexibility in targeting credit ratings by increasing cash holdings or reducing outstanding debt. A sample of UK firms was divided into three categories as developing firms with LFF, growth firms with MFF and mature firms with HFF, measured on the basis of their dividend pay-out ratio percentiles. The rationale for this classification was Byoun's (2011) finding of firms with different levels of financial flexibility possess different leverages. Thus, firms may have different debt policy within the different financial flexibility categories. This study shows that developing firms with LFF and mature firms with HFF tend to target credit ratings by increasing cash holdings, while growth firms with MFF tend to reduce outstanding debt. This suggests that developing firms tend to reserve cash flows to target credit ratings when they have LFF and have difficulty in raising external funding. When firms' financial flexibility improves, they are more likely to use cash flows to pay down

outstanding debt when adjusting their capital structure to target credit ratings. Opler et al. (1999) find that managers accumulate excessive cash flows opportunistically, which may explain the finding of this study that mature firms accumulate cash flows even in the presence of HFF.

Given that pension obligations are debt-like obligations, Chapter 3 then goes on to examine the extent to which managers take firms' financial flexibility into account when adopting pension de-risking strategies to target credit ratings. Interestingly, the findings reveal that growth firms with MFF change pension asset allocations from bonds to equities to target credit ratings, and that developing firms with LFF and growth firms with MFF are more likely to switch from DB to DC pension plans. This demonstrates that firms with weaker financial flexibility are more likely to switch to DC pension plans, whereas mature firms with HFF are more likely to retain their DB pension plans. Thus, firms' desire to maintain their financial flexibility appears to be strongly related to decisions to adopt pension de-risking strategies.

Chapter 3 contributes mainly to the financial flexibility literature. First, this study provides evidence that firms with different levels of financial flexibility are associated with capital structure decisions, consistent with the previous literature (Graham and Harvey, 2001). The study expands the prior literature (Acharya et al., 2007) in revealing that firms with different levels of financial flexibility are related to trade-off decisions between increasing cash holdings and reducing outstanding debt. Second, this study supports the role of financial flexibility in pension de-risking strategies. This contributes to documenting the factors relating to the adoption of pension de-risking strategies and informing

market participants of firms' desire to maintain financial flexibility through such strategies.

1.1.3 Firms' corporate governance and pension de-risking strategies

The recent crisis surrounding the British Home Stores (BHS) pension fund highlights the relationship between firms' corporate governance and pension fund risk. According to the parliamentary enquiry (House of Coomons, 2016) into BHS, firms with poor corporate governance have failed to address their pension deficits and have made insufficient pension contributions. The collapse of BHS suggests that firms with poor corporate governance may operate their businesses and pension funds at the expense of employees' benefits and public interests. Motivated by these events, Chapter 4 investigates the relationship among corporate governance, capital structure and pension de-risking strategies. The previous literature (Jung, Kim and Stulz, 1996; Berger et al., 1997; Harford, Mansi and Maxwell, 2012) suggests that managers who are given discretion are more likely to change firms' capital structure for their own benefit. Therefore, changes in corporate governance structure may relate to changes in capital structure in the interests of shareholders. Following the previous corporate governance literature (Brealey, Leland and Pyle, 1977; Ross, 1977; Morck, Shleifer and Vishny, 1988; McConnell and Servaes, 1990; Raheja, 2005; Boone, Field, Karpoff and Raheja, 2007; Harris and Raviv, 2008), this study uses board composition and ownership concentration as corporate governance measures. The findings suggest that board size and independence, insider ownership are negatively related to debt levels, whereas institutional ownership are positively related.

Prior research (Dhaliwal, 1986; Landsman and Ohlson, 1990; Wiedman and Wier, 2004; Salah, Smaoui, Coulombe and Paquette, 2015) confirms that investors treat pension assets and liabilities as part of corporate assets and liabilities. This study expands this strand of research to examine how corporate governance may be related to pension de-risking strategies. Prior research (Cocco and Volpin, 2007; Phan and Hegde, 2013; Anantharaman and Lee, 2014; Yu-Thompson, Cho and Fu, 2015) appears to confirm that firms with different corporate governance characteristics have different risk taking investment strategies on pension assets. Cocco and Volpin (2007) found that pension asset allocation strategies is influenced by the percentage of executive directors sat on the pension trustee board. Phan and Hegde (2013) suggest that firms with good corproate governance pursue higher investment returns and improve funding status. They found that firms with good external and internal corporate governance tend to allocate more pension assets on risky invesmtnets. Anantharaman and Lee (2014) and Yu-Thompson et al. (2015) found that executive compensation can be an incentive for managers taking risk on penison invesments. Thus, the results of Chapter 4 indicate that different corporate governance characteristics tend to relate to pension de-risking strategies in different ways. The presence of large and more independent boards encourages investment of pension assets in fixed income securities, whereas firms with higher institutional and insider ownership are more likely to invest pension assets in equities. In addition, firms with more independent boards are more likely to retain their DB pension plans, while firms with a higher institutional ownership are more likely to switch from DB to DC pension plans. Overall, it is concluded that there is relationship among corporate governance

characteristics, the adoption of pension de-risking strategies and firms' capital structures.

Chapter 4 contributes to the corporate governance literature by examining a sample of FTSE All-Share firms to determine the relationship between corporate governance and capital structure. It also contributes to the literature on pension de-risking strategies. This appears to be the first study to address the relationship between sponsoring firms' corporate governance and pension de-risking strategies, and may have implications for managing pension risk by taking account firms' corporate governance structure.

1.2 Institutional Background

1.2.1 UK occupational pension plans

The chapters in this thesis focus on UK occupational pension plans, which are organized by employers and managed by pension trustees. In the UK companies, DB pension assets and liabilities are reported in the financial statements of sponsor firms. Pension trustees, with the responsibility for managing and investing pension assets are legally independent from the sponsor firms. In the UK institutional setting pension assets and liabilities are distinct from corporate assets and liabilities as sponsor firms can only influence pension investment strategies via pension trustees. US studies, however, indicate that investors regard pension assets and liabilities as integrated into the capital structure of sponsor firms (Landsman, 1986; Gopalakrishnan, 1994). Therefore, this section provides relevant background information on the UK occupational pension system and highlights its differences from the US system. It also identifies various pension de-risking strategies in terms of re-designing

pension plans, financial products, investment strategies and government regulations. UK occupational pension plans are voluntary, private plans which differ significantly from the state pension plan. The aim of the state pension plan is to ensure that people receive a minimum level of income after retirement, whereas private pension plans are set up to redistribute income to individuals over their lifetimes (Pension Policy Institute, 2016). The OECD (2015; 2016) reports that the number of countries with a ratio of private pension investment to GDP of over 100% rose from four to eight between 2014 and 2015. In 2015, this ratio was 97.4% for the UK and 132.9% for the US, and these countries therefore had relatively high levels of private pension investment with pension fund systems important to their domestic economies and providing significant capital for industry.

DB and DC pension plans are the two major types of private pension plan in the UK. Appendix I summarises the differences between DB and DC pension plans. In DB pension plans benefits are usually linked to employees' final salary or average salary. DC pension benefits derive from the sum of accumulated contributions during employees' working period plus returns on investments. Contributions to DC pension plans are usually based on a fixed percentage of salary. Therefore, contributions are fixed in a DC pension plan, whereas the promised benefits are fixed in a DB pension plan. Traditionally, employers offered DB pension plans as a way of attracting human resources as they offer more generous benefits to employees than DC pension plans (Clark and Monk, 2007). Under DB pension plan rules, employers bear the risk of making promised benefit payments to employees and are usually responsible for additional contributions if pension funding levels are in deficit, although arrangements for 'deficit sharing' between employers and employees are

becoming more common. In contrast, employers who provide DC pension plans do not guarantee specific benefit payments to employees and bear no risk in pension fund investments. Liu and Tonks (2013) find that DB pension contributions crowd out investments and dividends when firms are under pressure to make pension contributions. Similarly, Clark, Caerlewy-Smith and Marshall (2006) point out that DB pension contributions impair firms' capacity to compete in the global market. Moreover, employers with DB pension plans may struggle to meet pension obligations and experience significant volatility in funding levels. This is defined as pension risk.

1.2.2 Changes in pension regulations

Changes in accounting standards

Changes in regulation, financial market conditions and actuarial assumptions of pension plans place enormous burdens on firms sponsoring DB pension plans. Financial Reporting Standard (FRS) 17 and IAS 19[1] regulate the reporting of pension costs, assets and liabilities in financial statements. The requirements for the full recognition of actuarial gains and losses, and implementation of fair value accounting for pension assets and liabilities have increased reported pension costs and balance sheet volatility compared with previous versions of accounting standards (Blake, 2003; Amir et al., 2010). Some researchers find that changes in standards have simply brought out the underlying economic reality of DB pension plans which was previously hidden by inadequate financial reporting. Mitra and Hossain (2009) find that markets evaluate pension

[1] The revised version of IAS 19 revised in 2011 had further significant influence on DB pension plans. IAS 19R eliminated the option, which allowed companies to defer the recognition of gains and losses, known as "corridor method". Fasshauer et al. (2008) suggests that the adoption of IAS 19 revised increase significant amount of pension liabilities. In addition, IAS 19 revised required disclosure of pension actuarial assumptions used to the valuation of DB pension liabilities. This increase the comparability and transparency of pension accounting reporting (Fasshauer et al., 2008).

information more effectively when recognized in financial statements rather than merely disclosed in footnotes. Overall, pension accounting standard changes that increase balance sheet volatility or reveal higher pension costs place significant financial pressure on firms with DB pension plans.

Pension fund governance: The trustee model

In the UK pensions framework, trustees play a key role in pension fund management and are expected to act in the best interests of pension beneficiaries. Blake (2003, p.9) defines a trust as:

A legal relationship between individuals and assets, by which assets provided by one individual (settlor) are held by another group of individuals (trustees) for the benefit of a third group of individuals (the beneficiaries).

The Occupational Pensions Regulatory Authority (OPRA) was established under the Pensions Act 1995 and was replaced by the Pensions Regulator (tPR) under the Pensions Act 2005. The aim of both OPRA and tPR was to establish a framework to regulate pension trustees. This framework defines roles and responsibilities, and sets guidelines for managing pension plans, and reporting requirements for pension trustees. Blake (2003) suggests that the Pensions Act 1995 had significant effects on trustees. In the past, sponsoring companies had exclusive power to appoint the majority of trustees (Blake, 2003). However, the 1995 Act allowed for one-third of the total number of trustees to be member-nominated trustees (MNT), with a minimum two MNTs for large plans and one for small plans. The Act required OPRA to monitor trustees' activities, and to state their qualifications, and specified a procedure for appointing trustees. It gave trustees responsibility for deciding on pension fund investment strategy,

which they may delegate to professional fund managers appointed to manage pension assets. The trustees must set out and follow a Statement of Investment Principles (SIP) in order to establish the strategic objectives of the pension fund and manage conflicts between pension plan administrators and members. Potential conflicts include employers encouraging higher risk taking in pension investment strategies to minimize contributions, whereas pension beneficiaries favour less risk taking on pension fund investments. Employers' risk-taking behaviour is driven by the risk that employers have to make contribution to pension fund shortfall when pension investments suffer losses, and by the reward that they benefit from contribution holidays when pension investments perform better (Franzen, 2010).

On the basis of twenty semi-structured, face-to-face interviews with UK pension trustees, Kakabadse, Kakabadse and Kouzmin (2003) conclude that trustees commit to their duties and address pension fund issues effectively. The recent changes in UK pensions regulations tended to improve the independence of the trustees from the employers' influence in determining pension investment strategies (Franzen, 2010). Overall, the regulations require pension fund trustees to take major responsibility for managing pension funds in the interests of pension members.

Pension assets are managed by the pension trustees in the UK, while they are fully managed by the sponsoring firms in the US (Cocco and Volpin, 2007). The fiduciary duty is generally referred to as the highest standard of care. The Employee Retirement Income Security Act (ERISA) explicitly obliges pension asset managers to manage and invest pension assets in the US. Given that the UK pension trustees take account of the interests of all stakeholders, trustees'

risk-taking attitudes in relation to pension investments can be influenced by sponsoring firms, pension beneficiaries and governance regulations. Therefore, the difference between UK and US pension managers in respect of their legal obligations for pension funds may lead to the adoption of different investment strategies. This difference may suggest that the independence of decision makers for pension policy is different between the UK and the US. .

In addition, there has been considerable debate regarding the consistency and competence of trustees' decision making in the UK. On the basis of Myners' (2002) review of the role of pension trustees in the investment decision-making process in the UK, tPR established guidelines to enhance the responsibility and capacity of pension trustees in the UK. Clark et al. (2006, 2007) have questioned various aspects of UK pension trustees regarding their formal qualifications, investment and management skills, and educational and professional qualifications to manage such significant amounts of pension assets effectively in the complex financial environment. Monk (2009) reveals that trustees' poor governance practices may put DB pension plans at risk. As pension trustees in the UK play a weak monitoring role in pension funds, additional monitoring mechanisms will be required to protect the interests of pension plan members. Thus, the corporate governance structure of sponsor firms may be related to the risk attitude of pension investments. This raises the importance of investigating the relationship between corporate governance of sponsor firms and pension funds in the UK. Therefore, Chapter 4 looks at the relationship between firm's corporate governance structure and pension asset allocations, representing the pension investment strategies.

The UK Minimum Funding Requirement (MFR)

The UK government issued funding standards to minimise the risk of underfunding. The Pensions Act 1995, which came into effect in 1997, required all pension funds to follow a MFR specified to ensure the maintenance of 'safe' levels of pension funding. Specifically, employers had to inject cash and make additional contributions to top up pension funds if funding levels fell below 90%. In addition, pension trustees and employers had to agree a recovery plan to ensure full funding in the future. However, a review by the Faculty and Institute of Actuaries (2000) suggested that the MFR would not guarantee full payment of pension benefits, and discouraged the adoption of an optimal pension asset allocation strategy. Thus, the MFR was replaced by a Scheme Specific Funding Standard in 2001, which came into effect in 2005. This requires the design of specific funding objectives for different pension plans, and requires companies to report their pension fund investment strategies and project returns on pension assets. A contribution agreement must also be made between trustees and employers. Overall, the aim of the Scheme Specific Funding Standard is to ensure that individual pension plans are sufficiently well funded to support pension benefit payments in the long-term. The advantages of this new standard are that it sets specific funding requirements and requires recovery plans to meet the specific financial circumstances of individual pension plans. Therefore, the UK government's regulations are aimed to monitor funding levels and reduce pension risk.

Similarly, the US Pension Protection Act 2006 introduced a stricter pension funding requirement for US companies, effective from 2008 in order to ensure that companies maintain well-funded DB pension plans.

The UK Pension Protection Fund

In order to further protect pension members' benefits, the UK government set up the Pension Protection Fund (PPF) in April 2005. This aims to provide compensation for qualifying DB plan members when sponsoring employers become insolvent and are unable to provide the promised pension benefits. The PPF is independent of the UK government and takes control of pension assets from insolvent firms. It is funded from a compulsory levy on pension plans supervised by tPR.

Sponsor firms are assessed for eligibility to transfer pension assets to the PPF as soon as a qualifying insolvency event occurs. The PPF assumes responsibility for a pension plan if pension assets are lower than protected pension obligations. Otherwise such pension plans would be continued or wound up outside the PPF. After a pension plan is transferred to the PPF, pension benefits are paid out by the PPF. Members who have already retired at the normal pensionable age or have retired on ill-heath grounds receive 100% compensation. Payments rise in line with inflation for pensionable service from 5 April 1997, subject to a maximum of 25.5% per year. Pension plan members who have not yet retired or retired earlier than the normal pensionable age receive 90% compensation, subject to a cap. Overall, the PPF was established to secure the benefits of pension plan members up to a certain level.

The Pension Benefit Guaranty Corporation (PBGC) in the US plays a similar role to the PPF in the UK. The PBGC was established by ERISA in 1974 to provide protection for private DB pension plans when sponsor firms default. The PBGC collects insurance premiums from employers and is funded by returns on investments of pension assets. The benefits paid by the PBGC may be varied or capped by the state. This means that members of pension plans will only

receive benefits lower than or equal to the statutory maximum benefit from the PBGC. Compared with the UK's PPF, the PBGC guarantees a lower level of pension benefits for pension fund members.

In addition, Guan and Lui (2016) find that the US companies with close to default are incentivized by PBGC to take high risks in allocating pension assets, while the PPF does not have such effect on pension asset allocations for the UK companies. This is because they have different bases for pension insurance premiums. PPF collect premium by taking account the risk-adjusted components including the financial position of sponsor firms, funding level and pension asset compositions (Baily and Kirkegaard, 2008). However, the PBGC does not take account these risk-based factors in the premium. Thus, empirical evidence suggests that pension regulations may impact on pension investment strategies, and that this effect is likely to differ between the UK and the US (Guan and Lui, 2016). It is therefore important to distinguish UK from US evidence when considering changes in asset allocations as a pension de-risking strategy.

Changes in tax regulations

The UK tax system has always greatly influenced pension funds. Historically, companies could inject cash into pension funds to avoid high corporate tax rates. However, the Finance Act 1986 specified a 40% charge payable on any refunds of pension fund surpluses to employers. The UK's 1997 tax reform also removed tax credits for dividend income. Therefore, pension funds with significant amounts of pension assets invested in equities no longer benefit from tax-exemptions, and dividend incomes are subject to the usual corporate tax rate. Thus, Broadbent, Palumbo and Woodman (2006) and Myners (2002)

conclude that UK pension tax reforms have created disincentives for firms to continue sponsoring DB pension plans. Lane Clark and Peacock (2013) suggest that frequent changes in tax regulations discourage firms from providing good pensions to employees. Anecdotal evidence also shows that the current tax reform will create a higher DB pension deficit and discourage long-term saving by employees (Williams, 2015). Overall, the tax policies relating to the UK DB pension plan play a significant role in the pension de-risking process.

1.2.3 Changes in financial market conditions

Financial market turbulence has resulted in increased pension risk for employers with DB pension plans. Between 2005 and 2015, the UK has experienced a reduction in the number of pension funds 47,984 (52.3%) as some of the closed of pension fund is a result of difficulties in meeting the funding requirements of DB pension plans (OECD, 2016). In contrast, there has been an increase in the number of private pension plans in the US, with 6,108 (0.9%) more in 2015 than in 2005. Since a high percentage of pension assets are invested in the equity market, the equity market performance is a key determinant of returns on pension assets. The ‘perfect storm’ in the US market, described by Clark and Monk (2006), suggests that average funding levels for Fortune 1000 sponsoring firms dropped from 122% to 76% between 1999 and 2002. In the UK, as the result of the 2008 financial crisis, the aggregate pension deficit for FTSE 100 companies was £41 billion in mid-2008 compared with a £12 billion aggregate surplus in 2007 (Lane Clark and Peacock, 2008). These volatilities indicate that financial crises have a significant impact on DB pension plan funding levels and investments (Lane Clark and Peacock, 2008).

In addition, pension funds use bond yields as a reference for long-term returns on investments and as a basis for discounting future pension obligations for reporting purposes. FRS 17 and IAS 19 require pension liabilities to be valued by reference to yields on high-quality corporate bonds. These yields have been falling since the 2008 financial crisis, creating a higher deficit that requires larger employer pension contributions. UK AA-rated corporate bond yields dropped from around 7.5% to 2.5% between 2008 and 2016 (Lane Clark and Peacock, 2016b). Moreover, the EU referendum worsened funding levels and increased corporate pension fund risk (The Pensions Regulator, 2016). Pension liabilities of the UK DB plans of FTSE 100 companies increase by between 8% and 12%, compared with increases in pension asset values of 5% to 12% (Lane Clark and Peacock, 2016b). The pension surpluses of FTSE 100 companies changed by between +1% and -4% in two weeks (Lane Clark and Peacock, 2016b). The subsequent quantitative easing by the Bank of England resulted in a fall in the 15-year government bond yield to 1.3% (The Pensions Regulator, 2016). Overall, the influence of changes in financial market conditions illustrates the sensitivity of pension risks.

1.2.4 Changes in actuarial assumptions

Future pension obligations reflect key actuarial assumptions on mortality rates, discount rates, and salary and price inflation. Under IAS 19, firms with DB pension plans are required to disclose significant actuarial assumptions. This draws attention to the impact of longevity risk on DB pension obligations. The longer the life expectancy of employees, the more pension benefits must be paid by employers. Increased life expectancy around the world indicates that pension obligations will continue to grow. The ASB (2007) reports that an

increase of one year in the mortality rate will increase pension obligations by 4.5%. Blake, Cairns and Dowd (2008) show that UK life expectancy at 65 has increased by nearly 4 years for males and 3.7 years for females over the past two decades, to nearly 17 years and 19.7 years respectively. The average assumed age at death for the DB plans of FTSE 100 companies increased from 88.1 years in 2007 to 88.5 years in 2014 (Lane Clark and Peacock, 2016b).

Actuaries make assumptions on discount, price and salary inflation rates in order to calculate projected pension obligations. The discount rate is used to derive their present value and projected pension obligations. Decreases in the discount rate will cause increases in pension obligations. The ASB (2007) indicates that a 0.5% change in the discount rate will change pension obligations by 9.5%. The average discount rate dropped from 6.2% per annum in 2008 to 3.5% in 2016 (Nick, 2014; Lane Clark and Peacock, 2016b). Inflation may also influence interest rates and final salary levels. The Pensions Act 1995 enforces compulsory inflation indexation up to 5% for retirement benefits payable by DB pension plans. Thus, indexation may be expensive and risky for firms with DB pension plan, as this may increase projected benefit obligations significantly. However, if inflation is higher than 5% cap, the value of pension liabilities may reduce as they are discounted at a higher rate (Kelleher, 2011). Thus, the cap on indexation may allow firms to avoid pressure from continued inflation rate rises. Inflation risk may drive switches from fully-indexed to partially-indexed pension plans (Feldstein, 1980). Lane Clark and Peacock (2016b) show that the average retail price index (RPI) assumption was 3.1% per annum at the end of 2015. The ASB (2007) calculate that a 0.5% increase in salary will result in a 5.5% increase in pension obligations. In general,

changes in key actuarial assumptions may significantly influence projected pension obligations and pension risk.

1.2.5 Ways to de-risk DB pension plans

Re-design the pension structure

Re-designing corporate pension plans is one possible solution to the 'pension crisis'. Rising pension contributions and costs have led employers to close DB pension plans (Clark and Monk, 2007). DC pension plans offer an option to transfer risk from employers to employees. In addition, the Pension Scheme Act 2015 established new legislation to encourage the development of hybrid pension plans, in which employees and employers share the risks of investment. Moreover, firms with small DB pension plans can re-design their pension plans through mergers and acquisitions (Clark and Monk, 2007), and firms with large DB pension plans may acquire those with smaller pension plans. In addition, the OECD (2016) suggest that consolidation of the pension sector may increase the competitiveness of pension funds and reduce management costs.

This thesis examines switching from DB to DC pension plans as a key pension de-risking strategy. Traditionally, DB pension plans dominated the UK occupational pension system, whereas DC pension plans offered occupational pensions to a small fraction of employees. The Pensions Regulator (2016) reports that between 2006 and 2016, UK DB pension assets increased from £769.5 billion to £1,341.4 billion, and DB pension liabilities rose from £792.2 billion to £1,563.1 billion (Figure 1.1). The funding ratio decreased from 97% to 85.8% in this period (Figure 1.1). Increases in pension assets and liabilities indicate that firms with DB pension plan may suffer from enormous payment

obligations when they reach maturity to pay benefits to the retired employees. Data from tPR (2006) show that the number of DC pension plans increased significantly from 1990 to 1999 and continued to rise after 2000, indicating the increasing popularity of DC pension plans. In contrast, tPR (2016) reports that the proportion of members in open DB pension plans declined sharply from 66% to 19% between 2006 and 2016, while the percentage of DB pension plans remaining open to all employees dropped from 43% in 2006 to 13% in 2016 (The Pensions Regulator, 2016). Broadbent et al. (2006) find that increasing numbers of employers are offering DC pension plans to employees in the UK. As shown in Figure 1.2, by 2015, DB pension plans accounted for 68% of total pension assets, versus 32% of DC pension assets in the UK (Willis Towers Watson, 2016). However, Figure 1.2 illustrates that in the US, pension assets are 40% DB pensions and 60% in DC pensions. As the UK has a higher proportion of DB pension assets than the US, this may make UK companies more desperate than US companies to de-risk their DB pension plans by adopting different pension de-risking strategies.

Changes in pension investment strategies

Pension investment strategies determine returns on pension assets, and consequently influence pension funding levels and pension risk where rates of and variability in returns vary for different asset classes. This thesis focuses on UK firms change within traditional asset classes (bonds and equities) to de-risk pension funds. The Pensions Regulator (2016) reports a movement in pension asset allocation reflecting the trend in pension investment strategies. Historically, the dominant investment strategy in the UK resulted in the highest equity investments (around 70%) of all OECD countries (Franzen, 2010). Figure 1.3

shows that in the UK between 2006 and 2016, the percentage of pension assets invested in equities fell from 61.1% to 30.3%, while the allocation to bonds rose from 28.3% to 51.3% (The Pensions Regulator, 2016). This general trend is consistent with a shift to Liability-Driven-Investment (LDI) strategies, which matches pension assets to the duration of pension liabilities in order to mitigate volatility in the funding position of DB pension plans (Blake, 2001). LDI strategies were widely adopted by UK sponsoring firms in the early 2000s (Franzen, 2010).

Changes in pension asset allocations from equities to bonds may be driven by changes in pension accounting standards, such as the adoption of FRS 17/IAS 19 and Statement of Financial Accounting Standard (SFAS) 158 (Kiosse and Peasnell, 2009; Amir et al., 2010). Amir et al. (2010) provide evidence that UK companies shifted pension asset allocations from equities to bonds when disclosing pension information in footnotes of financial statements, as well as adopting the full recognition requirement of FRS 17 and IAS 19. Similarly, US companies shifted pension assets from equities to bonds during the adoption of SFAS 158 in 2006. Changes in accounting standard-driven pension asset allocations in the UK mirror pension asset allocations in the US. Considering the similar changes in pension accounting standards, this thesis will provide supplementary evidence that UK firms use changes in pension asset allocations as a de-risking strategy.

Innovative financial products

Innovative financial instruments may be used as tools to de-risk DB pension funds (Clark and Monk, 2007). Pension buy-out transactions were originally used to transfer the pension assets and liabilities of insolvent firms to insurance

companies in exchange for a premium. There are differences between pension buy-ins and buy-outs. In buy-ins, firms transfer part of their pension obligations to insurance companies, but retain responsibility for paying pension benefits to members if the insurance company defaults. Thus, insurance companies only take on part of the pension risk, such as pension investment risk arising from corporate insolvency. In buy-outs, firms transfer all pension obligations to insurers, thereby removing pension obligations entirely from their financial statements. Thus, firms may choose full pension buy-outs or buy-ins according to their desired level of reduction in pension obligations. In addition to pension buy-ins and buy-outs, firms may implement longevity swaps to reduce mortality risk, or use inflation-linked bonds to hedge inflation risk. Clark and Monk (2007) suggest that those innovative financial instruments, if implemented successfully, may effectively hedge against various risks to reduce pension risk in part or in full.

Although a range of financial instruments may be used to reduce pension risk, this thesis focuses particularly on pension buy-ins and buy-outs. There is an established and growing market for pension buy-ins and buy-outs in the UK. The UK buy-out market has expanded since 2006 following significant pension regulation changes and its potential size was estimated at about £800 billion (Blake et al., 2008). Monk (2009) indicates that the UK pension buy-in and buy-out 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). Development of the pensions buy-in and buy-out market may be attributable to the fact that UK policy makers view pension buy-in and buy-out transactions positively as a safe process to remove pension obligations from companies (Monk, 2009). Thus, the emergence of the pension buy-in and

buy-out market was driven by the Pension Act 2005 and new accounting standards (Monk, 2009). Figure 1.4 shows that the total value of pension buy-in and buy-out transactions increased sharply between 2007 and 2016. The peak in transactions occurred in 2014, with £13.2 billion-worth of deals. There was more than £8.5 billion of pension buy-in and buy-out transactions at the end of 2016 (Lane Clark and Peacock, 2016a). Overall, the UK pension buy-in and buy-out market continues to grow, with more DB plans seeking to de-risk, and more insurers such as Canada Life and Scottish Widows in 2015, increasing their pension insurance business.

Compared with the UK pension buy-in and buy-out market, there appear to be more opportunities for pension buy-ins and buy-outs in the US in terms of the largest total pension assets. However, the US buy-in and buy-out market tends to be less active than in the UK (Monk, 2009). Internal Revenue Service (IRS) Revenue Ruling 2008-45 specifies types of pension buy-out and excludes non-insured pension buy-outs which are executed outside of the Financial Service Authority (FSA) -regulated insurance market. This has delayed the development of the US pension buy-in and buy-out market (Monk, 2009). In contrast, UK legislation allows both insured- and non-insured buy-outs. US policy makers interviewed by Monk (2009) appeared to favour preservation of DB pension systems, whereas UK policy makers treat pension buy-outs as a solution to the problems of the DB pension system.

The costs of pension buy-ins and buy-outs are lower for US companies than for UK companies. This is because UK pension buy-ins and buy-outs take account of inflation increases in calculating pension liabilities. According to Mercer's (2016) Global Pension Buyout Index, in October 2016, the insurance buy-in

premium for $100 million of pension accounting liabilities in the US market was $5.1 million. However, the premium in the UK buy-in market for £100 million of liabilities was £15 million. The differences between the UK and US market on pension buy-in costs is due to that the UK pension buy-in take account the inflation indexation. Thus, the pricing of UK pension buy-in and buy-out includes the mandatory indexation of pension benefits, which increases the prices of pension buy-ins and buy-outs (Judith, 2014).

Overall, UK is a good setting to explore the pension buy-in and buy-out market by default, as there are not as many buy-outs in the US. In addition, other countries developing their pension buy-in and buy-out markets may learn from the UK experience documented in this study.

New pension regulations

Governments may be able to assist in reconstructing pension systems by changing pension regulations and tax policies. Clark and Monk (2007) suggest that the increased costs of complying with regulations may pose a threat to firms with DB pension plans. Thus, changes in regulations will involve trade-offs between safeguarding pension funds and promoting effective management policies. Bikker and Vlaar (2007) indicate that overly strict funding rules may contribute to the closure of DB pension plan. Overall, government intervention may exert considerable influence in protecting the private pension system.

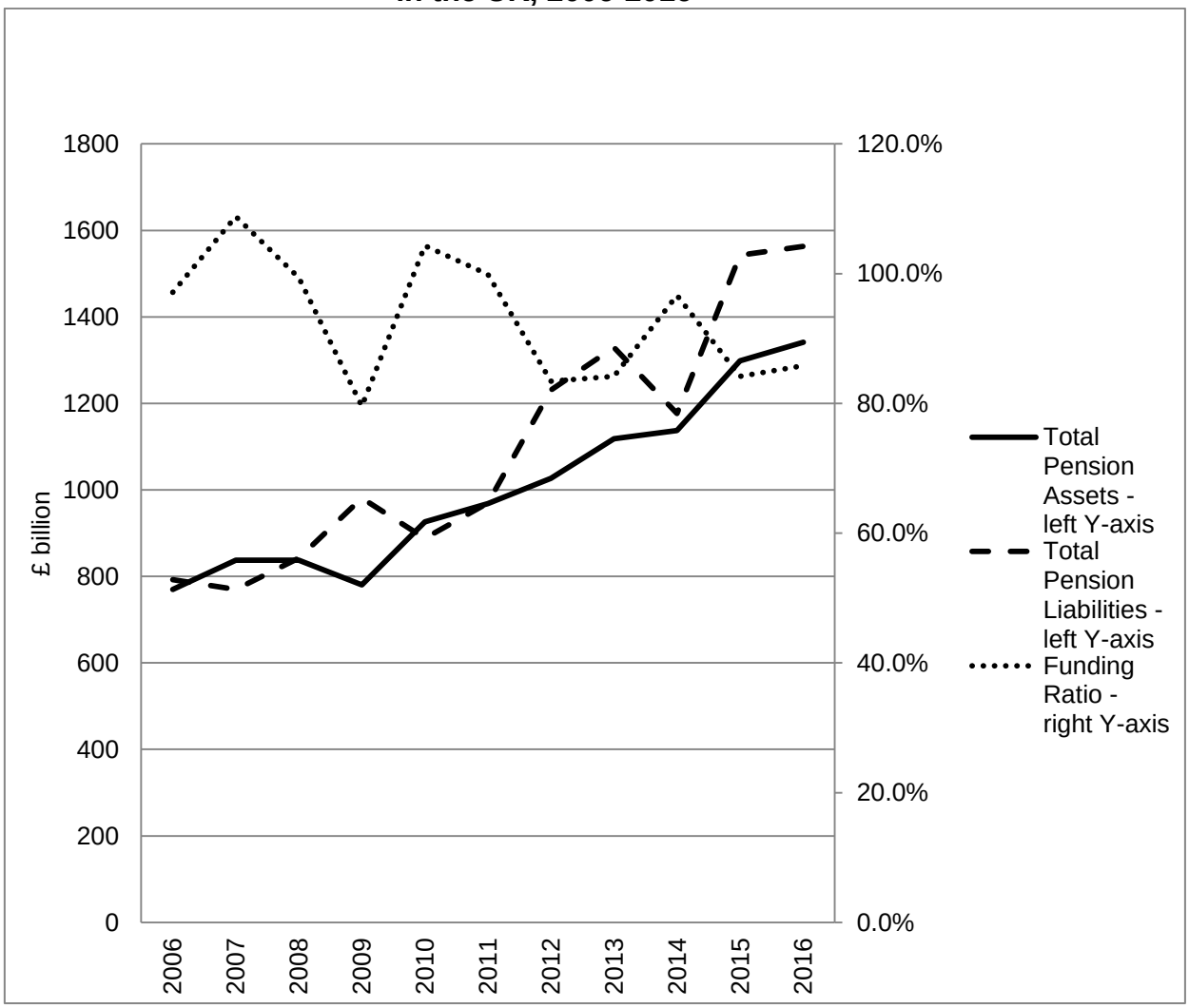
This section has provided background information on the UK pension system and has presented existing pension de-risking strategies. It has commented on differences and similarities between the UK and US pension systems and has highlighted the value of UK evidence on pension de-risking strategies.

Regulation changes, financial crises and changes in actuarial assumptions contribute to increases in pension risks. Although employers and governments are making joint efforts to de-risk pension funds, this thesis focuses particularly on pension asset allocations, switching from DB to DC pension plans and pension buy-ins and buy-outs. The mismatches between pension asset allocations and pension liabilities will present firms with high pension risks. Thus, LDI strategies suggest changing in pension asset allocations to mitigate this risk. Switching from DB to DC pension plans provides opportunities to mitigate the risk of future pension contributions and reduce DB pension plan costs. Increasing balance sheet volatility attributable to pension funding and the development of the buy-out market provide incentives for firms to adopt pension buy-ins and buy-outs to reduce pension obligations. Thus, this section has provided context for the following chapters by specifying the reasons for and importance of UK firms adopting pension de-risking strategies.

1.3 Thesis Structure

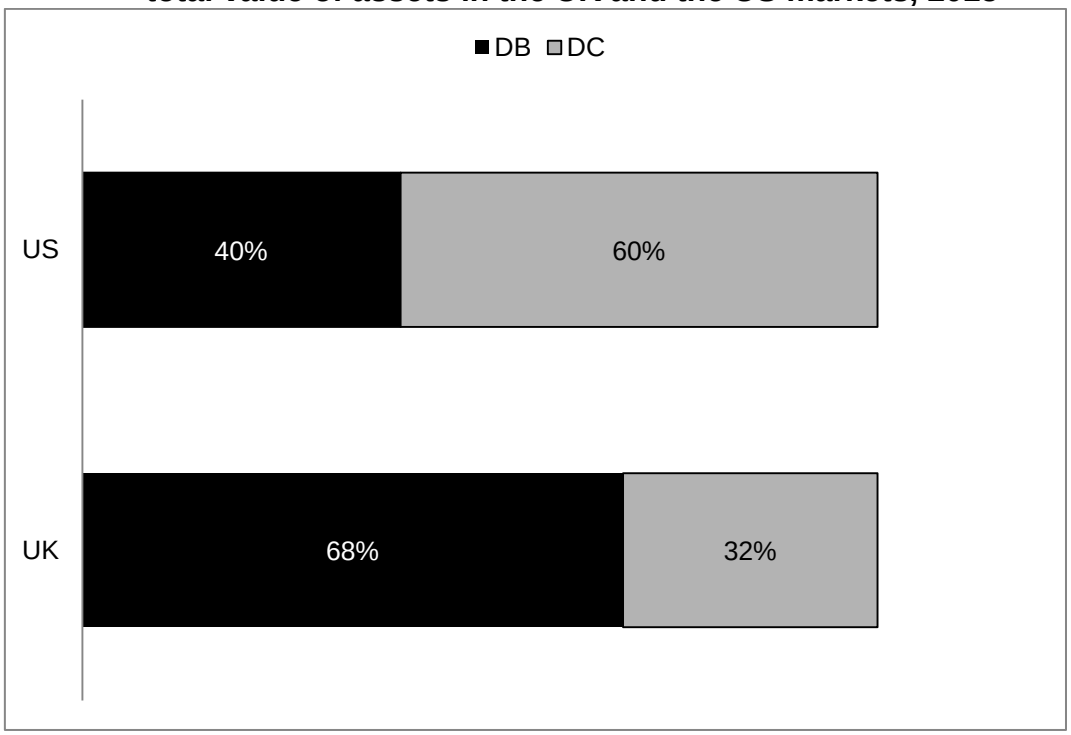
The remainder of this thesis is structured as follows. Chapters 2, 3 and 4 each present a major research study. Each discusses the motivation underlying the research question examined, before presenting a literature review and hypothesis development, the research design, sample and data, followed by univariate and multivariate analysis, and finishing with a conclusion. Chapter 5 concludes the whole thesis and discusses the limitations of the research and future research opportunities.

Figure 1.1: Total pension assets, total pension liabilities and funding ratio in the UK, 2006-2016



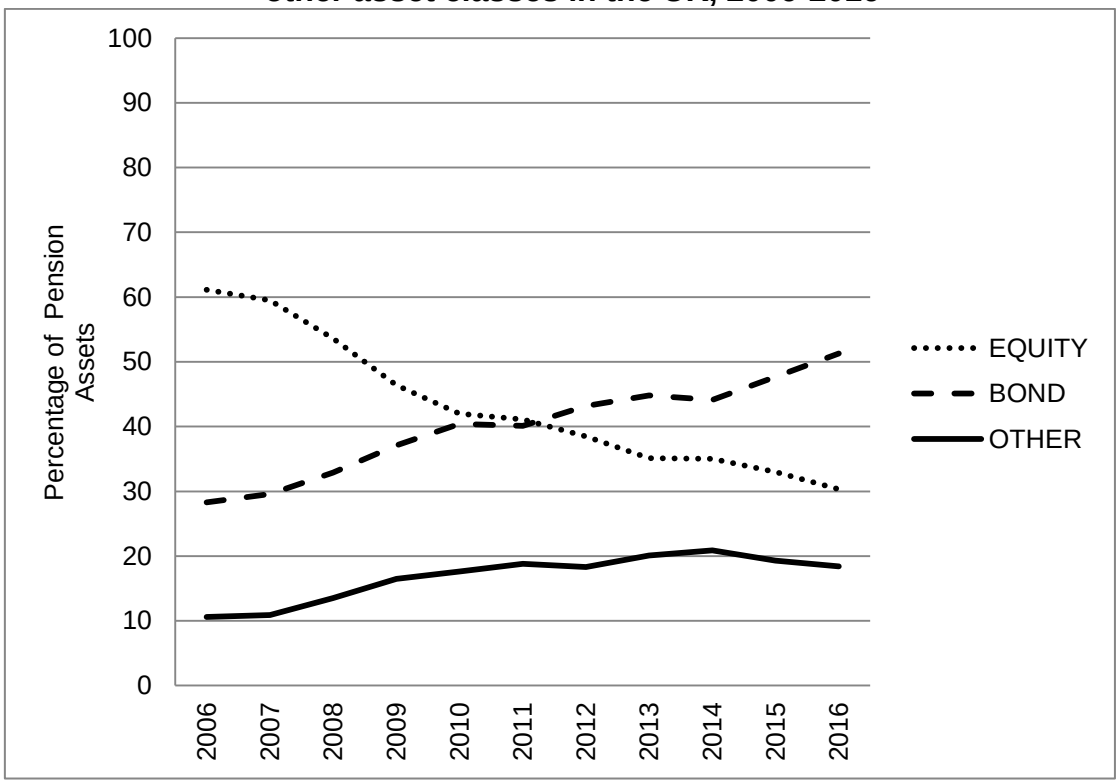
Source: The Pensions Regulator (2016)

Figure 1.2: Defined benefit and defined contribution pension plan assets: total value of assets in the UK and the US markets, 2015



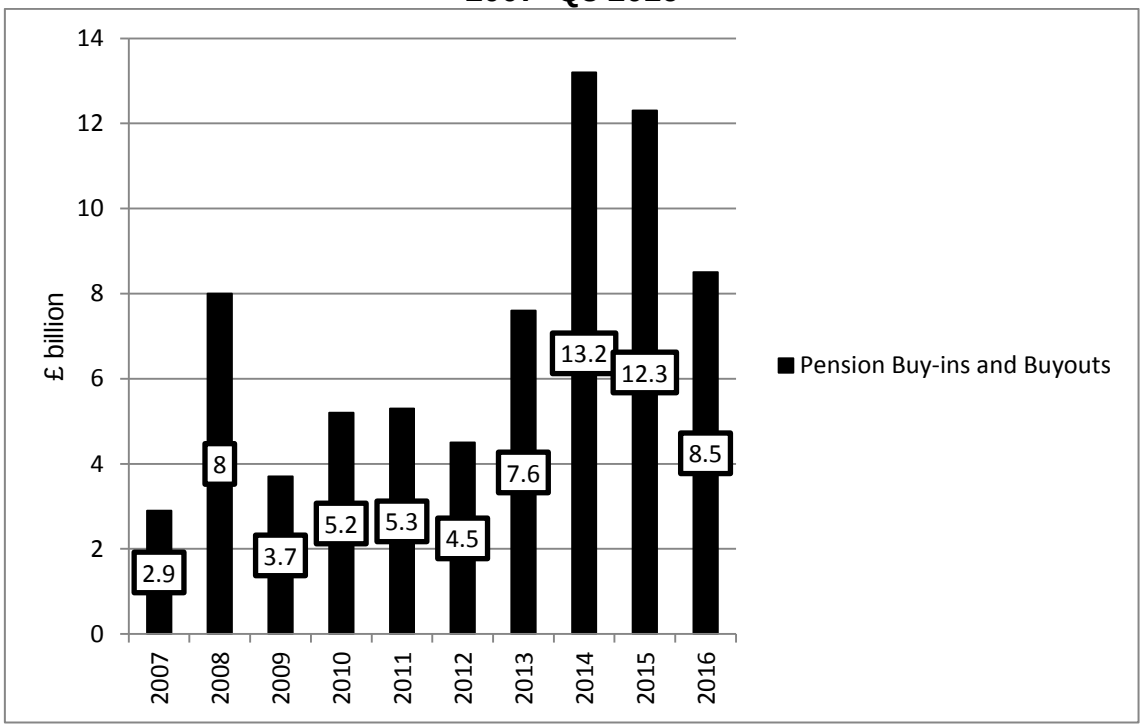
Source: Willis Towers Watson (2016)

Figure 1.3: Percentage of pension assets allocated to equities, bonds and other asset classes in the UK, 2006-2016



Source: The Pensions Regulator (2016)

Figure 1.4: Value of pension buy-in and buy-out transactions in the UK, 2007- Q3 2016



Source: Lane Clark and Peacock (2016a)

Chapter 2: Relationship between Firms' Hedging Needs and Pension De-risking Strategies

2.1 Introduction

Pension obligations have increased significantly in the past few years. Lane Clark and Peacock (2014a) report that in 2014 the pension liabilities of FTSE 100 companies stood at £512 billion compared with pension assets of £475 billion under IAS 19, resulting in an aggregate pension deficit of £37 billion. In addition, an ACCA survey (Holt, 2011) reveals that, owing to the elimination of the corridor method, adoption of the revised version of IAS 19 has made reported pension deficits more volatile than under the previous version. Pension obligations are viewed as corporate liabilities (Landsman, 1986). Jin et al.'s (2006) method of measuring pension risk establishes that the systematic equity risk of US firms reflects the riskiness of pension plans. This suggests that market participants integrate pension risk into their evaluations of firm risk. Thus, increasing in pension obligations may raise overall firm risk. This study follows previous research (Franzoni and Marin, 2006; Cardinale, 2007), in defining pension risk as the risk that firms may fail to meet the pension obligations set out in their financial statements.

Firms are incentivised to improve their credit ratings in order to reduce their cost of capital. Pension obligations are similar to other types of debt. Previous research (Feldstein and Seligman, 1981; Dhaliwal, 1986) indicates that pension obligations are viewed as an integral part of corporate financial policy. CRAs determine a firm's credit rating by evaluating its credit-worthiness. According to Standard & Poor's credit-rating methodology (S&P Global Ratings, 2011), CRAs make adjustments on the basis of pension information drawn from financial

statements. Bodie et al. (1985) research on 939 US corporations under SFAS No.36 reveals that lower bond ratings are associated with lower pension funding levels. Martin and Henderson (1983) find an association between pension obligations and credit ratings. In particular, they find that CRAs attach considerable weighting to pension obligations in determining firms' credit risk. Maher (1987) explores the relationship between pension variables and bond ratings in greater depth, and subsequently focuses on the pension-related items, other postretirement employee benefits (OPEB). The results suggest that OPEB is a significant factor for firms' credit ratings (Maher, 1996). Cardinale (2007) examines whether pension accounting disclosures are reflected in corporate bond spreads and provides evidence that the corporate bond market takes account of the presence of unfunded pension liabilities. McKillop and Pogue's (2009) analysis of a sample of FTSE 100 companies supports the existence of a relationship between pension liabilities and debt rating. In general, CRAs and creditors treat pension liabilities as debt-like obligations. They incorporate pension risk in assessing the default risk of a firm. Thus, managers may consider pension obligations in making decisions on capital structure, and it is likely that, in order to reduce the firm's overall risk, managers will reduce their pension risk.

Research by NISA (2013) states that "de-risking pension plans should improve credit ratings for some firms with large pension plans relative to their core business along with the reduction in pension volatility". For example, US Steel's reduction in the volatility of its pension obligations improved its rating by two full notches, from BB to BBB- (NISA, 2013). In addition, Lane Clark and Peacock (2005) mention that the recently introduced UK pension regulation improves the security of members' pension benefits. The notification requirement requires

firms with DB pension plans to inform the pension regulators if changes to their pension strategies may influence their credit rating (The Pension Regulator, 2005). Moody's identifies the key pension de-risking strategies which should be reviewed in the rating process. In their view, voluntary contributions, DB plan terminations and pension buy-outs are credit positive. Asset reallocation matching is credit neutral if the pension fund is well funded, but it is regarded as credit positive if it improves the rating metrics. In general, both academic research and anecdotal evidence suggest that managers may target credit ratings by engaging in pension de-risking strategies. In other words, managers are expected to reduce pension plan risk in order to achieve target credit ratings.

In examining whether firms' financial characteristics relates to decisions on adopting pension de-risking strategies, this study accepts the findings of previous research (Hovakimian et al., 2009; Kisgen, 2009) that firms target credit ratings. Kisgen (2009) finds that firms change their leverage following changes in their credit ratings in order to regain their target ratings. In addition, the traditional view of debt regards cash holdings as negative debt, as firms may use such holdings to redeem debt. Therefore, firms may also increase their cash holdings to achieve a target credit rating. It appears that accumulating cash is equivalent to reducing debt when there are no costs in external financing. This is consistent with the view that firms are indifferent between reserving cash flows or paying off outstanding debt in the absence of financial constraints (Opler et al., 1999). However, firms with different financial characteristics may behave differently in the presence of financial constraints by increasing cash holdings or reducing outstanding debt (Acharya et al., 2007), because there are costs for external financing. This suggests that firms must make a trade-off decision between increasing cash holdings or paying down

debt to achieve their target credit rating. Reducing outstanding debt or avoiding new debt issues is defined as saving debt capacity (Acharya et al., 2007).

This chapter aims to explore what drives these trade-off decisions when firms target credit ratings. Froot, Scharfstein and Stein (1993) suggest that the hedging motive, defined as firms matching their current cash flows to future investment opportunities, may be a factor driving such decisions. Acharya et al. (2007) measure hedging needs as the correlation between cash flows and future investment opportunities, and find that financially constrained firms with HHNs prefer to increase cash holdings, while firms with LHNs prefer to use cash flows to pay down debt. This chapter uses credit rating as a financial constraint to explore whether firms' hedging needs is related to the trade-off between increasing cash holdings and reducing outstanding debt when firms are targeting credit ratings.

The empirical tests in this chapter begin with Hovakimian et al.'s (2009) target credit-rating model. This chapter focuses on UK companies with DB pension plans from 2004 to 2013 where credit rating information is available. The UK sample is separated into two groups of firms: those with LHNs and those with HHNs. This study examines how these two groups make decisions to increase cash holdings or reduce outstanding debt to target future credit ratings. The results suggest that firms with HHNs tend to increase cash holdings to target credit ratings, whereas firms with LHNs tend to increase debt capacity. This is consistent with the finding of prior literature (Acharya et al., 2007) that financially constrained firms make trade-off decisions between increasing cash holdings and reducing debt.

This chapter also investigates the association between firms' hedging needs and adopting pension de-risking strategies to target credit ratings. The findings suggest that firms with HHNs are more likely to change their pension asset allocations from bonds to equities, and are more likely to switch from DB to DC pension plans to target credit ratings. In addition, the robustness tests suggest that firms target credit ratings by reducing their pension risk.

This chapter contributes to several existing strands of literature. First, it contributes to research on corporate hedging by exploring the substitutability relationship between reducing debt and increasing cash holdings. It provides evidence consistent with the notion that firms' hedging needs drive cash-saving behaviours in the presence of financial constraints (Almeida, Campello and Weisbach, 2004), contrary to the traditional view which regards cash as equivalent to negative debt.

Second, the relationship between firms' hedging needs and pension de-risking strategies is explored in the context of the UK. This chapter provides empirical evidence that managers use pension de-risking strategies to target credit ratings in the UK sample. This chapter extends the pension de-risking literature by investigating the factors associated with decisions in relation to pension de-risking strategies. This chapter sheds new light on such decisions by focusing on the UK. The differences between UK and US pension systems in respect of pension regulations, tax policies and the activeness of the pension buy-out market enrich the value of a UK study. Given that UK DB pension plans used to rely heavily on equity investments, UK companies may have stronger incentives than US firms to engage in pension de-risking strategies.

Third, this chapter contributes to the credit rating literature. It explores how managers change firms' capital structure to reduce their credit risk in targeting credit ratings. Previous research by Alissa et al. (2013) finds that firms tend to target credit ratings by using earnings management. This chapter explores whether firms change cash holdings, debt levels and adopt pension de-risking strategies to target credit ratings. The results are consistent with the targeting behaviour whereby managers change firms' financial fundamentals to achieve target credit ratings.

The remainder of this chapter proceeds as follows. Section 2 reviews relevant literature on debt-cash substitutability and pension de-risking strategies. The hypotheses to be tested in this study are developed in Section 3 and Section 4 describes the sample and data. Section 5 reports the results of the univariate analysis while Section 6 presents the multivariate results. Robustness tests are discussed in Section 7 and Section 8 provides concluding remarks.

2.2 Literature Review

2.2.1 Reduce debt or increase cash holdings

A survey by Graham and Harvey (2001) suggests that firms regard credit ratings as indications of distress costs when they change their capital structure. In addition, empirical evidence shows that firms may reduce their leverage to regain a target credit rating and avoid a downgrade. Kisgen (2009) also indicates that credit ratings may influence managers' capital structure decisions. Firms close to rating changes are compared with firms not close to rating changes, and suggest that the costs of rating changes drive managers to alter their issuance of debt. Hovakimian et al. (2009) provide empirical evidence

supporting target credit-rating behaviour. They conclude that firms that benefit more from higher credit ratings are more likely to change their financial characteristics to target credit ratings. In addition, firms that deviate from a target credit rating tend to change their financial structure to mitigate the shocks of lower credit ratings. Overall, the results suggest that firms change their capital structure, and more specifically their levels of debt, to target credit ratings (Kisgen, 2009).

In addition to changes in debt, changes in cash holdings may be used to target credit ratings. This is because the traditional view of cash holdings is that cash represents negative debt, which implies that increasing cash holdings is equivalent to reducing debt. Opler et al. (1999) find that the determinants of cash holdings are similar to the determinants of debt. However, they point out that cash holdings may play a different role from negative debt when firms' financial characteristics differ. Pinkowitz et al.'s (2013) large sample of US and non-US firms, from post-1990 to the end of the early twenty-first-century financial crisis, reveals that abnormal cash holdings increase before and after the financial crisis. They note that most profitable companies experienced increases in cash holdings as they lacked good investment opportunities. Lins, Servaes and Tufano (2010) focus on cash holdings and lines of credit, and find that managers increased liquidity before the financial crisis based on precautionary motives. In contrast, Campello, Graham and Harvey (2010) find that cash holding levels did not change before the crisis. They conclude that firms used up a large amount of cash savings during the crisis. Acharya, Davydenko and Strebulaev (2012) argue that long-term cash holdings may increase a firm's probability of default and credit spread, even though increasing short-term cash holdings can preserve the liquidity of the firm. This indicates

that the relationship between cash holdings and probability of default depends on the time horizon. Similarly, Davydenko (2012) explores the effects of insolvency and liquidity on the probability of default, and concludes that cash shortage and the value of assets seem to explain some variation in the timing of default. Therefore, liquidity and the cost of borrowing may jointly determine the probability of default. In general, firms change their cash holding levels in response to financial constraints.

Opler et al. (1999) find that a one-dollar increase in cash holdings does not equal one dollar less of debt. They find that the coefficient of leverage is significantly different from minus one, which implies that increasing cash holdings is not the same as spare debt capacity. Consistently, Acharya et al. (2007) support that cash holdings are not equivalent to negative debt. Since costs are incurred in external financing, whether firms choose to increase cash holdings or pay down debt may be related to cash flows and future investment opportunities (Acharya et al., 2007). This raises the concept of hedging needs, which determine trade-off decisions between increasing cash holdings and reducing debt. Since cash holdings are regarded as internal financing, Keynes (2006) suggests that a firm's liquidity is determined by the extent to which it can access external financing. Firms may need to safeguard future investment needs when they suffer financial constraints (Keynes, 2006), thus, they may prefer to save cash during a financial crisis. Almeida et al. (2004) explore changes in cash holdings, comparing financially constrained and unconstrained firms. They find that constrained firms tend to choose optimal cash holding levels to trade-off between current and future investments, while unconstrained firms' cash holding is not related to cash flows. Therefore, they conclude that firms try to save cash out of cash flows for future investments. In general, prior

research finds that there are incentives for firms to save cash in the presence of external financing costs.

2.2.2 Pension de-risking strategies

The corporate financial view of pension plans suggests that pension assets and liabilities should be treated as corporate assets and liabilities (Bodie, Light and Morck, 1987). Similarly to corporate debt, changes in pension obligations relate to changes in credit ratings. Previous literature (Martin and Henderson, 1983; Bodie et al., 1985; Maher, 1987; McKillop and Pogue, 2009) provides evidence consistent with the view that pension information is relevance to firms' equity price and credit rating. Therefore, firms may take pension assets and obligations into consideration when targeting their credit ratings. In particular, firms may engage in pension de-risking strategies to target credit ratings. In the following sub-sections, the costs and benefits of each pension de-risking strategy are identified and tabulated in the Appendix II.

2.2.2.1 Changes in pension asset allocations

Managers may seek to reallocate pension assets from equities to fixed income securities in order to match the duration of pension liabilities more effectively (Amir and Benartzi, 1999). This is consistent with the fact that, in 2014, FTSE 100 companies were continuing to move pension assets out of equities into bonds (Lane Clark and Peacock, 2014a). Holt (2011) suggests that these shifts were due to the adoption of a new pension accounting standard and increases in pension risk. Mashruwala (2008) provides UK evidence that pension asset allocations shifted away from equities into bonds following the implementation of FRS 17. Similarly, Amir et al. (2010) find that UK and US firms changed their

pension asset allocations to bonds away from equities following the adoption of IAS 19 at 2004 and SFAS 158 at 2006 respectively.

Harrison and Sharpe (1983) suggest that firms with extremely underfunded plans may benefit from the put option provided by the PBGC to allocate pension assets to equities. However, Guan and Lui (2016) find that PPF does not have any incentive for UK firms to reallocate pension assets to equity when firms approach to bankruptcy. Anecdotal evidence indicates that managers are advised to use an assets and liabilities modelling approach to manage pension asset allocations (Shtekhman, 2012). This is consistent with a LDI strategy, whereby firms match returns on pension investments to the duration of projected pension obligations. Overall, there appears to be a negative relationship between pension funding status and pension asset allocations to equities (Bodie et al., 1987).

Allocating pension assets to bonds may reduce the volatility of pension contributions (Bader and Leibowitz, 1988). However, costs are incurred in reallocating pension assets to fixed income securities. Returns on pension assets will generally be lower than returns on assets invested in equities. In particular, the global financial crisis led to lower interest rates, consequently lowering returns on pension assets invested in bonds. Low returns on pension assets may create the risk of firms failing to meet future pension benefit payments and the need for higher pension contributions. This risk may be higher for firms with longer duration of pension obligations. Thus, firms are likely to invest pension assets in equities. It can also be argued that allocating pension assets on equity is appropriate for firms with longer duration of pension liabilities as they have longer time horizon and are able to better capture the

‘equity premium’. Bodie (1990) finds that, when there is pressure on pension contributions, firms switch their pension asset allocations from bonds to equities in order to reduce their pension contributions by generating high investment returns. In addition, Amir et al. (2010) find a positive relationship between the proportion of pension assets allocated to equities and pension funding levels. Lane Clark and Peacock (2014a) suggest that companies may increase their pension asset allocations to equities and wait until bonds become less expensive. This implies that firms may be forced to invest pension assets in equities when they consider bonds to be too expensive. In general, companies may need to trade-off the benefits and costs of pension reallocations in response to increasing pension plan risk.

Pension trustee makes asset reallocation decisions in the UK. They are required to work independently and act as the interests of pension beneficiaries. Thus, the governance of pension plans and the independence of trustees may determine how likely the companies are able to engineer the reallocation in pension plan assets. The power of the pension trustee varies from different pension plans (Cocco and Volpin, 2007). Thornton and Fleming (2011) suggest that pension investment strategies is set up by taking account the view from pension trustees and sponsor firms. Since the pension trustees represents the interests of plan members, pension beneficiaries and sponsor firms are the key to influence the pension investment strategies. However, the shareholders and pension beneficiaries have different attitude towards risk taking on pension investments (Franzen, 2010). This is due to that higher return from pension investments can reduce the pension contributions and sponsors’ costs. Therefore, Thornton and Fleming (2011) suggest that it is important to identify the equilibrium of interests between sponsor firms and pension members.

Cocco and Volpin (2007) mentioned that the directors of sponsoring firms are also the members of trustees in practice. Thus, it suggests that pension trustees are likely to take account of the sponsor company's financial position when determining pension investment strategies.

2.2.2.2 Switching from defined benefit to defined contribution pension plans

Broadbent et al. (2006) explore factors contributing to the shift from DB to DC pension plans. These include tax benefits and regulatory changes, increasing costs of DB pension plans, increasing labour mobility and changes in pension accounting standards. Turner and Hughes (2008) show declines in DB pension plans in Canada, Ireland, the United Kingdom and the United States. They note that small DB pension plans are more likely to be closed than large ones. Lane Clark and Peacock (2014a) report that an increasing number of UK firms closed DB pension plans in 2014.

Only four FTSE 100 companies disclosed that they were keeping DB pension plans open for new employees (Lane Clark and Peacock, 2016b). Most companies had closed their DB pension plans to new staff and had put a stop on future accruals of benefits to existing members. In a DB pension plan, firms sponsoring the plan are responsible for funding and investment strategies, while this responsibility rests with employees under a DC pension plan. In addition, the recent financial crisis, combined with increasing life expectancy, have increased risks for firms with DB pension plans. The global financial crisis has made it more difficult for firms to maintain sufficient investment returns on pension assets. Changes in longevity assumptions increase the projected benefit obligations of DB pension plans, thereby significantly increasing plan deficits. Thus, the shift from DB to DC pension plans aims to reduce firm risk.

Some research has focused on the effect of terminating DB pension plans. Atanasova and Hrazdil (2010) suggest that freezing a DB pension plan, referred to closing the plan to new or further accruals, increases the firm's equity price and credit rating. They also find that firms freeze their DB pension plans in order to maximize shareholder wealth, even if they have a high funding ratio and high pension investment returns. In contrast, Choy, Lin and Officer (2014) provide evidence that firms change their risk-taking activities after freezing their DB pension plans. The freezing of DB pension plans leads to the increase in credit risk. This is due to that pension obligation is regarded as insider debt, which alight the interests between managers and debtholders. Thus, reduce of pension obligation leads to increase in credit risk. In addition, Comprix and Muller (2011) find that companies tend to downward biased expected rate of return and discount rate to opportunistically increase the pension expenses when firms close their DB pension plans. It is widely accepted in practice that the concerns of long-term costs of DB pension plan and volatility of the pension contribution drive firms to switch the DB pension plans (VanDerhei, 2006). In general, this chapter regards switching from a DB to a DC pension plan as a pension de-risking strategy.

The Pension Regulator (1995) provides guidance for the company to close a DB pension plan to new members or future accrual. It is required that sponsor firms need to discuss such issues with pension trustees and managers of the pension plan to make sure that they follow the rules and legislations of the pension plans. The guidance provided by The Penison Regulator (2015) encourages employees to express their view about the changes on their pension plans before the final decision is made. In addition, the role of pension trustees in the closure of DB pension plan is to safeguard the benefits of

pension beneficiaries and review the existing investment strategies. In reality, the decision of switch from DB to DC pension plans entirely relies on the sponsor firms (Munnell et al., 2007). However, Munnell et al. (2007) suggest that there are occasions that employers need to negotiate with labour union to close the DB pension plans.

2.2.2.3 Pension buy-ins and buy-outs

An alternative strategy is for managers to remove pension liabilities fully or partially from the balance sheet by means of buy-in or buy-out transactions with insurance companies. Monk (2009) identifies factors that slowed down the development of the pension buy-out market between 2007 and 2009, indicating that firms were unable to afford pension buy-outs during the financial crisis. This suggests that the premium paid to insurance companies for pension buy-outs may be rather costly for financially -constrained firms. In addition, insurance companies require higher premiums for pension plans with greater liabilities. The Mercer Global Pension Buyout Index (2016) shows that the ratio of estimated costs to pension accounting liabilities for full pension buy-out was 145% at the end of 2016. The above indicate that firms are concerned about the costs of pension buy-ins and buy-outs in de-risking their DB pension plans.

However, some companies may view the cost of a pension buy-out as lower than the cost of compliance with the new regulations (Monk, 2009). Biffis and Blake (2009) find that managers use pension buy-ins and buy-outs to mitigate longevity risk, and identify the increasing popularity of such transactions in the UK since 2006. Similar research suggests that some managers may think that insurers have superior expertise in effective management of asset and liabilities (Biffis and Blake, 2013). Pension buy-ins and buy-outs are thus widely used to

reduce companies' pension risk. For example, Motorola Solution announced a £3.1 billion liabilities buy-out in September 2014, paying a 3% premium in excess of the value of projected liabilities (Lane Clark and Peacock, 2014b). Given that IAS 19R requires further disclosure of increases in longevity risk, the increasing longevity risk may be an incentive to transfer pension obligations to insurance companies under the pressure from changes in accounting standards. In summary, firms need to trade-off between benefits and costs of pension buy-ins and buy-outs to reduce pension risk even though they are a direct way for employers to reduce pension obligations.

Engaging in pension buy-ins and buy-outs can involve different stakeholders such as sponsor firms, pension trustees and actuarial advisors (Association of British Insurers, 2011). However, employers are not required to consult pension members when they make such decisions. Securing a pension buy-in and buy-out is complex process. A suitable insurance company needs to be identified and is able to issue a quotation under the accurate pension plan-specific information. Pension trustee plays a key role to review the quotation and make sure the plan beneficiaries will receive their benefits when they are due (Matthew, 2008). This suggests that pension trustees also assess the strength of financial condition of insurance company that offers the pension buy-in and buy-out deal. Advisors provide professional service to help trustees make informed decision in this process. The final decision on pension buy-in or buy-out needs to be agreed by both pension trustees and sponsor firms in terms of the costs of buy-in or buy-out exercise and the affordability of them (Association of British Insurers, 2011).

2.2.3 The incentives for use of pension de-risking strategies to target credit ratings

Although pension de-risking strategies may reduce pension risk, it is questionable how likely firms are to consider reducing pension risk rather than non-pension related risk to target credit ratings. Firms tend to borrow money to contribute to pension funds and reduce pension deficits (Feldstein and Seligman, 1981). Tax advantages attract firms to contribute to pension funds, as pension contributions are tax deductible and earnings from pension fund assets are tax exempt. In addition, Rauh (2006) finds that required pension contributions not only reduce firms' internal resources, but also decrease their investments. This suggests that companies may weight pension contributions over other financial strategies. It is consistent to Liu and Tonks's (2013) finding that pension contributions crowd out investments. Pension regulations may drive firms to reduce pension obligations in preference to non-pension obligations. The MFR ensure that any drops below specified funding level require immediate actions to set up a recovery plan. Thus, companies may forgo reducing non-pension debt to improve funding levels. Overall, under such circumstances, firms are more likely to inject cash flows into pension funds to reduce pension deficits.

In contrast, Ippolito (1985b) suggests that firms may forgo the tax advantages of pension contributions if they have reached their maximum annual tax deductible amount. Franzoni (2009) finds that markets react negatively to cash reductions for pension contributions. The PPF may create incentives to underfund pension plans. However, Guan and Lui (2016) reveal that the PBGC promotes a moral hazard problem for US firms under financial constraints to underfund pension

plans, while the PPF provides incentivise to improve funding levels when UK firms approaching bankruptcy. In general, firms are likely to trade-off between reducing pension risks and non-pension related risk in making financial decisions. However, such trade-off decisions are not examined in this study.

2.3 Hypothesis Development

Acharya et al. (2007) develop a theory of cash-debt substitutability for the optimal financial policy of a firm. Their findings contradict the traditional view that cash is negative debt. In particular, when firms have limited access to external capital, they may have to decide whether they should reserve cash flows for future investment opportunities. Acharya et al. (2007) provide empirical evidence that firms with HHNs reserve cash flows, while firms with LHNs use cash flows to reduce outstanding debt. They explain that increasing cash holdings or issuing debt transfers current cash flows to satisfy future cash needs. However, firms that save debt capacity expect there to be sufficient cash flows for investments in the future. This is consistent with the view that firms must make trade-off decisions regarding increasing cash holdings or decreasing debt in terms of their future investment opportunities and future cash flows. In addition, Opler et al. (1999) draw attention to the value of holding liquid assets. First, they propose that firms may save on transaction costs by increasing cash holdings rather than raising funds. Second, when external funding is limited, firms may finance their investment internally. Thus, the empirical evidence suggests that managers must weigh the costs and benefits of increasing cash holdings and spare debt capacity during periods of financial constraint.

Rating downgrades may increase a firm's borrowing costs, leading to changes in its access to external financing. Credit rating changes are widely used as a

proxy for financial constraints. Greenaway, Guariglia and Kneller (2007) use the QuiScore as a credit rating to measure the likelihood of company failure, separating their samples into financially constrained and unconstrained firms. Hovakimian et al. (2009) provide evidence that firms change their capital structure to achieve target credit ratings.

Following Acharya et al. (2007), who suggest that future cash flows are risky, this chapter investigates the debt-cash relationship when firms are targeting credit ratings. Expected future cash flows determine whether firms will save cash or reserve debt capacity for future investment opportunities.

However, rating downgrades limit firms' access to external financing and increase their cost of capital. Firms therefore have an incentive to avoid rating downgrades and target higher credit ratings. Thus, if future cash flows are expected to be high, it is optimal for firms to reduce outstanding debt to preserve debt capacity in order to target credit ratings. If future cash flows are expected to be low, firms should accumulate cash to target credit ratings. This chapter follows Acharya et al. (2007) in defining the correlation between cash flows and future investment opportunities as firms' hedging needs. When there is a high correlation between cash flows and future investment opportunities, indicating LHNs, firms are expected to increase debt capacity to target credit ratings. When there is a low correlation between cash flows and future investment opportunities, indicating HHNs, firms are expected to save cash flows to target credit ratings.

The discussion above leads to the following hypothesis:

Hypothesis 1: *Ceteris paribus, firms with HHNs (LHNs) are more (less) likely to increase cash holdings over increase debt capacity to target credit ratings.*

Since pension obligations are debt-like obligations, it is expected that firms will engage in pension de-risking strategies when they change their capital structure to target credit ratings. The prior literature and anecdotal evidence shows that pension de-risking strategies may reduce pension plan risks. Bodie et al. (1985) and Friedman (1982) suggest that companies offset high corporate risk by investing more pension assets in bonds. In order to maintain stable pension contributions, managers switch pension asset allocations from equities to bonds. Amir et al. (2010) examine the influence of changes in the pensions accounting standard regarding pension asset allocations. They use the volatility of operating cash flows as a control variable, and show that this is negatively related to equity asset allocations. Thus, if there is high volatility in cash available for pension contributions, it is expected that pension asset allocations may switch from equities to bonds.

However, Bodie (1990) suggests that firms may invest a higher proportion of pension assets in equities to pursue higher investment returns to reduce the need for pension contributions. In addition, funding levels are positively related to pension asset allocation on equities (Amir et al., 2010). Firms changing the pension asset allocation on equities are expected to reduce pension contributions and save the internal resources.

Allocating pension assets on bonds can provide stable and less volatile pension investment returns. However, pension assets allocated on equities can offer higher investment returns with higher volatility in pension contributions. Thus, when firms tend to accumulate cash flows to prepare the future investments, they are likely trade-off the benefits and costs of allocating pension assets on equities to engage in pension reallocations to target credit ratings.

The discussion above leads to the following hypothesis:

Hypothesis 2: *Ceteris paribus, firms with high or low hedging needs reallocate their pension assets to target credit ratings in different ways.*

Atanasova and Hrazdil (2010) identify reasons for firms closing DB pension plans. Such closures aim to transfer to employees the pension risks posed by changes in actuarial assumptions, investment risk and regulatory changes (Atanasova and Hrazdil, 2010). As discussed above, it is expected that firms' switching from DB to DC pension plans has positive impact on credit rating. In addition, Munnell et al. (2007) suggest that switching DB pension plans can reduce the future retirement benefits. Therefore, firms are likely to switch from DB to DC pension plans to allow them to accumulate cash flows to target credit ratings.

The discussion above leads to the following hypothesis:

Hypothesis 3: *Ceteris paribus, firms with HHNs (LHNs) are more (less) likely to switch from DB to DC pension plans to target credit ratings.*

Pension buy-ins and buy-outs transfer part of or all pension obligations to an insurance company. This method may reduce pension obligations and significantly change a firm's capital structure. Thus, it is expected that firms' credit rating would be positively related to the pension buy-in and buy-out decisions. However, the costs of pension buy-ins and buy-outs should not be ignored. Lin et al. (2015) argue that for firms with extremely underfunded DB pension plans, it may be expensive to engage in pension buy-in and buy-out transactions. In addition, paying a significant amount of buy-in and buy-out premium will not benefit to those firms which tend to save cash flows for the

future investments, defined as HHNs. Therefore, whether firms are likely to engage in pension buy-ins and buy-outs to target credit ratings will be examined in the following sections. This is because firms must make trade-off decisions between transferring significant amounts of pension obligations and paying premiums to insurance companies.

The discussion above leads to the following hypothesis:

Hypothesis 4: *Ceteris paribus, firms with high or low hedging needs are associated with their engagement in pension buy-ins and buy-outs to target credit ratings.*

2.4 Sample and Data

2.4.1 Sample selection criteria

Data were collected on UK firms available for credit rating information for the period 2004 to 2013. Credit rating data were collected from the Thomson One Banker and Capital IQ databases, and from Standard & Poor's long-term issuer credit rating data. The sample of UK firms available for Standard & Poor's credit rating included 1,240 firm-year observations. Credit rating is an ordinal variable coded from 1 to 16: the highest credit rating of AAA was coded as 1, and the lowest rating of B- was coded as 16. All firms with D to CCC+ credit ratings were excluded. This method of excluding credit ratings is consistent with research by Alissa et al. (2013).

Pension asset allocation data were gathered from the Thomson One Banker database. For the period 2004 to 2013, 4,800 firm-year observations were available. The sample of firms with pension asset allocation information was

merged with the sample of firms with credit ratings to give a sub-sample of 418 firm-year observations. Pension information on switches from DB to DC pension plans was hand collected from annual reports for 1,402 firm-year observations for FTSE 100 companies. After merging these data with the credit rating data, 337 firm-year observations remained. Data on pension buy-ins and buy-outs were limited: only 510 firm-year observations were available for FTSE 100 companies with pension buy-in and buy-out information. After merging these data with credit rating data, 45 firm-year observations remained. The sample selection process is shown in Table 2.2. Data on other accounting variables were collected from the Thomson One Banker, including the main independent variables and control variables. In order to control the effect of outliers, all continuous variables were winsorized at 1% and 99%.

2.4.2 The model

Firms' credit rating targeting behaviour was developed from the notion that firms target leverage (Hovakimian et al., 2009). Previous research indicates that a firm's leverage is determined by its financial characteristics (Rajan and Zingales, 1995; Hovakimian, Opler and Titman, 2001; Flannery and Rangan, 2006), and managers may change a firm's financial characteristics to achieve a target leverage level. The target leverage model has been extended to a target credit rating model by Hovakimian et al. (2009).

The model of expected credit rating is an ordered probit model in which CR_{it} represents the credit rating of the firm for firm *i* at time *t*, and X_{it} represents the explanatory variables. The unobservable variable $\mathrm{Y_{it}}$ establishes a link between explanatory variables X_{it} and CR_{it}. Thus, the linear relationship between X_{it} and Y_{it} is expressed as:

$$Y_{it} = \alpha X_{it} + \mu_{it}$$

In this model, α is the correlation coefficient between X_{it} and Y_{it}, and μ_{it} represents the unobserved error term. CR_{it} is the ordered dependent variable, and Y_{it} to CR_{it} are related through the following equation:

$$CR_{it} = \begin{cases} 1 \; if \; Y_{it} \in [\infty, v_1] \\ n \; if \; Y_{it} \in [v_{n-1}, v_n] \\ 16 \; if \; Y_{it} \in [v_{16}, \infty] \end{cases}$$

where parameter v_i defines the partitions of the range of Y_{it} associated with each level of credit rating, CR_{it}. This model reflects how the credit rating was coded. The highest credit ratings were coded as 1 and the lowest credit ratings as 16. The main interest of this research is that changes in capital structure may influence changes in credit ratings. Thus, a change in credit rating (*DIFF*) is the difference between the next year's credit rating (CR_{it+1}) and the current year's credit rating (CR_{it}) for firm *i*.

Previous research has identified several independent variables that reflect a firm's financial fundamentals and influence its credit rating (Hovakimian et al., 2009) and following prior research this chapter includes the following control variables in the model. *SIZE* is the natural log of sales. Large firms may have more capacity to achieve a higher credit rating and to target a higher credit rating in the future. *PROFIT* is operating income scaled by total assets. High income means that firms are able to generate higher profits to maintain their operations and reduce the risk of default. *OPRISK* is operating risk measured by the standard deviation of operating income scaled by lagged total assets. Firms with higher volatility of income are more likely to face financial problems.

Kisgen (2009) uses research and development expenses (*RD*) to measure the asset specialization and future growth potential of firms. However, the focus of this study is on UK rather than US firms. US and UK accounting standards differ in their treatment of *RD* expenses. UK firms are allowed to capitalize development costs when the technical and economic feasibility of a project can be demonstrated to be in accordance with specific criteria, while US firms are not allowed to do so. In addition, there were limited observations for firms with *RD* information. Including *RD* limited the sample observations significantly, so it was excluded from the model based on UK firms. Tangibility represents asset tangibility measured by net property, plant and equipment scaled by total assets. It is widely accepted that more tangible assets and specialized products result in lower leverage, which indicates higher credit ratings. The growth opportunity of the firm is measured with *SGA* and *MB*. *SGA* represents the selling, general and administrative expenses scaled by sales, and *MB* is market-to-book ratio calculated by the market value of assets over the book value of assets, where the former is calculated as total assets minus the book value of equity plus the market value of equity. Firms with more growth opportunities are likely to have greater potential and are expected to have higher credit ratings. Measurement of cash holdings in this study is consistent with most of the cash-holding literature. Changes in cash holdings (*ΔCASH*) are measured by changes in cash and short-term investments scaled by total assets. Following Acharya et al. (2007), changes in debt issuance (*ΔDEBT*) are measured as changes in the ratio of net long-term debt issuance.

2.4.3 Measures of pension de-risking strategies

Pension de-risking strategies include changes in pension asset allocations, switches from DB to DC pension plans, and pension buy-ins and buy-outs. Pension asset allocations are measured by the percentage of pension assets allocated to equities (*EQUITY*), calculated as pension assets allocated to equities scaled by total pension assets. Data on switches from DB to DC pension plans (*SWITCH*) were hand-collected from UK companies' annual reports, and coded as 0 if a DB pension plan was still open to all employees, 1 if firms had partially closed their DB pension plan, and 2 if firms had fully closed their DB pension plan. Pension buy-in and buy-out data were gathered from Lane Clark and Peacock (2005); (2014b), who report UK pension buy-ins and buy-outs information from 2008 to 2014. They specify four types of pension buy-in and buy-out transactions (*BUYOUT*): pensioner buy-in, full buy-out, pensioner buy-out and buy-in. The pensioner buy-in (buy-out) is defined as a buy-in (buy-out) that covers payments to current pensioners and their dependants. Full pension buy-out is a buy-out contract covering all known liabilities in a pension plan, usually followed by winding up the pension plan. Buy-in represents a purchase of a bulk annuity contract with an insurance company as an investment to match some or all of a pension plan's liabilities. Firms with pensioner buy-in were coded as 1, full buy-out was coded as 2, pensioner buy-out was coded as 3, and buy-in was coded as 4. Table 2.3 gives descriptions of each type of pension buy-in and buy-out in the sample. Pension buy-ins constituted the majority of pension buy-in and buy-out transactions (26 out of 45 observations).

2.4.4 Measures of hedging needs

The notion of “hedging needs” is raised by Froot et al. (1993), who suggest that firms start to hedge when external financing is more costly than internal financing. In order to measure hedging needs, the relationship between a firm’s operating cash flows and future investment opportunities is examined. Future investment opportunities are measured following Acharya et al. (2007). To address endogeneity problems between a firm’s operating cash flows and investment spending, product-market demand is used to measure future investment opportunities. Information on estimated three-year-ahead sales growth was collected from the Thomson One Banker database. The median three-year-ahead sales growth rate was based on industry-level data. Firm industries were determined by Standard Industrial Classification (SIC) code.

A firm’s hedging needs are measured by the correlation between the firm’s median three-year-ahead sales growth and its operating cash flow. The cut-off between HHNs and LHNs was set as correlation coefficients below 0 and above 0. Thus, firms with HHNs exhibit a negative correlation between median three-year-ahead sales growth and operating cash flows, while those with LHNs exhibit a positive correlation between the two. The full sample for UK companies with credit rating information contained 295 firms with HHNs and 945 with LHNs with credit rating information.

Table 2.4 reports the distribution of Standard & Poor’s credit ratings categorized by firms’ hedging needs. The most common credit rating for firms with HHNs was BBB (23.1%), while for firms with LHNs it was BBB+ (14.2%). However, firms with LHNs tended to have higher credit ratings than firms with HHNs in the AA+ to BBB+ rating categories. In particular, no firms had an AA+ rating and

HHNs. The percentage of credit ratings from BBB- to B- for the sample with HHNs was greater than those with LHNs, although the difference was only 1.3%. Most firms in the sample were rated between BBB- and AA+.

Since the dependent variable for this research is changes in credit ratings (*DIFF*), Panel A in Table 2.5 describes the distribution of firm-year observations based on changes in Standard & Poor's credit ratings and firms' hedging needs. Firms without changes in credit ratings constituted the largest proportion of both the high (78.4%) and low (80.6%) hedging needs samples. This shows that few observations experienced changes in credit ratings in the sample year. In addition, -1 indicates a one-notch increase and +1 indicates a one-notch decrease in the credit rating. It appears that most firms with credit rating changes experienced only a one-notch increase (5%) or decrease (10.4%) in one year. Only one firm in the LHNs sample experienced a significant increase in credit rating, by six notches in one year. Overall, most sample firms retained unchanged credit ratings, and firms with credit rating changes did not experience significant rating changes.

In addition to the distribution of rating changes in full UK sample, Panel B in Table 2.5 presents the changes in credit ratings categorized by firms' hedging needs in the sub-sample for cash holding and debt. It is consistent to the full UK sample that majority of firms (80.5% for HHNs and 83.6% for LHNs) did not experience any rating changes. There were rating changes in 22 firm-year observations in HHNs and 47 firm-year observations in LHNs groups. Panel C, D and E in Table 2.5 show the sub-samples for pension asset allocations, switch from DB to DC pension plans and pension buy-ins and buy-outs. It is

worth noting that there were only 4 rating changes observations for HHNs and LHNs groups in the pension buy-in and buy-out sample.

2.4.5 Measures of pension risk

It is expected that firms that engage in pension de-risking strategies to target credit ratings will reduce the pension risk reported in their financial statements. This was tested for in robustness tests. There are two alternative proxies for pension risk, which are supported by Lane Clark and Peacock (2014b), who report pension obligations and pension deficits as benchmarks to compare financial statement pension risk among FTSE 100 companies. The first measure of pension risk (*Pension_Risk1*) is the projected benefit obligation divided by market capitalization. This measure is empirically supported by Cardinale (2007), who suggests that separate pension obligations are significant for bond spread, while the relationship between pension deficit and bond spread is not significant. This indicates that pension obligations may capture pension risk on the balance sheet, rather than using aggregate figures. The second measure of pension risk (*Pension_Risk2*) is suggested by Franzoni and Marin (2006), who measure pension risk as the difference between projected benefit obligations and the fair value of pension assets divided by market capitalization. They find that the equity market misprices firms with underfunded pension plans. Thus, it is expected that firms that engage in pension de-risking strategies will reduce pension risk.

2.5 Univariate Results

Table 2.6 presents descriptive statistics for all variables. The results reveal that the average credit rating in the sample was BBB+. Since the *DIFF* variable

indicates changes in credit rating from the current year to the next year, the average of credit rating changes was near to zero. This is consistent with the data shown in Table 2.5, indicating that many firms' credit ratings remained the same across time. This limits the observations available to capture the determinants of credit rating changes. In addition, Panel B of Table 2.6 shows that the average percentage of pension assets allocated to equities (*EQUITY*) was 48.66%, which indicates that sample firms typically invested a high percentage of pension assets in equities. The *SWITCH* variable indicates shifts from DB to DC pension plans. Panel C of Table 2.6 clearly shows that most firms for which information on switches from DB to DC pension plans was available had partially or fully closed their DB pension plans, since the average for *SWITCH* is far from zero. In addition, the average for *BUYOUT* is far from 1, suggesting that many firms in the sub-sample have engaged in pension buy-ins and buy-outs.

Two proxies were used to measure pension risk. Panel E of Table 2.6 shows a negative mean for *Pension_Risk2*, demonstrating that the pension funds of sample firms were generally underfunded. Table 2.6 presents the other financial characteristics of firms in each of the sub-samples.

In Table 2.7, the samples are separated between firms with HHNs and those with LHNs, based on the criteria specified earlier. HHNs indicate a negative correlation between operating cash flows and investment opportunities, while LHNs suggest a positive correlation between the two. The means of the key variables are reported to assist further discussion. T-tests were conducted to examine the mean differences in the two samples. The aim of the t-tests was to investigate the different characteristics of firms in the HHNs and LHNs groups.

There were differences in credit ratings (statistically significant at the 1% level) between firms with HHNs and LHNs; the former had lower credit ratings than the letter. In addition, firms with HHNs tended to hold more cash than those with LHNs. This is consistent with the expectation that firms with HHNs tend to accumulate more cash than firms with LHNs.

Firms with HHNs tended to issue less long-term debt (*DEBT*) than those with LHNs. Furthermore, firms with HHNs allocated a lower proportion of pension assets to equities than firms with LHNs. Other pension de-risking strategies indicators were not significantly different in the LHNs and HHNs samples.

A correlation matrix is presented in Table 2.8. Correlations between the key variables are consistent with the credit rating literature and the expected credit rating model. Firms' credit ratings (*CR*) were negatively related to their levels of cash holdings (*CASH*), although this was not statistically significant. This suggests that firms with higher credit ratings have higher levels of cash holdings. A significant negative relationship between net issuance of long-term debt (*DEBT*) and credit rating (*CR*) suggests that firms with higher credit ratings tend to be more able to access external financing. Thus, the results shown in Table 2.8 suggest that firms with higher credit rating issue more net long-term debt. Panel B of Table 2.8 shows a negative relationship between credit rating (*CR*) and pension assets allocated to equities (*EQUITY*). This indicates that firms with higher credit ratings allocate a lower proportion of pension assets to equities. There is also a positive relationship between switching from a DB to a DC pension plan (*SWITCH*) and credit rating (*CR*), but no significant relationship between credit ratings (*CR*) and pension buy-ins and buy-outs (*BUYOUT*).

The control variables are consistent with the previous literature. Larger firms (*SIZE*) with higher profitability (*PROFIT*), more growth opportunities (*SGA*) and more specialized assets (*Tangibility*) tended to have higher credit ratings (*CR*). However, firms' operating risk (*OPRISK*) was negatively related to their credit ratings (*CR*). The correlation between credit rating (*CR*) and pension risk (*Pension_Risk1*) supports the hypothesis that firms with lower pension risk have higher credit ratings.

2.6 Multivariate Analysis

2.6.1 Relationship between firms' hedging needs and cash and debt substitutability

Table 2.9 presents the regression results for Hypothesis 1, exploring whether firms target credit ratings through increased cash holdings or spare debt capacity. It supports the Hypothesis 1 and found that firms with HHNs target credit ratings by changing their cash holding levels. Changes in cash holdings (*ΔCASH*) are significantly negative in relation to changes in credit rating (*DIFF*) at the 1% significance level. The lower the *DIFF*, the higher the increase in credit ratings. This indicates that firms increase cash holdings in order to achieve higher credit ratings. The relationship between changes in cash holdings (*ΔCASH*) and changes in credit rating (*DIFF*) is less statistically significant (at the 5% significance level) in the LHNs group than the HHNs group (at the 1% significance level). This is consistent with the findings of previous literature that a firm's hedging needs may be related to its decision to increase cash holdings (Acharya et al., 2007). The findings shown in Columns 1 and 2 imply that firms accumulate cash to prepare for cash needs for future

investment opportunities, as they expect current cash flows to be insufficient for future investments.

Acharya et al. (2007) suggest that hedging needs may be related to decisions to use cash to reduce outstanding debt. Table 2.9 examines whether hedging needs is associated with the net issuance of long-term debt (*ΔDEBT*) when firms target credit ratings. Clearly, firms with HHNs do not use cash flows to reduce debt levels in order to target credit ratings, as *ΔDEBT* is not statistically significant to changes in credit ratings (*DIFF*), as shown in Column 3 of Table 2.9. However, firms with LHNs decrease their net issuance of long-term debt to target credit ratings. The coefficient of the net issuance of long-term debt (*ΔDEBT*) is significantly positive in relation to changes in credit ratings (*DIFF*) at the 1% significance level. This suggests that firms use cash flows to pay down outstanding debt in order to target credit ratings.

The findings also indicate that firms are more likely to use cash flows to pay down debt if they expect that current cash flows will be sufficient for future investments. Columns 5 and 6 include both the cash holding (*ΔCASH*) variable and the debt variable (*ΔDEBT*) in a single model. This provides consistent evidence that firms with HHNs are more likely to accumulate cash flows, while firms with LHNs are more likely to use cash flows to reduce debt.

In addition, firms with HHNs increase their specialized products, measured by *Tangibility*, to target credit ratings. Table 2.9 shows that changes in specialized products (*ΔTangibility*) are significantly related to changes in credit ratings (*DIFF*), while this indicator disappears in the LHNs group. This is consistent with the finding of prior literature that firms with more specialized products have lower leverage and higher credit ratings (Hovakimian et al., 2009). Similarly, the

proxy for firm size is sales. Firms with LHNs increase sales to target credit ratings. There is weak evidence that *ΔMB* is negatively related to credit rating changes (*DIFF*) in firms with LHNs.

Overall, the evidence shows that firms accumulate cash flows rather than paying down debt if there is a negative correlation between operating cash flows and future investment opportunities. The regression results are consistent with the finding of previous literature that firms make capital structure decisions with regard to cash flow needs for future investments (Acharya et al., 2007). In addition, the findings confirm that increasing cash holdings is not equivalent to reducing debt.

2.6.2 Relationship between firms' hedging needs and pension de-risking strategies

Previous research (Feldstein and Seligman, 1981; Bodie et al., 1987) indicates that pension assets and liabilities should be treated as corporate assets and liabilities. Managers take account of pension assets and liabilities to make capital strategies. Therefore, further analysis was conducted to examine the Hypotheses 2 and 3, and explore whether there is an association between firms' hedging needs and their engagement in pension de-risking strategies when they are targeting credit ratings.

This section examined whether firms changed their pension asset allocations, switched from DB to DC pension plans or engaged in pension buy-ins and buy-outs to target credit ratings. For firms with HHNs, Table 2.10 shows that pension asset allocations to equities (*EQUITY*) are negatively related to changes in credit ratings (*DIFF*) at the 10% significance level. However,

EQUITY is not statistically significantly related to changes in credit ratings (*DIFF*) for firms with LHNs. This is consistent with Hypothesis 2 that firms reallocate their pension assets differently in terms of their high or low hedging needs. This provides evidence that firms with HHNs target credit ratings by increasing asset allocations to equities, while firms with LHNs do not experience changes in pension asset allocations.

These results differ from expectations for two reasons. First, it is expected that firms will invest their pension assets in safer asset investments when they are targeting credit ratings. This expectation is supported by the previous literature (Friedman, 1982; Amir and Benartzi, 1999) which suggests that firms reduce balance sheet volatility and firm risk by switching pension asset allocations from equities to bonds. Second, since Landsman (1986) suggests that pension obligations are debt-like obligations for firms, it is expected that firms will be more likely to engage in pension de-risking strategies when there are changes in corporate debt. Thus, it is expected that pension asset allocations will change when firms change debt levels to target credit ratings.

However, the empirical evidence suggests that firms with HHNs shift pension assets from bonds to equities to target credit ratings. This may be consistent with the risk-shifting incentive for pension asset allocations. Rauh (2009) indicates that firms with strong credit ratings tend to invest pension assets heavily in equities. Bodie et al. (1987) and Sharpe (1976) provide similar evidence that firms facing financial constraints and temporary cash shortages increase their pension asset allocations in equities. Lane Clark and Peacock (2014b) suggest that firms increase pension asset investment in equities when bonds are expensive. Firms with more pension asset allocated on equities can

benefit from higher investments returns and lower future pension contributions. Therefore, the risk-shifting incentive explains that firms with HHNs switch their pension assets from bonds to equities to target credit ratings.

The findings not only support the risk-shifting argument, but also link pension asset allocations with cash holdings. The previous section noted the finding that firms with HHNs accumulate cash holdings to target credit ratings. Incorporating pension asset allocations, this may imply that firms invest more pension assets in equities when they are seeking to reduce pension fund cash contributions. Investment of pension assets in riskier and higher-return equities, if successful, may reduce firms' cash contributions (Bodie, 1990).

Table 2.10 examines how a firm's hedging needs relates to a switch from a DB to a DC pension plan to target a credit rating. The findings support Hypothesis 3 as firms with HHNs are more likely to switch from DB to DC pension plans. As shown in Column 3 of Table 2.10, switching from a DB to a DC pension plan (*SWITCH*) is negatively correlated with changes in credit rating (*DIFF*) at the 1% significance level. It is interpreted that firms switch from DB to DC pension plans to reduce future contributions when they expect current cash flows to be insufficient for future investments. Comprix and Muller (2011) suggest that operating cash flows are negatively related to freezes in DB pension plans. They indicate that firms with low operating cash flows are more likely to freeze their DB pension plans. The findings of this study support this view and also imply that firms switch from DB to DC pension plans when their operating cash flows are expected to be insufficient for future investments, as measured by their hedging needs. Combined with the previous finding that firms with HHNs accumulate cash flows to target credit ratings, the results imply that firms switch

from DB to DC pension plans to target credit ratings when they are seeking to accumulate cash flows.

In addition to the separate tests for changes in pension asset allocations and switches from DB to DC pension plans to influence credit ratings, the model shown in Columns 5 and 6 includes both pension de-risking strategies, *EQUITY* and *SWITCH*. The results are robust and support the previous findings, showing that firms with HHNs engage in pension de-risking strategies to target credit ratings.

As limited data were available, it was not possible to conduct regression tests on the pension buy-in and buy-out transactions of the HHNs and LHNs samples. Thus, whether firms engage in pension buy-ins and buy-outs to target credit ratings remains to be explored by future research.

In summary, the results of this study show that firms with HHNs are more likely to reallocate their pension asset allocations from bonds to equities and switch from DB to DC pension plans to target credit ratings. This chapter not only provides evidence that a firm's operating cash flow is important for its adoption of pension de-risking strategies, but also further supports the view that cash needs for future investment, as reflected in the firm's hedging needs, are associated with its decisions on pension de-risking strategies.

2.7 Robustness Checks

Since pension risk is expected to be reduced by following the implementation of pension de-risking strategies, robustness tests were conducted to examine whether firms reduced their balance sheet pension obligations to target credit ratings. In the US, Harrison and Sharpe (1983) and Bodie et al. (1987) suggest

that the PBGC creates an incentive to allocate more pension assets to equities to maximise the value of the PBGC's put option when pension plans are underfunded. There is therefore a negative relationship between firms' funding ratios and pension asset allocations to equities. In addition, Bader and Leibowitz (1988) find an inverted-U relationship between funding level and pension asset allocation to equities in the US. They suggest that firms with extremely overfunded and underfunded pension plans tend to minimise the volatility of pension contributions and invest pension assets in bonds. In contrast, those with moderately funded pension plans prefer to allocate pension assets to equities. Thus, the funding level correlates with changes in asset allocations.

Research reveals that a main purpose of switching from a DB to a DC pension plan is to reduce the total future employees' retirement benefits. Atanasova and Hrazdil (2010) find that firms experience increases in equity prices and reductions in the probability of downgrading following a DB pension plan freeze. In addition, pension buy-ins and buy-outs may remove pension obligations in part or in full from financial statements.

Clearly, engagement in pension de-risking strategies should be reflected in a decrease in pension risk. As shown in Table 2.11, pension risk (*Pension_Risk1*) appears to be significantly related to changes in credit ratings (*DIFF*) in the HHNs sample at the 1% significance level. As the credit rating methodology indicates that CRAs make adjustments to their debt levels by considering pension obligations, it is consistent with empirical evidence that *Pension_Risk1* is significantly related to firms' credit rating. This supports the previous finding

that firms with HHNs engage pension de-risking strategies to target credit ratings.

The second measure of pension risk (∆*Pension_Risk2*) is statistically insignificant with regard to changes in credit ratings (*DIFF*). However, the sign of ∆*Pension_Risk2* is consistent with the previous literature comparing between the results of ∆*Pension_Risk1 and* ∆*Pension_Risk2.* It suggests that market price pension deficits and excess pension assets in an asymmetrical way (Carroll and Niehaus, 1998). The aggregate of pension assets and obligations may not fully reflect the pension risk perceived by market participants. This may explain why the second measure of pension risk is insignificant for credit rating changes.

The first pension risk measure suggests that firms improve their credit ratings by reducing their reported pension obligations through pension de-risking strategies. Overall, the robustness tests are consistent with the finding that firms with HHNs target credit ratings by adopting pension de-risking strategies.

2.8 Summary and Conclusions

This study has followed previous research (Acharya et al., 2007) in exploring cash and debt substitutability when managers are concerned about cash flow needs for future investments, measured by hedging needs. Pension assets and obligations have been incorporated into the analysis to explore whether firms adopt pension de-risking strategies to target credit ratings. The study has also investigated whether firms' hedging needs are associated with the adoption of pension de-risking strategies. The empirical evidence of this study is consistent with Hovakimian et al.'s (2009) finding that managers change firms' capital

structure to target credit ratings. UK firms were split between those with HHNs and those with LHNs to explore whether managers make trade-off decisions between increasing cash holdings and paying down outstanding debt. The results confirm that firms with HHNs increase cash holdings, while firms with LHNs use cash flows to pay down outstanding debt to target credit ratings.

With regard to pension de-risking strategies, this chapter finds that firms with HHNs increase the percentage of pension assets allocated to equities. Since the return on pension assets invested in equities is expected to be higher than that on bonds, this evidence may support the risk-shifting incentive for pension asset allocations. Firms pursue higher returns on pension assets when they are targeting credit ratings. Reallocation of pension assets from bonds to equities relates to firms' current operating cash flow status and their need for cash flows for future investments.

Additionally, this chapter reveals that firms with HHNs switch from DB to DC pension plans to target credit ratings. Munnell et al. (2007) find that one purpose of switching from a DB to a DC pension plan is to reduce future benefits paying to employees. The results of this chapter are consistent with the finding of prior literature (Comprix and Muller, 2011) that there is negative relationship between cash flows and DB pension plan freezes. This chapter provides further evidence that switching from DB to DC pension plans relates to cash needs for future investments, with reference to firms' hedging needs. Since the available data on pension buy-ins and buy-outs was limited, it is not possible to draw conclusions regarding the relationship between firms' hedging needs, credit ratings and pension buy-in and buy-out transactions. The

robustness tests support the finding that firms with HHNs reduce pension risk to target credit ratings.

This chapter establishes a link between cash flow needs for future investments and pension de-risking strategies. It suggests that firms with HHNs change pension investment allocations to reduce future pension contributions, thereby reducing their overall risk. It also provides evidence of a risk-shifting incentive for pension asset allocations when firms are targeting credit ratings. In addition, firms concerned about cash flow shortages for future investment opportunities may be associated with switches from DB to DC pension plans.

This chapter contributes to the cash-debt relationship developed by Acharya et al. (2007) in terms of target credit rating behaviour. In the presence of external financing costs, firms treat cash and debt capacity differently when considering cash flow needs for investments. The research also provides support for target credit rating behaviour. Managers take firms' credit rating into account when making capital structure decisions such as whether to increase cash holdings or reduce debt.

Table 2.1: Definitions of variables

Variable	Definition
CR	Long-term issuer credit rating by Standard & Poor's. Credit rating for firm *i* at time *t*. Highest credit rating coded as 1 and lowest credit rating coded as 16.
DIFF	Differences between *t*+1 year credit rating for firm *i*, and *t* year credit rating for firm *i*. $DIFF = CR_{it+1} - CR_{it}$
CASH	Cash and short-term investment scaled by total assets for firm *i* at time *t*.
DEBT	Net long-term debt issuance scaled by total assets for firm *i* at time *t*.
EQUITY	Percentage of pension assets allocated to equities scaled by total pension assets for firm *i* at time *t*.
SWITCH	1 if firm *i* at time *t* has partially closed its DB pension plan, 2 if it has fully closed its DB pension plan, and 0 if DB pension plan remains open.
BUYOUT	1 if firm *i* at time *t* has engaged in a pensioner buy-in transaction, 2 if it has engaged in a full buy-out, 3 if it has engaged in a pensioner buy-out, and 4 if it has engaged in a buy-in, and 0 if no transactions.
Pension_Risk1	Projected benefit obligation divided by market capitalization for firm *i* at time *t*.
Pension_Risk2	Difference between projected benefit obligations and fair value of pension assets divided by market capitalization for firm *i* at time *t*.
MB	Market value of assets over book value of assets for firm *i* at time *t*, where the market value of assets is total assets minus book equity plus market value of equity for firm *i* at time *t*.
Tangibility	Net property, plant and equipment scaled by total assets for firm *i* at time *t*.
SGA	Selling, general and administrative expenses scaled by sales for firm *i* at time *t*.
PROFIT	Operating income scaled by total assets for firm *i* at time *t*.
SIZE	Natural log of sales for firm *i* at time *t*.
OPRISK	Standard deviation of profitability for firm *i* at time *t* over the previous five years.

Table 2.2: Sample selection

	Firm-year observations
Number of UK firms for which S&P's credit rating data available	1,240
Less: Firms for which no required accounting data available	(841)
Sub-sample for Hypothesis 1	**399**
Number of UK Firms for which pension asset allocation data available	4,800
Less: Firms without credit rating data	(4,382)
Sub-sample for Hypothesis 2	**418**
Number of FTSE 100 firms for which switch of DB pension plans available	1,402
Less: Firms without credit rating data	(1,065)
Sub-sample for Hypothesis 3	**337**
Number of FTSE 100 firms for which pension buy-ins and buyouts available	510
Less: Firms without credit rating data	(365)
Sub-sample for Hypothesis 4	**45**

Table 2.3: Frequency distribution for pension buy-ins and buy-outs

Panel A: Before matching with accounting information

Type of buy-in or buy-out (*BUYOUT*)	Freq.	Percent
No pension buy-out (0)	69	58.97%
Pension buy-in (1)	24	20.51%
Full buy-out (2)	17	14.53%
Pensioner buy-out (3)	2	1.71%
Buy-in (4)	5	4.27%
Total pension buy-in and buy-out	117	100%

Panel B: After matching with accounting Information

Type of buy-in and buy-out (*BUYOUT*)	Freq.	Percent
No pension buy-out (0)	28	62.22%
Pension buy-in (1)	13	28.89%
Full buy-out (2)	0	0.00%
Pensioner buy-out (3)	0	0.00%
Buy-in (4)	4	8.89%
Total pension buy-in and buy-out	45	100%

This table shows the numbers and percentage of pension buy-in and buy-out transactions by type from 2008 to 2013 (Lane Clark and Peacock, 2005; 2014b) before (Panel A) and after (Panel B) matching with accounting information.

Table 2.4: Distributions of credit ratings categorized by firms' hedging needs for the UK credit rating sample

S&P Credit Rating	Rating Variable	HHNs		LHNs		Total	
		Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
AA+	2	0	0.0%	35	3.7%	35	2.8%
AA	3	3	1.0%	51	5.4%	54	4.4%
AA-	4	11	3.7%	58	6.1%	69	5.6%
A+	5	33	11.2%	114	12.1%	147	11.9%
A	6	22	7.5%	95	10.1%	117	9.4%
A-	7	25	8.5%	120	12.7%	145	11.7%
BBB+	8	34	11.5%	134	14.2%	168	13.5%
BBB	9	68	23.1%	99	10.5%	167	13.5%
BBB-	10	47	15.9%	90	9.5%	137	11.0%
BB+	11	14	4.7%	29	3.1%	43	3.5%
BB	12	13	4.4%	22	2.3%	35	2.8%
BB-	13	9	3.1%	21	2.2%	30	2.4%
B+	14	13	4.4%	30	3.2%	43	3.5%
B	15	2	0.7%	31	3.3%	33	2.7%
B-	16	1	0.3%	16	1.7%	17	1.4%
Total		295	100.0%	945	100.0%	1240	100.0%
N		1240					

This table reports the distribution of Standard & Poor's long-term issuer credit ratings based on the HHNs and LHNs samples. A positive correlation between operating cash flow and future investment opportunity indicates HHNs, while a negative correlation indicates LHNs. The number and percentage of observations in each category of credit rating and total credit rating are reported in the table.

Table 2.5: Distribution of changes in credit rating categorized by firms' hedging needs

Panel A: Distribution of changes in credit rating categorized by firms' hedging needs for full UK credit rating sample

Changes in Credit Ratings (DIFF)	HHNs		LHNs		Total	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
-6	0	0.0%	1	0.1%	1	0.1%
-5	1	0.4%	0	0.0%	1	0.1%
-3	1	0.4%	0	0.0%	1	0.1%
-2	3	1.1%	4	0.5%	7	0.7%
-1	20	7.4%	32	4.1%	52	5.0%
0	211	78.4%	623	80.6%	834	80.0%
+1	24	8.9%	84	10.9%	108	10.4%
+2	5	1.9%	17	2.2%	22	2.1%
+3	4	1.5%	9	1.2%	13	1.2%
+4	0	0.0%	2	0.3%	2	0.2%
+9	0	0.0%	1	0.1%	1	0.1%
Total	269	100.0%	773	100.0%	1042	100.0%
N	1042					

Panel B: Distribution of changes in credit rating categorized by firms' hedging needs for sub-sample of cash holdings and debt

Panel C: Distribution of changes in credit rating categorized by firms' hedging needs for sub-sample of pension asset allocations

Changes in Credit Ratings (DIFF)	HHNs		LHNs		Total	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
-3	1	0.9%	0	0.0%	1	0.3%
-2	0	0.0%	1	0.3%	1	0.3%
-1	12	10.6%	8	2.8%	20	5.0%
0	91	80.5%	239	83.6%	330	82.7%
1	6	5.3%	26	9.1%	32	8.0%
2	2	1.8%	5	1.7%	7	1.8%
3	1	0.9%	6	2.1%	7	1.8%
4	0	0.0%	1	0.3%	1	0.3%
Total	113	100.0%	286	100.0%	399	100.0%
N	399					

Changes in Credit Ratings (DIFF)	HHNs		LHNs		Total	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
-2	0	0.0	1	0.3	1	0.2
-1	7	6.9	8	2.5	15	3.6
0	87	85.3	268	84.8	355	84.9
1	5	4.9	29	9.2	34	8.1
2	2	2.0	5	1.6	7	1.7
3	1	1.0	5	1.6	6	1.4
Total	102	100.0	316	100.0	418	100.0
N	418					

Panel D: Distribution of changes in credit rating categorized by firms' hedging needs for sub-sample of switching from DB to DC pension plans

Changes in Credit Ratings (DIFF)	HHNs		LHNs		Total	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
-2	0	0.0	1	0.4	1	0.3
-1	4	5.7	8	3.0	12	3.6
0	58	82.9	224	83.9	282	83.7
1	5	7.1	23	8.6	28	8.3
2	2	2.9	5	1.9	7	2.1
3	1	1.4	6	2.2	7	2.1
Total	70	100.0	267	100.0	337	100.0
N	337					

Panel E: Distribution of changes in credit rating categorized by firms' hedging needs for sub-sample of pension buy-ins and buy-outs

Changes in Credit Ratings (DIFF)	HHNs		LHNs		Total	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
-1	1	6.3	0	0.0	1	2.2
0	14	87.5	27	93.1	41	91.1
1	1	6.3	1	3.4	2	4.4
2	0	0.0	1	3.4	1	2.2
Total	16	100.0	29	100.0	45	100.0
N	45					

This table reports the distribution of Standard & Poor's credit rating changes (DIFF) based on HHNs and LHNs firms for full sample and sub-samples. Negative changes in credit rating indicate an increase in credit rating from the current to the next year, while positive changes indicate a decrease in credit rating. A positive correlation between operating cash flow and future investment opportunity indicates HHNs, while a negative correlation indicates LHNs. The number and percentage of observations in each category of credit rating changes and total credit rating changes are reported in the table.

Table 2.6: Descriptive statistics

Panel A: Descriptive statistics for cash holdings and debt

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	399	7.76	2.40	2.00	15.00	6.00	8.00	9.00
DIFF	399	0.12	0.65	-3.00	4.00	0.00	0.00	0.00
CASH	399	0.08	0.07	0.00	0.39	0.03	0.06	0.11
DEBT	399	0.01	0.06	-0.26	0.27	-0.02	0.00	0.03
MB	399	1.67	0.88	0.68	6.71	1.14	1.38	1.92
Tangibility	399	0.34	0.24	0.00	0.89	0.13	0.28	0.52
SGA	399	0.24	0.16	-0.01	0.93	0.10	0.22	0.34
PROFIT	399	0.11	0.09	-0.24	0.49	0.06	0.10	0.15
SIZE	399	22.73	1.44	18.55	25.98	21.72	22.93	23.62
OPRISK	399	0.05	0.05	0.00	0.28	0.02	0.03	0.06

Panel B: Descriptive statistics for pension asset allocations

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	418	7.56	2.39	2.00	15.00	6.00	8.00	9.00
DIFF	418	0.12	0.56	-2.00	3.00	0.00	0.00	0.00
EQUITY	418	0.49	0.17	0.05	0.08	0.04	0.50	0.62
MB	418	1.48	0.60	0.68	4.81	1.05	1.30	1.68
Tangibility	418	0.30	0.25	0.00	0.89	0.10	0.24	0.50
SGA	418	0.24	0.17	-0.01	0.93	0.10	0.21	0.34
PROFIT	418	0.10	0.09	-0.24	0.49	0.05	0.09	0.14
SIZE	418	22.79	1.48	18.55	25.98	21.68	23.03	23.73
OPRISK	418	0.04	0.04	0.00	0.28	0.01	0.03	0.05

Panel C: Descriptive statistics for switching from DB to DC pension plans

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	337	7.21	2.26	2.00	12.00	6.00	7.00	9.00
DIFF	337	0.15	0.62	-2.00	3.00	0.00	0.00	0.00
SWITCH	337	0.75	0.56	0.00	2.00	0.00	1.00	1.00
MB	337	1.55	0.63	0.68	4.81	1.12	1.35	1.81
Tangibility	337	0.28	0.22	0.00	0.77	0.10	0.22	0.46
SGA	337	0.23	0.16	-0.01	0.87	0.10	0.21	0.31
PROFIT	337	0.10	0.08	-0.24	0.49	0.05	0.09	0.14
SIZE	337	23.05	1.35	19.39	25.98	21.99	23.16	23.87
OPRISK	337	0.04	0.04	0.00	0.21	0.01	0.03	0.05

Panel D: Descriptive statistics for pension buy-out

Variables	N	Mean	S.D	Min	Max	25th Percentile	Median	75th Percentile
CR	45	7.62	2.32	3.00	12.00	7.00	8.00	9.00
DIFF	45	0.07	0.39	-1.00	2.00	0.00	0.00	0.00
BUYOUT	45	0.73	1.42	0.00	5.00	0.00	0.00	1.00
MB	45	2.20	0.88	1.01	4.30	1.57	2.00	2.69
Tangibility	45	0.26	0.13	0.00	0.48	0.19	0.28	0.37
SGA	45	0.22	0.11	0.04	0.48	0.13	0.19	0.31
PROFIT	45	0.15	0.11	0.00	0.37	0.07	0.12	0.25
SIZE	45	22.18	1.09	20.26	24.07	21.70	21.91	22.06
OPRISK	45	0.06	0.06	0.00	0.28	0.03	0.03	0.06

Panel E: Descriptive Statistics for Pension Risk

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	432	7.56	2.37	2.00	15.00	6.00	8.00	9.00
DIFF	432	0.13	0.60	-2.00	4.00	0.00	0.00	0.00
Pension_Risk1	432	0.42	0.51	0.01	3.56	0.12	0.25	0.57
Pension_Risk2	432	-0.04	0.10	-0.66	0.16	-0.06	-0.02	-0.00
MB	432	1.48	0.60	0.68	4.81	1.05	1.30	1.67
Tangibility	432	0.30	0.25	0.00	0.89	0.10	0.24	0.50
SGA	432	0.24	0.17	-0.01	0.93	0.10	0.21	0.34
PROFIT	432	0.10	0.09	-0.24	0.49	0.05	0.09	0.14
SIZE	432	22.79	1.47	18.55	25.98	21.67	23.03	23.74
OPRISK	432	0.04	0.04	0.00	0.28	0.01	0.03	0.05

This table reports descriptive statistics for firms' Standard & Poor's credit rating, pension de-risking strategies and financial characteristics from 2004-2013. Standard & Poor's credit rating data were collected from the Capital IQ and the Thomson One Banker databases. Accounting information was collected from the Thomson One Banker. Information[2] on switching from DB to DC pension plans was collected from annual reports. Pension buy-in and buy-out information was collected from Lane Clark and Peacock (2005); (2014b) reports. The initial sample covered FTSE All-Share companies. *CR* indicates the Standard & Poor's long-term issuer credit rating. The highest credit rating was coded as 1 and the lowest as 16. All variable definitions are reported in Table 2.1.

[2]Data about switch from DB to DC pension plans for FTSE 100 firms is hand-collected by my colleague Evisa Mitro in University of Exeter for the period from 2000 to 2013. I would like to thank her for providing these data for this research.

Table 2.7: Financial characteristics of firms with HHNs and LHNs

Variables	*HHNs*	*LHNs*	
	Mean	*Mean*	*Diff/SE*
CR	8.615	7.391	1.223***
			(0.209)
CASH	0.095	0.079	0.016**
			(0.006)
DEBT	-0.009	0.006	-0.015**
			(0.005)
EQUITY	0.445	0.486	-0.041**
			(1.521)
SWITCH	0.582	0.591	-0.009
			(0.060)
BUYOUT	0.714	1.115	-0.400
			(0.284)
Pension_Risk1	0.497	0.472	0.025
			(0.050)
Pension_Risk2	-0.044	-0.056	0.011
			(0.009)
MB	1.976	1.443	0.533***
			(0.075)
Tangibility	0.219	0.288	-0.070***
			(0.018)
SGA	0.241	0.229	0.013
			(0.015)
PROFIT	0.112	0.094	0.018*
			(0.009)
SIZE	22.040	22.250	-0.208
			(0.139)
OPRISK	0.068	0.053	0.015**
			(0.005)

This table reports the t-tests to compare the HHNs and LHNs samples. HHNs and LHNs are based on correlations between operating cash flows and future investment opportunities. A negative correlation indicates HHNs, with LHNs otherwise. Different financial characteristics, credit ratings and pension de-risking strategies of the HHNs and LHNs samples are compared. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Table 2.1.

Table 2.8: Correlation matrix

Panel A: Correlation between credit rating and firm's financial characteristics

	CR	*CASH*	*DEBT*	*MB*	*Tangibility*	*SGA*	*PROFIT*	*SIZE*	*OPRISK*
CR	1.000								
CASH	-0.064	1.000							
	(0.171)								
DEBT	-0.168***	0.063	1.000						
	(0.000)	(0.177)							
MB	0.049	0.297***	0.067	1.000					
	(0.297)	(0.000)	(0.153)						
Tangibility	0.093*	-0.258***	0.056	-0.219***	1.000				
	(0.046)	(0.000)	(0.234)	(0.000)					
SGA	-0.129**	0.356***	0.005	0.062	-0.316***	1.000			
	(0.006)	(0.000)	(0.910)	(0.187)	(0.000)				
PROFIT	-0.225***	0.193***	0.152**	0.522***	0.018	0.145**	1.000		
	(0.000)	(0.000)	(0.001)	(0.000)	(0.695)	(0.002)			
SIZE	-0.603***	-0.073	0.075	-0.111*	0.157***	-0.041	0.094*	1.000	
	(0.000)	(0.119)	(0.107)	(0.017)	(0.001)	(0.377)	(0.044)		
OPRISK	0.122**	0.167***	-0.004	0.246***	-0.203***	0.055	0.167***	-0.258***	1.000
	(0.009)	(0.000)	(0.924)	(0.000)	(0.000)	(0.239)	(0.000)	(0.000)	

Panel A presents correlation coefficients for the sample of hypothesis 1, focusing on relationships among firms' cash holdings, debt and credit ratings. *P-values* are reported in parentheses. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. All variables are reported in Table 2.1.

Panel B: Correlation between credit rating and pension asset allocation in sub-sample

	CR	*EQUITY*	*MB*	*Tangibility*	*SGA*	*PROFIT*	*SIZE*	*OPRISK*
CR	1.000							
EQUITY	-0.141**	1.000						
	(0.002)							
MB	0.013	0.099*	1.000					
	(0.778)	(0.030)						
Tangibility	0.178***	0.232***	-0.072	1.000				
	(0.000)	(0.000)	(0.116)					
SGA	-0.071	-0.055	-0.012	-0.217***	1.000			
	(0.123)	(0.233)	(0.790)	(0.000)				
PROFIT	-0.183***	0.083	0.545***	0.160***	0.121**	1.000		
	(0.000)	(0.071)	(0.000)	(0.000)	(0.008)			
SIZE	-0.583***	0.045	-0.097*	0.149**	-0.118*	0.070	1.000	
	(0.000)	(0.331)	(0.035)	(0.001)	(0.010)	(0.129)		
OPRISK	0.122**	-0.181***	-0.088	-0.105*	-0.025	0.072	-0.282***	1.000
	(0.008)	(0.000)	(0.056)	(0.022)	(0.579)	(0.117)	(0.000)	

Panel B presents correlation coefficients for the sub-sample, for relationships among pension asset allocations, firms' financial characteristics and credit ratings. *P-values* are reported in parentheses. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. All variables are reported in Table 2.1.

Panel C: Correlation between credit rating and switch from DB to DC pension plans in sub-sample

	CR	*SWITCH*	*MB*	*Tangibility*	*SGA*	*PROFIT*	*SIZE*	*OPRISK*
CR	1.000							
SWITCH	0.127*	1.000						
	(0.018)							
MB	0.060	0.022	1.000					
	(0.266)	(0.685)						
Tangibility	0.038	-0.092	-0.066	1.000				
	(0.484)	(0.085)	(0.220)					
SGA	-0.146**	0.120*	0.012	-0.321***	1.000			
	(0.006)	(0.025)	(0.829)	(0.000)				
PROFIT	-0.163**	0.018	0.618***	0.134*	0.124*	1.000		
	(0.002)	(0.739)	(0.000)	(0.013)	(0.021)			
SIZE	-0.501***	-0.072	-0.211***	0.307***	-0.231***	-0.011	1.000	
	(0.000)	(0.182)	(0.000)	(0.000)	(0.000)	(0.842)		
OPRISK	0.225***	0.161**	0.024	-0.051	0.021	0.115*	-0.210***	1.000
	(0.000)	(0.003)	(0.652)	(0.342)	(0.690)	(0.032)	(0.000)	

Panel C presents correlation coefficients for the sub-sample, for relationships among switching from DB to DC pension plans, firms' financial characteristics and credit ratings. *P-values* are reported in parentheses. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. All variables are reported in Table 2.1.

Panel D: Correlation between credit rating and pension buy-ins and buy-outs in sub-sample

	CR	*BUYOUT*	*MB*	*Tangibility*	*SGA*	*PROFIT*	*SIZE*	*OPRISK*
CR	1.000							
BUYOUT	0.187	1.000						
	(0.183)							
MB	-0.421**	0.468***	1.000					
	(0.002)	(0.000)						
Tangibility	0.423**	-0.016	0.070	1.000				
	(0.002)	(0.913)	(0.620)					
SGA	-0.420**	-0.067	0.149	-0.324*	1.000			
	(0.002)	(0.639)	(0.293)	(0.019)				
PROFIT	-0.294*	0.482***	0.875***	0.167	0.001	1.000		
	(0.035)	(0.000)	(0.000)	(0.237)	(0.997)			
SIZE	-0.752***	-0.092	0.526***	0.058	0.306*	0.443**	1.000	
	(0.000)	(0.515)	(0.000)	(0.683)	(0.027)	(0.001)		
OPRISK	-0.111	-0.072	-0.433**	-0.550***	-0.058	-0.482***	-0.418**	1.000
	(0.432)	(0.612)	(0.001)	(0.000)	(0.684)	(0.000)	(0.002)	

Panel D presents correlation coefficients for the sub-sample, for relationships among pension buy-ins and buy-outs, firms' financial characteristics and credit ratings. *P-values* are reported in parentheses. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. All variables are reported in Table 2.1.

Panel E: Correlation between credit rating and pension risks in sub-sample

	CR	*Pension_Risk1*	*Pension_Risk2*	*MB*	*Tangibility*	*SGA*	*PROFIT*	*SIZE*	*OPRISK*
CR	1.000								
Pension_Risk1	0.190***	1.000							
	(0.000)								
Pension_Risk2	-0.075	-0.719***	1.000						
	(0.094)	(0.000)							
MB	0.017	-0.044	0.053	1.000					
	(0.706)	(0.332)	(0.239)						
Tangibility	0.168***	0.088	-0.016	-0.071	1.000				
	(0.000)	(0.052)	(0.728)	(0.115)					
SGA	-0.073	0.030	-0.116*	-0.011	-0.219***	1.000			
	(0.106)	(0.512)	(0.010)	(0.799)	(0.000)				
PROFIT	-0.180***	-0.179***	0.115*	0.545***	0.155***	0.123**	1.000		
	(0.000)	(0.000)	(0.010)	(0.000)	(0.001)	(0.006)			
SIZE	-0.583***	0.033	-0.090*	-0.102*	0.147**	-0.117**	0.062	1.000	
	(0.000)	(0.459)	(0.046)	(0.023)	(0.001)	(0.009)	(0.166)		
OPRISK	0.121**	-0.163***	0.144**	-0.085	-0.103*	-0.024	0.070	-0.275***	1.000
	(0.007)	(0.000)	(0.001)	(0.060)	(0.023)	(0.596)	(0.119)	(0.000)	

Panel E presents correlation coefficients for the sub-sample, for the relationship among pension risks, firms' financial characteristics and credit ratings. *P-values* are reported in parentheses. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. All variables are reported in Table 2.1.

Table 2.9: Association between firm's capital structure and changes in credit rating in high and low hedging needs groups

$$DIFF_{it} = CR_{it+1} - CR_{it} = \alpha_0 + \beta_1 \Delta \text{CASH}_{it}(\Delta \text{DEBT}_{it}) + \beta_2 \Delta \text{MB}_{it} + \beta_3 \Delta \text{Tangibility}_{it} + \beta_4 \Delta \text{SGA}_{it} + \beta_5 \Delta \text{PROFIT}_{it} + \beta_6 \Delta \text{SIZE}_{it} + \beta_7 \Delta \text{OPRISK}_{it} + \text{YearF.E} + \varepsilon_{it}$$

Dependent Variable		*DIFF*					
	Exp. Sign	(1) *HHNs*	(2) *LHNs*	(3) *HHNs*	(4) *LHNs*	(5) *HHNs*	(6) *LHNs*
ΔCASH	-	-10.790***	-4.854**			-11.470***	-4.738***
		(4.082)	(2.025)			(4.449)	(1.738)
ΔDEBT	+			-1.567	3.253***	0.173	2.971***
				(1.268)	(1.164)	(1.209)	(1.143)
ΔMB	-	0.348	-1.416***	0.583**	-1.265***	0.337	-1.174**
		(0.276)	(0.461)	(0.245)	(0.451)	(0.263)	(0.459)
ΔTangibility	-	-12.050***	-3.065	-7.907**	-0.986	-12.150***	-2.065
		(3.122)	(2.493)	(3.465)	(2.764)	(3.400)	(2.682)
ΔSGA	-	3.258	-0.460	4.176	-3.541	3.170	-0.893
		(3.545)	(3.156)	(7.285)	(2.301)	(8.125)	(2.913)
ΔPROFIT	-	-0.903	1.531	-1.495	0.468	-0.667	1.276
		(2.007)	(1.578)	(1.940)	(1.492)	(1.969)	(1.474)
ΔSIZE	-	0.813	-1.922***	0.866	-1.934***	0.743	-1.957***
		(1.059)	(0.677)	(0.820)	(0.562)	(1.097)	(0.647)
ΔOPRISK	+	-2.617	9.389*	1.337	7.707	-2.941	6.538
		(5.456)	(5.273)	(4.843)	(5.674)	(5.026)	(5.546)
Observations		102	255	96	263	93	242
Year FE		Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2		0.162	0.149	0.121	0.154	0.163	0.164

This table reports estimations for an ordered probit model from 2004 to 2013 in a sample categorized by firms' hedging needs. Hedging needs are measured by the correlation between operating cash flows and future investment opportunities. This suggests an association between cash holdings or debt and changes in credit ratings. The number of observations and pseudo R^2 values are reported. All regressions included year fixed effects and clustered standard errors by firm. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Table 2.1.

Table 2.10: Association between pension de-risking strategies and changes in credit ratings in high and low hedging needs groups

$$DIFF_{it} = CR_{it+1} - CR_{it} = \alpha_0 + \beta_1 \Delta \text{EQUITY}_{it}(\text{SWITCH}_{it} \text{or} \text{BUYOUT}_{it}) + \beta_2 \Delta \text{MB}_{it} + \beta_3 \Delta \text{Tangibility}_{it} + \beta_4 \Delta \text{SGA}_{it} + \beta_5 \Delta \text{PROFIT}_{it} + \beta_6 \Delta \text{SIZE}_{it} + \beta_7 \Delta \text{OPRISK}_{it} + \text{YearF.E} + \varepsilon_{it}$$

Dependent Variable		*DIFF*					
		(1)	(2)	(3)	(4)	(5)	(6)
	Exp. Sign	*HHNs*	*LHNs*	*HHNs*	*LHNs*	*HHNs*	*LHNs*
ΔEQUITY	+	-0.048*	-0.013			-0.176***	-0.015
		(0.027)	(0.011)			(0.057)	(0.011)
SWITCH	-			-1.073***	-0.161	-1.658***	-0.118
				(0.360)	(0.251)	(0.433)	(0.221)
ΔMB	-	0.296	-1.659***	-0.918	-1.499***	-0.912	-1.653***
		(0.629)	(0.399)	(1.429)	(0.486)	(1.321)	(0.409)
ΔTangibility	-	-1.990	-1.875	-3.710	-1.008	-2.500	-1.061
		(4.970)	(2.573)	(3.863)	(2.943)	(3.850)	(2.786)
ΔSGA	-	13.17*	-3.006	11.43*	-2.675	6.828	-2.716
		(7.698)	(2.435)	(6.495)	(2.881)	(6.371)	(2.728)
ΔPROFIT	-	-5.497**	0.626	-26.25	0.600	-20.16	0.278
		(2.381)	(1.359)	(16.71)	(1.663)	(15.33)	(1.585)
ΔSIZE	-	2.256*	-2.007***	9.047*	-1.965***	3.837	-1.907***
		(1.304)	(0.653)	(5.294)	(0.730)	(5.219)	(0.732)
ΔOPRISK	+	-13.66***	11.34*	-54.87*	13.84*	-61.17*	15.52**
		(5.283)	(6.148)	(28.45)	(7.579)	(33.68)	(7.865)
Observations[‡]		83	257	61	230	60	213
Year FE		Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2		0.320	0.135	0.569	0.149	0.602	0.151

This table reports estimations for an ordered probit model from 2004 to 2013 in a sample categorized by firms' hedging needs. Hedging needs are measured by the correlation between operating cash flows and future investment opportunities. This suggests an association among pension asset allocations, switching from DB to DC pension plans, pension buy-in and buy-out decisions and changes in credit ratings. The number of all observations and pseudo R^2 values are reported. All regressions include year fixed effects and clustered standard errors by firm. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Table 2.1.

[‡] Due to the missing values of lagged independent variables, the numbers of observations for each sub-sample is further reduced and different from the sample selection table. However, this does not affect the main results in the regression tests.

Table 2.11: Association between pension risk and changes in credit ratings in low and high hedging needs groups

$$DIFF_{it} = CR_{it+1} - CR_{it} = \alpha_0 + \beta_1 \Delta \text{Pension\_Risk1}_{it}(\text{Pension\_Risk2}_{it}) + \beta_2 \Delta \text{MB}_{it} + \beta_3 \Delta \text{Tangibility}_{it} + \beta_4 \Delta \text{SGA}_{it} + \beta_5 \Delta \text{PROFIT}_{it} + \beta_6 \Delta \text{SIZE}_{it} + \beta_7 \Delta \text{OPRISK}_{it} + \text{YearF.E} + \varepsilon_{it}$$

Dependent Variable	*DIFF*			
	(1) *HHNs*	(2) *LHNs*	(3) *HHNs*	(4) *LHNs*
ΔPension_Risk1	1.325***	-0.041		
	(0.384)	(0.800)		
ΔPension_Risk2			-1.255	1.078
			(1.765)	(1.241)
ΔMB	0.214	-1.527***	-0.222	-1.514***
	(0.502)	(0.477)	(0.416)	(0.457)
ΔTangibility	-2.918	-2.223	-2.921	-2.130
	(3.356)	(2.592)	(3.948)	(2.610)
ΔSGA	9.782**	-3.136	8.434**	-2.990
	(4.878)	(2.538)	(4.170)	(2.510)
ΔPROFIT	-3.741	1.098	-4.588**	1.088
	(2.393)	(1.442)	(2.322)	(1.367)
ΔSIZE	1.535	-2.005***	1.242	-1.941***
	(1.227)	(0.610)	(1.148)	(0.616)
ΔOPRISK	-10.20**	9.804*	-13.27***	9.873*
	(4.299)	(5.630)	(4.462)	(5.676)
Observations	86	276	86	276
Year FE	Yes	Yes	Yes	Yes
Pseudo R^2	0.273	0.133	0.245	0.133

This table reports estimation for an ordered probit model from 2004 to 2013 in a sample categorized by firms' hedging needs. Hedging needs are measured by the correlation between operating cash flows and future investment opportunities. This suggests an association between pension risks and changes in credit ratings. The number of all observations and pseudo R^2 values are reported. All regressions include year fixed effects and clustered standard errors by firm. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Table 2.1.

Chapter 3: Relationship between Firms' Financial Flexibility and Pension De-risking Strategies

3.1 Introduction

Miller and Modigliani's (1961) theory assumes that, in a perfect capital market, firms can easily gain external financing whenever they want. Thus, firms with complete financial flexibility can adjust their capital structure without costs. However, there are always costs for firms raising external financing in an imperfect market. Firms with higher credit ratings have lower costs of debt, and vice versa. Credit rating downgrades are regarded as financial constraints for firms. Therefore, it is important for rated firms to maintain financial flexibility. This chapter focuses on the extent to which firms take financial flexibility into account when targeting credit ratings. Given that managers take account pension assets and liabilities into capital structure decisions, this chapter explores whether firms' desire to maintain financial flexibility relates to their use of pension de-risking strategies to target credit ratings.

Most research on the determinants of corporate capital structure has been based on pecking-order theory and trade-off theory. Pecking-order theory prioritises internal funds as preferable to other sources of financing. Thus, managers will use internal funding over other sources of financing when there are investment opportunities. Trade-off theory indicates that managers must consider the tax advantages for debt when making decisions on capital structure. However, these theories fail to identify the importance of firms' financial flexibility in capital decisions.

Graham and Harvey's (2001) empirical survey of the determinants of capital structure reveals that firms' financial flexibility plays a key role in corporate

capital structure. A similar empirical study conducted by Mittoo et al. (2011) concludes that European companies' capital structure is driven by concerns for financial flexibility as much as in US companies. In the current chapter, financial flexibility refers to firms' ability to maintain their financial resources in response to their financial constraints. Overall, firms' desire to maintain financial flexibility may be related to their capital structure decisions.

Previous literature (Bonaimé, Hankins and Harford, 2013) indicates that dividend pay-out policies are a key determinant of financial flexibility. DeAngelo and DeAngelo (2007) suggest that firms with fixed dividend pay-out policies increase their financial flexibility by reducing agency costs, preserving debt capacity and increasing access to external capital. They provide empirical evidence that firms with higher dividend pay-outs have more flexible access to capital than firms with lower dividend pay-outs. Thus, the dividend pay-out ratio is used to measure firms' financial flexibility needs. In addition, dividend policies may also signal firms' maturity. Grullon et al. (2002) suggest that increasing dividends conveys the impression that firms are becoming more mature and have fewer investment opportunities. This supports the view that increasing dividends signals a reduction in firms' systematic risk. Lintner (1956) indicates that higher dividend pay-out ratios signal firms' greater ability to maintain dividends in the long term. In addition, markets respond positively to increases in dividend pay-out ratios. Similarly, Fazzari et al. (1988) find that high-dividend firms may cut dividends to fund desired investments when their cash flows are low. This may be because dividend policies can be changed at managers' discretion (Jensen, 1986). However, Leary and Michaely (2011) argue that dividend payment is a constraint for firms as managers are reluctant to cut

dividends and Yoon and Starks (1995) suggests that the reduction of dividends is viewed negatively by the market.

This argument is further supported by Daniel et al.'s (2007) finding that firms resist cutting dividends during cash flow shortfalls. Thus, firms paying high dividends are likely to suffer from financial inflexibility if they are reluctant to cut dividends. DeAngelo and DeAngelo (2007) develop the earned-to-total capital ratio as an alternative proxy for firms' financial flexibility, as they suggest that firms with low earned-to-total capital require more financial resources than firms with high earned-to-total capital ratios. Firm size is also regarded as a financial flexibility measure, because large firms have more available financial resources than smaller firms. Opler et al. (1999) suggest that firms' cash holding levels indicate their financial flexibility. Therefore, lower cash holdings may indicate that firms have lower financial flexibility, although there are costs to holding cash to maintain financial flexibility (Jensen and Meckling, 1976). To sum up, this chapter uses dividend pay-out ratios as a proxy for firms' financial flexibility.

Hovakimian et al. (2009) find that managers adjust firms' capital structure to target credit ratings. Kisgen (2009) suggests that managers take account of the costs and benefits of rating changes as they relate to the costs of capital. Thus, the main focus of the changes in capital structure examined in this study is changes in debt and cash holdings. The previous literature suggests that managers preserve debt capacity to maintain firms' financial flexibility (Byoun, 2008; Lins et al., 2010; Denis and McKeon, 2012). The desire to maintain financial flexibility may determine firms' cash holding levels (Opler et al., 1999; Bates, Kahle and Stulz, 2009; Ang and Smedema, 2011). The traditional view in corporate finance research treats cash holdings as negative debt, but some

research shows that accumulating cash is different from reducing outstanding debt when firms are experiencing financial constraints (Acharya et al., 2007). Thus, firms must make trade-offs between increasing cash holdings or reducing outstanding debt to target credit ratings. Since firms' desire for financial flexibility may be related to capital structure decisions, their levels of financial flexibility may be related to trade-off decisions between increasing cash holdings and preserving debt capacity to target credit ratings. This chapter explores the relationship between financial flexibility and capital structure decisions when firms target credit ratings.

Anecdotal evidence suggests that firms reduce their pension obligations to improve credit rating (NISA, 2013). This suggests that pension de-risking strategies may be used to reduce pension risks in order to target credit ratings. Pension de-risking strategies refer to changes in pension asset allocations, switches from DB to DC pension plans, and pension buy-in and buy-out transactions. Several previous studies (Martin and Henderson, 1983; Bodie et al., 1985; Maher, 1987; Cardinale, 2007; McKillop and Pogue, 2009) have explored the relationship between credit ratings and pension obligations. These indicate that CRAs treat pension risk as an important factor influencing firms' default risk. This is consistent with Standard & Poor's methodology, whereby CRAs assess pension risk as part of firms' credit risk. In addition, Landsman (1986) indicates that markets treat pension assets and liabilities as assets and liabilities of sponsoring firms, and Wiedman and Wier (2004) add that investors view pension fund deficits as corporate liabilities. Therefore, it is expected, similarly to corporate debt, firms' desire to maintain financial flexibility may be related to their pension obligations. Thus, this chapter explores the extent to

which firms' financial flexibility is related to the use of pension de-risking strategies to target credit ratings.

The sample used in this study includes UK firms with credit rating information available from 2004 to 2013. The findings reveal that developing firms with LFF increase their cash holdings rather than reducing outstanding debt to target credit ratings. Developing firms which are defined as having low dividend payout ratios and lack financial flexibility are incentivised to preserve internal liquidity. Since CRAs value financial flexibility as an important factor in rating changes, firms are likely to improve their credit ratings by increasing cash holdings. The finding indicates that developing firms with LFF do not choose to reduce debt, as the costs of raising debt are high for firms suffering from financial constraints.

Byoun (2011) suggests that firms have different financial characteristics when they are in different phases of development. Firms categorised as developing firms tend to maintain relatively low leverage. This is because developing firms suffer high borrowing costs and struggle to raise external financing. In contrast, growth firms can rely on external financing and tend to have high leverage level. Mature firms have large positive cash flows and can rely on self-financing. Therefore, mature firms tend to have moderate levels of leverage. According to the predicted non-linear relationship between financial flexibility needs and leverage, this chapter also reveals that growth firms with MFF target credit ratings by reducing their debt levels. This shows that when firms' financial flexibility improves, managers use cash flows to reduce debt levels and save debt capacity for future borrowing. The relationship between the demand for financial flexibility and leverage is an inverted-U shape (Byoun, 2011), therefore,

it is expected that firms' decisions on debt policy will vary depending on firms' financial flexibility. Thus, this study examines whether mature firms with HFF choose to increase cash holdings or preserve debt capacity to target credit ratings. The results show that mature firms increase cash holdings rather than reduce debt to target credit ratings when they have HFF.

In taking pension de-risking strategies into consideration, the findings suggest that growth firms with MFF change their pension asset allocations from bonds to equities to target credit ratings. This is because high returns on pension assets invested in equities may reduce firms' pension contributions, thereby increasing firms' financial flexibility. Developing and growth firms with LFF and MFF are more likely to switch from DB to DC pension plans to target credit ratings. This is consistent with Atanasova and Hrazdil's (2010) finding that switching from DB to DC pension plans has a positive impact on firms' performance. Thus, firms' desire to maintain financial flexibility may provide an incentive to switch from DB to DC pension plans. Owing to limitations in pension buy-in and buy-out data, this study does not provide conclusive evidence on the relationship between firms' financial flexibility and pension buy-in and buy-out transactions.

This chapter contributes to the existing literature in the following ways. First, it contributes to the literature on target credit rating behaviours. Most previous literature focuses on the impacts of firms' financial characteristics on their credit ratings, reaching the conclusion that firms may alter their financial characteristics to target credit ratings. This study also explores how firms trade-off different financial characteristics to target credit ratings, such as increasing cash holdings or reducing outstanding debt. It not only provides consistent findings that firms change their financial characteristics to target credit ratings,

but also identifies that firms' concern for financial flexibility relates to such trade-off decisions.

Second, this chapter provides an overview of the relationship among concerns about financial flexibility, capital structure and pension de-risking strategies. The previous literature indicates that financial flexibility is a first-order determinant of capital structure (Graham and Harvey, 2001). This research uses dividend pay-out ratios as a measure of firms' financial flexibility to investigate whether financial flexibility relates to firms' capital structure. The findings indicate strong relationships among firms' financial flexibility, debt levels, cash holdings and pension de-risking strategies.

Given that firms take financial flexibility into account when engaging in pension de-risking strategies, this chapter also contributes to the pension de-risking literature. Pension de-risking strategies have been widely used in recent years in the UK. Under pressure from new pension accounting standards, changes in pension regulations and the recent financial crises, UK companies have reduced their corporate pension risk by adopting pension de-risking strategies. It is important to note that pension obligations have a strong influence on companies' financial position. Pension contributions constrain firms' internal financial resources. Thus, pension de-risking strategies may reduce corporate pension risk and significantly increase firms' financial flexibility. Since there are differences between UK and US pension systems in terms of regulation and their bulk annuity markets, this chapter provides UK pension de-risking evidence in relation to propositions derived from the US literature to highlight the relationship between firms' financial flexibility and pension de-risking strategies.

The remainder of this chapter proceeds as follows. Section 2 reviews the general literature on the relationship between firms' financial flexibility and capital structure and develops testable hypotheses. Section 3 describes the sample and data. Section 4 provides descriptive statistics for the sample. Empirical tests and analyses are presented in Sections 5 and 6. Section 7 provides concluding remarks.

3.2 Literature Review and Hypothesis Development

3.2.1 Financial flexibility and capital structure

Firms value financial flexibility during economic downturns (Graham and Harvey, 2001). Brounen, De Jong and Koedijk (2004) and Bancel and Mittoo (2004) extend previous research by comparing European firms with US firms, and find that financial flexibility is as important for European companies as for US companies in determining their debt structure. Gamba and Triantis (2008) further explore the value of financial flexibility and find that debt issuance costs lead firms to evaluate different combinations of debt and cash differently. Their evidence shows that financial flexibility considerably influences cash retention policies. Firms change their cash balance levels to mitigate the effects of external financing costs (Gamba and Triantis, 2008). In addition, Gamba and Triantis (2008) suggest that there is an optimal level of cash holdings when the marginal benefits of holding cash equal to the marginal costs of holding cash. Clearly, firms with LFF are more likely to increase their cash balances than those with HFF. Ang and Smedema (2011) further find that only firms with generous and unconstrained cash flows are able to manage their financial flexibility to prepare for future recessions. Given that firms manage financial

flexibility to respond to financial crises, Mittoo et al. (2011) find that French firms with HFF are less impacted by such crises. Firms with HFF are valued at a premium compared with financially inflexible firms (Gamba and Triantis, 2008), and this premium reduces for more mature firms with fewer growth opportunities. Generally, the previous research indicates that financial flexibility plays an important role in decisions on capital structure.

3.2.2 Financial flexibility and corporate debt

Firms may change their leverage levels to maintain financial flexibility. Denis and McKeon (2012) suggest that unused debt capacity may be used as a source of financial flexibility. In addition, Byoun (2008) concludes that firms preserve debt capacity for future financing needs to avoid external financing costs. Marchica and Mura (2010) explore conservative leverage policies and view financial flexibility as an untapped reserve of borrowing power. Thus, conservative leverage policies enable firms to make better investments, as they preserve firms' financial flexibility in advance. However, Byoun (2008) indicates that the adjustment costs of reducing debt are lower than the costs of increasing debt. Therefore, borrowing costs should be of concern to firms when raising funds for future investments. In general, maintaining financial flexibility requires firms to reduce leverage and maintain debt capacity.

3.2.3 Financial flexibility and cash holdings

Cash holdings are regarded as a key means of enhancing firms' financial flexibility. Denis (2011) provides an overview of the mechanism through which firms' financial flexibility influences corporate liquidity. Ang and Smedema (2011) predict that firms increase cash holdings to prepare for future financial

recessions, while Mittoo et al. (2011) suggest that firms may use cash holdings and lines of bank credit as alternative sources of financial flexibility to lowering leverage. The risks involved in re-financing increase external financing costs, thus, increasing external financing costs increases the value of cash holdings. Firms stockpile cash to mitigate re-financing risks (Harford, Klasa and Maxwell, 2014). This suggests that cash holdings act as a buffer against negative financial shocks by maintaining financial flexibility. However, an optimal financial policy limits the level of cash holdings and promotes accessibility to external financing (Strebulaev, 2007). The marginal value of cash holdings decreases in unconstrained firms compared with constrained firms (Denis and Sibilkov, 2010). This implies that firms value cash holdings according to the costs of external financing. Collectively, the previous literature suggests that firms accumulate cash flows in order to maintain financial flexibility in response to financial constraints.

3.2.4 Trade-off between cash holding and debt capacity

Firms target their credit ratings by changing their financial characteristics. This chapter thus focuses on the trade-off between increasing cash holdings and preserving debt capacity to target credit ratings. The rationale behind the trade-off decision is explained by previous study suggesting that reducing debt is not equivalent to increasing cash holdings (Acharya et al., 2007). The authors find that firms make trade-off decisions between preserving debt capacity and increasing cash holdings in terms of their hedging needs. Acharya et al. (2007) conclude that firms with HHNs prefer to accumulate cash flows, whereas firms with LHNs prefer to reduce outstanding debt. Following the previous discussion about the relationship between demand for financial flexibility and capital

structure, a firm's desire to maintain its financial flexibility could be related to the trade-off between increasing cash holdings and reducing outstanding debt to target credit ratings as there are costs for external financing. Byoun (2011) relies on different firms' financial characteristics to classify firms as developing, growth and mature firms with different financial flexibility. The study suggests that developing firms with demand for financial flexibility tend to maintain low levels of leverage as they suffer from the financial constrants and high costs of external financing. Growth firms with demand for financial flexibility maintain relatively high financial leverage, as they have relatively lower costs for external financing and raise external funding to support their investments. However, mature firms have moderate leverage to maintain their financial flexibility. This may suggest that mature firms can largely rely on their internal financial resources and replace debt with internal resources. Byoun (2011) indicates that firms are in different phases of development tend to make decision on capital structure differently. Following this argument, firms may trade-off between accumulating cash flow and reducing outstanding debts to target credit ratings. This chapter adopts the measure of the dividend payout ratio to categorize developing, growth and mature firms with low, moderate and high financial flexibility (DeAngelo and DeAngelo, 2007; Bonaimé et al., 2013).. It is hypothesised that developing firms with LFF are more likely to choose to accumulate cash to target credit ratings, as they incur high costs for external financing. However, improvements in financial flexibility may lead growth firms to choose to reduce debt to target credit ratings, as the costs of external financing are lower and growth firms have high level of leverage. Mature firms with HFF have few constraints on internal and external financing. Therefore,

they could either choose to increase cash holdings or reduce outstanding debt to target credit ratings.

The above discussion leads to the following hypotheses:

Hypothesis 1.1: *Ceteris paribus, developing firms with LFF are more likely to increase cash holdings over reducing debt to target credit ratings.*

Hypothesis 1.2: *Ceteris Paribus, growth firms with MFF are more likely to reduce debt over increasing cash holdings to target credit ratings.*

Hypothesis 1.3: *Ceteris Paribus, mature firms with HFF can either choose to increase cash holdings or reduce outstanding debt to target credit ratings.*

3.2.5 Financial flexibility and pension de-risking strategies

Since pension obligations are debt-like liabilities for firms, this study investigates whether firms with different levels of financial flexibility engage in pension de-risking strategies differently when firms are targeting credit ratings. Previous literature explores the relationship between credit ratings and pension obligations, finding that changes in pension obligations influence credit ratings (Martin and Henderson, 1983; Bodie et al., 1985; Maher, 1987; Cardinale, 2007; McKillop and Pogue, 2009). Therefore, adopting pension de-risking strategies is expected to improve firms' credit ratings.

3.2.5.1 Financial flexibility and pension asset allocation

Firms alter their pension asset allocations to mitigate pension risk. Lane Clark and Peacock (2014a; 2005) indicates that firms have switched their pension asset allocations from equities to bonds to mitigate pension risk arising from recent changes in accounting standards and financial crises. Amir and Benartzi

(1999) provide consistent evidence that UK and US firms have tended to reallocate pension assets from equities to bonds in response to the adoption of IAS 19 and SFAS 158. Amir and Benartzi (1999) recommend that firms should allocate pension assets to fixed income securities to match pension assets to the duration of pension liabilities. Overall, allocating pension assets to fixed income securities may reduce volatility in pension contributions.

However, managers may pursue higher returns from pension investments by allocating pension assets to equities. Investments in the equity market are likely to out-perform the bond market. Successful pension investments in equities may benefit firms through lower pension contribution requirements from sponsor firms (Bodie, 1990). Liu and Tonks (2013) find a negative relationship between pension contributions and dividend payments. The evidence indicates that pension contributions crowd out or reduce dividend payments to shareholders. Therefore, firms with higher pension asset allocations to equities are expected to have higher investment returns, thereby reducing pension contributions, maintaining levels of dividends payments and increasing financial flexibility. In contrast, Amir et al. (2010) suggest that for US firms, dividend pay-out ratios are negatively related to pension assets allocated to equities. This is because pension asset allocations to fixed income securities may reduce the volatility of dividend payments. However, their results are not statistically significant. Overall, firms with higher financial flexibility are expected to allocate more pension assets to equities. As financial flexibility is measured by dividend pay-out ratios, firms' desire to maintain their financial flexibility may be an incentive to change their pension assets allocations from bonds to equities.

The discussion above leads to the following hypothesis:

Hypothesis 2: *Ceteris paribus, developing or growth firms with lower financial flexibility tend to allocate more pension assets to equities to target credit ratings than mature firms with higher financial flexibility.*

3.2.5.2 Financial flexibility and switches from DB to DC pension plans

Increasing numbers of FTSE 100 firms are closing their DB pension plans to new employees or future accruals (Lane Clark and Peacock, 2014b; 2015; 2016). Several factors are driving this switch. A key reason is to pass the investment risk, longevity risk and other associated risks from employers to employees (Ippolito, 1995; Ippolito, 1997; Broadbent et al., 2006). In addition, the cost of funding DB pension plans is rising as a result of financial crises and low interest rates (Broadbent et al., 2006). AVIVA plc has experienced lower service costs and cash funding since switching from a DB to a DC pension plan (Josiah, Gough, Haslam and Shah, 2014), and BEA plc also reports that increases in its DB plan deficit increased cash contributions and reduced internal resources for other operating and financing activities (Josiah et al., 2014). These companies' responses suggest that DB pension plans constrained firms' financial resources. Therefore, firms' desire to maintain financial flexibility is likely to encourage them to switch from DB to DC pension plans.

Dividend pay-out ratios are used to measure financial flexibility in this chapter. Choy et al.'s (2014) empirical study confirms that increases in dividends are positively related to termination of DB pension plans. However, Atanasova and Hrazdil's (2010) results suggest a negative relationship between increasing dividends and freezing DB pension plans. This suggests that firms are more likely to retain their DB pension plans if they have high dividend payments. However, their findings become insignificant when controlling for other possible

effects. According to the findings of previous studies, a link is expected between firms with different levels of financial flexibility, measured by the dividend pay-out ratios, and to switch from DB to DC pension plans.

The discussion above leads to the following hypothesis:

Hypothesis 3: *Ceteris paribus, mature firms with HFF are more likely to switch from DB to DC pension plans to target credit ratings than developing firms with LFF.*

3.2.5.3 Financial flexibility and pension buy-in and buy-out decisions

Pension buy-ins and buy-outs may be used to transfer significant amounts of pension obligations to insurance companies. Thus, firms may benefit from pension buy-in and buy-out contracts by removing pension obligations in part or in full from their financial statements. Reducing pension obligations may increase firms' financial flexibility, as it removes the responsibility to make future pension contributions. The costs of pension buy-ins and buy-outs are the premiums paid to insurance companies, determined by differences between estimated pension obligations and the fair value of pension assets. Lin et al. (2015) suggest that paying significant amounts of cash for severely underfunded DB pension plans to secure pension buy-in or buy-out contracts are adverse consequences of pension de-risking strategies. This indicates that high cost for pension buy-in and buy-out is detrimental for the firms' financial flexibility. Therefore, firms wishing to maintain financial flexibility must make trade-offs between the costs and benefits of pension buy-ins and buy-outs.

Hypothesis 4: *Ceteris paribus, firms' desire to keep their financial flexibility is related to the use of pension buy-ins and buy-outs to target credit ratings*

3.3 Sample and Data

3.3.1 Sample selection and control variables

The sample for this research comprised UK firms with available Standard & Poor's credit ratings from 2004 to 2013. Standard & Poor's credit rating data were collected from the Thomson One Banker database and merged with data from the S&P Capital IQ database. Following the credit rating literature (Alissa et al., 2013), credit rating was treated as an ordinal variable, coded from 1 to 16. The highest credit rating of AAA is represented by 1, while the lowest credit rating of B- is represented by 16. Credit rating from D to CCC+ were excluded from the sample, as firms with severe credit risk may suffer serious financial issues and would not be expected to target credit ratings.

This chapter focuses on the influence of changes in capital structure on changes in credit ratings. Thus, a change in credit ratings (*DIFF*) is the difference between the next year's credit rating (CR_{it+1}) and the current year's credit rating (CR_{it}). The distribution of Standard & Poor's credit ratings is shown in Table 3.3. Firms for which credit ratings were available were categorized into groups with firms with LFF, MFF and HFF. The most common credit ratings in the LFF, MFF and HFF groups were B+ (11.4%), BBB+ (15.8%) and A- (18.1%) respectively. Since credit ratings above or equal to BBB- were considered as investment grade, 58.4%, 82.0% and 80.0% of firms were categorized with investment grades for LFF, MFF and HFF respectively. This suggests that firms with MFF and HFF had higher credit ratings than those with LFF. The distribution of changes in credit ratings categorized by different levels of financial flexibility for full UK sample is shown in Panel A of Table 3.4. In the first column, -1 indicates a one-notch increase and +1 indicates a one-notch

decrease in credit rating. A significant proportion of credit ratings remained unchanged within one year, for 74.3%, 83.8% and 80.6% of firms with LFF, MFF and HFF respectively. Greater numbers of firms with HFF were downgraded in a year than firms with LFF and MFF. Generally, firms with credit rating changes did not experience significant volatility in ratings within one year, as rating change observations (15.5% for LFF, 12.5% for MFF and 13.7% for HFF) were concentrated between 1 and -1.

In addition, Panel B in Table 3.4 describes the sub-sample for cash holding and debt. There were 23%, 16.1% and 15.2% of firm-year observations in LFF, MFF and HFF respectively experiencing rating changes in the sub-sample. The range of rating changes varies from -3 notches to +3 notches. Panel C, D and E of Table 3.4 present the sub-sample for each of pension de-risking strategy in terms of their credit rating changes categorised by different financial flexibility. It should be noted that there are no credit rating changes for pension buy-ins and buy-outs in the LFF groups.

Information on pension asset allocations was collected from the Thomson One Banker database. Data on firms with credit rating and pension asset allocation information were merged, which reduced the number of firm-year observations to 390. Information on FTSE 100 firms' switches from DB to DC pension plans was available from annual reports. Firms with credit ratings and information about switches from DB to DC pension plans were matched. This resulted in a sub-sample containing 312 firm-year observations. Information on pension buy-ins and buy-outs by FTSE 100 companies was available from 2008 (Lane Clark and Peacock, 2005; 2014a; 2014b), and after matching pension buy-in and buy-out data with credit rating data, 45 firm-year observations remained. The

sample selection process is shown in Table 3.2. Other accounting information was drawn from the Thomson One Banker database.

Prior research (Hovakimian et al., 2009) identifies several independent variables that reflect firms' financial fundamentals. Larger firms may have greater capacity to target higher credit ratings in the future. Firm size (*SIZE*) was measured as the natural logarithm of sales. Firms with higher income indicate higher profits and lower risk of default. Thus, *PROFIT* was measured as operating income scaled by total assets. High volatility in income suggests that firms are more likely to face financial problems. Operating risk (*OPRISK*) was measured by the standard deviation of operating income scaled by lagged total assets. The *RD* variable was excluded from the Kisgen's (2009) target credit rating model, which has been explained in the Chapter 2.

Tangibility represents tangibility of assets measured by net property, plant and equipment scaled by total assets. Firms with more tangible assets and specialized products have lower leverage, which indicates higher credit ratings. Firms' growth opportunities were measured with *SGA* and *MB*: *SGA* represents selling, general and administrative expenses scaled by sales, and *MB* is the market-to-book ratio calculated by the market value of assets over the book value of assets, where the market value of assets equals total assets minus book equity plus market equity. Firms with more growth opportunities have greater potential to target higher credit ratings. The measurement of cash holding used in this study is consistent with the relevant literature (Opler et al., 1999). Changes in cash holdings (*ΔCASH*) were measured as changes in cash and short–term investment scaled by total assets. Following Acharya et al. (2007), changes in debt issuance (*ΔDEBT*) were measured as the ratio of net

long-term debt issuance. All continuous variables were winsorized at 1% and 99% to address the effect of outliers.

3.3.2 Pension de-risking strategies

Pension asset allocations (*EQUITY*) were measured by pension assets allocated to equities scaled by total pension assets. Switches from DB to DC pension plans (*SWITCH*) were coded as 0 if DB pension plans were kept open to all employees, 1 if firms had closed their DB pension plans to new employees but kept them open to existing employees, and 2 if firms had fully closed their DB pension plans. Four types of pension buy-in and buy-out transactions were identified: pensioner buy-in, full buy-out, pensioner buy-out and buy-in. Pensioner buy-ins (buy-outs) are defined as buy-ins (buy-outs) that cover payments to current pensioners and their dependants. Full buy-outs are buy-out contracts covering all known liabilities in a pension plan, usually followed by winding up of the pension plan. Buy-ins represent purchase of bulk annuity contracts with insurance companies as investments to match some or all of a pension plan's liabilities. Firms engaging in pensioner buy-in transactions were coded as 1, full buy-outs were coded as 2, pensioner buy-outs were coded as 3 and buy-ins were coded as 4. Table 2.3 categorizes the different types of pension buy-ins and buy-outs. Panel A shows that pension buy-ins constituted a significant proportion of pension buy-in and buy-out transactions in the sample. The original sample comprised a total of 48 firm-year observations for pension buy-ins and buy-outs. However, pension buy-in and buy-out information was matched with control variables in the model, the results of which are reported in Panel B. The total number of firm-year observations for pension buy-ins and

buy-outs was reduced to 17, and data availability thus further reduced the sample size.

3.3.3 Firms' financial flexibility

Following the prior literature, firms' financial flexibility was measured as the dividend pay-out ratio, using information gathered from the Thomson One Banker database. Several studies (DeAngelo and DeAngelo, 2007; Alli, Khan and Ramirez, 1993) indicate that dividend pay-outs are positively related to firms' financial flexibility. In addition, markets respond positively to higher dividend pay-out ratios (Lintner, 1956). Managers may cut dividends to increase financial flexibility when firms are constrained (Fazzari et al., 1988). Therefore, the sample firms were split into three levels of financial flexibility based on their dividend pay-out ratio percentile. The cut-offs were at 0.3 between low and moderate levels, and 0.7 between moderate and high levels of financial flexibility. The reason for splitting the samples was that the relationship between leverage level and financial flexibility is non-linear and follows an inverted-U shape (Byoun, 2011), indicating that firms with different financial flexibility tend to have different debt policy. Thus, developing firms with LFF, growth firms with MFF and mature firms with HFF were expected to have different debt policies from each other's when targeting credit ratings.

Other research (Grullon et al., 2002) indicates that changes in dividends signal firms' systematic risk. Therefore, an alternative proxy for financial flexibility is changes in dividends. According to dividend signalling theory, firms' increases in dividends are regarded as good news, while decreases in dividends are regarded as bad news. Thus, empirical studies suggest that changes in dividends provide information to the market. Benartzi et al. (1997) find strong

evidence that dividend changes signal current information about firms but may not predict their future earnings. In sensitivity tests conducted for this study, negative and positive changes in dividends were used to differentiate the sample. Firms with positive changes in dividends were treated as having HFF, while those with negative changes in dividends were regarded as having LFF.

3.3.4 Corporate pension risk

It was expected that corporate pension risk would be reduced following the adoption of pension de-risking strategies. In robustness tests, two proxies were used for corporate pension risk. Previous studies suggest that greater pension risk may cause lower credit ratings and higher probability of default (McKillop and Pogue, 2009). Different pension risk measures are used in the previous literature. This chapter focused particularly on pension risk measures calculated from disclosures in financial statements, as these public-available figures enable market participants to estimate pension fund risks. Cardinale (2007) proposes measurement of corporate pension risk (*ΔPension_Risk1*) using projected benefit obligations divided by the sum of the book value of debt and book value of equity, suggesting that the absolute value of pension obligations is related to bond spread. In addition, projected benefit obligations take account of future salary increases and information on actuarial assumptions. Gopalakrishnan and Sugrue (1993) find that market participants regard future salary progression as a liability of firms. This indicates that market may assess the corporate pension risk by taking account the projected benefit obligations. Franzoni and Marin (2006) measure corporate pension risk (*ΔPension_Risk2*) as the difference between projected benefit obligations and the fair value of pension assets divided by market capitalization. They find that investors

misprice pension obligations, failing to recognize the true status of corporate pension risk. Lane Clark and Peacock (2014a) enclose these two pension risk measures as benchmarks to compare corporate pension risk between FTSE 100 companies. They also rank pension risk for FTSE 100 firms in terms of service costs, and employer contributions. Firms that engage in pension de-risking strategies aim to reduce the pension risk reflected in financial statements. Thus, corporate pension risk acts as an indicator of engagement in pension de-risking strategies.

3.4 Univariate Results

3.4.1 Firms' financial characteristics categorized by financial flexibility

Table 3.5 presents an overview of the sample firms categorized by different levels of financial flexibility. The table reports descriptive statistics for credit ratings and firms' financial characteristics. Developing firms with LFF appear to have had lower average credit ratings (8.72) than the groups with MFF and HFF. Mature firms with HFF experienced the largest average credit rating changes (0.14) of the financial flexibility groups. However, cash holding levels was around 0.8 across the financial flexibility groups.

Net debt issuance (*DEBT*) was 0 in the developing firms with LFF, indicating those firms have higher borrowing costs and more financial constraints. The sub-sample for pension asset allocations was also split to present the descriptive statistics in the three financial flexibility groups, as shown in Table 3.6. The descriptive statistics show that developing firms with LFF tended to allocate more pension assets to equities (51%) than growth firms with MFF (48%) and mature firms with HFF (48%) in average. Moreover, consistent with

expectation, developing firms with LFF had lower average credit ratings than those with MFF and HFF. The descriptive statistics for switching from DB to DC pension plans (*SWITCH*) demonstrate that developing firms with LFF had the highest average levels of *SWITCH* (0.93) among the three groups (see Table 3.7). The sub-sample for pension buy-ins and buy-outs and pension risk measures is described in detail in Table 3.8. Panel B of Table 3.8 reports descriptive statistics for the sub-sample for pension risk measures. The mean of the first pension risk measure (*Pension_Risk1*) is 0.54, and the mean of second pension risk measure (*Pension_Risk2*) is -0.04, indicating that funds were underfunded on average. In addition, the indicators for changes in credit rating (*DIFF*) are above zero in all samples. In general, developing firms with LFF had lower average credit ratings, more pension assets allocated to equities and a higher proportion of switching from DB to DC pension plans than the other financial flexibility groups.

Relationships among the key variables are reported for all sub-samples in correlation matrix in Table 3.9. In Panel A reveals that the correlation between credit ratings (*CR*) and net debt issuance (*DEBT*) is significantly negative at the 1% significance level. This suggests that firms with higher credit ratings were able to issue more debt than those with lower credit ratings. This is consistent with the fact that firms with lower credit risk have lower costs of borrowing, which may promote more external financing. However, cash holding levels were not significant related to credit ratings. *SGA*, *PROFIT* and *SIZE* are all negatively related to *CR*. This is consistent with the finding of previous literature that firms with higher growth, higher income and larger size are more likely to have higher credit ratings (Hovakimian et al., 2009). The positive but no significant correlation between *OPRISK* and *CR* suggests that firms with higher

operating risk had lower credit ratings. However, sample firms with lower credit ratings tended to have more tangible assets (*Tangibility*). The main finding from Panel B is a negative correlation between pension assets allocated to equities (*EQUITY*) and credit ratings (*CR*) at the 1% significance level. This suggests that firms with higher credit rating allocated more pension asset to equities. A positive correlation between switching from DB to DC pension plans (*SWITCH*) and credit ratings (*CR*) is shown in Panel C. This indicates that a greater proportion of firms with lower credit rating switched from DB to DC pension plans. However, they appear to be insignificant related. Panel D suggests a positive correlation between pension buy-in and buy-out decisions and credit ratings. However, this is statistically insignificant. Panel E reveals that the first pension risk measure (*Pension_Risk1*) is positively and significantly correlated with credit ratings (*CR*), whereas the second measure (*Pension_Risk2*) is negatively and insignificantly correlated with credit ratings (*CR*). This implies that firms with lower credit ratings tended to have more pension obligations than those with higher credit ratings.

3.4.2 Mean differences in different financial flexibility firms

3.4.2.1 Financial flexibility measured by the dividend pay-out ratio

Since samples were split in terms of firms' financial flexibility, descriptive statistics can be compared to understand the financial characteristics of the three groups of firms. As discussed above, financial flexibility was measured by the dividend pay-out ratio. The first and second cut-offs for financial flexibility were 0.3 and 0.7 respectively. Table 3.10 shows the results of t-tests to examine mean differences in key variables comparing the three samples. It shows that mature firms with HFF and growth firms with MFF had higher credit

ratings than developing firms with LFF. Specifically, the mean of credit ratings decreased statistically significantly, by 1.38 at the 1% significance level (Panel A), between the groups with LFF and MFF, and decreased by 0.811 at the 5% significance level between the MFF and HFF groups (Panel B). However, Panel C shows that the mean credit rating for growth firms with MFF was higher for those with mature firms with HFF (a mean difference of 0.569 at the 5% significance level). Surprisingly, the mean in cash holding levels and debt issuance did not differ statistically between the three financial flexibility groups. Comparison between developing firms with LFF and growth firms with MFF reveals that the mean of *SWITCH* was higher in the LFF group at the 10% significance level. The mean difference in *SWITCH* between developing firms with LFF and mature firms with HFF firms was 0.411 and 0.219 between firms with MFF and HFF, both at the 1% significance level. This suggests that the mean of *SWITCH* was higher in groups with lower financial flexibility than with higher financial flexibility. Panel B shows that the mean of pension buy-ins and buy-outs was higher in developing firms with LFF than mature firms with HFF at the 5% significance level. Significant mean differences were not found in pension risks across different financial flexibility groups. As shown in Panels A and B, the means of *MB*, *SGA* and *SIZE* were significantly lower in firms with LFF than those with MFF and HFF. The mean of *OPRISK* for LFF firms was higher than for the other two groups of firms. The signs of the control variables are consistent with the findings of previous literature that developing firms with LFF generally have fewer growth opportunities and are smaller in size. In addition, developing firms with LFF have greater operating risk than growth and mature firms with MFF and HFF. There were no significant differences between growth firms with MFF and mature firms with HFF in terms of their growth

opportunities and operating risks (Panel C). However, growth firms with MFF appear to have had a higher mean of income than mature firms with HFF.

3.4.2.2 Financial flexibility measured by changes in dividends

Changes in dividend are an alternative to using the dividend pay-out ratio as a proxy for financial flexibility. Negative changes in dividends represent developing firms with LFF, while positive changes in dividends apply to mature firms with HFF. Comparison of the mean differences between the two groups (Table 3.11) reveals results consistent with the expectation that developing firms with LFF hold less cash than mature firms with HFF. Developing firms with LFF issued more debt than those with HFF. Interestingly, the mean of *SWITCH* was higher in the HFF group than the LFF group at the 10% significance level. The mean differences in credit rating are not statistically significant between the LFF and HFF samples. None of the signs of the control variables supports the expectation. For example, the mean of growth opportunity measured by *MB* was lower in mature firms with HFF, and the mean of operating risk (*OPRISK*) was significantly higher in the HFF group.

3.5 Multivariate Analysis

3.5.1 Firms with different financial flexibility and the trade-off between cash holdings and debt to target credit ratings

Regression tests were conducted to investigate the hypothesis 1.1 to 1.3 (see Table 3.12). The regression results shown in Column 1 show that firms with LFF changed cash holdings to target credit ratings. Changes in cash holdings (*ΔCASH*) are negatively related to changes in credit ratings (*DIFF*) at the 5% significance level. This is consistent with the expectation that developing firms

with LFF accumulate cash flows to target credit ratings when they encounter lack of financial flexibility. The previous literature indicates that firms hold liquid assets to maintain sufficient funds to retain investments when there is a cash flow shortage (Opler et al., 1999). The results shown In Column 4 of Table 3.12 suggest that developing firms with LFF did not tend to change their level of debt issuance to target credit ratings, as the relationship between changes in issuance of debt (*ΔDEBT*) and changes in credit rating (*DIFF*) is statistically insignificant. Compared with Column 1, this suggests that developing firms with LFF are likely to increase their cash holdings rather than reduce their issuance of debt to target credit ratings. Therefore, findings support hypothesis 1.1. These findings contradict the traditional view and support that cash holdings are not equivalent to negative debt in the presence of external financing costs (Acharya et al., 2007). This is because firms stockpile cash to mitigate a shortage of internal resources and maintain their financial flexibility. Firms' decisions to accumulate cash rather than using cash to pay down outstanding debt are probably driven by the transaction costs of debt. Transaction costs are incurred when firms raise funding from external financing sources. Overall, it is important to note that developing firms with LFF are more likely to maintain their internal financing sources rather than relying on external financing sources in the presence of financial constraint.

Interestingly, the results reveal that managers decreased debt issuance to target credit ratings when firms' financial flexibility improved from low to moderate levels, as shown in Column 5. The results show a statistically significant relationship at the 5% significance level between changes in debt issuance (*ΔDEBT*) and changes in credit ratings (*DIFF*) for growth firms with MFF. In contrast, Column 2 shows that growth firms with MFF were less likely to

alter cash holding levels to target credit ratings, as the statistical significance level is 10%. Thus, the results support hypothesis 1.2 that growth firms with MFF were more likely to reduce their debt levels rather than accumulate cash to target credit ratings.

Byoun (2011) predicts that there is an inverted-U relationship between leverage and financial flexibility. His findings imply that growth firms with demand for financial flexibility have high leverage levels as they tend to raise external financing to fund their investments. This may explain that growth firms with MFF are more likely to reduce debts to target credit ratings as those firms maintain high level of leverage.

Columns 3 and 6 show that mature firms with HFF were more likely to change cash holding levels to target credit ratings than reduce their outstanding debt. The evidence confirms hypothesis 1.3. There is a statistically significant relationship at the 1% significance level between changes in cash holdings (*ΔCASH*) and changes in credit ratings (*DIFF*). However, the relationship between changes in debt issuance (*ΔDEBT*) and changes in credit rating (*DIFF*) is not significant. This raises a puzzle about why firms accumulate cash flows to target credit ratings even when they have HFF. These results may support Opler et al.'s (1999) finding that management accumulates excessive cash flows opportunistically. Firms with poor cash flow management holding excessive cash may not act in the best interests of shareholder (Harford, 1999), and increases in cash holdings may increase managerial discretion.

Increases in cash holdings by mature firms with HFF may have been caused by the measure used for financial flexibility. Firms' financial flexibility was measured by the dividend pay-out ratio. Dividend payments consume internal

financial resources, and a higher dividend pay-out ratio implies that firms must pay higher dividends to shareholders. The previous literature suggests that dividend payments are regarded as a financial constraint (Bonaimé et al., 2013). The motivation for increases in cash holdings by mature firms with HFF may indicate that managers are preparing for dividend payments and are seeking to maintain internal financial flexibility. Overall, the multivariate tests conducted in this study confirm that firms with different levels of financial flexibility make trade-off decisions between increasing cash holdings and preserving debt capacity to target credit ratings.

3.5.2 Firms with different levels of financial flexibility and pension de-risking strategies

This section addresses the hypotheses 2 and 3, exploring how firms with different financial flexibility engage in pension de-risking strategies to target credit ratings. Investors and CRAs take corporate pension risk into consideration when making investment decisions and issuing credit ratings. Therefore, firms are expected to adopt pension de-risking strategies as part of integrated decisions on capital structure to target credit ratings. Table 3.13 shows that growth firms with MFF changed their pension asset allocations from bonds to equities when targeting credit ratings. The results reveal that changes in pension asset allocations (*ΔEQUITY*) are significantly negatively related to changes in credit ratings (*DIFF*) at the 5% significance level, whereas LFF and HFF groups show no significant association between these variables. The results suggest that growth firms with MFF were more likely to pursue higher returns on pension asset investments by investing pension assets in equities. The motivation for changing pension assets to equities was to reduce pension

contributions from sponsor firms. Firms may benefit from saving financial resources as they are required to contribute less to pension funds. Therefore, pension asset allocations to equities may improve firms' financial flexibility. Column 1 indicates that developing firms with LFF were unlikely to change their pension asset allocations to target credit ratings. This may reveal that UK companies have no incentive to switch pension assets into risky investments to target credit ratings when they are financial inflexibilities. This partially supports hypothesis 2 that firms with lower financial flexibility are more likely to invest pension assets in equities. This may be because developing firms with LFF are concerned with the risk of investing pension assets in equities as the failure of such investments could lead to pension fund deficits. Although pension assets allocated to equities may generate higher investment returns than those invested in bonds, pension risk may be higher for pension assets invested in equities as the equity market is more volatile than fixed income securities. Thus, developing firms with LFF make trade-off decisions on pension asset allocations in terms of the costs and benefits of investing pension assets in equities. Column 3 shows that no significant relationship between changes in pension asset allocations (*ΔEQUITY*) and changes in credit ratings (*DIFF*) for mature firms with HFF. This may be interpreted that they are more concerned about the risk of pension asset investments than achieving higher returns on pension assets. Thus, mature firms with HFF are unlikely to change their pension asset allocations to target credit ratings. In general, developing firms with LFF and mature firms with HFF choose not to change their pension asset allocations to target credit ratings, rather than placing pension funds at greater risk to target credit ratings.

Table 3.14 shows how firms' concerns for financial flexibility relate to switches from DB to DC pension plans to target credit ratings. The finding is inconsistent with hypothesis 3. The results show that *SWITCH* is significantly negatively related to changes in credit ratings (*DIFF*) at the 1% significance level (Column 2). This suggests that growth firms with MFF are likely to switch from DB to DC pension plans to target credit ratings. Column 1 suggests that changes in DB plans is associated with downgrades in credit ratings. These results may be biased, as the sample contained only 28 observations for LFF. Therefore, developing firms with LFF and growth firms with MFF were combined to conduct regression tests. The results shown in Column 3 suggest that both developing firms with LFF and growth firms with MFF were likely to switch from DB to DC pension plans to target credit ratings. This is consistent with the finding of previous literature that dividend payments have a negative impact on switches from DB to DC pension plans (Atanasova and Hrazdil, 2010) but inconsisitent with Choy et al. (2014). This finding may reflect Munnell et al.'s (2007) view that switches from DB to DC can reduce future employees' benefits and release internal resources in order to maintain firms' financial flexibility. Thus, firms with lower dividend pay-out ratios are more likely to switch from DB to DC pension plans. The relationship between *SWITCH* and changes in credit ratings (*DIFF*) becomes insignificant in the sample of mature firms with HFF shown in Column 4. This provides empirical evidence that mature firms with HFF tend to keep their DB pension plans open to employees. Overall, the findings suggest that firms with lower financial flexibility tend to switch from DB to DC pension plans when targeting credit ratings.

3.6 Robustness Checks

3.6.1 Alternative measure for financial flexibility

This section presents the use of an alternative proxy for financial flexibility to examine whether firms with different levels of financial flexibility trade-off decisions between increasing cash holdings and preserving debt capacity. As discussed above, the cut-off for firms with HFF (LFF) was positive (negative) changes in dividends across years. Positive changes in dividends indicate mature firms with HFF, whereas negative changes in dividends suggest developing firms with LFF. The empirical results shown in Table 3.15 reveal that developing firms with LFF changed their cash holdings significantly to target credit ratings. Column 1 suggests a significant relationship between changes in cash holdings (*ΔCASH*) and changes in credit ratings (*DIFF*) at the 1% significance level. In contrast, developing firms with LFF were unlikely to reduce their debt issuance to target credit ratings, as the results reveal no statistically significant relationship between changes in net debt issuance (*ΔDEBT*) and changes in credit ratings (*DIFF*). Mature firms with HFF tended to reduce debt issuance rather than increase cash holdings to target credit ratings -changes in debt issuance (*ΔDEBT*) are positively related to changes in credit ratings (*DIFF*) in this group (Table 3.15, Column 4).

To sum up, changes in dividends were used to measure firms' financial flexibility as a sensitivity test to support the main hypothesis 1.1 to 1.3. The evidence is consistent with the above conclusion that firms with different levels of financial flexibility make trade-off decisions between increasing cash holdings and reducing debt to target credit ratings. Developing Firms with LFF are more

likely to accumulate cash, while mature firms with HFF are more likely to reduce debt to target credit ratings.

Table 3.16 presents the results of sensitivity tests to support the conclusion that firms with different levels of financial flexibility change pension asset allocations and switch from DB to DC pension plans to target credit ratings. These provide evidence that developing firms with LFF are more likely to change their pension assets from bonds to equities to target credit ratings. Column 1 shows that changes in pension asset allocations to equities (*ΔEQUITY*) are related to changes in credit ratings (*DIFF*) at the 1% significance level. In contrast, the significance level decreases to 5% in the HFF sample (Column 2). This captures that firms with lower financial flexibility tend to change pension asset allocations to equities. This is consistent with the main result that developing firms with LFF switch pension assets from bonds to equities in order to maintain internal financial flexibility. However, the results of tests show that firms with different levels of financial flexibility do not switch from DB to DC pension plans as the results are not statistically significant (Column 3 and 4). The sensitivity tests do not support Hypothesis 3 that firms with different levels of financial flexibility switch from DB to DC pension plans to target credit ratings.

3.6.2 Financial flexibility and corporate pension risk

Pension de-risking strategies aim to reduce corporate pension risk and pension obligations. Since the above results indicate that firms with different levels of financial flexibility engage in pension de-risking strategies, this section further investigates whether corporate pension risk is also correlated with firms with different levels of financial flexibility when firms target credit ratings. Columns 1 to 3 of Table 3.17 report the results of using the first pension risk measure to

conduct a regression analysis. The evidence confirms that developing firms with LFF tended to reduce their corporate pension risk to target credit ratings. Column 1 shows a significant positive relationship between changes in corporate pension risk (*ΔPension_Risk1*) and changes in credit ratings (*DIFF*) at the 10% level in the LFF group. In contrast, there is no evidence that growth firms with MFF and mature firms with HFF reduced their corporate pension risk to target credit ratings. The first pension risk measure appears to be relevant to changes in credit ratings. This suggests that CRAs take changes in projected benefit obligations into account when evaluating firms' pension risk changes. In addition, the robustness check is consistent with the main finding that developing firms with LFF are more likely to reduce their pension risk by engaging in pension de-risking strategies.

Additional regression tests were conducted using the second measure of pension risk. However, Columns 4 and 6 in Table 3.17 provide no evidence in any financial flexibility group indicating a relationship between changes in corporate pension risk (*ΔPension_Risk2*) and changes in credit ratings (*DIFF*). This insignificant relationship may be attributable to the corporate pension risk measurement, which was derived from pension deficit figures.

Although the second measure of pension risk is insignificant in the tests, the robustness tests provide weak evidence that firms change the corporate pension risks to target credit ratings. In addition, this changes in corporate pension risks is correlated to firms with different levels of financial flexibility as only developing firms with LFF tended to change corporate pension risk to target credit ratings.

3.7 Summary and Conclusions

This chapter has explored the relationship between firms with different levels of financial flexibility and their trade-off decisions between increasing cash holdings and reducing debt issuance to target credit ratings. Further empirical evidence has been provided to support the finding of prior research that financial flexibility has a significant influence on capital structure (Graham and Harvey, 2001). Specifically, when firms change their capital structure to target credit ratings, their desire to maintain financial flexibility is related to trade-off decisions between increasing cash holdings and preserving debt capacity.

According to Byoun (2011), firms with different levels of financial flexibility tend to make capital decisions differently. The sample for this study was split into three categories with developing firms with LFF, growth firms with MFF and mature firms with HFF. The findings reveal that developing firms with LFF and mature firms with HFF are more likely to increase cash holdings to target credit ratings, while growth firms with MFF tend to preserve debt capacity to target credit ratings. This is because developing firms with LFF are concerned about debt issuance costs and suffer financial constraints, so they increase their cash holdings rather than reducing debt. When firms' financial flexibility improves, they are more likely to reduce debt to target credit ratings. Interestingly, the findings suggest that mature firms with HFF accumulate cash to target credit ratings.

Since pension obligations represent debt-like liability for firms, this study investigated the relationship between firms with different levels of financial flexibility and their decisions on pension de-risking strategies. The findings provide evidence that growth firms with MFF are more likely to change their

pension asset allocations from bonds to equities to target credit ratings. Firms may benefit from higher returns on pension assets invested in equities, and higher returns may reduce firms' pension contributions and increase their financial flexibility. Moreover, firms are more likely to switch from DB to DC pension plans when they have LFF or MFF compared with mature firms with HFF. In other words, this may suggest that mature firms with HFF are more likely to keep their DB pensions open to employees. Since firms must bear the high risk of DB pension plans, mature firms with HFF may be able to keep DB pension plans open to employees. Unfortunately, due to the limitations of the data on pension buy-ins and buy-outs, this study provides no evidence on the relationship between firms with different levels of financial flexibility and their pension buy-in and buy-out decisions.

In conclusion, financial flexibility plays a pivotal role in firms' capital structure and pension de-risking strategies. This study provides consistent evidence confirming Acharya et al.'s (2007) proposition on the substitutability of cash holdings and debt. This chapter develops the new perspective that managers take financial flexibility into account when engaging in pension de-risking strategies. Future research might examine the relationship between firms' financial flexibility and pension buy-in and buy-out decisions, as pension buy-ins and buy-outs may be used remove pension obligations from financial statements.

Table 3.1: Definitions of variables

Variable	Definition
CR	Long-term issuer credit rating by Standard & Poor's. Credit rating for firm *i* at time *t*. Highest credit rating coded as 1 and lowest credit rating coded as 16.
DIFF	Differences between *t*+1 year credit rating for firm *i*, and *t* year credit rating for firm *i*. $DIFF = CR_{it+1} - CR_{it}$
CASH	Cash and short-term investment scaled by total assets for firm *i* at time *t*.
DEBT	Net long-term debt issuance scaled by total assets for firm *i* at time *t*.
EQUITY	Percentage of pension assets allocated to equities scaled by total pension assets for firm *i* at time *t*.
SWITCH	1 if firm *i* at time *t* has partially closed its DB pension plan, 2 if it has fully closed its DB pension plan, and 0 if DB pension plan remains open.
BUYOUT	1 if firm *i* at time *t* has engaged in a pensioner buy-in transaction, 2 if it has engaged in a full buy-out, 3 if it has engaged in a pensioner buy-out, and 4 if it has engaged in a buy-in, and 0 if no transactions.
Pension_Risk1	Projected benefit obligation divided by market capitalization for firm *i* at time *t*.
Pension_Risk2	Difference between projected benefit obligations and fair value of pension assets divided by market capitalization for firm *i* at time *t*.
MB	Market value of assets over book value of assets for firm *i* at time *t*, where the market value of assets is total assets minus book equity plus market value of equity for firm *i* at time *t*.
Tangibility	Net property, plant and equipment scaled by total assets for firm *i* at time *t*.
SGA	Selling, general and administrative expenses scaled by sales for firm *i* at time *t*.
PROFIT	Operating income scaled by total assets for firm *i* at time *t*.
SIZE	Natural log of sales for firm *i* at time *t*.
OPRISK	Standard deviation of profitability for firm *i* at time *t* over the previous five years.

Table 3.2: Sample Selection

	Firm-year observations
Number of UK firms for which S&P's credit rating data available	1,240
Less: Firms for which no required accounting data available	(869)
Sub-sample for Hypothesis 1	**371**
Number of UK Firms for which pension asset allocation data available	4,800
Less: Firms without credit rating data	(4,410)
Sub-sample for Hypothesis 2	**390**
Number of FTSE 100 firms for which switch of DB pension plans available	1,402
Less: Firms without credit rating data	(1,090)
Sub-sample for Hypothesis 3	**312**
Number of FTSE 100 firms for which pension buy-ins and buyouts available	510
Less: Firms without credit rating data	(365)
Sub-sample for Hypothesis 4	**45**

Table 3.3: Distributions of credit rating categorized by firms' financial flexibility

S&P Credit Rating	Rating Variables	LFF		MFF		HFF		Total	
		Obs.	Perc.	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
AA+	2	6	3.0%	20	3.9%	5	1.9%	31	3.2%
AA	3	12	5.9%	13	2.6%	5	1.9%	30	3.1%
AA-	4	10	5.0%	38	7.5%	11	4.2%	59	6.1%
A+	5	18	8.9%	80	15.7%	32	12.3%	130	13.4%
A	6	18	8.9%	41	8.1%	28	10.8%	87	9.0%
A-	7	11	5.4%	60	11.8%	47	18.1%	118	12.2%
BBB+	8	22	10.9%	83	16.3%	41	15.8%	146	15.0%
BBB	9	21	10.4%	82	16.1%	39	15.0%	142	14.6%
BBB-	10	14	6.9%	61	12.0%	38	14.6%	113	11.6%
BB+	11	12	5.9%	11	2.2%	3	1.2%	26	2.7%
BB	12	12	5.9%	13	2.6%	5	1.9%	30	3.1%
BB-	13	9	4.5%	3	0.6%	4	1.5%	16	1.6%
B+	14	23	11.4%	1	0.2%	0	0.0%	24	2.5%
B	15	9	4.5%	3	0.6%	1	0.4%	13	1.3%
B-	16	5	2.5%	0	0.0%	1	0.4%	6	0.6%
Total		202	100.0%	509	100.0%	260	100.0	971	100.0%
	N	971							

This table reports the distribution of Standard & Poor's long-term issuer credit rating based on the LFF, MFF and HFF groups. Firms' financial flexibility is measured by dividend pay-out ratio. The cut-offs were 0.3 between low and moderate levels, and 0.7 between moderate and high levels of financial flexibility. The number and percentage of observations in each category of credit rating and total credit rating are reported in the table.

Table 3.4: Distribution of changes in credit rating categorized by firms' financial flexibility

Panel A: Distribution of changes in credit rating categorized by firms' financial flexibility for full UK sample

Changes in Credit Rating(DIFF)	LFF		MFF		HFF		Total	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
-5	0	0.0%	1	0.2%	0	0.0%	1	0.1%
-3	0	0.0%	1	0.2%	0	0.0%	1	0.1%
-2	4	2.3%	1	0.2%	1	0.4%	6	0.7%
-1	19	11.1%	22	4.9%	4	1.8%	45	5.3%
0	127	74.3%	373	83.8%	183	80.6%	683	81.0%
1	16	9.4%	34	7.6%	27	11.9%	77	9.1%
2	4	2.3%	8	1.8%	5	2.2%	17	2.0%
3	0	0.0%	5	1.1%	6	2.6%	11	1.3%
4	0	0.0%	0	0.0%	1	0.4%	1	0.1%
9	1	0.6%	0	0.0%	0	0.0%	1	0.1%
Total	171	100.0%	445	100.0%	227	100.0%	843	100.0%
N	843							

Panel B: Distribution of changes in credit rating categorized by firms' financial flexibility for sub-sample of cash holding and debt

Changes in Credit Rating(DIFF)	LFF		MFF		HFF		Total	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
-3	0	0.0%	1	0.5%	0	0.0%	1	0.3%
-2	0	0.0%	1	0.5%	0	0.0%	1	0.3%
-1	7	11.5%	9	4.3%	3	3.0%	19	5.1%
0	47	77.0%	177	83.9%	84	84.8%	308	83.0%
1	5	8.2%	15	7.1%	9	9.1%	29	7.8%
2	2	3.3%	3	1.4%	1	1.0%	6	1.6%
3	0	0.0%	5	2.4%	2	2.0%	7	1.9%
Total	61	100.0%	211	100.0%	99	100.0%	371	100.0%
N	371							

Panel C: Distribution of changes in credit rating categorized by firms' financial flexibility for sub-sample of pension asset allocations

Changes in Credit Rating(DIFF)	LFF		MFF		HFF		Total	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
-2	0	0.0%	1	0.4%	0	0.0%	1	0.3%
-1	5	8.6%	8	3.4%	2	2.0%	15	3.8%
0	46	79.3%	199	85.8%	87	87.0%	332	85.1%
1	5	8.6%	16	6.9%	9	9.0%	30	7.7%
2	2	3.4%	3	1.3%	1	1.0%	6	1.5%
3	0	0.0%	5	2.2%	1	1.0%	6	1.5%
Total	58	100.0%	232	100.0%	100	100.0%	390	100.0%
N	390							

Panel D: Distribution of changes in credit rating categorized by firms' financial flexibility for sub-sample of switch from DB to DC pension plans

Changes in Credit Rating(DIFF)	LFF		MFF		HFF		Total	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
-2	0	0.0%	1	0.5%	0	0.0%	1	0.3%
-1	3	10.0%	7	3.5%	2	2.4%	12	3.8%
0	23	76.7%	170	85.4%	69	83.1%	262	84.0%
1	2	6.7%	13	6.5%	9	10.8%	24	7.7%
2	2	6.7%	3	1.5%	1	1.2%	6	1.9%
3	0	0.0%	5	2.5%	2	2.4%	7	2.2%
Total	30	100.0%	199	100.0%	83	100.0%	312	100.0%
N	312							

Panel E: Distribution of changes in credit rating categorized by firms' financial flexibility for sub-sample of pension buy-ins and buy-outs

Changes in Credit Rating(DIFF)	LFF		MFF		HFF		Total	
	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.	Obs.	Perc.
-1	0	0.0%	1	3.8%	0	0.0%	1	2.4%
0	1	100.0%	24	92.3%	13	92.9%	38	92.7%
1	0	0.0%	0	0.0%	1	7.1%	1	2.4%
2	0	0.0%	1	3.8%	0	0.0%	1	2.4%
Total	1	100.0%	26	100.0%	14	100.0%	41	100.0%
N	41							

This table reports the distribution of Standard & Poor's credit rating changes (*DIFF*) based on firms' financial flexibility for full UK sample and sub-samples. Negative changes in credit ratings indicate an increase in credit ratings from the current year to the next year, while positive changes indicate a decrease in credit ratings. Firms' financial flexibility is measured by dividend pay-out ratio. The cut-offs were 0.3 between low and moderate levels, and 0.7 between moderate and high levels of financial flexibility. The number and percentage of observations in each category of credit rating changes and total credit rating changes are reported in the table.

Table 3.5: Descriptive statistics for cash holdings and debt in different financial flexibility groups

Panel A: LFF sample

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	61	8.72	2.60	5.00	15.00	7.00	8.00	10.00
DIFF	61	0.03	0.58	-1.00	2.00	0.00	0.00	0.00
CASH	61	0.08	0.09	0.00	0.38	0.02	0.05	0.10
DEBT	61	0.00	0.08	-0.26	0.27	-0.02	-0.00	0.02
MB	61	1.61	1.27	0.76	6.71	1.00	1.18	1.79
Tangibility	61	0.45	0.28	0.00	0.89	0.21	0.49	0.67
SGA	61	0.22	0.14	-0.01	0.59	0.08	0.21	0.30
PROFIT	61	0.15	0.11	-0.04	0.49	0.09	0.12	0.17
SIZE	61	21.95	1.86	18.55	25.98	20.64	21.68	23.42
OPRISK	61	0.09	0.07	0.01	0.28	0.04	0.07	0.11

Panel B: MFF sample

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	211	7.25	2.51	2.00	12.00	5.00	8.00	9.00
DIFF	211	0.10	0.66	-3.00	3.00	0.00	0.00	0.00
CASH	211	0.09	0.07	0.00	0.39	0.04	0.07	0.12
DEBT	211	0.01	0.06	-0.14	0.27	-0.02	0.00	0.03
MB	211	1.82	0.89	0.79	6.07	1.23	1.53	2.17
Tangibility	211	0.33	0.23	0.00	0.89	0.13	0.28	0.51
SGA	211	0.25	0.16	0.02	0.72	0.10	0.24	0.35
PROFIT	211	0.14	0.08	-0.03	0.38	0.08	0.12	0.19
SIZE	211	23.06	1.25	20.33	25.98	22.06	23.03	23.76
OPRISK	211	0.04	0.05	0.00	0.28	0.02	0.03	0.05

Panel C: HFF sample

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	99	8.14	1.94	4.00	13.00	7.00	8.00	10.00
DIFF	99	0.14	0.57	-1.00	3.00	0.00	0.00	0.00
CASH	99	0.08	0.06	0.00	0.35	0.03	0.06	0.09
DEBT	99	0.02	0.06	-0.12	0.22	-0.02	0.00	0.05
MB	99	1.49	0.48	0.85	2.92	1.17	1.35	1.57
Tangibility	99	0.29	0.24	0.00	0.88	0.10	0.21	0.43
SGA	99	0.25	0.16	0.01	0.93	0.14	0.23	0.35
PROFIT	99	0.07	0.04	0.00	0.21	0.04	0.07	0.09
SIZE	99	22.53	1.15	20.26	24.89	21.54	22.45	23.50
OPRISK	99	0.03	0.04	0.00	0.28	0.01	0.03	0.04

This tables reports descriptive statistics for firms' Standard & Poor's credit rating, pension de-risking strategies and financial characteristics from 2004-2013. Standard & Poor's credit rating data were collected from the Capital IQ and the Thomson One Banker databases. Accounting information was collected from Thomson One Banker. Information on switching from DB to DC pension plans was collected from annual reports. Pension buy-in and buy-out information was collected from Lane Clark and Peacock (2005); (2014b) reports. The initial sample covered FTSE All-Share companies. *CR* indicates the Standard & Poor's long-term issuer credit ratings. The highest credit rating was coded as 1 and the lowest as 16. All variable definitions are reported in Table 3.1.

Table 3.6: Descriptive statistics for pension asset allocations in different financial flexibility groups

Panel A: LFF sample

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	58	8.50	2.72	5.00	15.00	6.00	8.00	10.00
DIFF	58	0.07	0.56	-1.00	2.00	0.00	0.00	0.00
EQUITY	58	0.51	0.17	0.05	0.83	0.40	0.55	0.64
MB	58	1.26	0.46	0.76	3.25	0.97	1.09	1.37
Tangibility	58	0.41	0.30	0.00	0.89	0.01	0.47	0.63
SGA	58	0.22	0.15	-0.01	0.59	0.07	0.21	0.31
PROFIT	58	0.15	0.11	-0.04	0.49	0.08	0.12	0.17
SIZE	58	21.99	1.90	18.55	25.98	20.68	21.53	23.49
OPRISK	58	0.08	0.06	0.01	0.28	0.04	0.06	0.10

Panel B: MFF sample

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	232	7.07	2.42	2.00	12.00	5.00	7.00	9.00
DIFF	232	0.12	0.60	-2.00	3.00	0.00	0.00	0.00
EQUITY	232	0.48	0.17	0.05	0.83	0.37	0.49	0.60
MB	232	1.60	0.68	0.79	4.81	1.12	1.36	1.87
Tangibility	232	0.30	0.23	0.00	0.89	0.11	0.24	0.48
SGA	232	0.26	0.18	0.01	0.78	0.10	0.22	0.37
PROFIT	232	0.12	0.08	-0.06	0.37	0.07	0.10	0.15
SIZE	232	23.12	1.29	19.52	25.98	22.14	23.08	23.84
OPRISK	232	0.03	0.03	0.00	0.28	0.01	0.03	0.04

Panel C: HFF sample

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	100	7.94	1.98	4.00	13.00	7.00	8.00	9.00
DIFF	100	0.12	0.48	-1.00	3.00	0.00	0.00	0.00
EQUITY	100	0.48	0.16	0.07	0.83	0.36	0.50	0.61
MB	100	1.44	0.45	0.85	2.92	1.11	1.33	1.55
Tangibility	100	0.28	0.24	0.00	0.88	0.08	0.19	0.42
SGA	100	0.25	0.18	-0.01	0.93	0.12	0.21	0.32
PROFIT	100	0.07	0.04	0.00	0.21	0.04	0.06	0.09
SIZE	100	22.55	1.20	19.39	24.60	21.51	22.84	23.53
OPRISK	100	0.03	0.04	0.00	0.28	0.01	0.02	0.04

This tables reports descriptive statistics for firms' Standard & Poor's credit rating, pension de-risking strategies and financial characteristics from 2004-2013. Standard & Poor's credit rating data were collected from the Capital IQ and Thomson One Banker databases. Accounting information was collected from the Thomson One Banker. Information on switching from DB to DC pension plans was collected from annual reports. Pension buy-in and buy-out information was collected from Lane Clark and Peacock (2005); (2014b) reports. The initial sample covered FTSE All-Share companies. *CR* indicates the Standard & Poor's long-term issuer credit rating. The highest credit rating coded as 1 and the lowest as 16. All variable definitions are reported in Table 3.1.

Table 3.7: Descriptive statistics for switches from DB to DC pension plans in different financial flexibility groups

Panel A: LFF sample

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	30	7.73	2.03	5.00	12.00	6.00	7.50	9.00
DIFF	30	0.10	0.66	-1.00	2.00	0.00	0.00	0.00
SWITCH	30	0.93	0.45	0.00	2.00	1.00	1.00	1.00
MB	30	1.34	0.51	0.87	3.25	1.02	1.18	1.41
Tangibility	30	0.34	0.23	0.00	0.67	0.10	0.43	0.53
SGA	30	0.23	0.14	-0.01	0.59	0.19	0.22	0.26
PROFIT	30	0.15	0.09	0.03	0.49	0.08	0.14	0.17
SIZE	30	22.43	1.74	19.49	25.98	20.75	23.09	23.42
OPRISK	30	0.08	0.06	0.01	0.21	0.04	0.06	0.10

Panel B: MFF sample

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	199	6.86	2.50	2.00	12.00	5.00	7.00	9.00
DIFF	199	0.13	0.63	-2.00	3.00	0.00	0.00	0.00
SWITCH	199	0.76	0.57	0.00	2.00	0.00	1.00	1.00
MB	199	1.66	0.70	0.86	4.81	1.15	1.45	1.93
Tangibility	199	0.30	0.23	0.00	0.77	0.11	0.25	0.48
SGA	199	0.23	0.16	0.02	0.78	0.10	0.20	0.32
PROFIT	199	0.12	0.08	-0.06	0.37	0.07	0.11	0.16
SIZE	199	23.24	1.29	19.52	25.98	22.25	23.22	24.07
OPRISK	199	0.03	0.03	0.00	0.19	0.01	0.03	0.04

Panel C: HFF sample

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	83	7.61	1.67	4.00	12.00	7.00	8.00	9.00
DIFF	83	0.18	0.61	-1.00	3.00	0.00	0.00	0.00
SWITCH	83	0.64	0.55	0.00	2.00	0.00	1.00	1.00
MB	83	1.46	0.47	0.85	2.92	1.14	1.31	1.54
Tangibility	83	0.23	0.20	0.00	0.76	0.09	0.17	0.36
SGA	83	0.24	0.16	-0.01	0.87	0.09	0.23	0.31
PROFIT	83	0.07	0.04	0.00	0.21	0.04	0.07	0.09
SIZE	83	22.78	1.13	19.39	24.89	21.89	23.04	23.56
OPRISK	83	0.03	0.03	0.00	0.14	0.01	0.02	0.04

This tables reports descriptive statistics for firms' Standard & Poor's credit rating, pension de-risking strategies and financial characteristics from 2004-2013. Standard & Poor's credit rating data were collected from the Capital IQ and the Thomson One Banker databases. Accounting information was collected from Thomson One Banker. Information on switching from DB to DC pension plans was collected from annual reports. Pension buy-in and buy-out information was collected from Lane Clark and Peacock (2005); (2014b) reports. The initial sample covered FTSE All-Share companies. *CR* indicates the Standard & Poor's long-term issuer credit rating. The highest credit rating coded as 1 and the lowest as 16. All variable definitions are reported in Table 3.1.

Table 3.8: Descriptive statistics for pension buy-ins and buy-outs and pension risk

Panel A: Descriptive statistics for pension buy-ins and buy-outs

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	45	7.62	2.32	3.00	12.00	7.00	8.00	9.00
DIFF	45	0.07	0.39	-1.00	2.00	0.00	0.00	0.00
BUYOUT	45	0.73	1.42	0.00	5.00	0.00	0.00	1.00
MB	45	2.20	0.88	1.01	4.30	1.57	2.00	2.69
Tangibility	45	0.26	0.13	0.00	0.48	0.19	0.28	0.37
SGA	45	0.22	0.11	0.04	0.48	0.13	0.19	0.31
PROFIT	45	0.15	0.11	0.00	0.37	0.07	0.12	0.25
SIZE	45	22.18	1.09	20.26	24.07	21.70	21.91	22.06
OPRISK	45	0.06	0.06	0.00	0.28	0.03	0.03	0.06

Panel B: Descriptive statistics for pension risk

Variables	*N*	*Mean*	*S.D*	*Min*	*Max*	*25th Percentile*	*Median*	*75th Percentile*
CR	432	7.56	2.37	2.00	15.00	6.00	8.00	9.00
DIFF	432	0.13	0.60	-2.00	4.00	0.00	0.00	0.00
Pension_Risk1	432	0.54	0.73	0.00	5.55	0.16	0.31	0.61
Pension_Risk2	432	-0.04	0.10	-0.66	0.16	-0.06	-0.02	-0.00
MB	432	1.48	0.60	0.68	4.81	1.05	1.30	1.67
Tangibility	432	0.30	0.25	0.00	0.89	0.10	0.24	0.50
SGA	432	0.24	0.17	-0.01	0.93	0.10	0.21	0.34
PROFIT	432	0.10	0.09	-0.24	0.49	0.05	0.09	0.14
SIZE	432	22.79	1.47	18.55	25.98	21.67	23.03	23.74
OPRISK	432	0.04	0.04	0.00	0.28	0.01	0.03	0.05

This tables reports descriptive statistics for firms' Standard & Poor's credit rating, pension de-risking strategies and financial characteristics from 2004-2013. Standard & Poor's credit rating data were collected from the Capital IQ and Thomson One Banker databases. Accounting information was collected from the Thomson One Banker. Information on switching from DB to DC pension plans was collected from annual reports. Pension buy-in and buy-out information was collected from Lane Clark and Peacock (2005); (2014b) reports. The initial sample covered FTSE All-Share companies. *CR* indicates the Standard & Poor's long-term issuer credit rating. The highest credit rating coded as 1 and the lowest as 16. All variable definitions are reported in Table 3.1.

Table 3.9: Correlation matrix

Panel A: Correlation between credit rating and firm's financial characteristics

	CR	*CASH*	*DEBT*	*MB*	*Tangibility*	*SGA*	*PROFIT*	*SIZE*	*OPRISK*
CR	1.000								
CASH	-0.078	1.000							
	(0.133)								
DEBT	-0.157**	0.085	1.000						
	(0.002)	(0.101)							
MB	0.077	0.326***	0.035	1.000					
	(0.139)	(0.000)	(0.505)						
Tangibility	0.076	-0.280***	0.047	-0.239***	1.000				
	(0.146)	(0.000)	(0.369)	(0.000)					
SGA	-0.145**	0.348***	-0.015	0.057	-0.350***	1.000			
	(0.005)	(0.000)	(0.779)	(0.276)	(0.000)				
PROFIT	-0.262***	0.261***	0.153**	0.499***	-0.031	0.195***	1.000		
	(0.000)	(0.000)	(0.003)	(0.000)	(0.555)	(0.000)			
SIZE	-0.621***	-0.067	0.017	-0.126*	0.131*	-0.029	0.122*	1.000	
	(0.000)	(0.198)	(0.749)	(0.015)	(0.011)	(0.579)	(0.018)		
OPRISK	0.136**	0.190***	-0.006	0.327***	-0.194***	0.046	0.252***	-0.233***	1.000
	(0.009)	(0.000)	(0.902)	(0.000)	(0.000)	(0.374)	(0.000)	(0.000)	

Panel A presents correlation coefficients for the sub-sample, focusing on relationships among firms' cash holdings, debt and credit ratings. *P-values* are reported in parentheses. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. All variables are reported in Table 3.1.

Panel B: Correlation between credit rating and pension asset allocation in sub-sample

	CR	*EQUITY*	*MB*	*Tangibility*	*SGA*	*PROFIT*	*SIZE*	*OPRISK*
CR	1.000							
EQUITY	-0.152**	1.000						
	(0.003)							
MB	0.016	0.112*	1.000					
	(0.758)	(0.028)						
Tangibility	0.160**	0.255***	-0.082	1.000				
	(0.002)	(0.000)	(0.104)					
SGA	-0.099	-0.045	-0.022	-0.237***	1.000			
	(0.050)	(0.373)	(0.671)	(0.000)				
PROFIT	-0.202***	0.092	0.509***	0.153**	0.157**	1.000		
	(0.000)	(0.070)	(0.000)	(0.002)	(0.002)			
SIZE	-0.573***	0.024	-0.089	0.137**	-0.119*	0.084	1.000	
	(0.000)	(0.642)	(0.080)	(0.007)	(0.018)	(0.099)		
OPRISK	0.118*	-0.187***	-0.048	-0.082	-0.030	0.156**	-0.229***	1.000
	(0.019)	(0.000)	(0.346)	(0.104)	(0.559)	(0.002)	(0.000)	

Panel B presents correlation coefficients for the sub-sample, for relationships among pension asset allocations, firms' financial characteristics and credit ratings. *P-values* are reported in parentheses. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. All variables are reported in Table 3.1.

Panel C: Correlation between credit rating and switch from DB to DC pension plans in sub-sample

	CR	*SWITCH*	*MB*	*Tangibility*	*SGA*	*PROFIT*	*SIZE*	*OPRISK*
CR	1.000							
SWITCH	0.102	1.000						
	(0.073)							
MB	0.064	0.026	1.000					
	(0.259)	(0.651)						
Tangibility	0.023	-0.112*	-0.060	1.000				
	(0.690)	(0.048)	(0.287)					
SGA	-0.151**	0.163**	-0.007	-0.341***	1.000			
	(0.008)	(0.004)	(0.907)	(0.000)				
PROFIT	-0.143*	0.042	0.619***	0.148**	0.116*	1.000		
	(0.011)	(0.458)	(0.000)	(0.009)	(0.041)			
SIZE	-0.502***	-0.057	-0.189***	0.308***	-0.223***	-0.011	1.000	
	(0.000)	(0.320)	(0.001)	(0.000)	(0.000)	(0.848)		
OPRISK	0.233***	0.169**	0.029	-0.036	-0.016	0.175**	-0.167**	1.000
	(0.000)	(0.003)	(0.609)	(0.527)	(0.784)	(0.002)	(0.003)	

Panel C presents correlation coefficients for the sub-sample, for relationships among switching from DB to DC pension plans, firms' financial characteristics and credit ratings. *P-values* are reported in parentheses. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. All variables are reported in Table 3.1.

Panel D: Correlation between credit rating and pension buy-ins and buy-outs in sub-sample

	CR	*BUYOUT*	*MB*	*Tangibility*	*SGA*	*PROFIT*	*SIZE*	*OPRISK*
CR	1.000							
BUYOUT	0.185	1.000						
	(0.246)							
MB	-0.501***	0.353*	1.000					
	(0.001)	(0.024)						
Tangibility	0.359*	-0.031	0.118	1.000				
	(0.021)	(0.846)	(0.464)					
SGA	-0.749***	-0.152	0.325*	-0.550***	1.000			
	(0.000)	(0.344)	(0.038)	(0.000)				
PROFIT	-0.289	0.436**	0.877***	0.252	0.087	1.000		
	(0.067)	(0.004)	(0.000)	(0.112)	(0.590)			
SIZE	-0.767***	-0.065	0.595***	0.105	0.553***	0.477**	1.000	
	(0.000)	(0.685)	(0.000)	(0.515)	(0.000)	(0.002)		
OPRISK	-0.095	-0.057	-0.457**	-0.557***	-0.054	-0.510***	-0.419**	1.000
	(0.555)	(0.724)	(0.003)	(0.000)	(0.736)	(0.001)	(0.006)	

Panel D presents correlation coefficients for the sub-sample, for relationships among pension buy-ins and buy-outs, firms' financial characteristics and credit ratings. *P-values* are reported in parentheses. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. All variables are reported in Table 3.1.

Panel E: Correlation between credit rating and pension risks in sub-sample

	CR	*Pension_Risk1*	*Pension_Risk2*	*MB*	*Tangibility*	*SGA*	*PROFIT*	*SIZE*	*OPRISK*
CR	1.000								
Pension_Risk1	0.177***	1.000							
	(0.000)								
Pension_Risk2	-0.061	-0.636***	1.000						
	(0.220)	(0.000)							
MB	0.019	0.222***	0.059	1.000					
	(0.711)	(0.000)	(0.236)						
Tangibility	0.156**	0.040	0.010	-0.081	1.000				
	(0.002)	(0.421)	(0.845)	(0.106)					
SGA	-0.098*	0.075	-0.098*	-0.019	-0.245***	1.000			
	(0.050)	(0.136)	(0.049)	(0.700)	(0.000)				
PROFIT	-0.203***	-0.036	0.136**	0.513***	0.150**	0.155**	1.000		
	(0.000)	(0.477)	(0.006)	(0.000)	(0.003)	(0.002)			
SIZE	-0.576***	-0.012	-0.096	-0.096	0.141**	-0.121*	0.080	1.000	
	(0.000)	(0.807)	(0.054)	(0.055)	(0.005)	(0.015)	(0.111)		
OPRISK	0.116*	-0.092	0.136**	-0.047	-0.079	-0.029	0.152**	-0.223***	1.000
	(0.020)	(0.066)	(0.006)	(0.351)	(0.114)	(0.561)	(0.002)	(0.000)	

Panel E presents correlation coefficients for the sub-sample, for the relationship among pension risks, firms' financial characteristics and credit ratings. *P-values* are reported in parentheses. * $p < 0.05$, ** $p < 0.01$ and *** $p < 0.001$. All variables are reported in Table 3.1.

Table 3.10: Financial characteristics for firms with different financial flexibility groups categorized by dividend pay-out ratio

Panel A: LFF versus MFF

Variables	*LFF*	*MFF*	
	Mean	*Mean*	*Diff/SE*
CR	8.485	7.105	1.380***
			(0.253)
CASH	0.085	0.080	0.006
			(0.007)
DEBT	0.001	0.008	-0.007
			(0.006)
EQUITY	0.465	0.478	-0.013
			(0.020)
SWITCH	0.877	0.685	0.192*
			(0.085)
BUYOUT	1.857	0.837	1.020
			(0.641)
Pension_Risk1	0.580	0.582	-0.002
			(0.104)
Pension_Risk2	-0.034	-0.045	0.011
			(0.010)
MB	1.297	1.710	-0.413***
			(0.095)
Tangibility	0.354	0.260	0.094***
			(0.025)
SGA	0.170	0.266	-0.096***
			(0.017)
PROFIT	0.112	0.122	-0.011
			(0.010)
SIZE	20.926	22.828	-1.902***
			(0.155)
OPRISK	0.105	0.042	0.064***
			(0.006)

Panel B: LFF versus HFF

Variables	*LFF*	*HFF*	
	Mean	*Mean*	*Diff/SE*
CR	8.485	7.674	0.811**
			(0.301)
CASH	0.085	0.081	0.004
			(0.008)
DEBT	0.001	0.007	-0.006
			(0.008)
EQUITY	0.465	0.489	-0.024
			(0.023)
SWITCH	0.877	0.466	0.411***
			(0.085)
BUYOUT	1.857	0.458	1.399**
			(0.397)
Pension_Risk1	0.580	0.551	0.029
			(0.126)
Pension_Risk2	-0.034	-0.052	0.018
			(0.012)
MB	1.297	1.657	-0.360***
			(0.101)
Tangibility	0.354	0.271	0.083**
			(0.029)
SGA	0.170	0.236	-0.066***
			(0.019)
PROFIT	0.112	0.083	0.029*
			(0.012)
SIZE	20.926	22.409	-1.482***
			(0.190)
OPRISK	0.105	0.037	0.068***
			(0.007)

Panel C: MFF versus HFF

Variables	*MFF*	*HFF*	
	Mean	*Mean*	*Diff/SE*
CR	7.105	7.674	-0.569**
			(0.195)
CASH	0.080	0.081	-0.001
			(0.006)
DEBT	0.008	0.007	0.001
			(0.005)
EQUITY	0.478	0.489	-0.011
			(0.016)
SWITCH	0.685	0.466	0.219***
			(0.059)
BUYOUT	0.837	0.458	0.379
			(0.343)
Pension_Risk1	0.582	0.551	0.031
			(0.076)
Pension_Risk2	-0.045	-0.052	0.007
			(0.008)
MB	1.710	1.657	0.052
			(0.089)
Tangibility	0.260	0.271	-0.011
			(0.020)
SGA	0.266	0.236	0.030
			(0.017)
PROFIT	0.122	0.083	0.039***
			(0.009)
SIZE	22.828	22.409	0.419***
			(0.121)
OPRISK	0.042	0.037	0.005
			(0.004)

This table reports the t-tests to compare firms with different financial characteristics, credit rating and pension de-risking strategies in LFF, MFF and HFF samples. Firms' financial flexibility is measured by dividend pay-out ratio. The cut-offs were 0.3 between low and moderate levels, and 0.7 between moderate and high levels of financial flexibility. Different financial characteristics, credit ratings and pension de-risking strategies of the LFF, MFF and HFF are compared. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Table 3.1.

Table 3.11: Financial characteristics for different financial flexibility groups categorized by changes in dividends

Variables	*LFF*	*HFF*	
	Mean	*Mean*	*Diff/SE*
CR	7.437	7.391	0.047
			(0.220)
CASH	0.078	0.098	-0.020**
			(0.007)
DEBT	0.008	-0.010	0.018**
			(0.006)
EQUITY	0.482	0.455	0.027
			(0.016)
SWITCH	0.645	0.780	-0.135*
			(0.063)
BUYOUT	0.909	0.773	0.136
			(0.357)
Pension_Risk1	0.546	0.628	-0.082
			(0.079)
Pension_Risk2	-0.049	-0.048	-0.002
			(0.009)
MB	1.644	1.367	0.277**
			(0.085)
Tangibility	0.262	0.283	-0.021
			(0.022)
SGA	0.239	0.204	0.035*
			(0.016)
PROFIT	0.110	0.081	0.029**
			(0.010)
SIZE	22.422	21.990	0.431**
			(0.158)
OPRISK	0.053	0.068	-0.015**
			(0.006)

This table reports the t-tests to compare firms with different financial characteristics, credit rating and pension de-risking strategies in LFF, MFF and HFF samples. Firms' financial flexibility is measured by changes in dividends. A negative changes in dividend indicates LFF, with HFF otherwise. Different financial characteristics, credit ratings and pension de-risking strategies of the LFF, MFF and HFF are compared. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All variable definitions are reported in Table 3.1.

Table 3.12: Relationship between firm's capital structure and changes in credit ratings in terms of financial flexibility levels

$$DIFF_{it} = CR_{it+1} - CR_{it} = \alpha_0 + \beta_1 \Delta \mathrm{CASH}_{\mathrm{it}} (\Delta \mathrm{DEBT}_{\mathrm{it}}) + \beta_2 \Delta \mathrm{MB}_{\mathrm{it}} + \beta_3 \Delta \mathrm{Tangibility}_{\mathrm{it}} + \beta_4 \Delta \mathrm{SGA}_{\mathrm{it}} + \beta_5 \Delta \mathrm{PROFIT}_{\mathrm{it}} + \beta_6 \Delta \mathrm{SIZE}_{\mathrm{it}} + \beta_7 \Delta \mathrm{OPRISK}_{\mathrm{it}} + \varepsilon_{\mathrm{it}}$$

Dependent Variable		*DIFF*					
	Exp. Sign	(1) *LFF*	(2) *MFF*	(3) *HFF*	(4) *LFF*	(5) *MFF*	(6) *HFF*
ΔCASH	-	-7.287**	-3.828*	-14.90***			
		(3.685)	(1.974)	(3.235)			
ΔDEBT	+				1.599	2.146**	4.018
					(1.666)	(0.892)	(2.822)
ΔMB	-	-0.599	-0.229	-1.099	-0.701	-0.0337	-1.175
		(0.598)	(0.322)	(1.135)	(0.598)	(0.322)	(0.989)
ΔTangibility	-	-9.324	-5.200	-7.416	-9.721	-3.065	2.838
		(7.635)	(3.241)	(5.061)	(8.909)	(3.283)	(5.639)
ΔSGA	-	-0.522	-3.477*	0.362	-6.850	-2.922*	-2.544
		(7.346)	(1.901)	(1.704)	(6.982)	(1.633)	(2.341)
ΔPROFIT	-	-2.195	0.792	-6.034*	-3.576**	-0.959	-4.246
		(1.489)	(2.567)	(3.652)	(1.597)	(2.388)	(3.535)
ΔSIZE	-	-2.628	-1.103	-0.948	-2.791*	-0.565	-0.618
		(1.646)	(0.803)	(1.342)	(1.495)	(0.732)	(0.863)
ΔOPRISK	+	12.16*	6.604	-3.630	9.605	6.779	-0.931
		(6.347)	(5.088)	(7.435)	(6.367)	(5.151)	(6.639)
Observations[§]		50	204	79	51	199	82
Pseudo R^2		0.174	0.042	0.127	0.137	0.042	0.079

This table reports estimations for an ordered probit model from 2004 to 2013 in a sample categorized by firms' financial flexibility. Firms' financial flexibility is measured by the dividend pay-out ratio. This suggests an association between cash holdings or debt and changes in credit ratings. The number of observations and pseudo R^2 values are reported. All regressions include clustered standard errors by firm. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All explanatory variables are winsorized at the 1% level. All variable definitions are reported in Table 3.1.

[§] Due to the missing values of lagged independent variables, the numbers of observations for each sub-sample is further reduced and different from the sample selection table. However, this does not affect the main results in the regression tests.

Table 3.13: Relationship between pension asset allocations and changes in credit ratings in terms of financial flexibility levels

$$DIFF_{it} = CR_{it+1} - CR_{it} = \alpha_0 + \beta_1 \Delta \text{EQUITY}_{it} + \beta_2 \Delta \text{MB}_{it} + \beta_3 \Delta \text{Tangibility}_{it} + \beta_4 \Delta \text{SGA}_{it} + \beta_5 \Delta \text{PROFIT}_{it} + \beta_6 \Delta \text{SIZE}_{it} + \beta_7 \Delta \text{OPRISK}_{it} + \varepsilon_{it}$$

Dependent Variable		*DIFF*		
	Exp. Sign	(1) *LFF*	(2) *MFF*	(3) *HFF*
ΔEQUITY	?	-2.042	-2.077**	-1.977
		(1.626)	(0.970)	(2.373)
ΔMB	-	-1.235**	-0.767**	-2.255**
		(0.602)	(0.336)	(1.075)
ΔTangibility	-	-6.064	-3.204	3.079
		(9.574)	(3.849)	(4.352)
ΔSGA	-	-3.814	-2.521	-1.036
		(9.120)	(1.675)	(2.160)
ΔPROFIT	-	-3.061**	3.508	-1.312
		(1.372)	(3.182)	(3.380)
ΔSIZE	-	-2.552	-1.227	-0.731
		(1.883)	(0.891)	(1.021)
ΔOPRISK	+	8.502	9.899	12.11**
		(5.357)	(6.542)	(6.090)
Observations		48	194	75
Pseudo R^2		0.145	0.0736	0.0920

This table reports estimations for an ordered probit model from 2004 to 2013 in a sample categorized by firms' financial flexibility. This suggests an association between pension asset allocations and changes in credit ratings. The number of observations and pseudo R^2 values are reported. All regressions include clustered standard errors by firm. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All explanatory variables are winsorized at the 1% level. All variable definitions are reported in Table 3.1.

Table 3.14: Relationship between switches from DB to DC pension plans and changes in credit ratings in terms of financial flexibility levels

$$DIFF_{it} = CR_{it+1} - CR_{it} = \alpha_0 + \beta_1 \mathrm{SWITCH}_{it} + \beta_2 \Delta \mathrm{MB}_{it} + \beta_3 \Delta \mathrm{Tangibility}_{it} + \beta_4 \Delta \mathrm{SGA}_{it} + \beta_5 \Delta \mathrm{PROFIT}_{it} + \beta_6 \Delta \mathrm{SIZE}_{it} + \beta_7 \Delta \mathrm{OPRISK}_{it} + \varepsilon_{it}$$

Dependent Variable		*DIFF*			
	Exp. Sign	(1) *LFF*	(2) *MFF*	(3) *LFF and MFF*	(4) *HFF*
SWITCH	?	1.360**	-0.977***	-0.686***	-0.126
		(0.553)	(0.241)	(0.229)	(0.292)
ΔMB	-	-6.071**	-1.014**	-0.731**	-2.581***
		(2.420)	(0.411)	(0.339)	(0.941)
ΔTangibility	-	-7.902	-3.018	-3.675	4.212
		(11.81)	(4.342)	(2.875)	(4.223)
ΔSGA	-	-17.60*	-2.310	-0.299	-3.104
		(9.537)	(2.009)	(2.953)	(2.099)
ΔPROFIT	-	-18.02**	5.128	-0.382	-0.362
		(7.055)	(3.371)	(1.029)	(2.294)
ΔSIZE	-	-2.683	-1.387	-1.594**	-0.882
		(1.976)	(1.025)	(0.707)	(0.869)
ΔOPRISK	+	77.11***	10.50	8.338	12.78**
		(27.95)	(9.467)	(7.967)	(6.012)
Observations		28	175	203	88
Pseudo R^2		0.338	0.169	0.116	0.102

This table reports estimations for an ordered probit model from 2004 to 2013 in a sample categorized by firms' financial flexibility. This suggests an association between switching from DB to DC pension plans and changes in credit ratings. The number of observations and pseudo R^2 values are reported. All regressions include clustered standard errors by firm. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All explanatory variables are winsorized at the 1% level. All variable definitions are reported in Table 3.1.

Table 3.15: Association between capital structure and changes in credit ratings in terms of alternative financial flexibility measure

$$DIFF_{it} = CR_{it+1} - CR_{it} = \alpha_0 + \beta_1 \Delta \mathrm{CASH}_{\mathrm{it}}(\Delta \mathrm{DEBT}_{\mathrm{it}}) + \beta_2 \Delta \mathrm{MB}_{\mathrm{it}} + \beta_3 \Delta \mathrm{Tangibility}_{\mathrm{it}} + \beta_4 \Delta \mathrm{SGA}_{\mathrm{it}} + \beta_5 \Delta \mathrm{PROFIT}_{\mathrm{it}} + \beta_6 \Delta \mathrm{SIZE}_{\mathrm{it}} + \beta_7 \Delta \mathrm{OPRISK}_{\mathrm{it}} + \varepsilon_{\mathrm{it}}$$

Dependent Variable		*DIFF*			
	Exp. Sign	(1) LFF	(2) HFF	(3) LFF	(4) HFF
ΔCASH	-	-5.234***	-12.14**		
		(1.411)	(5.338)		
ΔDEBT	+			0.401	4.395**
				(1.119)	(2.160)
ΔMB	-	-0.303	-1.337***	-0.169	-1.423***
		(0.297)	(0.490)	(0.333)	(0.483)
ΔTangibility	-	-6.336***	-3.552	-4.605**	3.847
		(2.280)	(5.429)	(2.342)	(5.909)
ΔSGA	-	-0.0986	-6.659	-1.057	-5.929***
		(1.966)	(6.110)	(1.778)	(1.328)
ΔPROFIT	-	-1.635	-6.377***	-2.327*	-6.091***
		(1.162)	(2.020)	(1.202)	(2.256)
ΔSIZE	-	-1.281**	0.595	-0.970**	0.198
		(0.645)	(1.247)	(0.494)	(0.869)
ΔOPRISK	+	3.446	28.37***	5.138	17.41**
		(3.364)	(7.395)	(3.579)	(7.797)
Observations		284	66	282	70
Pseudo R^2		0.0566	0.170	0.0383	0.165

This table reports estimations for an ordered probit model from 2004 to 2013 in a sample categorized by firms' financial flexibility. Firms' financial flexibility is measured by changes in dividends. This suggests an association between cash holdings or debt and changes in credit ratings. The number of observations and pseudo R^2 values are reported. All regressions include clustered standard errors by firm. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All explanatory variables are winsorized at the 1% level. All variable definitions are reported in Table 3.1.

Table 3.16: Association among pension asset allocations, switches from DB to DC pension plans and changes in credit ratings in terms of alternative financial flexibility measure

$$DIFF_{it} = CR_{it+1} - CR_{it} = \alpha_0 + \beta_1 \Delta \text{EQUITY}_{\text{it}}(\text{SWITCH}_{\text{it}}) + \beta_2 \Delta \text{MB}_{\text{it}} + \beta_3 \Delta \text{Tangibility}_{\text{it}} + \beta_4 \Delta \text{SGA}_{\text{it}} + \beta_5 \Delta \text{PROFIT}_{\text{it}} + \beta_6 \Delta \text{SIZE}_{\text{it}} + \beta_7 \Delta \text{OPRISK}_{\text{it}} + \varepsilon_{\text{it}}$$

Dependent Variable		*DIFF*			
	Exp. Sign	(1) LFF	(2) HFF	(3) LFF	(4) HFF
ΔEQUITY	?	-2.613**	-6.153*		
		(1.107)	(3.672)		
SWITCH	-			-0.301	-0.538
				(0.223)	(0.563)
ΔMB	-	-1.059***	-1.686*	-1.222***	-2.615***
		(0.406)	(0.984)	(0.408)	(0.975)
ΔTangibility	-	-1.051	-2.327	-0.346	6.661
		(2.604)	(6.866)	(2.947)	(9.041)
ΔSGA	-	-0.372	-15.82***	-0.397	-32.85***
		(2.117)	(5.213)	(2.194)	(9.740)
ΔPROFIT	-	0.302	-9.953**	1.366	-17.79***
		(1.545)	(4.651)	(1.989)	(5.181)
ΔSIZE	-	-1.857***	-0.00200	-2.145**	6.459***
		(0.686)	(1.034)	(0.864)	(2.402)
ΔOPRISK	+	3.369	20.09	3.779	53.90***
		(5.091)	(18.73)	(7.784)	(18.67)
Observations		267	66	225	61
Pseudo R^2		0.132	0.426	0.147	0.464

This table reports estimations for an ordered probit model from 2004 to 2013 in a sample categorized by firms' financial flexibility. Firms' financial flexibility is measured by changes in dividends. This suggests an association between pension asset allocations and changes in credit ratings. The number of observations and pseudo R^2 values are reported. All regressions include clustered standard errors by firm. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All explanatory variables are winsorized at the 1% level. All variable definitions are reported in Table 3.1.

Table 3.17: Association between corporate pension risk and changes in credit ratings in terms of financial flexibility levels

$$DIFF_{it} = CR_{it+1} - CR_{it} = \alpha_0 + \beta_1 \Delta \text{Pension\_Risk1}_{it}(\text{Pension\_Risk2}_{it}) + \beta_2 \Delta \text{MB}_{it} + \beta_3 \Delta \text{Tangibility}_{it} + \beta_4 \Delta \text{SGA}_{it} + \beta_5 \Delta \text{PROFIT}_{it} + \beta_6 \Delta \text{SIZE}_{it} + \beta_7 \Delta \text{OPRISK}_{it} + \varepsilon_{it}$$

Dependent Variable		*DIFF*					
VARIABLES	*Exp. Sign*	(1) LFF	(2) MFF	(3) HFF	(4) LFF	(5) MFF	(6) HFF
ΔPension_Risk1	+	1.342*	0.312	-0.247			
		(0.801)	(0.266)	(0.570)			
ΔPension_Risk2	-				-2.886	-1.318	-0.961
					(2.245)	(2.014)	(1.512)
ΔMB	-	-1.556**	-0.955***	-2.386**	-1.444**	-0.883***	-2.538***
		(0.631)	(0.357)	(1.067)	(0.583)	(0.334)	(0.897)
ΔTangibility	-	-8.401	-3.166	3.979	-8.215	-2.988	3.160
		(9.703)	(3.802)	(4.274)	(9.908)	(3.767)	(4.434)
ΔSGA	-	-4.371	-3.602*	-2.461	-5.314	-3.591*	-2.609
		(8.878)	(1.877)	(2.068)	(9.189)	(1.921)	(2.105)
ΔPROFIT	-	-2.830**	3.178	0.271	-2.879**	3.256	0.672
		(1.123)	(3.147)	(1.928)	(1.122)	(3.109)	(1.972)
ΔSIZE	-	-2.815	-1.241	-0.718	-3.041	-1.302	-0.796
		(1.825)	(0.918)	(0.753)	(1.967)	(0.934)	(0.787)
ΔOPRISK	+	7.603	8.988	4.995	7.884*	9.364	4.891
		(4.699)	(6.479)	(5.669)	(4.743)	(6.368)	(5.377)
Observations		49	206	107	49	206	107
Pseudo R^2		0.158	0.0684	0.0878	0.157	0.0685	0.0887

This table reports estimations for an ordered probit model from 2004 to 2013 in a sample categorized by firms' financial flexibility. Firms' financial flexibility is measured by dividend pay-out ratio. This suggests an association between corporate pension risk and changes in credit ratings. The number of observations and pseudo R^2 values are reported. All regressions include clustered standard errors by firm. Standard errors are reported in parentheses. *, ** and *** represent significance levels of 10%, 5%, and 1% respectively (two-tailed). All explanatory variables are winsorized at the 1% level. All variable definitions are reported in Table 3.1.

Chapter 4: Corporate Governance and Pension De-risking Strategies

4.1 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, managers, and debtholders. Numerous theoretical and empirical studies have addressed agency problems and corporate governance. A key role of boards is to monitor, assess and control the top management (Adams, Hermalin and Weisbach, 2010). However, some evidence suggests that UK boards play a weak monitoring role with regard to corporate governance regulations (Guest, 2008). In addition, Erkens, Hung and Matos (2012) find that firms with more independent boards encourage riskier investments. Ownership concentration of a firm, an important corporate governance measure, has been shown to be related to capital structure. Empirical evidence (Demsetz and Lehn, 1985; Shleifer and Vishny, 1997; Berger et al., 1997; Burkart, Gromb and Panunzi, 1997) suggests that highly concentrated ownership structures relate to high debt levels. Overall, the previous literature (Stulz, 1990; Ivashina, Nair, Saunders, Massoud and Stover, 2009; Whitehead, 2015) 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 relationship between board composition and capital structure (Aguilera, Williams, Conley and Rupp, 2006).

In this chapter, the focus is on UK DB pension plans. Lane Clark and Peacock (2016b) 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 the aggregate pension deficit had increased by £21 billion to £46 billion from 2015. For DB plans, sponsoring firms are responsible for ensuring that future pension benefits are met. Thus, DB pension plans pose a higher level of risk and uncertainty for employers, 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 (Lane Clark and Peacock, 2014a). For example, in 2015, HSBC, Severn Trent and Standard Life announced the closure of their DB pension plans to new employees. Moreover, Lane Clark and Peacock (2014a) 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 (2014b) expect the pension buy-in and buy-out 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 buy-out transactions.

Pension trustees are responsible for managing and making investment decisions in DB pension plans. Given the potential conflict of interests between employers and pension beneficiaries in setting pension investment strategies, the role of pension trustees is the key to dealing with different stakeholders' risk attitudes. However, Myners's (2002) review suggests that UK pension trustees may make poor decisions on pension investments. Monk (2009) indicates that UK trustees exercise poor governance of pension plans. Thus, sponsor firms can exert significant influence in determining pension investment strategies.

This chapter focuses on the corporate governance characteristics of sponsor firms when firms seek to de-risk their DB pension plans.

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 relates to 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 shareholders 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 relate to pension de-risking strategies. Few existing studies indicate any relationship between corporate governance and switches from DB to DC pension plans. To our knowledge, this chapter appears to be the first to explore the relationship between corporate governance and pension buy-in and buy-out decisions.

The sample for this study consisted of 1,617 firm-year observations for FTSE All-Share firms for the period 2005-2014. A sub-sample exploring the

relationship between corporate governance and pension de-risking strategies included UK firms with DB pension plans, with 1,418 firm-year observations for the same period. This chapter 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 buy-out information was drawn from Lane Clark and Peacock (2014b).

Empirical tests reveal different relationship among board composition, ownership concentration and 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 larger 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 relate to 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 relationship between corporate governance measures and allocations of pension assets and switches from DB to DC pension plans. Since limited data were available on pension buy-ins and buy-outs, the tests produce mixed evidence regarding the relationship between corporate governance proxies and pension buy-in and buy-out decisions.

This chapter 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 chapter draws on a UK-based sample of companies, providing empirical evidence that differentiates the results from the US literature.

This chapter 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 chapter 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 relationship between corporate governance characteristics and pension asset allocations to changes in pension plans and pension buy-in and buy-out decisions. Given that

UK pension trustees play a key role on determining pension policy, this chapter contributes by adding UK evidence to existing pension de-risking literature.

Finally, this chapter has implications for investors in the risk management of corporate pension funds. Board composition and ownership concentration may have different relationship with pension de-risking strategies and risk taking with regard to pension fund management.

The remainder of this chapter 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.

4.2 Related literature and hypothesis development

4.2.1 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 (1986) 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 their agents. Jung et al. (1996) find that firms issuing equity and lacking valuable investments are regarded unfavourably by investors, 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.

4.2.1.1 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 board members. Peasnell, Pope and Young (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, Pasiouras and Nnadi (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 financial institutions 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 be related to 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 smaller boards are more effective due to communication 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 shareholders' benefit may pursue their own interests at the expense of shareholders'. 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 firms 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 of firms for 1976 and 1986. Han and Suk (1998) find that insider ownership and institutional ownership are positively related to stock returns, but very high level of insider ownership is negatively related. McConnell et al.'s (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. Literatures (Almazan, Hartzell and Starks, 2005; Chen, Harford and Li, 2007) confirm that the role of institutional investors is to monitor firms' management .

4.2.1.2 Substitutional relationship between 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 supports the view that other governance mechanisms may act as substitutes for debt (Setia‐Atmaja, Tanewski and Skully, 2009).

The previous literature (Grier and Zychowicz, 1994; Moh'd, Perry and Rimbey, 1998; Crutchley, Jensen, Jahera and Raymond, 1999) also explores the substitution relationship between corporate debt and institutional ownership, and finds that firms with higher institutional ownership tend to have lower leverage. Firms that place greater reliance on external monitoring tend to reduce internal monitoring devices by reducing their use of debt (Bathala, Moon and Rao, 1994).

4.2.1.3 Different institutional settings of UK and US firms

The dominant literature focuses on the effects of US rather than UK board composition. Overall, empirical research finds that board structure is not effective in the UK.

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 (Cosh and Hughes, 1987; Franks, Mayer and Renneboog, 2001; Higgs, 2003; Black, Cheffins and Klausner, 2005; 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.

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 governance structure and firm performance.

However, in contrast to the UK's relatively weak board monitoring, 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 relationship between corporate governance and firms' capital structure suggests that levels of debt may be related to firms' corporate governance, and leads to the following hypothesis:

Hypothesis 1: *There is a relationship between corporate governance characteristics and firms' leverage levels.*

4.2.2 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 plans 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) extended the study of Landsman (1986) that pension assets and projected benefit obligations are corporate assets and obligations, and that the accounting standards regulator should bring them onto the face of balance sheet.

Some research focuses on DB pension plans 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 to the view of Wiedman and Wier (2004), Salah et al. (2015) appear to argue that market participants view pension surpluses as corporate assets. Jin et al. (2006) suggest that firms should incorporate pension risk into firm risk. 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. This chapter adopts the

corporate financial view of pension plans, incorporating pension obligations and assets into firms' capital structure.

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

4.2.2.1 Corporate governance and pension asset allocations

Pension asset allocations may be changed to reduce pension risk. The adoption of IAS 19 and SFAS 158, issued by the Financial Accounting Standard Board (FASB), have introduced greater volatility into the pension assets and liabilities reported 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 reported figures. 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 reallocation of pension assets to fixed income securities. In terms of tax benefits, Black (1980) and Tepper (1981) strongly support 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 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 (Bodie et al., 1987; Amir and Benartzi, 1999) 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 may pursue higher returns from pension asset investments. Similarly, Lane Clark and Peacock (2014b) report that some FTSE 100 firms were 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 chapter explores the relationship between corporate governance and changes in pension asset allocations. Cocco and Volpin (2007) find that 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 external corporate governance of US firms using the G-index and E-index to explore the relationship between corporate governance and risk taking in pension asset allocations. G-index is constructed by Gompers, Ishii and Metrick (2003) and regards that market insert the control on management as external corporate governance. Alternatively, Bebchuk, Cohen and Ferrell (2009) propose E-index to measure managerial entrenchment. Thus, Phan and Hegde (2013) find 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 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.

Risk taking in pension asset allocations may be driven by the interest of top management. 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 executive compensation that aligns the interest between managers and stockholders

tends to allocate more pension assets to equities. 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 reallocate pension assets in risky investment. Therefore, the previous literature supports the view that corporate governance structure is related to 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' governance structures 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 stakeholders. 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 addition to the relationship between board characteristic and risk taking on investments, institutional ownership concentration is found to be positively related to risk taking (Chen and Steiner, 1999; Wright, Ferris, Sarin and Awasthi, 1996; 2002; Erkens et al., 2012). 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 is positively related to risk taking on investments. 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.

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.

The discussion above leads to the following hypothesis:

Hypothesis 2: *There is a relationship between corporate governance characteristics and the risk taking of firms' pension asset allocations.*

4.2.2.2 Corporate governance and switches from DB to DC pension plans

Given that firms with DB pension plans are exposed to 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 reducing future retirement benefits, 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.

As discussed in the chapter 2, the decision of switches from DB to DC pension plans entirely rely on the sponsor firms. However, the pension trustees plays a role to protect the benefits of pension members. Thus, the decision of switches from DB to DC pension plans is expected to be related to firm's corporate governance characteristics.

The discussion above leads to the following hypothesis:

Hypothesis 3: *There is a relationship between corporate governance characteristics and firms' decisions to switch from DB to DC pension plans.*

4.2.2.3 Corporate governance and pension buy-ins and buy-outs

In pension buy-ins and buy-outs, a premium is paid to transfer pension liabilities to an insurance company. Insurance companies must estimate future pension obligations based on assumptions including mortality, interest and inflation rates to calculate the present value of these 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 buy-out their pension assets and obligations. Pension buy-in and buy-out 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 buy-out market is that insurers appear to be better able than sponsor firms to forecast and manage pension risk and beat market returns on pension investments (Biffis and Blake, 2009). Compared with the UK, the US pension buy-in and buy-out market has experienced modest growth (Monk, 2009). Thus, there is little empirical literature focusing on pension buy-ins and buy-outs, 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 buy-outs 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 buy-outs to investigate how employers transfer the mortality risk to insurance companies. Therefore, pension buy-in and buy-out transactions have been used to de-risk DB pension plans in UK. As discussed in the chapter 2, pension buy-in and buy-out decision is jointly made by sponsor firms and pension trustees. Thus, pension buy-in and buy-out decision should represent the interest of sponsors firms. Following the discussion about the relationship between corporate governance and pension de-risking strategies, this chapter also explores the relationship between corporate governance and pension buy-in and buy-out decisions.

The discussion above leads to the following hypothesis:

Hypothesis 4: *There is a relationship between corporate governance and firms' engagement in pension buy-ins and buy-outs.*

4.3 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 relationship among corporate governance, 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 buy-outs were different from the other dependent variables, the Cox proportional model was applied to handle the censoring of observations.

4.3.1 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 the literature.

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

$$Market\ Value\ Leverage$$

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

4.3.2 Measures of corporate governance

Following Harford et al.'s (2012) construct, two sets of proxies were used to measure corporate governance. Harris and Raviv (2008) and 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 measure used 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 chapter 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.

4.3.3 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 not close its DB pension plan, and 1 if it partially or fully closed its DB pension plan. Data on pension buy-in and buy-out transactions were collected from 2008 to 2014 from Lane Clark and Peacock (2015). Since there were not many pension buy-out transactions during the sample years, all buy-in and buy-out transactions were combined, and coded as 1 if they occurred and 0 otherwise. Although there are different types of pension buy-ins and buy-outs, these were not differentiated, as the main interest of this study was the population of pension buy-in and buy-out transactions.

4.3.4 Empirical models and control variables

4.3.4.1 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. Leverage (LVG) was measured by book value of leverage (*LVG_BOOK*) and market value of leverage (*LVG_MARKET*). The key independent variables were corporate governance characteristics, including size of board (*BOARD*), independence of board (*BOARD_INDEPENDENCE*), institutional ownership (*INSTITUTIONAL_OWNERSHIP*) and insider ownership (*INSIDER_OWNERSHIP*). 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, Ofek and Stulz (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 divided by 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, a measure of product specialization 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.

$$LVG_{it} = \alpha_0 + \beta_1 BOARD_{it} + \beta_2 BOARD\_INDEPENDENCE_{it} + \beta_3 ROA_{it} + \beta_4 ASSET\_COLLATERAL\_VALUE_{it} + \beta_5 SIZE_{it} + \beta_6 ASSET\_UNIQUENESS1_{it} + \beta_7 ASSET\_UNIQUENESS2_{it} + \beta_8 NONDEBT\_TAX_{it} + YearF.E + IndustryF.E + \varepsilon_{it}$$

4.3.4.2 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 buy-outs.

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 follow liability-driven investment strategies; firms with more young employees invest a higher proportion of pension assets in equities than firms with more mature employees. The investment horizon (*HOR*) was measured as the log of projected benefit obligations divided by service costs. Firms with longer investment horizons have younger workforces and lower service costs, while firms with shorter investment horizons have older workforces and higher 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 low funding levels crowd out dividend payments. This suggests that firms are likely to reduce their dividend payments when pension funds are in deficit. Firms with underfunded pension plans are

incentivised to pursue higher returns to recover low funding ratios by reallocating pension assets to equities. Thus, 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 as return on pension assets are tax-free and bonds are heavily taxed. Therefore, the tax deductibility induces firms to invest more pension assets on bonds. 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 firm size 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 (1986). This enables exploration of whether different corporate governance mechanisms and levels of leverage jointly relate to pension asset allocations.

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

The same control 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 buy-out 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 relationship with them to switch from a DB to a DC pension plan. The indicator variable, *LOSS*, was coded as 1 if firms reported losses for the fiscal year, 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 buy-outs, 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. Although there have been strikes against the switching from DB to DC pension plans, these cases are not common. Again, the corporate governance proxies were interacted with the book value of leverage (market value of leverage) to explore the interaction between corporate governance mechanisms and leverage in relation to the decisions to switch from DB to DC pension plans and enter pension buy-ins and buy-outs.

$$SWITCH_{it} = \alpha_0 + \beta_1 BOARD_{it} + \beta_2 BOARD\_INDEPENDENCE_{it} + \beta_3 UNDERFUND_{it} + \beta_4 FUND_{it} + \beta_5 PLAN\_SIZE_{it} + \beta_6 OP\_CF_{it} + \beta_7 LOSS_{it} + \beta_8 delta\_DIV_{it} + \beta_9 delta\_LEV_{it} + \beta_{10} delta\_RD_{it} + \beta_{11} delta\_CAPEX_{it} + \beta_{12} delta\_SALE_{it} + \beta_{13} BOARD_{it} \times LVG_{it} + \beta_{14} BOARD\_INDEPENDENCE_{it} \times LVG_{it} + \beta_{15} LVG_{it} + \varepsilon_{it}$$

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

4.4 Sample and data

The recent accounting standard change and the financial crisis have created a unique empirical setting for UK companies, which are experiencing financial pressure from DB pension plans. Lane Clark and Peacock (2016b) report that DB pension plan closures have become commonplace in the UK. IAS 19 increased the high volatility of pension obligations reported in financial

statements. In addition, the emerging market for pension buy-ins and buy-outs has created opportunities for companies to transfer their pension obligations to insurance companies. This market is expected to continue to grow. The availability of data on pension buy-ins and buy-outs enabled empirical tests to be conducted to explore the determinants of these transactions.

The sample selection process is shown in Table 4.2. 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 buy-out information was collected from Lane Clark and Peacock (2015) report.

First, the data from the Bloomberg database and the Thomson One Banker databases were merged to amalgamate the accounting and corporate governance information. Financial firms with SIC codes 6000 to 6999 were excluded, as such firms have different leverage and corporate governance structures from other firms. Firms for which corporate governance information was unavailable were also excluded. This resulted in 1,617 firm-year observations for the years 2005 to 2014.

The sub-sample for investigating pension asset allocations comprised 1,418 firm-year observations from 2005 to 2014. Since data on switches from DB to DC pension plans and pension buy-ins and buy-outs were limited, a sub-sample was established to explore the relevant empirical questions. 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 buy-outs only had 510 firm-year observations. After merging the data for switches from DB to DC pension plans and pension buy-in and buy-out data with the corporate governance data, 415 and 58 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.

4.5 Univariate results

Two measures of leverage were used to enable to best estimate of the value of leverage based on accounting numbers and market valuations. Panel A of Table 4.3 therefore 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 with prior literature that the market value of leverage is higher than the book value of leverage (Berger et al., 1997). For the full sample, firms had an average of 8.7 directors on the board. Since information on institutional and insider ownership was only available for 2010-2014, the number of firm-year observations was reduced to 1,201 for the regression tests including these two variables. Descriptive data for pension de-risking strategies are shown in Panels C, D and E. The sub-sample for pension asset allocation analysis reveals that firms allocated an average of 48 percent of pension assets to equities and the average funding level was 87 percent which suggests that the pension funds of sample companies tended to be underfunded (Panel C). Panel D 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. Panel E shows that

firms in the sub-sample engage in pension buy-ins and buy-outs with average of *BUYOUT*, 0.62.

A correlation matrix is given in Table 4.4. Panel A indicates that the book value of leverage (*LVG_BOOK*) is significantly positively related to the market value of leverage (*LVG_MARKET*) and is close to 1. The signs and levels of significance for the correlations between the control variables and different governance measures are generally consistent. The number of directors on the board (*BOARD*) is negatively related to leverage at the 1% level of significance. Firms with lower profitability tended to have higher leverage, as the *ROA* is negatively related to leverage. The correlations between *ASSET_UNIQUENESS1* and both leverage measures 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.

Panel B indicates that board size (*BOARD*) appears to be unrelated to pension asset allocations (*EQUITY*), 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 are consistent with 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 firms with small pension plans than for those with large plans to switch from DB to DC pension plans. The correlation between pension buy-in and buy-out transactions and other firm and pension fund characteristics can be seen in Panel D.

4.6 Multivariate analysis

4.6.1 Corporate governance and leverage levels

This section provides empirical evidence to support hypothesis 1. The relationship between corporate governance and capital structure was examined using an industry and year fixed effects model. Table 4.5 reports the empirical results. The results in Column 1 suggest that firms with more directors tended to have lower leverage levels as 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 a higher proportion of independent directors were more likely to have lower leverage levels. Using the market value of leverage to measure a firm's capital structure, as shown in Column 4, yields consistent results, 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 4.5 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 a higher

proportion of 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 (Model 6). Thus, there is weak evidence that firms with higher insider ownership tended to have lower leverage. This is not consistent with the expectation that firms sharing ownership with managers can better align the interests of managers and shareholders. This finding on ownership concentration shows that different corporate governance characteristics may be related to debt levels in different ways.

Columns 3 and 6 include both board composition and ownership concentration variables in the same model. The significance levels for board independence, institutional ownership and insider ownership are weaker when using the market value of leverage (Column 6), but the signs are consistent with using the book value of leverage (Column 3). The regression tests therefore 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 (Cosh and Hughes, 1987; Franks et al., 2001; Higgs, 2003; Black et al., 2005; 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 relationship with 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 managerial discretion. Overall, the findings suggest that corporate governance measures are related to leverage levels, representing the firms' capital structure.

4.6.2 Corporate governance and pension asset allocations

Since the above empirical evidence confirms that corporate governance is related to firms' capital structure, it is expected also to be related to changes in pension asset allocations as stated in the hypothesis 2. Table 4.6 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. The empirical tests support hypothesis 2 that corporate governance characteristics are related to changes in pension asset allocations. Columns 1 and 2 of Table 4.6 show that firms with larger boards tended to allocate lower proportion of 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 (*EQUITY*) at the 5% and 1% significance levels respectively. The results in Columns 3 and 4 show that firms with both higher institutional ownership and higher insider ownership tended to allocate a higher proportion of pension assets to equities. All of these results are statistically significant at the 1% or 5% level.

Interaction terms between leverage and corporate governance measures were added to explore the extent to which the level of leverage and corporate governance jointly influence pension asset allocations. Columns 1 and 2 show that the interaction between the book and market values of leverage and board independence are 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. In contrast, Columns 3 and 4 indicate that 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 relationship between corporate governance measures and pension asset allocations. The board composition measures suggest that board size and independence are negatively related to the percentage of pension assets invested in equities, while the ownership measures suggest a positive relationship.

These findings support the expectation that different corporate governance mechanisms 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 (Pathan, 2009). 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 are likely to make less risky investments. Therefore, the evidence of this study supports the view that firms

with more independent boards tend to invest higher proportion of 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 to equities is also consistent with the findings of previous literature (Wright et al., 1996; Chen and Steiner, 1999; Wright et al., 2002; Erkens et al., 2012) that higher ownership concentration promotes greater risk taking in investments. Black and Scholes (1973) and Galai and Masulis (1976) explain this behaviour by arguing that managerial ownership can be 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 corporate governance mechanism. 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 be related to pension asset allocations on bonds, while increases in institutional ownership and insider ownership encourage pension asset allocations to equities. The relationship between corporate governance and pension asset allocations may vary according to different levels of leverage, representing an internal 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 investment. This indicates that firms with higher funding levels allocate more pension assets to equities to pursue expected higher returns on stock market investments. 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 a lower proportion of 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 a higher proportion of pension assets to bonds, with a negative relationship between *SIZE2* and *EQUITY*.

4.6.3 Corporate governance and switches from DB to DC pension plans

To examine the relationship between corporate governance and switches from DB to DC pension plans, the Cox proportional hazard model was used to examine the hypothesis 3. Coefficients and hazard ratios are reported in Table 4.7. The results support hypothesis 3 and suggest that firms' corporate governance characteristics are related to the decision on switching from DB to DC pension plans. The dependent variable is *SWITCH*, representing the 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 relationship between corporate governance and switching from DB to DC pension plans, the book and market value of leverage were interacted with the 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 relationship between board independence and 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 4.7. The findings reveal that firms with higher

institutional ownership were more likely to switch from DB to DC pension plans, whereas insider ownership was unrelated to switching from DB to DC pension plans. The interaction terms between ownership concentration and leverage reveals no influence of leverage on the ownership measures. The interaction terms are 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 (Comprix and Muller, 2011; Choy et al., 2014). 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, 1985a) confirms that healthy firms terminate their pension plans even if their DB pension plans are sufficiently funded. Overall, the relationship between board composition and pension asset allocations was greater for firms with high leverage.

4.6.4 Corporate governance and pension buy-ins and buy-outs

Pension buy-in and buy-out transactions result in the transfer of large pension obligations to insurance companies. Following the above tests, the relationship

between corporate governance and pension buy-in and buy-out decisions as stated in the hypothesis 4 is investigated. The results in Table 4.8 support hypothesis 4 that there is a relationship between board composition and pension buy-in and buy-out decisions. Board size (*BOARD*) is positively related to pension buy-ins and buy-outs (*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 buy-out transactions. Although the coefficient of board independence shows that board independence (*BOARD_INDEPENDENCE*) is significantly negatively related to pension buy-ins and buy-outs (*BUYOUT*), the hazard ratio is close to zero. Thus, board independence was unlikely to influence pension buy-in and buy-out decisions. The two measures of leverage (*LVG_BOOK* and *LVG_MARKET*) interacting with board size (*BOARD*) and board independence (*BOARD_INDEPENDENCE*) indicate that leverage may enhance the influence of board composition on pension buy-in and buy-out 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 buy-outs than firms with high leverage. Columns 5 and 7 provide weak support that institutional ownership may be related to pension buy-in and buy-out 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 buy-outs (*BUYOUT*). This suggests that firms with higher insider ownership were more likely to pursue pension buy-ins and buy-outs to transfer their pension obligations. In addition, the interaction between leverage and insider ownership shows that lower leverage may create stronger relationship between insider ownership and pension buy-ins and buy-outs.

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

4.7 Robustness checks

4.7.1 Endogeneity concern

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 there is simultaneity between capital structure and corporate governance structure or pension de-risking strategies. Therefore, it was important to employ an estimation to support the causal relationship.

The two-stage least squares (2SLS) method is commonly used to examine causal relationship arguments. However, since corporate governance shared the same controls as leverage, it was difficult to find valid instrumental variables for a 2SLS estimation. Thus, an alternative method was employed to provide empirical evidence for the influence of corporate governance measures on capital structure as proposed in hypothesis 1. 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. This is

consistent with the results (Table 4.5) that there is causal relationship between corporate governance and capital structure shown in Table 4.9.

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.

4.7.2 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 for hypothesis 3, a probit model was used to conduct the same regression using the same group of dependent and independent variables. In Table 4.10, 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 relationship between institutional ownership and 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 relationship between corporate governance and switching from DB pension plans.

Table 4.11 provides no evidence to support the previous finding based on Table 4.9 and hypothesis 4. The limited availability of pension buy-in and buy-out data may have been a significant factor leading to a different conclusion. The estimation in Table 4.11 suggests that firms with larger boards are less likely to engage in pension buy-ins and buy-outs transactions. This is inconsistent with the results in Table 4.8 that firms with larger boards are more likely to engage in pension buy-in and buy-out. In addition, the results in Table 4.11 indicate the positive relationship between board independence (*BOARD_INDEPENDENCE*) and pension buy-ins and buy-outs decisions (*BUYOUT*), which is contradicted to the negative relationship between *BOARD_INDEPENDENCE* and *BUYOUT* in Table 4.8. The data are insufficient to conduct a test with a probit model to explore the relationship between ownership concentration and pension buy-in and buy-out decisions. Thus, it is difficult to draw any conclusions regarding to the relationship between corporate governance proxies and pension buy-in and buy-out transactions.

4.8 Conclusions

This chapter adopted Berger et al.'s (1997) method to examine the relationship between corporate governance and firms' capital structure. In the sample of

FTSE All-Share companies for the period 2005-2014, it has been observed that there is mixed evidence regarding to the relationship between corporate governance and 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 related to different corporate governance mechanisms in different ways. This reflects 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 (Grier and Zychowicz, 1994; Setia‐Atmaja et al., 2009).

This chapter has also investigated the relationship between corporate governance and pension de-risking strategies. A fixed effects model was applied to explore the relationship between corporate governance and pension asset allocations, controlling for industry and year fixed effects. The findings reveal that the relationship between pension de-risking strategies to board composition differs from the relation with ownership concentration. Firms with larger and more independent boards tend to invest a lower proportion of pension assets in equities. However, higher institutional and insider ownership tend to relate to increased investment 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 (Wright et al., 1996; Chen and Steiner, 1999; Wright et al., 2002; Erkens et al., 2012). 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 a higher proportion of shares owned by institutions are more likely to switch from DB to DC pension plans. The findings suggest that different corporate governance mechanisms are related to decisions to switch from DB to DC pension plans differently. Finally, limited data on pension buy-in and buy-out transactions were used to explore the association between corporate governance and such transactions. However, the results may have been affected by the limitations of the data.

This chapter enhances our understanding of how different corporate governance mechanisms are related to pension de-risking strategies and capital structure differently. Specifically, board composition is negatively related to risk taking in pension asset allocations. Larger and more independent boards appear to act as a constraint allocating pension assets to equities and aggressive pension investment strategies. This chapter also reveals that higher insider ownership is related to pension asset allocations to risky assets. In addition, it informs investors that corporate governance mechanisms may be related to whether or not firms take decisions to switch from DB to DC pension plans.

This chapter use board size and independence as representative for the board structure. The CEO and chair duality can also represent the board structure. in addition, Gompers et al. (2003) and Bebchuk et al. (2009) develop G-index and E-index to measure external corporate governance. However, there is no such index for the UK market. Moreover, executive compensation can be regarded as incentive to align the interest between managers and shareholders (Anantharaman and Lee, 2014). Changes in executive compensation could also change the corporate governance. Therefore, future research should focus on alternative corporate governance measures that may be also related to pension de-risking strategies.

Table 4.1: Definitions of variable

Variable	Definitions
ASSET_COLLATERAL_VALUE	Net property, plant and equipment plus inventory divided by 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*.
BUYOUT	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 scaled by total assets for firm *i* at time *t* and capital expenditure scaled by total assets 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. Leverage is calculated by short and long-term debt divided by total assets.
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, scaled by sales for firm *i* and time *t*.
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 than the projected benefit obligations, and 0 otherwise.

Table 4.2: Sample selection

	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	(2,207)	(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 buy-out data	(357)	(59)
Sample available for corporate governance and pension buy-ins and buy-outs	**58**	**8**

Table 4.3: Descriptive statistics on corporate governance, pension de-risking strategies and firm characteristics

Panel A: Descriptive statistics for firm 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 firm 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 buy-outs

	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

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 sub-sample for institutional ownership and insider ownership. Panel C reports the control variables in equation 2: *FUND*; *FUND_SQUARE*, *HOR*; *LEV, DIVP*, *TAXR*, *SDCF* and *SIZE2*. Panel D and E reports the sub-sample for switch from DB to DC pension plans and pension buy-ins and buy-outs and the control variables in equations 3 and 4: *UNDERFUND*, *PLAN_SIZE*, *OP_CF*, *LOSS*, *delta_LEV*, *delta_RD*, *delta_CAPEX* and *delta_SALE*. All variable definitions are reported in Table 4.1.

Table 4.4: Correlation matrix

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 A's diagonal describes correlations between measures of leverage and all variables. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. All variable definitions are reported in Table 4.1.

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 B describes correlations between pension asset allocations and all variables. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. All variable definitions are reported in Table 4.1.

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 C describes correlations between switches from DB to DC pension plans and all variables. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. All variable definitions are reported in Table 4.1.

Panel D: Correlation between pension buy-ins and buy-outs, 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)	

Panel D describes correlations between pension buy-in and buy-out transactions and all variables. *, **, and *** represent significance levels of 10%, 5%, and 1% respectively. All variable definitions are reported in Table 4.1.

Table 4.5: Corporate governance and firms' leverage

$$LVG_{it} = \alpha_0 + \beta_1 BOARD_{it} + \beta_2 BOARD\_INDEPENDENCE_{it} + \beta_3 ROA_{it} + \beta_4 ASSET\_COLLATERAL\_VALUE_{it} + \beta_5 SIZE_{it} + \beta_6 ASSET\_UNIQUENESS1_{it} + \beta_7 ASSET\_UNIQUENESS2_{it} + \beta_8 NONDEBT\_TAX_{it} + YearF.E + IndustryF.E + \varepsilon_{it}$$

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^2		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 Table 4.1.

Table 4.6: Corporate governance and pension asset allocations

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

Dependent Variable		*EQUITY*			
		(1)	(2)	(3)	(4)
	Exp. Sign	*Fixed Effects*	*Fixed Effects*	*Fixed Effects*	*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*
		(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^2		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 errorsare reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively (two-tailed). All variable definitions are reported in Table 4.1.

Table 4.7: Corporate governance and switches from DB to DC pension plans

$$SWITCH_{it} = \alpha_0 + \beta_1 BOARD_{it} + \beta_2 BOARD\_INDEPENDENCE_{it} + \beta_3 UNDERFUND_{it} + \beta_4 FUND_{it} + \beta_5 PLAN\_SIZE_{it} + \beta_6 OP\_CF_{it} + \beta_7 LOSS_{it} + \beta_8 delta\_DIV_{it} + \beta_9 delta\_LEV_{it} + \beta_{10} delta\_RD_{it} + \beta_{11} delta\_CAPEX_{it} + \beta_{12} delta\_SALE_{it} + \beta_{13} BOARD_{it} \times LVG_{it} + \beta_{14} BOARD\_INDEPENDENCE_{it} \times LVG_{it} + \beta_{15} LVG_{it} + \varepsilon_{it}$$

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*
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
		(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 Table 4.1.

Table 4.8: Corporate governance and pension buy-in and buy-out transactions

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

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*
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)
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 buy-out data for the period 2008–2014. All the buy-ins and buy-outs are treated as the same events and coded as 1, or 0 otherwise. Types of pension buy-in and buy-out 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 Table 4.1.

Table 4.9: Corporate governance and capital structure in robustness tests

$$LVG_{it} = \alpha_0 + \beta_1 BOARD_{it-1} + \beta_2 BOARD\_INDEPENDENCE_{it-1} + \beta_3 ROA_{it-1}$$
$$+ \beta_4 ASSET\_COLLATERAL\_VALUE_{it-1} + \beta_5 SIZE_{it-1} + \beta_6 ASSET\_UNIQUENESS1_{it-1}$$
$$+ \beta_7 ASSET\_UNIQUENESS2_{it-1} + \beta_8 NONDEBT\_TAX_{it-1} + YearF.E + IndustryF.E + \varepsilon_{it-1}$$

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^2	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. When the model includes the variables institutional ownership and insider ownership, the sample covers only 2010 to 2014 due to data availability constraints. Industry variables are based on 4-digit (CRSP) SIC codes. P-*value* are reported in parentheses. *, **, and *** represent significance levels of 10%, 5%, and 1%, respectively (two-tailed). All variable definitions are reported in Table 4.1.

Table 4.10: Corporate governance and switches from DB to DC pension plans in probit model

$$SWITCH_{it} = \alpha_0 + \beta_1 BOARD_{it} + \beta_2 BOARD\_INDEPENDENCE_{it} + \beta_3 UNDERFUND_{it} + \beta_4 FUND_{it} + \beta_5 PLAN\_SIZE_{it} + \beta_6 OP\_CF_{it} + \beta_7 LOSS_{it} + \beta_8 delta\_DIV_{it} + \beta_9 delta\_LEV_{it} + \beta_{10} delta\_RD_{it} + \beta_{11} delta\_CAPEX_{it} + \beta_{12} delta\_SALE_{it} + \beta_{13} BOARD_{it} \times LVG_{it} + \beta_{14} BOARD\_INDEPENDENCE_{it} \times LVG_{it} + \beta_{15} LVG_{it} + \varepsilon_{it}$$

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)
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 Table 4.1.

Table 4.11: Corporate governance and pension buy-in and buy-out transactions in probit model

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

Dependent Variable	*BUYOUT*	
	(1)	(2)
	Probit coefficient	*Probit coefficient*
BOARD	-10.580	-17.930***
	(6.45)	(4.24)
BOARD_INDEPENDENCE	9.054*	22.540**
	(5.25)	(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***	4.334***
	(1.34)	(1.62)
FUND	32.670***	37.240***
	(6.75)	(9.97)
PLAN_SIZE	3.126	5.417***
	(2.1214)	(1.34)
OP_CF	16.660***	22.740***
	(3.44)	(5.88)
delta_DIV	1.733***	1.889**
	(0.65)	(0.78)
delta_LEV	10.150***	16.100**
	(3.29)	(7.73)
delta_RD	-0.016**	-0.017**
	(0.01)	(0.01)
delta_CAPEX	-71.760**	-68.880***
	(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 buy-out data for the period 2008–2014. All the buy-ins and buy-outs are treated as the same events and coded as 1, and 0 otherwise. Types of pension buy-in and buy-out 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 Table 4.1.

Chapter 5: Conclusion

5.1 Summary and Limitations

5.1.1 Contributions

This thesis has examined three aspects of relationships between firms' characteristics and pension de-risking strategies using a sample of UK firms for which data were available. It has focused on how firms' hedging needs, financial flexibility and corporate governance are linked to the adoption of pension de-risking strategies and capital structure decisions. Given the different features of pension de-risking strategies, relationships between the three aspects of firm characteristics and changes in pension asset allocations, switches from DB to DC pension plans and pension buy-in and buy-out decisions have been examined separately. Therefore, this thesis contributes to establishing links between firms' financial characteristics and corporate governance in the context of pension de-risking strategies.

In addition, this thesis provides further evidence of firms' target credit rating behaviours. Consistent with Hovakimian et al. (2009) and Kisgen (2009), the findings confirm that firms target credit ratings by changing their financial characteristics and adopting pension de-risking strategies. This thesis extends the literature on the substitutability of cash holdings and debt reduction for firms operating under financial constraints. Firms' credit ratings are used as a proxy for financial constraints. Moreover, this thesis contributes to the hedging literature on how firms' hedging needs relate to capital structure changes. A relationship is established between hedging needs and pension de-risking strategies. Since Graham and Harvey (2001) indicate the importance of

financial flexibility for firms, this thesis contributes to the financial flexibility literature by conducting empirical tests on UK samples. This highlights that managers take firms' financial flexibility into account when making capital structure decisions. This thesis also links financial flexibility with pension de-risking strategies. Moreover, this thesis contributes to the corporate governance literature. The previous literature suggests that corporate governance influences on firms' capital structure (Jung et al., 1996; Berger et al., 1997; Harford et al., 2012) and explores the relationship between corporate governance and pension asset allocations (Cocco and Volpin, 2007; Phan and Hegde, 2013; Anantharaman and Lee, 2014; Yu-Thompson et al., 2015). This thesis adds two further pension de-risking strategies into the analysis of the relationship between corporate governance and firms' decisions on reducing pension risk: switching from DB to DC pension plans; and pension buy-in and buy-out decisions. Finally, this thesis provides UK empirical evidence to extend the non-US research on pension de-risking strategies. This is because the pension systems of the UK and the US differ in terms of pension regulations, activeness of the bulk annuity market and corporate governance arrangements for pension trustees and sponsor firms. This thesis therefore provides new insight into how UK companies adopt pension de-risking strategies to reduce the risk arising from their DB pension plans.

5.1.2 Summary of findings

Chapter 2 explored the relationship between firms' hedging needs and trade-off decisions between increasing cash holdings and reducing debt to target credit ratings. It concluded that firms with HHNs are more likely to increase cash holdings to target credit ratings, while firms with LHNs are more likely to reduce

debt. Chapter 2 also investigated the relationship between firms' hedging needs and pension de-risking strategies. The findings reveal that firms with HHNs tend to change pension asset allocations from bonds to equities to target credit ratings, and are also more likely to switch from DB to DC pension plans.

Building on the findings of Chapter 2, Chapter 3 focused on the relationship between financial flexibility and trade-off decisions between accumulating cash flows and using cash flows to pay down debt to target credit ratings. A sample of UK firms was categorized into LFF, MFF and HFF. The findings reveal that firms with LFF and HFF tend to increase cash holdings to target credit ratings, while firms with MFF tend to reduce debt. Since pension obligations are debt-like obligations, this chapter tested the relationship between firms' financial flexibility and pension de-risking strategies when firms are targeting credit ratings. The empirical evidence confirms that firms with MFF are more likely to reallocate pension assets from bonds to equities. Firms with LFF and MFF are also more likely than those with HFF to switch from DB to DC pension plans to target credit ratings.

The study presented in Chapter 4 builds on US studies and provides new insight with UK evidence that the relationship between corporate governance and capital structure. Different proxies of corporate governance for board composition and ownership concentration were used to explore the relationship between corporate governance and leverage levels. The findings reveal that firms with larger and more independent boards tend to have lower levels of leverage. In contrast, firms with higher institutional and insider ownership tend to have higher levels of leverage. Further tests were conducted on the relationship between corporate governance and pension de-risking strategies.

The evidence shows that firms with larger and more independent boards are less likely to invest pension assets in equities, while firms with higher institutional and insider ownership are more likely to do so. Firms with more independent boards are more likely to retain their DB pension plans, whereas firms with higher institutional ownership are more likely to switch from DB to DC pension plans.

This thesis raises several implications for managers, investors and regulators. First, the studies presented in Chapters 2 and 3 provide empirical evidence that firms may adopt pension de-risking strategies to target credit ratings, as pension de-risking strategies change capital structure. This may help investors understand the relationship between firms' financial characteristics and pension de-risking strategies. Second, the research in this chapter might help managers to construct effective strategies to manage pension risk according to their firms' financial characteristics, such as hedging needs and financial flexibility. The third implication is that the relationship between corporate governance structure and pension risk might caution regulators to pay greater attention to firms' corporate governance structure in understanding pension risk.

5.1.3 Limitations

The major limitation of the research in the thesis is the availability of data on pension buy-in and buy-out transactions. In Chapters 2 and 3, analysis of pension buy-ins and buy-outs was limited to the descriptive level. It was not possible to draw conclusions regarding the relationship between firms' financial characteristics and pension buy-in and buy-out decisions. In the study presented in Chapter 4, it was possible to conduct regression tests using pension buy-in and buy-out data; however, robustness tests appeared not to

support the main tests. This is possibly due to the lower power of the tests. Pension buy-in and buy-out data are limited because the market is relatively small compared to the total size of DB pension liabilities, although it is growing significantly.

The second limitation is that there is a causality problem in this research. Although robustness tests were provided to address endogeneity issues, it was difficult to identify strong instrumental variables. However, the empirical evidence strongly supports an association among financial characteristics, corporate governance and pension de-risking strategies.

Finally, and importantly, Chapters 2 and 3 assume that firms change their financial fundamentals to target credit ratings. It may be difficult to determine whether every firm targets credit ratings, which may limit the generalizability of these findings.

5.2 Future Research

5.2.1 Pension buy-in and buy-out market

The limitations of this study provide opportunities for future research. Future research might focus on the pension buy-in and buy-out market. In this thesis, pension buy-in and buy-out transactions were not differentiated. This is due to the limitation of the data for pension buy-outs. The UK pension buy-outs is rather expensive compared to the other countries (Biffis and Blake, 2009). This may reduce the volume of the pension buy-out transactions each year. Future studies could separate pension buy-ins and buy-outs as they differ in nature. Previous literature highlights that the costs and benefits of pension buy-ins and buy-outs differ in practice (Lin et al., 2015). Therefore, future studies might

explore the determinants of pension buy-ins and buy-outs when more data become available.

5.2.2 Alternative pension de-risking strategies

Three pension de-risking strategies are addressed in this thesis. However, firms also pursue other pension de-risking strategies. Firms are now paying increasing attention to the longevity risk of pension funds. As discussed in this thesis, firms make assumptions about the life expectancy of pension members to estimate their pension benefit obligations. Increases in life expectancy therefore cause such estimates to rise. The market for longevity swaps is developing to mitigate this risk. Lane Clark and Peacock (2015) report that the largest longevity swaps were undertaken by BT (£16 billion) and AXA (£2.8 billion), in 2014 and 2015 respectively. Unlike pension buy-ins, whereby firms transfer all the investment risk to insurers, firms adopt longevity swaps specifically to address longevity risk. Recent research focuses on the costs and benefits of longevity swaps in the US market (Lin et al., 2015). Therefore, the growth of the longevity swap market provides an opportunity to include longevity swaps in future research on pension de-risking strategies.

5.2.3 Alternative pension asset investments

Since equities and bonds are the dominant BD pension plan assets classes, this thesis has focused only on changes in pension asset allocations between these two classes as indicators of pension de-risking strategies. However, the OECD (2015) reports that firms are increasingly allocating pension asset investments to alternative high-yield pension asset classes such as real estate, private equities, hedge funds and mutual funds. The share of alternative

investments has increased by 12.8% between 2004 and 2014 in the UK (OECD, 2015). Such investments are likely to be a form of pension de-risking strategy, and future research might investigate the extent to which they reduce pension risk.

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Appendix I:

Differences between defined benefit and defined contribution pension plans

	Defined Benefit	Defined Contribution
Pension Contributions	Employees and employers make contributions to the pension fund. Individuals' pension contributions differ to meet their pension benefits requirements. Pension fund is managed and invested by pension trustees. Regulation requires additional contributions from sponsoring employers if the pension fund is underfunded.	Employees and employers make contributions of a fixed percentage of the employee's salary or total earnings to individual pension accounts. Individual accounts are managed by the plan sponsor.
Pension Benefit	Employers promise to pay a fixed amount of pension benefits after the employee's retirement, as defined by scheme rules, usually related to final or average salaries, index-linked to inflation.	The level of pension benefit is not guaranteed. Pension benefits are determined by the contributions and pension investment returns.
Regulatory Risk	UK: (1) Accounting treatment: the adoption of FRS 17 and IAS 19 require full pension recognition and fair value measurement of pension assets and liabilities. IAS 19R eliminated the corridor method and the option of deferred recognition of unvested past service costs. These accounting standards lead to greater volatility of profit and loss and balance sheet statements. (2) The PPF aims to provide compensation for DB pension plans when sponsoring companies become insolvent. (3) MFR requires companies to take actions to ensure that pension funds are well-funded if there is any drop below the specific funding level. (4) UK tax reform increases costs of DB pension plan.	Plan assets are controlled by the employees. Contributions are fixed and treated by sponsoring employers as annual expenses.
	US: (1) Accounting treatment: adoption of SFAS 158 requires firms to recognize funding status on the balance sheet and use projected benefit obligations to measure pension liabilities. This draws attention to the funding status and increases reported pension obligations.	

	(2) PBGC aims to provide pension benefits when sponsoring companies are in default. (3) US tax policies allow the tax deductibility of employers' pension contributions. Transfers of excess assets to employers are heavily taxed. Overall, the US tax laws allows favourable tax treatment in order to encourage personal saving for retirement.	
Financial Conditions	UK: Initially during the 2008 financial crisis reductions in equity prices decreased the value of pension assets. Subsequently, falling interest rates increased the value of pension liabilities but the prices of fixed interest securities and equities rose. US: The 2008 financial crisis had a similar impact on the US market and US DB pension plans.	The 2008 financial crisis significantly reduced the value of DC pension assets. Since employees are responsible for their own plan assets, the value of their future pension benefits falls.
Actuarial Assumption Risk	Projected benefit obligations are valued by taking account of price inflation, salary inflation, mortality rate and discount rate. Actuarial assumptions are determined by managers based on actuaries' advice. Price and salary inflation influence the valuation of pension obligations. The longer plan members live, the more companies must pay to employees; hence, the mortality rate influences the value of pension obligations. Managers must discount the future value of pension obligations to determine the current value. Thus, a lower discount rate will result in a higher current value of pension obligations.	There is no need to estimate pension obligations under a DC pension plan. Thus, actuarial assumptions are irrelevant to employers with DC pension plans.

Appendix II :

Pros and cons of pension de-risking strategies for the UK sponsor firms

	Benefits and costs for pension de-risking strategies			
Changes in pension asset allocation	Equity → Bond		Equity ← Bond	
	Benefits (1) Support the LDI strategy, whereby firms match returns on pension investments to the duration of project pension obligations. (Shtekhman, 2012) (2) Reduce the volatility of the balance sheet (Amir and Benartzi 1999)	Costs: (1) Lower the long-term return of pension investments. (2) Suffer pressure to make additional pension contributions (3) Bond could be relatively expensive for companies in terms of its low return.	Benefits: (1) Reduce the pension contribution from sponsor firms if equity investment is successful. (Bodie 1990) (2) Long-term investment on equities could outperform than bond. (3) Firms with longer duration of pension liabilities allocate pension assets to equities to better capture the 'equity premium '	Costs: (1) Suffer the volatility of equity markets, this increasing the volatility of pension contributions. (2) Unsuccessful investment in equities could lead to significant deficits for pension funds
Switch from DB to DC pension plans	Benefits: (1) Cut the retirement benefits of employees (Munnell et al. 2007) (2) Transfer the investments and demographic risks to employees. (3) Experience an increase of equity return and decrease the probability of downgrade after the switch of DB to DC pension plans (Atanasova and Hrazdil 2010)		Costs: (1) Costs negotiating with labour unions and employees to close DB pension plans. (2) Possible increases in equity risk and credit risk after the switch (Choy, Lin , and Officer 2014)	
Pension buy-in and buy-out	Benefits: (1) Transfer part or full costs arising from pension obligations to insurers. (2) Remove significant amount of pension obligations from financial statement. (3) Firms with pension buy-out transfer pension investment and demographic risk to insurance companies (4) Insurers may have superior expertise in effective management of pension assets and liabilities (Biffis and Blake 2013)		Costs: (1) Pay an expensive premium to insurance company. (2) Buy-out contract is less affordable for companies with large amount of pension deficits. (3) Pension buy-in may increase the pension risk for the part of pension obligation left in the companies.	