FAIR VALUE PENSION ACCOUNTING, CORPORATE RISK AND INVESTMENT

by

Iain Clacher

Submitted in accordance with the requirements
for the degree of Doctor of Philosophy.

The University of Leeds
Leeds University Business School
Centre for Advanced Studies in Finance

April, 2008

The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

ACKNOWLEDGEMENTS

I would like to express my appreciation and thanks to Professor David Hillier, for his guidance, support and advice throughout the course of my studies. His experience and encouragement has provided an invaluable source of motivation to me throughout my education. I would also like to express my thanks to Professor Kevin Keasey, Dr. Charlie Cai, Dr. Alistair Byrne, Michelle Dickson, all of my colleagues in CASIF and countless others all of whom have encouraged and supported me during my studies. I am also grateful for the financial support I received from the Centre for Advanced Studies in Finance.

Finally, I would like to thank my parents Margaret and Ian, and the rest of my family and friends for their love and support through my studies.

ABSTRACT

The purpose of this research is to analyse the impact of defined benefit pension schemes on UK corporations. In doing so the analysis contributes to a number of existing literatures in Accounting and Finance. First the thesis contributes to the accounting literature by analysing the adoption of fair value pension accounting. Second, I contribute to the extant literature on market efficiency and firm risk by analysing whether measures of systematic risk, financial risk and operational risk reflect the underlying risk of the pension scheme. Finally, the thesis contributes to the literature on internal capital markets and investment decisions through analysing the relationship between pension contributions, capital expenditures and firm profitability.

In analysing how fair value accounting of pensions has been implemented I consider the extent to which managers exercise discretion under fair value accounting and the value relevance of these disclosures. My main findings can be summarised as follows. First, despite little variation in the underlying economic inputs, differences in stated assumptions across companies, auditors and actuaries are significant. Further, I find that the adoption of fair value pension accounting provides value relevant disclosure and so share prices reflect the value of the underlying pension scheme. However, managers display considerable variation in conservatism when implementing fair value accounting and this variation is related to scheme-specific characteristics, such as asset allocation and pension scheme solvency. Consequently, the chapter argues that the observed inconsistency in reporting across firms brings into question the efficacy of fair value accounting for assessing corporate risk.

The second research area considers the relationship between measures of systematic risk, firm distress and pension risks. My results show that systematic, default, financial and operational risks reflect the underlying risk of the pension scheme. Further, pension scheme asset allocation is consistent with active pension risk management. Managers therefore choose to undertake risk management of pension risks as opposed to risk-shifting through asset substitution.

The final research area investigates the impact of pension contributions on firm capital expenditure and profitability. Pension contributions are shown to be a function of the size of the pension scheme, pension asset allocation and scheme funding. My results also suggest that firms who pay the highest contributions have lower capital expenditure and higher profitability. Lastly, I find that contributions are unrelated to the level of dividends paid or to fixed asset disposals

TABLE OF CONTENTS

LIST OF TABLES, FIGURES AND APPENDICES

Tables

Figures

LIST OF ABBREVIATIONS

ASB	Accounting Standards Board
ASC	Accounting Standards Council
DB	Defined Benefits
DC	Defined Contributions
ED	Exposure Draft
FAS-158	Financial Accounting Statement 158
FRS-17	Financial Reporting Standard 17
IAS-19	International Accounting Standard 19
ICAEW	Institute of Chartered Accountants in England and Wales
IFRS	International Financial Reporting Standards
IT	Information Technology
MFR	Minimum Funding Requirement
MV	Market Value
OLS	Ordinary Least Squares
ONS	Office for National Statistics
OPRA	Occupational Pensions Regulatory Authority
PBGC	Pension Benefits Guaranty Corporation
SEC	Securities Exchange Commission
SFAS-87	Statement Financial Accounting Standard 87
SORP	Statement of Recommended Practice
SSAP-24	Statement of Standard Accounting Practice 24
STRGL	Statement of Total Recognised Gains and Losses
UK	United Kingdom
US	United States

1
INTRODUCTION

1.1 Introduction

Pensions and the provision of incomes in retirement is one of the biggest challenges facing developed economies. The rapid fall in mortality rates that has occurred over the past 50-100 years is the result of much higher standards of living and rapid advances in medical technology. As a consequence individuals are now longer lived as many of the diseases that were previously fatal are now treated successfully. The speed of the medical advances and the impact that it has had on survival rates is startling. In looking at survivor rates for common cancers the improvement in just the past decade is huge. Between 1993 and 1995 the 5 year survival rate for prostate cancer in men was 59.8% while the 5 year survival rate between 1999 and 2003 increased to 74.4%[1].

The rapid increase in medical advances and the successful treatment of illness has increased the average UK life expectancy dramatically. In 1982 the average life expectancy for a male in the UK at 65 was 13 years. By 2005 however the average life expectancy at 65 had risen to 17 years. For women the increase is from 17 years to 20 years. Although this increase is not as large as the improvements seem in male life expectancy this is still a large increase in costs as women retire earlier. The cost of both state and private pension provision therefore is now considerably higher than previously estimated. In addition, given how wrong previous estimates of pension costs have been the possibility of costs increasing further is a very tangible risk. Such dramatic increases

[1] Cancer Survival Rates 1993-1995 and 1999-2003, www.statistics.gov.uk.

in the costs of provision effect both the government and firms, straining the fiscal budgets of government and the balance sheets of corporations.

In response to this the government have started to undertake reforms to ensure that there will be adequate retirement incomes in the future. Many of the solutions for government that have been discussed, and are likely to be implemented, are based upon the recommendations and findings of the Turner Report (2006). The report itself was a rigorous and comprehensive analysis of the problems facing the current system of pension provision. As well as adopting many of the recommendations of the report, the government also aims to change the burden of pension provision away from the state to the private sector. Currently, around 60% of pensions are provided by the state and around 40% by the private sector. It is the aim of the government to redress the balance so that 40% of pensions are provided by the state and 60% by the private sector.

Within industry there is a shift from the more generous defined benefit arrangements to defined contribution schemes. This is in part due to the shift from state to private pension provision; however the risks associated within defined benefit pension schemes are considerable. For many firms, and in particular former nationalised and 'smokestack' industries the burden of the defined benefit scheme is huge. This is a function of the generous benefits that were put in place and the sizeable workforces that they employed when the company was formerly nationalised. Coupled with the dramatic changes in life expectancy the pension scheme is now one of the most significant risks in many firms.

This thesis analyses the impact of defined benefit pension schemes on a sample of large UK corporations. The thesis will address and contribute to three main areas surrounding defined benefit pension provision. First, it contributes to the extant literature on pension accounting and how firms account for their pension schemes.

Second, it will analyse whether the risk of the pension scheme is reflected in measures of market and firm risk. Last, it examines the impact of the pension scheme on the financial resources of the firm.

The rest of the chapter is organised as follows. Section 1.2 discusses the theoretical context of the subsequent analysis and the different incentives that affect the structure, investment policy and funding strategy of corporate pension plans. Section 1.3 discusses the issues surrounding pension accounting and gives an overview of the changes to pension accounting that have occurred. Section 1.4 discusses market efficiency and pension risks. In Section 1.5 the cost of pension provision, firm investment and performance is discussed. The final section 1.6 presents the structure of the thesis.

1.2 Theoretical Framework and Assumptions

The subsequent analysis in this thesis makes a number of assumptions about complete markets, perfect markets, informational asymmetry, managerial incentives, labour market implications and the prevailing tax regime. One of the most important theoretical considerations is the role of both complete markets and perfect markets.

In a complete market managers of a firm would simply buy insurance to hedge any shortfall in pension scheme funding. This is important for both the management and the employees of the scheme. For employees this hedges them against any funding shortfall and any associated loss in pension benefits. Conversely, for management this minimises the cost of pension provision and having to provide additional finance where funding of the scheme is insufficient in such a situation pension plan funding is irrelevant (Sharpe(1976)).

In addition to this if perfect markets exist then scheme funding and investment strategy would again be irrelevant. In a Miller and Modigliani (1958) perfect capital markets scenario, where funding shortfalls occur, the management would simply go to the capital markets to raise finance to fund the shortfall as internal and external finance are equivalent. Implicitly, the funding of the scheme will not have any effect on corporate strategy as the internal resources of the firm will remain the same. However, due to taxes, informational asymmetry and the costs associated with raising external finance this is not possible.

Underpinning the subsequent analysis I assume that markets are incomplete as there is no insurance for funding shortfalls and that markets are imperfect. This has a number of implications. First, management must fund the pension scheme through dedicated financial assets and meet any funding shortfall. In the UK this is very much the case over the sample period I analyse, as there was no regulatory safety net, unlike in the US where the Pension Benefit Guaranty Corporation (PBGC) provides some form of insurance coverage. Second, markets are imperfect and so it is not possible for firms to simply raise additional finance in the capital markets to meet any deficiencies in scheme funding, as finance is not costless as a result of informational asymmetry, taxes and transaction costs.

Bringing these two assumptions together this means that first, the management of the firm must fund the scheme and they must also meet any shortfall in funding. Second, the management of the firm will fund the scheme from the existing financial resources of the firm. As a consequence of this management are going to be concerned about, the level of funding in the scheme, the cost of provision, the investment strategy of the firm, the impact that shortfalls have on corporate risk and the investment strategy of the firm.

Aside from these theoretical considerations a number of other important assumptions underlie my analysis. One situation that is not possible to consider is the different conflicts that management face when funding a scheme. The decisions that management make with respect to a given scheme will be closely linked to whether or not their own personal pension is in the same scheme as all other employees. In this situation, if managers are rational utility maximising individuals, then it is in their own interest to fully fund the scheme. Conversely, if managers have a separate scheme from employees it is reasonable to assume that their behaviour would be different as they would not gain any personal benefit from fully funding the employees' scheme.

In the subsequent analysis I assume that managers essentially provide the scheme for employees and that management are not part of the scheme. I make this assumption as it is not possible disentangle where management are part of the company scheme and where management have a separate scheme.

Despite this conflict, management may have other incentives with regards to the provision of a pension scheme. One interesting factor with regards to the provision and security of a pension scheme is the impact this may have on labour markets. The provision of a pension can in some respects be viewed as deferred remuneration. As such, where firms provide a generous pension scheme, assuming a rational labour market, then this will affect both the ability of firms to attract employees and retain staff. In addition to this it has been shown that the pension also provides management leverage with employees and trade unions (Ippolito (1985). In situations where management are negotiating costly wage increases, these can be limited by promising additional funding to the pension scheme. The provision of such pension benefits can therefore benefit management in terms of attracting and retaining higher quality labour while limiting costly wage increases.

Managers therefore have to trade off a number of incentives in deciding what level of funding is optimal. Managers must weigh up the costs and benefits of fully funding the scheme and the subsequent benefits that they can derive from the scheme. Although these issues are of interest, within the subsequent analysis it is not possible to empirically test these issues.

Two final issues that relate to the provision of defined benefit pension schemes are the regulatory environment and the tax regime. Over the sample that I consider pension scheme funding was subject to the Minimum Funding Requirement (MFR). This however, proved to be an onerous burden on firms with many not being able to afford the deficit recovery schedules that the MFR imposed. Managers therefore negotiated with the trustees of the pension scheme and the employees with regards to deficit recovery plans and the rate of additional funding that would be provided. The regulator, the Occupational Pensions Regulatory Authority (OPRA), at this time was satisfied with this outcome as additional funding was being provided and so we have a situation where there is a regulatory expectation that deficits would be funded.

The final issue that has to be considered is the role of taxation and pensions. In the UK pension contributions, capital gains and interest on fixed income securities are tax exempt, and so there are benefits associated with operating a pension scheme. Management can therefore implicitly pay employees a higher wage without having to bear the full cost as the contributions to the scheme are tax deductible. A secondary issue that affects the UK is the abolition of dividend tax relief on equities in 1997-8. One may expect therefore that this would push firms away from equities as the realised return on equities is therefore lower after tax. However, this does not seem to be the primary factor at work as equities are still the dominant asset in UK pension portfolios.

In addition to this the government in the 1980's placed a cap on the maximum level of funding that a scheme may have. The cap was placed at 105% to prevent firms from over-investing in the pension scheme to reduce the taxable profit of the firm.

In considering tax and pensions I believe that the tax costs/benefits of running pension schemes do not dominate management's desire to provide pensions. Other considerations such as the risk of shortfalls, uncapped liabilities and regulatory pressure to provide immediate financing will play a stronger role in influencing managerial decision making.

1.3 Pension Accounting

Pension accounting is one of the biggest challenges currently facing accounting standard setting bodies. There are a number of issues that surround what is a very complex area. The biggest source of the controversy is the role of fair value accounting as opposed to historical cost accounting. The UK adopted a system of fair value accounting with the introduction of Financial Reporting Standard 17 in 2001. Subsequently the International Accounting Standards Board has continued along the fair value path with the introduction of International Accounting Standard 19.

The use of fair value accounting is controversial for a number of reasons. The marking to market of the pension assets is a relatively straight forward process as the value of the assets on the balance sheet date can be taken from the prevailing market prices. The calculation of the liability however is based around complex assumptions about future rates of mortality for different cohorts of workers, future rates of inflation and interest. The liability that is presented in the annual report would be more accurately described as marked to assumption as opposed to marked to market. Here in lies the controversy as the choice of the appropriate discount rate, rates of inflation,

interest rates and future mortality are subjective and are therefore open to a wide range of variation. As a result the liability that is presented may not be a true representation of obligation on the firm.

One of the most crucial aspects of this is the value relevance of the accounting amounts that are presented in the annual reports. The goal of the financial reports is simply to present a true and fair view of the firm's assets and liabilities. In an efficient market these amounts should be impounded into the share price of the firm. Pension accounting is by its very nature complex and as a consequence the amounts presented in the financial accounts may be opaque as the market cannot assess them properly.

In tandem with this the process of marking to market potentially exposes the balance sheet and the profit and loss to a considerable amount of volatility. The average pension portfolio consists of 70% equity, 25% bonds, and 5% other assets (cash, property and insurance contracts etc). In having such a large equity exposure the assets of the pension scheme will fluctuate up and down with movements in the stock markets. As a result many firms will report high levels of scheme funding in one year and substantial deficits in subsequent years. Underlying this problem is the fact that the financial reports are presenting the level of funding in the scheme today for a liability that may be due in 40 years. As such it may be somewhat counter intuitive to look at today's market prices.

In chapter 4 I therefore consider the implementation of FRS-17. I document the range of assumptions that are adopted across firms, auditors and actuaries. Further, I analyse the determinants of the assumptions that are adopted by management. Last I test the value relevance of the assumptions and the accounting amounts that are disclosed in the annual report.

My results are as follows. I find that the cross-sectional variation in assumptions I observe across firms cannot be explained by the identity of either the auditor or actuary of the firm. Further, I find that the assumptions that are disclosed are on the whole significantly different from expectations. I present evidence that the choice of assumption is a function of the asset composition of the pension portfolio and funding of the pension scheme. Last I show that the accounting amounts that are presented in the annual reports are value relevant and so the introduction of fair value accounting has resulted in accounting amounts that are impounded into share prices. However, the variation in assumptions that is observed shows that the discretion afforded to management prevents a 'true' picture of the pension scheme of the firm.

1.4 Pensions, Risk and Market Efficiency

One of the key factors in a well developed financial market is the efficiency of the stock market. Efficient stock markets should in theory incorporate all relevant information into stock prices. Under the efficient markets hypothesis (Fama (1966)) the market will reflect all of the underlying fundamentals of the firm. However, in reality there are situations where the market may not be able to do this. One such situation is with pensions.

The complex way in which pensions are accounted for may prevent the market from seeing through to the true risks of the underling pension scheme risks (Jin, Bodie and Merton (2006)). In such a situation measures of systematic risk may not accurately reflect the risks associated with the pension scheme. Consequently, firms will be under/over priced and investors will not be able to appropriately assess the risk and return of their investments.

Pensions and their concomitant risks are also complex as the scheme presents many different risks. The first is the size of the liability. Large pension liabilities are inherently risky as they represent a substantial long-term burden on the firm. The level of funding in the scheme presents a further risk as the scheme may have a large liability relative to firm size but be fully funded. If the market is efficient the funding of the scheme relative to firm size should also be reflected in measures of systematic risk. Lower levels of funding relative to the size of the firm should be associated with higher measures of beta.

Another important factor in assessing the risk of the pension scheme is the asset allocation strategy that the firm adopts. If equity is the dominant asset in the pension portfolio the funding level of the pension scheme will be subject to a higher degree of short-term volatility. Essentially significant falls in the stock market will severely reduce the funding of the pension scheme thereby increasing the risk of the firm. Measures of market efficiency should therefore reflect this risk.

In circumstances where all of these factors are reflected in measures of systematic risk the market is reasonably efficient. This is important for two reasons. First, the prices that are quoted in the stock market will reflect this risk. Second, the market can properly asses the information that is presented in the financial accounts of the firm.

The pension however will not just affect market measures of risk but also measures of financial distress and operating distress. Large pension liabilities are associated with higher pension costs. Consequently, the magnitude of the liability will contribute to increased financial distress within the firm.

Further, the asset allocation of the scheme may be determined by the level of financial distress within the firm. If equity is the dominant asset in the portfolio the

funding of the pension liability will be subject to higher levels of volatility. As a consequence of large shifts in the assets of the pension scheme the firm may be required to provide large amounts of additional financing and this in turn will increase the financial distress of the firm. Conversely, higher investment of pension assets in bonds increases the duration of the pension portfolio and creates a more stable pension cost. In such circumstances the likelihood of large amounts of additional funding being required are reduced.

As with financial distress firms are also exposed to operating distress. The generation of low returns on the assets of the firm may simply be a function of the operating environment of a given industry. However, the pension asset allocation strategy should reflect this risk. As with financial leverage the level of equity held in the pension portfolio will subject the funding level of the scheme to greater levels of volatility. In response to such shifts the firm may be called on to pay higher contributions to the scheme to shore up funding. However, due to the low margins of the firm such large costs will have a detrimental effect on the firm. In response to such a risk managers may opt allocate a greater percentage of scheme assets into bonds as this will create a more stable and consistent pension cost.

One final risk that may also be affected by the pension scheme is the probability of default. The pension liability in many instances is greater than the market value of the firm. For some companies, such as British Airways, the deficit of the pension scheme is close to the market capitalisation of the firm. In such circumstances where the pension liability dwarfs the corporation this must impact upon the probability of default. The size of the scheme, funding of the scheme and the additional financing that may be required may increase the likelihood of default. Further, pension liabilities are now classed as debt like obligations between the firm and employees consequently

the liability in many respects is a further debt on the firm and could therefore contribute towards increased probability of default in the firm.

In chapter 5 I analyse all of these different risks. The first part of my analysis considers systematic risk and pension risk. I extend Jin, Bodie and Merton (2006) as I consider each of the different pension risk components separately. Further, I also analyse the relation between pension risks and the Fama-French (1993) size and value risk factors.

I also consider the relation between pension risk and measures of operating and financial distress as well as the probability of default. In addition to this I test for risk-shifting and risk management within the pension portfolio in response to higher levels of operating, financial and default risk within the firm.

My results can be summarised as follows. First, measures of systematic risk reflect the size of the pension liability, the level of funding in the scheme and the asset allocation. Further, I find that the size and value loading factors from the Fama-French (1993) 3 factor model also reflect the risks of the pension scheme.

In looking at operating risk, financial risk and probability of default I find that higher measures of risk are associated with larger pension liabilities and poor levels of scheme funding. For my analysis of risk shifting and risk management I find evidence of risk management by firms that have higher levels of operating risk and financial risk. However, I find no evidence of risk management or risk shifting in response to increased default risk.

1.5 Pension Contributions, Internal Capital Markets and Firm Profitability

The funding of pension deficits through large contributions constrains the resources of firms. Under a Modigliani and Miller (1960) costless finance model the funding of the pension liability would be financed through external capital markets. In circumstances where the cost of internal and external finance is equivalent managers would simply opt to raise finance from the markets and maintain the level of investment within the firm. However, external finance is not costless as a result of information asymmetries, taxes and costs of issuance (Rauh (2006)). Managers will therefore opt to utilise the internal resources of the firm.

For management there are a number of internal resources that could be exploited to provide large contributions to the scheme. These resources would have to allow management a high degree of discretion over the assets as well as being substantial enough to make an impact in the deficit of the scheme. Three such internal resources are capital expenditures, dividends and asset disposals.

The most obvious choice of internal resource for management to exploit is capital expenditure as this affords them the greatest level of discretion. However, in choosing to reduce capital expenditure to fund the pension scheme will obviously decrease investment in the firm. Managers may therefore have to forgo profitable projects that they would otherwise have invested in. As a result the profitability of the firm may reduce as a consequence of having to fund the pension deficit.

Another potential source of funds is dividends. For many firms dividends are a significant cash outlay. As such managers may tap into this resource. Dividends however act as a signal to the market (Battacharya (1979) and Miller and Rock (1985)).

In reducing dividends to fund the pension deficit this would convey negative news to the market and consequently the share price of the firm may fall.

Asset disposals are also a potential source that managers may utilise to fund a pension deficit. Managers may opt to sell off obsolete assets or assets that have a high market value and can be substituted with low cost alternatives. One such case would be to sell some of the property owned by the firm and purchase cheaper property or even lease premises. This outcome is complex, however, when faced with the market implications of cutting dividends or the loss of potentially profitable investments this strategy may be the most optimal choice. There are also real life examples of such complex strategies. The Pensions Corporation fund pension deficits in exchange for the ownership and lease back of the IT facilities of the corporation whose deficit they fund.

Profitability is also a major factor in looking at the impact of large contributions to fund pension deficits. As a result of pension deficits being funded from the internal resources of the firm, profitability may be impacted upon. There are two potential outcomes if this is the case. First the funding of the pension deficit may reduce profitability as the firm has to reduce investment. Consequently, managers are unable to undertake all of the profitable investments that are available to the firm. However, there are also potential upside benefits to having to pay large contributions to the pension scheme. The large contributions may reduce excessive free cash flow in the firm and reduce overinvestment and empire building. Potentially, large pension contributions may reduce agency issues and its associated costs and improve profitability in the firm through more efficient asset allocation strategies.

In chapter 6 I analyse the relation between large pension contributions, internal capital markets and firm profitability. I firstly document the relationship between scheme size, asset allocation and funding levels. Further, following Rauh (2006) I test

the relation between capital expenditure and large pension contributions. I extend this analysis by testing other potential sources of internal finance that managers may exploit namely dividends and asset disposals. Last I analyse the relationship between firm profitability and large pension contributions.

My final set of results can be summarised as follows. First, I show that the contributions paid to the scheme are a function of the size of the pension scheme, the level of funding and the asset allocation of the scheme. Further, consistent with Rauh (2006), capital expenditures fall in response to large pension contributions. In addition to this I find that the level of dividends paid and asset turnover within the firm are unaffected by large contributions to the pension scheme. Finally, I find that the profitability of those firms that pay the largest contributions is higher. This is consistent with a reduction in agency costs within the firm as there is a more efficient use of firm assets and a reduction in over investment within the firm.

1.6 Structure of the Thesis

The rest of the thesis is set out as follows. Chapter 2 presents an institutional setting with an extensive discussion of the evolution of pension accounting in the UK from SSAP-24 to FRS-17. Chapter 3 provides a detailed description of the data, the challenges that the data presents and descriptive statistics of the data that will be used in the subsequent analysis. Chapter 4 is the first empirical chapter and analyses how firms account for their pensions under FRS-17 and the value relevance of the new standard. Chapter 5 is the second empirical chapter and presents my analysis of risk and pensions. Chapter 6 is the final empirical chapter and present my analysis of pension contributions, internal capital markets and firm profitability. Chapter 7 concludes with a summary of my main findings and contributions as well as suggestions for further research.

2
ACCOUNTING FOR PENSIONS

2.1 Introduction

This chapter provides a detailed summary of the evolution of pension accounting in the UK. The chapter presents the historical development of pension accounting in the UK from Statement of Standard Accounting Practice 24 (SSAP-24) to Financial Reporting Standard-17 (FRS-17). In tandem with this I highlight the issues and concerns that emerged over time and the main features of each new standard.

The chapter itself is expansive and covers not only the evolution of pension accounting from the mid-1980's but also the role of the actuary and the issues associated with the fair value approach that the Accounting Standards Board have subsequently adopted. I discuss the role of the actuary and the complications surrounding pension calculations as they are inextricably linked to the development of how pensions are accounted. One very clear result of this discussion is the complexity that underlies any method of pension accounting. The chapter also highlights some of the issues surrounding the role of fair value accounting for pensions. I finally arrive at the disclosure requirements of Financial Reporting Standard-17.

The rest of chapter is set out as follows. Section 2.1 provides the background to SSAP-24 and some of the issues that early standards tried to address. Section 2.2 discusses the role of the actuary in pension accounting. Section 2.3 presents how pensions are accounted for under SSAP-24. Section 2.4 provides the background to the

development of FRS-17. Section 2.5 discusses the use of market values in pension account and the final section 2.6 presents the accounting disclosure requirements of FRS-17.

2.2 Background

Since the early eighties there have been a number of significant changes to the accounting treatment of company pension schemes. The main objective of the accounting standards has been to increase disclosure and transparency as to the true position of company pension funds. In doing so the users of financial accounts should be able to compare, the current cost, scheme liability and funding level when analysing the annual reports of firms. However, due to the complex nature of the problem there are a number of issues that have arisen with each of the standards[2].

In 1983 the UK Accounting Standards Committee (ASC) introduced Exposure Draft 32 (ED 32) "Disclosure of Pension Information in Company Accounts". This was the first real move towards fuller disclosure as there was little prior to this. The lack of disclosure meant that it was not possible to adequately assess the current state of a company's pension fund, that is to say the current liability or the magnitude of any future liabilities. However, this Statement of Recommended Practice (SORP) did not consider the measurement methods used to arrive at the liability, and more significantly it did not consider the pension cost to the company.

Further, ED 32 did not state how any surplus/deficit should be accounted for. This is one of the key issues in looking at the position of a pension fund. Consequently, after a consultative process the ASC issued ED 39 (1986). The most significant

[2] This Chapter covers much of the discussion surrounding the different discussion papers and consultation documents that were released throughout the evolution of UK pension accounting.

improvement to the previous SORP was to account for the pension cost on a "regular and systematic basis over the service lives of employees". In doing so, the costs of providing benefits are matched with the benefits received.

Another key part of the new SORP was its differential treatment of surpluses and deficits, unlike ED 32, that did not make this distinction. At the time of ED 39 there were many pension funds that were on payment holidays (where no contributions are made to the pension scheme). The payment holidays were a function of past downsizing and high levels of return on current pension investments. This, in turn, translated into a false increased profit level as the cost of the pension scheme contributions was lower[3]. However, ED 39 stated that any surplus must be spread over the remaining service lives of employees.

Another significant change was the enactment of the Finance Act 1986. This was a wide-ranging piece of legislation that attempted to remedy the problem of excessive pension fund surpluses that capped the maximum level of funding to a pension scheme and placed a cap on the maximum surplus a fund could have. The Act placed a 5% cap on scheme surplus, the assets in a scheme could therefore not be greater than 5% over the total liability of the fund. A number of options were provided on how to allocate any surplus above this level.

A scheme could reduce the surplus to the 5% maximum allowing for the tax benefits a scheme received to remain in place. The first option made available for allocating the surplus was that it could be refunded as a lump sum to employers; however, such a refund was eligible for tax as no tax had been paid upon the capital gains while invested in the scheme. Few firms therefore took advantage of refunds. A

---

[3] In this situation profits can be inflated by taking payment holiday as this pension cost is a significant portion of total payroll costs. Consequently, the contribution holiday reduces payroll costs and increases profits.

payment holiday or a period of lower contributions was also an option, although a 5-year maximum was placed upon this. The pension fund could increase the final benefits that the scheme provided. The 1986 Act also allowed for firms to mix all of the options.

2.3 Pension Costs and the Profit and Loss

The significance of pension costs to a firm is not always clear in company accounts and the implied liability is often misunderstood in the analysis of a firm's pension scheme. Pensions are firstly part of an employees' remuneration package. Consequently, the cost of pension provision is a significant percentage of total payroll costs. However, due to the complex and long-term nature of the pension liability, it is problematic to account consistently from year to year for the true cost and liability facing a firm arising from providing a pension scheme to employees.

2.3.1 Different Types of Pension Schemes

There are a number of schemes that are available to employees and these schemes offer different levels of pension income and pension rights to employees. The most common schemes are defined contribution schemes and defined benefit schemes. There are however ex-gratia pension schemes. These schemes are applied on a case by case basis where there has been no prior formal arrangement or legal obligation on the employer to provide a pension scheme to employees.

The first common type of pension scheme is a defined contribution or money purchase scheme. Under this arrangement contributions are paid by the employer to the pension scheme on an annual basis. The most important factor here is that the employer is under no obligation to provide a specified level of benefits on retirement. Consequently, the pension that is received is dependant upon the level of contributions

paid to the scheme and the return on the pension scheme investments (assets). The cost to an employer can, therefore, be measured with a high degree of certainty as it is simply the cash contribution.

The second defined benefits scheme is more complicated than a defined contributions scheme. Such a scheme is dependant either on the average earnings of employees, or more commonly, their final salary. Due to the uncertainty over what the average salary of an employee will be, or what their final salary will be, there is a significant and complicated problem as to how an annual cost can be calculated to meet the company's obligations.

This problem is exacerbated by the uncertainty over whether or not the scheme's assets will be adequate to meet the scheme's liabilities. Essentially, if the return on investments and contributions is not sufficient to meet the scheme liabilities then the scheme will be in deficit. Further, the actuarial assumptions about future rates of mortality, interest rates, and inflation all affect the solvency of a scheme and the schemes ability to meet their pension obligations.

To further complicate the issue of how to account for defined benefit schemes, the scheme is a legal promise by employers to provide a specific level of retirement benefits to employees. In this situation, if the return on the pension assets is insufficient to meet the pension liability the company is legally bound to cover any short fall from corporate profits.

Alternatively, if a pension scheme had a surplus (pension assets are greater than pension liabilities) this can benefit the company. This could result in a payments holiday,

reduced contributions or a rebate[4]. All of which are governed by accounting regulations and statute law.

Pension funds can also be classified as funded or unfunded schemes. For a scheme to be funded it will involve contributions from an employer, and usually an employee, that are paid into a scheme where they are invested in financial assets. An unfunded scheme is one where the benefits are paid directly by an employer. The accounting standard however, applies to both types of scheme as the cost of pension provision must be accounted for in the annual report.

2.4 The Role of the Actuary

In seeking to provide useful disclosures about pension schemes it is necessary to rely on actuarial advice, to cost the pension scheme as well as for advice in administering a scheme. For a defined contribution scheme it is not necessary to use an actuary to calculate the annual cost as the scheme is simple to administer. However, in arriving at a cost for a defined benefits scheme it is essential to apply actuarial methods and techniques.

Actuarial calculations are the most appropriate method for assessing the position and associated costs of defined benefit schemes. Such schemes are extremely complicated to cost as they are sensitive to small changes in assumption as a result of their long-term in nature. The cost calculation can therefore be significantly affected by the model used and the assumptions that lie behind the cost calculation.

In performing a calculation an actuary must consider many factors that are extremely sensitive to wider economic circumstances and difficult to predict. These

---

[4] All of these terms are discussed in greater detail later in the chapter.

include future rates of inflation, pay increases, pension contributions, return on investments, increases to the number of members in a scheme, the demographics of a scheme, and mortality rates.

> *"An actuary will therefore make assumptions about all of these factors as a whole. Any assumptions are mutually compatible, in the knowledge that, if experience departs from the assumptions made, the effects of such departures may well be offsetting, notably in the case of investment yields and increases in prices and earnings*[5]*."*

Actuaries also structure funding plans for pension schemes to allow them to accumulate assets over time to enable the scheme to meet the pensions liability. In theory this accumulation will be performed in a prudent and controlled method, allowing for pensions to be provided without impacting upon a firm's cash flow. Underlying any funding plan is the objective that the present level, and estimated future levels, of contributions will be sufficient to meet the liability of the scheme.

There are a number of methods that actuaries apply in calculating the contribution levels of a scheme. However, one of the most common objectives is to achieve a level contribution rate over future pensionable service. One example of assumptions that can be applied to reach a level contribution rate, using accrued benefits methods, is that the new entrants to scheme will not affect the average age of the workforce. Alternatively, the prospective benefits method only looks at the current workforce, and then arrives at a contribution rate that will remain stable regardless of changes to the workforce size and age profile.

In both of these assumptions there are two of the key economic fundamentals that underpin pension provision. The first is the ratio of workforce to pensioners. If this ratio remains stable overtime then pension provision is less problematic, assuming

---

[5] SSAP-24 paragraph 9.

that the return on investments is sufficient to meet the scheme liabilities. The second is the impact of increasing longevity (stochastic mortality). This is a much more complicated factor and requires either an increased level of contributions or later retirement as the scheme must provide a pension over a much longer time horizon. Implicitly the prospective benefits method therefore will result in a higher rate of contributions than the accrued benefits method.

Another key factor here is the impact of discounting and reporting present values in pension costs and the scheme assets and liabilities. In accounting there is no time value of money considerations, and accounting values are predominantly reported at current values. However, the role of discounting has a serious impact upon the current and future cost of a pension scheme. Consequently, if there is a change to the prevailing interest rates between contributions the effect is not material and can be broadly ignored. However, if the changes in interest rates are expected to persist the situation resembles that of an unfunded scheme[6]. Therefore, a change to the charge (contribution in funded scheme) and interest on the unfunded liability will have to be adjusted.

In assessing a scheme and applying a funding plan, the actuary sets out a general plan for the cost of providing a pension scheme. However, due to the long term nature of the problem then it is possible that a deficit can occur. If the deficit is not expected to be offset by future surpluses, or the circumstances that have given rise to the deficit are expected to remain, then it is necessary for additional contributions to be made. It is also possible for firms to increase contributions at one period in time to reduce future payments.

---

[6] In an unfunded scheme the charge to the profit and loss is reviewed, discounted and adjusted each year based upon the charge and interest on the unfunded liability.

There are a number of options open to companies for doing so. The first is to have a period of increased contribution levels. The second is a lump sum payment that will reduce future liabilities. The third is to pay lump sum contributions over a period of time.

Regardless of expectations about increased contribution levels or lump sum payments to the scheme, the underlying principle of level contributions will be applied in calculating the annual pension cost.

2.5 Accounting for pensions under SSAP-24 1988

The accounting objective of SSAP-24 was that;

"From the point of view of the employee a pension may be regarded as deferred remuneration; from the point of view of the employer it is part of the cost incurred in obtaining the employee's services. The accounting objective therefore requires the employer to recognise the cost of providing pensions on a systematic and rational basis over the period during which he derives benefits from the employees' services. Many companies have until now, simply charged the contributions payable to a pension scheme as the pension cost in each accounting period. In future, in order to comply with this statement, it will be necessary to consider whether the funding plan provides a satisfactory basis for allocating the pension cost to particular accounting periods."

2.5.1 Defined Contribution Schemes under SSAP-24

Under SSAP-24 there was no change to how defined contribution schemes are accounted for. This is because at any one point in time the employer's obligation is only the amount of contributions that they must pay to the fund. The cost is, therefore, simply the amount of contributions payable in respect of a particular accounting period.

2.5.2 Defined Benefit Schemes under SSAP-24

In accounting for defined benefit schemes, the standard accepted that actuarial valuations and assumptions are necessary to arrive at an annual cost for the provision of the pension scheme. The method used, however, must be one which satisfies the accounting objective of the standard. In applying a model the actuarial method must allow for, full provision being made over the service life of employees' for the expected cost of providing a pension in retirement, the effect of increased future earnings (including merit increases), up to the estimated retirement date, early retirement or death in service.

The calculation of the cost should also be based upon the most likely scenario and not on outcomes that are unlikely to occur. Further, the methods that are applied should be consistent from year to year and should be disclosed; as should any change to the actuarial method. In circumstances where a change of method occurs this must be quantified to show the impact of the change.

In calculating an annual pension cost for a company, a regular cost must be calculated. Essentially this will form a large percentage of the total payroll costs based upon the actuarial method that is applied. This can be seen as the basis for calculating the regular cost in accordance with the accounting objective as long as this cost will make full provision for benefits over the service lives of employees.

However, there are a number of factors that can result in variations from the regular pension cost:

1) A surplus or deficit;

2) The effects on the actuarial value of accrued benefits of changes in assumptions or model;

3) Subsequent changes in benefits or in conditions;

4) Increases to pensions in payment or to deferred pensions for which provision has not been made;

In providing defined benefit schemes for employees companies will experience both surpluses and deficits. This occurs as changes to the return on assets, mortality, earning estimates etc. All of which, impacts upon both the ultimate liability and value of assets in a scheme. To account for such changes, the current and future costs that are charged to the company should be adjusted either by increasing or decreasing the cost, thereby allowing the company to meet their final liability.

The standard states that the normal period for such adjustments, for both surpluses and deficits, is the remaining service lives of current employees[7]. It is also permissible to spread this cost over the average service lives of employees. This period will change from scheme to scheme and over time, and will be based upon actuarial estimates. Where:

For a surplus:

Regular Cost – (Surplus/Average Remaining Service Life)

And for a deficit:

Regular Cost + (Deficit/Average Remaining Service Life)

In an attempt to limit volatility in the profit and loss, there are only limited circumstances that allow for a surplus or deficit to be accounted for in a single year. For a situation to fall out with the scope of the standard, events that are not within the capacity of actuarial estimates must occur.

---

[7] This will be adjusted to include expected withdrawals from the scheme.

First, if a company has experienced a large restructuring resulting in a much smaller number of employees. In this situation, any surplus or deficit falls upon those who are no longer employees, to spread either the benefits or costs over those who are still within the scheme would not be fair. Second, under the Finance Act (1986) firms can realise a refund from a surplus in the year that it is received, although full disclosure about the surplus is still required.

These circumstances do not however apply to any periods of changes to contribution levels to account for a surplus or deficit. In these situations the increase or decrease to the level of contributions will be accounted for in the year/years in which they occur. This also applies to contribution holidays, although such events are foreseeable they are to be accounted for in the period in which they occur and the benefit cannot be accumulated into one accounting year.

There is one final set of circumstances that allows for a 'material deficiency' to be recognised in one year. If there has been mismanagement of the funds assets then prudence requires the firm to realise this loss over a much shorter time period. This situation also falls out with the scope of actuarial assumptions. Due to the impact that this would have on the scheme liabilities, then it is not prudent to account for this over the remaining service lives of employees, as it could lead to shortfalls.

2.5.3 Accounting for Changes to Actuarial Assumptions and Valuation Methods

Changes to the assumptions and model that are used to analyse the scheme assets and liabilities and therefore the current cost of benefit provision are treated in the same way as other changes. These changes are not exceptional; consequently, changes to the estimated costs and contribution rates should be spread over the remaining service lives of employees.

As with changes to assumptions and valuation methods, subsequent changes to the level of benefit provision should be accounted for over the remaining service lives of employees. Further, if a surplus is allocated to increase the benefit provision to employees, the surplus should be allocated over the remaining service lives of employees.

2.5.4 Increases to Pensions in Payment and Deferred Pensions

Limits to increases in pension scheme contributions will be stated within a scheme's rules and trust deeds. However, it is possible that the rules may be changed to allow for an increased level of contributions. This may arise through negotiation with employees, trustees or unions. For deferred pensions UK law specifies that there needs to be a minimum level of provision. Such changes to the scheme should be accounted for within the actuarial assumptions. The change to the cost should therefore be charged over the remaining service lives of employees. Any exceptional change that is out with the scope of the actuarial assumptions will contribute towards the creation of a surplus or deficit.

Discretionary increases may also occur through the life of a pension. However, if a discretionary increase becomes regular, then it is no longer discretionary, and therefore becomes part of the regular cost. Such increases can be paid by the employer directly or they can be paid from the scheme itself. Further, discretionary increases may be subject to a review as they are not part of any commitment that the employer has made. However, once in place such increases in benefits will be expensed over the service lives of employees and will encompass part of the actuarial valuation method.

If there is a one off payment this should be treated as an ex-gratia payment. Consequently, the cost of such a payment should be accounted for in the year in which it occurs, and not spread over the remaining service lives of employees. The treatment

of providing ex-gratia pensions for certain employees is the same as for non-recurring discretionary payments.

2.5.5 Accounting for Different Company Schemes

There are a number of schemes that could be classed as hybrid schemes. Such schemes combine features that are common to both defined contribution and defined benefit schemes. In trying to account for such pensions, it is necessary to assess what type of scheme is closest to the pension scheme in operation. This can be conducted through an examination of trust deeds and how the scheme is operated. Whereby,

'The accounting treatment that should be applied will be dependant upon the underlying substance of the scheme[8]*'*

In looking to companies that provide international pension schemes, the standard requires that there should be a consolidation between the domestic and foreign schemes under the rules of SSAP-24. There are only two exemptions, and they occur in special cases as the standard recognises that foreign obligations are as important as domestic obligations in determining the true position of a company's pension scheme.

One exemption will be where the foreign obligation is fundamentally different from the UK obligation. One such situation would be where the firm has to pay into a national pension pot and so the obligation here are essentially different from the UK defined benefit or defined contribution costs.

The second exemption is more encompassing, that is where there is not enough accounting disclosure or actuarial disclosure to adequately assess the foreign scheme under the standard. In this situation however, there should be a disclosure of the pension cost that is attributable to the foreign scheme and that a measure of the foreign

---

[8] SSAP-24 paragraph 39.

liabilities to the foreign assets should be given. This will allow for a more accurate picture of the companies overall pension liabilities.

Further to this, the company must account for subsidiary schemes in a similar way to which international schemes are accounted for. The main company should therefore show the full liability for the group as a whole. The subsidiary company should disclose the name of the holding company that bears the ultimate responsibility for the pension liability.

2.5.6 Disclosure Requirements under SSAP-24

In line with the accounting objective and the general movement towards greater transparency, the information that is presented should give the user of financial statements a true view of the impact of the pension scheme and its' liability on the group's and/or company financial statements.

For a defined contribution scheme it will usually suffice to indicate the nature of the scheme and the amounts included in the profit and loss account and the balance sheet.

For a defined benefit scheme more extensive disclosures are needed. This is due to the complex long term nature of problem and the uncertain liability that it places upon the firm. Disclosures that are required include the accounting policy, the actuarial valuation method and assumptions, the cost charged, with explanations of the cost, and certain actuarial valuation information.

As a result of the long term nature of the problem, it is also required that the disclosures are not only in relation to the financial statements, but also to future changes. Any significant changes to the future costs that are expected under the current method of actuarial valuation and assumptions applied should be reported. There should also

be a disclosure with regard to variation in the contribution rates, as the actuarial valuation method that is applied should lead to level contribution rates. This will usually result in disclosures about how new entrants to the scheme are incorporated[9].

In addition to these much more extensive disclosures, the standard requires that there should be a report of the most recent formal actuarial valuation or a review of the scheme on an ongoing basis. This should include disclosures about the market value of scheme assets and the level of funding in the scheme. Further, if these values have changed significantly between the formal or on going valuation, then there should be a disclosed adjustment figure so that the reported values are closer to their true value[10].

2.5.7 Formal Disclosure Requirements (SSAP Paragraphs 87 & 88)

The following disclosures should be made in respect of a defined contribution scheme:

a) the nature of the scheme (defined contribution);

b) the accounting policy;

c) the pension cost charge for the period;

d) any outstanding or prepaid contributions at the balance sheet date;

The following disclosures should be made in respect of a defined benefit scheme:

a) the nature of the scheme (defined benefit);

b) whether it is funded or unfunded;

c) the accounting policy, and if different, the funding policy;

---

[9] As explained in the assumptions of both the prospective benefits and accrued benefits examples.

[10] This would occur if there was a significant change in the level of contributions or in performance of the stock market between the assessment of the scheme assets/funding and the release of the annual report.

d) whether the pension cost and provision (or asset) are assessed in accordance with the advice of a professionally qualified actuary and, if so, the data of the most recent formal actuarial valuation or later formal review used for this purpose. If the actuary is an employee or officer of the reporting company, or of the group of which it is a member, this fact should be disclosed;

e) the pension cost charge for the period together with explanations of significant changes in the charge compared to that of the previous accounting period;

f) any provisions or prepayments in the balance sheet resulting from a difference between amounts recognised as cost or funded or paid directly;

g) the amount of any deficiency on a current funding level basis, indicating the action, if any, being taken to deal with it in the current and future accounting periods;

h) an outline of the results of the most recent and formal actuarial valuation or later formal review of the scheme on an on going basis;

This should include disclosure of:

(i) the actuarial method used and a brief description of the main actuarial assumptions;

(ii) the market value of scheme assets at the date of their valuation or review;

(iii) the level of funding expressed in percentage terms;

(iv) comments on any material actuarial surplus or deficiency indicated by (iii) above;

i) any commitment to make additional payments over a limited number of years;

j) the accounting treatment adopted in respect of a refund made in accordance with the provisions of paragraph 83 where a credit appears in the financial statements in relation to it;

k) the details of any expected effects of future costs of any material change in the groups and/or company's pension arrangements;

2.6 Background to FRS-17 – ASB Discussion Paper (2000)

SSAP-24 was found to have two main flaws:

1) There were too many options were available to the preparers of accounts, leading to inconsistency in accounting practice and allowing employers a great deal of flexibility to adjust results on a short-term basis.

2) The disclosure requirements did not necessarily ensure that, the pension cost and related amounts in the balance sheet were properly explained in the accounts.

Despite the attempts of SSAP-24 to increase the disclosure of information regarding defined benefit schemes, problems still existed in trying to account for such schemes. How to arrive at a representative and useful cost for such schemes remains

extremely complicated. The nature of these schemes means that, it is not possible to arrive at a full cost for providing such benefits to an employee, until all recipients die[11].

For accounting purposes the cost of providing these benefits needs to be spread over the service lives of employees. However, the cost is dependant upon the length of service, length of retirement, return on investments, interest rates, inflation and final salary. The number of significant variables and assumptions that are applied to arriving at a pensions cost is the fundamental flaw in SSAP-24. The standard requires,

"the employer to recognise the cost of providing pensions on a systematic and rational basis over the period during which he derives benefits from the employees' services"

The scope of the definition was too wide and the standard is not prescriptive. The objective allowed for the use of models and assumptions that will satisfy the standard, but were actually insufficient for disclosing useful or comparable pension values. The accounting objective therefore allowed for the short term manipulation of the pension cost.

"the standard in its' present form allows employers a great deal of flexibility to adjust results on a short term basis, substantially impairs an uninformed reader's ability to make judgements about annual pension costs, and in practice prevents any general attempt to compare one employer's pension cost with another's by adjusting one or both to a common calculation basis[12]."

"To increase the comparability between entities and to make accounts more comprehensible the ICAEW believe that the number of options in SSAP-24 should be reduced[13] "

The ASB conclusions are;

---

11 This refers to the direct benefits an employee will receive and any death in service benefits.
12 Paragraph 10 Pension Research Accounting Group Report (PRAG) 1992.
13 Paragraph 7(d) Institute of Chartered Accountants in England and Wales Report (ICAEW) 1992.

"...based upon the belief that an employer has an obligation to meet the pensions promised to employees and that the obligation is the liability for pension benefits earned by employees to the balance sheet less the assets set aside to meet the obligation. It is sometimes suggested that the accounts of the pension scheme should be consolidated in the group accounts of the sponsoring employer or that the liabilities for pension benefits and the assets set aside to meet it should be presented as separate items on the face of the employer's balance sheet. The board does not take this view."

2.6.1 Alternative Approaches to Accounting for Pension Schemes

The ASB selected two methods of calculating pension costs in considering how to remedy the problems with SSAP-24. Underlying these two approaches are two different perceptions of the pension cost.

1) The pension is viewed as an obligation of the employer that emerges over the long-term because of the present commitment to provide pension benefits.

2) The pension is viewed as an obligation of the employer as it exists now for the promised pension benefits.

The first view, of a long-term obligation that only becomes apparent as retirement approaches, necessitates an actuarial valuation approach. This valuation results in a present value of the pension liability being calculated based upon actuarial assumptions. In this situation market values are not appropriate as they do not represent the long-term outcome of providing retirement benefit.

The second view, of applying market values, results in an employer measuring their obligations and liabilities based upon the current value of assets. In arriving at an assessment of a scheme, then the market value of assets such as equities are applied. To arrive at a market value of the liabilities, the current value of deferred annuities can be

applied. This therefore, allows a market value based surplus or deficit to be calculated; this will result in very different values to the actuarial method.

The ASB preferred to apply the long-term actuarial method; however, they recognised that there was both the desire and precedent for applying the market value approach. From the consultation process there was a general desire to apply the market value approach. Further, international accounting standards were moving towards a market value approach. Consequently, in line with the ASB objective of international harmonisation the market value approach has been assessed (and subsequently applied).

2.6.2 Accounting for Pensions Using Market Values – International Evidence

In considering the problem the ASB recognised that both Australia and the US apply the market value approach. However, both Australia and the US apply the method in different ways. Australia was considering applying the difference between the scheme assets and liabilities as the pension cost. However, given the volatile nature of market values, this approach would result in profit and loss volatility. The ASB did not consider this as viable as excessive volatility in the profit and loss that is not related to firm performance is undesirable.

The US approach in applying market values attempts to avoid this volatility. In the US such fluctuations can be smoothed over time through a process of amortisation. As a result, fluctuations in market prices are not immediately recognised, and so the result is a lower level of volatility in the profit and loss.

The ASB, therefore, found that individually both methods were undesirable. The Australian method results in excessive volatility in the profit and loss. Where as the American method masks the true impact of market values, and so the disclosures are no

more useful than the SSAP-24 disclosures. As a result, the ASB propose a synthesis between the two methods.

2.6.3 Accounting for Pensions – Applying the Actuarial Valuation Method

The application of an actuarial valuation method is based upon many complex and long term assumptions. The actuarial theory is that, over a long time period these assumptions are mutually compatible, and therefore, offsetting. This would occur for example in asset returns. High equity prices would lead to lower bond yields and so if this changed the converse would be true. The ASB states,

"In making this proposal the ASB is not suggesting that the employer, or actuary to the pension scheme, is inherently better than the market at predicting the future course of prices for either the assets or the liability of the scheme. Although the assumptions are expressed in individual estimates, their essential characteristic is that they are compatible with each other over the long-term."

Essentially, the ASB and the actuarial profession believe, that over the long term such relationships are stable. For the actuarial valuation methods there are four assumptions that are required. First, there are salary assumptions, second, the method of cost allocation, third, the recognition of surpluses and deficits, and last, how information should be disclosed in the company accounts.

2.6.4 Incorporating Assumptions into Valuations

In reaching a value for the pension liability, one of the most important assumptions is how to measure and incorporate the expected final salary of members. Under both the market value and the actuarial methods of valuation the expected final salary is incorporated into the calculation. In this case the liability is based upon the expected final salary of scheme members, including general pay rises and merit increases.

There is however, another contrary view to this method. This method views the pension liability as not being dependant upon the final salary of members, but upon members' current salaries. The logic to such an approach is that, the firms obligations only extend as far as the current level of salary and not upon an unspecified future amount.

The ASB however, views that a defined benefits scheme constitutes a legally binding promise based upon final salary. It is therefore appropriate to calculate estimates of the final salary to arrive at a value for the pension cost, regardless of whether actuarial or market values are applied.

"A critical choice when calculating the obligation for pension benefits is to determine how the obligation for pension benefits accumulates over the lives of employees."

In allocating these costs over the lives of employees there are two main methods that are applied by actuaries. The first is the accrued benefits method and the second is the prospective benefits method.

The accrued benefits method takes the present value of benefits earned in the accounting period by an employee as the pension cost. Ignoring other assumptions that are required to arrive at a truly representative cost[14], results in the pension cost rising year on year for each employee. For an individual employee then,

---

[14] Ignoring assumptions about demographics, new members, inflation etc., with an annual percentage increase in salary, and therefore an annual percentage increase in the pension cost.

Figure 2-1 Pension Cost under Accrued Benefits Method

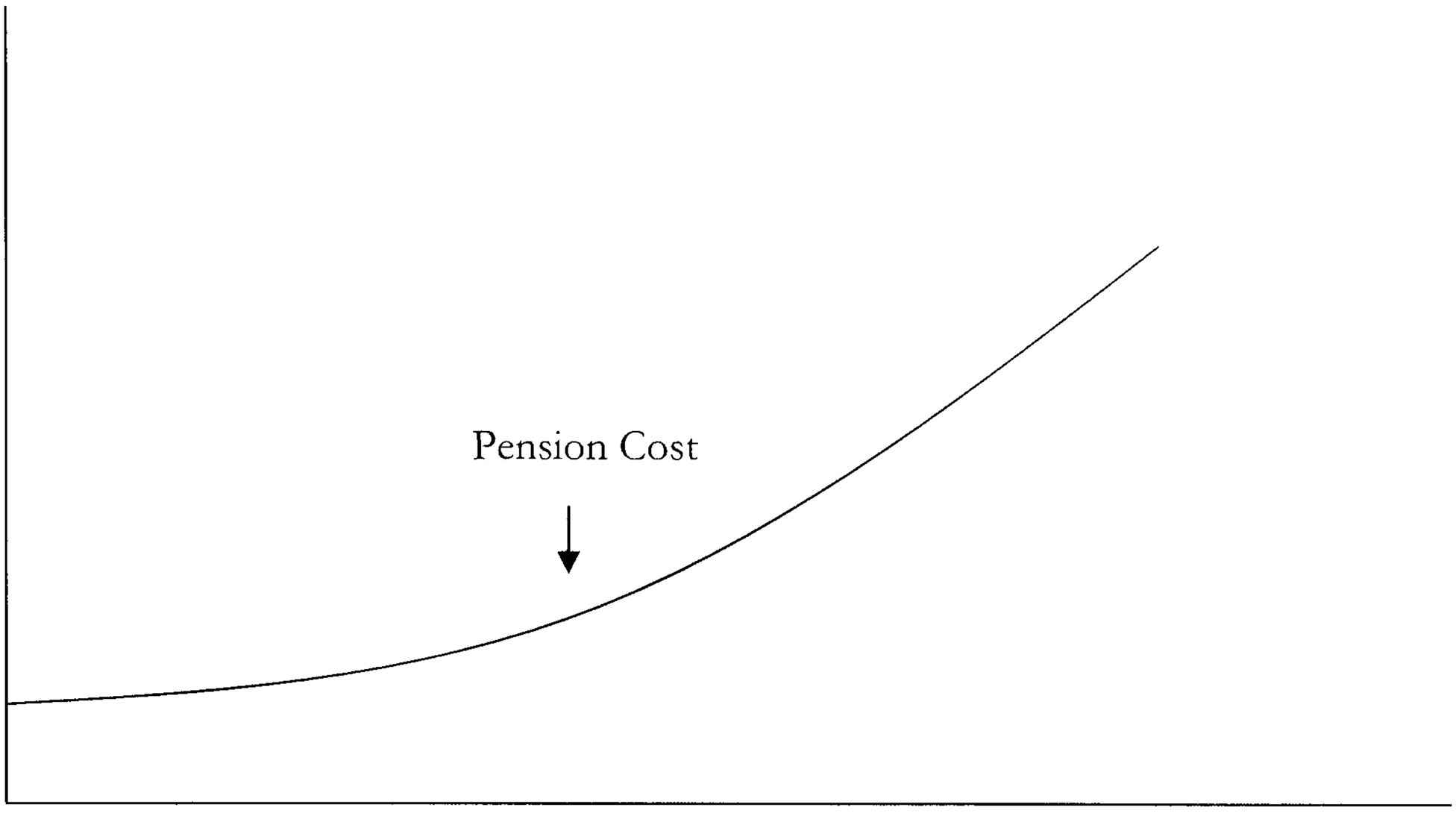


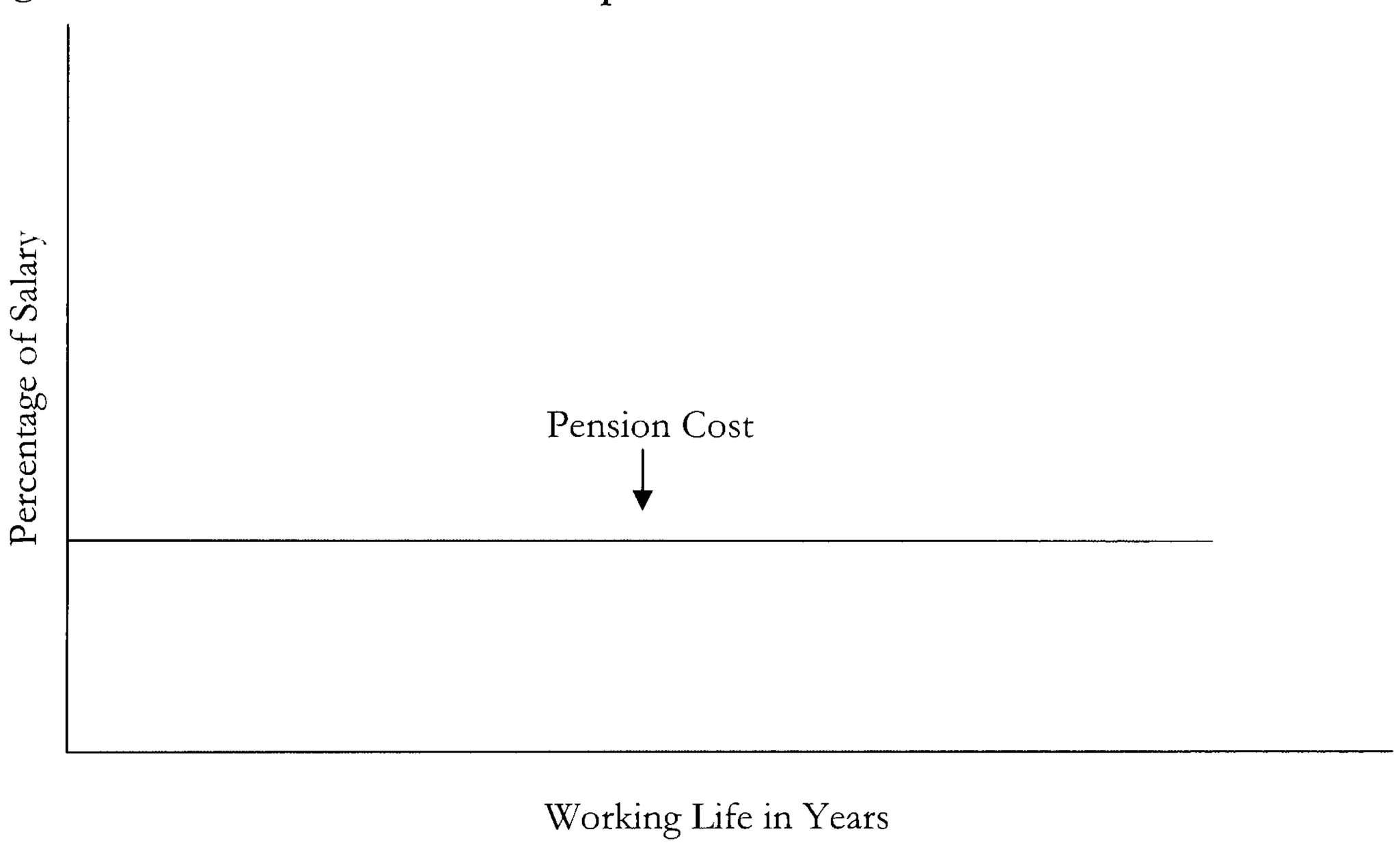
Figure 2-1 highlights the evolution of pension costs over the life of a single employee under the accrued benefits method. Here the investments (contributions) that occur at the start of an employees working life are worth more as they will generate returns over a much longer time period, than the contributions made at the end of an employees working life. Consequently, the cost of pension provision rises over the working life of an employee.

Under a standard final salary scheme where each additional year of employment contributes to the pension benefits received in retirement. As a result of the time value of money for earlier contributions to equal later contributions, whereby, earlier contributions will be smaller and generate a larger investment component while later contributions will be larger and generate a smaller level of return from investments.

Figure 2-2Figure 2-1 illustrates the pension cost for an employee under the prospective benefits method. The prospective benefits method is fundamentally different from the accrued benefits method in its treatment of the pension cost.

Prospective benefits attempts to value the total pension cost over the working lives of employees and then allocate the cost evenly over the remaining service lives of employees as a percentage of salary, consequently the pension cost is the same percentage of salary in every year of an employees working life.

Figure 2-2 Pension Costs under Prospective Benefits



The fundamental difference between these two approaches is the treatment of investment income over time. The underlying issue is,

'For a pension scheme that provides an equal proportion of the final pension benefit for each year of service, the question is, whether the pension benefit should be 'equal' when service is provided or 'equal' by the time retirement is reached[15]*"*

Accrued benefits follows that benefits should be equal on retirement, where as prospective benefits follows that it should be equal for each year of service. These issues become more complicated when applied to a whole scheme where there is a large work force, with many members of different ages, and at different lengths of service.

---

15 SSAP-24

To look at these issues under the accrued benefits method, there must therefore be a number of assumptions applied; first, it should be assumed that for each new member to the scheme there should be an older member leaving the scheme. Second, there must be an even age distribution, essentially there will be a symmetrical distribution, and it is also necessary to assume stable past service[16].

In this situation, when an accrued benefits model is applied, then, for every 'cheap' new or young employee, there will be an 'expensive' older worker. Consequently, it is possible to arrive at a level contribution rate. The accrued benefits method, however, will lead to higher pension costs if the assumption about the ratio of young to old workers is relaxed. If the average age of employees rises or there is a decreasing intake of new younger employees, the result will be a higher pension cost[17].

2.6.4.1 Advantages of Accrued Benefits

i) This method more closely represents the economic reality of pension provision. Older employees cost more than younger employees to provide benefits for. This method takes into account the time value of money;

ii) The calculated cost is directly linked to the level of benefits earned up to a specific point in time;

iii) The underlying premise of prospective benefits does not hold. The assertion that, salary represents the value of services of the employee is not consistent. There exist circumstances where, a lower paid employee can provide the same service as a higher paid employee;

---

[16] Essentially all workers in the scheme only ever work for one company and there is no early retirement or deferred pensions in this scenario.
[17] The prospective benefits method will arrive at the same level cost as the method accounts for new employees and retirees in the assumptions of the model.

2.6.4.2 Advantages of Prospective Benefits

i) Given that pension benefits are deferred remuneration, then it is best to recognise this cost evenly over an employees' service life, as benefits are accrued over an employees service live;

ii) An employee's salary is the best measure of their worth in any given period. The percentage of salary that is taken under prospective benefits therefore, is the most realistic measure of the benefits earned to services provided;

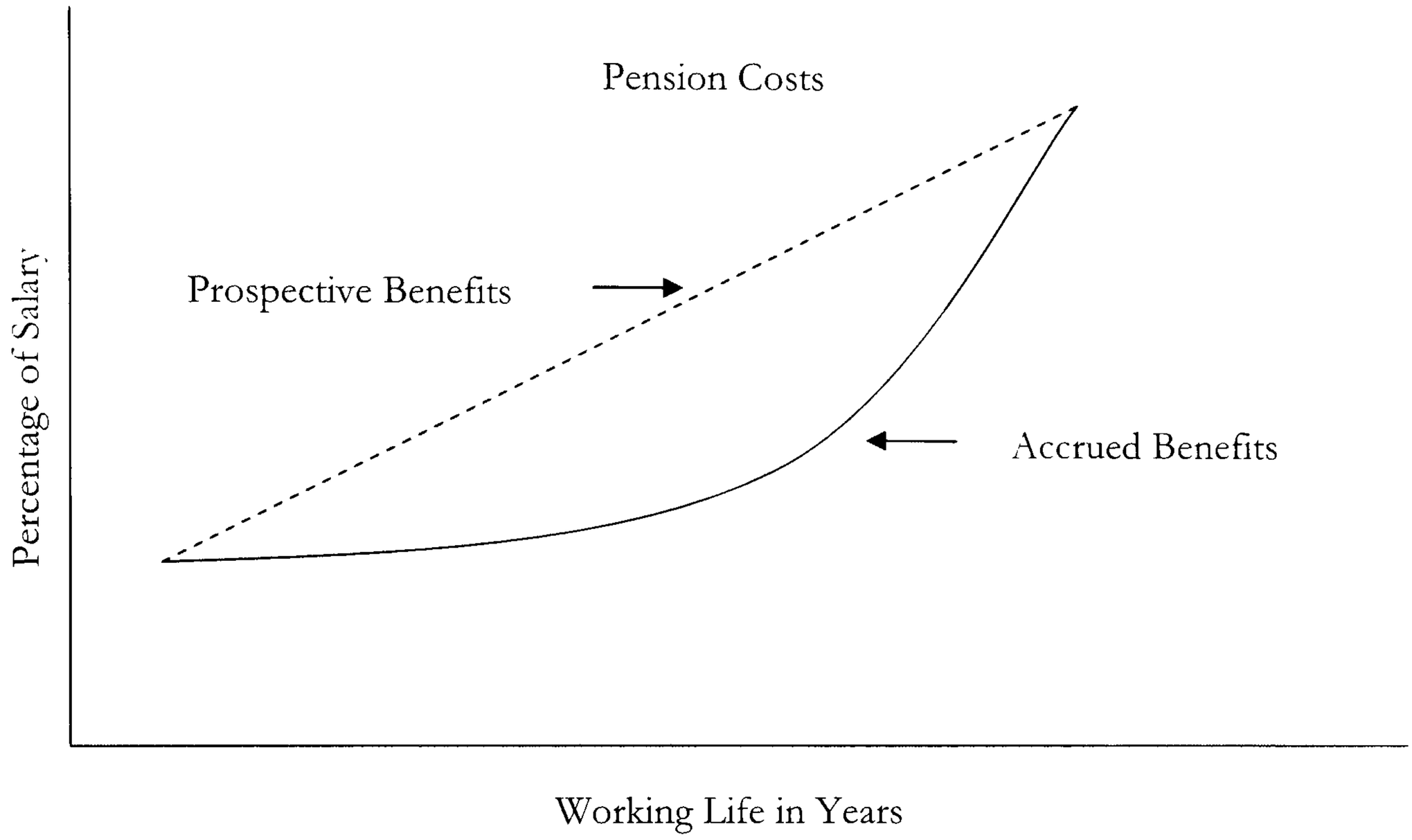
iii) Prospective benefits results in a stable and predictable pension cost;

iv) Prospective benefits is a simple percentage of salary figure, where,

$$ExpectedPensionCost = \frac{TotalExpectedCosts}{TotalExpectedSalaryCosts}$$

If the assumptions of a stable worker to pensioner ratio, age profile and demographics etc are applied, then, both methods will produce similar costs. However, the prospective benefits method will show a larger cost than the accrued benefits method. This occurs as the full cost of pension provision will only be realised at the end of the expected service lives of employees. Figure 2-3 shows highlights the fact that although the methods are associated with different cost structures over the service life of employees, they both should arrive at the same total cost figure for pension provision. For prospective benefits the cost is a stable percentage of salary over time, and for accrued benefits there is an increasing cost as older employees are more expensive than younger employees as the contributions paid will be invested over shorter time horizons.

Figure 2-3 Pension Costs under Prospective Benefits and Accrued Benefits



2.7 Recognition of Surpluses and Deficits

The application of an actuarial valuation method results in the calculation of the 'normal pension cost' that will be charged annually to the profit and loss. However, there are a number of situations which can lead to the creation of a surplus or deficit in a pension scheme. Surpluses or deficits require careful treatment within the company accounts as they can have a significant impact on a firm. There are two methods for recognising surpluses and deficits:

1) Gradual Recognition;

2) Immediate Recognition;

2.7.1 Is a Surplus or Deficit an Asset or a Liability to an Employer?

If the levels of assets in a pension scheme are less than the pension scheme liability, then there will be a deficit in the scheme. Due to the legal obligation such schemes

place upon employers, then, there are two possible outcomes. First, additional contributions can be paid to the scheme. Second, the employer can provide the necessary benefits directly from profits.

Conversely, if the level of assets in a scheme is greater than the scheme liability, then there will be a surplus in the scheme. This situation is beneficial to the employer as a surplus is an asset to the employer. There are a number of options that are open to an employer to account for this. A surplus can be used to reduce contributions, increase the benefits provided by a pension scheme or a refund of the excess contributions can be taken[18].

To access a surplus is not straight forward for the employer however. There are regulations, laws and covenants within the trust deeds of a scheme which restrict both, the access and the options of an employer. In a situation where withdrawals of surpluses are not allowed, then the employer can access the surplus indirectly through a period of reduced contributions.

2.7.2 Causes of Surpluses and Deficits

There are three broad categories which can cause surpluses or deficits. First, there are measurement assumptions. If the actuarial assumptions that were applied to calculate the liability and a funding plan for a scheme are not borne out by experience, the result will be a surplus or deficit for the scheme; these are classed as experience deficiencies or surpluses. The second measurement effect occurs when there is a change in the actuarial valuation method or the assumptions underlying the valuation model, consequently, the new measurement could result in surplus or deficit.

---

18 A refund will be subject to taxation as no tax has been paid on the contributions.

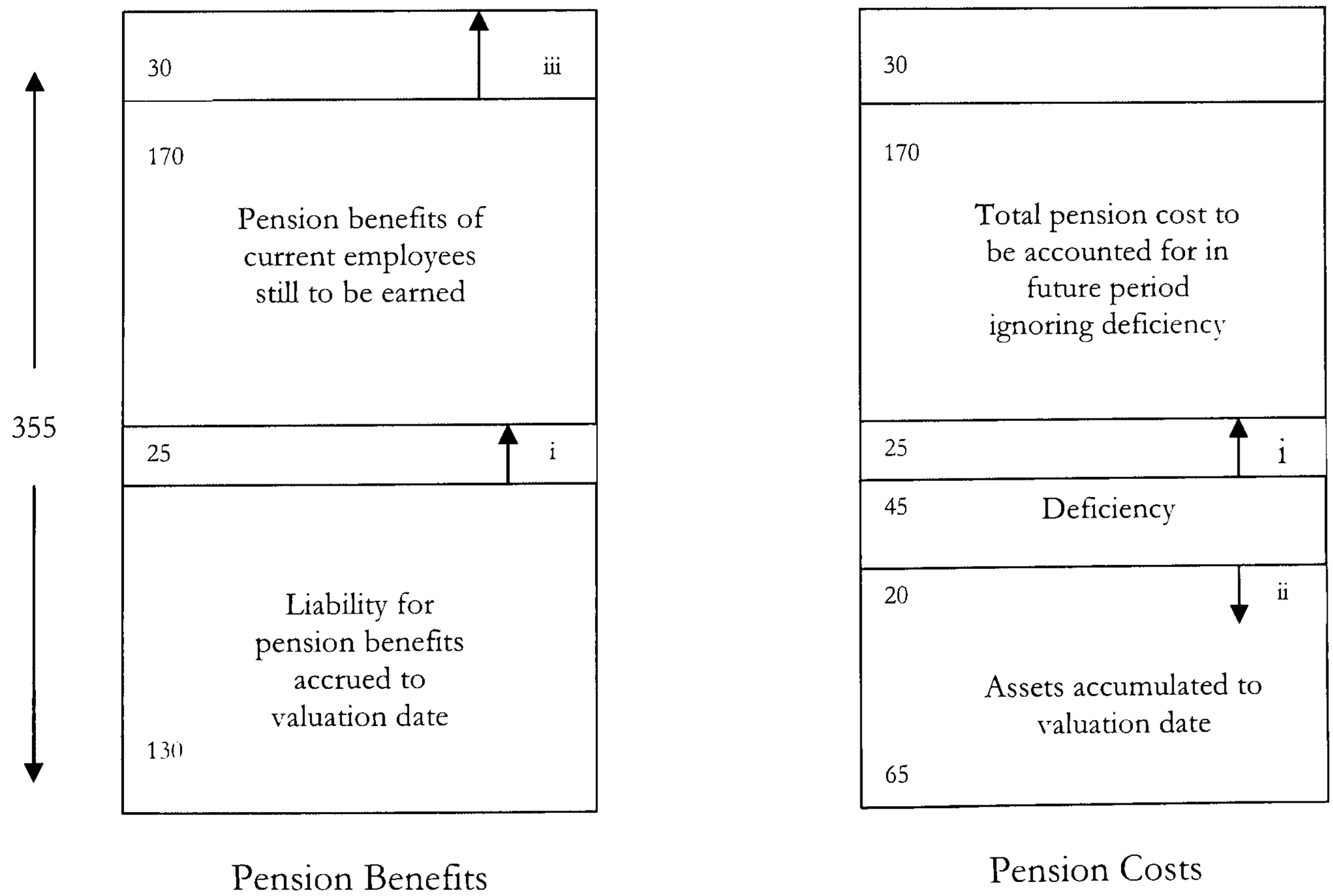
In this situation, an actuary will make assumptions to arrive at the liability of a scheme and will then create a funding plan, so that assets can be accumulated over time to meet the liability. However, if these assumptions do not hold in reality, then there will be a surplus or deficit within the scheme. For example, if the assumptions about the rate of return on assets are too high then the scheme will experience a deficit as the assets in the scheme are not sufficient to meet the liability. As a result of the long-term nature of the problem, experience surpluses and deficits can be significant. Such changes are common when triennial actuarial assessment occurs[19].

The impact of these changes is shown on Figure 2-1, where,

(i) Liability for accrued pension benefits is greater than expected by 25;

(ii) The Value of Assets accumulated is less than expected by 20;

Figure 2-4 Impact of Changes in Scheme Experience on Pension Costs and Benefits



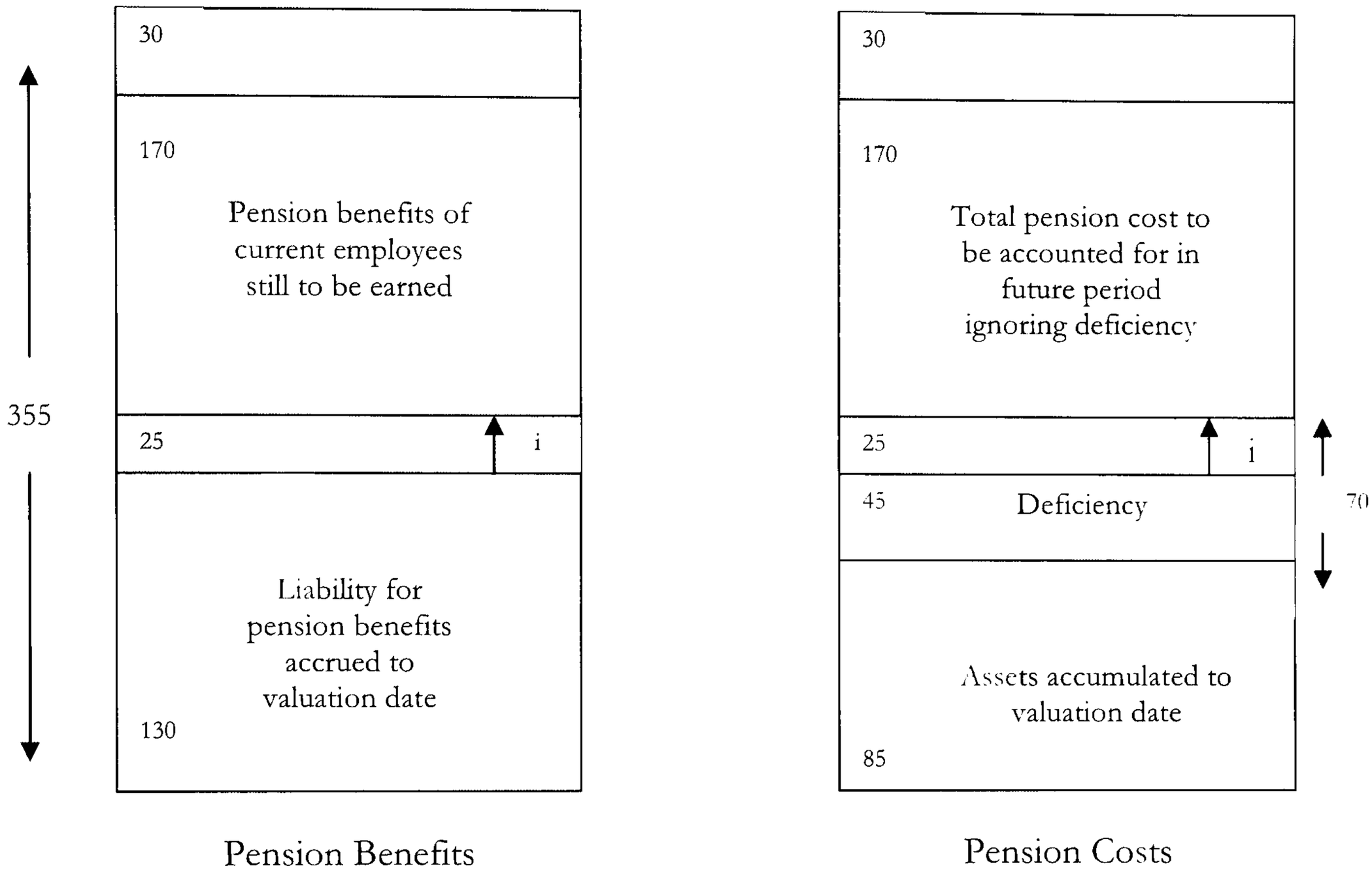
[19] Illustrations are taken from ASB Discussion Paper Appendix 4.

If there are changes to the underlying assumptions e.g. changes to the demographic assumptions, then this will also impact upon the pension scheme. If the life expectancy of workers is expected to be longer, employers will have to provide retirement benefits over a longer time period than previously estimated. Consequently, the long-term cost of pension provision has increased, implicitly, this means that the liability of the scheme has increased and the assets from the funding plan will no longer be sufficient to meet this additional cost.

The second factor that can affect whether or not a pension fund has a surplus (deficit) is changes to the level of pension benefits provided. There are two categories of changes that can occur. First, there are retrospective changes. These are changes in real benefits relating to the past service of current employees. Second, there are changes to the real benefits of former employees. In both of these situations therefore, the past service cost that has been charged has been too low to accumulate a sufficient level of assets, the funding plan will not be able to meet pensions liability implied by the new and more generous level of benefits provided.

One example of current employees receiving more generous benefits would be, where based upon a final salary scheme, the annual benefits could be improved form 1/60th to 1/55th. These changes will firstly, increase the normal pension cost until retirement, and secondly, result in the past pension cost being insufficient. Such changes will have a number of impacts upon the scheme. First, the final liability will increase. Second, the assets accumulated will be insufficient to meet the new liability, thereby increasing the deficit. Third, the past service cost will be inadequate and consequently, the deficit will be further increased.

Figure 2-5 The Impact of Changes in the Level of Benefits Provided



The impact of changing the benefits of former employees is not as clear. In arriving at the pension cost an actuary will make assumptions which will take a position of improved benefits to former employees. Consequently, in this situation a portion of the normal pension cost will be allocated to an expected increase in future benefits. If a deficit occurs after such changes then this is an experience change rather than a change in real benefits.

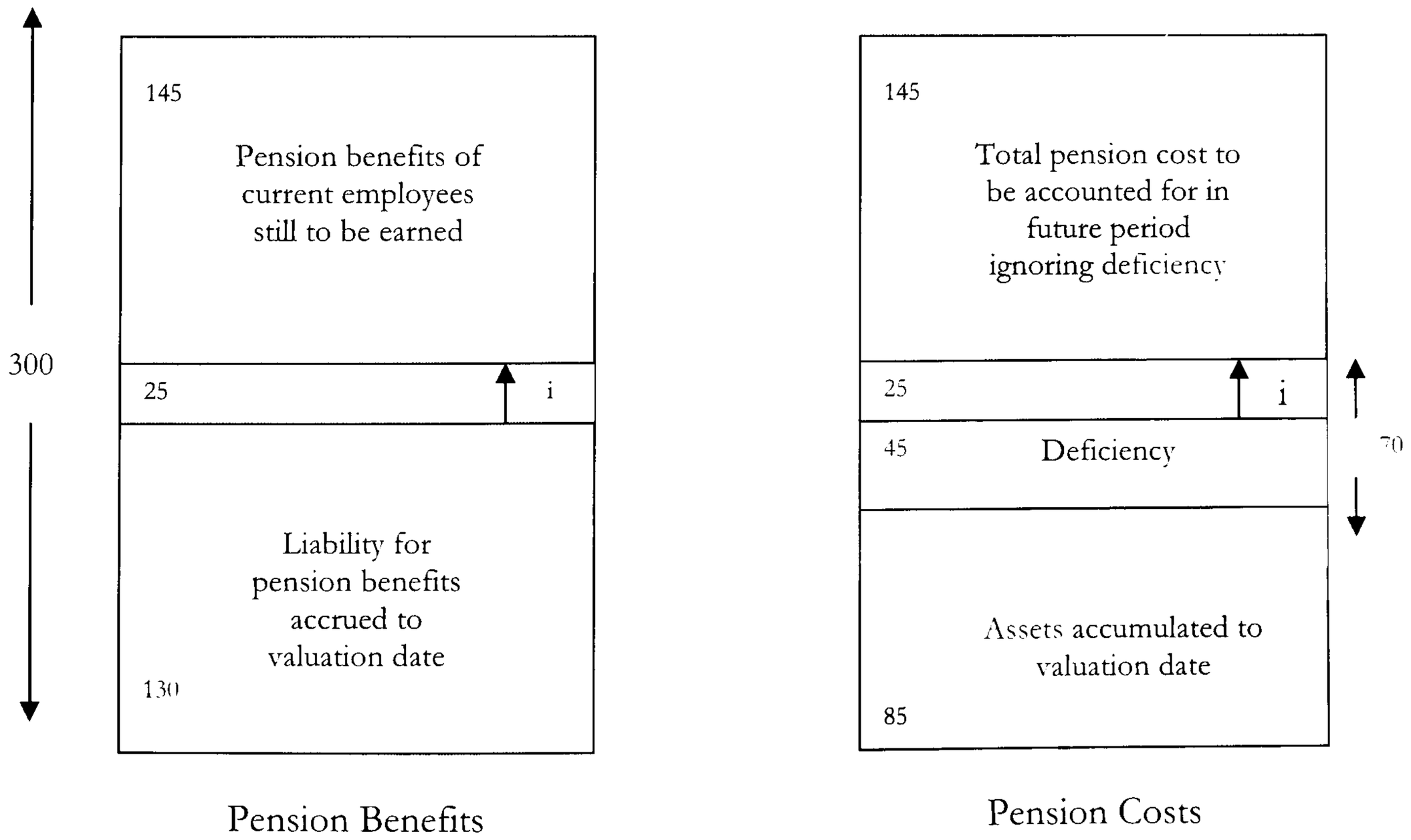
There are however, adjustments to the benefits provided that will result in a real increase in benefits provided for former employees. One such change would be the transfer of a pension to a spouse on the death of a former employee. In this scenario there has been a fundamental change to the level of benefits provided to former employees. Consequently, there will be a change to the final liability of the scheme.

Such a change will increase or result in a deficit as the level of past pension cost has been insufficient.

The final set of changes that result in the creation of a surplus or deficit within a scheme are changes to the actuarial valuation method. If the model of calculation is changed there will be a number of effects. First, the liability for the pension benefits that have been accrued up to the valuation date will be changed. Second, the liability for benefits that will be accrued in the future will be altered. Last, the adjustment of method changes the past pension cost, current service and future service cost.

In the following example it is assumed there has been a change in the actuarial valuation method. The pension liability and the value of benefits to be earned have fallen by 25. However, the change of method has increased the fund deficit from 45 to 70.

Figure 2-6 Impact of Changes in Actuarial Valuation Method



2.7.3 The Relationship between Recognition and Basis of Measurement

In applying an actuarial valuation method, the assumption about the pension cost is that it will 'emerge over the long-term'. Surpluses and deficits occur due to short-term movements in factors that the actuarial assumptions are based upon such as periods of lower returns on investments, high inflation and volatile interest rates all of which impact upon the level of assets and the size of the scheme liability.

It follows that the recognition of any surplus or deficit should occur over the long-term. Consequently, the solution would be to spread these costs evenly over the remaining service lives of employees i.e. the approach of SSAP-24.

Alternatively, if the surplus or deficit is based upon current market values, then it is consistent to recognise any surplus or deficit immediately. In this situation the current values represent the employer's liability as it exists now and the assets are the employer's current ability to meet these obligations.

"The overall gain or loss to the employer is then the sum of the incremental cost of the pension earned in the period i.e. the normal pension cost, the effect of any real changes in pension benefits, and any surplus or deficiency occurring in the period because of measurement changes.[20]*"*

How to account for deficiencies and surpluses is a major issue. There are arguments for immediate recognition of actuarial surpluses and deficits. Essentially, if the actuarial model and method of valuation are consistent, then the recognition of such deficiencies should be immediate.

Alternatively, following the US approach, SFAS-87 applies an accruals method for recognising any surplus or deficit. In this situation, benefits earned and the scheme liability are calculated using and accrued benefits method, and the scheme assets are

---

[20] SSAP-24

measured against market values. However, there is no immediate recognition of any surplus or deficit. As a result, any fluctuations or unanticipated movements in assets and or liabilities can be smoothed over time.

2.7.4 Gradual Recognition of Surpluses and Deficits over Time

Gradual recognition is the preferred method of the ASB. In this situation then the 'normal pension cost' for each accounting period will be adjusted to include an additional component that will take account of the surplus or deficit over the remaining service lives of employees.

Where there are experience deficiencies or surpluses then, gradual recognition is the most appropriate method of accounting. If there is for example an experience deficit, it is possible that over time the deficiency will be removed through long term changes in asset returns or changes to the measurement basis. Essentially the deficit is the result of short term deviations from the underlying assumptions of the model, but that over the long term then the assumptions could hold. Consequently, to account for these deficiencies immediately is not prudent, and so to account for them over the remaining service lives of employees is more suitable.

Unlike experience deficiencies and surpluses, changes to the level of pension benefit provision do not emerge over the long-term. The change to the benefits provided is the result of a conscious decision by management. Furthermore, such changes will normally affect a specific part of the workforce or former workers. When accounting for any surplus or deficit that arises from such changes immediate

recognition is considered desirable by the ASB, as it is a truer representation of the economic reality that exists[21].

There are however, changes to benefits that occur where immediate recognition is consider inappropriate. If there is a change to the level of benefits that are provided for current employees, such a situation is a much broader change. Given that employee compensation is given in return for service, in this situation it is likely that the firm will derive greater economic benefits from current employees. Consequently, it is more appropriate to account for the cost of the extra service costs over the remaining service lives of employees.

How to properly account for former employees is more difficult. Any increase in benefits that are received is only an increase in the liability to the company as there will be no additional economic benefit received. However, in general, changes to the benefits that former employees receive are a result of wider changes to the pension benefits of current employees. It is sometimes argued therefore, that the changes to current employees will result in increased economic benefit to the firm; such an argument is somewhat tenuous though. The ASB therefore takes the position that, the cost from changes to benefits should be split, where, the cost for current employees will be recognised over their remaining service lives, and the cost of former employees will be recognised immediately[22].

Under the new standard there will not be any changes to the actuarial valuation method that is applied year on year. The only changes that will occur when FRS-17 is implemented will be subject to the transitional arrangements put forward by the ASB.

---

21 In the case of former workers there is no additional economic return to be gained from increased benefit provision.

22 This applies to real changes such as the ability to transfer pension rights to a spouse when the former employee dies and not to cost of living increases i.e. price inflation.

2.7.5 How to Account for Interest on Surpluses and Deficits

"Each stage of the calculation of a pension cost implicitly involves interest. When an actuarial basis of measurement is applied the surplus or deficiency is calculated as a present value of future cash flows. When a market valuation is used the market prices are the market perception of that present value. Thus, from period to accounting period there will be an interest effect upon any surplus or deficiency due to the passage of time. When a market basis of measurement is used then it will be easier to view the change as a value adjustment from one period to the next to take account of the passage of time[23]."

	Case A	*Case B*
Deficiency at the end of year 1	100	100
Normal Pension Cost in year 2	15	15
Contribution in year 2	(15)	(115)
Interest at 10% per annum	10	0
Deficiency at the end of year 2	110	0

The above example highlights the two approaches to the impact that interest has upon a scheme deficit.

In case A, the employer does not increase contributions above the normal level. Consequently, in the following year the deficit increases by 10, that is, the original deficit plus interest charged at 10%. However, in case B, the employer immediately pays the normal pension cost plus an additional lump sum to remove the deficit. As a result, in the following year there is no deficit and the employer does not incur an interest charge[24].

---

[23] ASB

[24] It is also possible to incur a smaller interest charge by only removing a portion of the deficit.

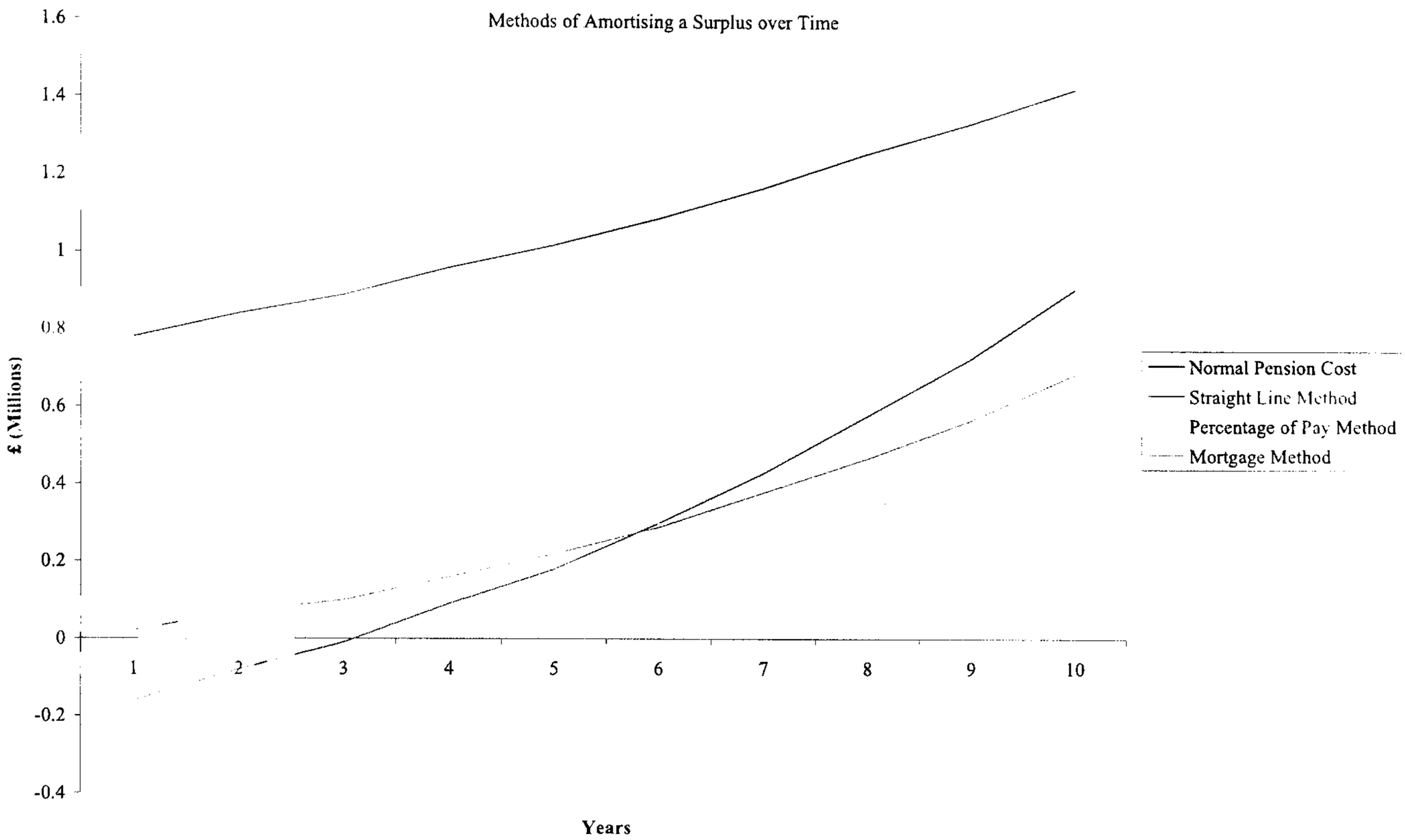
Any interest cost on a surplus or deficit must be accounted for within the normal pension cost from year to year. If there is not any annual recognition, then the result will be a much larger change to the surplus or deficit within a scheme when a triennial valuation occurs. There are however, three methods which can be applied to take account of the interest on a surplus or deficit.

The first is the straight line method, the second is the percentage of pay method and the last is the mortgage method. The straight line method divides the surplus (deficiency) into equal amounts for the remaining service lives of current employees, and then accounts for the interest element of the surplus or deficiency. The percentage of pay method allocates the surplus (deficiency) so that the pension cost, net of amortisation and any interest payable, increases at the rate of salary increases.

The mortgage method is not considered useful by the ASB but is included for illustrative purposes. In this situation the surplus (deficiency) is treated like the capital component of a repayment method and so any contribution pays of the interest and capital.

If we assume that there is, a surplus of £5.2m, initial pensionable salaries of £6.5m which increase at the rate of 7% per annum, an interest rate of 9% and a normal pension cost of 12% of salary then:

Figure 2-7 Different Methods of Amortising Pension Surpluses over Time



From figure 2-7 it be seen that depending on the method of amortisation then the annual pension cost variation can be substantial. The straight line method results in a negative pension cost over the first two years. This occurs because the amount allocated in the first years is highest, with the impact of interest on the surplus, then the pension cost in these years is negative.

For the percentage of pay method there is a net cost in each year after crediting the portion of the surplus and interest to the pension cost. Under this method the amount of the surplus that is allocated increases with salary increases. There is therefore more allocated in later years than earlier years.

The last method is the mortgage method. Under this method of allocation there is an increasing net pension cost over time. This occurs as the credit that is received in the earlier years is purely interest and only a small portion of the surplus. Over time however, the interest portion falls and the capital portion received is greater.

In accounting for a surplus the there is a strong logical argument for using the percentage of pay method. Under this method there is a correlation between the increasing costs of pension provision with reducing contributions over time to account for the surplus.

The ASB however in their consultation believes that the application of the straight line method of allocation as this method is simpler. Further, there should be no separation of the interest cost and the total pension cost, as this would keep the total cost of the pension provision simple in the company accounts.

2.7.6 Gradual Recognition Disclosure Requirements

"It is the objective of the ASB that any disclosure in the new accounting standard will allow for a greater understanding of the true position of a company pension scheme. Due to the complicated nature of such schemes then, any changes to the underlying assumptions and their impacts must be disclosed. This however, will need to be balanced with the prescriptive nature of the new standard, as it provides less discretion to actuaries and accountants in a number of areas e.g. in amortising a surplus or deficit.[25]*"*

The focus of the ASB disclosure is therefore upon how the pension cost is arrived at. The explanation should include the measurement assumptions, components of the pension cost, the accounting treatment of any surplus or deficiency that has occurred and the balance sheet quantity for the pension cost and the impact of any unrecognised surplus or deficit.

If a gradual recognition approach is applied then it is necessary to disclose the basis for arriving at a pension cost and any surplus or deficit within a scheme. The disclosures that are common within a scheme under SSAP-24 are:

---

[25] ASB (2000)

1) the rate of increase in salaries

2) the rate of return on investments

3) the rate of increase in pension payments

4) the rate of increase in dividend income

5) the rate of interest applied to discount liabilities[26]

The impact of even a small change in an assumption can have a significant impact upon a scheme. Any change in the underlying assumptions can lead to the creation of a deficit or a surplus, as well as impacting upon both future service costs and past service costs. Consequently, the ASB proposed that it would like the disclosure of all of the above categories and an explanation as to how the change has impacted upon the scheme.

To allow for the pension cost to be fully analysed then it is necessary for the pension cost, and any amortisation of a surplus or deficit, to be fully described in the company accounts. Any pension cost disclosure will also, therefore, have to show if there is any past service costs included in the current years pension cost.

2.8 The Alternative Market Valuation Approach

A market value approach is extremely different from the preferred actuarial method. Under the market value approach, there is immediate recognition of surpluses and deficits, as well as a market value based valuation of the scheme assets, liability and the pension cost. In this situation the market values of these factors are applied instead of an actuarial valuation. The market valuation, in theory, will represent the market price that would be paid for a scheme. There are situations where schemes are sold on to

[26] This is usually the same as the rate of return on investments.

insurance companies; however, the price that is usually paid is much greater than the FRS-17 value.

2.8.1 Immediate Recognition of Surpluses and Deficits

Under the market valuation approach there would be immediate recognition of surpluses and deficits. Year on year this could result in significant changes to the pension cost of a firm. If there is no amortisation of surpluses or deficits, any change in the value of the scheme assets, the liability of the scheme and the past service cost would need to be taken account of in the year in which they occur. The result will be that in a given year the pension costs will fluctuate with market values, and the pension cost will be the change in any surplus or deficit plus contributions. Due to the volatile nature of market prices then there will be a significant increase in the volatility of the pension cost year on year.

To try and mitigate the impact of applying market values, the ASB proposed that there should be a separation of the normal pension cost and valuation impacts. In this situation, then the volatility would be removed as there would be a normal pension cost charge in the profit and loss, and any variations that occur year on year would be included in the Statement of Total Recognised Gains and Loses (STRGL). Any changes therefore, in market values, demographics and other basis measurements would be accounted for in the STRGL. This would result in a predictable pension charge and the balance sheet would show the employers liability, while accounting for the true liability of a scheme based upon market values[27].

[27] In moving the market value impact to the STRGL then it also prevents a negative pension charge appearing in the balance sheet.

2.8.2 Surpluses and Deficits under the Market Value Approach

The impact of changes to the underlying measurement assumptions would not have a significant impact over the long-term. As with the actuarial approach, then over the long-term assumptions are considered to be mutually compatible. The STRGL would be close to zero in the long run e.g. lower returns in one period would be offset in the future with higher returns. The implication being that, the underlying assets will follow a random walk with a positive drift.

To prevent manipulation of this STRGL facility the firms should disclose the assumptions underlying the calculation of the normal pension cost. This will prevent the understatement (overstatement) of the pension cost year on year. If the cumulative STRGL records a series of deficits then the long term assumptions that are being applied are too generous and should be revised downwards.

As with the actuarial valuation, significant disclosure about the assumptions that underlie the valuation of the scheme and the normal pension cost are required. For the market valuation approach this would also require disclosure about how the STRGL has changed from the previous year as well as the cumulative total. The ASB believes that this disclosure should also include,

'In addition, the board would require a five-year record of the cumulative surplus or deficiency expressed as a percentage of the liability for accrued pension benefits at the end of the current and past four years. Explanations and changes in the assumptions governing the normal pension cost would be expected if it appeared that the surplus or deficiency was continuously accumulating.[28]''

As with the actuarial method any changes in the benefits provided are the result of conscious decisions and actions by management. Such changes are not the result of

---

[28] ASB (2000)

experience or market fluctuations. Consequently, such changes should be reflected immediately in the pension cost for the year in which they occur. This cost will also include the change in past service cost[29].

2.8.3 Disclosure under a Market Valuation Approach

The disclosure under the market valuation approach still requires a normal pension charge. The ASB stipulated that this will be arrived at through the accrued benefits method, and will represent the increased liability to the firm from the additional year of service from employees. If there are any changes to the assumptions or unanticipated shifts in the scheme surplus or deficit these will be reported in the STRGL with explanatory notes. As with the actuarial method, the cost of changes to the benefits that are provided will be recognised in the profit and loss in the year in which they occur.

In addition to the disclosures that are required under the actuarial valuation method the board requires disclosures of:

i) the market basis used to value assets, including equity, bonds and property;

ii) the rate of interest that is used to discount liabilities, this is usually the expected rate of return on investments;

2.9 FRS-17 - Accounting for Pension Costs

After the consultation period the ASB issued FRS-17. However, despite the case and rationale put behind the actuarial approach, the biggest change is the use of market

---

[29] As with the actuarial approach there will be no change in the valuation model as the new standard puts forward a prescribed model of valuation.

values. Their must be a fair value applied to defined benefit schemes. The main changes are:

1) scheme assets are to be measured at market value;

2) scheme liabilities are to be measured applying the projected unit method;

3) the interest rate used to discount liabilities should be the yield at the balance sheet date of a high quality corporate bond of equivalent currency and term to liability;

4) the resultant deficit will be presented on the balance sheet, net of deferred tax and located after all other assets and liabilities;

The performance of the scheme will be measured as the change in the balance sheet figure. This will also show the current service cost, interest cost, the expected return on assets, gains and loses on settlements and curtailments[30], and the past service costs. However, actuarial gains and loses e.g. experience gains or loses will be accounted for in the STRGL.

Last, the new standard requires disclosure of the main actuarial assumptions underlying the scheme. The assets in the scheme when placed into broad asset classes must be examined, and the expected rate of return on these portfolios must be disclosed. There must also be an analysis of the costs in the operating profit, finance costs and the STRGL. The STRGL must show the cumulative change over five years and consider the changes that occur with respect to the actual return and the expected return. Last there must be an analysis of shifts in the surplus and deficit of a scheme, and over the long-term these must be accounted for in the balance sheet.

---

[30] A settlement is an action that relieves the employer of the pension liability such as lump sum cash payments in exchange for pension rights. A curtailment is an event that reduces the expected years of future service of employees such as termination of employment.

2.9.1 FRS-17 Disclosure Requirements

2.9.1.1 Defined contribution schemes

75 The following disclosures should be made in respect of a defined contribution scheme:

(a) the nature of the scheme (i.e. defined contribution);

(b) the cost for the period; and

(c) any outstanding or prepaid contributions at the balance sheet date;

2.9.1.2 Defined benefit schemes

76 The following disclosures should be made in respect of a defined benefit scheme:

(a) the nature of the scheme (i.e. defined benefit);

(b) the date of the most recent full actuarial valuation on which the amounts in the financial statements are based. If the actuary is an employee or officer of the reporting entity, or of the group of which it is a member, this fact should be disclosed;

(c) the contribution made in respect of the accounting period and any agreed contribution rates for future years; and

(d) for closed schemes and those in which the age profile of the active membership is rising significantly, the fact that under the projected unit method the current service cost will increase as the members of the scheme approach retirement;

77 Each of the main financial assumptions used at the beginning of the period and at the balance sheet date should be disclosed. They should be disclosed as separate individual figures, not combined or netted. The main financial assumptions include:

(a) the inflation assumption;

(b) the rate of increase in salaries;

(c) the rate of increase for pensions in payment and deferred pensions; and

(d) the rate used to discount scheme liabilities;

78 The most important assumptions underlying the present value of the scheme liabilities are the rates of increase in salaries and pensions in payment and the rate of interest applied to discount the estimated cash flows arising under the liabilities. The valuation of assets in the scheme is not affected by the actuarial assumptions because the assets are measured at fair value;

79 The fair value of the assets held by the pension scheme at the beginning and end of the period should be analysed into the following classes and disclosed together with the expected rate of return assumed for each class for the period and the subsequent period:

(a) equities;

(b) bonds; and

(c) Other (sub-analysed if material);

80 The assumption made for expected return on assets does not affect the valuation of scheme assets as they are measured at fair value. It does,

however, determine the amount to recognise in the profit and loss account;

81 The following amounts included within operating profit (or capitalised with the relevant employee remuneration) should be disclosed in the notes to the financial statements:

(a) the current service cost; any past service costs;

(b) any previously unrecognised surplus deducted from the past service costs;

(c) gains and losses on any settlements or curtailments; and any previously unrecognised surplus deducted from the settlement or curtailment losses.

82 Any gains and losses on settlements or curtailments (and any previously unrecognised surplus deducted from the losses) included within a separate item after operating profit should be disclosed in the notes to the financial statements;

83 The following amounts included as other finance costs (or income) should be disclosed separately in the notes to the financial statements:

(a) the interest cost; and

(b) the expected return on assets in the scheme;

84 The following amounts included within the statement of total recognised gains and losses should be disclosed in the notes to the financial statements:

(a) the difference between the expected and actual return on assets;

(b) experience gains and losses arising on the scheme liabilities; and

(c) the effects of changes in the demographic and financial assumptions underlying the present value of the scheme liabilities;

85 The notes to the financial statements should disclose, for the accounting period and previous four periods:

(a) the difference between the expected and actual return on assets expressed as (i) an amount and (ii) a percentage of the scheme assets at the balance sheet date;

(b) the experience gains and losses arising on the scheme liabilities expressed as (i) an amount and (ii) a percentage of the present value of the scheme liabilities at the balance sheet date; and

(c) the total actuarial gain or loss expressed as (i) an amount and (ii) a percentage of the present value of the scheme liabilities at the balance sheet date;

86 A consistent trend of experience losses/gains in the statement of total recognised gains and losses may indicate that the assumptions used have been overoptimistic/over-pessimistic and may cast doubt upon the reliability of the amounts reported in the profit and loss account. Where such a trend has emerged it is important that careful consideration is given to the choice of assumptions in the future;

87 The fair value of the scheme assets, the present value of the scheme liabilities based on the accounting assumptions and the resulting surplus or deficit should be disclosed in a note to the financial statements. Where the asset or liability in the balance sheet differs from the surplus or deficit in the scheme, an explanation of the difference should be

given. An analysis of the movements during the period in the surplus or deficit in the scheme should be given;

88 Differences between the asset or liability in the balance sheet and the surplus or deficit in the scheme will arise because of the related deferred tax balance and also when part of a surplus or deficit has not been recognised in the balance sheet, for example when part of the surplus in the scheme is not recoverable by the employer or when past service awards have not yet vested.

89 The analysis of reserves in the notes to the financial statements should distinguish the amount relating to the defined benefit asset or liability net of the related deferred tax.

90 There is a general requirement in company legislation and accounting standards for comparative figures to be given. It should be noted that this requirement applies to the disclosures specified in paragraphs 78 and 80 relating to the position at the beginning of the period.

91 Where an employer has more than one defined benefit scheme, disclosures may be made in total, separately for each scheme, or in such groupings as are considered to be the most useful. When an employer provides disclosures in total for a number of schemes, the assumptions should be given in the form of weighted averages or of relatively narrow ranges with any outside the range disclosed separately.

92 Useful groupings of schemes for disclosure purposes may be based on:

(a) the geographical location of the schemes, for example by distinguishing UK schemes from overseas schemes; or

(b) whether the schemes are subject to significantly different risks, for example pension schemes and retirement medical care schemes.

2.10 Summary

This chapter has documented the evolution of pension accounting in the UK. In particular the chapter details the complexities associated with pensions and how best to account for them. These complexities and the concerns raised about the way in which pensions are accounted for has driven the development of the latest pension accounting standard FRS-17. The next chapter is the first empirical chapter and presents the data that is used in the subsequent analysis and the issues surrounding the creation of my sample are discussed.

3
AN OVERVIEW OF CORPORATE PENSION PLANS IN THE UK

3.1 Introduction

Chapter 3 discusses and describes the data that will be used in the following empirical chapters. The data is collected from the FRS-17 disclosures in the annual reports of FTSE 350 companies. The FTSE 350 was chosen for two reasons. First, disclosure even in the largest companies (FTSE 100) is relatively poor in 2001 and 2002. The data disclosure in smaller companies over the sample is increasingly variable and worsens considerably if the list of companies expands to incorporate the rest of the FTSE All Share. However, as the transitional period for adopting FRS-17 reaches its end, the level of disclosure improves as a greater number of firms move towards full implementation of FRS-17. As a result of the variable quality of disclosure and the time consuming nature of manually collecting complex data then the FTSE 350 is currently the optimal sample to work with.

3.2 FRS-17 Disclosures and the Firm's Pension Promise

As discussed in the previous chapter FRS-17 is the UK's new fair value accounting standard for company pension schemes and supersedes SSAP-24. The new market based approach provides much greater disclosure, of the structure of the pension scheme, the assumptions by which the present value liabilities are calculated and the

assumed return on scheme assets. The new method results in the annual marking to market of where the pension assets, are in relation to changes to the present value of the pension obligation of the firm.

Another significant change in the UK relates to the nature of the pension liability. The pension liability has, for a number of reasons, both political and economic, become a bond like obligation on the firm. Previously, pension arrangements were between the firm and the employee. The implicit understanding was that employees were deferring some current remuneration to receive an income in retirement. However, there was no explicit and legally binding guarantee that the firm would meet this obligation to the detriment of the ongoing operations of the firm.

However, this has all changed and under the Pension Act 2004. The Act set up The Pensions Regulator (who replaces the Occupational Pension Regulatory Authority) and the Pension Protection Fund (similar to the Pension Benefit Guaranty Corporation in America). The Regulator has been given wide ranging powers for the 'enforcement' of the pension obligation on the firm to prevent default on the pension promise. With this objective in mind, and the much wider ranging powers of the Regulator, provided by the Pension Act 2004, the pension liability is now a bond like obligation[31].

"A pension scheme in deficit should be treated in the same way as any other material unsecured creditor[32]."

[31] This is linked however to the new accounting standard as it has made the magnitude of the pension promise much more apparent.
[32] Clearance Statements: Guidance from The Pensions Regulator, April 2004.

3.3 FRS-17 Data

3.3.1 Individual Pension Asset Classes

FRS-17 data can be divided into two main categories, first assets and liabilities, second, assumptions. The assets fall into four broad categories, equity, bonds, property and other. Equity is the shares that are held in the pension portfolio, this constitutes the most significant component of the assets for most schemes. As a general rule of thumb the equity will amount to around 60% of the assets held, (Lane Clark & Peacock (2006)). This figure is more representative of the end of my sample however, as equity accounted for around 70% of the assets in the portfolio at the start of my sample period. However, there are also a number of schemes that hold no equity and hold predominantly bonds and cash.

The next most significant asset class is bonds making up around 30% of the assets held (in the latter part of my sample). This comprises government bonds, corporate bonds and index linked bonds. There is an issue here with the level of disclosure. Generally the disclosure is under the broad category of bonds; however, there are a small number of firms who disclose the quantity of the different types of bonds held. In the descriptive statistics presented the bonds held have been aggregated to allow for an examination of the assets and liabilities of the firm. It should also be noted however, that despite the disclosure of different bonds held by some firms the return assumption on bonds is never split into different bond return assumptions.

The third category of assets held is property[33] making up about 5% of a typical pension fund. Despite the appeal of property, in terms of its long term nature and the

---

33 Pension funds will have very little exposure if any to residential housing as the market does not suit the nature and structure of pension funds and so we assume that property refers to commercial property.

performance of commercial property over the past 30 years, there is, somewhat surprisingly, very little property held. The main reason for property being held in such small quantities is that property is an illiquid asset which makes it undesirable to hold in significant quantities.

The last asset class is 'other' and this makes up the remainder of the assets held. This is, for the most part, cash holdings. However, a small number of schemes have very small exposures to insurance contracts and index linked funds. I also incorporate these assets into the other asset category. Where a firm holds annuities and deferred annuities, although these assets are 'other', however I include them into the bonds asset class as they have similar characteristics. There are only five firms in the sample who hold small amounts of annuities and so the impact of this will not be material on my analysis.

In the disclosures for certain companies there are a number of unusual asset combinations. One example is Headlam Group, who group equity and property together, in this case the value of equity and property is around £20m and constitutes about 65% of the assets in the scheme. It consequently does not seem plausible that the major asset in the combined figure will be property and so the property and equity have been input as solely equity. Again a number of firms aggregate bonds and cash. In this situation I categorise these assets as bonds as it is unlikely, based on the average scheme, that a scheme would be 25% cash.

3.3.2 Pension Assets and Liabilities

The next categories extracted from the FRS-17 disclosures are the total assets and the pension liability. Total Assets is simply the sum of all the individual asset categories discussed in section *3.3.1*. The next category is the total liability of the pensions that

have been accrued by the employees within the scheme. This liability is the present value of the current benefits due to employees and is calculated through the accrued benefits method. Under this method, the pension liability says nothing about the liability in relation to the expected final salary of members. It therefore only reflects the benefits that the employees of the firm have accrued at the time of valuation.

From the total assets and the pension liability I can calculate the gross surplus/(deficit) of the scheme. This is simply the sum of total assets and total liability. If the assets in the scheme are greater than the liabilities then the scheme is in surplus, however, if the assets in the scheme are less than the liability then the scheme is in deficit.

The next category is deferred taxation. This is a rather complex part of the disclosure as it is somewhat misleading. Essentially, given a surplus/(deficit) in the scheme, the firm, on winding up a scheme, would have to pay tax on any surplus assets, assuming that they returned to the firm, as no tax has been paid on them previously. Alternatively, where there was a deficit, the firm would be able to write-off some of the cost of fully funding the deficit against taxation paid on its operations.

Interestingly, 3i state that although their scheme would have a £30m tax asset it is not included as the firm feel that this asset cannot be realised in the near future. As a result of the position that 3i take and the fact that all of these tax figures are notional then whether they are material is open to interpretation. In the proceeding analysis therefore I only consider the gross surplus/(deficit) as I feel that it more accurately reflects the liability and risk of the firm. For completeness in this chapter however, I present both the gross position and the net position (gross surplus/(deficit) + deferred tax asset).

3.3.3 Multiple Schemes

There are a number of firms who operate multiple schemes. This can be split into two broad categories, first, multiple UK schemes where the firm runs a number of different schemes for its UK employees. Second, UK and overseas schemes (OS), in this situation firms provide pension benefits to both UK employees and foreign employees in the countries in which they operate. Where there are multiple UK schemes these schemes are simply aggregated and the average return assumptions are used[34].

Although a weighted average could be used to calculate the average assumption, the difference is not going to be significantly different from the average. Further, in certain cases it is not possible as disclosure is neither practical nor useful – HSBC for example operate 169 schemes worldwide. In disclosing for all of these schemes broad aggregates are provided, so any weighted average is not going to prove to be anymore useful than a general average, given the method of aggregation by HSBC is unknown.

Where firms operate both UK and overseas schemes (OS) I consider each as a separate category. The OS scheme has the same categories as the UK schemes in terms of the assets, liabilities, pension assumptions and the return assumptions. This also allows for the calculation of a total category where both the UK scheme and the OS scheme are combined so I calculate total pension assets (UK+OS) and total pension liabilities (UK+OS).

There are significant problems in assessing the accounting disclosure for overseas schemes. The level of provision expectations of future mortality, inflation and asset return assumptions are essentially without any reference point. In the UK for example, from experience for a firm to assume equity returns are 7.5% for example is

---

[34] Where assumptions are given as a range then the mid-point is used. Again this seems plausible given that the inflation assumption may be given as between 2%-3% and so the actual range is small.

plausible as the historical rate of return is 7.1%[35] and so the assumptions that are used can be benchmarked to some extent. However, if there are OS schemes in South Africa, South America and Australia (BHP Billiton) and there are assumptions that are put forward as an aggregate for these schemes it not possible to asses whether the return on equity, or any other assumption for that matter, is appropriate or prudent.

In incorporating overseas schemes many are denominated in foreign currency and must be converted to Sterling for compatibility. I use the exchange rate at the balance sheet data for conversion as this seemed most appropriate. All of the figures that are used for the valuation and assessment of both UK and overseas assets are denominated in Sterling.

3.3.4 Asset and Liability Assumptions

The assumptions that are disclosed under FRS-17 are used to calculate the liability of the scheme and the expected return on the pension assets. These can therefore be broken down into two main parts; liability assumptions and asset return assumptions. The liability assumptions consist of inflation, wage growth, pension growth and a discount rate. The asset assumptions are expected rates of return for the different asset classes that are held in the pension portfolio.

The first pension assumption is inflation; this is used to adjust the future value of the pension liability. The second variable is expected wage increases that are used to calculate the value of the pension liability. These two variables are significant together when arriving at the value of the pension promise. In actuarial terms this is called the basis. A stylised example being where expected wage increases are 7% if inflation is 3% there is only a 4% increase in wages in real terms.

---

[35] Barclays Capital Equity Gilts Study 2007 – 50 year historical return.

The next variable is the expected increase in pensions. This variable is also important as there will be different rates of pension accruals based upon wage increases, contracts and life expectancy. This variable links with the increase in wages if there are high increases in (expected wages) then there will be a higher level of pension accrual and consequently an increase in the pension liability.

The last variable in this category is the discount rate. This is used to discount the future liability to the present value of the pension liability which is disclosed in FRS-17. Under FRS-17 it is supposed to be a AA bond yield of suitable duration and maturity.

The last category of assumption is asset returns and are the expected rates of return on the assets held in the pension fund portfolio. These are important in looking at the solvency of the pension scheme. If the experience of the scheme is radically different from expectations then this will have a significant bearing on the ability of the firm to meet its pension liability. For example, if the expected returns on equities were to fall significantly, then the pension liability would essentially increase as there would be a shortfall in the value of the assets that will be used to meet this liability.

3.4 Descriptive Statistics Pension Assets and Liabilities

3.4.1 Total Pension Assets and Liabilities

The first group of descriptive statistics, presented in Table 3.1, are the annual statistics for the total pension assets and liabilities of my sample companies. The table presents a break down of the individual asset classes, the total assets, the pension liability, the gross surplus/(deficit), the deferred tax and the net surplus position. The sample consists of FTSE 350 FRS-17 disclosures for 2001-2004.

Table 3-1 Descriptive Statistics for Total Pension Scheme Assets and Liabilities

The panels below show descriptive statistics for 4 years of FRS-17 disclosures for FTSE 350 firms total pension assets as well as pooled descriptive statistics for the whole sample. The data consists of assets which are equity, bonds, property and other. The bonds data presented is the aggregate bonds held i.e. both corporate and government debt, the other category is assets which are predominantly cash although a small number of firms hold small amounts in insurance policies etc. The gross surplus/(deficit) is total assets plus liability and the net surplus is the gross surplus/(deficit) plus deferred tax. Deferred tax is the amount of tax that would be paid or credited if the pension scheme was to be wound up immediately. The data period is 2001- 2004. For each cell the first variable presented is the mean value, the next value down is the standard deviation and the last values are the minimum/maximum. For example, in 2001 the average value of equity is £598.77m, the standard deviation is 1832.32m and the minimum is £0 while the maximum is £19200m.

	2001	2002	2003	2004	Pooled
Equity	598.77	461.23	549.66	577.07	546.69
	1832.32	1426.68	1795.34	1958.96	1763.34
	0/19200	0/14701	0/20978	0/24305	0/24305
Bonds	282.87	258.96	294.92	314.81	287.89
	1007.9	775.3	862.78	928.54	896.96
	0/13117	0/5988	0/6436	0/7400	0/13117
Property	37.13	39.28	39.88	47.33	40.91
	200.73	225.52	226.52	258.44	228.51
	0/2800	0/3300	0/3300	0/3600	0/3600
Other	39.15	32.38	37.12	60.93	42.4
	128.88	106.54	121.75	251.28	162.92
	0/1383	-400/1067.53	0/1114.08	-0.6/3855	-400/3855
Total Assets	957.92	791.85	921.58	1000.14	917.89
	2844.65	2317	2804.37	3082.91	2774.29
	0/27100	0/21500	0/27820	0/31682	0/31682
Liability	968.9	997.53	1108.81	1186.27	1065.37
	2886.36	2976.01	3297.75	3592.36	3198.02
	28930/0	30533/0	32036/0	36269/0	36269/0
Gross Surplus	-10.97	-206.45	-187.22	-186.12	-147.68
	246.48	710.43	530.62	563.44	544.78
	-1830/1753	-9033/154	-5136/146.7	-4731/786	-9033/1753
Deferred Tax	5.77	48.36	43.18	48.13	36.36
	82.46	193.3	137.12	150.38	147.19
	-821/863	-48/2710	-36.1/1541	-55/1434	-821/2710
Net Surplus	-5.2	-158.09	-144.04	-137.99	-111.32
	210.73	532.53	421.4	435.82	421.08
	-1281/1753	-6323/108	-3859/334.83	-4424/774	-6323/1753

Table 3-1 presents the descriptive statistics for the total pension scheme, this is made up of both UK schemes and any overseas pension schemes that a firm may have. For 2001 the average equity held is £598.77m, the average quantity of bonds held is £282.87m, property is £37.13m and other assets such as cash are £39.15m. The average

total assets held are £957.92m. However, the average liability is greater than the average total assets held at £968.90m giving an average deficit of £10.97m[36].

The averages for these figures do not capture the magnitude of the liabilities of many firms. The maximum 'total assets' held in 2001 is £27bn while the minimum is £1.9m. Again with the total liability the largest liability is £28.93bn and the smallest liability is £2.2m. We can see therefore that the range of the sample is considerable[37].

In analysing the figures for 2002 what is most significant is the change in the average value of the equity held and the value of the bonds. As the stock market goes through a bear market over 2002 and into the first half of 2003 then the variability in the value of the assets held to meet the pension promise becomes apparent.

The mean value of the equity held is significantly lower than the value of the equity held in 2001. The mean equity value held is £461.23m this is about £138m less than the previous year. The value of the bonds held has also fallen to £258.96m. However, property is slightly larger at £39.28m and while other assets have fallen to £32.38m. The value of the total assets that are held therefore is clearly dependant upon the performance of the stock market. This follows expectations given the composition of the average pension portfolio.

The liability has also increased with an average liability of £997.53m in 2002. The pension promise has therefore become a bigger risk for most firms as the value of the assets held has fallen quite considerably, and the average liability that firms face has increased by about £30m. This is reflected in the gross deficit of the average scheme of £206.45m.

---

36 With the average notional deferred tax being £5.77m then the average net deficit is £5.2m.
37 This ignores the zeros that were included to remove missing values. The figures reported are taken from the raw data.

Again the average masks the true extent of the problem. For the smallest liability this has fallen to £1.8m while the largest liability has risen to £30.53bn. As noted above the gross deficit increased to £206m. The biggest deficit in 2001 however stands at just over £9bn. It is very clear that over 2001 and 2002 the pension problem faced by firms became much more significant.

It is also interesting to note that around this time there was a substantial increase in the press coverage given to the pension 'crisis' facing the UK. The new accounting standard provided disclosure that could be readily understood by investors. Faced with tumbling equity prices then pensions' liabilities became a significant problem. However, when the stock market crashed in 1987 most pension funds had significant equity exposures, despite this there was no significant discussion of a funding crisis. The new accounting standard has therefore changed the awareness of investors and analysts with regards to pensions, the previous view was much more long term, and so market falls and even crashes did not matter as much as they do under the market approach currently employed.

As the market recovers through 2003 and 2004, the average value of the equity held increases to £549.66m and £577.07m respectively. The 2004 value however is still around £20m lower than the average 2001 value. The value of the bonds held increases above the 2001 level by 2004 where the average value of the bonds held is £314m.

Interestingly there are some signs of a change in the structure of the average pension portfolio. The equity values are obviously lower despite the recovery in the market, and the value of the bonds held has increased – this could be due to a combination of better bond prices and increased exposure to bonds as an asset class. The property held however increases by a large amount. The 2003 average holdings are comparable to 2001 and 2002 with average value of property in the portfolio being

around £39m. However, in 2004 this has risen to £47m which is an increase of about 20%. Again the exposure to other assets increases significantly between 2003 and 2004 where the average value increases from £39.15m to £60.7m. The composition of the assets in pension portfolios definitely changes over the sample however this is not conclusive as we cannot be certain if this is due to restructuring or drifts in asset prices.

The average liabilities increase year on year between 2001 and 2004. However between 2002-2003 and 2003-2004 the liabilities increase by quite considerable amounts. Between 2001 and 2002 the increase is about £30m. However, over 2002-2003 the liability increases by about £112m and between 2003 and 2004 the liability increases by about £70m.

In 2001 the gross surplus/(deficit) position is a deficit of about £11m. In 2002 however the gross deficit position increases to £206m. In the following years the gross position recovers slightly to £187m and £186m for 2003 and 2004 respectively. This trend also persists when the net position is considered; the values are only lessened by the notional deferred tax asset. The solvency of the pension scheme can be seen to deteriorate significantly between 2001 and 2002 but improves slightly over 2003 and 2004. However, the magnitude of the problem is significant over the whole sample.

3.4.2 UK and OS Pension Assets and Liabilities

From Table 3-2 and Table 3-3 we can analyse separately the UK pension exposure (Table 3-2) and the overseas pension exposure (Table 3-3). The average asset values are much higher in all years for the UK compared to the overseas schemes. In 2004 for example we can see that the average UK portfolio was made up of £513m equity, £283m bonds, £44m property and £51m other, while the average overseas scheme was £64m equity, £31m bonds, £2.9m property and £9.5m other. However, the range of

overseas exposures is large. There are a number of large firms which have very significant overseas pension exposures, these firms are mainly large international banks such as Barclays and HSBC, large mining firms such as Anglo American and BHP Billiton and the big oil companies; BP for example has the largest overseas liability at £15.8bn in 2004.

Table 3-2 Descriptive Statistics for UK Pension Scheme Assets and Liabilities

The panels below show descriptive statistics for 4 years of FRS-17 disclosures for FTSE 350 firms UK pension assets as well as pooled descriptive statistics for the whole sample. The data consists of assets which are equity, debt, property and other. The debt data presented is the aggregate debt i.e. both corporate and government debt, the other category is assets which are predominantly cash although a small number of firms hold small amounts in insurance policies etc. The gross surplus/(deficit) is total assets plus liability and the net surplus is the gross surplus/(deficit) plus deferred tax. Deferred tax is the amount of tax that would be paid or credited if the pension scheme was to be wound up immediately. The data period is 2001- 2004. For each cell the first variable presented is the mean value, the next value down is the standard deviation and the last values are the minimum/maximum. For example, in 2001 the average value of equity is £534.17m, the standard deviation is 1643.88 and the minimum is £0 while the maximum is £19200m.

	2001	2002	2003	2004	Pooled
Equity	534.17 1643.88 0/19200	412.49 1277.22 0/13800	484.96 1551.1 0/17300	513.16 1686.19 0/18600	486.2 1546.82 0/19200
Bonds	250.76 971.67 0/13117	228.45 723.01 0/5446	261.25 804.25 0/6300	283.39 874.72 0/7400	255.96 847.68 0/13117
Property	35.58 197.17 0/2800	37.29 221.4 0/3300	37.48 221.14 0/3300	44.43 252.73 0/3600	38.7 223.77 0/3600
Other	33.64 114.53 0/1146	25.27 92.38 -400/1067.53	30.34 106.23 0/1114.08	51.46 233.17 -0.6/3647	35.18 147.91 -400/3647
Total Assets	854.16 2599.51 0/27100	703.51 2094.5 0/21500	814.04 2486.25 0/26900	892.45 2742.28 0/29600	816.04 2490.6 0/29600
Liability	845.32 2597.64 28930/0	864.61 2591.85 30533/0	962.34 2836.89 32036/0	1039.55 3087.38 34331/0	927.95 2784.02 34331/0
Gross Surplus	8.84 303.25 -1830/4134	-161.1 598 -9033/316	-148.3 457.66 -5136/1458	-147.1 491.12 -4731/1908	-111.91 479.02 -9033/4134
Deferred Tax	2.63 94.64 -1240/863	39.24 176.74 -95/2710	35.56 128.94 -437/1541	41.02 143.84 -572/1434	29.61 139.94 -1240/2710
Net Surplus	11.47 240.39 -1281/2894	-121.86 430.62 -6323/221	-112.74 343.07 -3595/1021	-106.08 355.41 -3297/1336	-82.3 352.86 -6323/2894

The data also show that in both the UK and overseas schemes equity is the dominant asset held in the pension portfolio. In looking at the value of the equity in both UK schemes and OS schemes there is significant variation as the stock markets fall from the highs of 2001 and enter into the bear market of 2002 and 2003 although they do recover some of their value at the end of the sample period.

Table 3-3 Descriptive Statistics for Overseas Pension Scheme Assets and Liabilities

The panels below show descriptive statistics for 4 years of FRS-17 disclosures for FTSE 350 firms overseas pension assets as well as pooled descriptive statistics for the whole sample. The data consists of assets which are equity, debt, property and other. The debt data presented is the aggregate debt i.e. both corporate and government debt, the other category is assets which are predominantly cash although a small number of firms hold small amounts in insurance policies etc. The gross surplus/(deficit) is total assets plus liability and the net surplus is the gross surplus/(deficit) plus deferred tax. Deferred tax is the amount of tax that would be paid or credited if the pension scheme was to be wound up immediately. The data period is 2001 - 2004. For each cell the first variable presented is the mean value, the next value down is the standard deviation and the last values are the minimum/maximum. For example, in 2001 the average value of equity is £64.60m, the standard deviation is 335.60 and the minimum is £0 while the maximum is £5094m.

	2001	2002	2003	2004	Pooled
Equity	64.6 335.6 0/5094	48.74 250.6 0/3886	64.7 382.21 0/6336	63.91 407.83 0/6976	60.49 348.92 0/6976
Bonds	32.11 133.7 0/1317	30.51 131.15 0/1392	33.67 149.98 0/1755	31.42 146.49 0/1914	31.93 140.42 0/1914
Property	1.55 11.07 0/141	1.99 16.46 0/231	2.4 19.06 0/257	2.9 18.7 0/222	2.21 16.62 0/257
Other	5.51 23.75 0/237	7.11 30.64 0/251.25	6.78 30.68 0/335	9.47 47.24 0/549.63	7.22 34.18 0/549.63
Total Assets	103.77 477.55 0/6789	87.57 402.95 0/5653	107.55 556.62 0/8596	107.7 586.92 0/9375	101.65 510.58 0/9375
Liability	123.58 601.21 9247/0	132.92 720.77 11906/0	146.47 834.4 14085/0	146.72 921.14 15870/0	137.42 777.95 15870/0
Gross Surplus	-19.81 154.95 -2458/514	-45.35 350.16 -6253/49.49	-38.92 305.42 -5489/367.82	-39.02 353.74 -6495/62.3	-35.77 301.92 -6495/514
Deferred Tax	3.14 26.76 -43.9/419	9.12 67.57 -30/1170	7.62 39.78 -21.8/609	7.11 44.25 -53/735	6.75 46.97 -53/1170
Net Surplus	-16.67 132.77 -2039/514	-36.23 285.56 -5083/148.41	-31.3 270.94 -4880/471.73	-31.91 312.27 -5760/38.3	-29.02 259.68 -5760/514

UK equity in 2001 was, on average valued at £534m in 2001 and this fell to £412m in 2002. For the overseas schemes the 2001 equity value was £65m and in 2002 the equity fell to £49m. The fall in the UK schemes was more pronounced and was around 20% of the 2001 value. This is consistent with expectations as UK pension schemes are invested heavily in the UK stock market. Overseas schemes are likely to hold shares in the countries in which the pension liability is owed. Implicitly, they will benefit from both higher emerging market returns, and lower correlation with the US and UK markets. One consequence of this is that these schemes were not as exposed to the declines observed in developed markets.

The UK liability is again on average more significant than the average overseas exposure. In 2001 the average liability was £854m and by 2004 this had risen to £1.04bn. For the overseas schemes however, the average liability in 2001 was £124m and by 2004 this had risen to £147m. Again there is great variation in the magnitude of the pension liability in both the UK and the overseas schemes. The maximum liability in the UK in 2004 is £34bn (BT) and while for OS schemes it was £15.8bn (BP). The liability and the magnitude of the promise are considerable for some firms and both overseas and UK schemes exhibit quite a significant amount of variation.

This variation is also apparent in the surplus or deficit that these schemes have. In the UK in 2001 the gross surplus was on average £9m however, by 2004 these surpluses had turned to deficits with the average deficit being £147m. This is due to increasing liabilities over time and significant falls in the value of the assets held to meet the pension obligation. For the overseas schemes, interestingly the average for 2001 was a deficit of £20m. By 2004 this has doubled to be a gross deficit of £40m. Again this occurs as the pension liability increases year-on-year and the value of the equity held to meet the liability is lower in 2002 – 2004.

3.4.3 UK Pension Liability Assumptions

The pension liability assumptions are used to arrive at the value of the pension liability. The figures are nominal increases in wages and pensions, inflation assumptions and a discount rate. In this data there is again significant variation. For the inflation assumption in the UK this varies across companies more than across time. From Panel A, in Table 3-4 we can see that in 2001 the average inflation assumption is 2.55% and increases to 2.77% in 2004. There are quite large ranges within this; in 2001 the range was 1.5% although in 2004 the range had fallen to 1.05%.

For the wage growth assumption there is some variation over the sample. In 2001 the average wage growth assumption is 4.11%, this falls in 2002 to 3.84% and by 2004 this has recovered somewhat to 4.07%. The pattern of wage growth in each year broadly follows the performance of the stock market performance. This again seems plausible as one would expect that increases in wages would be tied into firm performance. The range for this assumption however is quite considerable and is 5.8% in 2001 and 5.7% in 2004. This is also a significant assumption because if the wage increase is lower then the implied liability for that scheme will be less.[38]

As with wage growth there is a change in the pension growth assumptions year on year. For 2001-2004 pension growth was 2.55%, 2.43%, 2.69% and 2.74% respectively. As with the wage growth assumption if the pension growth assumptions are low then the change in the liability year on year will be reduced and so the presented liability will not be as severe.

---

[38] In analysing the pension assets and liabilities we replaced missing values with zeros to average the pension assets and liabilities across all firms. However, for the assumptions we do not follow this procedure as 0% wage growth for example is an assumption that some firms make and so missing values are retained here.

The last pension assumption is the discount rate. This is used to discount the pension liability into a present value. If a firm employs a higher discount rate then they will reduce the magnitude of the liability. Over the sample the average discount rate falls from 5.95% in 2001 to 5.40% in 2004.

Table 3-4 Pension Scheme Assumptions for UK and Overseas Pension Liabilities

The panels below present the descriptive statistics for 4 years of FRS-17 disclosures for FTSE 350 firms' UK and OS pension liability assumptions. The data consists of expected rates of inflation, wage growth, pension growth and a discount rate. These variables are used to calculate the present value of the pension liability based upon the benefits that have been accrued. Panel A shows the data for the UK Schemes and Panel B for the overseas schemes. All of the figures are in percentages. The data period is 2001 2004.

Panel A	2001			2002			2003			2004		
	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max
Inflation	2.55	0.17	2.00/3.50	2.38	0.15	2.00/3.00	2.68	0.16	2.00/3.00	2.77	0.15	1.95/3.00
Wage Growth	4.11	0.59	0.00/5.80	3.84	0.58	0.00/5.70	4.05	0.67	0.00/6.00	4.07	0.68	0.00/5.70
Pension Growth	2.55	0.50	0.00/5.00	2.43	0.43	0.00/5.00	2.69	0.37	0.00/5.00	2.74	0.43	0.00/3.88
Discount Rate	5.95	0.20	5.50/7.25	5.60	0.20	5.00/6.50	5.50	0.15	5.00/6.25	5.40	0.17	4.63/6.20

Panel B	2001			2002			2003			2004		
	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max
Inflation	2.61	1.10	0.00/6.75	2.41	1.07	0.00/6.50	2.53	0.75	0.00/5.00	2.55	0.52	1.00/4.00
Wage Growth	4.22	1.10	0.00/8.30	3.74	1.29	0.00/7.75	3.91	1.00	0.00/6.50	3.92	0.75	2.40/5.90
Pension Growth	1.69	1.49	0.00/6.50	1.61	1.70	0.00/11.00	1.50	1.25	0.00/4.80	1.52	1.23	0.00/4.00
Discount Rate	6.78	0.92	3.75/11.80	6.07	1.38	0.00/11.25	5.82	0.88	1.33/9.50	5.48	0.83	3.25/8.50

Over time the range of the values used to discount the liability falls. In 2001 the range is 2.25% while in 2004 the range is 1.57%. These changes however, may reflect changes in the AA bond yield or alternatively there may be a 'bedding in' of the new standard and so firms move to the 'optimal' assumption.

3.4.4 OS Pension Liability Assumptions

As mentioned previously the pension assumptions for the overseas schemes are not easy to put into context. The pension promise for a US scheme is not the same as a pension promise in South Africa, if both of these schemes are together then it is not possible to understand how appropriate of favourable any of the assumptions are. Consequently, the descriptive statistics only show how the data looks without any underlying story.

Panel B of Table 3-4 presents my descriptive analysis of the liability assumptions of overseas schemes. The overseas inflation assumption is 2.61% in 2001 and is lower in all the other sample years. The wage growth assumptions are 4.22% in 2001 and this falls in the other years and in 2004 average expected wage growth is 3.92%. Again with the other assumptions average pension growth falls over the sample from 1.69% in 2001 to 1.52% in 2004.

The most interesting assumption here is the discount rate for the scheme liabilities. In 2001 the discount rate is 6.78%; however, this value falls over time to 5.48% in 2004. The range in 2001 is 8.52%, however, in 2004 this range has fallen to 5.25%. The average discount rate for the overseas scheme in 2004 is only 0.08% higher than UK discount rate. Given that the discount rate is linked to the risk of the schemes, then the discount rates would suggest that the overseas promises are actually of a similar risk to the UK schemes, although this seems unlikely given the potential differences that exist in the regulatory environment and the pension promises that the firm is making.

Asset return assumptions can be used to impact upon the profit and loss reserves. If the return on equity is expected to be 7% and the actual return is 7.5% then the firm can put a credit into reserves based upon the extra return generated on equity. Conversely if the return was to be below this there would be a fall in the value of the reserves. However, these assumptions can have a significant effect depending on the size of the pension scheme. Consequently, only a small percentage difference in equity returns for example, such as 50 basis points, could have a considerable effect on the income statement where the equity held in the portfolio is large enough.

3.4.5 UK Asset Return Assumptions

Panel A of Table 3-5 shows that in 2001 the average equity return on UK schemes was 7.69%. There was however, considerable cross sectional variation as the range is 2.88%. For the other years the expected return on equity falls slightly and in 2004 the expected return on equity is 7.66%. Interestingly however, the range increases considerably to 3.9% as the minimum expected return on equity has falls to just 5.10%.

For the bond return assumptions the same pattern broadly emerges. In 2001 the average expected rate of return was 5.29% and the range was relatively high at 3.25%. Interestingly, the maximum expected return on bonds was 7.25% and this is just 0.47% lower than the average return on equity. The expected return however falls over the sample period and in 2004 the average expected return on bonds is 4.89%. The range of the bond return assumptions in 2004 however has increased significantly to 4.62%.

Table 3-5 Pension Scheme Asset Return Assumptions for UK and OS Scheme Assets

The panels below present the descriptive statistics for 4 years of FRS-17 disclosures for FTSE 350 firms' UK and OS asset return assumptions. The data consists of expected rates of return on the different asset classes held within the OS schemes. The data shows expected rates of return on equity, debt, property and other. Within the debt asset the rate of return will be for both government debt and corporate debt where both of these assets are held by firms. The other asset class will generally be an expected rate of return on cash, but where there are other assets held such as insurance policies the average rate of return has been used. Panel A shows the data for the UK Schemes and Panel B for the overseas schemes. All of the figures are in percentages. The data period is 2001-2004.

Panel A	2001			2002			2003			2004		
	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max
Equity Return	7.69	0.55	6.12/9.00	7.70	0.82	0.00/9.50	7.69	0.92	0.00/9.50	7.66	0.57	5.10/9.00
Bond Return	5.29	0.40	4.00/7.25	4.91	0.54	0.00/6.50	4.97	0.55	0.00/6.00	4.89	0.39	1.88/6.50
Property Return	6.90	0.56	5.90/8.50	6.75	1.00	0.00/8.50	6.83	0.60	4.80/8.20	6.57	1.06	0.00/8.50
Other Return	4.60	1.25	0.00/8.00	4.37	0.92	2.50/8.00	4.29	0.97	0.00/7.50	4.61	1.06	0.00/9.00

Panel B	2001			2002			2003			2004		
	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max	Mean	St. Dev	Min/Max
Equity Return	8.81	1.19	5.90/12.75	8.78	1.11	6.25/13.00	8.51	1.01	6.00/12.50	8.25	1.07	5.10/11.50
Bond Return	6.27	1.21	2.50/11.75	5.68	1.40	0.00/10.50	5.48	0.94	3.76/9.50	5.21	1.05	2.20/8.50
Property Return	8.21	3.35	4.00/18.00	6.63	1.68	3.00/9.50	6.31	1.22	3.00/8.00	6.27	1.71	3.00/9.50
Other Return	5.52	2.10	1.75/14.50	4.81	2.06	1.00/14.00	4.34	1.65	1.00/9.00	4.19	2.33	0.00/14.00

For the return on property assumptions the average expected return on property is 6.9% in 2001 and is similar across all of the years and by 2004 this has fallen to 6.57%. As with the other asset return assumptions the spread of the assumptions increases quite significantly over time. In 2001 the range is 2.6% and in 2003 the range has increased to 3.4%. Although the largest range is 8.5% (2002 and 2004), this figure is somewhat misleading as there was an assumption of zero return on property and so the increase is not representative.

Unlike the return assumptions for the main assets held in the portfolio, the returns on other assets does not follow the trend with higher averages in 2001 and lower averages in 2004. Over time the return is broadly the same and with the highest average return being 4.61% in 2004 and the lowest being 4.29% in 2003. The range in the assumptions is quite large with the maximum being 5.5% given that other assets are predominantly cash such a return on a cash portfolio in this instance is extremely high[39].

One possible reason for the pattern that emerges with the assumptions over time is that the new accounting standard was introduced in 2001. Over the sample we therefore see an evolution in how to account for pensions. Potentially, as the way to effectively apply the accounting standard to benefit the company emerges then assumptions are changed to benefit the numbers reported in the company accounts.

3.4.6 OS Asset Return Assumptions

As with the pension assumptions for the overseas schemes it is not possible to anything from the asset return assumptions as it is difficult to benchmark the return assumptions and put them into an appropriate context. The figures only tell how the data looks but there is little story that can be brought to light.

---

[39] As with property the inclusion of a zero return on other assets in 2001, 2003 and 2004 biases the largest range in the sample and so we only discuss the 2002 range.

From Panel B in Table 3-5 it is clear that the average return assumption for overseas equity is higher in all years than the UK equity return assumption. In 2001 the average expected return on overseas equity is 8.81% with a range of 6.85%. In 2004 the equity return is 8.25% but the range has actually narrowed to 6.4% unlike the UK assumptions where there is an increase in the range over time.

For bond returns the picture is the same as the average bond return in 2001 is 6.27% with a range of 9.25% and in 2004 the average return has fallen to 5.21% with a range of 6.3%. The same pattern emerges in both property and other assets where in 2001 the property expected return is 8.21% and this falls to 6.27% in 2004 as well as this there is a dramatic fall in the spread from 14% in 2001 to 6.5% in 2004. For the other assets the average expected return falls from 5.52% in 2001 to 4.19% in 2004. Interestingly the range in for other assets decreases from 12.75% in 2001 to 8% 2003[40].

3.5 Pension Assets and Liabilities – Sorted by Tobin's Q

The final two sections of this chapter carry out descriptive statistics over two separate sorts of the data. The first set of sorts carried out was by Tobin's Q, where,

$$Q = \frac{MarketValue + TotalDebt + PreferenceCapital}{TotalAssetsEmployed}$$

I sort the data using Tobin's Q for a number of reasons. First, it is a standard metric by which company data is sorted in corporate finance. Second, Tobin's Q serves as a proxy for corporate value. As such my expectation would be that measures of corporate value would reflect the magnitude of the pension promise and the associated funding of the scheme[41]. Based upon this intuition I would expect those firms that have

[40] Again we do not report the 2004 range as it is biased by the assumption of zero return.
[41] Assuming that market efficiency holds.

high measures of Q to be associated with high levels of scheme funding and/or smaller liabilities. Conversely, for low Q firms the expectation would be that they have larger pension exposures and worse levels of funding. In this situation corporate value should be lower as the large liabilities and low funding levels reflect a long-term cash outflow as the liability has to be funded from the within the existing resources of the firm. This expectation also ties up with the notion that Q proxies for the investment opportunities of the firm. Those firms that have large liabilities and low levels of funding are therefore less likely to be able to invest in all available projects as the funding of the pension scheme reduces the availability of cashflow within the firm for investment.

Table 3-6 to Table 3-9 present the descriptive statistics of the UK pension assets, liabilities and assumptions sorted by Tobin's Q. I present quartiles where quartile 1 contains those firms with the lowest Q values and quartile 4 has the highest Q values[42]. The data is analysed in by different years and in different groups. The data is grouped into pension assets (Equity, Bonds, Property and Other), total pension assets and liabilities, (Total Assets, Total Liability Gross Surplus Deferred Tax and Net Surplus), pension assumptions (Inflation, Wage Growth, Pension Growth and Discount Rate) and lastly return assumptions (Equity Return, Bond Return, Property Return and Other Return).

From carrying out the descriptive statistics based on the sorts it is problematic to derive strong patterns within the data from standard descriptive statistics. This is in part due to the fact that the pension can be viewed as an external factor to the performance of the firm.

---

[42] Table 4e presents the Q values for each quartile. The values are slightly lower as the stocks are more mature for the majority of the sample.

One example which highlights the variance of this is, by considering a single industry. I look at three large banks, namely, Royal Bank of Scotland, HBOS and HSBC. All of these companies are in the FTSE 100, all are in the same industry and are comparable in many ways and serve as a good example of the nature of the problem. In 2001 the Royal Bank had a surplus of £446m, HBOS had a surplus of £3m (essentially zero relative to the liability) and HSBC had a deficit of £742m. The standard sorts of the data therefore make it very difficult to build up a coherent picture as there is no clear relationship that emerges. This is in itself however an interesting facet of the data and the nature of the problem.

Table 3-6 Pension Assets by Tobin's Q

The data is taken from the FRS 17 disclosures from company accounts. The sample period is from 2001-2004 and shows the mean, standard deviation, and Minimum/Maximum. The data consists of assets which are equity, debt, property and other. The debt data presented is the aggregate debt i.e. both corporate and government debt, the other category is assets which are predominantly cash although a small number of firms hold small amounts in insurance policies etc. Here firms are sorted by Tobin's Q where Q1 is the lowest values of Q and Q4 is the quartile with the highest Q values.

Panel A	Equity – 2001			Equity – 2002			Equity - 2003			Equity – 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	700.84	1650.61	0/8603	646.79	1419.89	0/7175	685.28	1547.31	0/7621	639.91	1563.43	0/8042
2	495.24	1198.11	0/7462	188.67	306.03	0/1659	213.7	339.81	0/1769	318.3	665.03	0/4978
3	658.97	2507.02	0/19200	391.38	1369.09	0/10815	793.05	2571.4	0/17300	792.1	2870.09	0/18600
4	255.82	574.75	0/3234	383.74	1558.16	0/13800	189.46	451.27	0/2927	240.27	508.57	0/2716

Panel B	Bonds – 2001			Bonds – 2002			Bonds - 2003			Bonds – 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	393.78	1516.04	0/13117	352.18	898.47	0/5446	387.19	960.44	0/5690	357.43	981	0/6991
2	270.07	846.13	0/5191	148.26	576.72	0/5216	175.66	623.65	0/5312	254.8	749.59	0/5770
3	191.25	649.23	0/4900	188.16	683.72	0/5436	336.93	1014.02	0/6300	332.88	1125.62	0/7400
4	125.83	345.17	0/2375	204.29	653.15	0/4800	111.02	368.86	0/2831	153.63	414.51	0/2593

Panel C	Property – 2001			Property – 2002			Property - 2003			Property – 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	50.56	182.49	0/1177	55.08	188.05	0/1159	53.57	184.22	0/1157	60.19	218.14	0/1409
2	27.5	124.59	0/852	6.04	20.48	0/147	7.31	22.41	0/131	6.4	22.81	0/123
3	50.1	325	0/2800	33.18	176.39	0/1352	77.16	399.54	0/3300	93.01	456.17	0/3600
4	11.84	47.11	0/333	52.08	364.22	0/3300	6.93	38.2	0/316	10.24	45.75	0/343

Panel D	Other – 2001			Other – 2002			Other - 2003			Other – 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	50.59	123.26	0/597	43.24	97.24	0/567	47.26	126.02	0/652	94.64	376.76	0/3647
2	28.21	105.29	0/796	10.3	24.31	0/177	13.03	35.89	0/269	35.35	148.57	0/1227
3	38.41	153.55	0/1146	33.33	139.83	-0.1/1068	44.25	155	0/1114	31.97	77.34	0/459
4	14.75	44.83	0/365	11.04	61.3	-400/299	12.1	41.13	0/308	24.22	71.41	-0.6/483

Table 3-6 presents the descriptive statistics for the different asset classes held in each year. It is difficult to see an obvious pattern over all quartiles in the data over time. In 2001 for the lowest performing firms (Q1) the average amount of equity (£700m) is the highest. The range here is quite large with the minimum equity held being zero and the maximum being £8.6bn. However, if Q3 is considered the average equity held is slightly lower at £659m but the range is considerably higher at £19.2bn. This occurs as some of the largest schemes have fallen into this quartile and their pension scheme assets and liabilities dwarf the pension schemes of the other firms in the sample. The only consistent pattern that can be seen is that Q1 is always greater than Q4 for the equity held.

For the bonds held the only pattern that can be observed is the same as for equity where year on year the quantity of bonds held in Q1 (low Q firms) is greater than the amount held in Q4 (high Q firms). From the table it can also be seen that the firms with the largest pension schemes move between quartiles over time as the range in the different quartiles is significant over time. For Q4 for example in 2001 the range is £2.4bn but in 2002 this has increased to £4.8bn but falls back down again in 2003 and 2004 to £2.8bn and £2.6bn respectively.

This pattern can be seen over all of the assets held and also over time. In 2001 for example in Q1 the average value of bonds held was £489m and the range was £13.1bn, highlighting the significant range in pension promises that firms have made. Again in Q4 the average value of bonds held was £413m while the range was £5.2bn showing the extent of pension promises.

The average value of property assets held for Q1 are worth £51m and the range is £1.2bn. While for Q4 the average value of property is £11.84m and the range is £333m. The dominant quartile for property however changes. In 2001 and 2002 Q1

holds the largest amounts of property, in 2003 and 2004 however Q3 holds significantly larger amounts of property in the portfolio than the other quartiles. Again this does not tell us much about the pension liabilities of the firm's in these groups but that companies are moving from 1 group to another.

For the other asset class Q1 is greater than Q4 in all years but the range changes significantly year on year. In 2001 the average other assets held in Q1 is £51m and in 2004 this has risen considerably to £94.64m. For Q4 the 2001 value of other assets is £15m and for 2004 the average is £24m. One interesting fact that emerges from this sort is that in 2002 and 2004 there are minimums which are negative, in these instances the pension scheme has borrowed cash to fund their positions. This only occurs three times over the whole sample.

Table 3-7 presents the total assets, total liability, gross surplus and net surplus for UK schemes between 2001 and 2004. The broad pattern across all of these categories is that Q1 dominates Q4. As with the individual asset classes the variation in the ranges show where the firms with the largest schemes, move between quartiles over time.

From the total assets it is apparent that the value of the equity held falls in 2002 quite considerably and recovers in the latter years. This is the same for all quartiles. For the total liability there is no discernable pattern above the fact that Q1 has greater liabilities in all years than those firms in Q4, this is not down to performance however but the size of the pension promise. BT for example have the largest pension promise and in 2001 the firm is in Q3 but in 2001 they move into Q4 and in 2003 they track back to Q3.

Table 3-7 Pension Assets and Liabilities by Tobin's Q

The data is taken from the FRS-17 disclosures from company accounts. The sample period is from 2001-2004 and shows the mean, standard deviation, and Minimum/Maximum. The data consists of Total Assets which are equity, debt, property and other. The Total Liability which is the outstanding pension promise. The Gross Surplus which is Total Assets plus Total Liabilities. Lastly, the net surplus is presented which is the Gross Surplus plus deferred tax. Here firms are sorted by Tobin's Q where Q1 is the lowest values of Q and Q4 is the quartile with the highest Q values.

Panel A	Total Assets 2001			Total Assets 2002			Total Assets 2003			Total Assets 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	1195.78	2976.65	0/16341	1097.3	2391	0/10682	1173.29	2665.12	0/12447	1152.16	2834.48	0/13667
2	821.01	2127.54	0/12949	353.27	843.28	0/7052	409.7	935.24	0/7350	614.85	1380.62	0/8151.62
3	938.73	3539.29	0/27100	646.05	2196.38	0/15138	1251.38	3909.35	0/26900	1249.96	4325.84	0/29600
4	408.24	827.76	0/3715	651.15	2436.23	0/21500	319.51	711.52	0/3686	428.36	898.39	0/4164

Panel B	Total Liability 2001			Total Liability 2002			Total Liability 2003			Total Liability 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	1187.48	2981.9	18080/0	1336.98	2842.83	12418/0	1395.4	3124.64	14037/0	1367.58	3359.94	16051/0
2	836.72	2176.92	12642/0	444.03	971.68	7866/0	492.99	1065.56	8337/0	737.53	1627.74	10102.65/0
3	900.97	3500.79	28930/0	757.5	2397.11	14822/0	1443.97	4371.48	32036/0	1387.87	4667.97	34331/0
4	403.17	821.53	3970/0	840.91	3423.01	30533/0	394.49	889.77	5181/0	509.35	1062.39	5326/0

Panel C	Gross Surplus 2001			Gross Surplus 2002			Gross Surplus 2003			Gross Surplus 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	8.3	291.03	-1739/1753	-239.68	544.29	-2931/115.4	-222.11	543.63	-3055/120.3	-215.42	643.15	-3870/786
2	-15.71	136.17	-650/356	-90.76	153.81	-814/12.1	-83.29	156.72	-987/53	-122.68	269.99	-1951.03/0
3	37.76	506.34	-1830/4134	-111.45	340.8	-2171/316	-192.58	658.41	-5136/1458	-137.91	597.82	-4731/1908
4	5.07	105.92	-388.8/491	-189.76	1004.92	-9033/154	-74.98	214.47	-1495/54.87	-80.99	190	-1162/2.78

Panel D	Net Surplus 2001			Net Surplus 2002			Net Surplus 2003			Net Surplus 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	22.63	282.11	-1185/1753	-184.04	398.28	-1963/80.8	-166.86	404.49	-2139/150	-155.23	473.22	-2748/774
2	-13.02	102.55	-455/249	-72.17	127.81	-688/5.2	-67.49	136.58	-865/37	-92.24	204.75	-1409.59/0
3	30.06	359.6	-1281/2894	-88.48	281.52	-1946.1/221	-146.12	489.07	-3595/1021	-97.68	417.38	-3297/1336
4	4.44	96.25	-388.8/491	-132.52	702.96	-6323/108	-55.66	169.87	-1103/54.87	-56.64	132.4	-813/0.8

The gross surplus (total pension assets plus pension liability) shows that in 2001 on average firms had a surplus in their schemes. However, when the range is considered there is a huge amount of variation in each quartile. The greatest variation is in Q3 where largest deficit is £1.8bn and the largest surplus is £4.1bn giving a range of just under £6bn. This highlights the fact that many pension schemes were in considerable difficulty even before the fall of the equity markets in 2002 and 2003.

The net surplus tells the same story as the gross surplus although the values here are not as large as they take into account the impact of the notional tax asset/liability that the scheme could utilise.

Table 3-8 presents the descriptive statistics of the liability assumptions that are applied to arrive at the pension liability. These are the inflation, wage growth, pension growth and discount rate assumptions. Here there is very little variation in the sample for different values of Q. For inflation in Q1 in 2001 the average inflation assumption is 2.52%, the largest average is Q3 where inflation is 2.58%. This variation is very small, although it should be noted that depending on the size of the scheme such small changes, in conjunction with other favourable assumptions may lead to quite significant changes in the implied liability of a scheme.

Over the other years there is a similar picture and there is no discernable pattern between quartiles. However, over time it is clear that inflation is expected to increase as the average values increase in all quartiles over time. For wage growth it is a similar story in that there is no real pattern to be found across the quartiles. Expected wage growth can be seen to vary with the performance of the stock market and thereby firms. As the market declines the expected increase in wages falls and as the market recovers the expected increase in wages rises again. Inflation and wage growth clearly exhibit similar characteristics as the ranges through time and across different quartiles, is similar.

Table 3-8 UK Liability Assumptions by Tobin's Q

The panels below present the descriptive statistics for 4 years of FRS-17 disclosures for FTSE 350 firms' UK pension assumptions. The data consists of expected rates of inflation, wage growth, pension growth and a discount rate. These variables are used to calculate the present value of the pension liability based upon the benefits that have been accrued. The data period is 2001-2004. For the UK scheme in 2001 – 2004. Here firms are sorted by Tobin's Q where Quartile 1 is the lowest values of Q and Quartile 4 is the highest Q values. All values are in percentages.

Panel A	Inflation 2001			Inflation 2002			Inflation 2003			Inflation 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	2.52	0.19	2.00/3.50	2.33	0.13	2.00/2.70	2.68	0.15	2.25/3.00	2.75	0.14	2.40/3.00
2	2.56	0.16	2.25/3.00	2.37	0.15	2.00/2.75	2.72	0.16	2.40/3.00	2.77	0.15	2.40/3.00
3	2.58	0.16	2.25/3.00	2.42	0.18	2.00/3.00	2.66	0.15	2.30/3.00	2.77	0.18	1.95/3.00
4	2.54	0.17	2.00/3.00	2.39	0.14	2.20/2.80	2.66	0.19	2.00/3.00	2.79	0.13	2.50/3.00

Panel B	Wage Growth 2001			Wage Growth 2002			Wage Growth 2003			Wage Growth 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	4.02	0.82	0.00/5.00	3.78	0.56	1.25/4.80	3.94	0.80	0.00/5.30	4.00	0.63	2.00/5.00
2	4.14	0.48	3.00/5.32	3.87	0.51	2.70/5.34	4.17	0.52	2.00/5.50	4.11	0.6	2.00/5.70
3	4.15	0.46	3.00/5.60	3.79	0.79	0.00/5.70	4.09	0.53	3.00/5.77	4.07	0.74	0.00/5.00
4	4.14	0.5	3.00/5.80	3.92	0.46	3.00/5.50	3.99	0.77	0.00/6.00	4.10	0.77	0.00/5.45

Panel C	Pension Growth 2001			Pension Growth 2002			Pension Growth 2003			Pension Growth 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	2.53	0.4	0.00/3.50	2.43	0.29	2.00/3.50	2.72	0.25	2.40/3.80	2.71	0.43	0.00/3.88
2	2.57	0.64	0.00/5.00	2.48	0.44	2.00/5.00	2.75	0.36	2.20/5.00	2.76	0.24	2.00/3.60
3	2.55	0.47	0.00/3.80	2.37	0.53	0.00/3.10	2.70	0.20	2.20/3.15	2.71	0.53	0.00/3.25
4	2.57	0.48	0.00/3.70	2.42	0.45	0.00/3.50	2.60	0.56	0.00/3.50	2.77	0.48	0.00/3.60

Panel D	Discount Rate 2001			Discount Rate 2002			Discount Rate 2003			Discount Rate 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	5.95	0.24	5.50/7.25	5.6	0.19	5.14/6.50	5.51	0.17	5.25/6.25	5.41	0.19	5.15/6.20
2	5.92	0.17	5.54/6.80	5.59	0.20	5.25/6.50	5.51	0.15	5.19/6.00	5.41	0.17	4.89/5.90
3	6.00	0.2	5.75/6.70	5.61	0.24	5.00/6.50	5.51	0.16	5.00/6.00	5.37	0.16	4.63/6.00
4	5.92	0.2	5.50/6.50	5.58	0.20	5.10/6.00	5.48	0.13	5.20/6.00	5.39	0.16	5.05/5.80

For pension increases there is, as with the other assumptions, no pattern across quartiles. In 2001 the average pension increase for Q1 is 2.53% and for Q4 this is 2.57%. It is interesting to notice that the maximum pension increase in 2001 is 5% and this is the same for both 2002 and 2003, this value however, falls to a maximum in 2004 of 3.88%. However, the expected increase in pension payments rises over the sample for all quartiles.

Again for the discount rate there is no discernable pattern across time. For the different quartiles Q1 has a slightly larger discount rate than Q4. In 2001 for example Q1 has an average discount rate of 5.95% while Q4 has an average discount rate of 5.92%.

Table 3-9 presents the asset return assumptions. For equities the expected return for Q1 is 7.7% in 2001 and 7.66% in 2004. While for Q4 the return in 2001 and 2004 is 7.71% and 7.63%. With the exception of 2001 the expected return on equities from 2002 onwards is greater in Q1 than in Q4. Although there is only a small difference of 0.03%, and no discernable pattern emerges over quartiles or through time.

In analysing the return on bonds the pattern is less clear as no one quartile has consistently higher returns in each year and the range for different quartiles year-on-year varies by considerable amounts. While the expected return on property it is consistently higher for Q1 compared to Q4 in all years. The range for these quartiles varies significantly over time and there is no apparent order. Finally, for the other asset class Q1 has greater mean expected returns when compared to Q4 for all years except 2004.

As noted above the lack of patterns through time or cross-sectionally reflects the an interesting facet of the problem as the liability is not systematically related to standard corporate finance variables such as Tobin's Q or even industry.

Table 3-9 UK Asset Return Assumptions by Tobin's Q

The panels below show the descriptive statistics for 4 years of FRS-17 disclosures for FTSE 350 firms' UK pension assumptions. The data is the expected rates of return on equity, bonds, property and other assets. Within the debt asset the rate of return will be for both government and corporate debt where both of these assets are held by firms. The other asset class will generally be an expected rate of return on cash. The data period is 2001 2004. Here firms are sorted by Tobin's Q where Q1 is the lowest values of Q and Q4 is the quartile with the highest Q values. All values are in percentages

Panel A	Equity Return 2001			Equity Return 2002			Equity Return 2003			Equity Return 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	7.70	0.57	6.25/9.00	7.74	0.58	6.39/8.60	7.80	0.60	6.30/9.50	7.66	0.64	5.10/9.00
2	7.68	0.54	6.12/8.60	7.73	0.64	6.26/9.50	7.59	1.18	0.00/8.90	7.59	0.55	6.50/8.80
3	7.68	0.58	6.50/9.00	7.74	0.68	6.00/8.80	7.83	0.55	6.50/8.90	7.74	0.55	6.08/8.80
4	7.71	0.51	6.25/9.00	7.61	1.21	0.00/9.00	7.52	1.17	0.00/8.50	7.63	0.52	6.00/8.50

Panel B	Bond Return 2001			Bond Return 2002			Bond Return 2003			Bond Return 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	5.34	0.48	4.50/7.25	4.90	0.75	0.00/5.85	5.08	0.37	3.80/6.00	4.89	0.53	1.88/5.90
2	5.25	0.33	4.62/6.00	4.82	0.38	4.30/6.00	4.86	0.71	0.00/5.50	4.86	0.24	4.20/5.50
3	5.26	0.40	4.00/6.20	4.96	0.46	4.40/6.50	5.01	0.27	4.50/5.80	4.92	0.27	4.20/5.50
4	5.33	0.35	4.70/6.20	4.95	0.49	2.90/6.50	4.91	0.73	0.00/6.00	4.91	0.45	3.50/6.50

Panel C	Property Return 2001			Property Return 2002			Property Return 2003			Property Return 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	7.15	0.65	5.90/8.50	7.03	0.71	6.00/8.50	7.00	0.46	6.30/8.00	6.71	0.83	3.80/8.00
2	6.86	0.55	6.00/8.25	6.87	0.60	5.50/8.00	6.73	0.80	4.80/8.20	6.76	0.65	5.70/8.10
3	6.58	0.42	6.00/7.10	6.27	1.60	0.00/7.50	6.76	0.60	5.50/8.00	6.72	0.65	5.50/8.50
4	6.90	0.38	6.40/7.70	6.80	0.65	5.20/7.75	6.78	0.57	5.80/7.75	5.94	1.81	0.00/7.50

Panel D	Other Return 2001			Other Return 2002			Other Return 2003			Other Return 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	4.56	1.56	0.00/8.00	4.56	1.10	3.00/8.00	4.39	0.94	2.75/6.75	4.56	1.19	0.00/9.00
2	4.50	0.96	0.00/6.50	4.11	0.76	2.50/6.41	4.25	0.80	1.20/6.48	4.73	0.81	3.00/7.50
3	4.87	1.07	2.50/8.00	4.45	0.98	2.50/6.80	4.31	1.09	0.00/6.70	4.53	1.34	0.00/8.00
4	4.47	1.28	0.00/6.60	4.37	0.78	3.00/6.40	4.22	1.03	0.00/7.50	4.65	0.71	2.80/6.05

3.6 Pension Assets and Liabilities – Sorted by Market Value

Next I perform sorts of the data based upon the market value of the firm and here the data presents a much more obvious pattern. I choose to sort by the absolute market value as this allows for a specific characterisation of the data. The alternative sort would be to use some relative metric such as pension liabilities scaled by market value. However, if this relative sort was used then very small firms with very small liabilities may fall into the category of having large pension exposures e.g. a £50m market capitalisation and a £25m pension liability would produce a ratio of pension liabilities to market value of 50%. As such this firm would fall into the category of large pension exposures; the actual cash value of this however, is very small and prevents me from being able to typify companies based on size.

Conversely, if I sort by absolute market capitalisation, this allows for me to assert that the largest firms have the largest absolute liabilities and are invested heavily in equity. Further, this sort also highlights that the largest pension exposures by absolute value are concentrated in the largest firms. This would otherwise not be possible if a relative sort had been used.

For the individual assets and the pension liabilities it is the firms with the largest market values that have bigger pension liabilities. This follows expectations for two reasons. First the biggest firms for the most part will have the greatest number of employees and will have been operating for the longest period of time. The result of this will be that these firms will have the biggest pension promises to keep. Second, a number of the biggest firms in the UK were formally nationalised companies and consequently have a much higher number of deferred or retired employees. The most

highly publicised example of this is British Airways whose pension liability was 37% of the market capitalisation of the firm in 2003[43].

From Table 3-10 it can be seen that for all years, the equity for those firms with the highest market value (Q4) is significantly higher than all of the other quartiles. In all years the average equity value is over £1.2bn and the range for all years is much greater than in all of the other quartiles.

[43] Lane Clarke and Peacock, Accounting for Pensions (2003).

Table 3-10 UK Pension Assets by Market Value

The data is taken from the FRS-17 disclosures from company accounts. The sample period is from 2001-2004 and shows the mean, standard deviation, and Minimum/Maximum. The data consists of assets which are equity, debt, property and other. The debt data presented is the aggregate debt i.e. both corporate and government debt, the other category is assets which are predominantly cash although a small number of firms hold small amounts in insurance policies etc. Here firms are sorted by market value (MV) where Quartile 1 is the lowest MV and Quartile 4 is the highest MV.

Panel A	Equity – 2001			Equity – 2002			Equity - 2003			Equity - 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	124.96	391.53	0/2957	76.12	185.63	0/1061	58.12	142.67	0/1029	48.25	151.77	0/1265
2	85.9	165.32	0/847.5	78.38	164.83	0/1180	96.98	144.58	0/621.3	94.41	185.11	0/1300
3	266.28	591.37	0/4993	288.32	638.97	0/3893	240.49	528.91	0/4501	297.98	565.77	0/4459
4	1664.22	2943.45	0/19200	1211.02	2289.4	0/13800	1549.17	2805.26	0/17300	1617.36	3073.87	0/18600

Panel B	Bonds – 2001			Bonds – 2002			Bonds - 2003			Bonds - 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	191.25	1402.34	0/13117	50.33	195.09	0/1702	31.78	116.24	0/930.7	34.07	153.03	0/1076
2	29.73	93.43	0/820	49.93	211.37	0/1932	46.26	78.33	0/383.2	73.55	258.54	0/2239
3	141.68	590.69	0/5472	226.37	766.89	0/5446	196.5	668.65	0/5690	237.85	786.69	0/6991
4	641.08	1119.93	0/5191	589.23	1116.97	0/5436	773.12	1334.37	0/6300	790.94	1419.8	0/7400

Panel C	Property – 2001			Property – 2002			Property - 2003			Property - 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	5.5	21.2	0/134	5.72	22.63	0/150	2.22	10.22	0/74.5	1.67	8.19	0/63.4
2	1.46	7.53	0/56	1.95	9.48	0/75.9	3.64	16.92	0/121.8	2.74	15.66	0/117.1
3	13.72	72.69	0/663	12.21	75.28	0/691	16.14	78.75	0/705	19.57	80.74	0/708
4	121.99	376	0/2800	129.65	424.88	0/3300	128.34	424.32	0/3300	154.24	484.96	0/3600

Panel D	Other – 2001			Other – 2002			Other - 2003			Other - 2004		
Q	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	11.11	50.54	0/384	8.11	38.92	0/349	1.66	4.51	0/33.7	4.25	17.6	0/152
2	1.76	4.55	0/32.4	3.89	16.45	0/150	3.43	7.09	0/33.3	4.73	11.26	-0.6/76.3
3	14.61	27.78	0/169.2	26.58	79.29	-0.1/567	13.58	47.27	0/425	24.44	66.73	0/510
4	107.36	205.65	0/1146	62.69	155.76	-400/1067.53	103.02	190.15	0/1114.08	172.98	441.51	0/3647

In all of the other assets classes this pattern can be seen across all of the quartiles for all of the years. For Q4 in 2001 and 2004 the value of the bonds held is £641m and £790m respectively while for Q1 in the same years the value of bonds held is £191m and just £34m. In looking at the same quartiles for property in 2001 the smallest firms hold an average of just £5.5m while the largest holds £122m. However, by 2004 the quantity of property held by firms in Q1 has fallen to just £1.67m whereas the value for the largest firms has increased to £154m. This is the pattern which also emerges for the other asset class. Between 2001 and 2004 for Q1 the quantity held falls from £11m to £4.25m. Whereas for Q4, the quantity held rises from £107m to £172m.

Table 3-11 presents much the same pattern as Table 3-10. In all years the total assets held by the firms with the largest market values are significantly larger than those firms with smaller market values. For those firms in Q1 the average total assets held is £333m, £140m, £94m and £88m for 2001-2004 respectively. In Q4 over the same period however, the average total assets held were £2.53bn, £2bn, £2.6bn and £2.74bn respectively.

Table 3-11 also presents the pension liability. Again those firms with the largest market values have the largest pension liabilities. For 2001 the average liability for Q4 is £2.5bn and by 2004 this has risen to £3.2bn. Within this however there is a considerable range with the maximum liability in these years being £29bn in 2001 and £34bn in 2004 (British Telecom).

Table 3-11 UK Assets and Liabilities by Market Value

The data is taken from the FRS 17 disclosures from company accounts. The sample period is from 2001-2004 and shows the mean, standard deviation, and Minimum/Maximum. The data consists of Total Assets which are equity, debt, property and other. The Total Liability which is the outstanding pension promise. The Gross Surplus which is Total Assets plus Total Liabilities. Lastly, the net surplus is presented which is the Gross Surplus plus deferred tax. Here firms are sorted by market value (MV) where Quartile 1 is the lowest MV and Quartile 4 is the highest MV.

Panel A	Total Assets 2001			Total Assets 2002			Total Assets 2003			Total Assets 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	332.82	1773.07	0/16341	140.28	364.26	0/2340	93.78	244.96	0/1439.9	88.24	312.08	0/2493
2	118.85	250.03	0/1685	134.15	379.95	0/3262	150.31	230.47	0/1074.9	175.43	432.38	0/3587
3	436.3	1247.21	0/11255	553.48	1509.98	0/10395	466.71	1295.98	0/11321	579.84	1459.54	0/12668
4	2534.65	4322.85	0/27100	1992.59	3582.85	0/21500	2553.65	4365.77	0/26900	2735.52	4826.73	0/29600

Panel B	Total Liability 2001			Total Liability 2002			Total Liability 2003			Total Liability 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	353.81	1952.44	18080/0	177.62	434.32	2535/0	119.03	294.39	1952.4/0	115.25	427.74	3689/0
2	120.19	240.03	1631/0	165.77	429.61	3701/0	190.71	278.43	1248/0	216.46	484.34	3885/0
3	413.45	1066.84	9502/0	666.35	1663.17	10307/0	536.86	1317.95	11203/0	643.18	1413.6	11882/0
4	2499.49	4303.11	28930/0	2456.58	4523.38	30533/0	3012.44	4989.89	32036/0	3193.93	5453.38	34331/0

Panel C	Gross Surplus 2001			Gross Surplus 2002			Gross Surplus 2003			Gross Surplus 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	-20.99	189.96	-1739/318	-37.34	97.81	-554/15.36	-25.26	65.47	-512.5/18.7	-27.01	129.62	-1196/18.7
2	-1.34	25.85	-74.94/116.1	-31.62	64.45	-439/115.4	-40.41	76.78	-429/120.3	-41.02	76.39	-365/108.9
3	22.85	205.75	-228/1753	-112.87	251.39	-1596/105.8	-70.15	111.73	-604.6/118	-63.35	137.04	-499/786
4	35.16	539.17	-1830/4134	-463.99	1114.55	-9033/316	-458.79	832.98	-5136/1458	-458.42	896.16	-4731/1908

Panel D	Net Surplus 2001			Net Surplus 2002			Net Surplus 2003			Net Surplus 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	-14.73	130.23	-1185/219	-28.69	72.53	-390.5/10.75	-18.63	49.48	-393.5/13.1	-19.03	90.87	-837/13.1
2	-1.29	22.87	-74.94/116.1	-27.68	66.48	-518/80.8	-31.34	58.92	-262/84.2	-29.67	56.63	-298/82.5
3	22.37	202.58	-230/1753	-86.1	181.42	-1117/80	-54.43	96	-602.6/150	-45.63	117.47	-349/774
4	39.78	416.32	-1281/2894	-346.04	798.57	-6323/221	-347.64	621.35	-3595/1021	-331.02	645.94	-3297/1336

Next I consider both the gross and net surplus/(deficit)[44] it is interesting to see that those firms with the largest market value in 2001 had gross surplus assets of around £35m but in 2002 the average firms has a gross deficit of £464m. However, for those firms with the smallest market value in 2001 to 2004 there a deficit in all years, in 2002 the deficit is £37m and by 2004 this has increased to a deficit of £27m. Interestingly the deficit for those firms with the largest schemes hardly moves from the low of 2002. By 2004 the average deficit is £458m; this is only a fall of £6m and is only a fraction of the deficit.

Table 3-12 presents the economic assumptions that are applied to calculate the pension liability. Inflation does not vary by much across quartiles. However, over time the range between the average values falls. For 2001 the range between the highest and lowest values falls from 0.05% in 2001 to 0.03% in 2004. It should also be noted that the expected inflation increases over time from around 2.5%in 2001 to about 2.78% in 2004.

My sorts of wage growth present a more obvious pattern across time as in all years, as the expected wage growth for the largest firms is greater than the average wage growth of smaller firms. Again this is consistent with expectations. First those firms with the biggest employee base would have on average higher wage increases than smaller firms with a smaller employee base. Second given that the liability of the largest firms does not change significantly over the period then, lower expected wages would increase liabilities by a smaller amount and higher expected wages would increase liabilities by a larger amount.

---

[44] Only the gross position is discussed but the exact same pattern emerges in the net data.

Table 3-12 UK Liability Assumptions by Market Value

The panels below present the descriptive statistics for 4 years of FRS-17 disclosures for FTSE 350 firms' UK pension assumptions. The data consists of expected rates of inflation, wage growth, pension growth and a discount rate. These variables are used to calculate the present value of the pension liability based upon the benefits that have been accrued. The data period is 2001-2004. For the UK scheme in 2001 – 2004. Here firms are sorted by market value (MV) where Quartile 1 is the lowest MV and Quartile 4 is the highest MV. All values are in percentages.

Panel A	Inflation 2001			Inflation 2002			Inflation 2003			Inflation 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	2.53	0.14	2.25/2.90	2.35	0.17	2.00/2.80	2.71	0.17	2.30/3.00	2.79	0.15	2.50/3.00
2	2.58	0.17	2.30/3.00	2.42	0.16	2.20/2.80	2.68	0.18	2.00/3.00	2.76	0.17	1.95/3.00
3	2.57	0.21	2.00/3.50	2.36	0.16	2.00/3.00	2.69	0.15	2.40/3.00	2.77	0.16	2.00/3.00
4	2.53	0.14	2.15/3.00	2.37	0.13	2.00/2.70	2.66	0.17	2.25/3.00	2.76	0.12	2.40/3.00

Panel B	Wage Growth 2001			Wage Growth 2002			Wage Growth 2003			Wage Growth 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	3.95	0.79	0.00/5.30	3.77	0.69	1.25/5.34	3.96	0.84	0.00/5.77	4.07	0.48	2.90/5.00
2	4.16	0.50	3.00/5.60	3.82	0.53	1.75/5.70	3.93	0.67	1.25/5.50	3.93	0.84	0.00/5.70
3	4.06	0.67	0.00/5.80	3.77	0.64	0.00/5.50	4.07	0.69	0.00/6.00	4.01	0.75	0.00/5.45
4	4.21	0.42	3.00/5.50	3.96	0.51	2.25/5.10	4.16	0.54	2.50/5.50	4.22	0.53	2.75/5.50

Panel C	Pension Growth 2001			Pension Growth 2002			Pension Growth 2003			Pension Growth 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	2.50	0.62	0.00/3.25	2.39	0.26	2.00/3.25	2.71	0.24	2.25/3.50	2.85	0.17	2.50/3.25
2	2.68	0.42	2.20/5.00	2.54	0.55	0.00/5.00	2.76	0.37	2.00/5.00	2.73	0.23	1.88/3.20
3	2.45	0.64	0.00/3.70	2.33	0.48	0.00/3.50	2.62	0.51	0.00/3.70	2.70	0.64	0.00/3.88
4	2.59	0.28	2.00/3.80	2.44	0.31	1.88/3.80	2.70	0.25	2.20/3.80	2.72	0.38	0.00/3.60

Panel D	Discount Rate 2001			Discount Rate 2002			Discount Rate 2003			Discount Rate 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	5.96	0.26	5.50/6.80	5.63	0.31	5.00/6.50	5.51	0.13	5.30/6.00	5.43	0.17	5.15/5.80
2	5.95	0.15	5.70/6.25	5.59	0.15	5.30/6.00	5.51	0.21	5.00/6.25	5.40	0.17	4.89/6.00
3	5.96	0.24	5.60/7.25	5.56	0.19	5.10/6.50	5.50	0.16	5.25/6.00	5.39	0.18	4.63/5.90
4	5.93	0.17	5.50/6.50	5.61	0.18	5.15/6.00	5.49	0.11	5.20/5.90	5.39	0.16	5.05/6.20

For pension growth the firms with the largest pension liabilities in the first three years the expected growth in pensions is greater than for those firms in Q1. Over time for all quartiles expected pension growth increases. The higher year-on-year pension growth that is observed over time is consistent with the observed increase in the pension liabilities of the largest firms.

The discount rate however lacks a clear pattern both cross-sectionally and through time. Firms with the smallest market values and the smallest liabilities they apply, on average a larger discount rate than for those firms with the largest liabilities in all years. For Q4 the range of discount rates increases over time and by 2004 the range is 1.15% while for the smallest firms the range has fallen to 0.65%. There is therefore greater variation in the discount rate that is applied by the largest firms. This is also consistent with the greater range in the gross surplus/(deficit)s within Q4 compared to Q1 that was observed in Table 3-11.

Finally, I consider the return assumptions of firms with the highest market value, Q4, from Table 3-13 we can see that they apply the highest expected rate of return of equity in all years. The range of the assumptions in Q4 is also greater than the range observed in Q1. Interestingly, the expected return on bonds, for those firms with the smallest pension liabilities, have the highest expected rate of return on bonds in all years. This can also be seen for the return on property in all years. However, for the return on other assets those firms which have significantly larger exposure to this asset class i.e. those firms in Q4 apply the highest expected rate of return for these assets.

Table 3-13 UK Asset Return Assumptions by Market Value

The panels below show the descriptive statistics for 4 years of FRS-17 disclosures for FTSE 350 firms' UK pension assumptions. The data is the expected rates of return on equity, bonds, property and other assets. Within the debt asset the rate of return will be for both government and corporate debt where both of these assets are held by firms. The other asset class will generally be an expected rate of return on cash. The data period is 2001-2004. Here firms are sorted by market value (MV) where Quartile 1 is the lowest MV Quartile 4 is the highest MV. All values are in percentages.

Panel A	Equity Return 2001			Equity Return 2002			Equity Return 2003			Equity Return 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	7.57	0.57	6.12/8.60	7.68	0.57	6.26/9.50	7.62	0.56	6.30/8.70	7.50	0.57	6.08/8.50
2	7.59	0.50	6.25/8.70	7.55	0.66	6.50/8.90	7.52	1.21	0.00/9.50	7.67	0.61	6.00/9.00
3	7.71	0.58	6.25/9.00	7.66	0.68	5.85/8.90	7.78	0.60	6.10/8.90	7.62	0.57	6.50/8.80
4	7.81	0.52	6.50/9.00	7.87	1.08	0.00/9.00	7.79	1.01	0.00/8.60	7.76	0.52	5.10/8.50

Panel B	Bond Return 2001			Bond Return 2002			Bond Return 2003			Bond Return 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	5.31	0.43	4.20/6.60	5.00	0.47	3.75/6.00	5.00	0.41	3.80/6.00	5.02	0.43	4.20/6.50
2	5.22	0.34	4.50/6.20	4.84	0.83	0.00/6.50	4.87	0.99	0.00/6.00	4.84	0.35	3.50/5.50
3	5.34	0.48	4.00/7.25	4.86	0.40	4.40/6.30	5.01	0.31	4.25/6.00	4.92	0.30	4.10/5.75
4	5.29	0.33	4.50/6.20	4.95	0.38	4.50/6.50	4.98	0.23	4.30/5.70	4.85	0.44	1.88/5.40

Panel C	Property Return 2001			Property Return 2002			Property Return 2003			Property Return 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	7.00	0.63	6.12/8.00	7.06	0.72	6.26/8.50	6.99	0.68	5.70/8.00	6.76	0.66	6.00/8.00
2	7.15	0.41	6.70/7.70	6.80	0.51	6.00/7.50	6.69	0.78	4.80/8.20	6.51	2.16	0.00/8.50
3	6.72	0.62	5.90/7.80	6.38	1.88	0.00/8.40	6.95	0.57	5.80/8.00	6.65	0.63	5.50/8.00
4	6.91	0.50	6.30/8.50	6.79	0.54	5.20/8.00	6.77	0.50	5.50/8.00	6.49	0.76	3.80/7.70

Panel D	Other Return 2001			Other Return 2002			Other Return 2003			Other Return 2004		
Quartile	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max	Mean	Std	Min/Max
1	4.61	1.34	0.00/8.00	4.34	0.93	3.00/8.00	4.22	0.80	2.75/6.00	4.63	1.37	0.00/9.00
2	4.36	1.32	0.00/6.50	4.29	0.98	2.60/8.00	4.30	1.19	0.00/7.50	4.56	1.04	0.00/7.00
3	4.50	1.27	0.00/7.00	4.39	0.92	2.50/7.00	4.30	0.79	3.00/6.75	4.52	0.87	0.00/6.20
4	4.80	1.14	0.00/8.00	4.42	0.91	2.80/6.80	4.32	1.04	0.00/6.70	4.73	1.09	1.50/8.00

3.7 Summary

The descriptive statistics tell us a number of things about the pension schemes that are in operation in the FTSE 350. First the magnitude of the pension promise varies significantly from firm to firm. This was highlighted with the banking example above. Second there is no clear relationship between firm performance and the pension promise. Although for those firms which have the largest market capitalisation a picture has emerged.

Large firms are more likely to have much more significant pension liabilities. This follows expectations as the biggest firms will have a much larger number of employees to whom pensions have been promised. As a result they will have more assets with which to meet these liabilities. Further, those companies that were formally nationalised industries such as BA, BP and BT have extremely large pension liabilities as they have significant numbers of current, deferred and retired members.

The next chapter is the second empirical chapter of the thesis. Chapter 4 analyses the way in which managers account for the pension scheme of the company. I ask two main questions. First, how has the new fair value accounting standard been implemented in practice? Second, are the accounting amounts that are disclosed in the annual report value relevant?

4

FAIR VALUE ACCOUNTING AND MANAGERIAL DISCRETION

4.1 Introduction

In this chapter I analyse the extent to which managers exercise discretion when applying fair value accounting and the value relevance of these disclosures. Proponents of fair value accounting argue that historical cost obscures the true underlying economic position of the firm, whilst critics believe that the transitory nature of fair value injects unnecessary volatility in to financial reports.

Prior research has shown that market participants are unable to reach a consensus on information presented in annual reports, particularly when it is complex (Hirst (1998)). Similarly, pension accounting under fair value has considerable potential to remain opaque and problematic for users of financial accounts. There are two main reasons for this. First, pension accounting is, by its very nature, complex. Any assessment of the liabilities in a pension scheme requires detailed mortality calculations and forecasts on future macroeconomic conditions. Second, fair value accounting for pensions gives considerable discretion to management. The accounting assumptions used in the assessment of pension valuation are ultimately decided upon by management, under the guidance of the firm's actuary, and overseen by the auditor. They are potentially open to manipulation within broad confidence intervals. If there is large, and unwarranted, variation in pension assumptions across firms, fair value accounting

fails in one of its key goals, namely the provision of transparent, consistent and accessible financial statements.

Recent work on pension accounting has focused on the value and credit relevance of fair value footnote disclosures under U.S. Statement of Financial Accounting Standards 87 (SFAS-87) (Hann, Heflin and Subramanyan (2007)). They found that fair value footnote disclosures did not improve the information quality of financial reports above SFAS-87 disclosures. However, they were unable to assess how management implement fair value when there needs to be full recognition in the balance sheet.

The ongoing debate in the U.S. about the appropriateness of introduction of fair value accounting for pensions is one of the key issues for future accounting standard development. A number of researchers have tried to assess the potential impact of such a move (Hann, Heflin and Subramanyam (2007)). However, the U.S. has yet to fully adopt a system that is equivalent to IAS-19, although it has recently moved closer with the introduction of FAS-158. Analysing FAS-158, Grant, Grant and Ortega (2007) reported that the setting of aggressive assumptions still exists, although almost all the fair value disclosure still only appears in the footnotes to accounts.

The U.K. introduced fair value pension accounting in 2001 with Financial Reporting Standard 17 (FRS-17). It therefore presents a unique opportunity to analyse how fair value pension accounting has been implemented in practice. This setting is important for two reasons. First, to my knowledge it is the largest available sample of fair value pension accounting disclosures in existence. Second, a longer time period allows for an analysis under changing economic circumstances, such as changes in bond yields and falling equity values, which have a significant impact upon the value and risk of pension schemes.

I make four main contributions to the literature. First, I document the variation in assumptions that management apply when accounting for pensions under fair value. One of the fundamental reasons for adopting fair value is to make the information in financial accounts consistent and representative across firms. (ASB (2001)). If there is significant variation in accounting assumptions across firms, this calls into question the underlying motivation for adopting fair value.

My second contribution is to analyse the impact of auditor and actuary on managerial discretion. I investigate whether the variation in assumptions across firms can be attributed to either of these external groups. Although accounting and auditing firms are likely to have similar technologies, there is scope for different firms to have different 'house views' on particular assumptions. This would be reflected in variations in pension accounting assumptions across companies that can be explained by their choice of audit or actuarial firm. Conversely, if there is considerable variation in the assumptions used across the clients of a particular auditor and/or actuary (i.e. no consistent house view), this could suggest that actuaries and auditors are influenced in the assumption process by commercial considerations and potential conflicts of interest.

I then consider the determinants of both managerial choice and conservatism in accounting for pensions. The assumptions that management adopt may be driven by a number of scheme-based and/or firm characteristics. Prior research has found strong links between the percentage of pension assets held in equity, the expected return on plan assets and corporate events (Bergstresser *et al.* (2006)). My analysis examines the determinants of assumption choice in accounting for pensions, as well as, for the first time, the determinants of managerial conservatism under fair value.

My final contribution is to analyse both the value relevance of the assumptions that are used to arrive at the accounting amounts as well as the fair value disclosures

presented in the annual report. Prior research on pension disclosures in the US has considered the value relevance of these factors under SFAS-87 (Barth, Beaver and Landsman (1993)). The results showed that the amounts that were disclosed in the annual report were reflected in the market valuation of the firm. I therefore test whether fair value disclosures have any value relevance i.e. do they impact upon firm value.

My results are as follows. I document that the difference in underlying pension assumptions across firms is substantial. There are sound economic reasons why discount rates and expected rates of return on particular asset classes should be similar across firms, but this is not what I observe in my sample. The differences are not related to the identity of the firm's actuary or auditor, suggesting differing 'house views' amongst advisers is not the explanation.

I also find that management have very different objectives depending on the solvency of the pension scheme. Companies with the greatest level of funding (i.e. the ratio of pension assets to pension liabilities) have the highest discount rates and discount rate spread assumptions. I also find that firms with large pension scheme deficits relative to the size of the firm tend to choose higher equity return and equity return spread assumptions. In this case, management appear to choose assumptions that maximise the level of reported financial income that can be derived from pension scheme assets.

Finally I show that the assumptions underlying the pension calculation are value relevant. Further I show that the amounts presented in the annual report impact upon the market value of the firm. Pension funding levels, liabilities and asset class all effect the value of the firm. The market therefore views both the assets and liabilities of the pension scheme as the assets and liabilities of the firm. This is consistent with the

corporate finance view of pensions. Fair value disclosures therefore impact upon the value of the firm.

In the next section, FRS-17 is described in detail. In section 4.3, I develop the motivation and hypotheses that are tested in the chapter. Section 4.4 presents the data and methodology. Section 4.5 discusses the empirical results and Section 4.6 concludes.

4.2 Financial Reporting Standard 17

The introduction of FRS-17 in the UK has fundamentally changed how firms account for defined benefit pension schemes. Until 2001, pension accounting was governed by the Statement of Standard Accounting Practice 24 (SSAP-24). This standard was widely criticised as not providing useful or comparable disclosure of the underlying risks of company pension schemes[45]. One of the major criticisms was that the Standard afforded management too much latitude in how they accounted for pensions.

After a wide consultation, the Accounting Standards Board (ASB) issued FRS-17, which applied to all companies reporting financial statements after June, 2001. FRS-17 was a watershed in accounting for pensions in the UK. For the first time, firms had to apply fair value in accounting for their pensions within a much more rigorous framework than under any previous standard.

The framework for FRS-17 can be split into two broad categories: methodological and information disclosure. Unlike previous standards, which allowed the actuary and/or management to select the actuarial method of liability calculation,[46] FRS-17 specifies that liabilities must be calculated using the projected unit method.[47]

---

[45] Institute of Chartered Accountants in England and Wales (ICAEW).
[46] SSAP-24 paragraph 18.
[47] FRS-17 paragraph 20.

This is an accrued benefits valuation model, which takes account of the rights to benefits earned by scheme members up to the valuation point, allowing for future increases in the level of pensionable salaries and the value of pensions in payment.

The standard also sets out the appropriate discount rate that must be applied when calculating the present value of the pension liability, where the discount rate must reflect both the time value of money and duration of the pension liability. The ASB states that the yield on a high quality (AA-rated) bond of equivalent duration to the pension liabilities is the appropriate benchmark. This rate should reflect both the time value of money and a small premium for the risk of the scheme.[48]

The second focus of the standard is on information disclosure, which is broken down into four categories: valuation assumptions, asset return assumptions, pension costs, and recognition. The required valuation assumptions are the rate of inflation, wage growth, pension growth and the discount rate. The pension scheme assets are recorded at fair (market) value and their valuation does not require actuarial assumptions. The disclosure of the fair value of pension assets is split into four broad asset classes: equities, bonds, property and 'other'. 'Other' assets are generally cash and annuities, although some firms also hold insurance contracts or small exposures to managed funds. The company must also disclose the expected rate of return on the various asset classes. While the expected rates of return assumptions do no affect the stated asset values, they do affect the amount of pension income credited to the profit and loss account.

In addition to the different assumptions, a detailed disclosure of the costs of the defined benefit scheme is provided. FRS-17 requires that the current service cost, past service cost, actuarial gains and losses (including the difference between the actual and

---

48 FRS-17 paragraphs 32-33.

expected return on scheme assets), and any historical adjustments to pension costs as a result of changes in the level of benefit provision are disclosed.

The final disclosure is the difference between the assets and the liabilities of the scheme on the balance sheet of the firm. Where the fair value of assets exceeds the present value of the pension liability, the scheme is declared to be in surplus and a net asset should appear on the balance sheet. Conversely, where the value of scheme assets are less than the present value of the pension liability, a net liability will appear on the balance sheet.

To mitigate the impact of applying market values, the standard separates the normal pension cost and valuation impacts. In so doing, the volatility of market values is lessened as there is a normal pension cost charge against the profit and loss, and any variations that occur year-on-year are included in the Statement of Total Recognised Gains and Loses (STRGL) and taken directly to reserves. Any changes, therefore, in market values, demographics and other basis measurements are accounted for in the STRGL rather than on the face of the profit and loss account. In doing so, the ASB ensures there is a predictable pension charge and that the balance sheet reflects the employer's liability, while at the same time accounting for the true liability of a scheme based upon market values.

4.2.1 Pension Accounting under FRS-17: An example.

Two stylized examples are presented to illustrate the interactions between different pension components and how management can manipulate the assumptions to impact upon the size of the liability faced by the firm and the income it can derive from the pension scheme assets.

4.2.1.1 Liability Manipulations

Pension liabilities increase year on year due to increases in employee wages, changes to the benefits provided and projections of future mortality and interest rates. If I assume that the present value of this payment is £500m[49] based upon a discount rate that is taken from the prevailing AA bond yield (for the example I will assume a rate of 5%). The management of the firm may choose to apply a higher discount rate and so the increase in the present value of the liability will be less. Consequently, the change in the liability from one year to the next will be underestimated in the annual report.

Through the application of an 'actuarial rule of thumb' Bozewicz (2004) highlights the impact of small changes to the chosen discount rate and the present value of the pension liability. Where[50],

$$New\ Liability = (Old\ Liability)*(1.06^{-4\Delta})$$

From this, if I assume an increase in the discount rate 5.00% to 5.50% then

$$New\ Liability = (£500m)*(1.06^{(-4)*(0.005)}) = £445m$$

The 0.5% change in the discount rate has therefore reduced the present value of the pension liability by 12%.

The above example highlights a number of key features of changing the discount rate for pension liabilities. First, it is clear that the size of the liability is functionally related to the size of the discount rate and so *ceteris paribus* a higher discount rate will reduce the

---

[49] Although we only focus on wage growth, the increase of the pension liability will be a function of pension growth, inflation wage growth and changes to the level of benefits provided. The assumed increase in wages however, is by far the biggest driver of increases in the liability owed by the firm.

[50] $-4\Delta=(-4)*$*(Increase/(Decrease) In the Discount Rate)*. In the formula that is presented by Bozewicz (2004) 1.06 is a constant and $-4\Delta=(-4)*$*(Increase/(Decrease) In the Discount Rate)*.

pension liability of the firm. Second, the magnitude of the pension liability is very sensitive to small changes in the discount rate. As such management have considerable scope for understating the liability of the firm.

4.2.1.2 Profit and Loss Manipulations

Firms also have considerable scope to manipulate the pension assets for crediting the profit and loss account under other financial income. I now assume that a firm pension is 100% invested in equity with a liability of £100m and assets of £80m, thus having a £20m deficit. Further, the discount rate is assumed to be 5% and the expected return on equity 10%. From one year's unwinding of the scheme, the interest cost will be £5m (5% discount rate multiplied by the pension liability). The expected return on plan assets in the same year will be £8m (from the 10% return on the £80m of plan assets). In reconciling this to the profit and loss statement, there would be an interest charge of (£5m) and a financial income credit of £8m. The profit and loss will therefore be credited with a net income of £3m. Consequently where the difference between the discount rate and the expected return on plan assets is higher then firms can credit the profit and loss with more income from the pension assets.

4.3 Motivation and Hypotheses

In the U.S., FAS-87 has come under increasing criticism and pressure from regulators and industry amid calls for a move towards fair value pension accounting. The CFA Institute has stated that the FAS-87 method of accounting "imposes a huge and costly burden" on the users of financial accounts. The U.S. Senate Finance Committee has also threatened legislation that would remove the complex smoothing mechanism of actuarial gains and losses under FAS-87.

In 2005, the Securities and Exchange Commission (SEC) concluded that balance sheets are "often not transparent as to the true funded status of pension plans"[51] leading to calls that pension accounting should be reformed by the FASB. In response, the FASB proposed a two-stage process to reform pension accounting, the first part of which was the introduction of FAS-158. Phase one came into effect for fiscal year ends after December 15, 2006. Phase two is predicted to be much more significant and wide ranging. One of the most controversial aspects of this second phase may be the removal of the FAS-87 smoothing mechanism altogether (Hann *et al.* (2007)).

Underpinning the proposed solution is the notion that fair value accounting will improve the reporting quality of financial accounts. If this is true, it is to be expected that profit and loss statements will become more meaningful, transparent and comparable. However, the perceived benefits of fair value in theory and its application in practice may differ considerably. I therefore firstly look at whether the assumptions underlying the calculation of the different pension components are consistent across firms[52]. Where this is so, the application of fair value would address some of the concerns about current methods of pension accounting. This leads us to the following hypothesis:

H1: The choice of pension accounting assumptions by management is consistent across firms.

Another facet of consistency in reporting is the relationship that different advisors and/or external bodies have with the firm. Firms employ actuaries to give advice on their scheme and auditors to provide an objective assessment of the quality of

---

[51] SEC (2005).

[52] The use of the word consistent is with respect to the average case. If all firms adopted the standard without exercising selectivity in the choice of assumption used then on average there would be no statistically significant difference between the expected value of a given assumption and the average assumption.

their financial reports. It is possible that any patterns observed in the cross-section of assumptions are a function of who advises the firm, since different advisors may hold 'house views' on the various assumptions. Similarly, the auditor may hold a 'house view' on what assumptions are acceptable and represent a fair and true view of a firm's pension liability.

H2a: The pension accounting assumptions of a firm are not related to the identity of the firm's actuary.
H2b: The pension accounting assumptions of a firm are not related to the identity of the firm's auditor.

Despite the intention for FRS-17 to provide a more prescriptive basis of pension accounting, management still have considerable latitude in the underlying assumptions that are applied. Bergstresser *et al.* (2006) focus on the sensitivity of firm earnings to the expected return on pension plan assets. Their results show that where a firm's income is sensitive to the expected return on pension assets, for example where pension assets are large relative to firm size, management are more likely to choose higher expected return assumptions. They also find that the adoption of such favourable assumptions is linked to corporate events such as takeovers, and to the exercise of share options by management.

In my sample, equity accounts for the vast majority of pension assets. Despite the tax advantages of holding large amounts of bonds in pension assets, (Black (1980) and Tepper (1981)) the average pension portfolio in 2001 in my sample consisted of 70% equity, 25% bonds and 5% other assets. The high allocation to equity has implications for the potential for management to manipulate earnings via the assumptions for expected returns on pension scheme assets. The expected return on equity is arguably the most subjective of all the pension accounting assumptions. Consequently, if management wish to boost reported income from the pension assets

then they would hold larger amounts of equity in the pension portfolio and use a high expected return figure for those assets.

H3: The expected return on equity assumption is not related to the proportion of equity in the pension assets

In the U.S. there has been little scope for management to select a favourable pension discount rate because since 1993 the discount rate has been based upon Moody's Aa interest rate index.[53] As a result, previous studies have not considered the determinants of the choice of discount rate. However, recent legislation, passed in 2004, allows firms to apply the yield on a portfolio of long-dated corporate bonds as the discount rate for the pension liability. In doing so, there is greater potential for selectivity in the discount rate of the firm in the future.

The example in section one highlights how sensitive the pension liability is to small changes in the discount rate. Under FRS-17, management have greater discretion over the discount rate. From this, a number of insights can be gained into the behaviour of management in exercising this discretion. There may be a number of motivations that determine how management behave in this situation. Consequently, I derive a number of competing hypotheses to test which factors influence management's choice of discount rate.

The first hypothesis is the null that there is no relationship between the chosen discount rate and pension scheme characteristics. If this is the case, it implies that management are applying fair value accounting in the spirit of the standard. Under FRS-17 the required discount rate is the yield on a AA-rated corporate bond of

---

[53] In 1993, the SEC's Chief Accountant ruled that this was the appropriate discount rate for calculating the present value of a firm's pension liability.

equivalent duration to the pension liabilities, which may be a sufficiently prescriptive requirement to limit the exercise of management discretion.

H4a: There is no relationship between the choice of discount rate and pension scheme characteristics.

However, there are also a number of other potential outcomes. First, the firm would be perceived to be bearing significant risk when the pension liability is large relative to the size of the firm. In response, management may elect to apply a higher/lower discount rate than other firms to reduce the perceived risk of the firm.

H4b: Those firms with the largest pension liability select the largest discount rate

Conversely it could also be that the management of the firm choose to adopt a higher discount rate in circumstances where the pension liability is small relative to the firm. Over time, management may therefore systematically understate the liability of the scheme so that it does not increase the perceived risk of the firm.

H4c: Those firms with the smallest pension liability select the largest discount rate

Last, management may be concerned with the level of funding in the pension scheme. The funding level of a pension scheme (pension assets divided by pension liabilities) is the figure that is regularly quoted in the financial press. Although this is unrelated to the size of the firm, it is a significant variable since it measures the solvency of the pension scheme. Scheme funding is a function of both the increases in the pension liability and the fair value of the assets held to meet the pension liability. Where there are large fluctuations in asset values, a scheme will appear to have a volatile

funding level[54]. Management may therefore choose to apply a higher discount in this situation to present a 'stable' funding ratio in the annual report.

H4d: The choice of discount rate is determined by the solvency of the pension scheme

My analysis is also introduces a methodological refinement. Prior studies have considered the absolute level of pension accounting assumptions that are presented in the annual report. However, as the example in section one illustrated, the true impact of the pension scheme on the profit and loss account or balance sheet comes not from the absolute value of assumptions such as the expected return on equity or the discount rate, but from the relationships between them. In particular, the valuation of the pension liability on the balance sheet is affected by the spread between the discount rate and assumed future wage growth and pension growth, while the pension income or expense on the profit and loss account is affected by the spread between the expected return on scheme assets and the discount rate.

If managers attempt to minimise the pension liability or boost the reported income from the pension scheme, the difference between these assumed values for these variables becomes important. A high spread between the discount rate and future wage growth will reduce the pension liability, other things being equal, and a high spread between the assumed return on equity and the discount rate will boost reported financial income from the pension scheme. From these spread variables, I proxy managerial conservatism. If assumption spreads are large, management are not applying prudent assumptions in accounting for their pension schemes. If I observe considerable variation in managerial conservatism this will undermine the usefulness of fair value accounting since the economic reality of the true position of the firm will be obscured.

---

54 This is more likely to be the case where equity is the dominant asset in the pension portfolio.

As this is the first analysis to consider managerial conservatism, I have a number of competing hypotheses that follow the motivations for the choice of discount rate, as differing levels of conservatism would be driven by similar factors.

H5a: There is no relationship between balance sheet conservatism and pension scheme characteristics

H5b: Firms with the largest pension liability select the largest discount rate spread

H5c: Firms with the smallest pension liability select the largest discount rate spread

H5d: The choice of discount rate spread is determined by the solvency of the pension scheme

Management may also opt to derive financial income from the pension assets. The spread between the expected return on assets and the discount rate therefore measures the 'true' manipulation that occurs. When the spread is large, the firm incurs a low interest charge from applying a low discount rate thereby increasing the return generated from plan assets that can be credited to the profit and loss account.[55] As noted above, when the equity component of pension assets is large, management have the greatest potential to derive income from the pension scheme in this way.

H6: There is no relationship between managerial profit and loss conservatism and the value of the pension scheme assets.

Although fair value accounting provides considerable scope for manipulating the pension assets and liabilities such actions are only beneficial if they have a tangible effect on the market value of the firm. I firstly test the relationship between the discount rate, the expected return on equity, my discount rate spread variable and my equity spread variable. I test the discount rate and the expected return on equity variables individually as they are two of the most important variables in arriving at the

[55] It is also possible that firms will apply a comparable discount rate in their assumptions and then select a much higher expected return on equity to ensure a large spread.

pension liability and the return on the plan assets. A high discount rate, all other things being equal, will reduce the pension liability thereby increasing the market value of the firm as the pension scheme funding appears to be higher. Conversely, a high expected return on equity, all other things being equal, will increase the other financial income component on the income statement of the firm.

H7a: The market value of equity is unrelated to the discount rate of the pension liability

H7b: The expected return on equity assumption does not affect the expected return on equity.

As noted above the interactions between different assumptions have a much more significant bearing on the accounting amounts that are disclosed. I therefore test the value relevance of my spread variables. The discount rate spread could have two effects. First, given that a higher spread reduces the present value of the pension liability then this may increase the market value of the firm as the pension scheme appears to be more solvent. However, in employing a large spread variable a higher interest cost will be incurred and this could potentially reduce the market value of the firm.

H8: The market value of equity is unrelated to the magnitude of the discount rate spread

Again for mangers to be able to credit the profit and loss with other financial income the more important variable is the interaction between the expected return on equity and the discount rate. Higher spreads will result in a larger credit to the profit and loss. If this holds then larger spreads should result in significantly higher market values.

H9: The market value of equity is unrelated to the size of the equity return spread

Another important part of the extant literature on pension accounting is the value relevance of the actual accounting amount reported in the annual report. Barth *et al* (1993) and Weidman and Weir (2004) analyse the value relevance of pension disclosures. Pension amounts are reflected in the market value of the firm. However, the extent to which the values are reflected is dependant upon the legal regime in which the firm operates. Barth *et al* (1993) show that both the assets and liabilities of the scheme are reflected in the market value of the firm for a sample of US firms. Weidman and Weir (2004) for a sample of Canadian companies, show that the market value of firms only reflects the liabilities of the scheme and so any surplus assets do not add to the market value of the firm. This occurs as Canadian law stipulates that any surplus assets are the property of the pension holders and the not the firm.

I therefore analyse the value relevance of the accounting amounts that are presented in the annual report. This is important for two reasons. First, if fair value disclosures improve the quality of financial reporting then the amounts presented in the annual report should relate to the value of the firm. Second, if managers are manipulating they must expect that this impacts on the value of the firm.

H10: The accounting amounts presented in the annual report do not affect the market value of equity.

4.4 Data and Methodology

My analysis employs two main data sources. Individual firm pension accounting data is collected from FRS-17 disclosures in the financial reports of sample companies. For all other data I use Worldscope. From the FRS-17 disclosures, I collected the value of pension assets and liabilities, the value of the individual asset classes, the expected return

assumptions and the valuation assumptions. From Worldscope, I collected the year-end firm market value, total assets, total debt, and the book value of equity.

My sample comprises companies from the FTSE 350 between June 2001 and June 2004. The index is made up of the largest 350 corporations in the UK and is rebalanced quarterly. I include all companies that appear in the index over this time, which amounts to a total of 392 firms.

From the FTSE 350 universe I exclude 44 investment trusts (listed closed end investment funds). For defined contribution schemes there is no balance sheet effect (Cooper *et al* (2001)). Consequently I exclude 62 companies that only provide defined contribution schemes to employees. Finally, I drop 2 firms that do not provide any retirement benefits for employees. In addition, over the sample period a number of firms merged or de-listed. My final sample ranges from 206 to 232 companies in each year giving a total of 876 firm years.

A number of different variables are created to characterize the pension scheme. I construct two variables that proxy for scheme size through scaling the total pension liability by firm total assets and by firm market value. The solvency of the pension scheme is defined in several ways. First, I calculate the absolute solvency of the scheme by considering total pension assets and pension liabilities. Where pension assets are greater than/(less than) the pension liability, the scheme is in surplus/(deficit). The gross surplus/(deficit) is scaled by firm both market value and firm total assets. In addition, I calculate the funding ratio of the scheme - the ratio of plan assets to plan liabilities.

In my analysis on expected returns I only consider the equity component of plan assets. This decision is based upon the work of Bergstresser (2006) who finds that the expected return on plan assets and the equity component of the pension assets is

significant for deriving financial income from pension assets. This is also intuitive due to the composition of pension assets in UK pension schemes[56]. It follows, therefore, that if management are going to attempt to derive a large amount of reported financial income by manipulating expected return assumptions, the equity component is the most significant as it is the largest asset in the portfolio. Further, it will also afford management the greatest latitude in choosing a high expected rate of return. I therefore characterize scheme assets by calculating the equity percentage of scheme assets.

In addition, all pension assumptions are standardized to a year-on-year level to remove any biases that may occur due to time-varying factors such as changes in the AA bond yield from year to year. For each assumption I calculate;

$$\frac{Assumption_{it} - \mu_t}{StandardError_{it}}$$

4.4.1 Descriptive Statistics

Table 4-1 presents descriptive statistics for the sample companies in year one. The final column in the table presents the difference between the mean values in year one and year four. The first section of the table presents firm characteristics. It can be seen that the average market value of firms falls during the sample period, consistent with wider market experience during this time. Further, I observe an increase in leverage as the mean total debt of firms in the sample grows.

---

[56] U.S. pension schemes are of a similar composition to UK schemes and on average hold large amounts of equity.

Table 4-1 Descriptive Statistics of Sample Companies and Company Pension Schemes in 2001

Table 4-1 presents descriptive statistics for the sample companies in 2001. The table presents the mean, standard deviation, quartile 1, median, quartile 3, minimum maximum, and the change in the means from 2001 to 2004 (μ_{2004}- μ_{2001}). The data items in the table are company market value, total assets, total debt, liability/total assets, surplus/total assets, funding level (pension assets/pension liability), equity percentage, discount rate, wage growth, expected equity return, expected return on bonds, discount rate spread (discount rate-wage growth) and the equity spread (expected equity return-discount rate). All figures not shown as £m are percentages.

	Mean	Std	Q1	Median	Q3	Min	Max	μ_{2004}-μ_{2001}
Market Value (£m)	6040.77	16471.72	478.68	1304.59	4060.20	110.77	126124.30	-1036.03
Total Assets (£m)	17654.96	60655.78	683.56	1707.40	5914.20	104.67	477184.70	1101.33
Total Debt (£m)	4050.70	15493.26	140.92	418.40	1552.90	0.00	117507.00	809.74
Liability to Total Assets	27.00	32.00	6.00	17.00	37.00	1.00	265.00	5.00
Surplus to Total Assets	-1.00	5.00	-2.00	0.00	1.00	-12.00	25.00	-4.00
Funding	97.00	16.00	87.00	94.00	105.00	61.00	110.00	-17.00
Equity Percentage	69.00	16.00	62.00	73.00	80.00	0.00	100.00	-7.00
Discount Rate	5.94	0.20	5.80	6.00	6.00	5.50	7.25	-0.53
Wage Growth	4.14	0.53	4.00	4.00	4.50	0.00	5.80	-0.04
Return on Equity	7.69	0.55	7.30	7.75	8.00	6.12	9.00	-0.02
Return on Bonds	5.29	0.39	5.00	5.25	5.50	4.00	7.25	-0.37
Discount Rate Spread	1.81	0.59	1.50	1.80	2.00	0.20	7.25	-0.49
Equity Return Spread	1.75	0.54	1.41	1.75	2.10	0.25	3.00	0.51

From Table 4-1, it is clear that a number of firms had significant pension exposures both in terms of the magnitude of the pension liability and from the level of funding in the scheme. In 2001 the median pension liability was 17% of total assets. This, in itself, is large and British Telecom,[57] for example, illustrates the magnitude of the problem faced by some firms. Their ratio of pension liability to total assets was 111% with a 70% funding ratio. The size of this scheme liability was also substantial at approximately £30bn in 2001.

The mean funding level (pension assets / pension liabilities) in 2001 was 97% with a median of 94%. As with the size of the pension liability, the minimum funding level is significantly different from the average at 61%. To put this into context, the surplus to total assets serves as a more useful illustration of the problem. Where a scheme is 61% funded it appears to be at risk, however, it is only at risk when the shortfall in assets is large relative to the firm. In looking at the surplus to total assets, on average, pension deficits were 1.00% of firm total assets. However, by 2004 the mean had increased to 5.00% of total assets. From this it is clear that under fair value the pension exposures of UK firms are substantial.

An analysis of the range of assumptions gives some insight into managerial conservatism in pension accounting. For the discount rate the median rate was 6.00%. The range was 1.75%, with a minimum of 5.50% and a maximum of 7.25%. It should be noted that the inter-quartile range is only 20 basis points, which suggests firms tend to select the discount rate in a broadly similar way. However, it is more important to focus on the spread between the discount rate and wage growth, which has a more direct impact on the reported pension liability. Here, the range (from 0.20% to 7.25%) and the inter-quartile range (50 basis points) are larger than the comparable figures for

---

[57] A former government owned utility.

discount rate alone. The wide range of the spread means that individual firms assign quite different present value (liability) figures to the pension obligation to employees with equivalent current salary and tenure.

As highlighted by Bergstresser *et al* (2006), the return assumptions applied by management are highly subjective. In looking at the composition of the equity held in these pension funds it is reasonable to assume that they hold broadly diversified portfolios that can be considered to reflect the market portfolio.[58] As a result, I would not expect to see much variation in the expected return on equity assumption across firms. From the table it can be seen that the median equity return assumption is 7.25% and the mean is 7.69%. The magnitude of the range however, is substantial from 6.12% to 9.00%. As before, the more direct impact on the financial statements comes from a spread between two variables, rather than from the return variable itself. If I look at the spread between the equity return assumption and the discount rate, I find a similar range and inter-quartile range as for the equity return assumption alone.

4.5 Results

In this section, I explicitly test the hypotheses developed in the chapter. Section 4.5.1 discusses firm-level variation in pension assumptions. Section 4.5.2 examines the role of the auditor and actuary in assumption formation and Section 4.5.3 analyses the relationship between firm and pension scheme characteristics and the stated assumptions across auditors and actuaries. Lastly, in section 4.5.4 I analyse the determinants of managerial choice and conservatism across firms.

---

[58] This information comes from private correspondence with actuaries and fund managers about the composition of assets in defined benefit pension schemes of large UK corporations.

4.5.1 Variation in Assumptions across Firms

My first hypothesis relates to the consistency of pension assumptions that are chosen. Where fair value is adopted consistently by management across firms, there will be little variation in the underlying pension assumptions and these will centre on the mean economic fundamentals on which the assumptions are based. The variation I see across assumptions is considerable.

The results in Table 4-1 show that firms select discount rates in a broadly similar way. Although, as noted above, this may be due to the restrictions (AA bond yield) placed on firms with respect to this variable. However, the discount rate although important, is much more significant when it interacts with other assumptions for manipulating the profit and loss and/or balance sheet.

In looking at both the equity return spread and the discount rate spread I find that the inter-quartile ranges are large. The potential implication of this variation is that if firms are choosing unwarrantedly high discount rates (or discount rate spreads), they will be understating the level of their pension liabilities, and if they are choosing unwarrantedly high equity return assumptions (or equity return spreads) they will be overstating the financial income flowing from the pension scheme.

Table 4-2 presents results from inference tests on the difference between the stated assumptions that are used to impute pension valuations and expected assumptions based on the economic fundamentals. To arrive at these priors I select the average yield on a AA bond over the sample period. For wage growth I calculate the average wage growth for the private sector in the UK over the sample period[59]. Finally for the expected return on equity I take the 50 year historical return on UK equities[60].

---

[59] Data is taken from the Office for National Statistics.
[60] The 50 year historical average is taken from Barclays Capital Equity Gilt Study 2007.

The choice of the 50 year historical average may be at first glance and arbitrary choice. However, within the actuarial community there is no hard and fast rule as to what a suitable expected return on equity is, and there is still a considerable level of debate surrounding this (and other) assumptions. With respect to the choice of the 50 year historical return it is the case, therefore, that this is one of many plausible expected rates of return. Management however have scope to apply an assumption within an accepted range based on differing expectations of the underlying economic fundamentals.

Table 4-2 Sign Test for Distribution of Assumptions across Firms

Table 4-2 presents a pooled firm level cross-sectional analysis of the different pension assumptions. I analyse whether the mean assumption adopted is significantly different from expected values. The table presents the mean assumption across all firms, the median, the average expected value, and the t-statistic for the associated sign-test. My expected values are the median AA bond yield for the discount rate, average wage growth for the UK, and the historical average return on equity.

	Mean	Median	Expected Value	T-Stat
Discount Rate	5.60	5.50	5.48	20.80*
Wage Growth	4.03	4.00	3.70	10.33*
Expected Return on Equity	7.70	7.80	7.10	17.48*
Discount Rate Spread	1.55	1.50	1.78	-8.70*
Equity Return Spread	2.11	2.20	1.62	25.24*

If assumptions are unbiased, the mean stated assumption should on average be equal to my expected economic fundamental. It is clear from Table 4-2 that pension assumptions are systematically different from expectations. For each assumption, there are statistically significant differences between the expected value and the mean value that is used in the financial accounts. When considered jointly, the observed variation, and the differences between expected values and actual values, raises serious questions about the implementation of fair value in practice, since management are clearly exercising a high degree of selectivity in arriving at their chosen assumptions. I can therefore reject my null hypothesis that the choice of assumption is consistent and unbiased across firms.

4.5.2 Analysis of the Role of Auditors and Actuaries in Assumption Setting

If individual firms of actuaries have 'house views' on the key pension accounting assumptions, disclosed assumptions may vary across firms because of which actuarial firm they use. If disclosed assumptions vary widely across the clients of a particular actuary, this suggests that firms may be exerting influence on their actuaries to get them to move away from their house view. A similar analysis applies in each case to firms of auditors who are required to sign off accounts as giving a true and fair view.

Table 4-3 presents the results of inference tests of differences between stated assumptions and unbiased historical average economic fundamentals. There is striking consistency in the degree to which assumptions deviate from historical averages across both auditor and actuary groupings. Within both actuary and auditor groupings, Pension accounting assumptions are at the extreme end of the allowable historical ranges.

Taking the discount rate first, the average historical yield on AA-rated corporate bonds was 5.48%. Irrespective of the auditor or actuary identities, the actual assumptions that were used on average were at the higher end of the variation in AA bond yields. Similar results apply to the other four assumptions. Thus, I am able to reject my null hypotheses that the pension assumptions of actuaries and auditors are unbiased. Consequently I can argue that these firms do not hold house views on the 'correct' assumption.

Table 4-3 Sign Test for Distribution of Assumptions across Auditor and Actuary

Table 4-3 presents a pooled cross-sectional analysis of the pension assumptions across auditors in Panel A, and actuaries in Panel B. I analyse whether the mean assumption passed is significantly different from expected values. The table presents the mean assumption across auditors/actuaries and the associated t-statistic. My expected values are the median AA bond yield for the discount rate, average wage growth for the private sector in the UK, and the historical average return on equity. Expected values are given in parenthesis under each assumption.

Panel A	**Discount Rate (5.48%)**		**Wage Growth (3.70%)**		**Equity Return (7.10%)**		**Discount Rate Spread (1.78%)**		**Equity return Spread (1.62%)**	
	Mean	**T-Stat**	**Mean**	**T-Stat**	**Mean**	**T-Stat**	**Mean**	**T-Stat**	**Mean**	**T-Stat**
Auditor (A)	5.62*	7.04	4.04*	4.65	7.58*	4.50	1.58*	-3.48	1.97	1.44
Auditor (B)	5.58*	5.06	4.04*	4.60	7.77*	8.29	1.54*	-4.02	2.20*	6.06
Auditor (C)	5.59*	6.43	3.97*	4.24	7.62*	5.75	1.62*	-3.28	2.03*	2.94
Auditor (D)	5.60*	8.10	4.07*	6.77	7.80*	14.63	1.51*	-6.19	2.21*	10.10
Panel B	**Discount Rate (5.48%)**		**Wage Growth (3.70%)**		**Equity Return (7.10%)**		**Discount Rate Spread (1.78%)**		**Equity return Spread (1.62%)**	
	Mean	**T-Stat**	**Mean**	**T-Stat**	**Mean**	**T-Stat**	**Mean**	**T-Stat**	**Mean**	**T-Stat**
Actuary (A)	5.60*	2.55	3.85	1.39	7.91*	6.40	1.75	-0.75	2.31*	4.63
Actuary (B)	5.58*	4.29	4.02*	3.61	7.84*	9.54	1.55*	-3.15	2.26*	7.40
Actuary (C)	5.59*	5.82	4.11*	5.47	7.42	0.60	1.47*	-4.95	1.84*	-2.32
Actuary (D)	5.63*	5.64	3.96*	4.57	7.60*	25.70	1.66*	-3.86	2.00*	19.94
Actuary (E)	5.59*	6.83	4.02*	3.53	8.07*	4.43	1.56*	-2.35	2.48**	1.83

4.5.3 Cross-Sectional Determinants of Pension Assumptions

My analysis now considers the determinants of managerial choice and conservatism in adopting fair value accounting. I report the results of linear regressions of assumptions on alternative specifications of firm and pension scheme characteristics. All specifications include firm-by-year fixed effects and controls for firm size, book-to-market and the capital structure of the firm. I do however add an additional proxy for funding relative to firm size by scaling the gross surplus/(deficit) by total assets (STA)[61].

$$Assumption_{it} = \alpha + \beta^1 STA_{it} + \beta^2 Funding_{it} + \beta^3 Equity_{it} + \beta^4 Size_{it} + \beta^5 BTM_{it} + \beta^6 D/E_{it} + e_{it}$$

The descriptive analysis showed that there is little consistency in the assumptions that management adopt when accounting for their pension schemes. The previous analysis has also shown that these differences are unrelated to the firm auditor or actuary. I therefore analyse the different factors that may influence the choices that management make.

Hypothesis 3 considers the ability of managers to derive income from the pension scheme assets. The work of Bergstresser *et al* (2006) finds strong results for management deriving income from pension assets based upon subjective assumed returns, pension portfolio composition and corporate events. Where management derive large amounts of financial income to credit the profit and loss then the meaningfulness of financial reports is reduced as investors cannot estimate the true profitability of the firm.

Table 4-4, column 1, presents my analysis of the expected return of equity assumption. The results on portfolio composition are consistent with the work of

---

[61] We have only presented a single regression for each assumption. The analysis was carried out over a number of different specifications. The analysis of the size of the pension liability relative to the firm by market value and total assets was insignificant as was the gross surplus/deficit scaled by market value.

Bergstresser *et al.* (2006) in that where equity is the largest component of the pension portfolio the assumed return on equity is higher. I therefore reject my null that portfolio composition and expected return assumptions are unrelated.

Table 4-4 Regression Analysis of Managerial Choice and Conservatism

Table 4-4 presents the results for fixed effects regressions for the determinants of the pension assumptions and managerial conservatism. The table presents the regression coefficient and immediately below is the corresponding t-statistic. * indicates significant at 99%, ** indicates significance at 95% and *** indicates significance at 90%. The dependent variable for each model is presented at the head of each column and the independent variables are presented in the far left column. Size is measured by the log market value the market-to-book ratio is the market value of equity/book value of equity, debt-to-equity is total debt/market value of equity. Surplus to Total Assets is the pension surplus (deficit)/ Total Assets, funding is measured by pension assets/pension liabilities and the equity percentage which is calculated as equity/total pension assets. The standardised assumption is calculated by $(Assumption_{it} - \mu_t)/Standard\ Error_{it}$.

	Equity Return	Discount Rate	Discount Spread	Equity Spread
Intercept	-22.51	-9.28	13.75	-18.48
	(-1.81)***	(-0.47)	(1.03)	(-1.34)
Surplus/Total Assets	-36.31	6.27	-3.43	-34.30
	(-2.68)*	(0.29)	(-0.24)	(-2.28)**
Funding	20.10	54.76	20.44	2.77
	(3.39)*	(5.83)*	(3.23)*	(0.42)
Equity Percentage	17.39	4.80	-2.54	14.42
	(3.27)*	(0.56)	(-0.44)	(2.45)**
Size	-0.31	-5.57	-2.80	1.44
	(-0.23)	(-2.53)**	(-1.89)***	(0.94)
Book-to-Market	-5.43	-0.53	-4.20	-2.67
	(-2.17)**	(-0.13)	(-1.55)	(-0.96)
Debt-to-Equity	2.19	-3.01	1.00	2.01
	(1.24)	(-1.07)	(0.53)	(1.03)

For the discount rate analysis I posited a number of competing hypotheses. My findings reject my null and support the alternative hypothesis H4d, that firms select the discount rate on the basis of scheme solvency. Column 2 of Table 4-4 presents the analysis of the discount rate. I find that those firms that have the highest funding ratio of pension assets to liabilities are applying higher discount rates. For managers the size of the pension liability relative to the firm is not a significant determinant of the discount rate. Further the size of the surplus/deficit is insignificant. This is interesting as it suggests that management are concerned only about the perceived solvency of their pension scheme.

My funding variable is commonly reported in the financial press, and as such will impact upon the markets perception of firm risk. Another explanation of my result is that well funded schemes may be concerned about transitory fluctuations in the solvency of the pension scheme. As a result the selection of a larger discount rate will understate the 'true' liability and will reduce the impact of large asset fluctuations.

In addition to this, I examine the level of managerial conservatism that is applied in calculating the present value of the pension liability under hypothesis 5. The selection of a high discount rate is not sufficient to minimise the pension liability. My discount rate spread variable proxies for the level of conservatism that management are applying in estimating their pension liability. Where the spread is large then management are not applying prudent assumptions. From the descriptive analysis in section 4.1 it is clear that cross-sectionally management are discounting their pension liabilities differently. The results in column 3 of Table 4-4 allow us to reject my null hypothesis 5a in favour of the alternative hypothesis 5c, which is consistent with the selectivity observed in the discount rate. I therefore show that the least conservative estimates are used by firms that have the highest funding levels.

This supports the results in column (2) that managers are concerned about perceived risk of the firm. As a result they choose assumptions that understate the liability of the firm. This again supports my assertion that fair value has not improved the transparency of balance sheets as management are systematically understating their pension liability. In doing so they are reducing the perceived risk of the firm.

It should also be noted however that the magnitude of the pension liability and the discount rate are functionally related e.g. smaller pension liabilities are associated with a higher discount rate. As a result the level of funding in a scheme would be expected to be a function of the size of the discount rate. If scheme assets and all

liability assumptions, with the exception of the discount rate, are held constant over time the funding of the scheme becomes solely a function of the discount rate and so the application of a larger discount rate reduces the pension liability and increases scheme funding.

Next I consider the ability of management to derive income from the pension assets by employing a large equity spread. In column (1) of Table 4-4 my analysis on scheme funding and the surplus/(deficit) to total assets at first appear to be at odds as those schemes that have high funding and those schemes that have large deficits relative to firm size both adopt higher expected return assumptions. However, when the equity spread analysis is considered in conjunction with the expected return analysis in column 1, then the result becomes more intuitive. In the final column of Table 4-4 it can be seen that for the spread variable then funding becomes insignificant.

This is important as I find that across management there are two different objectives. For those schemes that are well funded then management are concerned about the perceived risk and solvency of the pension scheme. Where they adopt a higher discount rate and discount rate spread then they will incur a high interest cost. To offset this interest cost the management then assume a higher expected return to offset the cost. This will minimise any resulting charge against profits.

Conversely, where schemes have significant solvency/funding concerns, the management do not elect to manipulate the size of the liability/deficit. Instead they choose to maximise the financial income that can be derived for the profit and loss from the assets of the pension scheme. They therefore adopt lower discount rates, higher expected returns on equity, thereby maximising the equity return spread.

4.5.4 Value Relevance Regressions of Fair Value Accounting Amounts

Table 4-5 presents my value relevance of the disclosed assumptions that are used for discounting the pension liability and the expected return on scheme assets. Following a similar methodology to Weidman and Weir (2004) I regress the market value of equity against the different pension assumptions that are applied.

$$MarketValu\ eofEquity_{it} = \alpha + \beta^{1} Assumption_{it} + \beta^{2} FirmAssets_{it} + \beta^{3} FirmDebts_{it} + e_{it}$$

Where the market value of equity is balance sheet market value scaled by common equity outstanding, assumption is the pension assumption from the annual reports, firm assets and firm debts are the total assets and debts of the firm at the balance sheet date scaled by common shares outstanding. From the table 5 I can see that individually neither the discount rate nor the expected return on equity has a significant effect on the market value of the firm. I cannot therefore reject my null hypotheses 7a and 7b.

Table 4-5 Value Relevance Regression Analysis of Pension Assumptions

Table 4-5 presents the results for regressions for the value relevance of the pension assumptions. The table presents the regression coefficient and immediately below is the corresponding t-statistic. * indicates significant at 99%, ** indicates significance at 95% and *** indicates significance at 90%. The dependent variable is presented at the head of each column and the independent variables are presented in the far left column. The discount rate and Equity return are taken from the FRS-17 disclosures. Discount rate spread is the difference between the discount rate and wage growth. Equity return spread is the difference between the expected return on equity and the discount rate. Firm assets are the total assets of the firm, firm debts is the total debts of the firm and market value of equity (dependant variable) is the balance sheet market value of equity all scaled by the number of common shares outstanding at the balance sheet date.

	Market Value of Equity/Ords			
Intercept	4.78	1.13	4.44	2.98
	(1.62)	(0.64)	(11.12)*	(6.29)*
Discount Rate	-0.18	-	-	-
	-(0.34)			
Equity Return	-	0.34	-	-
		(1.51)		
Discount Rate Spread	-	-	-0.41	-
			-(1.73)***	
Equity Return Spread	-	-	-	0.38
				(1.77)***
Firm Assets	0.06	0.06	0.06	0.06
	(4.82)*	(4.71)*	(4.75)*	(4.70)*
Firm Debts	-0.03	-0.03	-0.03	-0.03
	-(0.82)	-(0.73)	-(0.80)	-(0.72)

However, when I consider my spread variables they have a significant impact on the value of the firm. The discount rate has a significantly negative relationship with the market value of the firm's equity. I can therefore reject my null that the discount rate spread does not impact on the value of the firm. Firms that apply higher discount rates and lower wage growth i.e. understate the magnitude of the pension liability receive a lower market value. This is consistent with such a manipulation being associated with higher interest charges that will reduce the profitability of the firm.

Conversely I find that those firms who apply the highest equity return spread have higher market values. This is again consistent with expectations as higher spreads are associated with lower interest costs from one years unwinding of the pension liability

and deriving higher levels of income from pension assets. I can therefore reject my null hypothesis 9 that the equity return spread is not value relevant.

My final set of tests considers the value relevance of the amounts that are disclosed in the annual report again following Weidman and Weir (2004) where,

$$MarketValueofEquity_{it} = \alpha + \beta^1 Assets_{it} + \beta^2 Liabilities_{it} + \beta^3 Funding_{it} + Controls_{it} + e_{it}$$

The market value of equity is balance sheet date market value scaled by common equity outstanding, assets and liabilities are the pension assets and liabilities scaled by common shares outstanding. I also include firm assets and firm debts scaled by common shares outstanding as controls.

From Table 4-6 it can be seen that the pension assets and liabilities, funding levels and asset composition all have some value relevance. This is itself an important factor in looking at managerial discretion and the application of fair value accounting. Managers utilise the discretion that the standard affords them as it has a tangible effect on the equity value of the firm. From columns 3 and 4 of table 6 I can see that pension assets have a positive effect on market value while liabilities have a negative effect and so well can reject my null.

Table 4-6 Value Relevance Regression Analysis of Pension Assumptions

Table 4-6 presents the results for regressions for the value relevance of the pension assumptions. The table presents the regression coefficient and immediately below is the corresponding t-statistic. * indicates significant at 99%, ** indicates significance at 95% and *** indicates significance at 90%. The dependent variable is presented at the head of each column and the independent variables are presented in the far left column. Pension assets are the total assets in the pension portfolio. Pension equity is equities held in the pension assets. Pension liabilities are the gross pension liability owed by the firm. Firm assets are the total assets of the firm, firm debts is the total debts of the firm and market value of equity (dependant variable) is the balance sheet market value of equity all scaled by the number of common shares outstanding at the balance sheet date. Funding is the ratio of pension assets to pension liabilities.

	Market Value of Equity/Ords							
Intercept	3.74	3.75	3.62	1.89	1.86	2.34	1.88	2.53
	(25.84)*	(26.09)*	(23.82)*	(2.61)**	(2.56)**	(2.94)*	(2.59)**	(3.51)*
Pension Assets/Ords	0.03	-	0.47	0.03	-	0.30	-	-
	(1.55)		(2.57)**	(1.46)		(1.48)		
Pension Equity/Ords	-	-	-	-	-	-	0.09	1.21
							(2.28)*	(5.66)*
Pension Liabilities/Ords	-	0.02	-0.30	-	0.02	-0.19	-	-0.36
		(1.31)	(-2.44)**		(1.34)	(-1.36)		(-5.34)*
Funding	-	-	-	2.27	2.33	1.62	2.25	1.04
				(2.60)	(4.29)*	(4.29)*	(2.57)**	(1.17)
Firm Assets/Ords	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	(4.81)*	(4.82)*	(4.59)*	(4.30)*	(4.29)*	(4.29)*	(4.29)*	(4.15)*
Firm Debts/Ords	-0.03	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
	(-0.81)	(-0.82)	(-0.66)	(-0.43)	(-0.43)	(-0.44)	(0.44)	(-0.46)

However, from columns 5 and 6 when the funding level in the scheme is controlled for, this relationship becomes insignificant but funding becomes significant. Consistent with Barth *et al* (1993) and the corporate finance view of pensions funding is positively related to the market value of equity and so both the pension assets and liabilities of the firm are perceived as belonging to the firm. This is contrary to the findings of Weidman and Weir (2004) who find evidence of the labour economics view of pension assets and liabilities.

Finally in column 5 and 6 I test asset composition. Bergstresser *et al* (2006) showed that equity affords management the greatest scope for generating financial income for the profit and loss. If this is the case then higher equity allocations should be associated with higher equity market valuations. Consistent with this I find a significant and positive relationship between the percentage of pension assets invested in equity and the market value of the firm. Interestingly when I control for the funding level of the scheme I find that the percentage of equity increases in significance and pension liabilities become significant. This is suggestive that asset allocation and liabilities have a greater bearing on the market value of the firm as opposed to the funding level.

4.6 Summary

This chapter analyses managerial discretion, value relevance and fair value accounting. I consider whether the adoption of fair value will address many of the concerns that have been voiced about current methods of pension accounting. Using a unique sample of fair value pension disclosures from the new UK fair value pension accounting standard FRS-17 I analyse the way in which fair value has been adopted by firms in practice. First my results show that the variation in the underlying assumptions

for the pension scheme across firms is considerable. This in itself brings into question the suitability of fair value as method of accounting for pensions as financial accounts will remain opaque where management are not reporting consistently across firms.

Second I also find that variation in the assumptions that are presented in the financial accounts cannot be explained by the use of different audit or actuarial firms. This finding also raises questions as to the efficacy of fair value accounting for pensions as auditors and actuaries are not applying the standard consistently across firms. Further it is also clear that these external bodies do not hold 'house views' on what constitutes a reasonable or prudent assumption.

Third I consider the determinants of managerial discretion. My results show that management adopt different assumptions in response to the solvency of the pension scheme. Where scheme solvency is high, management choose to apply higher discount rates. Further where scheme solvency is high management apply less conservative methods of estimating the pension liability. In this case they systematically understate the liability. Conversely, where schemes have large deficits relative to the firm managers choose to derive a larger amount of financial income from the assets in the pension scheme. Here management apply the least prudent return assumptions and thereby increase the profit of the firm.

Last I analyse the value relevance of both the assumptions and accounting amounts that are disclosed in the annual report. I find that these amounts do impact upon the market value of the firm. This is important for two reasons. Pension disclosures under the new standard firstly impact upon the value of the firm. However, the observed variation in disclosures suggests that the manipulations that are undertaken by management will have a tangible effect on the value of the firm.

Bringing all of these results together I find that the case for adopting fair value accounting is questionable. Advocates of fair value accounting believe that it will make financial accounts more representative of the true economic position of the firm. However, my results show that where management have discretion over how the standard is applied, financial accounts remain opaque.

5
RISK MANAGEMENT AND TRANSPARENCY: EVIDENCE FROM DEFINED BENEFIT PENSION SCHEMES

5.1 Introduction

In this chapter I analyse whether measures of systematic risk and firm distress reflect pension risks, and if managers actively manage these risks. Pension liabilities represent a very real risk to the ongoing operations of the firm. For many companies the size of the pension liability is large relative to both the market value and total assets of the firm. Schemes with very low funding levels are likely to attract pressure from employees and pension fund trustees. Likewise, pension fund asset allocation can have a significant effect on the observed level of funding in a given year. Those pension schemes with large equity components will be more sensitive to funding ratio swings as the equity markets go up and down. To manage this risk, schemes can move out of volatile assets, such as equity, and into bonds to reduce volatility in the funding ratio.

Rauh (2007) examines risk management and risk shifting in U.S. corporate defined benefit pension schemes and found that riskier firms, having higher credit risk, are more likely to invest in low risk debt securities as pension assets. This relationship is shown to be present both cross-sectionally and through time. The desire to limit financial distress is also a particularly strong determinant of asset allocation in defined benefit schemes. Although much of the existing empirical evidence supports the

presence of risk management, and not asset substitution/risk shifting, earlier work fails to address a crucial point. If firms do not receive a concomitant reduction in overall firm risk then the necessity or motivation for undertaking pension risk management is unclear.

I make four main contributions to the extant literature on risk transparency and risk management. First I analyse whether the market correctly prices pension risk. If the market does not correctly incorporate pension risks companies will be mispriced in a standard risk-return context. I extend the analysis of Jin, Bodie, and Merton (2004) by considering the impact of different types of pension risk. Rather than deriving a beta for the total pension exposure I analyse whether funding and scheme size are reflected in measures of systematic risk. I do this because a large pension scheme is markedly different from a poorly funded scheme and so both factors are therefore separate risk factors. Further to this I consider the relationship between pension asset allocation and measures of systematic risk.

Second, I analyse whether measures of firm-level operational distress reflect the risk of the pension scheme. Pension schemes with greater liabilities and volatile risky assets are prone to large swings in their net surplus/deficit position. Consequently, these risks should be reflected in measures of operating distress[62]. Firms that have higher levels of operating distress can opt to manage their pension risk by investing pension portfolio assets into less volatile securities. I would therefore expect that those firms with higher levels of operational distress to invest more pension assets in bonds. Higher levels of operating distress within in the firm is characterised by lower levels of cash being generated from ongoing projects and investments. Consequently the firm is less able to provide additional finance to the pension scheme, an investment in bonds

[62] Following Andrade and Kaplan (1998) we measure firm-level operational distress as the return on assets.

therefore creates a more predictable and stable pension cost and limits the need to provide exceptional finance.

Third, I analyse the relation between firm financial distress, pension liabilities, funding, and asset allocation. I argue that firms with higher levels of financial distress are likely to have higher pension liabilities and lower funding levels. Large pension liabilities and deficits represent large constraints on the firm as it must fund the scheme through cash contributions from the firm and employees. In terms of asset allocation, higher levels of financial distress imposes a cash flow risk on firms and risky pension assets may exacerbate that risk because of the higher probability of additional funding being required in poor market conditions. Bonds provide a more predictable cash flow and thus a more predictable pension costs for highly leveraged firms. As a result I would expect those firms with higher levels of financial distress to allocate a larger percentage of pension assets to bonds.

Finally, I examine the relationship between firm-level default risk, pension liabilities and the level of funding in the pension scheme. If pension liabilities are large and funding of the scheme is low, the likelihood of default is higher. A high default probability provides a setting whereby risk management and risk shifting incentives are strongest (Rauh (2007)). If risk shifting is observed in the pension portfolio then managers would allocate larger amounts of pension assets to equity when their firms have higher credit risk. Conversely if risk management is undertaken then a higher percentage of pension assets would be invested in less risky assets, namely bonds.

In examining market efficiency I consider the Fama-French 3-factor model (1993). From this I analyse the relationship between firm risk, measured by beta and pension risk. My results show that market risk reflects the risk of having a large pension

liability and also a poorly funded scheme. This is an important finding as both risk factors are reflected by the market risk factor.

Further, consistent with expectations, for the market beta I find that higher betas are associated with greater pension asset risk i.e. where equity is the dominant asset in the portfolio. The market therefore prices the investment risk and the implied volatility in the funding level of the pension scheme associated with high levels of equity investments. For the HML loading factor we do not find a significant relationship between HML and pension portfolio risk. However, for the SMB factor we find that higher loadings on the SMB factor are associated with higher levels of pension portfolio risk.

I then consider the relationship between value and growth risk factors and firm and pension risk. Intuitively I would expect these groups to have very different pension risk exposures. Value firms are characterised as having large pension exposures since they are more mature, while growth firms have lower exposure to pension risks since they are relatively smaller. My results show that value firms are exposed to large pension liabilities and funding deficits. However, I find that size risk factors increase as pension risks fall. However, one possible explanation may be due to migration effects (Fama and French (2007)). Over time, successful high-growth companies migrate from growth to value portfolios. As a firm's exposure to size risk falls, i.e. they become larger, then their pension risk exposure increases as they migrate towards the value portfolio.

My results also suggest that measures of operating distress reflect both the size and deficit of the pension scheme. Those firms that have higher operating distress are therefore more exposed to larger pension liabilities and lower funding ratios. Further, I find that firms with higher levels of operational risk tend to have a larger portion of pension assets allocated to bonds. This is consistent with pension risk management. In

this situation there is a lower probability that the pension scheme will require additional financing since the pension assets are more stable.

I also report that firms with higher financial distress have larger pension liabilities relative to market value. This finding also holds for the surplus/deficit position of the scheme and so higher financial distress is linked to large pension funding deficits relative to market capitalisation. Further, the observed pension asset allocation is consistent with risk management and so those firms with higher levels of financial distress allocate a greater amount of pension assets to bonds.

An examination of default probability suggests that the size of the pension liability relative to the firm is associated with a higher probability of default. In analysing the composition of the pension portfolio however I do not observe any relation between probability of default and pension scheme asset allocation.

In Section 2, I discuss the various risk management strategies that firms can undertake. Section 3 presents the relevant literature and the hypotheses are developed in Section 4. Data and Methodology is discussed in Section 5, results are presented in Section 6 and I conclude in Section 7.

5.2 Risk Management Strategies in Defined Benefit Pension Schemes

The adoption of fair value pension accounting in the UK has highlighted the risks that defined benefit pension obligations pose to firms. Management have to address these risks, since they face considerable pressure from investors, employees and pension trustees to ensure the solvency of both the firm and the scheme. Investors are naturally concerned that the scheme will be a drain on the cash flow of the firm thereby

reducing the return on firm investment, while employees and trustees are concerned that management will under-fund the scheme, reducing the long-term security of their own benefits.

The most common form of pension scheme risk management is liability driven investment. This is achieved through liability duration matching, where the investment strategy of a scheme is designed to take account of plan-specific characteristics such as the composition of the firm's workforce, industry type, and sensitivity of the scheme to changes in inflation and interest rates. Most pension portfolio allocation strategies are founded on the rationale that equities outperform bonds in the long term and the total return on equity meets the future pension liability. This strategy however is not always effective. Under fair value accounting, the year-on-year fluctuation in asset values are reflected in the reported plan assets, which results in an increase in balance sheet and scheme funding volatility. Furthermore, when funding deteriorates, the firm may have to provide additional finance to ensure the solvency of the scheme, with a concomitant impact on the income statement.

Pension liability calculations are very sensitive to changes in both inflation and interest rates. Although it is possible to estimate the duration of a scheme's liabilities and assets, there is generally a value mismatch because of the long investment horizons associated with pension liabilities. Significant mismatches will cause asset and liability movements to differ when changes in interest rates occur. Consequently, the funding level of mismatched schemes can deteriorate quite substantially over time if the tracking error between plan assets, liabilities and interest rates is large.

Liability driven investment strategies therefore attempt to increase the duration of the pension plan assets. This can be done in a number of ways, the most common of which is a significant increase in long-term bonds within the pension portfolio.

Although increased duration can also be achieved through the use of fixed income derivative products, this is unlikely to occur since it introduces counter-party risks and may also put pressure on the liquidity of the scheme and firm at some point in the future.

5.3 Relevant Literature

5.3.1 Risk Management Vs Risk Shifting Effects

There is a substantial literature that considers whether managers adopt risk management or risk shifting strategies. Managers face conflicting incentives to manage risk, particularly when their firms are most constrained i.e. high default risk. In this situation, firms trade-off the ability to undertake new investments (Mayers and Smith (1987)) with the need to ensure liquidity so as to prevent bankruptcy (Smith and Stultz (1985)). Jensen and Meckling (1976) posit risk shifting in this situation, whereby, undertaking riskier strategies increases shareholder value as firms move towards distress. In this case, the risky project, if successful, leads to a much larger pay-off which increases shareholder value as opposed to bankruptcy where shareholders experience total loss.

There is very little empirical research that reports strong evidence of risk shifting in pension funds. Cocco and Volpin (2007) find some evidence in a small sample of UK firms. However, they focus on the governance of pension schemes rather than firm risk. Essentially, firms with lower levels of governance allocate more pension assets to equity and pay lower contributions to the pension scheme since this maximises shareholder value.

5.3.2 Pension Portfolio Composition

There are a number of theoretical papers which show that the optimal allocation of pension assets should be concentrated in bonds. Both Black (1980) and Tepper (1981) show that this should be true for tax reasons. Essentially the use of bonds allows for some risk reduction in the portfolio and where bonds are the sole asset class in the portfolio a dollar change in the pension plan surplus, before tax (t), increases the value of the firm by $(1–t).

There are other incentives that may dictate why firms invest in other asset classes. A wide range of assets in the pension portfolio offers access to asset classes to which investors would otherwise not have access (Campbell and Viceira (2005)). With respect to investments, individuals generally overweight their exposure to property and underweight all other assets classes that have a large effect on household consumption (Case, Quigley and Shiller (2005)). A broader range of pension portfolio assets therefore provides households with a more diversified portfolio. Alternatively, firms may also wish to offer the upside potential of riskier assets to employees since individuals are underweight in most assets (Sweeting (2005)).

The objectives of the pension fund also come into effect in this situation. If the firm only provides the scheme to generate retirement incomes for current and former employees, the optimal portfolio will be one that follows a Black (1980), Tepper (1981) and Bodie (1990) investment strategy which will be dominated by long dated, high quality corporate debt. Alternatively firms may wish to minimise the long-term cost of the pension scheme, as well as offering potential upside gains to shareholders. In this situation, management will adopt a total return strategy and pension assets will be invested predominantly in equity.

However, pension assets have consistently been shown to be a useful tool for management who can manipulate the pension accounting assumptions to smooth the earnings figures of the firm (Bergstresser, Desai and Rauh (2006)). Investment in more volatile assets classes, such as equity, creates an incentive for management to manipulate earnings through the discretionary setting of pension plan accounting assumptions.

5.3.3 Risk Transparency and Value Transparency

The first part of my analysis looks at risk transparency, where the risk of the firm is a function of the risk of the pension scheme. There are a limited number of papers in this area and they have shown that the stock market is able to price the underlying pension risks despite the opaque accounting that surrounds pensions. Most recently Jin, Bodie and Merton (2006) for the US, and Trivendi and Young (2006) for the UK, have shown that the stock market reflects the underlying risk of the pension scheme.

Research on value transparency (Bodie, Light, Morck and Taggert (1985), Bulow, Morck and Summers (1987) and Bodie and Papke (1992)) has found that equity market valuations incorporate information in the annual report about the pension scheme, and that the surplus or deficit in a scheme is a determinant of equity market values. However, all of the research so far has focussed on US data, and fall under a very different pension accounting regime to the one in which all countries are moving towards.

U.S. pension accounting is guided by SFAS-87. Under this regime there is a smoothing of pension costs and volatility of pension assets. Further, there is a complex mandatory contributions system that is triggered if scheme funding falls below a certain threshold. Under fair value – the situation in the U.K. - pension assets and liabilities are annually marked to market and so there is greater volatility in both the funding level of

the scheme and pension assets. Consequently, this volatility may impair the relevance of any accounting amounts in the financial reports.

There is still some debate on the value transparency of pension assets and liabilities. First is the view that the assets and liabilities of the pension scheme are the assets and liabilities of the firm. Surpluses should thus be reflected as assets of the firm, which is generally the starting point for research in this area. However, there is also a view that only the liability/deficit of the scheme should be considered. This is because the pension assets belong to the members and so the scheme should be viewed as a separate legal entity of the firm (Weidman and Weir (2003)).

Carroll and Neihaus (1998) address this issue by looking at the relevance of pension funding and corporate debt ratings. They show that for every dollar decrease in scheme funding, there is a dollar fall in firm market value. However, a dollar increase in the surplus of a pension scheme does not actually increase the value of the firm by a dollar. This is consistent with the notion that the cost of the pension liability is fully the responsibility of the firm. Surplus assets however, are not really the assets of the firm since the firm may not be able to access the surplus, and in any event the firm will have to pay tax on any assets that can be returned.

5.4 Motivation and Hypotheses

The most recent paper to exam risk transparency of corporate pension schemes is Jin *et al* (2006), who derived a beta measure for pension scheme risks and showed that the total risk of equity, measured by the CAPM beta, incorporated their beta for pension risks. My approach is different in that I investigate whether extended measures of systematic risk (i.e. Fama-French size and value factors) reflect the individual

components of pension risks. To create pension risk measures, I scale the liability and pension surplus/deficit by firm size. If I observe that higher pension liabilities and smaller pension surpluses, relative to the size of the firm, are associated with higher risk estimates, this would suggest that the market incorporates pension risk when assessing companies.

As noted in Jin *et al* (2006) there are a number reasons why this may not be the case. First, pension accounting is complicated and the values that are presented in the financial accounts are the result of complex estimates about interest rates, future earnings and life expectancy. Second, there are two very distinct views on how the pension scheme relates to the firm. The labour economics view is that the pension scheme is a distinct legal entity to the firm. Consequently, only deficits would be a risk factor in this view of the world. Alternatively, there is the corporate finance view, where both the assets and liabilities belong to the firm. In this situation I would expect that the size of the pension liability, and any surplus/deficit would be incorporated into measures of risk.

I include book to market equity and size to control for different firm characteristics. In general, larger firms have bigger workforces with larger pension exposures where benefits are being provided. Conversely, small firms will have a smaller exposure to pension risks by virtue of their size. Companies with stronger growth characteristics will have small workforces and be earlier in their life cycle. This would be in contrast to value firms that are likely to be later in their life cycle and be more exposed to pension risks than growth firms.

H1: Systematic risk measures do not reflect the underlying risks of the pension scheme.

In looking at the risk of pension schemes the risk is not limited to the relative size of the scheme but also to the investment risk of the scheme. The choice of investment and the portfolio weightings between equities and bonds can have a significant impact upon the year-on-year funding level of the scheme. If the dominant asset in the pension portfolio is equities, the funding level of the scheme, measured as the ratio of pension assets to liabilities, will fluctuate with equity market movements. Consequently, the risk of their being significant underfunding in the scheme is high. We therefore expect that higher measures of beta will be associated with higher levels of equity investment in the pension portfolio.

H2: Measures of systematic risk do not reflect the risk of the pension portfolio

In trying to further assess the relationship between firm risks and pension risk I consider two additional measures of firm risk. Andrade and Kaplan (1998) analyse a number of different risk characteristics of firms that undertook leveraged transactions that terminated in financial distress. Their analysis considers two different types of risk, financial distress (debt-to-equity) and operating distress (Return on Assets). I therefore apply these measures to reflect the operating and financial distress of our sample firms.

My first measure considers financial distress, which is measured as the debt-to-equity ratio of the firm. Firms with higher levels of financial distress are likely to have large pension schemes as they represent a large cost to the firm. Further, poorly funded schemes will put additional constraints on the cash flow of the firm since there may be a need to provide additional financing in the future, putting pressure on the ability of the to service its debt. Firms with higher levels of financial distress would be expected to have pension schemes that are poorly funded.

H3: The financial distress of the firm is unrelated to pension risk characteristics of the firm.

My second measure of firm risk is operating distress, measured as the return on assets. The return on assets reflects the ability of the firm to generate cash flow from its investments. Jin *et al* (2006) analyse the relation between their pension risk beta and show that pension risks are associated with higher levels of operating distress. If the return on assets is low, the firm will have less cash flow to maintain ongoing projects, undertake new investments and service its debts. Pension risks may therefore pose a real risk to the ongoing operations of the firm. Firms with large pension deficits would have to provide additional contributions to their scheme.

H4: The operating distress of the firm is unrelated to pension risk characteristics of the firm.

In analysing the probability of default in the firm, pension risks are likely to be a contributing factor to an increased risk of default in the firm. This is likely where the size of the pension scheme relative to the firm is large. Further, where a pension deficit is large relative to the firm, the shortfall in funding of the pension scheme increases the likelihood that additional finance will be required. Again this may impact upon the probability of default. One further relationship that may hold is between the debt of the firm, the pension deficit and the probability of firm default. High levels of leverage in firms, increases the probability of bankruptcy in the firm. As a result of the binding nature of pension liabilities it is possible that the level of debt in the firm and the pension deficit are jointly related to the probability of default in the firm.

H5: The probability of firm default is unrelated to the risks of the pension scheme

To examine whether risk shifting or risk management occurs I analyse the relation between portfolio composition and my different risk factors. With respect to firm leverage, the pension portfolio composition will reflect conscious decisions by management on how the pension liability is managed. If risk shifting is observed, equity

would be the dominant asset in the pension portfolio. Alternatively, if management undertake risk management, I would expect pension assets to be predominantly invested in bonds.

H6: Pension portfolio composition is unrelated to the financial distress of the firm.

The ability of the firm to finance its ongoing operations is a tangible current risk to the firm, while the capital structure of the firm represents a long-term risk to the firm. This is therefore another environment where risk shifting and risk management incentives may be particularly strong. When faced with limited financial resources, a risk management strategy (predominance of bonds) would result in a relatively stable and predictable pension cost. Although more volatile assets over the long-term may meet the pension liability on a total return basis, this strategy could expose the firm to large intermittent pension contributions which would increase their operating distress further.

H7: Pension portfolio composition is unrelated to the operating distress of the firm.

Following much of the literature on risk-shifting and risk management I consider the role of default, as measured by Altman's Z-Score. Risk management and risk shifting is most likely to occur in firms in financial distress. Firms with high default risk can shift value from bondholders to equity holders by undertaking risky projects. Prior research however has found little evidence of risk shifting. Many studies, most recently Rauh (2007), have found that that as the probability of default increases, firms allocate more of their pension assets to safer securities.

H8: The asset allocation of the pension scheme is unrelated to the probability of default in the firm

5.5 Data and Methodology

My sample comprises all firms in the FTSE 350 from June 2001 until June 2004. The FTSE 350 is the index of the largest 350 corporations in the UK[63]. Again from this list I remove 44 listed investment trusts, 62 firms that provided incomplete pension data and 2 that do not provide any retirement benefits. My maximum sample is therefore 284 firms per year and 1,136 firm years. The final sample however is 884 firm years. This occurs for two reasons. First a number of companies suspended listing, merged or were taken over. Second, the sample period covers the transitional arrangements for FRS-17 and not all firms adopted the standard at the start of the sample period. The level of disclosure therefore in the early part of the sample is low and improves over time.

FRS-17 is the new fair value accounting standard that covers pension accounting in the UK and was replaced in 2005 with IAS 19. However, much of the disclosure requirements under both standards are the same[64]. When firms comply with FRS-17, they present in the financial accounts different asset classes compositions of the defined benefit pension scheme. This allows us to collect data for equities, bonds, property and cash in each scheme for every year in the sample. From this, I sum the individual asset classes to calculate the total pension assets. I also calculate the surplus(deficit) of the pension scheme by summing total pension assets and total pension liabilities. To characterise the pension portfolio assets, I calculate the percentage of total pension assets composed of equity and the percentage of pension assets invested in bonds.

---

63 Taking account of quarterly rebalancing the total number of companies that appeared in the index over our sample period was 392.

64 Both standards require fair value accounting for the pension scheme assets and liabilities. FRS-17, in some respects, has a stricter disclosure regime because the return on each individual asset class must be presented whereas IAS-19 allows for a weighted average return on all plan assets.

Daily share price data and FTSE All Share market index data, year end market capitalisation, total assets, book value of equity, total debt, return on assets, earnings before interest and tax, retained earnings and sales are collected from Worldscope.

The pension liability and funding variables are each scaled by the market capitalisation of the firm because the standardised measure more accurately reflects the risk that the scheme poses to the firm. For example, although a pension deficit of £50m is a large number, relative to a firm with a market capitalisation of £10bn, the amount is relatively small. However, if the market value of the firm was £100m, the deficit of the pension of the scheme would be very large, since it constitutes 50% of the firm's market value.

From the stock returns data, I calculate both the market model beta where,

$$R_{it} = \alpha + \beta_i R_{mt} + \varepsilon_{it}$$

And the Dimson beta with one lead and one lag:

$$R_{jt} = \alpha_j + \sum_{k=-1}^{1} \beta_{j+k} R_{It+k} + \mu_{jt}$$

In addition, I calculate the Fama-French (1993) 3-Factor model. Monthly portfolios are created at the end of the first month of my sample period. Each portfolio is then re-weighted monthly until the end of my sample. SMB and HML follow the standard definitions and are the returns on arbitrage portfolios consisting of small minus large firms and high book to market firms minus low book to market firms.

$$R_{it} = \alpha + \beta_i R_{mt} + \gamma_i HML + \delta_i SMB + \varepsilon_{it}$$

Finally, I estimate the probability of default from Altman's Z-Score where,

$$Z = 3.3\frac{EBIT}{TotalAssets} + 0.99\frac{Sales}{TotalAssets} + 0.6\frac{MVEquity}{BVDebt} + 1.4\frac{RetainedEarnings}{TotalAssets} + 1.2\frac{WorkingCap}{TotalAssets}$$

5.5.1 Descriptive Statistics

Table 5-1 presents the descriptive statistics of my sample firm and risk characteristics. The top row of the table presents the firm characteristics. It is clear that firm market values fluctuated quite considerably over the sample. The mean market value in 2001 being about £5.7bn and by 2004 this had fallen to £5.2bn. The movements in the equity values that I see are consistent with equity market movements over the sample period I analyse.

Table 5-1 Descriptive Statistics Companies and Risk Factors

Table 5-1 presents the descriptive statistics of a sample of FTSE 350 companies and their risk factors. Market Capitalisation is the balance sheet market value of equity. Total assets are the year end total assets of the firm. Total debt is the total debt outstanding of the firm for the year. Operating distress is the return on assets (ROA). Financial distress is the level of gearing in the firm measured by the debt to equity ratio. The Z-Score is the probability of default in the firm measured by Altman's Z-Score. The market model beta is the beta of the firm with no lags $R_{it} = \alpha + \beta_i R_{mt} + \varepsilon_{it}$. The Dimson beta is the beta of the firm with one lead and one lag $R_{jt} = \alpha_j + \sum_{k=-m}^{m} \beta_{j+k} R_{It+k} + \mu_{jt}$. Fama-French beta is the market beta from the 3-factor Fama French model based upon monthly portfolios where $R_{it} = \alpha + \beta_i^1 R_{mt} + \beta_i^2 HML + \beta_i^3 SMB + \varepsilon_{it}$. All variables are Winsorized at 1% and 99%.

	Market Capitalisation				Total Assets				Total Debt			
Year	**Mean**	**Q1**	**Median**	**Q3**	**Mean**	**Q1**	**Median**	**Q3**	**Mean**	**Q1**	**Median**	**Q3**
2001	5657	471	1223	3460	16582	634	1595	5324	3820	114	400	1540
2002	4538	416	1035	3199	16970	658	1658	5249	4143	121	420	1506
2003	4682	439	1123	2978	18352	683	1738	5208	4664	125	433	1475
2004	5167	571	1410	3414	20186	694	1814	5302	5293	129	425	1427
	Return on Assets				**Debt/Equity**				**Z-Score**			
2001	0.04	0.01	0.04	0.07	0.26	0.13	0.27	0.37	7.10	2.26	3.67	6.65
2002	0.03	0.01	0.03	0.07	0.27	0.15	0.27	0.38	5.72	1.89	3.21	5.56
2003	0.04	0.01	0.04	0.07	0.26	0.16	0.26	0.37	6.04	2.08	3.33	6.26
2004	0.05	0.02	0.04	0.08	0.25	0.14	0.26	0.36	6.81	2.51	3.92	7.35
	Market Model Beta				**Dimson Beta**				**Fama-French Beta**			
2001	0.58	0.24	0.44	0.80	0.81	0.40	0.69	1.16	0.87	0.47	0.76	1.16
2002	0.61	0.26	0.53	0.86	0.68	0.36	0.57	0.92	0.88	0.54	0.78	1.13
2003	0.68	0.31	0.59	0.96	0.83	0.42	0.72	1.09	0.98	0.61	0.86	1.20
2004	0.79	0.50	0.72	1.00	0.87	0.50	0.81	1.13	1.00	0.66	0.92	1.25

In looking at the total assets and debt of the firms in the sample, both measures increase over my sample period. For total assets, the median is considerably lower than the mean. This high level of skewness is driven by the largest firms in the sample. This is also evident when the total debt of the sample firms is considered, since the median is appreciably lower than the mean in all years.

I also consider a number of firm risk characteristics. The next section of the table presents the operating distress, financial distress and the probability of default in the firm. The operating distress of the firm is measured as the return on assets. It is clear that the average and median return on assets is relatively stable over the sample period. Financial distress is measured by the debt-to-equity ratio of the firm. As with operating distress, this is broadly similar year-on-year, with an average debt-to-equity ratio of 26 percent.

The probability of bankruptcy is measured from Altman's Z-Score. In all years, the mean score is greater than 3 and so on average firms are not likely to experience bankruptcy. However, it is also clear that there are a number of firms that lie within the grey area between 1.8 and 3. Of the firms in my sample, I therefore have a number of companies where there is an increased risk of bankruptcy. This is important since one of the key areas that I consider is the relationship between default probability, pension schemes risk and pension asset allocation.

The final section of Table 5-1 shows the different betas that were calculated. I present the standard market model beta, the Dimson beta and the Fama-French market beta. The Dimson beta was calculated to mitigate the problem where the risk of those shares that are traded most frequently is overestimated and the risk of those shares that are thinly traded is underestimated. Following the methodology of Dimson (1979) I calculated two different beta specifications, one lead and one lag, and two leads and two

lags[65]. From the table I can see that all of the betas in the sample increase between 2001 and 2004.

Table 5-2 presents the descriptive statistics of the pension scheme characteristics. It is clear that the size of the pension exposure in some firms is large. In 2001, the median pension liability constituted 21% of the market value of the firm and by 2004 this had risen to 29% of market value. The funding level of the schemes also deteriorated over the sample period, which is consistent with accruing pension liabilities and equity market volatility. By 2004 the average pension deficit was 8% of market capitalisation.

Table 5-2 Descriptive Statistics Pension Risks and Asset Allocation

Table 5-2 presents the descriptive statistics of a sample of FTSE 350 company defined benefit pension schemes. Liability-to-Market-Value is the year end pension liability divided by the year end firm market value. Surplus-to- Market-Value is the surplus/(deficit) in the pension scheme scaled by the year end market value of the firm. Where the pension surplus/(deficit) is calculated as pension assets + pension liability. Equity percentage is the percentage of pension assets invested in equity. Where equity percentage is calculated by pension assets invested in equity/total pension assets. Bonds percentage is the percentage of pension assets invested in bonds. Where bonds percentage is calculated by pension assets invested in bonds/total pension assets. All figures are presented as decimals and are Winsorized at 1% and 99%.

	Liability to Market Value				Surplus to Market Value			
Year	**Mean**	**Q1**	**Median**	**Q3**	**Mean**	**Q1**	**Median**	**Q3**
2001	0.40	0.08	0.21	0.50	-0.02	0.01	-0.01	-0.03
2002	0.49	0.10	0.28	0.59	-0.09	-0.02	-0.06	-0.14
2003	0.50	0.10	0.29	0.68	-0.09	-0.02	-0.05	-0.14
2004	0.46	0.09	0.29	0.58	-0.08	-0.01	-0.05	-0.11
	Equity Percentage				**Bonds Percentage**			
2001	0.69	0.61	0.73	0.80	0.24	0.15	0.21	0.29
2002	0.64	0.54	0.68	0.76	0.29	0.17	0.25	0.36
2003	0.64	0.55	0.68	0.76	0.29	0.18	0.26	0.36
2004	0.62	0.53	0.65	0.73	0.29	0.18	0.27	0.38

Table 5-2 also presents the asset allocation of the pension portfolio. The proportion of equity in the pension portfolio fell over my sample from a mean of 69% equity in 2001 to a mean equity percentage of 62%. Conversely the mean allocation of bonds increased between 2001 and 2004 from 24% to 29%. Despite this it is clear that equity and bonds are the dominant asset classes in the pension portfolio since, together,

[65] In the testing that is carried out we only use the one lead and one lag beta as a descriptive analysis of the different specifications showed there was essentially no difference from the two lead and lag beta.

the mean equity and bonds held constituted 93% of total pension assets in 2001 and 91% in 2004.

5.6 Results

In this section, I explicitly test the hypotheses that were developed in section 5.5. Section 5.6.1 examines the relationship between pension risk and measures of systematic risk. Section 5.6.2 discusses financial distress and pension risk. Section 5.6.3 analyses the relationship between pension risk, operating distress and default risk. Section 5.6.4 examines pension portfolio composition, systematic risk and the Fama-French factors. 5.6.5 analyses pension asset allocation and financial distress. Section 5.6.6 looks at the relationship between operating distress and probability of default with pension portfolio asset allocation. Lastly in section 5.6.7 I analyse the impact of active risk management on measures of firm risk.

5.6.1 Pension Risk and Systematic Risk Measures

The first part of the analysis considers market efficiency and risk transparency. If markets are efficient, a firm's systematic risk (beta) will be higher when the pension liability is large relative to the size of the firm. The same rationale applies to the deficit of a pension scheme.

From Table 5-3, it is clear there is a significant and positive relationship between systematic risk (beta) and the pension liability. Further I find a significantly negative relation with the pension surplus. In both cases, a large pension liability and significant pension deficit relative to the size of the firm increases corporate risk. Due to the complexity and opacity of pension accounting, this is an unexpected result but strongly suggestive of market efficiency and transparent assessment of risk.

Table 5-3 Pooled Regressions of Firm Risk Measures against Pension Risk Factors

Table 5-3 presents the results of pooled regressions of firm risk against pension scheme risks. I calculate the market beta and the size and book value portfolios from the Fama-French 3-Factor model where, $R_{it} = \alpha + \beta_i^1 R_{mt} + \beta_i^2 HML + \beta_i^3 SMB + \varepsilon_{it}$ Liability/Market value is the FRS-17 pension liability divided by the balance sheet market value of the firm. Surplus/Market Value is the sum of pension assets and liabilities divided by the balance sheet date market value of equity. I also include controls for firm size and capital structure and book-to-market. The dependant variable is presented at the head of each column and the independent variables are present in the far left hand column. The parameter estimate is presented in the top row and the corresponding t-stat is presented directly below, * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Market Beta		HML		SMB	
Intercept	0.94	0.93	-0.57	-0.58	2.70	2.71
	(7.66)*	(7.48)*	(-3.78)*	(-3.79)*	(26.52)	(25.95)
Liability/MV	0.10	-	0.18	-	-0.05	-
	(2.71)*		(4.14)*		(-1.69)**	
Surplus/MV	-	-0.48	-	-0.92	-	0.20
		(-2.37)**		(-3.67)*		(1.16)
Size	0.00	0.00	0.03	0.03	-0.30	-0.30
	(0.00)	(0.08)	(1.43)	(1.54)	(-23.94)*	(-23.55)*
Book-to-Market	-0.18	-0.16	0.77	0.79	-0.29	-0.29
	(-3.15)*	(-2.91)*	(10.96)*	(11.30)*	(-5.95)*	(-6.08)*
Capital Structure	0.09	0.09	0.00	0.00	0.08	0.07
	(2.78)*	(2.78)*	(0.09)	(0.10)	(2.78)*	(2.70)*

The next systematic risk measure I examine is the HML factor. From Table 5-3, it can be seen that corporate exposure to the HML risk factor is higher when firms have large positive exposures to pension risks, large pension liabilities being significant and positive and pension deficits being significant and negative. This is consistent with market efficiency, since both the size of the pension scheme and the size of the pension deficit are captured by the value risk factor.

The final column of Table 5-3 analyses the relationship between the SMB factor and pension risks. Interestingly I find that higher size risk factors are associated with smaller pension liabilities relative to firm size. Further I find that there is no relation between the size risk factor and the surplus or deficit of the pension scheme.

I can therefore reject my null for hypothesis 1 that the market does not incorporate pension risk measures. My results extend those of Jin *et al* (2006) since I show that not only does the market price pension risks of the firm but that it also prices the different individual components of pension risk.

5.6.2 Systematic Risk and Pension Portfolio Composition

Table 5-4 presents our analysis of systematic risk and pension investment risk. From column 1 it can be seen that there is clearly a significant and positive relationship between higher levels of systematic risk and increased pension risk through higher allocations to equity. In terms of market efficiency this clearly demonstrates that the market incorporates the risk of the investment risk of the pension scheme.

Table 5-4 Pooled Regressions of Firm Risk Measures against Pension Portfolio Risk

Table 5-4 presents the results of pooled regressions of firm risk against pension portfolio risks. We calculate the market beta and the size and book value portfolios from the Fama-French 3-Factor model where, $R_{it} = \alpha + \beta_i^1 R_{mt} + \beta_i^2 SMB + \beta_i^3 HML + \varepsilon_{it}$ Equity/Market Value is the market value of equity held in the pension portfolio on the balance sheet date scaled by the market value of the firm on the balance sheet date. The dependant variable is presented at the head of each column and the independent variables are present in the far left hand column. The parameter estimate is presented in the top row and the corresponding t-stat is presented directly below, * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Market Beta	HML	SMB
Intercept	0.97	0.25	0.39
	(8.13)*	(1.78)***	(10.28)*
Equity/Market Value	0.07	0.05	0.10
	(3.03)*	(1.61)	(3.77)*
Size	-0.002	-0.03	-
	-(0.13)	-(1.69)***	
Book-to-Market	-0.17	-	-0.20
	-(3.02)*		(0.41)
Capital Structure	0.09	0.18	-0.05
	(2.92)*	(4.55)*	-(1.49)

Columns 2 and 3 of Table 5-4 show or analysis of the HML factor and SMB factor and investment risk respectively. For the HML factor there a positive relation between the HML factor loading and the investment risk of the scheme. The relationship however is insignificant. From the final column of the table that considers the SMB factor we can see that there is a positive and significant relationship between the size loading factor and the investment risk of the firm.

5.6.3 Pension Risk and Measures of Financial Distress

Table 5-5 presents an analysis of the relationship between financial distress and pension risks. I again extend Jin *et al* (2006) as I consider different components of pension risk. From column 1 of table 4 higher levels of financial distress are significantly related to the size of the pension liability relative to the market value of the firm. This is consistent with expectations, since a large scheme, regardless of funding, is a significant burden on the firm. Firms with a large pension scheme liability tend to have a large number of active, retired, and deferred scheme members and this will increase the annual service cost. I can therefore reject my null hypothesis that measures of financial distress are unrelated to pension scheme risks.

Table 5-5 Pooled Regressions of Financial Distress against Pension Risk Factors

Table 5-5 presents the results of pooled regressions of financial against pension scheme risks. I estimate financial distress as the level of gearing in the firm measured by the debt-to-equity ratio. Liability/Market value is the FRS-17 pension liability divided by the balance sheet market value of the firm. Surplus/Market Value is the sum of pension assets and liabilities divided by the balance sheet date market value of equity. Liability/Total Assets is the FRS-17 pension liability divided by the total assets of the firm. Surplus/Total Assets is the sum of pension assets and liabilities divided by the Total Assets of the firm. I also include controls for firm size and book-to-market. The dependant variable is presented at the head of each column and the independent variables are present in the far left hand column. The parameter estimate is presented in the top row and the corresponding t-stat is presented directly below, * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Debt-to-Equity			
Intercept	-0.51	-0.57	-0.3	-0.32
	(-4.10)*	(-4.48)*	(-2.28)**	(-2.42)*
Liability/Market Value	0.18	-	-	-
	(4.88)*			
Surplus/Market Value	-	-1.11	-	-
		(-5.41)*		
Liability/Total Assets	-	-	-0.06	-
			(-0.93)	
Surplus/Total Assets	-	-	-	0.17
				(0.48)
Book-to-Market	0.6	0.63	0.62	0.63
	(10.94)*	(11.49)*	(10.97)*	(11.01)*
Size	0.09	0.1	0.07	0.07
	(5.87)*	(6.22)*	(4.68)*	(4.69)*

I then consider the relationship between financial distress and pension scheme funding. Funding is measured as the pension surplus/(deficit) scaled by the market capitalisation of the firm. From column 2 of table 4, firms that have a bigger pension

deficit relative to firm size also have higher levels of financial distress. Again this is consistent with expectations. Firms with large pension short-falls are likely to require additional funding for their pension scheme. As a result, firms have additional pressures on their cash flow and therefore experience higher levels of financial distress. Again I can reject my second null hypothesis that measures of financial distress do not incorporate measures of a firms pension risks.

Measuring pension liabilities and funding using total assets as the scaling instrument causes the regression models to lose power. As a result, the models in columns 3 and 4 of table 5.5 are insignificant. Given that the distress variable debt to equity is market determined this is not a particularly surprising result.

5.6.4 Pension Risk and Measures of Operating Distress and Default Probability

In panel A of Table 5-6 I present my analysis of operating distress and pension risk. Following Jin *et al* (2006), operating distress is measured as the return on assets. A firm with a low return on assets generates inferior amounts of income from its investments causing it to have less free cash flow. Under such constraints the firm will be less able to finance ongoing projects, undertake new investments and service any debts that the company may have. A large pension liability would have a significant impact upon the level of operating distress in the firm and, as noted earlier, large pension liabilities are associated with substantial contributions. This would reduce free cash flow, further increasing the level of operating distress in the firm. From the first regression in Panel A, there is a significantly negative relation between the return on assets and the size of the pension liability. I can therefore reject my null hypothesis 3 that operating distress is unrelated to pension risks since increased operating distress is associated with large pension risk exposures.

In looking at the level of funding in the pension scheme, the second regression in Panel A shows a significant and positive relationship between the pension surplus/deficit and return on assets. Again this is consistent with expectations. If a scheme is well funded or even in surplus, the firm will have to contribute less and in certain circumstances may even underfund the scheme. Conversely, a scheme in deficit will force the firm to provide additional funds thereby reducing cash flow and increasing operating distress. Again I can reject my null hypothesis that the operating risk is unrelated to pension risks within the firm.

Panel B of Table 5-6 presents an analysis of pension risks and the probability of default. There are a number of reasons to expect that the size of the pension liability will contribute to the likelihood of default in the firm. Large pension liabilities represent a significant burden to firms. Moreover, pension liabilities are also debt-like in nature, and in some respects, could be considered to be an additional form of gearing in the firm. My results, from the first regression in panel B, suggest that there is an increased likelihood of bankruptcy when the pension scheme is large relative to the firm. I can therefore reject my fourth null hypothesis that the probability of default is unrelated to pension risk.

The second regression in panel B presents results for the probability of default and scheme funding. Interestingly, there is no significant relationship between funding and default. This is contrary to expectations. However, since pension funding could be classed as a short-term risk, large asset swings or special one-off contributions could mitigate the impact of poor funding levels. However, for my other measures of distress, funding exacerbates these problems.

Table 5-6 Pooled Regressions of Operating Distress and Default Risk against Pension Risk Factors

Table 5-6 presents the results of pooled regressions of operating and default risks against pension scheme risks. I estimate operating distress as the return on assets (ROA). The Z-Score measures the probability of default measured by Altman's Z-Score. Liability/Market value is the FRS-17 pension liability divided by the balance sheet market value of the firm. Surplus/Market Value is the sum of pension assets and liabilities divided by the balance sheet date market value of equity. I also include controls for firm size (log MV) and the capital structure of the firm measured by debt-to-equity. The dependant variable is presented at the in the far left hand column and the independent variables are presented at the head of each column. The parameter estimate is presented in the top row and the corresponding t-stat is presented directly below in parenthesis, * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

Panel A	Intercept	Liability/Market Value	Surplus/Market Value	Size	Book-to-Market	Debt-to-Equity
Return on Assets	0.08	-0.02	-	-0.00	-0.02	-0.03
	(8.62)*	(-6.37)*	-	(-0.67)	(-5.46)*	(-10.39)*
	0.08	-	0.08	-0.00	-0.03	-0.03
	(8.29)*	-	(4.89)*	(-0.69)	(-5.94)*	(-10.39)*
Panel B	**Intercept**	**Liability/Market Value**	**Surplus/Market Value**	**Size**	**Book-to-Market**	**Debt-to-Equity**
Z-Score	14.13	-1.01	-	-0.37	-2.28	-7.45
	(7.49)*	(-1.83)***	-	(-1.61)	(-2.50)**	(-10.53)*
	13.77	-	2.59	-0.35	-2.37	-7.69
	(7.16)*	-	(0.85)	(-1.47)	(-2.58)**	(-11.01)*

5.6.5 Pension Asset Allocation and Measures of Firm Distress

The next part of my analysis considers the relationship between pension portfolio asset allocation and measures of firm distress. As with measures of systematic risk, this allows for an assessment of whether risk shifting or risk management is observed when firms have higher levels of distress.

Higher levels of financial distress constrain the finances of the firm since debt has to be serviced. Management have two choices when faced with increased levels of distress in the firm. First, undertake risk shifting through increasing the allocation of pension assets to volatile asset classes, namely equity. Alternatively, managers can choose to reduce the volatility of pension assets by investing more in bonds. In so doing, the firm would incur a more stable pension cost and for managers this option would reduce the likelihood of further financial distress. An allocation to riskier assets, however, may exacerbate the financial distress of the firm at some point in the future if there are adverse equity movements.

Table 5-7 Pooled Regressions of Pension Portfolio Asset Allocation against Financial Distress

Table 5-7 presents the results of pooled regressions of pension asset allocation against financial distress, measured by the debt-to-equity ratio of the firm. At the head of each column is pension asset allocation. In the far left column are the explanatory variables. We control for firm size log(market value), book-to-market equity value and the probability of default in the firm measured by Altman's Z-Score. The parameter estimate is presented in the top row and the corresponding t-stat is presented directly below, * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Equity %	**Debt %**	**Equity %**	**Debt %**
Intercept	0.75	0.24	0.73	0.23
	(20.59)*	(6.85)*	(18.17)*	(5.95)*
Financial Distress	-0.01	0.01	-0.03	0.04
	(-0.78)	(1.31)	(-2.20)**	(2.48)**
Firm Size	-0.01	0.002	-0.01	0.00
	(-2.23)**	(0.34)	(-1.66)***	(0.64)
Book-to-Market	-0.04	0.03	-0.01	0.02
	(-2.14)**	(1.99)**	(-0.51)	(1.10)
Z-Score	-	-	0.03	-0.05
			(0.41)	(0.77)

Table 5-7 presents the results. It is clear that when financial distress is higher, controlling for the probability of default in the firm, there is a significantly higher allocation to safer pension assets. This result is consistent with risk management of pension risks. For example, firms that experience a 1% increase in the ratio of debt to equity will reduce their allocation of pension assets in equity by 0.03% and increase their exposure to bonds by 0.04%. I can thus reject my null hypothesis 6 that pension portfolio allocation is unrelated to financial distress within the firm. Economically however, the relation between pension asset allocation and financial distress is very small. If the debt-to-equity ratio of the firm increased by 50% this would only result in a 1.5% decrease in the percentage of equity in pension assets.

Table 5-8 Pooled Regressions of Pension Portfolio Asset Allocation against Operating Distress

Table 5-8 presents the results of pooled regressions of pension asset allocation against operating distress, measured by the return on assets. At the head of each column is pension asset allocation. In the far left column are the explanatory variables. The far left column is the dependant variables pension equity percentage and pension debt percentage and along the top row are the independent variables. I control for firm size log(market value), book-to-market equity value and the capital structure of the firm measured by the debt-to-equity ratio. The parameter estimate is presented in the top row and the corresponding t-stat is presented directly below, * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Intercept	Operating Distress	Firm Size	Book-to-Market	Leverage
Equity %	0.72	0.40	-0.01	-0.02	0.02
	(19.25)*	(3.02)*	(-2.29)**	(-1.55)	(0.75)
Bonds %	0.26	-0.36	0.001	0.02	0.001
	(7.34)*	(-2.79)*	(0.33)	(1.42)	(0.15)

Table 5-8 shows the results of an analysis of pension asset allocation and operating distress. Similar to financial distress, operating distress reflects a situation where the firm has cash flow constraints. A low return on assets reflects an inability within the firm to generate returns on their investments. In such a situation the firm does not have sufficient scope to pay large amounts of additional finance to a poorly funded pension scheme. Consequently, if pension assets have a higher bond weighting they will be more stable, reducing the likelihood of the firm to provide large amounts of additional finance to the scheme.

The regression results show that the firm allocates significantly lower amounts of pension assets to equity and significantly higher amounts to bonds when operating distress is higher. From the regression results, a 10.0 percentage point fall in the return on assets would be associated with a 4.0 percentage point decrease in assets allocated to equity and a 3.6 percentage point increase in bonds. This is again consistent with risk management of pension risk, and so I can reject my null hypothesis 7 that pension portfolio composition is unrelated to operating distress.

5.7 Summary

This chapter considers two important questions relating to market efficiency and risk management. First, I look for risk transparency between measures of systematic risk, firm distress and pension risks. My results show that measures of systematic risk, namely market, value (HML), and size (SMB) risk, reflect the underlying risk of the pension scheme. Moreover, both market and value risks are influenced by the size of the pension liability, the investment strategy and the funding of the pension scheme relative to firm market capitalisation. This finding is significant because there are many reasons to suspect that systematic risk factors would not price these risks. Pension accounting is governed by complex and opaque accounting methods and, in many respects, can be considered as 'off balance sheet'. However, I find that measures of systematic risk reflect these pension risks and so I find evidence of market efficiency.

My analysis also extends the literature on risk transparency to consider measures of operating distress, financial distress and default. Again, firms with higher levels of operating and financial distress are characterised by having large pension liabilities and poor levels of funding in their pension scheme. My analysis of default probability

shows that only the size of the pension liability relative to the firm is a significant determinant of default.

The second part of the chapter considers pension risk management. I present evidence of pension risk management as firm risk and levels of distress increase. Managers actively allocate pension assets away from risky investments to safer assets. If equity is the dominant asset in the pension portfolio then large swings in the stock market can have a significant impact upon the funding level of the pension scheme. In this situation, firms may have to provide additional contributions to the scheme. However, those firms that are the riskiest and most constrained, are least able to do so. Mangers therefore choose to manage these risks by allocating pension assets to safer securities, namely bonds. This provides the pension scheme with a more stable portfolio and managers with a more predictable pension cost.

6
DO DEFINED BENEFIT CONTRIBUTIONS REDUCE CAPITAL EXPENDITURE AND PROFITABILITY?

6.1 Introduction

In this chapter I analyse the relationship between firm capital expenditure, profitability and employer contributions to defined benefit pension schemes. For most companies, contributions to finance pension obligations are generally equal to the service cost of the pension scheme. Contributions therefore equal the increase in the pension liability from one year's additional pension benefit accrual by employees. However, for a large number of companies, their pension schemes are severely under-funded. Managers of these schemes will be pressured by employees and pension scheme trustees to provide additional financing so as to ensure sufficient assets in place to provide for future pension benefits to employees.

Rauh (2006) examines the relationship between capital expenditures and mandatory contributions to defined benefit pension schemes in a large sample of US corporations. He shows that capital expenditures fall in response to increased mandatory pension contributions. This relationship is shown to be present after controlling for pension scheme funding and the unobserved investment opportunities of the firm. For firms that are already financially constrained (low credit ratings), this result was shown to be even stronger.

Reducing capital expenditure to fund pension contributions is an obvious internal strategy for management to exploit. However, there are a number of other actions that management could employ, such as reducing dividends or increasing asset disposals. One consequence of reducing capital expenditure is the potential impact on the profitability of the firm. Falls in capital expenditure may therefore result in firms rejecting profitable projects that would otherwise have been undertaken if the financial resources were available to management. Conversely, falls in capital expenditure may result in a reduction in over-investment and an increase in asset utilisation.

I make four contributions to the existing literature on internal capital markets and pension plan funding. First, I document the relationship between pension contributions, the magnitude of the pension liability and pension scheme funding levels. This relationship is clear in the US because of complex legally defined funding rules. The UK however, is a different regulatory environment, and there is no legally imposed trigger point that forces management to provide additional financing to fund a pension scheme deficit. Managers of firms with poorly funded schemes may elect to maintain this position and not provide large amounts of finance to the scheme. Conversely, management may provide additional financing as a result of pressure from employees and trustees or because the funding level of the scheme is seen as a risk to the business.

Second, I analyse the relationship between capital expenditure and large voluntary pension contributions. Rauh (2006) observes that pension contributions can be separated from the firm's investment opportunities and therefore presents a situation where the impact of changes in the internal financial resources of the firm can be tested. The UK environment presents a more direct opportunity on how managers choose to allocate the resources of the firm, since there is no legal compulsion on managers to provide high levels of additional finance to fund their pension scheme. In undertaking

this analysis I can therefore gain insights into how managers allocate the resources of their firm in response to a tangible risk to operations.

Third, I extend the analysis of Rauh (2006) and test the relationship between dividends and pension contributions. There is a wide literature on why firms pay dividends and how the market responds to changes in the dividend payout policy of the firm. Bhattacharya (1979) and Miller and Rock (1985) argue that dividends are used as a signalling method and convey news to the market. Easterbrook (1984) puts forward the notion that dividends reduce agency problems within the firm as they reduce the level of free-cash flow available to management. In looking at the internal financial resources of the firm, dividends represent a potential source of financing which management can access. Consequently, managers may utilise this resource when providing large amounts of additional financing to the pension scheme.

Last, I analyse the impact of large pension contributions on the profitability of the firm. If capital expenditure falls in response to large pension contributions, firm profitability may be reduced as the firm cannot undertake all of the projects that are available since there are not sufficient assets to invest. Conversely, I could observe an increase in profitability because there is a reduction in the free cash-flow within the firm and so managers are not able to over-invest. The payment of large contributions may therefore increase asset utilisation in the firm and reduce agency problems. In this situation, the funding of the pension scheme will benefit both employees and shareholders as the scheme is better funded, and shareholders are investing in a more profitable firm with lower agency risks.

My results are as follows. First I find that the magnitude of pension contributions is functionally related to the size of the pension liability, the funding of the scheme and composition of pension assets. Higher contributions are paid when the

pension liability of the firm is large, since larger schemes will incur higher costs and firms therefore have to pay more to the scheme. Higher contributions are paid to schemes when the pension scheme deficit is large relative to the size of the firm. Managers therefore provide additional financing to pension schemes where large deficits exist and potentially this could be taken from the financial resources available to managers from within the firm. Pension portfolio contributions are lower when equity is the dominant asset in the scheme. This suggests that managers undertake a total return investment strategy for the pension portfolio. Over long time horizons managers believe that the performance of the equity investment will be sufficient to meet their pension obligation and so therefore do not pay large contributions to the scheme.

Second, I find that those firms who pay the highest contributions to the pension scheme have significantly lower capital expenditure. This result holds even after controlling for the funding of the pension scheme and the unobserved investment opportunities of the firm. Capital expenditure is therefore dependant upon the internal financial resources of the firm and is evidence that that managers fund the pension scheme from the internal financial resources of the firm. As there is no legal compulsion on management to provide additional financing to the scheme, this result indicates that the pension scheme is perceived to be a risk within the firm.

Third, my analysis shows that the level of contributions paid to the pension scheme are unrelated to the level of dividend payments in the firm. If dividends are reduced to fund the pension scheme, this could potentially produce a negative signal to the market. Although dividends are an available source of financing for management to utilise they elect not to do so. Dividend changes are a clearly observable event and so the market would be able to observe where the finance for the dividend payment had

been re-allocated. Capital expenditure, however, varies year-on-year and managers have a higher degree of control and discretion over the allocation of this resource.

Finally, my examination of profitability shows that those firms who pay the highest levels of contributions to their pension schemes have higher profitability. This finding suggests that high levels of contributions have two effects on the firm. First, there is a reduction in free cash-flow within the firm. Consequently, there is a reduction in the scope for over-investment in unprofitable projects. Implicitly there is a reduction in agency problems and empire building. Second, the reduction in over investment and higher profitability that I observe is suggestive of better asset utilisation within firms that contribute the most to their pension scheme.

In Section 6.2, I discuss the funding and structure of UK defined benefit pension schemes. Section 6.3 presents the relevant literature and the hypotheses are developed in Section 6.4. Data and Methodology is discussed in Section 6.5, results are presented in Section 6.6 and I conclude in Section 6.7.

6.2 Pension Plan Funding in the UK

Pension plan funding in the UK has been the subject of much debate over the past decade. In 1997 the Minimum Funding Requirement (MFR) was introduced as part of the Pensions Act 1995. By introducing this legally binding deficit recovery plan it was hoped that employees and pension scheme trustees would have greater certainty about the funding of pension deficits. However the method of calculating the MFR status of a scheme was complex and the resultant contribution schedule imposed an onerous burden on firms. Essentially the basic premise of the requirement was that the pension scheme must hold a minimum amount of assets to meet the pension liability. In

circumstances where the asset to liability ratio did not meet the MFR a deficit recovery plan was initiated i.e. the company had to provide additional finance to the pension scheme.

In practice many firms did not fully implement these arrangements during the transition period between 1997 and 2001. For those companies who did many found the contribution repayment schedule to be an excessive and costly burden. Consequently managers negotiated with trustees to put other arrangements in place. One such case was Imperial Chemical Industries (ICI) who in 2000 had an FRS-17 deficit of £500m. Under the MFR recovery plan the level of contributions and the time horizon set out to make good the deficit proved too difficult for the firm to maintain. Consequently, the managers of the firm and the scheme trustees negotiated a deal where ICI would provide a £250 million guarantee to the pension scheme backed by assets placed in a special purpose vehicle. For most other firms, longer time periods over which contributions must be paid were negotiated and in many cases firms had to provide credit guarantees to reduce concerns over plan sponsor insolvency risks.

There were also examples of firms being fully funded on an MFR basis but in reality there were substantial short-falls in scheme funding. In bankruptcy the MFR imposed a pecking order as to what benefits employees received. Current employees were at a serious disadvantage as they only received residual benefits once retired employees benefits had been bought out in full[66].

In the case of Allied Steel and Wire current employees were left with less than their fully accrued benefits despite one of the pension schemes of the company being fully funded on a MFR basis. This mis-match occurred as the MFR liability calculation applied annuity rates that were significantly higher than the current market rates and so

---

66 In this case the pension liability was funded through the bulk purchase of annuities.

the pension liability was understated. As a result, when the scheme was wound up and the bulk purchase of annuities for retired employees occurred there were insufficient assets left to meet the liability due to current employees.

In 2001 however, the government announced that the MFR would be abolished under the recommendations of the Myners Report. The report criticised the one-size-fits all MFR as the investments of the pension fund were far more significant in meeting the pension obligation as opposed to the current ratio of assets to liabilities. As a result the transition period for adoption of the MFR was extended to 31st of December 2005. In abolishing the MFR the Myners Report proposed that firms and trustees should agree on long-term scheme funding plans and this has subsequently been adopted by newly established Pensions Regulator as of 2005.

6.3 Relevant Literature

Finance and economic theory is not clear on the optimal level of pension scheme funding. This is in part due to the complexities in funding a pension scheme that result from firm specific issues such as asset allocation strategies and agency issues. One factor that will influence scheme funding and the level of contributions paid is the provision of pension insurance within an economy. In a complete market firms will purchase insurance contracts to secure the full benefits of employees in the event of any funding shortfall. This has two benefits where contributions have been insufficient to fully fund the scheme. First insurance hedges employees against the loss of pension benefits. Second the firm hedges against having to provide additional finance to the pension scheme to fund any shortfall in employee benefits. Consequently, pension plan funding and contributions are irrelevant (Sharpe (1976)).

The decision to fund pension liabilities and deficits in the absence of such insurance is complex. If the pension scheme of the firm is under-funded, firms are faced with a trade-off between liquidation and continuation. In continuing, the firm has to fund the pension deficit through contributions from the assets of the firm. This has two effects; first, it reduces the value of equity, and second, it increases the risk of long-term debt (Webb (2007)). As a consequence, the continuation option is likely to result in closure of the scheme to new members and further accrual thereby limiting the cost to shareholders and reducing long-term debt holders' risks.

Pension deficits can however in certain circumstances create leverage for management in negotiating with trade unions. The promise to improve the security of employee pension benefits can limit costly wage increases (Ippolito (1985)). It may not therefore be optimal to fully fund the pension scheme as it provides management with bargaining power.

Another factor that has a significant bearing on funding and contribution levels is the scheme asset composition and investment strategy. There are two main investment strategies available to managers. The first is a total return strategy. In this situation equities are the dominant asset in the portfolio. Underlying this decision is the expectation that over long time horizons equities will outperform bonds. Consequently this should be cheaper in the long run. Such a strategy however exposes the pension scheme to adverse stock market movements. In circumstances where the stock market performs poorly managers may have to provide significant amounts of additional finance in the short-run.

The second option is to undertake liability driven investment. In doing so pension assets are mainly invested in long dated bonds. This strategy results in a more stable pension cost. Although the annual cost is greater as bonds do not offer as high a

return as equities, the return is more predictable. The inclusion of a significant amount of long dated bonds in the portfolio also increases the duration of pension assets and so there is a reduction in the basis risk exposure of the scheme.

In providing additional finance to fund pension deficits managers face a trade-off between internal and external sources of finance. Under a Modigliani and Miller (1958) costless finance model the price of internal and external finance is equivalent. If costless finance holds, managers faced with having to pay large contributions to the firm pension scheme will opt to raise finance in the market to finance any deficit. This choice allows investment levels in the firm to remain constant as the internal resources of the firm will be unchanged. External finance however is not costless due to agency and issuance costs. Consequently, when faced with costly external finance managers will exploit the internal resources of the firm to fund pension deficits. The internal resources of the firm should therefore be negatively related to large pension contributions.

Williamson (1970) puts forward the notion that internal capital markets are more efficient than external markets as there is greater information within the firm as to the profitability of available projects. However, Rajan, Servaes and Zingales (2000) and Sharfstein and Stein (2000) suggest that internal capital allocation is not efficient in the face of divisional rent seeking by managers. As a result the internal capital allocation process becomes distorted as managers compete for a greater share of the finite resources within the firm.

The distortion of the internal capital market is a consequence of agency issues within the firm as large amounts of internal cash flow provide scope for overinvestment and empire building. In analysing internal capital markets Blanchard, Lopez-de-Silanes and Schleifer (1994) show managers retain cash windfalls from successful law suits and

undertake empire building through over-investment. While Lamont (1997) shows firms to undertake unprofitable investments in non-core businesses and cross-subsidise these investments from more profitable core divisions in the firm.

Gertner, Powers and Scharfstein (2002) analyse the asset allocation of internal capital markets after corporate spin-offs. After the spin-off low Q industries decreased investment while high Q industries increased investment. This has two implications for internal capital markets. First, prior to the spin-off the investment allocation in the firm was inefficient. Second the internal capital allocation improved after the spin-off occurred. The change in the structure of the firm therefore reduced over/under investment and agency problems within the firm, and so the efficiency of internal resource allocation can be improved.

Large contributions to fund pension schemes have been found to impact upon the internal financial resources of the firm. Rauh (2006) found that capital expenditures fall in response to large contributions to fund pension scheme deficits. For those firms that were the most constrained through lower credit ratings for example, the result was shown to be stronger.

The internal financial resources that are available to management however are not limited to capital expenditure. Another potential source of finance that managers may exploit is dividends. Much like capital expenditure dividends afford managers a high degree of discretion and for many firms they represent also substantial cash resource.

Bhattacharya (1979) and Miller and Rock (1985) argue that dividends are used as a method of conveying news to the market. Firms therefore disclose good news to the markets through dividend payments and bad news through cuts in dividends. If

dividends are exploited as a source of finance to fund pension deficits it is likely to convey negative news to the market as dividends would be reduced.

The fact that investors and markets react to changes in dividends provides and interesting situation. Myers (1984) proposes a pecking order of financing options between internal finance, debt and external equity in the presence of costly external finance. However within the firm there are a number of internal sources of finance that have unique and different characteristics. Dividends under signalling theory are unlikely to change in response to large contributions as this signals bad news to the market. Capital expenditures however offer managers more discretion and are therefore more likely to be exploited before dividends. It is possible therefore that a pecking order exists across different sources of internal capital in the firm.

6.4 Motivation and Hypotheses

Defined benefit pension schemes in the UK represent both a significant liability and risk to many of the firms who provide these benefits. As with all defined benefit schemes the liability due to employees is dependant upon the salary, length of service and age of the active employees within the scheme plus the liability due to deferred and retired participants. The funding of these liabilities is generally through a mixture of employee and employer contributions to the pension scheme. These contributions are invested in dedicated financial assets that are held in trust for the employees by the trustees of the pension scheme. In theory the returns and capital appreciation on these assets should be sufficient to provide the agreed benefits to all employees.

In practice asset and liability mis-matches are common and so the scheme will be under-funded. This occurs primarily for two reasons. First the assets that

contributions are invested in may not perform as well as expected and so the long-term returns generated are insufficient to meet the liability. Second, the experience of the scheme differs from the assumptions used to estimate the liability of the scheme and so the reality of the economic environment may be radically different from expectations. This occurs as the calculation of the pension liability is complex and requires estimates of future interest rates, inflation and mortality.

Although there is a high degree of discretion over how any funding shortfall will be addressed, there is an expectation on firms to resolve any funding concerns. As noted above, this is generally through negotiation between management and scheme trustees. Firms will however have to provide additional finance to the scheme through either large one-off contributions or through a period of higher contributions.

How pension schemes are funded should therefore be a function of the size of the pension scheme, the asset allocation and funding level of the scheme. Many firms have large pension liability exposures i.e. the liability is large relative to the size of the firm. In this case the contributions that have to be paid by the firm will comprise a greater percentage of the assets of the firm by virtue of the size of the pension liability.

H1: Pension contributions are unrelated to the size of the pension scheme

Scheme funding levels will also have a significant bearing on the contributions that are paid into the pension scheme. For pension schemes in the UK there is a 5% cap on any surplus assets that can be held in the pension scheme[67]. This cap is to prevent tax avoidance by the firm through over-funding the pension scheme. At the other end of the funding spectrum are those schemes that are severely under-funded. In such circumstances there is a regulatory expectation that the firm will fund this deficit.

[67] This 5% cap was introduced as part of the Finance Act 1986 and so the assets held in surplus cannot be greater than 5% of the total pension liability of the firm.

However, the legally imposed trigger point that exists in the US does not exist in the UK. Any additional funding of the scheme is as a result of pressure on the management from employees and pension trustees. However, it is difficult to say how the firm will choose to pay the contributions to the scheme. Managers may opt to pay a one-off special contribution to the scheme. Alternatively they may negotiate a longer time horizon and pay a series of increased payments to the scheme.

H2: Pension contributions are unrelated to scheme funding

Pension contributions are also a function of the investment strategy of the pension scheme. There are two broad categories of pension investment strategies, total return strategies and liability driven investment strategies. Total return strategies invest heavily in equities based on the assumption that over long time horizons equities will out perform long dated high quality bonds. As a result managers pay lower contributions to the scheme as the performance of the investment should offset the lower contributions. Liability driven investment strategies invest a larger proportion of pension assets in long dated bonds as opposed to equities. This strategy is based on duration matching. Changes in asset values and pension liabilities in response to interest rate changes are therefore offsetting. Liability driven investment however requires on average higher pension contributions as the returns generated from the pension assets are lower. The strategy however results in more stable funding ratios within the scheme and a more predictable pension cost.

H3: Pension contributions are unrelated to pension asset allocations

Contributions to pension schemes provide a useful environment for analysing internal capital allocation decisions within firms. Rauh (2006) for a sample of US firms showed that capital expenditures fell in response to large pension contributions. The

UK environment presents a more direct case to analyse managerial choices as the legal funding trigger that exists in the US is not present. I can therefore analyse how management choose to exploit the internal resources of the firm. Capital expenditure is an obvious resource to consider. Managers have a high degree of control over the capital expenditures of the firm and have been shown to utilise this resource in providing additional finance to the pension scheme.

H4: Capital expenditures have no relation to pension scheme contributions

Firm profitability is related to the level of capital expenditure in the firm. The internal capital allocation process within firms however has been shown to be distorted. This is due to inefficient investments occurring and so managers over-invest and undertake projects that are not shareholder wealth maximising. This is consistent with an agency view of managerial behaviour and empire building taking place. However, in the absence of such behaviours there is potential for large pension contributions to adversely affect the profitability of the firm. If the firm only undertakes shareholder wealth maximising projects any reduction in capital expenditure may lead to current investments having to be cut back or new projects being rejected. Consequently, large contributions may lead to lower profitability. Conversely, where there are agency risks and empire building the payment of large contributions to the pension scheme may reduce overinvestment in unprofitable projects and result in a higher profitability.

H5: Firm profitability is unrelated to pension scheme contributions

Dividends for many firms represent a substantial cash outlay. As such this is a potential source of finance that is available to management. If dividends are accessed to provide additional funding to the pension scheme the level of dividends paid to shareholders will fall. Cuts in dividends however are associated with conveying negative

news to the markets. It is unlikely therefore that management will choose to access this finance as it may cause a negative share price reaction. Implicitly there may be a pecking order of the internal financial resources of the firm.

H6: The level of dividends paid is unrelated to pension scheme contributions

Another potential source of funding for financing special contributions to the pension scheme is through the disposal of fixed assets. Managers again have a high degree of control over the fixed assets of the firm. However, one of the factors that contribute to firm size is the quantity of fixed assets the firm has. If managers exhibit agency behaviours firm size will be a factor that they are sensitive to as compensation and bonuses are often related to the size of the firm. Managers may therefore avoid fixed asset disposals as a way of generating cash to fund any pension deficit.

H7: Fixed Asset sales are unrelated to pension scheme contributions

6.5 Data and Methodology

My sample comprises all firms in the FTSE 350 from June 2001 until June 2004. The FTSE 350 is the index of the largest 350 corporations in the UK[68]. From this list I remove 44 listed investment trusts, 62 firms that only provide defined contribution pension benefits and 2 that do not provide any retirement benefits. My maximum sample is 284 firms per year and 1,136 firm years. The final sample however is just 536 firms. This occurs for two reasons. First a number of companies suspended listing, merged or were taken over. More importantly however, the sample period covers the transitional arrangements for FRS-17 and the disclosure of the service costs of the scheme and firm contributions data is extremely low. Although pension disclosure

[68] To avoid survivorship bias we include all firms that were listed in the index over the sample period.

improves over the sample period for pension scheme characteristics the disclosure for the financing and cost of schemes remains relatively poor over the whole sample.

FRS-17 is the new fair value accounting standard that covers pension accounting in the UK between 2001 and 2004. Under FRS-17 the different asset classes for pension asset investments, the pension liability, the return assumptions and the liability assumptions are disclosed. Pension contributions paid by the firm and the service cost of the scheme are also disclosed but the level of disclosure is significantly lower.

From this, I sum the individual asset classes to calculate the total pension assets. I calculate the gross surplus/(deficit) of the pension scheme by summing total pension assets and total pension liabilities. To characterise the pension portfolio assets, I calculate the percentage of total pension assets composed of equity. The pension liability and surplus/(deficit) variables are scaled by the total assets of the firm as the standardised measure more accurately reflects the risk that the scheme poses to the firm. For example, although a pension deficit of £50m is a large number, relative to a firm with a market capitalisation of £10bn, the amount is relatively small. However, if the market value of the firm was £100m, the deficit of the pension of the scheme would be very large, since it constitutes 50% of the firm's market value.

Following Rauh (2006) I then calculate Tobin's Q, cash flow and non-pension cash flow. Tobin's Q is simply the market-to-book ratio of firm assets where,

$$Tobin'sQ = \frac{(MarketValueofEquity + BookValueofAssets) - (BookValueofEquity + DefferredTaxes)}{BookValueofAssets}$$

The cash flow variables are based upon specifications derived in Kaplan and Zingales (1997) and Baker, Stein and Wurgler (2003). In these studies cash flow is defined as net income plus depreciation and amortization. Depreciation and

amortization are added back as they are in reality non-cash charges and so should not be removed from net income when deriving the cash flow of the firm. Rauh (2006) adjusts this calculation to incorporate the pension expense (service cost) as this is charged against income but does not reflect the true cash charge against income, namely the actual contributions. These cash flow variables are then scaled by the total assets of the firm.

$$Cashflow = NetIncome + Depreciation + Amortization + ServiceCost - Contributions$$

$$NonPensionCashflow = NetIncome + Depreciation + Amortization + ServiceCost$$

6.5.1 Descriptive Statistics

Table 6-1 presents the pooled descriptive statistics of my sample firms. In looking at the magnitude of the pension contributions it is clear that the contributions are on average greater than the cost of the scheme. This is shown by the fact that contributions to service cost is on average 1.72, firms are therefore paying more to their pension schemes than simply the estimated cost of providing the pension benefits. From Figure 6-1 it can also be seen that firms are contributing more to their pension schemes over the sample period.

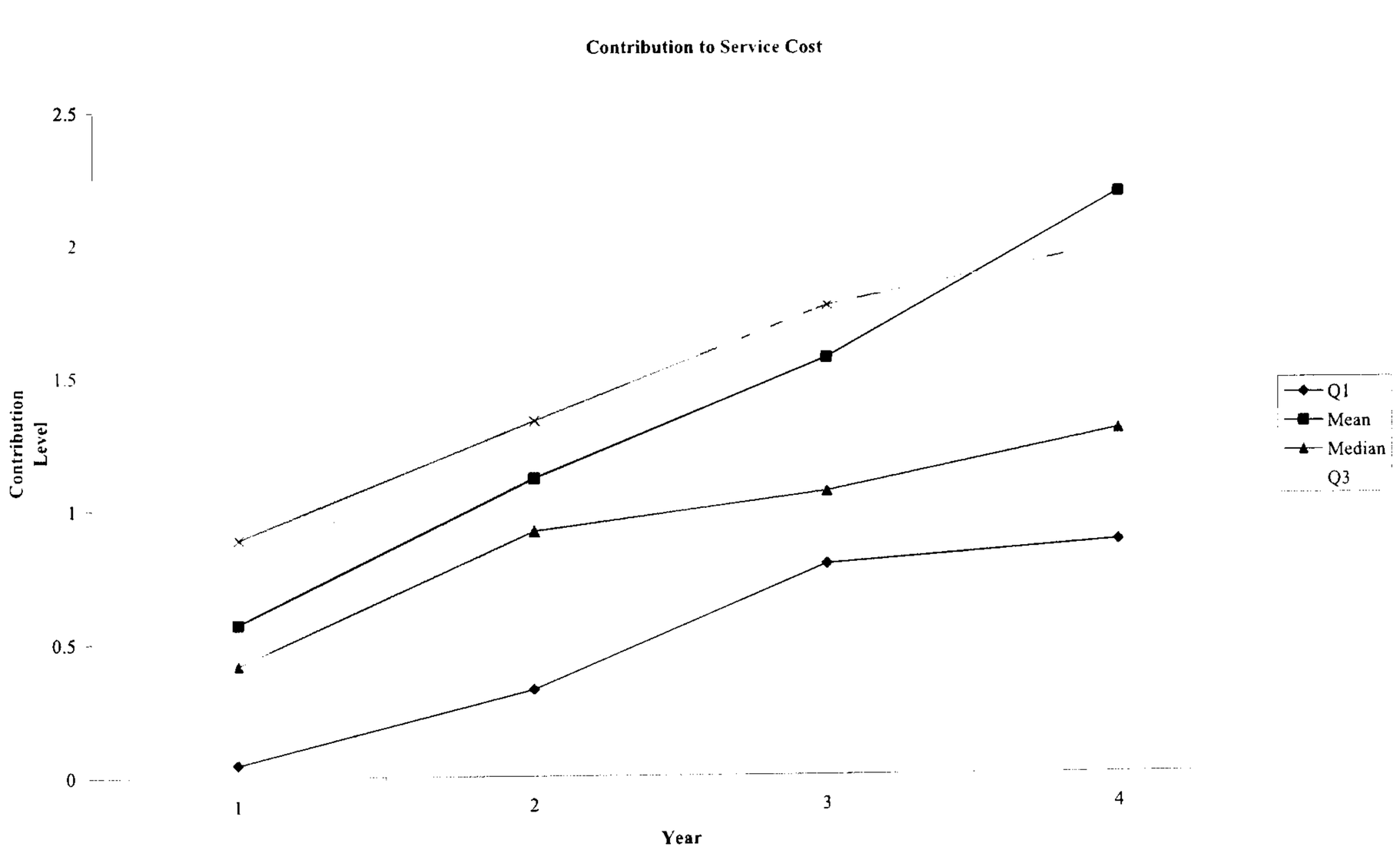
The magnitude of the contributions relative to the assets of the firm I can see that the average contribution only constitutes 1% of total assets. However, in considering the size of contributions relative to the cash flow of the firm it is clear that the contributions are not insignificant as they account for 13% of firm cash on average. From looking at the 90th percentile of the pooled sample I can see that this rises to 29% of cash flow and is therefore a considerable outlay relative to cash flow in the firm.

Table 6-1 Summary Statistics of Firm Characteristics and Pension Contributions

Table 6-1 presents pooled descriptive statistics for my sample companies over the period 2001-2004. The table presents the mean, and percentiles. The data items in the table are capital expenditure/total assets, cash flow/total assets, non-pension cash flow/total assets, contributions/service cost, contributions /total assets, contributions/cash flow, liability/total assets, pension assets/total assets, funding measured by the ratio of pension assets to pension liabilities and Tobin's Q. The final three items present the 20% of highest contributions scaled by total assets, cash flow and capital expenditure.

		Percentiles				
	Mean	10th	25th	50th	75th	90th
Capex/Assets$_{t-1}$	0.054	0.006	0.022	0.043	0.071	0.116
Cash Flow/ Assets$_{t-1}$	0.082	0.006	0.041	0.087	0.127	0.171
Non-Pension Cash Flow/ Assets$_{t-1}$	0.097	0.009	0.053	0.099	0.140	0.188
Tobin's Q	1.498	0.922	1.038	1.279	1.681	2.304
Contributions/ Assets$_{t-1}$	0.009	0.000	0.002	0.005	0.012	0.022
Contributions/Cash Flow	0.134	0.003	0.021	0.057	0.133	0.291
Liability/ Assets$_{t-1}$	0.495	0.015	0.079	0.210	0.433	0.777
Pension Assets/ Assets$_{t-1}$	0.383	0.012	0.055	0.171	0.344	0.645
Funding	0.795	0.634	0.696	0.773	0.862	0.951
Voluntary Contributions/ Assets$_{t-1}$	0.015	0.001	0.003	0.010	0.019	0.042
Voluntary Contributions/Cash Flow	0.235	0.007	0.039	0.102	0.259	0.593
Voluntary Contributions/Capex	0.037	0.000	0.001	0.003	0.008	0.012

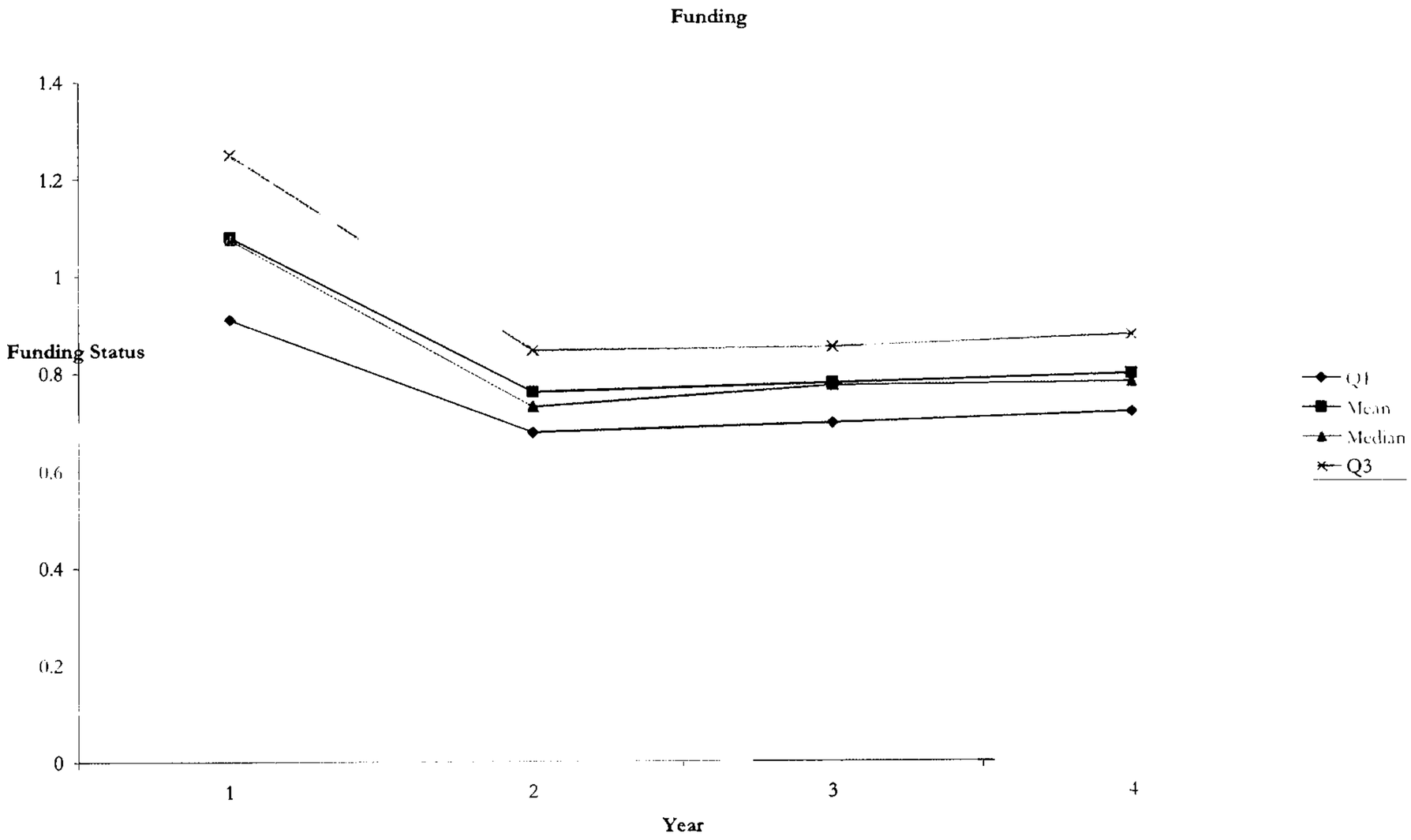
Figure 6-1 Contributions to Service Cost



The level of contributions that I find and the fact that most firms are contributing more above the cost of provision is a result of the poor levels of funding that I observe. From Table 6-1 the average level of funding, measured by the ratio of pension assets to pension liabilities, is 79%. However, when I look at the percentiles it

can be seen that there is significant variation in the funding with funding for some firms being as low as 63%. Figure 6-2 presents scheme funding over time. It is clear that the level of funding has deteriorated considerably for most firms. This is predominantly due to the declines in the stock market over the sample period.

Figure 6-2 Pension Scheme Funding Levels 2001-2004



In bringing Figure 2-1 and Figure 6-2 together it is clear that as funding has decreased across all firms the magnitude of the contributions paid has increased. Managers are therefore responding to the decreased funding in the pension schemes that they operate. This will in part be due to the clarity with which the pension liabilities and funding levels are presented in the annual report. However, there is also a regulatory requirement to address poor levels of funding and this is clearly what I observe.

Another fact that is very apparent is the size of the pension schemes firms hold relative to the firm. The average pension liability is almost half the total assets of the firm. Again I do observe a positive skew as for certain firms' this ratio is considerably

higher. From the 90th percentile I can see that the liability is 77% of total assets and so this is a significant risk to the firm, even in circumstances where funding is relatively high any deficit in such a scheme will be a considerable burden on the firm.

The final section of Table 6-1 presents the descriptive statistics of those firms that pay the highest contributions relative to the cost of the scheme. These firms are selected on the magnitude of contributions to service cost. The data was ranked on sorted on this metric and I analyse the top 20%.

Although the average for total assets to contributions is not considerably higher at 1.5% of total assets, the 90th percentile is much higher at 4% of total assets. Further, when I consider the ratio of contributions to cash flow I can see that the magnitude of the contributions that the top 20% of firms pay is significant. The average contribution to cash flow is 23% and the 90th percentile is almost 60% of cash flow.

6.6 Results

In this section, I test the hypotheses that were developed in section 6.4. Section 6.6.1 examines the relationship between pension contributions the size of the pension scheme, scheme funding and pension asset allocation. Section 6.6.2 discusses the relationship between large pension contributions and capital expenditure. The third section 6.6.3 analyses firm profitability and large pension contributions. The final section 6.6.4 investigates the impact of large contributions on other potential sources of funding from within the firm.

6.6.1 Contributions and Scheme Characteristics

The first section of my analysis tests the relationship between pension scheme characteristics and the level of contributions paid by the firm. I would expect that

where a pension scheme is large relative to the size of the firm then the contributions that have to be paid to the scheme would be large relative to the size of the firm[69].

Table 6-2 OLS Analysis of Pension Contributions and Pension Liabilities

Table 6-2 presents OLS regressions of pension contributions scaled by total assets against the liability of the firm scaled by total assets, firm size measured by the log of market value and the book to market ratio. Columns 1-3 correspond to 2002, 2003 and 2004 respectively. I exclude 2001 from the analysis as only 7 firms disclose their contributions data. The table presents the regression coefficient and immediately below in parenthesis is the corresponding t-statistic. * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Contributions $_{it}$/Total Assets$_{i,t-1}$		
	2002	**2003**	**2004**
Intercept	0.01	0.01	0.02
	(2.20)**	(2.19)**	(3.58)*
Liability/Total Assets$_{t-1}$	0.016	0.018	0.0189
	(11.28)*	(12.85)*	(9.08)*
Size	-0.0004	-0.0003	0.0016
	(-1.29)	(-0.78)	-(2.29)**
Book-to-Market	-0.002	-0.003	-0.01
	(-2.12)**	(-3.24)*	(-2.88)*

From Table 6-2 I can see that year-on-year contributions are functionally related to the size of the pension scheme. In all years there is a positive and significant relationship between contributions and the size of the firm. Further, I can see that the coefficients increase over time, this is consistent with broader experience as the contributions paid by all firms regardless of size increase over time. I can therefore reject my first null hypothesis that pension contributions are unrelated to the size of the pension liability.

Next I test the relationship between the funding level of the scheme and the contributions paid to the scheme. As with the size of the scheme my expectation would be that contributions are related to the funding of the scheme. I use the gross surplus/(deficit) of the scheme scaled by the total assets of the firm to proxy for

[69] We only analyse 2002-2004 as the disclosure in 2001 was limited with only 7 firms disclosing their contribution information. Consequently it is not possible to perform regression analysis for 2001.

funding as the more widely reported ratio of pension assets to pension liabilities does not account for the size of the scheme relative to the firm.

Further, there is no legal trigger point in the UK where firms must make mandatory contributions to fund pension deficits, unlike in the US. However, there is a regulatory expectation that firms must provide appropriate funding for their pension schemes and this includes deficit recovery contributions. In addition to this a legal cap is placed on the level of contributions that can be paid to a scheme in surplus to prevent tax avoidance through over funding. I would therefore expect a linear relationship between funding and contributions.

Table 6-3 OLS Analysis of Pension Contributions and Pension Funding

Table 6-3 presents OLS regressions of pension contributions scaled by total assets against the gross pension surplus/(deficit) of the firm scaled by total assets, firm size measured by the log of market value and the book to market ratio. Columns 1-3 correspond to 2002, 2003 and 2004 respectively. I exclude 2001 from the analysis as only 7 firms disclose their contributions data. The table presents the regression coefficient and immediately below in parenthesis is the corresponding t-statistic. * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Contributions $_{it}$/Total Assets$_{i,t-1}$		
	2002	**2003**	**2004**
Intercept	0.01	0.004	0.02
	(3.24)*	(1.01)	(2.56)**
Surplus/Total Assets$_{t-1}$	-0.04	-0.09	-0.09
	(-4.06)*	(-8.55)*	(-7.24)*
Size	-0.0001	-0.00	-0.001
	(-1.83)***	(-0.01)	(-1.34)
Book-to-Market	-0.005	-0.004	-0.004
	(-2.62)**	(-0.33)	(-1.80)***

From Table 6-3 it is clear that lower levels of funding are associated with higher levels of contributions. In all years there is a significant and negative relationship between the level of funding and the contributions paid to the scheme. Again I can see that over time as the funding levels of schemes deteriorate the level of contributions paid increases. This is again consistent with broader experience. I can therefore reject my second null hypothesis that contributions are unrelated to the funding level of the scheme.

Finally I consider the relationship between the level of contributions paid to the scheme and the investment strategy of the pension scheme. As noted above there are broadly two types of investment strategy that are implemented, total return strategies and liability driven investment strategies. Total return strategies are typified by large allocations to equity. I therefore test the relationship between contributions and the percentage of equity investment in the pension portfolio.

Table 6-4 OLS Analysis of Pension Contributions and Pension Asset Allocation

Table 6-4 presents OLS regressions of pension contributions scaled by total assets against the composition of the pension portfolio measured by the percentage of equity, firm size measured by the log of market value and the book to market ratio. Columns 1-3 correspond to 2002, 2003 and 2004 respectively. I exclude 2001 from the analysis as only 7 firms disclose their contributions data. The table presents the regression coefficient and immediately below in parenthesis is the corresponding t-statistic. * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	$Contributions_{it}/Total\ Assets_{i,t-1}$		
	2002	**2003**	**2004**
Intercept	0.03	0.03	0.05
	(5.46)*	(5.51)*	(5.68)*
Equity Percentage	-0.011	-0.014	-0.009
	(-2.35)**	(2.63)**	(-1.26)
Size	-0.001	-0.001	-0.003
	(-2.92)*	(-3.08)*	-(4.19)*
Book-to-Market	-0.007	-0.004	-0.01
	(-4.16)*	(-2.49)**	(-2.99)*

Table 6-4 presents the results of this analysis. I can see that for both 2002 and 2003 there is a significant and negative relationship between pension contributions and the percentage of pension assets invested in equity. For the final year (2004) the direction of the relationship remains the same as in the earlier years, however, the relationship is no longer significant and the magnitude of the coefficient is slightly smaller. I can still therefore reject my null hypothesis in 2 out of 3 cases. This finding is interesting however, as the funding pattern I observe over time shows that all firms increase the levels of contributions to their scheme regardless of funding and this may provide an explanation as to why the significance of the relationship changes over time.

6.6.2 Contributions and Firm Capital Expenditures

The next part of my analysis considers the relationship between the capital expenditures of the firm and contributions. Rauh (2006) documented that large mandatory contributions are related to falls in capital expenditures in the US. Based on the methodology employed by Rauh (2006) I analyse this relationship for the UK.

Table 6-5 presents the relationships between contributions, cash flow and capital expenditure. Regression 1(a) is a standard analysis of capital expenditures, cash flow and the unobserved investment opportunities of the firm (measured by Tobin's Q). Consistent with expectations I can see that capital expenditures are positively related to both the level of cash within the firm and the investment opportunities of the firm. Regression 1(b) introduces the Rauh (2006) non-pension cash flow variable. Again consistent with expectations I find that higher levels of capital expenditure are associated with increased levels of non-pension cash flow.

Regression 1(c) includes my interactive dummy variable that captures the top quintile of contributions paid by firms. Consistent with Rauh (2006) I find that these firms have significantly lower capital expenditures. Based upon the point estimate of the coefficient for a £1 increase in contributions to the pension scheme there is a concomitant £0.31 decrease in capital expenditures. This finding is therefore not only statistically significant but economically significant also.

Table 6-5 Pooled Regressions of Capital Expenditure against Pension and Non-Pension Cash Flows

Table 6-5 presents regression results from my pooled regressions of capital expenditures scaled by the total assets of the firm. The explanatory variables are presented in the far left column of the table. Contributions are the cash contributions paid to the pension by the firm. Cash flow is the amount of free cash flow in the firm, Non-pension cash flow is the Rauh (2006) non-pension cash flow, Voluntary Contributions is in an interactive dummy variable that takes the value of 1 if the contributions of the firm scaled by total assets is in the top quintile of pension contributions relative to the size of the firm. Q is Tobin's Q and funding is the ratio of pension assets to pension liabilities. * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Dependant Variable: Capital Expenditure$_{it}$/Total Assets$_{i,t-1}$							
	(1a)	**(1b)**	**(1c)**	**(1d)**	**(2a)**	**(2b)**	**(2c)**	**(2d)**
Intercept	0.037	0.036	0.036	0.034	0.038	0.038	0.037	0.035
	(8.28)*	(8.01)*	(8.31)*	(7.62)*	(2.77)*	(2.83)*	(2.71)*	(2.58)**
Cash Flow/Assets$_{t-1}$	0.064							
	(4.35)*							
Non-pension Cash Flow/ Assets$_{t-1}$		0.158	0.162	0.150	0.111	0.157	0.161	0.148
		(6.09)*	(6.40)*	(5.73)*	(4.84)*	(5.97)*	(6.27)*	(5.62)*
Voluntary Contributions/Assets$_{t-1}$			-0.305	-0.612			-0.31	-0.612
			(-1.66)***	(-2.48)**			(-1.66)***	(-2.47)*
Contributions/Assets$_{t-1}$		0. 384		0.390		0.40		0.390
		(0.25)		(1.85)***		(0.25)		(1.85)**
$Q_{i,t-1}$	0.008	0.002	0.001	0.002	0.004	0.002	0.002	0.002
	(2.83)*	(0.55)	(0.68)	(0.77)	(1.38)	(0.56)	(0.71)	(0.80)
Funding					-0.006	-0.003	-0.0003	-0.001
					(-0.10)	(-0.18)	(-0.02)	-0.04

Regressions 2(a)–2(d) introduce a control for the funding level of the pension scheme measured by the ratio of pension assets to pension liabilities. The results show that even after controlling for the unobserved investment opportunities of the firm and the level of funding in the pension scheme higher levels of non-pension cash flow are associated with increased capital expenditures in the firm. The regression coefficient is broadly similar under all specifications and so for every £1 increase in non-pension cash flow capital expenditures increase by £0.15.

From regression 2(d) I can see that after controlling for the level of funding in the scheme that the effect of large contributions to the scheme on capital expenditures is even stronger. Based upon the regression coefficients I find that for every £1 paid to the pension scheme in large voluntary contributions capital expenditures fall by around £0.61. Based upon this analysis I can therefore reject of null that capital expenditures are unrelated to the contributions paid to the pension scheme.

6.6.3 Contributions and Firm Profitability

I extend the analysis of Rauh (2006) by considering the relationship between large contributions and the profitability of the firm. There are a number of reasons for considering this relationship. One of the key drivers of firm profitability is the level of capital expenditure within the firm. If managers only make shareholder wealth maximising investments then large contributions to the pension scheme will reduce capital expenditure. In such circumstances this would be detrimental to shareholder wealth as potentially profitable projects are forgone. However, the internal capital allocation process has been shown to be distorted as a result of divisional rent seeking by managers. Consequently, as a result of agency costs and over investment through empire building the process of resource allocation and investment within the firm may

be inefficient. The payment of large contributions may therefore reduce the level of free cash flow and reduce the level of empire building.

Table 6-6 presents the results of my analysis of large contributions and firm profitability. My main finding is that those firms that make large contributions to their pension scheme have higher profitability. I measure firm profitability as the ratio of cash flow to sales. From the results presented in Table 6-6 I can also see that higher levels of non-pension cash flow are associated with higher profitability. This, however, may be due in part to the cash flow component of my dependent variable. If I look at the contributions to total assets and voluntary contributions I find that there is a significant and negative effect between cash flow to sales and contributions to total assets. However, for those firms making the highest contributions to the pension scheme there is a significant and positive relationship. I can therefore reject my null that firm profitability is unrelated to pension contributions.

Table 6-6 Pooled Regressions of Firm Profitability against Pension and Non-Pension Cash Flows

Table 6-6 presents regression results from my pooled regressions of capital expenditures scaled by the total assets of the firm. The explanatory variables are presented in the far left column of the table. Contributions are the cash contributions paid to the pension by the firm. Cash flow is the amount of free cash flow in the firm, Non-pension cash flow is the Rauh (2006) non pension cash flow, Voluntary Contributions is in an interactive dummy variable that takes the value of 1 if the contributions of the firm scaled by total assets is in the top quintile of pension contributions relative to the size of the firm. Q is Tobin's Q and funding is the ratio of pension assets to pension liabilities. * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Cash Flow/Sales							
	(1a)	**(1b)**	**(1c)**	**(1d)**	**(2a)**	**(2b)**	**(2c)**	**(2d)**
Intercept	-0.02	-0.01	-0.02	-0.01	0.02	0.02	0.02	0.03
	(-2.13)*	(-1.73)*	(-2.15)**	(-1.35)	(0.75)	(0.76)	(0.81)	(1.04)
Cash Flow/Assets$_{t-1}$	0.03							
	(0.90)							
Non-pension Cash Flow/ Assets$_{t-1}$		0.14	0.12	0.16	0.11	0.14	0.11	0.16
		(2.85)*	(2.42)**	(3.20)*	(2.48)**	(2.79)*	(2.37)|**	(3.14)*
Voluntary Contributions/Assets$_{t-1}$			0.22	1.26			0.27	1.31
			(0.63)	(2.68)**			(0.76)	(2.77)**
Contributions/Assets$_{t-1}$		-0.60		-1.32		-0.57		-1.31
		(-2.00)**		(-3.29)*		(-1.91)***		(-3.28)*
$Q_{i,t-1}$	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00
	(2.41)**	(1.13)	(1.04)	(0.91)	(0.97)	(0.92)	(0.79)	(0.67)
Funding					-0.04	-0.04	-0.05	-0.05
					(-1.53)	(-1.42)	(-1.60)	(-1.59)

In bringing the results of Table 6-5 together with Table 6-6 those firms that make the highest contributions to the pension scheme have lower capital expenditure and increased profitability. This finding is consistent with the agency theory of internal capital allocation. The large contributions to the pension scheme may therefore be reducing overinvestment and empire building in the firm through the reduction of free cash flow.

6.6.4 Contributions and Other Sources of Financing

The final part of my analysis considers other potential sources of internal financing that the managers of the firm may choose to utilise when paying large contributions to the pension scheme. Although the main focus of the research thus far has been on capital expenditures, there are a number of other sources of internal cash flow that management may be able to exploit when having to pay large contributions to the pension scheme.

Table 6-7 Pooled Regressions of Dividends against Pension and Non-Pension Cash Flows

Table 6-7 presents regression results from my pooled regressions of total dividends scaled by the total assets of the firm. The explanatory variables are presented in the far left column of the table. Contributions are the cash contributions paid to the pension by the firm. Non-pension cash flow is the Rauh (2006) non-pension cash flow. Voluntary Contributions is in an interactive dummy variable that takes the value of 1 if the contributions of the firm scaled by total assets is in the top quintile of pension contributions relative to the size of the firm. Q is Tobin's Q and funding is the ratio of pension assets to pension liabilities. * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Dividends/Assets$_{t-1}$			
Intercept	-0.003	-0.004	-0.003	-0.004
	(-0.81)	(-0.87)	(-0.72)	(-0.82)
Contributions/Assets$_{t-1}$		0.080		0.060
		(1.60)		(0.98)
Non-pension Cash Flow/ Assets$_{t-1}$	0.060	0.066	0.068	0.066
	(7.89)*	(7.29)*	(7.82)*	(7.27)*
Voluntary Contributions/Assets$_{t-1}$			0.080	0.029
			(1.31)	(0.36)
$Q_{i,t-1}$	0.020	0.017	0.017	0.017
	(16.64)*	(15.96)*	(15.79)*	(15.82)*
Funding	0.004	0.000	0.000	0.000
	(0.09)	(0.02)	(-0.04)	(-0.01)

Table 6-7 presents my analysis of dividends and contributions. I consider dividends in detail as they represent a large cash resource within the firm that managers have a high degree of discretion over. My results show that there is no relationship between dividends and large pension contributions. This result is unsurprising as dividends have been shown to be a signalling device (Miller and Rock (1985), Battacharya (1979)). If dividends were lower as a result of paying large contributions to the pension scheme it is conceivable that this could be interpreted as a very negative signal and so it is unsurprising that no relationship was found. The table also shows that dividends are significantly higher where there are higher levels of non-pension cash flow and levels of Q. The funding of the pension scheme was also found to be unrelated to the dividends in the firm. I cannot therefore reject my null that there is no relation between contributions and dividends.

Table 6-8 Pooled Regressions of Disposals against Pension and Non-Pension Cash Flows

Table 6-8 presents regression results from my pooled regressions of asset disposals scaled by the cash flow of the firm. The explanatory variables are presented in the far left column of the table. Contributions are the cash contributions paid to the pension by the firm. Non-pension cash flow is the Rauh (2006) non-pension cash flow. Voluntary Contributions is in an interactive dummy variable that takes the value of 1 if the contributions of the firm scaled by total assets is in the top quintile of pension contributions relative to the size of the firm. Q is Tobin's Q and funding is the ratio of pension assets to pension liabilities. * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Disposals/Cash Flow			
Intercept	2.71	2.71	2.71	2.72
	(1.79)***	(1.79)***	(1.78)***	(1.79)***
Contributions/Assets$_{t-1}$		-0.96		-1.94
		(-0.06)		(-0.09)
Non-pension Cash Flow/ Assets$_{t-1}$	-2.83	-3.58	-3.62	-3.56
	(-1.14)	(-1.23)	(-1.26)	(-1.21)
Voluntary Contributions/Assets$_{t-1}$			0.19	1.71
			(0.01)	(0.06)
$Q_{i,t-1}$	-0.53	-0.50	-0.49	-0.50
	(-1.61)	(-1.47)	(-1.46)	(-1.46)
Funding	-1.15	-1.12	-1.13	-1.13
	(-0.67)	(-0.65)	(-0.66)	(-0.65)

Table 6-8 presents my analysis of asset disposals. As with dividends managers exercise a high level of control over the disposal of assets. It is feasible that managers

may dispose of assets to create income to fund the pension scheme. However, as with dividends I find no relationship between asset disposals and the magnitude of the pension contributions. I cannot therefore reject my null hypothesis that asset disposals are unrelated to large contributions to the pension scheme.

For completeness I also consider a range of other factors that were analysed in Rauh (2006). I test R&D, changes in the level of debt in the firm, trade credit and working capital. Table 6-9 presents the results of this final analysis. On the whole these other factors are unrelated to large pension contributions. Consistent with expectations however, firms with large levels of non-pension cash flow have lower R&D, lower changes in the level of debt in the firm and higher levels of working capital.

Table 6-9 Pooled Regressions of R&D and Financing against Pension and Non-Pension Cash Flows

Table 6-9 presents regression results from my pooled regressions of research and development, changes in the debt of the firm, trade credit and the working capital of firm scaled by the total assets of the firm. The dependent variables are presented in the far left column of the table. Non-pension cash flow is the Rauh (2006) non-pension cash flow Total Contributions are the cash contributions paid to the pension by the firm. Voluntary Contributions is in an interactive dummy variable that takes the value of 1 if the contributions of the firm scaled by total assets is in the top quintile of pension contributions relative to the size of the firm. Q_{t-1} is Tobin's Q and funding is the ratio of pension assets to pension liabilities. * indicates significance at 99% and **indicates significance at 95% and *** indicates significance at 90%.

	Explanatory Variables					
	Intercept	**Non-Pension Cash Flow**	**Total Contributions**	**Voluntary Contributions**	**Q_{t-1}**	**Funding**
R&D	-0.009	-0.062	0.336	-0.016	0.027	-0.011
	(-0.60)	(-2.41)**	(1.20)	(-0.05)	(10.23)*	(-0.77)
ΔDebt	0.579	-0.431	-0.925	0.962	0.042	0.069
	(9.34)*	(-3.53)*	(-1.02)	(0.88)	(2.89)*	(0.99)
Trade Credit	0.013	0.060	-0.941	0.499	-0.046	-0.005
	(0.40)	(0.98)	(-2.00)**	(0.92)	(-6.43)*	(-0.13)
Working Capital	0.168	0.340	-1.950	1.909	-0.011	-0.118
	(2.46)*	(2.71)*	(-2.03)**	(1.73)***	(-0.76)	(-1.53)

6.7 Summary

This chapter analyses the relationship between pension contributions, capital expenditure and firm profitability. I show that where firms make large contributions to their pension scheme capital expenditures are lower. My results suggest that after controlling for the level of funding in the scheme a £1.00 increase in contributions lowers capital expenditures by approximately £0.22. The economic impact of these contributions on firm capital expenditure is significant. However, I also find that these firms have higher levels of profitability. This suggests that where large contributions are paid to fund the pension scheme there is a reduction in over-investment and empire building within the firm.

Pension contributions are also shown to be functionally related to the size of the pension scheme, scheme funding and the asset allocation strategy of the scheme. Interestingly I find that for the final year of my sample the significance of the asset allocation strategy disappears. Over the sample period I also find that there is an increase in the level of contributions paid to schemes.

I also consider other sources of internal finance that are available to managers to finance the contributions to the scheme. In particular I consider dividends and asset disposals. For dividends I find that there is no relationship between dividends and the level of contributions paid to the scheme. Again for asset disposals I find that there is no relationship with pension contributions.

7
CONCLUSIONS AND IMPLICATIONS FOR FUTURE RESEARCH

7.1 Introduction

How incomes are provided in retirement and the associated costs and risks of doing so is one of the most important challenges facing both the government and corporations in the UK. Further, it is the objective of the government to increase the level of provision by the private sector and thereby corporations. Consequently, the impact and cost of provision on firms is of interest not only to academics but also regulators and practitioners. Utilising newly available data on pension accounting disclosures this study has attempted to analyse how defined benefit pension provision relates to the firm.

This chapter will present a summary and overview of the main findings of the empirical analysis that was undertaken in the preceding chapters. In addition the chapter will discuss the strengths and weaknesses in the existing study as well as suggesting areas for future research. It should also be noted that this thesis does not have a stand alone literature review, this occurs for two reasons. First, the literature on pensions specifically does not sit well within this analysis as it is concerned with, behavioural finance, choice in retirement, stochastic mortality, annuities etc. Second, I analyse three very distinct aspects of the problem and so to include the relevant literatures for each topic in one chapter would have been disjointed. The rest of the chapter is organised as follows. Section 7.2 restates the motivations and the context of

the research. Section 7.3 presents and discusses the findings of the analysis. Section 7.4 discusses the strengths and weaknesses of the current research and also proposes a number of areas for future research.

7.2 Research Background and Objectives

As noted above the provision of retirement incomes for citizens is one of the biggest economic challenges in the 21st century. A mixture of improved standards of living and rapid increases in medical technology has dramatically increased the life expectancy of individuals. Consequently, the cost and uncertainty associated with providing pensions has increased dramatically over the past 50 years and in particular over the past decade. In tandem with this the move to shift the burden of provision away from the state towards the private sector increasingly places these risks on corporations. This thesis contributes to the extant literature on pensions through analysing three key areas, namely pension accounting; pension risk and firm risk; and pension plan funding and firm investment.

How firms account for their pensions is extremely important. From a regulatory point of view the objective of accounting standards is that firms should present a 'true and fair' view of the corporation in financial reports. However, this is an important goal for users of financial accounts, as it allows investors to assess the risks of the firm both cross-sectionally and through time. The clear and consistent application of the accounting standards is also important for employees and trustees of the scheme as they can analyse the security of the benefits that they have been promised.

This study is, to the best of my knowledge, the first to analyse the way in which managers have adopted the new fair value accounting standard for pension accounting,

FRS-17. I consider a number of different facets that allow for a comprehensive analysis of UK pension accounting. The study considers the cross-sectional variation across firms, auditors and actuaries. Further, I test the determinants of the assumptions and finally, the value relevance of the accounting disclosures to assess whether the accounting amounts are incorporated into stock prices.

I also put forward a methodological refinement for analysing pension accounting through the construction of more appropriate estimators of pension accounting manipulations. Prior studies such as Bergstresser *et al* (2006) only consider absolute assumptions e.g. the expected return on plan assets. However, these do not capture the full effect of any manipulation. I attempt to create better proxies for manipulation through the application of spread variables as they reflect the 'true' manipulation.

The second part of my analysis considers risk and market efficiency. In an efficient market measures of systematic risk will reflect the underlying risk of the pension scheme. However, there are a number of reasons that this may not be the case. First, pensions in many respects are considered to be off-balance sheet and so may therefore be 'unobservable' in the market. Second as noted by Jin *et al* (2005) pension accounting is opaque and so the market may not be able to see through the veil of pension accounting.

Further how management address these risks is of considerable interest. Faced with large risks management have two options. First, they can undertake risk management. Second, they can engage in asset substitution through investing in riskier projects in the hope that, the risky project, if successful will result in a much larger pay-off.

I therefore analyse if the market prices the different components of pension risk. My analysis looks at the relationship between systematic risk factors and the different types of pension risk. In an extension of Jin *et al* (2006) I also consider the Fama-French (1993) size and value risk factors. I also examine measures of operational and financial risk within the firm and whether I observe risk shifting or risk management of pension risks within the firm.

My final research area is on the cost of pension provision and the internal capital allocation process within the firm. The cost of funding and providing benefits is significant. In addition to this the firm has limited financial resources with which to fund any shortfalls in the scheme. Consequently, if the funding of large shortfalls results in lower firm wide investment then the profitability of the firm may be reduced.

This study therefore analyses the relationship between contributions to fund pension deficits and internal capital markets. In an extension of Rauh (2006) I consider a range of internal sources of finance that management may utilise to fund the scheme. Further I also consider the impact on firm profitability as changes in the internal capital resources of the firm may result in changes to corporate investment strategies and thereby profitability.

7.3 Summary of Main Findings

In undertaking an in depth analysis of the impact of pensions on firms 7 different chapters are included in this thesis. The first chapter introduced the topic highlighting why pensions research is important and also identified the three main research areas that the subsequent analysis covered. Chapter 2 discusses in detail the evolution of pension accounting in the UK. The Chapter also provides an overview of the many

complexities that are faced when accounting for pensions. Chapter 3 presents and summarised the data that would be used in the proceeding empirical chapters. In addition the chapter also discusses some of the issues associated with the collection and creation of the variables that are used in the subsequent empirical analysis. The next three chapters present my empirical analysis of pension accounting, risk and investment. The proceeding sections of this chapter highlight the key findings from each of these chapters.

7.3.1 Pension Accounting

In the first empirical chapter I analyse how the new Accounting Standard for pension accounting, FRS-17, has been implemented. In particular I document the firm level cross-sectional variation in the different assumptions that are being applied. Second I consider the role of both the auditor and the actuary in the choice of assumption. Third I then analyse the determinants of the choice of assumption across firms. Finally, I test whether the accounting amounts that are presented in the financial reports are value relevant.

My findings can be summarised as follows. I find that the observed cross-sectional variation in assumptions across firms cannot be explained by the identity of either the auditor or actuary of the firm. Further, I find that the assumptions that are disclosed are on the whole significantly different from expectations. I present evidence that the choice of assumption is a function of the asset composition of the pension portfolio and funding of the pension scheme. Last I show that the accounting amounts that are presented in the annual reports are value relevant and so the introduction of fair value accounting has resulted in accounting amounts that are impounded into share prices. However, the variation in assumptions that is observed shows that management

utilise the discretion afforded to them under the standard preventing a consistent picture of the pension.

7.3.2 Pensions Risk and Market Efficiency

In the second empirical chapter I analyse the relationship between measures of firm risk and the underlying pension scheme. First I analyse whether measures of systematic risk reflect the underlying risks of the pension scheme. Second I analysed the relationship between pension risk, operational and financial risk within the firm and the probability of default. Finally, I tested whether I observe risk management or risk shifting in response to pension risk.

My results can be summarised as follows. First, measures of systematic risk reflect the size of the pension liability, the level of funding in the scheme and the asset allocation. Further, I find that the size and value loading factors from the Fama-French (1993) 3 factor model also reflect the risks of the pension scheme.

In looking at operating risk, financial risk and probability of default I find that higher measures of risk are associated with larger pension liabilities and poor levels of scheme funding. For my analysis of risk shifting and risk management I find evidence of risk management by firms that have higher levels of operating risk and financial risk. However, I find no evidence of risk management or risk shifting in response to increased default risk.

7.3.3 Pension Contributions, Internal Capital Markets and Firm Profitability

The final part of my empirical analysis in Chapter 6 considers the relationship between pension contributions, firm investment and profitability. I firstly analyse the relationship between capital expenditures and large pension contributions. Second I

examine other potential sources of finance that managers may utilise, namely dividends and asset disposals. Third I analyse the impact of contributions on profitability. Last I examine a range of other potential sources of internal capital that may be used by management to fund large contributions to the pension scheme of the firm.

My results can be summarised as follows. First, I show that the contributions paid to the scheme are a function of the size of the pension scheme, the level of funding and the asset allocation of the scheme. Further, consistent with Rauh (2006), capital expenditures fall in response to large pension contributions. In addition to this I find that the level of dividends paid and asset turnover within the firm are unaffected by large contributions to the pension scheme. Finally, I find that the profitability of those firms that pay the largest contributions is higher. This is consistent with a reduction in agency costs within the firm as there is a more efficient use of firm assets and a reduction in over investment within the firm.

7.4 Constraints of the Current Study and Further Research Directions

Utilising the newly available FRS-17 disclosures of the largest corporations in the UK this study has contributed to the existing understanding of how the provision of employee pension schemes relate to the firm. The findings of the thesis contribute towards the extant research in pensions, accounting, market efficiency and risk and corporate finance and investment. In addition the thesis presents a different perspective on all of these relationships, as the majority of research in this area is dominated by US research.

Although there are a number of strengths in the research contained in the thesis there are also a number of weaknesses that must be considered when assessing the results of the current analysis.

First, the analysis is constrained by a small sample. The data only spans four years and even in the largest firms the level of disclosure is inconsistent. In particular the contributions data is particularly poor and this potentially could have some bearing on my findings.

Second many of the relationships that I discuss are complex and the immediate intuition of the results is not always self evident. There are a wide range of factors that may influence my findings that I cannot control for or take account of such as stochastic mortality and scheme specific experience. Further, I also cannot observe how many of the complex accounting variables have been arrived at such as the pension liability.

Underpinning the preceding analysis a number of assumptions have been made. The first is that I have assumed that markets are both imperfect and incomplete. In doing so this means that the pension and all the associated risks, costs and benefits are relevant to management. Implicitly management must address the risks of the pension such as a deficit in funding as there is no insurance contract that can be purchased to hedge pension risks. In assuming imperfect markets management must fund the scheme from firm assets, as external and internal finance are not equivalent as a result of informational asymmetries, taxes and issuance costs.

Again, another assumption is that management are motivated to address these risks either because they are in the scheme, although we cannot distinguish where this is the case, or because of labour market implications and employee relations. Management may use the pension scheme as a recruitment and retention tool. One example where

this is actually the case in practice is in accountancy, Baker Tilly, a large UK accounting firm, are the only big accountancy firm to provide an open defined benefits scheme, all other firms, including the Big Four, only offer defined contributions. Baker Tilly utilise these generous benefits as part of their recruitment strategy.

Two other considerations are funding requirements and tax. Funding and deficit recovery over my sample period was essentially through negotiation between trustees and management. However, OPRA, the regulator monitored this situation to ensure that firms were meeting their pension obligations and addressing any substantial shortfalls. This is very distinct to the US system where there is a legal trigger point, and if funding falls below this level the US regulator ensures that firms provide deficit recovery.

Finally, tax is a complex issue and throughout my analysis I have assumed that the competing tax incentives of underfunding and overfunding the pension scheme are secondary to issues with respect to managerial decision making. The preceding analysis assumes that factors such as the costs of providing the scheme, asset allocation, risk management and corporate strategy have a stronger impact on managerial decision making. Although the tax issue is of considerable interest it is out with the scope of this thesis, however, it is an area that merits further research in the future.

In undertaking the analysis it is also clear that there are a number of future research topics in this area. First in pension accounting I imply a relationship between other financial income, asset return assumptions and the composition of the pension portfolio. I do not however explicitly test this relationship. This is in part due to a lack of data as the persistence of this relationship would be of considerable interest. Further, to relate the manipulation of the pension scheme to wider accounting manipulations

within the firm would be a significant extension of the research I have already carried out.

Further, recent accounting disclosure under International Accounting Standard 19 (IAS-19) has provided some limited data on the mortality assumptions underlying the calculation of the pension liability. An analysis of this disclosure would be of great interest to both academics and practitioners.

More widely there is a growing desire to create derivatives that can hedge stochastic mortality. Research in this area is very limited and has to date focused on catastrophe bonds and mortality swaps. To consider a wider range of mortality derivatives is an interesting direction for future research in pensions.

While there are a wide range of insights that can be gained from future research in the areas noted above, it is believed that the analysis and findings in this study provide a number of valuable insights and contributions to the extant literature. With the adoption of International Financial Reporting Standards across a large part of Europe it is hoped that a wider cross-country analysis will be undertaken in the future to provide greater understanding and context to the findings presented in this thesis.

BIBILIOGRAPHY

Amir, E. and S. Benartzi (1998) 'The expected rate of return on pension assets and asset allocation as predictors of portfolio performance' *The Accounting Review*, No. 3, pp. 335-352

Andrade D. and S. N., Kaplan (1998) 'How Costly is Financial (Not Economic) Distress? Evidence from Highly Leveraged Transactions That Became Distressed', *Journal of Finance*, No. 5, pp. 1443-1493

Almeida, H., M., Campello, and M. S., Weisbach (2004) 'The cash flow sensitivity of cash', *Journal of Finance* 59, 1777–1804

ASB (2000) Financial Reporting Standard 17: Retirement Benefits, London: Accounting Standards Board

ASB (1988) Statement of Standard Accounting Practice 24, London: Accounting Standards Board

Baglati, B. H., (2005) 'Econometric Analysis of Panel Data' 3rd Edition, John Wiley and Sons

Baker, M., J. C., Stein and J., Wurgler (2003) 'When Does the Market Matter? Stock Prices and the Investment of Equity Dependent-Firms' *Quarterly Journal of Economics*, 118 pp. 969-1005

Barth, M., W. H., Beaver and W. R., Landsman (1993) 'A Structural Analysis of Pension Disclosures under SFAS-87 and Their Relation to Share Prices' *Financial Analyst Journal*, 1 pp.18-26

Bergstresser D., M.., Desai, and J., Rauh (2006) 'Earnings Manipulation, Pension Assumptions and Managerial Investment Decisions' *Quarterly Journal of Economics*, No. 1, pp. 157-195

Bhattacharya, S., (1979) 'Imperfect Information, Dividend Policy, and "The Bird in the Hand" Fallacy', *The Bell Journal of Economics*, No. 1, pp. 259-270

Black F., (1980) 'The Tax Consequences of Long-run Pension Policy' *Financial Analysts Journal*, No. 5, pp. 21-28

Blanchard, O. J., F., Lopez-de-Silanes, and A., Shleifer, (1994) 'What do firms do with cash windfalls?' *Journal of Financial Economics*, No.36, pp. 337–360

Bodie, Z., J. O., Light, R., Morck and R.. A.., Taggart, (1987) 'Funding and Asset Allocation in Corporate Pension Plans: An Empirical Investigation' in *Issues in Pension Economics*, Z. Bodie, J. Shoven, and D. Wise, eds., Chicago, University of Chicago Press

Bodie, Z., (1990) 'The ABO, the PBO, and pension investment policy' *Financial Analysts Journal*, No. 46, pp. 27–34

Bodie, Z., A., Kane and A. J., Marcus (2002) 'Investments' 5th Edition, Mcgraw Hill

Brealy, R., and S., Myers (2000) 'Principles of Corporate Finance' 6th Edition, Mcgraw Hill

Bulow, J., and M., Scholes, (1983) 'Who Owns the Assets in a Defined-Benefit Pension Plan?' in *Financial Aspects of the U.S. Pension System*, Z. Bodie and J. Shoven, eds., Chicago, University of Chicago Press

Bozewicz, J., (2004) 'Changes Ahead: Pension Liabilities and New Discount Rate Assumptions.' *AFP Exchange*, No. 2 pp. 36-38

Campbell, J., and L., Viceira, (2005) 'Strategic Asset Allocation for Pension Plans' prepared for the *Oxford Handbook of Pensions and Retirement Income*

Carrol, T., and G., Niehaus, (1998) 'Pension Plan Funding and Corporate Debt Ratings' *Journal of Risk and Insurance*, No. 3, pp. 427-443

Case K. E., J. M., Quigley and R.., Shiller, (2005) 'Comparing Wealth Effects: The Stock Market versus the Housing Market' *The B.E. Journal of Macroeconomics*, No. 1,

Cocco J., and P., Volpin (2007) 'Corporate Governance of Pension Plans: The UK Evidence' *Financial Analysts Journal*, No. 1, pp. 70-83

Cooper S., G., Sutherland, Z., Deng, and P., Suozzo (2001) 'Pension Obligations: Accounting and Valuation Implications' UBS Equity Research, London: UBS

Coronado J., and S., Sharpe, (2003) 'Did Pension Plan Accounting Contribute to a Stock Market Bubble?' *Brookings Papers on Economic Activity*, No. 1, pp. 323-371

Dimson, E., (1979) 'Risk Measurement when Shares are Subject to Infrequent Trading' *Journal of Financial Economics*, No. 2 pp. 197-226

Easterbrook, F. H., (1984) 'Two Agency-Cost Explanations of Dividends' *The American Economic Review*, No. 4, pp. 650-659

Fabbozzi F. J., (2006) 'Fixed Income Analysis' *CFA Institute*, Frank J. Fabbozzi Associates

Fama E. F., and K. French, (1992) 'The Cross-Section of Expected Stock Returns' *Journal of Finance*, No.2, pp. 427-465

Fama E. F., and K. French, (1993) 'Common Risk Factors in the Returns on Stocks and Bonds' *Journal of Financial Economics*, No.1, pp. 3-56

Fama E. F., and K. French, (2007) 'Migration' *Financial Analysts Journal*, No. 3, pp. 48-58

Gertner, R., E., Powers, and D., Scharfstein, (2002) 'Learning about internal capital markets from corporate spin-offs' *Journal of Finance*, No. 57, pp. 2479–2506

Gold J., (2003) 'Accounting/Actuarial Bias Enables Equity Investment by Defined Benefit Pension Plans' *Working Paper.*

Grant C.T., G., H., Grant, and W. R., Ortega, (2007) 'FASB's quick fix for pension accounting is only first step' *Financial Analyst Journal*; No.2, pp. 21-35

Gujarati, D., (1999) 'Essentials of Econometrics' 2nd Edition, Mcgraw Hill

Hann R., F., Heflin, and K.R., Subramanayam (2007) 'Fair-value pension accounting', *Journal of Accounting and Economics*, No. 3, pp. 328-358

Healy, P., and J., Whalen (1999) 'A review of the earnings management literature and its implications for standard setting' *Accounting Horizons*, No. 4, pp. 365-383

Hirst, D. E., and P. E., Hopkins (1998) 'Studies on Enhancing the Financial Reporting Model' *Journal of Accounting Research*, No. 1 pp. 47-75

Ippolito, R. A., (1985) 'The Labour Contract and True Economic Pension Liabilities' *The American Economic Review*, No. 5, pp. 1031-1043

Ippolito, R. A., (1985) 'The Economic Function of Underfunded Pension Plans' *Journal of Law and Economics*, No. 3, pp. 611-651

Jensen, M. C., and W. H., Meckling, (1976) 'Theory of the firm: Managerial behavior, agency costs and ownership structure' *Journal of Financial Economics*, No. 3, pp. 305–360

Jin, l., R. C., Merton and Z., Bodie, (2006) 'Do a Firm's Equity Returns Reflect the Risk of its Pension Plan?' *Journal of Financial Economics*, No. 1 pp. 1-26

Kaplan, S., and L., Zingales (1997) 'Do Investment Cash-Flow Sensitivities Provide Useful Measures of Financing Constraints' *Quarterly Journal of Economics*, No. 1 pp. 169-215

Lamont, O., (1997) 'Cash flow and investment: Evidence from internal capital markets' *Journal of Finance*, No. 1, pp. 83–109

Lane Clark and Peacock (2002) 'Accounting for Pensions UK and Europe Annual Survey 2002' London: Lane Clark and Peacock Actuaries and Consultants

Lane Clark and Peacock (2003) 'Accounting for Pensions UK and Europe Annual Survey 2003' London: Lane Clark and Peacock Actuaries and Consultants

Lane Clark and Peacock (2004) 'Accounting for Pensions UK and Europe Annual Survey 2004' London: Lane Clark and Peacock Actuaries and Consultants

Lane Clark and Peacock (2005) 'Accounting for Pensions UK and Europe Annual Survey 2005' London: Lane Clark and Peacock Actuaries and Consultants

Lane Clark and Peacock (2006) 'Accounting for Pensions UK and Europe Annual Survey 2006' London: Lane Clark and Peacock Actuaries and Consultants

Mayers, D., and C., Smith (1987) 'Corporate Insurance and the Underinvestment Problem' *Journal of Risk and Insurance*, No. 1, pp. 45-54

Miller, M. H., and K.., Rock, (1985) 'Dividend Policy under Asymmetric Information' *Journal of Finance*, No. 4, pp. 1031-1051.

Modigliani, F., and M. H., Miller, (1958) 'The cost of capital, corporation finance, and the theory of investment' *American Economic Review*, No. 2, pp. 261–297

Myers, S. C., (1985) 'The Capital Structure Puzzle' *Journal of Finance*, No. 3, pp.575-592

Myners Review of Institutional Investment in the UK, 2001, H.M. Treasury

Rajan, H., H., Servaes and L., Zingales (2000) 'The Cost of Diversity: The Diversification Discount and Inefficient Investment' *The Journal of Finance*, No. 1, pp. 35-80

Rauh J. D., (2007) 'Risk Shifting Versus Risk Management: Investment Policy in Corporate Pension Plan. *Review of Financial Studies,* Forthcoming

Rauh, J. D., (2006) 'Investment and Financing Constraints: Evidence from the Funding of Corporate Pension Plans' *Journal of Finance*, No. 1, pp. 33-71

Scharfstein, D. S., and J., Stein (2000) 'The Dark Side of Internal Capital Markets: Divisional Rent Seeking and Inefficient Investment' *The Journal of Finance*, No. 6, pp. 2537- 2564

Sharpe, W. F., (1964) 'Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk' *Journal of Finance*, No. 3, pp. 425-442

Sharpe, W. F., (1976) 'Corporate Pension Funding Policy' *Journal of Financial Economics*, No. 2, pp. 183 - 193

Smith C., and R., Stulz (1985) 'The determinants of Firm's Hedging Policies,' *Journal of Financial and Quantitative Analysis*, No. 4, pp. 391-405

Sweeting P., (2005 'Funding and Asset Allocation Strategies — Why Firms and Trustees Behave As They Do," *Working Paper*, Presented to the 2005 U.K. Finance and Investment Board Conference

Stulz, R., (1990) 'Managerial discretion and optimal financing policies' *Journal of Financial Economics*, No. 1, pp. 3–27

Sloan R.., (1996) 'Do stock prices fully reflect information in accruals and cash flows about future earnings' *The Accounting Review*, No. 3, pp. 289-315

Tepper I., (1981) 'Taxation and Corporate Pension Policy' *Journal of Finance*, No 1, pp. 1-13.

Treynor J. L., (1977) 'The Principles of Corporate Pension Finance' *Journal of Finance*, No. 2, pp. 627-638

Trivendi K.., and G., Young (2006) 'Corporate Cross-Holdings of Equity, Leverage and Pensions: Simulation and Empirical Evidence from the UK' *Economic Journal*, No 510, pp. 190-208

Webb, D. C., (2007) 'Sponsoring Company Finance, Investment and Pension Plan Funding' *Economic Journal*, No. 520, pp. 738-760

Weidman, C. I., and H. A., Weir (2003) 'The Market Value Implications of Post-Retirement Benefit Plans and Plan Surpluses – Canadian Evidence' *Canadian Journal of Administrative Sciences*, No. 3 pp. 229-241

Williamson, O. E., (1970) 'Corporate Control and Business Behaviour' *Englewood Cliffs, New Jersey*