

“The Affect of a Dynamic De-Risking Strategy on Defined Benefit Pension Scheme Funding Levels”

Name: John Donoghue

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Abstract

Demographic changes, and aging populations specifically, will provide a challenge to the continued provision of state pensions in developed countries. Private pensions are going to become more important in providing a good standard of living for the current working age population. Defined benefit pension schemes remain a significant component of the pension landscape in both the UK and Ireland. Over one third of the current workforce that are members of occupational pensions are in defined benefit schemes. This paper will look at how defined benefit pension schemes impact stakeholders and are structured. The ability of a defined benefit pension scheme to meet its future liabilities is measured by the schemes funding level. Under funded schemes represent a risk to both the sponsor employers and scheme members. Different strategies are used to try improve and maintain funding levels. Dynamic de-risking strategies, whereby the portfolio of scheme assets is systematically de-risked as funding level triggers are reached, is being used by a significant number of schemes. This dissertation tests the affect that a dynamic de-risking strategy has on scheme funding levels. While the scheme funding levels did increase over the test period, the test did not evidence a significant affect. The analysis of the test data provided a number of insights into dynamic de-risking strategies, markets and the evolution of the defined benefit pension scheme universe over the last five years that are worthy of discussion.

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Student Number: 18131417 _____

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“The Affect of a Dynamic De-Risking Strategy on Defined Benefit Pension Scheme Funding Levels”

Chapter 1 – Introduction

While not an immediate concern for younger people, income in retirement becomes a bigger consideration as people age and look to maintain a good quality of life post their working career. The state will look to provide a pension to all eligible citizens that covers the basics required to live day to day. The state pension is a return to citizens from the state for the economic value that was derived from them working and contributing tax. The ability to pay the state pension into the future is now under threat with a fast aging global population. This is starkly borne out in the latest OECD report on pension provision in member countries. The number of people of pension age is expected to double in proportion to the number of people of working age over the next forty years. This is not a long period considering the average working life would last forty years or more. It is a problem that governments globally are struggling to develop acceptable and workable policies to address. The current model will be unsustainable in the future. Election cycles do not lend themselves to good long-term policy formation. The tendency is to maintain the status quo and leave the more difficult decisions to change eligibility criteria, increase the qualification age, or reduce the payment levels to future governments. Eventually, these changes will have to be made.

Private occupational pensions have been an important supplementary income to the state pension for the last fifty plus years, since they became common for employers to implement post the Second World War. Employers do not put pension schemes in place for altruistic reasons. Traditionally, as outlined by Bridgen and Meyer (2005),

employers used pensions as a tool to manage human capital. They formed part of the employee compensation package and elicited loyalty and made employees less likely to change jobs due to the benefit, current and in the future, foregone. The reasons for the provision of a pension scheme have evolved and are now more based on regulation and trade union pressure, as opposed to human capital management. This has seen a big shift in the provision of scheme type from a more traditional defined benefit pension scheme to defined contribution schemes. A defined benefit pension scheme is a “promise by the scheme to pay a pre-determined amount of pension to its members based on their salary and years of contribution, regardless of investment returns”. (Department of Works & Pensions, 2017). A defined contribution scheme, on the other hand, is one where the employee, and often the employer, contribute to a pension plan and the amount contributed determines the level of pension paid on retirement. The employer does not make any guarantee or commitment to paying any pension to the employee.

Notwithstanding this shift in the type of occupational pension scheme provided by employers, defined benefit pension schemes still make up a significant portion of pension coverage in the UK and Ireland. In the UK 35% of those with occupational pension scheme membership are in defined benefit schemes (Office for National Statistics, 2020). In Ireland, the equivalent number is 36% (Central Statistics Office, 2020). While this coverage level is not as high as it was previously the decline has slowed significantly. The narrative is that defined benefit schemes are a thing of the past. That does not stand up when you view the size of the membership within the current work population.

As discussed by Clark and Monk (2008), amongst others, there is a “pension promise” in place between employers and employees in defined benefit pension schemes. When establishing the scheme employers effectively guarantee the payment of the assigned benefit to the employee in their retirement. This obligation is a liability for the sponsoring employer. The funding level of a scheme is the proportion of the value of assets held in relation to the liabilities due in the future. When the assets are lower in value than the liabilities the scheme is said to be underfunded. Antolin and Stewart (2009) outlined how an underfunded scheme is a solvency risk for the sponsoring company. If the funding deficit represents a solvency risk for the sponsor then the same deficit is a credit risk for the scheme members (Boverberg, 2007). Having fully funded schemes is in the interest of all stakeholders.

The traditional investment approach to managing a pension scheme was to adopt a buy and hold strategy with an intermittent review of asset allocations. There has been an increased tendency towards outsourcing of the investment management of pension schemes post the global financial crisis of 2008. This has resulted in the use of more specialised de-risking strategies (Menzar et al, 2014). Among those strategies is the use of strategic asset allocations (SAA) with periodic rebalancing and dynamic de-risking. A dynamic de-risking strategy (DDS) is one that de-risks in line with a specified framework when triggers are reached. The decisions made are not arbitrary but rather pre-defined. This dissertation will test the affect that using a DDS strategy has on the funding levels of defined benefit pension schemes.

Most investment strategies are implemented with the aim of maximising the target return while simultaneously reducing the risk of losses on the portfolio. For a defined

benefit pension scheme this means growing the assets and reducing risk as the funding levels improve. There are different opinions in the existing literature on the best way to achieve this. Brinson et al. (1986) and Hoernemann et al. (2005) are among the advocates for the SAA and rebalancing strategy. This approach places a lot of importance on the quality of the design of the SAA. A DDS strategy is predicated on the belief that when the opportunity arises to take risk out of the portfolio, the manager should do so. Gains are locked in and the improvement achieved in funding levels should be more secure (Huang, 2015), (Watkins, 2011). There is agreement across the literature that the initial asset allocation is a very important determinant of performance.

The affect of using a DDS strategy on funding levels will be tested by analysing the change in the aggregate funding level of a sample portfolio of forty three UK defined benefit pension schemes using a DDS strategy against the aggregate funding level of the PPF 7800 Index. The PPF 7800 Index is the latest funding level estimate of all eligible defined benefit pension schemes in the UK and is an official statistic of the UK Statistics Authority Code. The data points will be month end values for a five-year period between March 2015 and March 2020.

The test did not demonstrate a significant affect. The funding levels improved similarly in the both the sample portfolio and the PPF 7800 Index. While the specific findings of the test were not conclusive the analysis of the supporting data and market conditions provided a number of valuable insights, which are worthy of discussion.

Chapter 2 - Literature Review

2.1 Introduction

Pensions are complex and multi-faceted. This is true for all pension types: public, private, defined benefit and defined contribution. To examine one element in detail it is important to review through a wider lens to fully understand the context. The literature review for this study focussed on the global pension landscape and trends, the UK pension industry, defined benefit schemes, the pension promise, the management and design of defined benefit schemes, risk, funding levels, performance and alternatives for implementing life cycle plans. The literature is structured to build an understanding of the ongoing relevance of pensions and, specifically, defined benefit pension schemes. Managing risk and performance to try achieving fully funded status is the goal of scheme trustees. This dissertation is looking to assess the affect a dynamic de-risking implementation strategy has on trying to reach this goal. The literature demonstrates arguments for and against such an approach.

2.2 Pension Landscape

The OECD “Pensions at a Glance” report (2019) looked in depth at how the landscape for pension provision was changing globally. The global population is aging rapidly. In 1980 there were two people aged over sixty five for every ten people of working age. This number will be over three in 2020 and is predicted to be six in 2060. Not alone is the population aging, the number of working age people is also falling. Many countries are facing a future crisis whereby they will struggle to continue to pay state pensions to eligible citizens. Paradoxically, governments are making politically expedient

decisions to put on hold plans to increase the state pension age, and in some cases, as in Germany, decreasing the eligibility age (Adams, 2014). In Ireland, during the recent election of February 2020 all parties committed to freezing the application of a previously agreed age increase. Currently it is sixty-six and it was due to increase to sixty-seven in 2021 and sixty-eight in 2028 (Barrett and Mosca, 2013).

The changes in population make up were highlighted by Assa (2011) when he wrote about the common wisdom that was warning about the effects of the demographic shifts and the necessity to move away from defined benefit to defined contribution schemes. Countries have adopted this thinking and proceeded to cut benefits, increase retirement ages and essentially shifted the risks of old age income insurance away from themselves and employers. In this environment, employees will become increasingly reliant on private pension schemes (D'Addio and Whitehouse, 2010).

The OECD 2019 report showed that countries with the largest coverage of voluntary schemes, which include the UK and Ireland, boost future income replacement rates by 26%. The earlier employees are in the schemes the better the replacement rate. Voluntary private pension schemes now account for more than 40% of pension coverage in ten OECD countries. Occupational pension schemes are a large percentage of the voluntary private pension system, established by employers and offered to their employees. The pension forms part of a remuneration package and is funded by the employer, and in most cases the employee too. The aim of the scheme is to provide a replacement income to employees on their retirement and supplement the state pension they receive (McNally and O'Connor, 2013).

Barr and Diamond (2009) reviewed the perceived crisis in the pension industry and made the point of noting how many of the problems are created by decisions being

made based on short term rather than long term trends. The long term trends identified are an aging population, early retirement and declining fertility. Governments have to countenance these trends as opposed to voting patterns in upcoming elections when making policy decisions. Changes to the pension system affect numerous elements of society; labour market, economic growth, the distribution of risk, and the distribution of income, including by generation and gender. Changes to one element of a pension system may require changes to another. This was further expanded on by Collard and Moore (2010) when they concluded that pension systems are complex and critical for individuals and society. Changes need to be debated as it is better to have consensus, or close to it, when looking to implement them.

Pensions are costly, so with employers playing the key role as scheme founders and sponsors it is important to look at what motivates them to do so. Exley et al (1997) researched the theme and said the reasons companies provide pensions is altruistic, in that they want to look after their employees in old age, and practical in wanting to retain, attract and reward high calibre employees. Whether the former still holds is questionable but the latter to an extent does. Barr and Diamond (2009) presented a number of reasons from academic literature as to why employers are influenced to commit scarce resources to pension schemes for their employees:

1. Tool to manage human capital;
2. Government regulation of occupational pensions whereby they are obliged to and supported by law to provide a scheme to their employees;
3. Pressure from trade unions in order to maintain industrial peace;
4. Size of the business. Economies of scale are said to be available to larger companies;

5. The macro-economic environment in which companies operate. Employers are part of a social fabric.

It follows that in countries with a large portion of private pension provision that employers are major social policy players (Bridgen and Meyer, 2005). What are employers doing? They are retrenching by switching from defined benefit to defined contribution. This shift was fashionable throughout the 1990's and 2000's and has changed fundamentally the global pension's landscape. Clark and Monk (2008) examined why employers were making this change. Increasing costs was by the far the most predominant reason followed by competitive pressure and accounting rules. Employers should establish credibility with their employees in advance of making changes to their scheme or offering. A crisis is not a time to build credibility, rather it is the time to use your credibility as a buffer (Shuit, 2003).

This research will look at it further in a following section but The Pensions Authority in their "Statement of Strategy 2016-2020" declared that the private sector pension provision is broken beyond repair for a multiple of reasons including increased life expectancy, more intense regulation, suppressed interest rates and volatile investment returns. Companies cannot afford defined benefit pension schemes. What does that say for the thousands of existing schemes and millions of members in Ireland and the UK?

2.3 UK Pension Industry

The Office for National Statistics in the UK produce a report on employee workplace pensions on an annual basis. The most recent report, "Employee workplace pensions

in the UK: 2019 provisional and 2018 final results”, was released in March 2020. The data is compiled from the annual survey of hours and earnings. The following section is a summary of the items in the report related to this research topic. .

General;

- The number of people who are members of a workplace pension scheme has increased from 47% in 2012 to 77% in 2019. This is the highest percentage recorded since records were maintained. This increase can be directly attributed to the introduction of auto enrolment in 2012.
- Participation in defined contribution schemes is 36% as a percentage of all those with scheme membership. This is consistently rising and is the first time that this pension type had the highest individual participation rate.
- Contribution rates to defined contribution schemes was above 3% for 77% of members. This is up from 37% in 2018.

Defined Benefit;

- The membership of occupational defined benefit pension schemes has essentially stabilised since 2012. In 2019 the rate was 27%, down from 28% in 2018. Prior to this there was a trend of decline from 46% in 1997 to 28% in 2012. Figure 2.3 (1) shows the breakdown of pension scheme membership from 1997 to 2019, with the trend of growing defined contribution membership evident.
- Defined benefit schemes still account for 35% of scheme membership, marginally below defined contribution. Figure 2.3 (2) shows the breakdown of pension membership by type.

- The remainder of the pension schemes are group personal pensions and group stakeholder pensions. These are schemes generally established by employers and members grouped by age and profile.

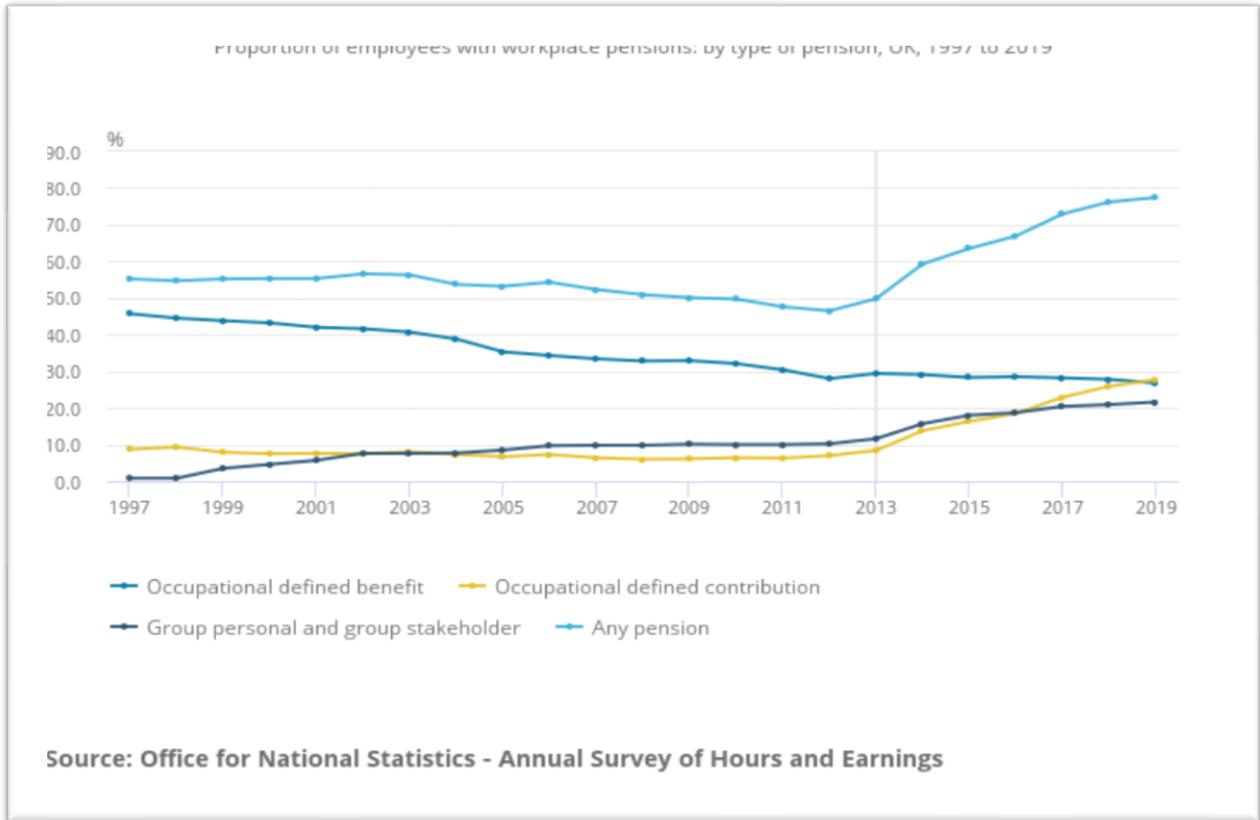


Figure 2.3 (1)

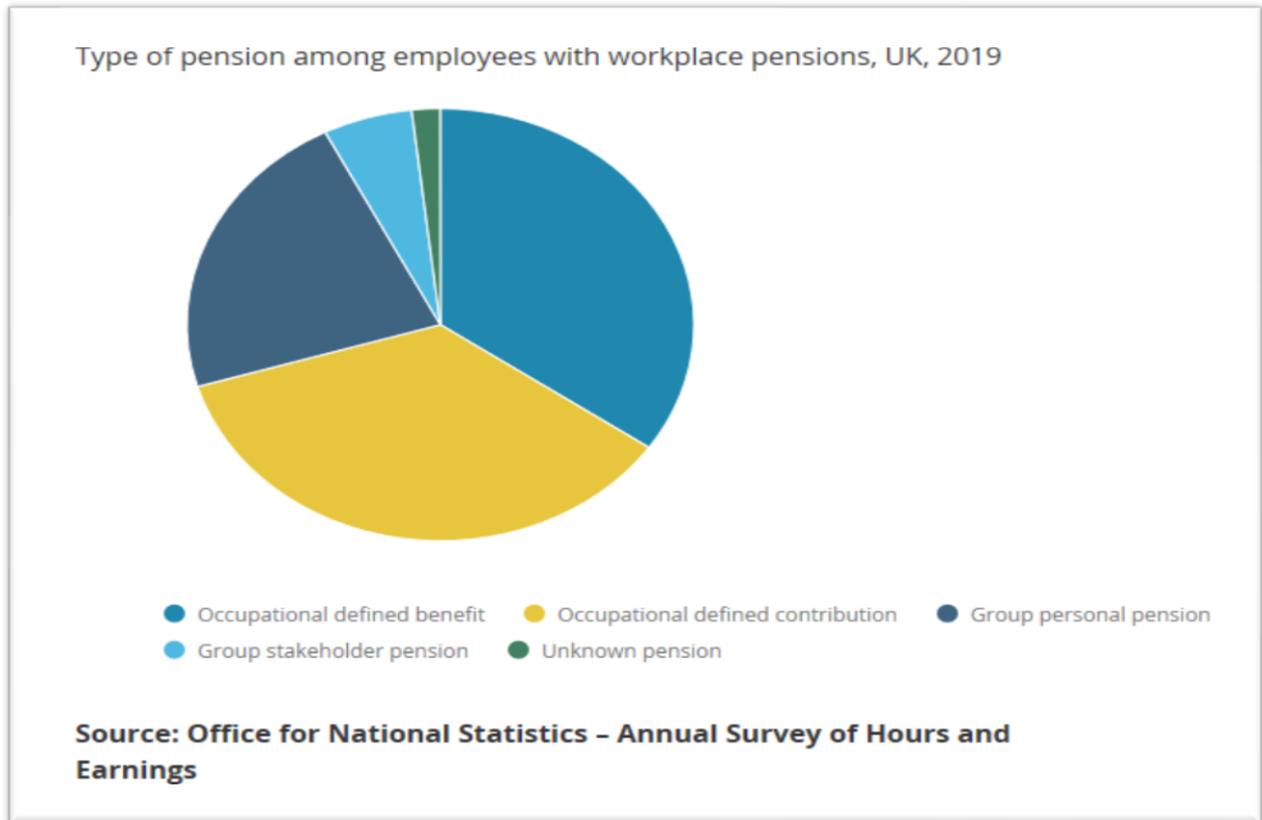


Figure 2.3 (2)

Earnings;

- There is a strong correlation between earnings and pension scheme membership. The more you earn, the more likely it is that you will be a member of a scheme. Historically, pension membership for low earners was only common in the public sector. Auto enrolment has led to increases in membership across all earnings bands. Figure 2.3 (3) demonstrates this.

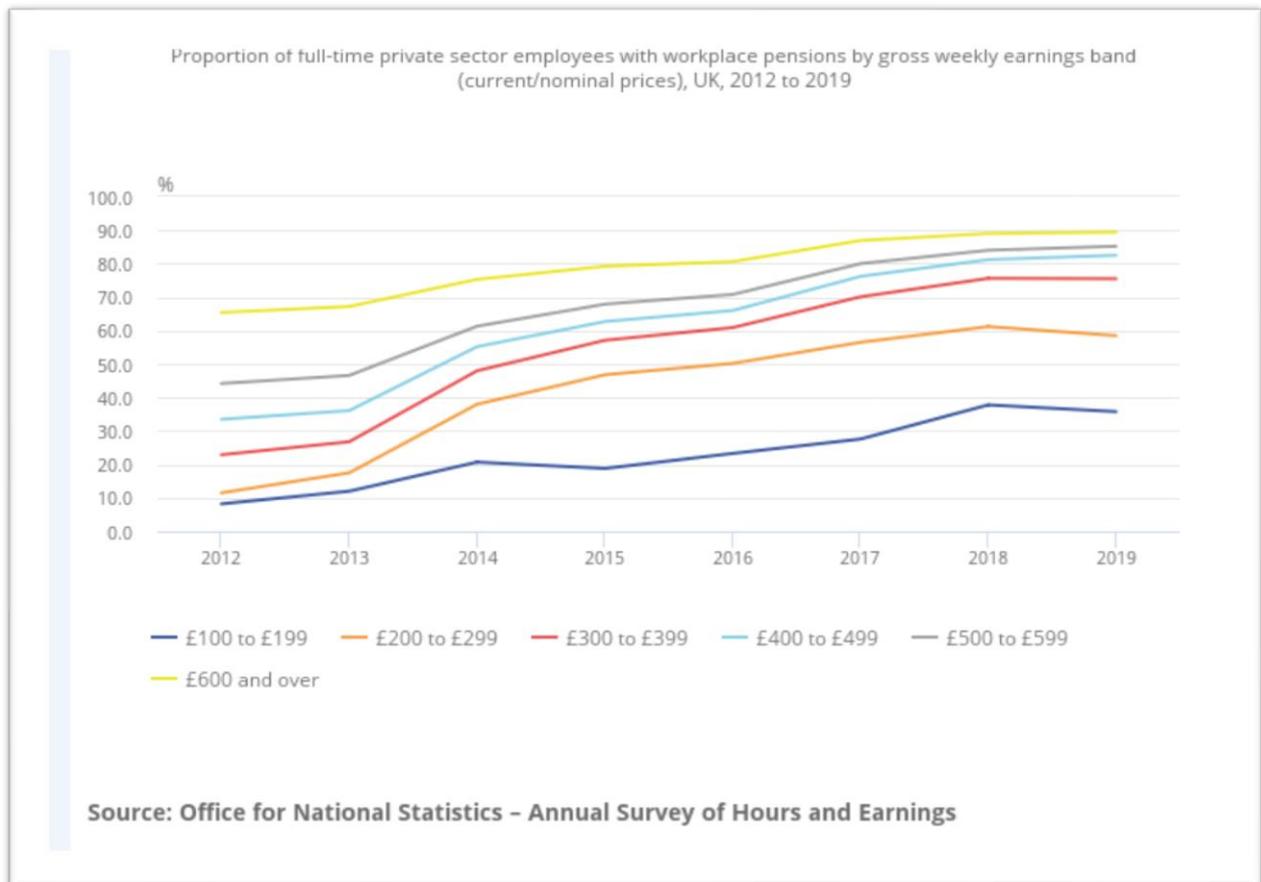


Figure 2.3 (3)

Employee Contributions;

- For defined benefit schemes there is an obligation on employers to ensure the scheme is funded sufficiently to make future pension payments. That means that employer and employee contributions are likely to be higher for defined benefit than for defined contribution schemes.
- In 2019, consistent with 2018, 47% of employees with defined benefit schemes contributed 7% or more of their eligible salary. See Figure 2.3 (4).
- In contrast, and although rates are increasing, the majority of employee contributions to defined contribution schemes are between 2 and 5% with only 9% contributing 7% or more. This is represented in Figure 2.3 (5).

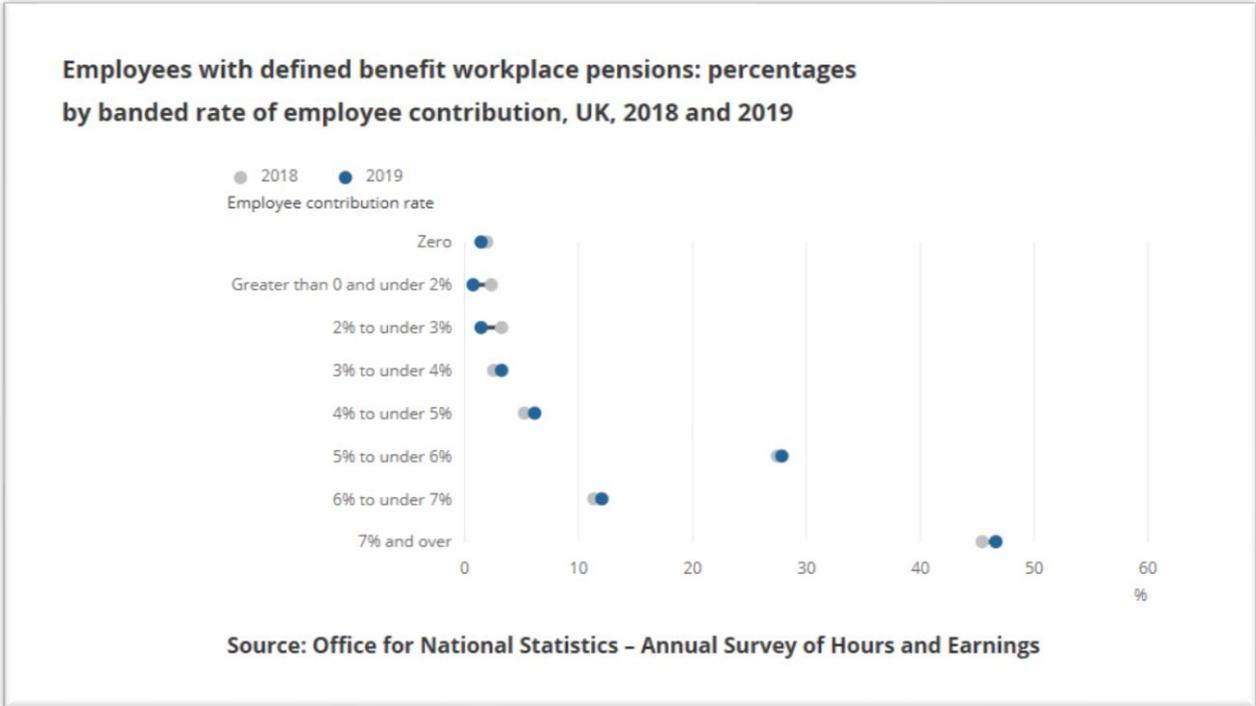


Figure 2.3 (4)

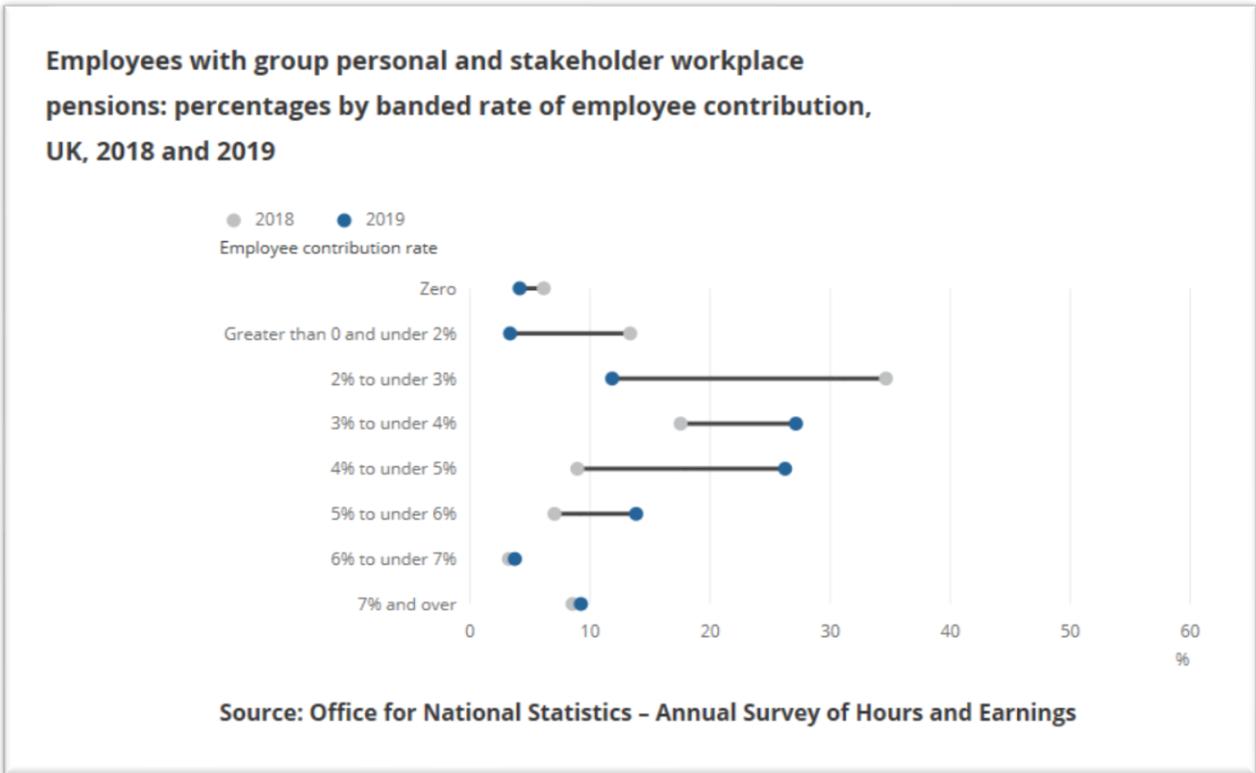


Figure 2.3 (5)

Employer Contributions;

- The biggest increase in employer contributions has been in public sector defined benefit schemes. 34% of employees are receiving employer contributions greater than 20%. This is likely a result of funding level valuations showing up deficits.
- The difference in contribution rates by employers between defined benefit and defined contribution schemes is very marked. 29% of employees received contributions greater than 20% and a further 56% had employer contributions greater than 12% in defined benefit schemes.
- Defined contribution employee members received employer contributions of between 0 and 2% in 9% of cases and between 2 and 4% in another 49% of cases.
- These figures demonstrate just how much more expensive defined benefit pension schemes are for employers.
- Employer contributions are displayed in figures 2.3 (6) and 2.3 (7).

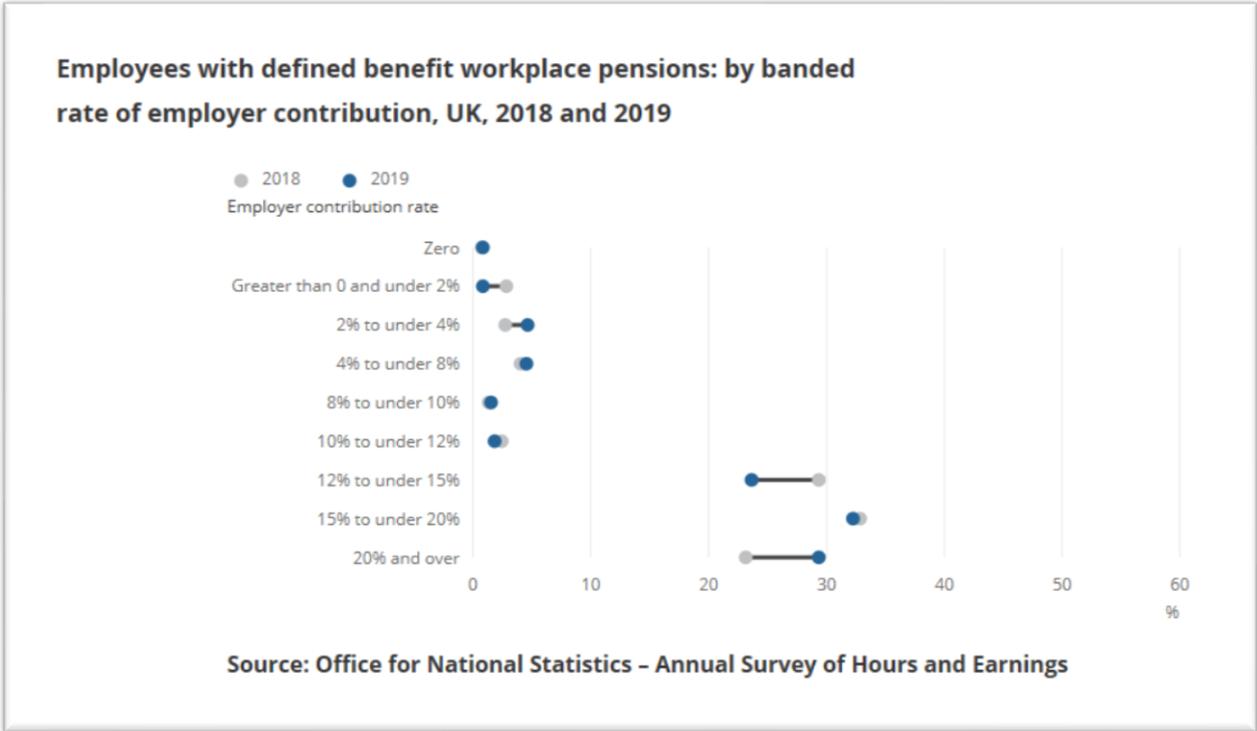


Figure 2.3 (6)

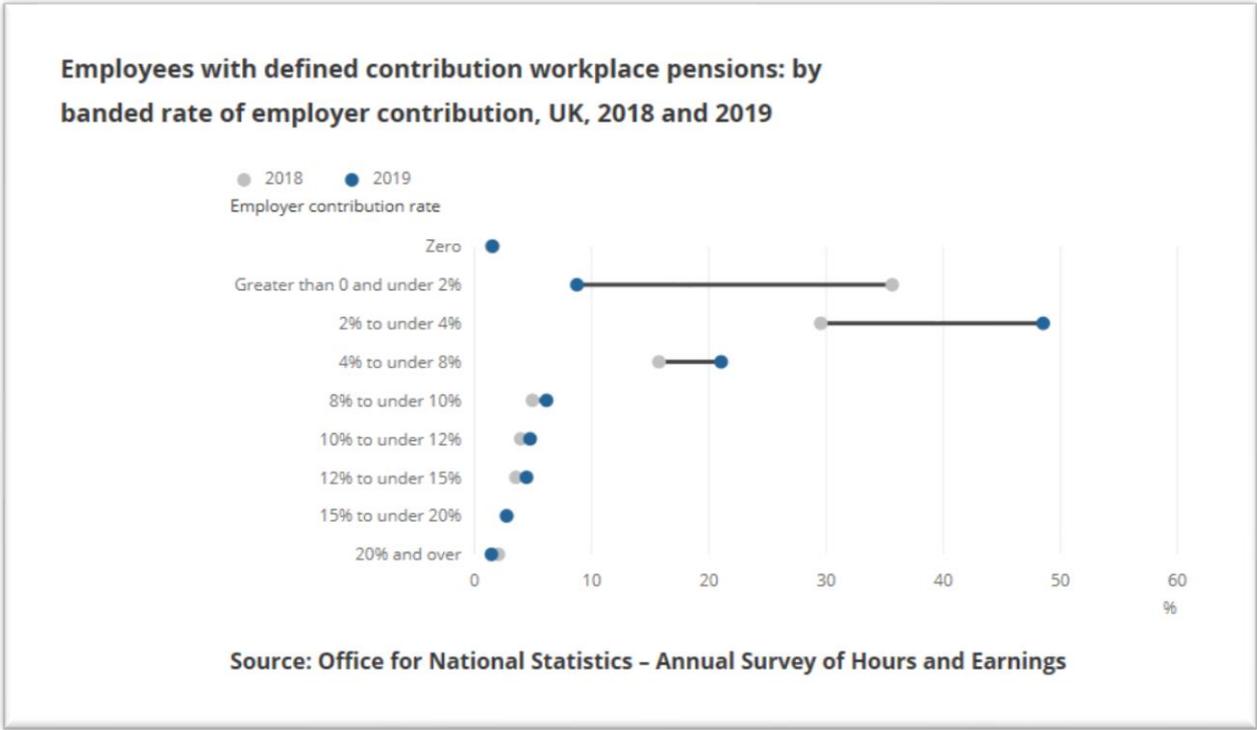


Figure 2.3 (7)

2.4 Defined Benefit Pension Schemes

As defined previously a defined benefit pension scheme is an occupational pension scheme in which the rules specify the rate of benefits to be paid (Office for National Statistics, 2020). The benefits paid are generally based on salary and years of service. Defined benefit schemes provide a promise of a certain amount of pension to be paid to members in retirement.

An article in *The Economist* (2008) provided an overview of the history of defined benefit schemes. They were introduced by employers post the Second World War as a benefit for employees, often as a way of suppressing higher wage demands. The costs were manageable as long as employers could control benefit increases. The prevailing bull market through a lot of the 1980's and 1990's disguised the challenges coming down the line as returns outpaced the increase in liabilities. That turned in the early 2000's with the sustained markets downturn, falling interest rates and changes to accounting rules that made companies recognise losses in their income statement. Over time, the schemes became more expensive, with pressures of trying to protect employees from inflation and the increased life expectancy as discussed earlier. Defined benefit schemes require companies to take bets on financial markets and are a distraction from their core business. If defined benefit pension schemes are a risk to the solvency of a company then they are also a risk to the employees.

Defined benefit schemes were traditionally the most common type of scheme in both the public and private sector. As Bridgen and Meyer (2005) noted in a paper, when closures and freezes of schemes were at their highest, they are also the most generous and least costly from an employee perspective. Alternatively, they are the most costly for employers. They likened the closing of schemes to "keeping up with

the Jones” for employers. Easier and cheaper readymade defined contribution schemes were simpler to direct their employees in to. It is unheard of for new defined benefit schemes to be launched in the private sector.

There were four reasons put forward by Munnell et al (2006) as to why employers are freezing their defined benefit pension schemes. Freezing a plan occurs when a sponsor closes a scheme to new members, while continuing to fund and operate the scheme for existing members. Terminating a scheme is different and occurs when a scheme is fully closed and all benefits paid out to its members. The first reason is due to global competition and reduced resources. The second is that the increased cost of providing health benefits for employees has reduced the capacity to contribute to the pension scheme. The third explanation is to do with the financial risks associated with committing to meeting further benefit requirements. The final explanation is that with CEO and executive management pay now so large the pension benefits are less important for these decision making employees. Munnell et al concluded that while these may be factors in some instances, overall the desire to freeze defined benefit schemes comes from wanting to reduce the employer’s total compensation bill.

2.5 The Defined Benefit Pension Promise

The defined benefit pension promise is widely debated. The promise is the commitment from the employer to pay an agreed pension to its employees post their retirement and in perpetuity until they die. Clark and Monk (2008) debate the robustness of the claim that it is best conceptualised as an implicit contract. No one would dispute that employers intend to meet their obligations when setting up a

scheme. The question is whether there is a difference between implied intentions and actual responsibilities.

Employees have to trust their employer, and their agents, to honour promises they make in relation to pension schemes. This is at a time when the financial services industry as a whole are suffering from a lack of public confidence, with memories of the global financial crisis still vivid. Ring (2012) expanded on the trust theory by looking at the different types of trust associated with a pension scheme. There is an interpersonal trust between the employee and employer, there is an impersonal trust between the employee and the professional service providers, and, finally, there is system trust in the pension system as a whole. Trust is essential for employees when they assume the risk of putting their future income in the hands of an employer's pension scheme.

Returning to Clark and Monk's work, they compared the pension promise to a personal promise. When someone makes a promise there is an implicit understanding that if circumstances change substantially the ability to make whole on the promise will be compromised, and renegeing on the promise would then be acceptable. Is the pension promise really a guarantee and is the viability of the company an acceptable price to pay to continue meeting financial obligations? If it is, the promise is an absolute rule that can fail absolutely. The long term liabilities can then become unsustainable future financial burdens. If the promise was to be viewed as a contingent commitment, it might better serve the interests of both the employer and its employees. Is default because of moral hazard by employers an acceptable risk? Most would say no.

2.6 Defined Benefit Structure and Design

There are some established norms associated with the structure and design to be followed when committing to a private pension scheme. Antolin and Stewart (2009) made a series of recommendations for private pension scheme sponsors in a paper written for the OECD. First, commit to the scheme and stay the course. Private pensions are important to maintain a balanced retirement income. This is an altruistic ask of employers for the greater good. Second, a pension is a long term commitment so it is important to contribute appropriately. This is applicable for both employers and employees. Third, funding and solvency rules for defined benefit plans should be counter-cyclical. Pension assets should be allowed act as long term investors and in effect be stabilising forces in the market. Finally, employers should maintain and improve risk and governance of their scheme by reducing exposures to risky assets and not investing in assets that are not fully understood.

Focusing on long term strategies was a topic also addressed by Barr and Diamond (2009) when examining the principles by which defined benefit pension schemes are managed. Traditionally schemes had a static design. This is unlikely to be successful and the design should be adjusted to reflect demographic trends. Ultimately, there is no one best design and flexibility is required. In tandem with the design, a focus also has to be given to implementation. Implementation has to be an important part of the design and not an afterthought. One requires as much skill as the other. Getting the design and implementation right does not guarantee success but it will help when challenges are presented (McNally and O'Connor, 2013).

The Pensions Authority in Ireland released general principles, which defined benefit schemes should follow when setting a strategy. They can be condensed into three

core elements to be agreed; contribution rate, target rate of return and the risk tolerance. When these are agreed and aligned trustees should engage their advisors to develop a proposal for the scheme's strategic asset allocation. Again, this is a long term as opposed to a short term strategy.

2.7 Funding Levels

The funding level of a pension scheme is determined by projecting the asset and liability cash flows, while realising the need to potentially reinvest asset income or to pay liabilities that arise. It is obvious how this is open to interpretation and manipulation (Exley et al, 1997). The Minimum Funding Requirements (MFR) were introduced to the UK in 1995 and came into effect in 1997. The act was updated in 2004 and the MFR was replaced with a statutory funding objective. This came into force in 2005. Prior to the introduction of the statutory requirements the historic approach was to maintain an open and accruing pension plan with the funding level determined by the market and the liability valuation (Buck and Flynn, 2012). The MFR set a minimum level of assets that needed to be held by a scheme and if there was a shortfall the scheme had to be subsidised to remove it. The timescale to make this funding was three years if the funding level was below 90% and ten years if the funding level was between 90 and 100%. The MFR was viewed as being too prescriptive and restrictive and led to a high number of scheme closures. The statutory funding objective, based on openness and disclosure rather than hard limits, offers more flexibility to individual schemes, while still requiring them to maintain and improve funding levels. These changes aimed to improve member protection while also allowing schemes time and scope to manage their funding levels. Cowling et al (2004) looked at how while

previously actuaries of schemes had a tendency to look past guidelines with a “these don’t apply” or plead “special case” exemptions it was now important to accurately report funding levels and transfer values. The optimal pension policy is to fully or over fund the pension liabilities and invest all assets in low risk bonds.

Funding levels have gone up and down over the years. The financial crisis in 2008 had a severe effect on funding levels. In Ireland, the aggregate funding level in December 2008 was 75% compared with 120% a year previously. Similarly, in the UK funding levels fell to 76% in February 2009 having been 97% a year earlier and 118% at their peak in June 2007 (D’Addio and Whitehouse, 2010). This paper will look in detail at how funding levels in the UK moved in the second half of the 2010’s. With a bull market dominating the levels improved before falling back again following the market collapse during the ongoing COVID 19 outbreak. The OECD (2019) noted that the funding ratio remained much the same (+ / - 5%) in 2018 compared to 2008 when the levels were first recorded in the UK, US, Norway and Luxembourg. Funding levels were above 100% in most countries at the end of 2018 with the UK and US notable exceptions. To put these figures in context it would not be unusual for a scheme to be worth \$1 billion or more. If this scheme had a funding level of 90%, the deficit would be \$100m. That level of capital is very difficult sourced for any company.

McNally and O’Connor (2013) produced a very focussed piece on the actuarial valuation of pension schemes. The liabilities of a scheme are the future monetary amounts to be paid out over time. Meeting these liabilities as they fall due is a principle objective. Valuing liabilities is very complex and is really just a best estimate at any time as they have dependencies that are difficult to predict. Assets are relatively straightforward to value. Liabilities on the other hand require estimation. An accurate valuation is required for three purposes, at least. First, to submit a statutory funding

valuation for regulatory purposes. Second, trustees will require the valuation to review contribution rate. Finally, the valuation and change in funding level is likely to be required by the sponsor for their financial statements. It is possible that different valuations could be produced for each purpose, due to different conventions used and assumptions made.

The introduction of the International Accounting Standard No.19 (IAS19) added further complexity to defined benefit scheme valuation and funding level determination. IAS19 has two stated objectives. The first is to reflect the funding level surplus or deficit as an asset or liability on the balance sheet of the scheme sponsor company. The second objective is to show the economic benefit, consumed by the employer in return for services from an employee, as an expense on the income statement (McNally and O'Connor, 2013).

Another aspect related to valuations and funding level determination worth noting is the discounting of liabilities. Discounting reduces the current value of future liabilities, therefor improving reported funding levels (Mills, 2005). Mills also pointed out that many schemes run matching government bond portfolios to secure liabilities alongside growth portfolios. This had the paradoxical effect of creating excess demand and driving down yields, resulting in lower discount rates being used and liabilities increasing. The OECD in 2019 discussed the same topic and pointed to the low interest rates also impacting performance on the growth portfolio. These are not just accounting considerations. Decreasing returns and higher liability valuations can threaten the solvency of reasonably well funded defined benefit pension schemes.

2.8 Pension Scheme Performance

Private pensions' returns suffer during times of volatility. Pension providers do not reduce costs during times of underperformance, meaning that all of the downside is suffered by the sponsor and members (Adams, 2014). This paper is being undertaken a little over ten years on from the peak of the global financial crisis and the scars from this are still evident for pensions. Antolin and Stewart (2009) noted that the OECD had estimated that there were declines of \$5.4 trillion in pension assets in 2008. This represented over 20% of assets and put huge pressure on schemes, particularly funding levels of defined benefit pension schemes. While losses were spread across almost all countries, they were more pronounced in countries with larger shares of private pensions, such as Ireland, the US and the UK. To substantiate this D'Addio and Whitehouse (2010) estimated that pension funds in Ireland suffered losses of 38% in 2008. Many private pension funds in Ireland had large allocations to Irish bank shares, which were reduced to near no value in the crisis. It is unlikely you would have such a home and concentrated bias in a properly structured and life cycle managed defined benefit scheme.

Robert Schiller (2005) produced an excellent analysis on how the structuring of the strategic asset allocation of a pension scheme affects performance by focussing on targeted life cycle portfolios. The conventional rule of thumb is that workers should invest roughly one hundred minus their age in equities. That is a forty year old should have an allocation of about 60% of their pension assets to equities and so on. Schiller found this to be far from optimal. Looking at targeted life cycle funds such as the Vanguard 2045 Fund, he found that they had initial allocations to equities of 90% with plans to taper the allocation over time to 20%. Without getting too detailed, the average

internal rate of return on a standard life cycle portfolio is less than the offset rate. That means in the majority of cases the typical employee will be behind in their targeted income come retirement. Employees would be more likely to meet or exceed targeted returns if they invested and retained all their assets in equities and never reduced the allocation. The risk with this is the lack of protection on the downside. Schiller's proposal is counter intuitive to the way most pension schemes are managed. Are employees happy to accept a higher risk of a small loss in return for protection against a bigger loss?

The more recent COVID 19 crisis substantiates the widely held belief that bear markets and pensions are a toxic combination (Isola, 2020). The combination of double digit declines in stock values with very low interest rates have the double effect for defined benefit schemes of eliminating performance and weakening funding levels. Many pension funds target a return in excess of 7%. This is an aggressive target and very difficult to achieve with any consistency. In addition, achieving superior returns is no guarantee that a scheme will be in a position to meet their future liabilities. Isola used California state teachers defined benefit scheme as an example of how challenging it is to make performance returns to meet liability growth, particularly in difficult market conditions. During the volatile bear market period of 2007 to 2012 the scheme lost a total of 3% in asset value. That is not terrible performance. The issue is that in the same period the scheme's liabilities rose by 29%. As a result, the funding level of the scheme deteriorated from 98% in 2007 to 67% in 2012. In absolute terms the unfunded liabilities rose from \$19 billion to \$71 billion. These figures highlight the challenge facing sponsors when managing their portfolios to achieve sufficient returns.

2.9 Risk

Risk in defined benefit pension schemes is multi-faceted. Changes in the value of assets affects both the solvency of the pension plan and the funding level of the scheme. With the obligation there for employers to meet the liabilities of the scheme it is not the case that one area can be prioritised over another (Antolin and Stewart, 2009). Boverberg (2007) reviewed how the financial and actuarial risks associated with meeting pension obligations are among the top risks for companies. As a result, decisions were being made to withdraw from underwriting the risks of pension schemes. If a pension scheme is causing a real solvency risk for a company the same scheme then becomes credit risk for its members, with no guarantee that their future income that is promised will be received. Boverberg expanded further to highlight how the solvency risk can lead to decisions being made to invest in more risky investments to generate returns, therefore adding investment risk. As discussed previously, Clark and Monk (2008) made the point that by holding employers absolutely responsible for meeting scheme liabilities you increase the risk of corporate failure.

Similar to other portfolios, investment risk can be reduced for pension assets. This is achieved through life cycle investing. This involves switching to less risky assets such as bonds and fixed income deposits as you near retirement. This effectively switches members on to autopilot. It is important when making decisions on risk profile of a portfolio that long term considerations are at the forefront. The temptation will be there to make reactionary decisions but this should be resisted if they will threaten long term stability and sustainability. Risk is created by the longevity of pensions. The longevity of pensions make them intrinsically risky, regardless of the strategy followed, when

you consider there could be 50 years between the first payment into it and out of the scheme (D'Addio and Whitehouse, 2010).

Gray (2014) in a paper for the Irish Institute of Pensions Management outlined how a risk management framework can be developed. The two primary areas for consideration are the risk policy and monitoring. In the risk policy, you have to determine the return seeking versus risk reducing portions of the portfolio, what hedging will be undertaken, diversification, timing of actions and pressing issues. To monitor the risk the sponsor has to set a frequency of review and rebalancing. It will also be required to monitor market and industry trends and changes to demographic profiles. Following the establishment of the policy and monitoring framework key risk factors are then assessed. Accept the risks that you expect to be rewarded, such as investing in equities, alternatives and corporate bonds. Mitigate the unrewarded risks; inflation, interest rate and mortality. Finally, risks that have to be borne will need to be monitored; that is sponsor, demographic and regulatory risk. It is repetitive, but again these decisions should be taken through a long term lens. The trustees are ultimately responsible for the risk framework. They have to understand the risks, consider are they being rewarded for risks taken, and monitor and action where necessary.

Mercer and ICAEW (The Institute of Chartered Accountants in England and Wales) produced a survey paper specifically on risk management of defined benefit pension schemes in 2012. The introductory line was from John F. Kennedy; "There are risks and costs to a programme of action. But they are far less than the long-range risks and costs of comfortable inaction." That is to say when it comes to risk management it is better to have a plan in action than to do nothing and hope for a good outcome. While acknowledging that the challenges for defined benefit schemes had never been

greater, there was universal recognition that it was necessary to mitigate and reduce risk. It was predicted that 80% of defined benefit pension schemes would put a life cycle or de-risking plan in place. With the trustees and sponsor responsible for the risk management strategy the elements to successful implementation are largely consistent with those outlined by Gray. Mercer and ICAEW recommend a gradual implementation with contingency protections and flexibility to react built into the plan. When designing a risk management framework it must be recognised that defined benefit pension risk is unique, bigger, more complex and more long term than other financial risks. Risk can be all but eliminated by committing more resources to a scheme but that is inefficient and better directed to growth strategies.

2.10 Balancing Risk and Performance

The previous two sections of the literature review have focussed on performance and risk in defined benefit pension portfolio. This section looks at how portfolio managers seek to balance the two conflicting goals of maximising performance and minimising risk. The approach taken by almost all is to design a multi-asset, diversified portfolio. The origin of this approach is Modern Portfolio Theory (MPT) developed by the celebrated economist and Nobel Prize winner Harry Markowitz (1952). MPT theorises that through diversification a portfolio can achieve superior returns and reduce risk. Leading investment managers of pension portfolios will have diversification inbuilt into their investment strategies as they have looked to expand and tailor MPT (Wealthfront Methodology, 2018), (Betterment Portfolio, 2018).

A 60/40 rule has been commonly put forward as a reference portfolio. The larger allocation to a growth portfolio usually represented by equities, and the smaller

allocation to defensive fixed income assets. Qian (2005) found that 60/40 did not represent a “well diversified” portfolio as when losses occurred the majority of them are associated with the more heavily weighted equities. Finding the correct balance between performance and risk in a portfolio requires genuine diversification.

The approach to managing pension funds from an investment perspective has often focussed on a defensive strategy, whereby the goal is to manage the downside risk in the portfolio. A.D Roy first introduced this model in 1952, ironically the same year as Markowitz published MPT. It is a safety first approach that focusses on achieving the minimum acceptable return which may be less than the expected return on the portfolio. This approach has more recently developed into the use of complex Value at Risk (VaR) models, where the focus is on identifying a maximum amount of risk that will be accepted on a portfolio (Ardia et al, 2016).

Achieving genuine diversification and implementing a defensive risk management investment approach requires asset classes with the requisite return characteristics and applying the correct quantitative analysis to keep a low level of correlation, particularly in market downturns. A well constructed multi-asset portfolio offers pension schemes the opportunity to minimise losses during economic declines and benefit as markets rise (Hughes, 2013). It is possible that scheme sponsors and trustees believe that simply selecting a multi-asset portfolio will be enough. There is more science to it than that. A proper understanding of how asset classes interact is important and some believe multi-asset portfolios may actually underperform in the long run (Duncan, 2019).

2.11 Rebalancing to a Strategic Asset Allocation

Following the setting of the strategic asset allocation (SAA) the next step in managing a pension portfolio is generally to put in place a periodic review or rebalancing model. The review and rebalancing will generally take place at regular intervals, based on the allocations deviating through market movement, or on a bespoke basis at the behest of the sponsor, trustee or investment manager. The most important piece in this process for any manager using a rebalancing strategy remains the initial allocation (Hoernemann, Junkens, & Zarate, 2005).

Modern investment managers of pension portfolios will look to introduce more asset classes into portfolios to try enhance diversification. With a more global focussed economy it is harder to achieve diversification within asset classes. In a study undertaken by fidelity they found that post the global financial crisis global equities were now 90% correlated and that US treasury bonds had a positive correlation to equities (Phipps, 2019). When setting the SAA the manager not only needs to consider performance and risk parameters and long term targets but they must also try to assess the correlation between asset classes. There is added difficulty trying to deal with increased risks associated with having a diverse asset pool. There is a need to understand how the risk horizons of the asset classes align to those of the overall portfolio (Byrne and Lee, 1995).

Assuming the investment manager (together with the trustee) can overcome the challenges associated with trying to put in place the correct SAA the benefits are clear. Brinson et al. (1986) looked at the returns from a passive SAA against an active market driven strategy and found that the returns from the passive strategy were much greater. They estimated that up to 90% of the returns were generated from the initial

SAA selection. It was also noted that the fees associated with a passive strategy are much lower than what is applied on actively managed strategies. These findings were repeated in numerous other studies, including Hoernemann et al. (2005). Their study found that of the returns on a portfolio, 77.5% were associated with the initial asset allocation and a further 10% attributed to individual security selection. The attribution is less than Brinson but again demonstrated the significance of getting the SAA right in what is relatively simple model of buy and retain with periodic rebalancing.

Markowitz' MPT laid the foundation for the original application of a SAA strategy, and the theory continues to evolve. The principles have not changed; diversify to maximise return and minimise risk. It is the asset classes used in the portfolios where there has been most change. New emerging asset classes have become popular and their risk and return profiles can differ to that of the traditional equities and bonds. If the investment manager fails to characterise these risks correctly the SAA will not be optimal and will result in excess losses in distressed markets and under performance in buoyant periods. The key benefit for pension schemes in implementing a standard SAA with periodic rebalancing lies in its simplicity, and the returns the associated with the initial allocation. The scheme trustee will review the SAA annually, or even every three to five years, with the investment manager and make whatever adjustments are necessary to align with the life cycle plan before reverting to the delegated rebalancing model.

2.12 Dynamic De-Risking

An alternative approach to implementing a life cycle plan through a SAA and rebalancing model is to adopt a dynamic de-risking strategy (DDS). In relation to

defined benefit schemes, Miccolis and Chow (2016) stated, “de-risking takes the form of reducing the holding in equities below the norm for that investor.” According to Menzar et al (2014), historically the convention was to go with rules of thumb such as 60:40 equities to fixed income but it has been desirable to try and design more advanced systems for de-risking. This has coincided with an increasing tendency to outsource the management of pension assets and their de-risking strategies rather than implement internally through the office of the Chief Investment Officer. A result of this is the development of de-risking frameworks and the monitoring of performance within the framework. This sentiment was further supported by Buck and Flynn (2012) who associated the move towards outsourcing investment management with the development of proactive de-risking strategies.

Gray (2014) demonstrated and graphed how a dynamic de-risking strategy is applied on a portfolio. There are a number of steps to be followed;

- Specify a time horizon, risk appetite and target funding level
- Define an appropriate path based on this information
- Monitor the funding level at a set frequency
- As funding levels improve and reach set targets the portfolio is de-risked by reducing the allocation to growth assets within the portfolio
- If the funding level deteriorates below the downside protection level then the strategy needs to be adjusted

Figure 2.12 (1) provides a visual graphic of the approach from Gray’s presentation.

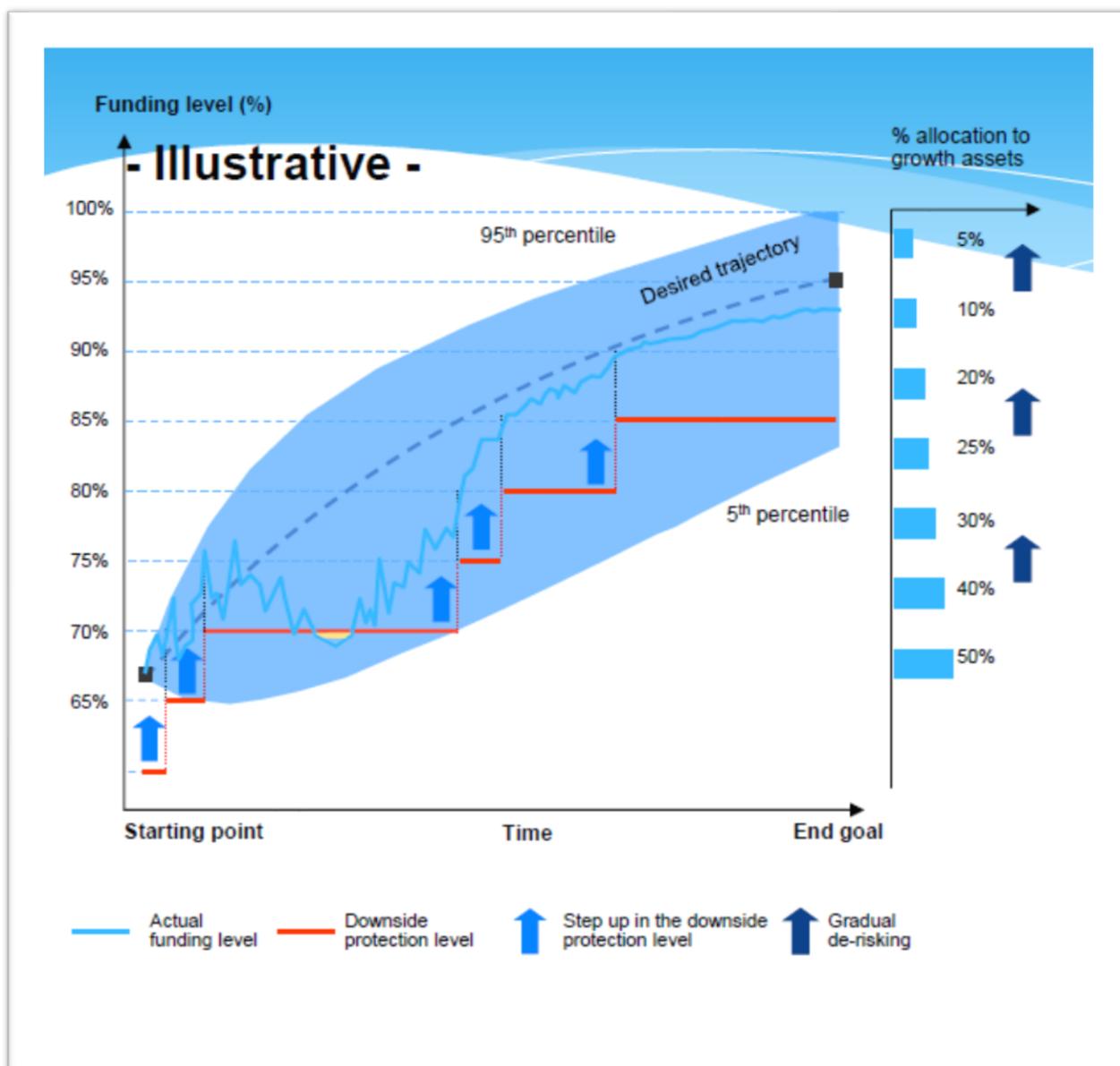


Figure 2.12 (1)

Miccolis and Chow (2016) challenged the standard de-risking investment model and said it may not be prudent to reduce equity allocations as they are the growth generator in a portfolio and provide inflation protection. A DDS strategy will not make arbitrary decisions but rather de-risk in line with the specified framework. Haldane (2014) in discussing asset management as an agency activity pointed towards the actions of pension funds at the time of the global financial crisis in 2008 where the stronger funds

reduced equity allocations to protect gains and the weaker ones did not. There is no one de-risking strategy that suits all schemes.

Actuaries by their nature prefer to take a longer view and base their decisions on long term goals as opposed to reacting to market moves. This actually creates a bit of a paradox when considering de-risking. Should decisions be made and the asset allocation be left as is and only reviewed on a periodic basis or should the approach be more dynamic and react quicker in order to act faster as proposed by Exley et al (1997).

A key consideration for any investor is whether to adopt a buy and hold investment approach or undertake a more dynamic strategy. Traditionally a buy and hold approach whereby the asset allocation of the scheme would undergo periodic or annual reviews but remain largely static for periods of three to five years was favoured. Huang (2015) estimates that most investment pools have reached superior returns status at least twice in the last fifteen years. By following a static and asset centred investment policy they missed the opportunity to de-risk. De-risking is reducing the risk profile of the portfolio as gains are achieved. A DDS overlay strategy provides an asset allocation framework that capitalises on risk reduction opportunities to take risk off incrementally (Huang, 2015). As with any decision, entering into a DDS overlay strategy is not black and white. By transferring assets from a growth to a liability portfolio there may be further growth opportunities foregone. A periodic review and re-structure of the portfolio allocations may generate better long-term funding levels and portfolio growth (Huang, 2015) and (Watkins, 2011).

Defined benefit pension schemes with their unique assets and liabilities structure would seem suitable for a dynamic de-risking strategy. Locking in gains as they are

made and taking risk off the table seems intuitive. Countering that, making the returns necessary to grow the portfolio at a rate higher than liabilities grow is essential to improving funding levels. Do you jeopardise that by de-risking based on triggers being hit and not allowing the portfolio, as allocated, to maximise returns?

2.13 Conclusion

As populations age globally, it is going to become more difficult for the state to support older populations through state pensions. The importance of private pensions will only increase. After a period of significant closures in the 2000's the size of the defined benefit coverage and membership has held constant in the UK in recent years. With sponsors effectively guaranteeing liabilities, achieving fully funded status remains as important as ever, and not just because of regulatory obligations. Having a long term life cycle plan is standard now for these schemes. How the life cycle plan is implemented is not. A portion of the schemes are being entered into dynamic de-risking strategies with the aim of improving funding levels faster than traditional implementation approaches. Current literature is not conclusive or unanimous on whether this is the case.

Chapter 4 - Research Question

The title of this dissertation is “The Affect of a Dynamic De-Risking Strategy on the Funding Levels of Defined Benefit Pension Schemes.” The specific aim of the research is to compare the movement of funding levels in schemes that implement a dynamic de-risking strategy against the aggregate funding level of all defined benefit pension schemes.

From a detailed review of the literature it is evident that funding levels are a key concern for sponsors, trustees, members and regulators. Achieving a fully funded scheme is the target. An under-funded scheme is a solvency risk for a sponsor company and a credit risk for scheme members. Performance, risk management, contribution levels and all the building blocks of a defined benefit pension scheme are structured to maintain or achieve fully funded status.

Most schemes now implement a life-cycle plan. How the life cycle plan is implemented differs. Most schemes will complete periodic portfolio reviews and make decisions that are then implemented. Other schemes adopt a dynamic de-risking strategy, which is one that systematically reacts to market conditions as they present themselves to reduce the risk exposure on the portfolio. Decisions are made based on a set framework and are not arbitrarily made by the trustee or investment manager.

Question: Does a Dynamic De-Risking Strategy affect the funding level of defined benefit pension schemes?

To test this research question the following hypothesis are formed;

- **Null Hypothesis:**

- Ho: There is no difference in funding level outcomes when implementing a life cycle plan through a dynamic de-risking strategy.
- **Alternative Hypothesis:**
 - HA: There is a difference in funding level outcomes when implementing a life cycle plan through a dynamic de-risking strategy.

Chapter 4 - Methodology

The dissertation focussed on defined benefit pension schemes in the UK implementing a life cycle plan using a dynamic de-risking strategy. Empirical research examining the relationship between the funding levels of such schemes and the use of this strategy has not been completed previously. This is a quantitative analysis using data from a sample sourced specifically for the purposes of this dissertation.

4.1 Sample

The sample selected was UK defined benefit pension schemes implementing a life cycle plan through a dynamic de-risking strategy. There were a number of parameters to be met to ensure that the sample selected was representative and the results valid.

- **Sample Size** – minimum sample size required was thirty schemes. The sample used was made up of forty-three schemes.
- **Domicile** – All schemes are UK based.
- **Type** – All schemes are defined benefit occupational pensions.
- **Scheme Size** – Minimum size for a scheme to be included was £20 billion in assets. When reviewing funding levels, which are percentage based, schemes smaller than this would be more sensitive to changes in value.
- **Strategy** – All schemes had to be implementing a life cycle plan through a formal dynamic de-risking strategy. That is to say, an investment manager had to be appointed to implement such a strategy through a discretionary investment management agreement. Without such a control schemes could be included

that were using less formal strategies. Detail of the strategy will be provided in a subsequent section.

- **Consistent** – The schemes had to be using the dynamic de-risking strategy for the full test period.

Sample Source

The sample data was sourced from an authorised investment manager domiciled in the UK and Ireland.

4.2 Control Group

The control group is the PPF 7800 Index. The index gives the latest estimate funding position for all eligible defined benefit schemes. It is a UK index. The Pension Protection Fund has been in effect since 2005 and was founded as part of the Pensions Act in 2004. The index is an official statistic produced in accordance with the UK Statistics Authority Code. As of July 31st, 2020 there were 5,422 schemes included in the in the index. The PPF 7800 publishes the following information on a monthly basis;

- The aggregate surplus or deficit of all schemes in the index and the movement from the prior month.
- The funding ratio and monthly movement.
- The monetary value of the total assets and total liabilities.
- The number of schemes in deficit and surplus.
- The total monetary value of the schemes in deficit.

The assets and liabilities are valued using the s179 measure of funding. s179 refers to Section 179 of the Pensions Act 2004. The s179 measure is an illustration of the impact of changes in the market on the PPF's total exposure. As stated previously and covered in McNally and O'Connor (2013) there are a number of other measures of a schemes funding level, including IAS19 and FRS17. Using these different measures could return very different funding levels. Conventional and index-linked gilt yields are used to discount the value liabilities.

Adjustments are made to the scheme valuations provided to the Pension's Regulator, when making annual returns. This is done at various dates using changes in market indices. These changes are smoothed in the input data for testing to avoid representing invalid spikes. Full notes on the composition and methodology of the PPF 7800 Index are in Appendix 1.

4.3 Test Period

The test period is five years from March 2015 to March 2020. Using monthly data for five years provides sixty data points.

4.4 The Dynamic De-Risking Strategy

Following the setting of the investment strategy with the scheme trustees, the investment manager designs a scheme specific dynamic de-risking strategy. The strategy is designed to move the scheme to fully funded status within the target timeframe.

- The initial asset allocation is set with growth and matching portfolio allocations.
- De-risking trigger points are determined. There is generally a set gap between funding level triggers. The triggers are reviewed by an actuary.
- Funding levels are monitored daily.
- Annual reviews of the investment strategy are undertaken with the trustees.
- When triggers are reached the portfolio is de-risked the next day by reallocating assets from the growth to matching portfolio.
- Fully funded status is achieved when all triggers have been reached.
- The portfolio is fully de-risked and the final growth weight band implemented.

Figure 4.4 (1) is a visual illustration of the life cycle with triggers and a simulated funding level.

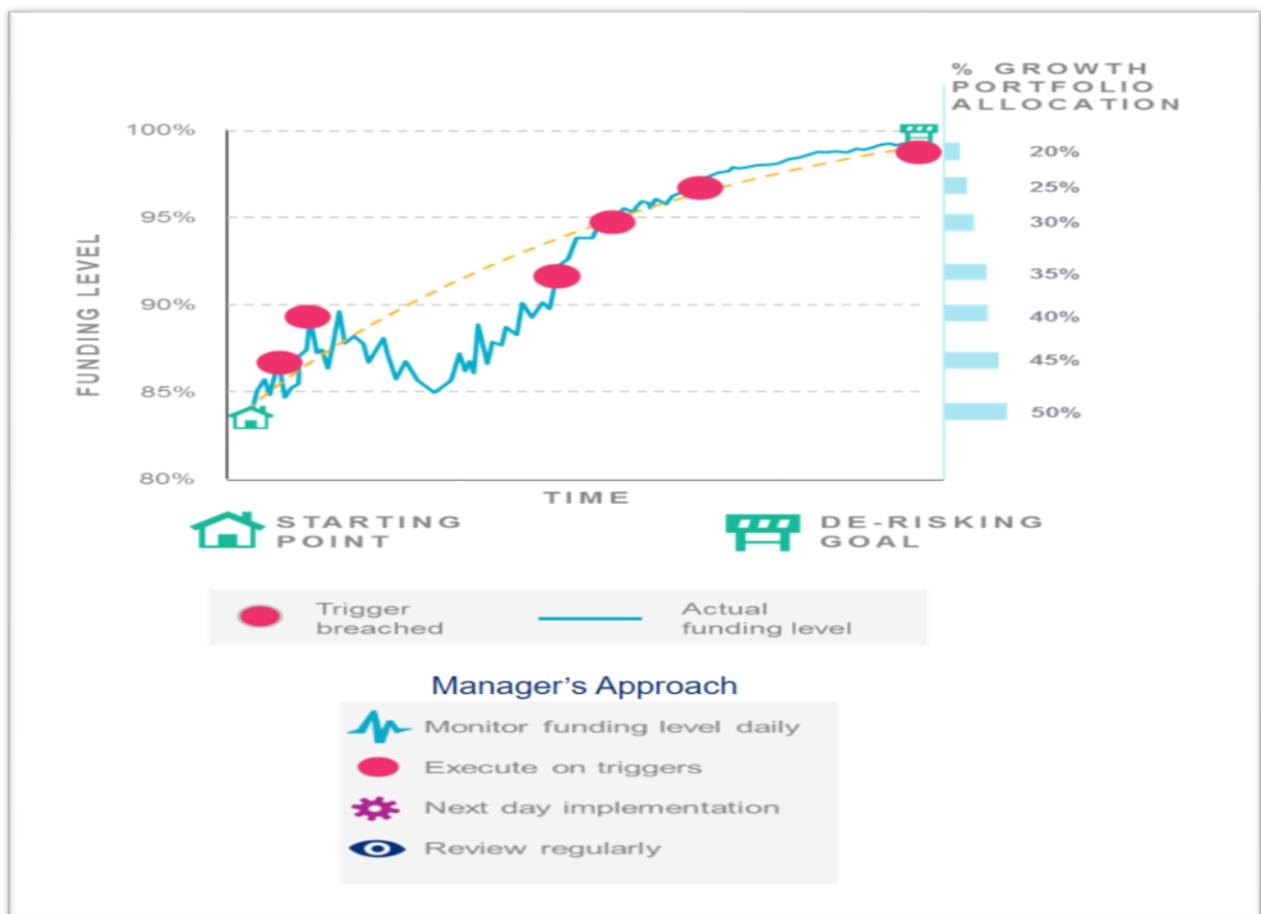


Figure 4.4 (1)

4.5 Testing

- This is a traditional two-group experiment with homogeneity among the schemes that use the dynamic de-risking strategy and the control group.
- The independent variable is the use of the dynamic de-risking strategy.
- A significance level of 5% was applied. That means we can be 95% confident in the results returned.
- A two-sample t-test assuming unequal variances was used.

Chapter 5 - Analysis and Findings

5.1 Sample Data Analysis

Figure 5.1(1) charts the movement in asset and liability valuations of the sample over the test period. From March 2015 to March 2020 the assets of the DDS schemes in the sample grew from £6,888m to £8,785m. In the same period the liabilities of the schemes grew from £9,538m to £10,878m. That represents a 28% growth in assets and 14% growth in liabilities. In monetary terms, the deficit fell from £2,650m to £2,093m. At December 2019, the deficit was as low as £1,233m. The deficit increased by 70% between December 2019 and March 2020 following the large market decline because of the COVID 19 global pandemic.

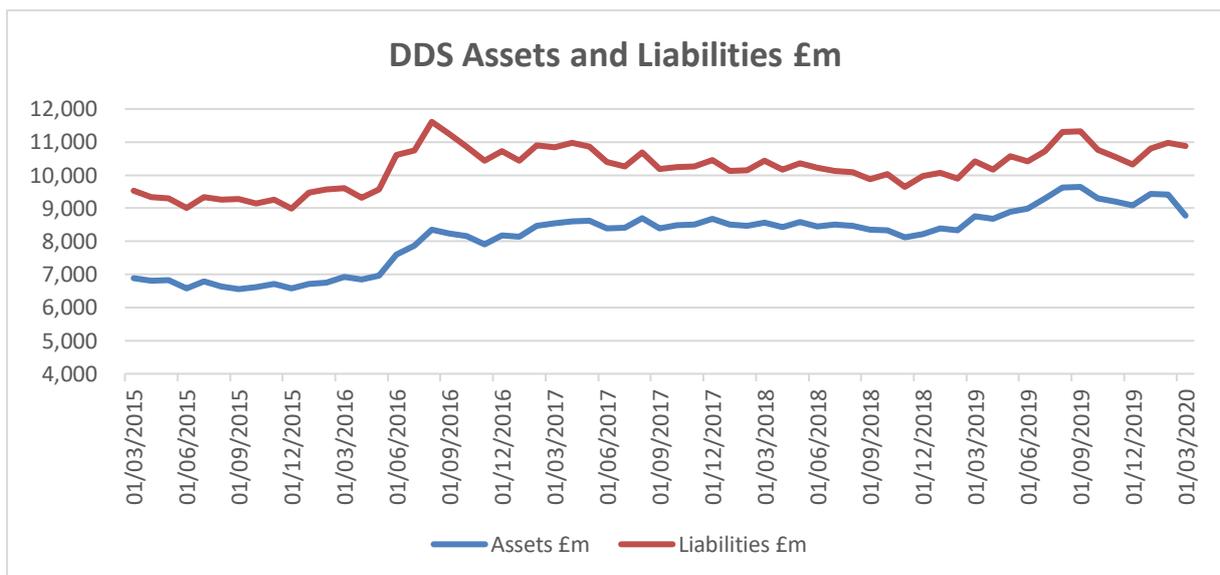


Figure 5.1 (1)

Figure 5.1(2) illustrates the trajectory of the aggregate funding level of the sample DDS schemes. The funding levels improved 12%, or just over 2% per annum, over the five-year period. This initial aggregate funding level was 72.22% and closing level was 80.76%. The first 3 months of 2020 saw an almost 6% decline. Funding levels were at

their lowest in February 2016 at 70.59% and at their highest in December 2019 at just over 88%.

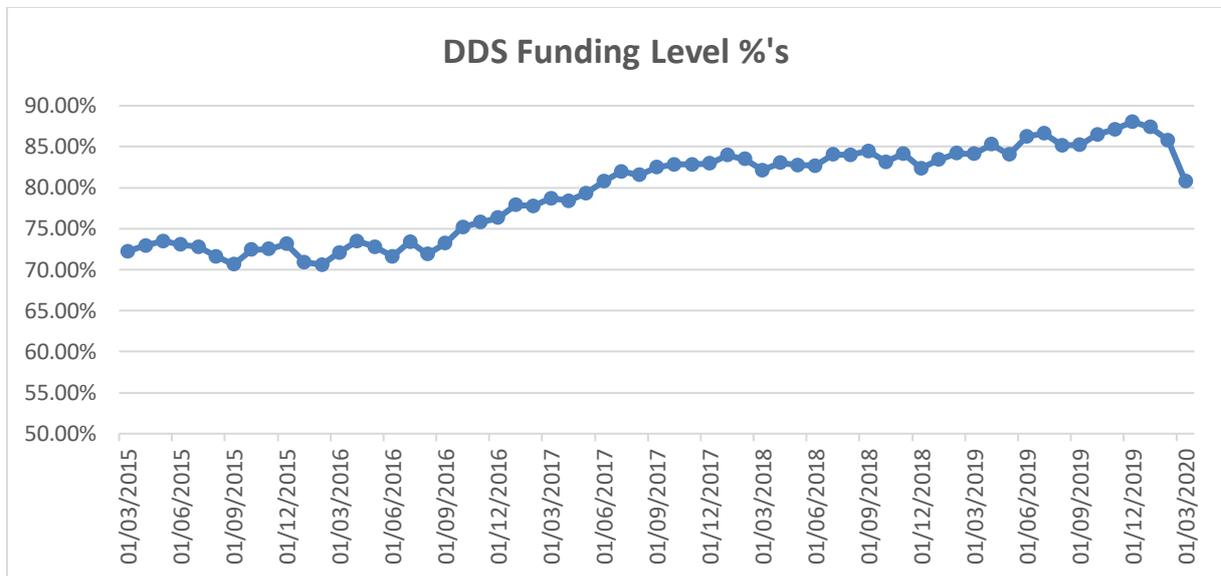


Figure 5.1 (2)

At the start of the test period the average number of triggers that had been hit by the sample DDS schemes was 2.5. At the end of the period that number was 6.4. This evidences the implementation of the DDS strategy over the period with just under one trigger per annum on average being hit per scheme. This is graphed in Figure 5.1 (3).

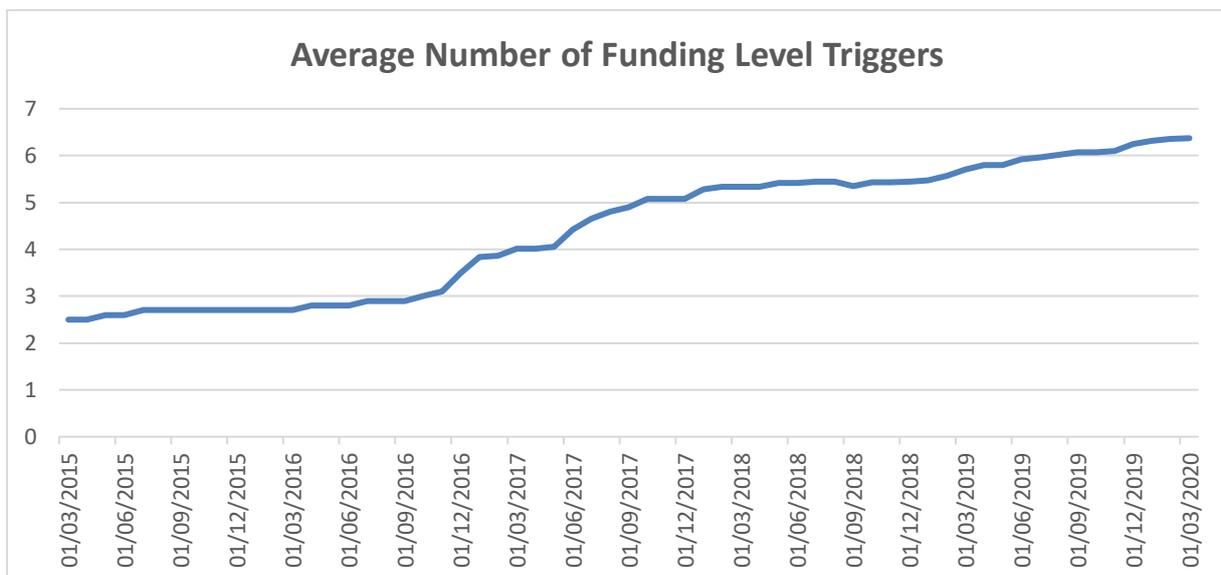


Figure 5.1 (3)

The level of de-risking that took place on the sample portfolio is reflected in the average growth allocation of the schemes over the period. Figure 5.1(4) shows the reduction in the allocation from 56% at the start of the period to 36% at the end. From a liabilities perspective that shows the allocation to the matching portfolio grew from 44% to 64%. The initial allocation aligns broadly with a standard multi-asset growth portfolio allocation. The ending allocation is demonstrative of the level of de-risking that took place over the period under review.

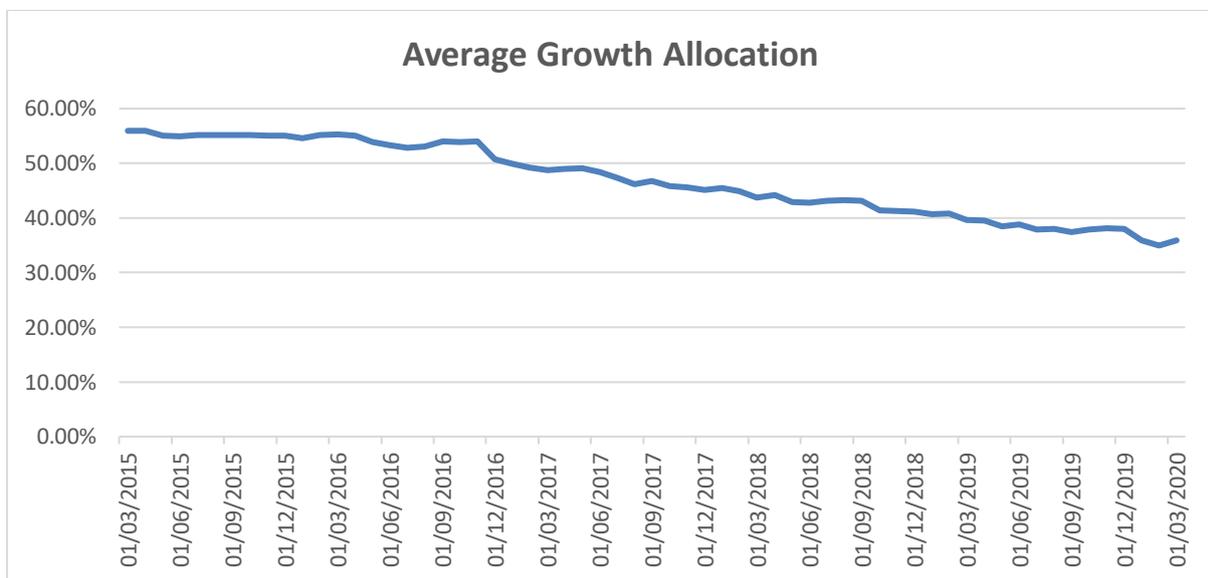


Figure 5.1 (4)

5.2 Control Data Analysis

The PPF 7800 Index data was recorded in a similar way to the sample data to support the conducting of the tests. The assets in the index grew by 31% and the liabilities grew by 15%. These are very similar in percentage terms to the sample DDS schemes.

The deficit at the beginning of the period was £292.7 billion. At the end of the period the deficit had reduced to £135.9 billion. That is a 54% reduction.

The index reported a surplus once in the five years. That was when the assets exceeded the liabilities by £14.3 billion in November 2018. On aggregate defined benefit pension schemes in the UK were fully funded at that time.

Over the period the funding ratio of the PPF 7800 index improved by 14% from 81.5% to 92.5%. The lowest ratio recorded was 77.9% in August 2016. The highest ratio was 100.9% when the surplus was reported. Similar to the DDS sample, the index reported a sharp decline in funding levels from December 2019 to March 2020. The funding level fell 6.9% and the deficit almost trebled in this period from £35.4 billion to £135.9 billion. Figure 5.2 (1) shows the trajectory of the index funding level from March 2015 to March 2020.

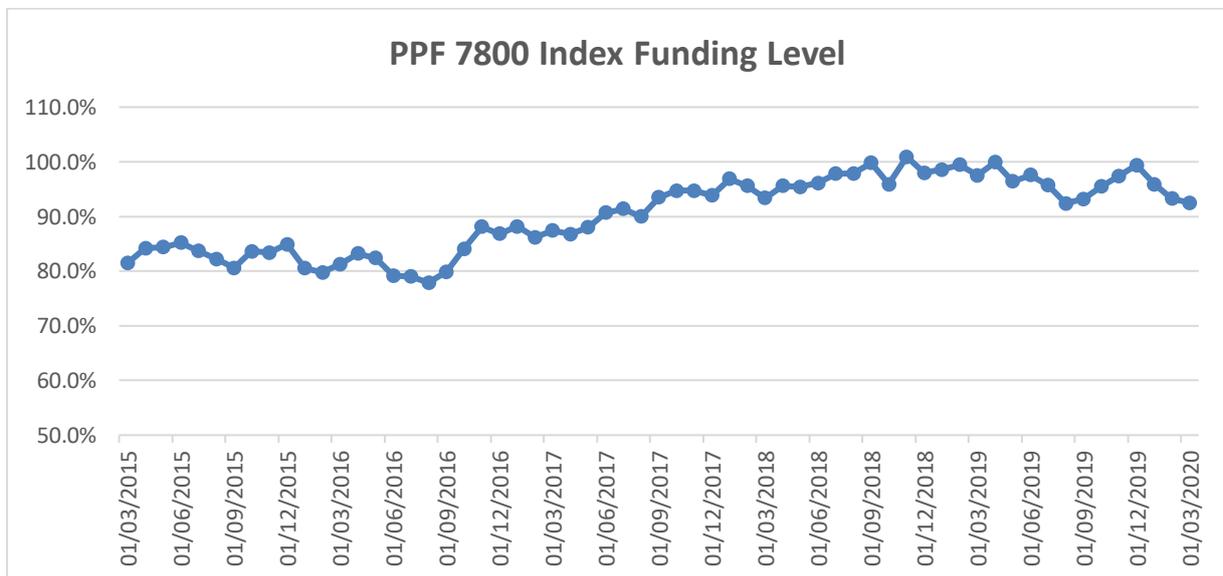


Figure 5.2 (1)

The number of individual schemes included in the PPF 7800 index fell from 6,057 at the beginning of the period to 5,422 at the end of the period. It can be interpreted, and

would be consistent with the Office for National Statistics numbers discussed earlier, that the schemes were very small and were wound up or merged with other schemes. There was no discernible shift in assets or liabilities during the test period. The number of schemes was re-stated annually. The total number of schemes is declining at just over 100 per annum. It is not insignificant but does not represent the environment of the early 2000's where schemes were closing in their multiples as discussed by Barrett and Mosca (2013), Bridgen and Meyer (2005) and Munnell (2006). Figure 5.2 (2) tracks the number of schemes included in the index for review period.

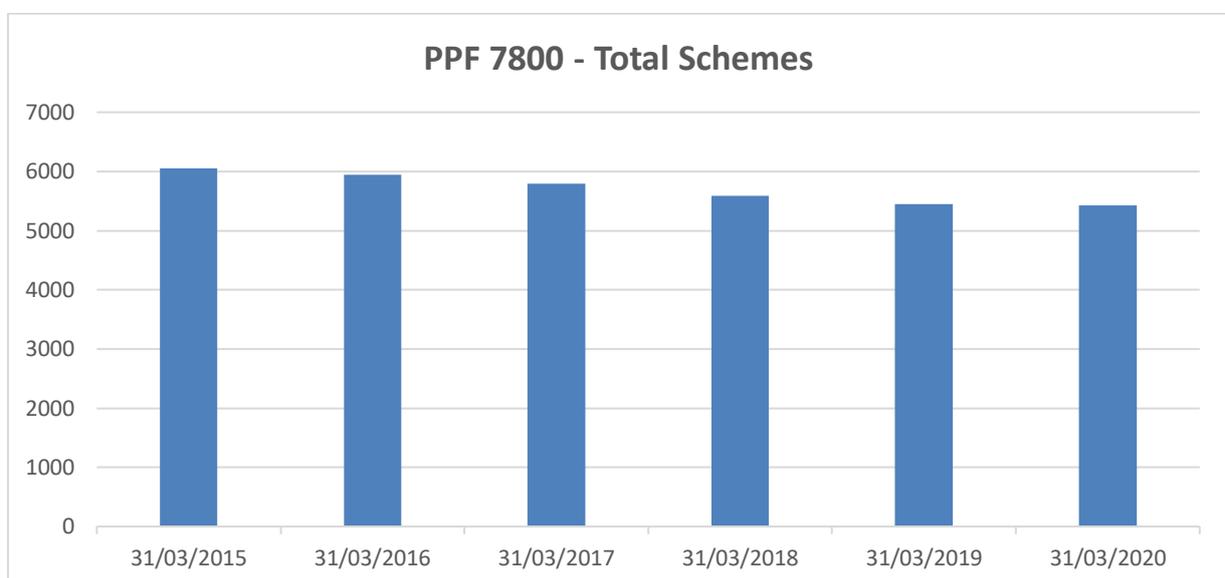


Figure 5.2 (2)

The number of individual schemes reporting a deficit decreased from 82% at the start of the period to 67% at the end. This percentage was relatively static until the end of 2016 and improved significantly since. Figure 5.2 (3) illustrates this.

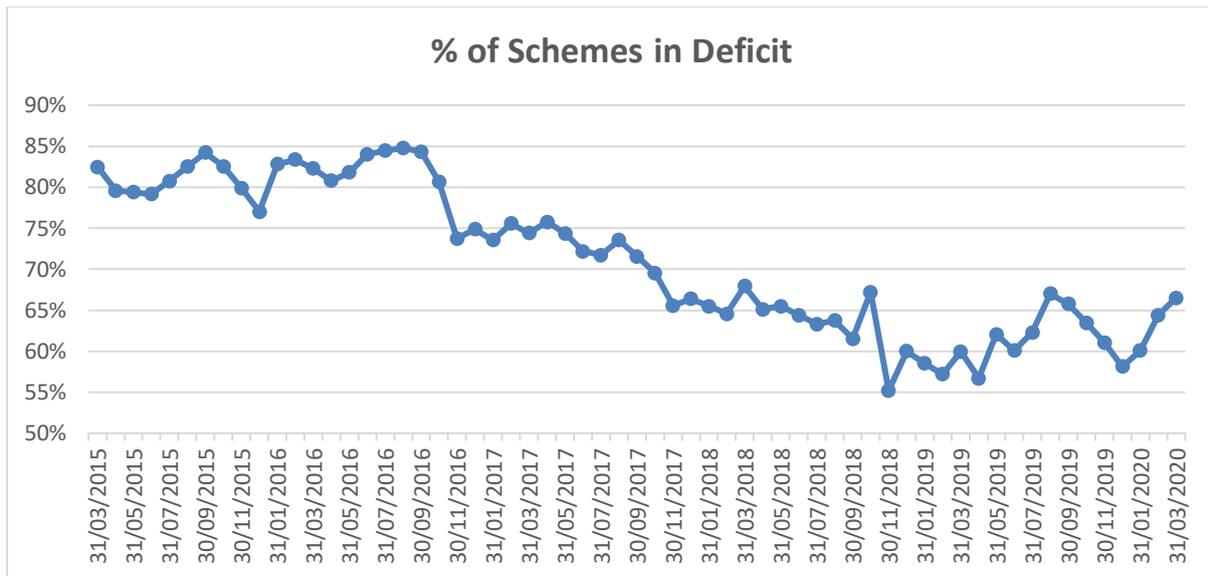


Figure 5.2 (3)

5.3 Test Statistics and Results

The research question was as follows: Does a Dynamic De-Risking Strategy affect the funding level of defined benefit pension schemes?

Figure 5.3 (1) shows the trajectory of the funding levels over the five year test period from March 2015 to March 2020 for both the DDS sample portfolio and the PPF 7800 Index. The DDS sample portfolio had a lower aggregate level. This is not unexpected as only schemes in need of funding level improvements would be in such a strategy. The benchmark index has both fully funded and under funded schemes included.

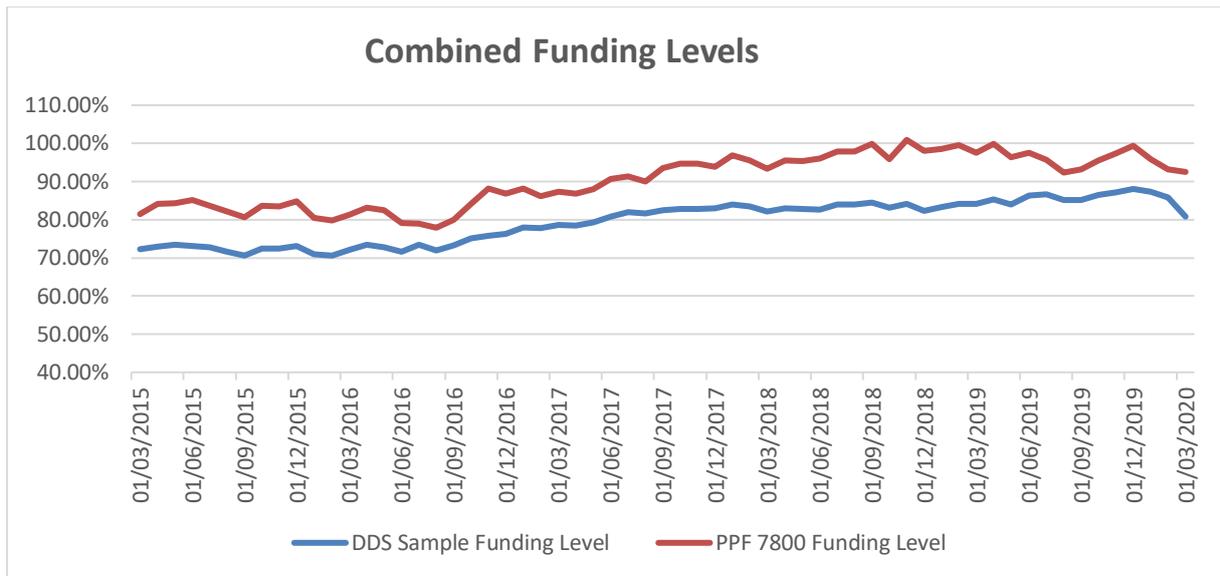


Figure 5.3 (1)

The test statistics for the DDS sample portfolio and the PPF 7800 Index are displayed in Table 5.3 (2). The statistics show that the index had a larger average movement and variation in movement in funding level from month to month than the DDS portfolio. In both cases the variance is small relative to the mean. Both data sets had relatively normal distributions as can be seen in Appendix 2.

	DDS Sample Portfolio	PPF 7800 Index
Mean	0.0020	0.0024
Standard Deviation	0.0157	0.0243
Variance	0.0002	0.0006

Table 5.3 (2)

The t-test did not produce a significant result. The results are provided in Table 5.3 (3). The t Statistic returned was -0.112. This does not exceed the critical two-tail value of 1.984. Also, the P two-tail value is greater than our significance level of 0.05. On

that basis we fail to reject the null hypothesis that there is no difference in funding level outcomes when implementing a life cycle plan through a dynamic de-risking strategy.

	<i>DDS Sample Portfolio</i>	<i>PPF 7800 Index</i>
Mean	0.001985995	0.002405809
Variance	0.000246033	0.000591169
Observations	60	60
Hypothesized Mean Difference	0	
df	101	
t Stat	-0.112387564	
P(T<=t) one-tail	0.455369591	
t Critical one-tail	1.66008063	
P(T<=t) two-tail	0.910739183	
t Critical two-tail	1.983731003	

Table 5.3 (3)

In analysing these results, and undertaking basic chart analysis of this section, it is clear that the changes in funding levels on the DDS sample portfolio were not significantly different to the benchmark index. The outcomes for both are actually remarkably homogeneous. In the next section these results will be discussed further.

Chapter 6 - Discussion

When tests return an inconclusive or insignificant result there can be a tendency to discount it. That would be wrong to do in this instance. The analysis of the data offers a number of insights that are worthy of discussion. What was found is consistent with previous literature, particularly in relation to the SAA initial asset allocation (Hoernemann et al., 2005), (Byrne and Lee, 1995). Although not generating a conclusive answer to our research question we can make a number of interpretations and, also, some suggestions on how the same topic could be researched and tested in the future.

First, can we say that we demonstrated that the sample we used was implementing a DDS strategy? The answer is conclusively yes. To de-risk a portfolio you have to take risk out of the portfolio. The allocation to growth assets reduced by 36% over the 5 years. The portfolio at the end had a much lower risk quotient than it did at the start. We know that this was done systematically because the average number of triggers hit per scheme in the sample increased by almost one trigger per annum. As a follow on this allows us to look in isolation at the sample portfolio and the funding level over the period. The funding level increased by a little over 2% per annum. If that rate was to be maintained the portfolio as a whole will be fully funded in 10 years. The researcher is not ignoring the fact that similar improvements were recorded in the PPF 7800 Index, only affirming that the funding levels did improve for the DDS schemes.

Before discussing further, it is worthwhile considering the market environment for the period. It was predominantly one of growth as can be seen in Figure 6 (1) showing the MSCI World Index for global equities performance from the start of 2015 through to

March 2020. The story is one of pretty much constant growth up to end of 2019, apart from a fall off at the end of 2018 that was quickly recovered. In total the index grew 57% from January 2015 to December 2019. In these conditions static portfolios tend to perform better. It might be expected that a DDS portfolio would underperform the index in this type of environment. By reducing the allocation to growth portfolios the opportunity to enhance performance may be foregone, as suggested by Miccolis and Chow (2016). The DDS schemes performance matched that of the index, as the liabilities were seen to grow consistently in both the sample and index.

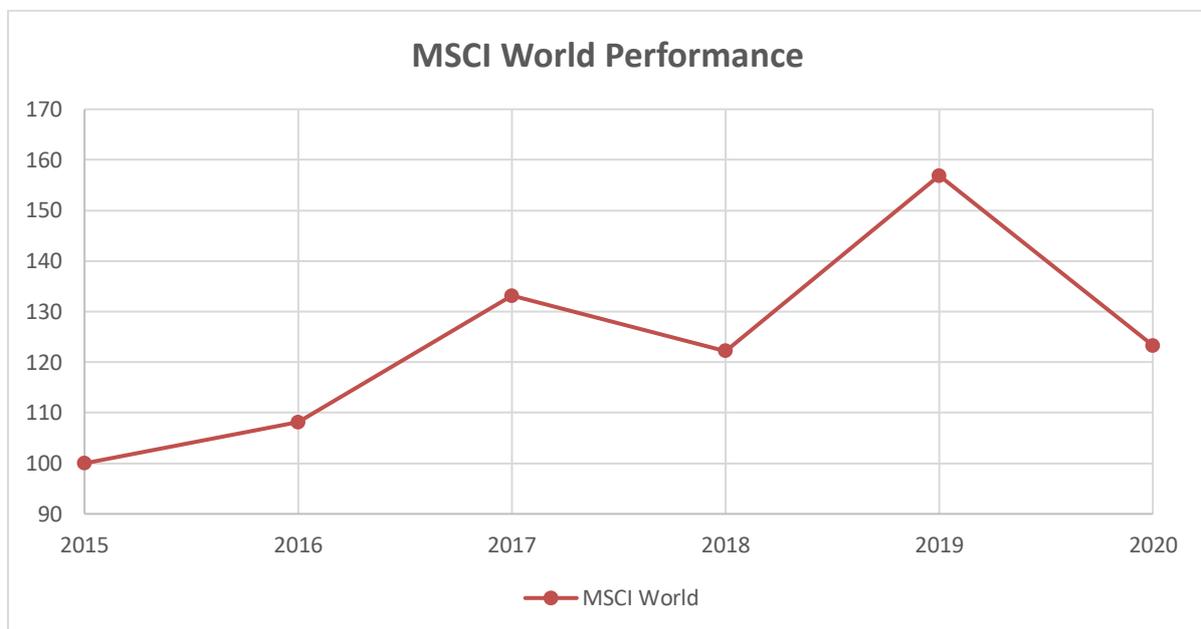


Figure 6 (1)

Source: <https://www.msci.com/>

If the DDS sample portfolio did not lag the index in growth it follows that when there was a decline in values and the market that the DDS portfolio lost asset value in a similar way to the index. It has already been outlined how the DDS portfolio had significantly decreased their growth allocation. The portfolio had been de-risked. The theory put forward by Huang (2015) and Watkins (2011) would indicate that a de-

risked portfolio should not be as exposed when there is an equity market downturn. What our evidence shows is that the DDS portfolio suffered the same losses and associated funding level deterioration as the index during the first three months of 2020. There are factors why this was the case.

Firstly, the market decline was severe and quick. A 21% fall in global equity values in three months effectively wiped out the gains of the previous 3 years. Two thirds of the fall happened in March alone. When a fall is that sharp and sudden there is often no safe harbour for the investor. Therefore, although the DDS portfolio was well along the de-risking journey there was still enough risk exposure to be severely impacted by the decline in equity values.

Secondly, there was correlation in the decline in values across most asset classes. This is more the case now and aligns with Phipps (2019) finding of increased correlation between multiple asset classes. Figure 6 (2) shows how yields on ten year UK Gilts increased five-fold in the space of a couple of weeks in March 2020 before coming back down. An increase in yields decreases prices and value. The simultaneous fall in value of equities and bonds will have a double impact on a de-risked portfolio because there will be a loss in value on both the growth and matching allocations.

The DDS portfolio was in the process of being de-risked but the severity, speed and correlation between assets meant the impact of the markets decline was not negated. The index was impacted in a similar fashion. This would indicate that the investment managers across the full universe of defined benefit pension schemes did not achieve true diversification in their SAA's, as espoused by Markowitz in his MPT theory (1952). It is not obvious what the solution is but a review of how the asset classes reacted

individually and interacted with each other will be important for asset managers as they look to design SAA's for the future.



Figure 6 (2)

Source: <https://markets.ft.com/data/bonds/tearsheet/summary?s=UK10YG>

Following on from the results found in this dissertation, there is a reluctance to categorically dismiss the proposition that a DDS strategy can significantly affect the funding levels of defined benefit schemes. Pensions are long term, as was pointed out by numerous authors and highlighted in the literature review. It would be worthwhile to undertake the same research over a longer period. The sample used in the

dissertation was valid and the five year time period with sixty data points was enough to complete a good test. In any period markets will be exceptional as it is unlikely market movement will ever mirror from one period to the next. In this case there was essentially five years of growth following by the COVID 19 driven market crisis. A normalised market over a longer period with a series of rises and falls could be a better test of the affect of a DDS strategy on funding levels. A defined benefit pension scheme is likely to have a life cycle that encompasses at least 50 years if not more. The scheme will start with the intention to remain fully funded throughout but circumstances may force those running the scheme to enter into a remedial strategy at one or more points to improve funding levels. A DDS strategy should be considered, and we have seen funding levels improve in the DDS sample portfolio. If the DDS strategy has more of an effect than buy and hold or SAA and rebalance strategies is worthy of a review over a longer period.

Chapter 7 - Conclusion

Pensions play a hugely important role in society by providing an income for people after they have finished their working lives. Most states, including the UK, Ireland, all European Union members and the majority of developed societies provide a universal state pension to those who have been tax contributors or reliant on social welfare payments. Demographics, and specifically aging populations, are starting to and will put a huge strain on individual states' ability to maintain the payment at the levels and breadth they do currently. With this backdrop, private occupational pensions are going to become more important. Relying on a state pension solely in the future is unlikely to support a good quality of life.

Within the private occupational pension industry, defined benefit pension schemes still occupy a significant space. 35% of UK citizens with private occupational pension scheme membership are members of defined benefit schemes. The equivalent number for Ireland is 37%. There are not many, if any, new defined benefit schemes being founded, and many of the existing schemes are frozen to new members. However, the membership and size of the industry has held steady for much of the last ten years, even since auto-enrolment was introduced in the UK. The existing schemes are being retained as opposed to wound down or bought out.

Meeting defined benefit pension scheme liabilities is the responsibility of the scheme sponsor. The pension promise is viewed as a guarantee by most. Being obliged to honour the guarantee can make scheme liabilities a solvency risk for many sponsor companies. If they are a solvency risk for the sponsor, the guarantee of the liabilities

is in turn a credit risk for scheme members. Achieving and maintaining good funding levels is key to mitigating and reducing these complimentary risks.

Many defined benefit scheme sponsors and trustees have had difficulty in maintaining good funding levels, either through not committing enough resources or poor investment decisions. With the increased outsourcing of the investment management function to specialist investment managers has come an evolution of the strategies used to grow assets and improve funding levels. Traditional buy and hold strategies are less common with managers more likely to use a SAA with rebalancing or dynamic de-risking strategy, amongst others. Taking as much risk out of the portfolio while still meeting necessary growth targets is the investment target for the scheme.

This dissertation looked to assess the affect a dynamic de-risking strategy has on scheme funding levels in comparison to the PPF 7800 Index of virtually all defined benefit pension schemes in the UK. The findings were not conclusive and there was no significant difference in the movement of funding levels between the sample DDS portfolio and the index. The funding levels in the sample portfolio did improve by circa 2% per annum and this aligned with, as opposed to differed, from the movement on the index.

As outlined in detail in the discussion section, the market environment over the test period probably contributed to the homogeneity within the test data. Although not finding a difference in this dissertation the researcher would be reluctant to definitively say there is no difference in how funding levels evolve for defined benefit pension schemes when using a dynamic de-risking strategy. Further testing over a longer time period would be worthwhile in trying to reach a conclusive finding.

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Appendix

Appendix 1 - PPF 7800 Index Valuation Notes

1. The PPF universe The PPF covers certain occupational defined benefit pension schemes and defined benefit elements of hybrid schemes. For more information about eligible schemes see the PPF's website at: <https://www.ppf.co.uk/your-scheme-eligible>

2. PPF compensation For individuals who have reached their scheme's normal pension age or are already in receipt of a survivor's pension or pension on the grounds of ill health, the PPF will generally pay compensation at the 100 per cent level, i.e. these members will not see any reduction in retirement income when their scheme sponsor goes insolvent. For the majority of people below their scheme's normal pension age the PPF will generally pay compensation at the 90 per cent level. This is subject to a cap which is currently equal to £36,018.31 per annum at age 65, after the 90 per cent has been applied. Increases in future payments for members may not be as much as they would have been under their pension schemes. For more information about PPF compensation see the PPF's website at: <https://www.ppf.co.uk/what-it-means-ppf>

3. s179: one of many different funding measures s179 is one particular measure of funding. The change in the deficit of schemes in deficit on an s179 basis is an illustration of the impact of changes in financial markets on the PPF's total exposure. Schemes in surplus on an s179 basis at the time of insolvency usually do not enter the PPF. For more information please see our official s179 assumptions guidance at: <https://www.ppf.co.uk/sites/default/files/file-2018-11/s179-assumptions-guidance-a9-nov2018.pdf>

In addition to s179, there are many different measures of a scheme's funding position. Among the other common measures are full buy-out (what would have to be paid to an insurance company for it to take on the payment of full scheme benefits), IAS19 or FRS17 (the measures used in UK company accounts), and Technical Provisions (that are used in the UK's scheme funding regime). The different measures can give very different levels of scheme funding at any point in time and move very differently over time.

4. Methodology The figures shown throughout this document are based on adjusting the scheme valuation data supplied to The Pensions Regulator as part of the schemes' annual scheme returns, including Deficit Reduction Contribution certificates. This data is transformed on an s179 valuation basis at various dates using changes in market indices for principal asset classes. Conventional and index-linked gilt yields are used to value liabilities. The approximation does not allow for benefit accrual or outgo or actual scheme experience.

5. Estimating the impact of changes in market conditions on the PPF 7800 Index We have developed a number of 'rules of thumb' to estimate the impact of changes in asset prices on scheme assets and s179 liabilities. A 7.5 per cent rise in equity markets boosts assets by 1.9 per cent while a 0.3 percentage point rise in gilt yields reduces scheme assets by 2.3 per cent. Meanwhile, a 0.3 percentage point rise in gilt yields reduces scheme liabilities by 5.7 per cent. The rules of thumb strictly speaking only apply to small changes from the 31 March 2019 level. For more information see Chapter 5 of the Purple Book 2019, available on the PPF's website at: <https://www.ppf.co.uk/purple-book>

6. Moving to the Purple Book 2019 dataset In January 2020 we moved to a dataset consistent with the Purple Book 2019 covering 5,422 schemes. The Purple Book 2019 dataset is estimated to include over 99 per cent of liabilities of PPF eligible schemes. The new dataset is based on a more up-to-date universe of schemes, excluding for example schemes that have entered PPF assessment, and it also uses more up-to-date funding information from the schemes in our universe. This is a standard procedure performed annually after the publication of the Purple Book. The impact of the change increased the funding ratio at 31 December 2019 by 1.4 percentage points (this figure can differ slightly depending on the date at which it is calculated) and improved the aggregate funding position by £24.5 billion. The aggregate funding position recorded as at 31 December 2019 was -£10.9 billion (99.4 per cent funded) compared with -£35.4 billion (98.0 per cent funded) using the old dataset.

The PPF 7800 is produced in accordance with the UK Statistics Authority Code for official statistics which came into force in February 2009.

Appendix 2 - Test Data Distributions

