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Underfunding of Defined Benefit Pension  
Schemes?**

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Geary WP2012/02

January 2012

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# What Should Be Done About The Underfunding Of Defined Benefit Pension Schemes?

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January 2012

## Abstract

Underfunding of defined benefit (DB) pension schemes is prevalent throughout the Western world, and no more so than Ireland. This paper examines underfunding of DB schemes and discusses alternative ways of overcoming this problem. It critically reviews alternative government sponsored insurance schemes including the US Pension Benefit Guaranty Corporation (PBGC) and the UK Pension Protection Fund (PPF), underpinned by the introduction of risk-based levies. Commentators have suggested introducing some variant of the latter scheme in Ireland. The paper also examines alternative schemes that have been proposed to understand the dynamics of the level of underfunding and how this can be addressed. Finally it examines the risks inherent in DB schemes and details how these will affect the introduction of any mechanism that tries to address the levels of underfunding in Ireland.

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## **I Introduction:**

Underfunding of defined benefit (DB) pension schemes is prevalent throughout the Western world, and no more so than Ireland. The average scheme is approximately 20 per cent in deficit. Underfunding results in large claims and insolvencies.<sup>1</sup> Underfunding exists because pension assets are insufficient to meet pension liabilities. This implies that pension promises made to scheme members will not be fully met and in extreme cases will not be met at all.

We begin by providing details of the level of underfunding of Irish defined benefit schemes. We then outline a number of causes of the underfunding. These have resulted in both a reduction in pension assets and increases in pension liabilities. Central to this is the asset allocation of Irish funds where a heavy weighting in equities has resulted in a reduction in the value of pension assets as these risky markets perform poorly. There is little evidence of increased contributions either by scheme sponsors or members that would be sufficient to remove the impact of the negative investment performance on Irish pension assets. We also document the importance of longevity and demographic shifts which has increased the liabilities of pension schemes. People are living longer, but there is also a demographic shift where the number of employees compared to retirees has plunged dramatically, and is forecasted to fall further over time. Thus, the ability to use employee contributions to fund projected pension liabilities is very much constrained.

So how do we solve this funding problem? The first possibility is to do nothing which we will overlook. In an international context it has become common for government sponsored

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<sup>1</sup> A high profile case in Ireland is Waterford Wedgewood. Here there were workers based in Ireland and in the UK. In the latter there was a pension insurance scheme in place giving some protection to workers whereas one did not exist in Ireland. Later in the paper we will provide details and a critique of the different schemes that exist internationally.

insurance schemes to be introduced as a solution to support defined benefit plans.<sup>2</sup> This paper provides a critique of these schemes. We outline and provide illustrations of the rationale and the associated costs of this type of government intervention. These schemes aim to address the poor and incomplete design of the pension contract and the lack of diversification associated with these schemes, and it is argued this is where government intervention plays a part. However it is important to note that there are substantial risks for these schemes, most notably, moral hazard, adverse selection, systematic risk and political risk. We discuss these risks and document how they have impacted on various schemes introduced internationally with particular focus on the US Pension Benefit Guaranty Corporation (PBGC) and the UK Pension Protection Fund (PPF).

We provide details of approaches that try and mitigate these risks. These include 1) placing limits on pension benefits, 2) supporting prudential asset allocation, 3) using risk based pricing for the pension premiums; 4) using a funding standard, 5) providing sufficient and independent powers for the supervising body and 6) placing a lien on the sponsors assets. Given the core of the problem for defined benefit pension schemes is their level of underfunding the use of risk based pricing of pension premiums is seen as critical in providing a solution. There is a body of literature and actual mechanisms in place that try and deal with the complexities associated with the correct pricing for these schemes. The main message is that the levy charged should relate to the pension plans level of underfunding with higher levels attracting higher premiums.

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<sup>2</sup> In the National Pensions Framework (Government of Ireland, 2010) a set of changes to defined benefits schemes were outlined. In the main they were proposals that schemes may voluntarily adopt in the future.

The plan of the paper is as follows. Section II provides details of funding of Irish defined benefit pension schemes. In Section III, we document the rationale given for government sponsored insurance schemes and their associated risks. This is followed in section IV where we outline ways of mitigating the risks of these schemes and discussing current schemes in operation internationally. In section V, we provide concluding remarks.

## **II The World Facing Irish Defined Benefit Pension Schemes:**

Defined benefits pensions are composed of pension assets and liabilities (see appendix 1 for further details on the dynamics of these schemes). Pension assets and liabilities are substantial in Ireland and affect a large number of scheme members (see Table 1). There are varying levels of control (or lack of) for the different drivers of the magnitude of pension assets and liabilities. For pension assets we assume that we have, or can, take some control over the level of contributions and the investment performance of the accumulated assets. However, in contrast, we assume little control over longevity risk that is increasing the length of payoffs associated with our pensionable population. As we progress through this paper we are going to comment on how we can take control of some of the drivers of the pension asset and liability mix and how these will have positive effects on the levels of funding.

INSERT TABLE 1 HERE

### **II.A Underfunding of Irish Pensions:**

The level of underfunding has changed over time and in recent years has been high. Although there was an improvement in much of the 2000s this reversed dramatically in recent years. To illustrate for OECD countries, the percentage levels of annual funding have traditionally been in double figures as can be seen in Figure 1. The funding in DB schemes has worsened considerably since the onset of the financial crises. For Ireland underfunding has increased from 8.1% in 2007 to 19.0% in 2008 and to 19.4% in 2009. These large levels

of underfunding are also associated with a high degree of variability and much of this is driven by asset market performance, and in particular, equities. Note, that whilst the level of funding available for future drawdown by Irish employees is by no means the worst of OECD countries, the performance is pretty poor, especially in comparison to the UK.

INSERT FIGURE 1 HERE

Whilst the underfunding levels vary according to different sources, it is very hard to make underfunding disappear regardless of the source. Taking data provided by Mercer we find that underfunding is prevalent for Irish DB schemes as shown in Figure 2. As of August 2011, underfunding is over €4,000m across the schemes representing over 20% of a shortfall between assets and liabilities. One further key feature is the variability in the level of underfunding. In line with the country data outlined in the OECD graph it is important to note that there has been substantial change in the defined pension deficit over time. Much of this is due to the performance of pension assets and their large weighting in equities.

INSERT FIGURE 2 HERE

The first conclusion we must accept is that underfunding of pension schemes is prevalent and represents a serious problem for policy makers, and more importantly, future pensioners (see Moloney and Whelan, 2009 for analysis of before financial and economic crises). The numbers of members in defined benefit schemes are large and in excess of 0.5 million (see Table 1). These numbers remain reasonably stable over time and approximately twice their defined contribution counterparts. In general companies that have defined benefit schemes tend to be large employers with semi-state companies prominent in this regard. Note the lack of sufficient funds for retirees in Ireland is not just a defined benefit pension issue.

Whilst this paper is mainly concerned with underfunding in DB schemes, there are a multiple of funding problems across other types of schemes, namely defined contribution schemes.

To illustrate, Mercer (2011) have some information on defined contribution schemes and asset allocation. One of the key drivers of insufficient funding of pension schemes is the level of pension asset investment in equity markets. Mercer report that there is an even greater allocation to equities for defined contribution schemes (combining domestic and foreign equity weighs more than 80% of total asset allocation) compared to defined benefits ones. Poor funding extends itself to State pension provisions. Here we have seen that one of the elements of the EU/IMF package was to use the National Pension Reserve Fund to finance much of the Irish government's contribution to the package. Although the objective of the fund original was to meet the costs of public service pensions from 2025 and that no money was to be taken from the fund prior to that date, the economic conditions have dictated otherwise leaving a very small pool to meet future pension obligations.

## **II.B Longevity and Population Dynamics:**

There are a number of causes for the level of underfunding emanating from both pension assets and liabilities. In appendix 1 we discuss a pension model providing further details of on the relationship between pension assets and liabilities. Some like longevity are positive for society (most of us want to live longer) but have serious consequences for the funding requirements for future retirees (see McCarthy, 2009). The fact that we are living longer is accentuated by a demographic shift with the population growth rate slowing down. This results in a much smaller pool of workers who can contribute to theirs (and others) retirements. This demographic time bomb is prevalent internationally as evidenced in Figure

3. Here the ratio of a working population to a retirement population has been falling dramatically and is forecasted to fall further in the coming years. In Japan this is most extreme with this ratio falling from 10 to 1 in 1950 to 3 to 1 in the mid-2000s and is expected to fall further to 1.29 to 1 by the year 2050. Regardless of any other issue that would impact on pensions this demographic effect puts serious constraints on the funding of pensions. The projected decline in the working/retirement ratio is reasonably similar throughout the geographical areas.

INSERT FIGURE 3 HERE

Closer to home the Central Statistics Office (CSO) has produced population pyramids that encapsulate the population time bomb and this is given in Figure 4. Based on 2006 figures and forecasts for 2041 the landscape of those working relative to retirees is going to drop dramatically over this timeframe, for example, from a ratio of 6.2 down to 2.13 for males, and with a similar decline for females. Note these ratios do not take account the large subsidy the workforce has to give to those not yet of the age to be in the labour market, due to being still in education etc. The burden on those in the workforce is even greater if one considers that not all of the available labour force are employed, but still have to meet the retirement payments of the full pensionable population. This demographic characteristic represents a serious challenge for developing sustainable pension policies regardless of any other weakness in the system.

INSERT FIGURE 4 HERE



## **II.C Pension Asset Performance and Allocation:**

Next we turn to the performance of Irish pension assets. Overall the level of assets under management of Irish occupational pensions is very substantial, in excess of €75 billion as seen in Table 1. Note that approximately two-thirds of this is currently invested on behalf of defined benefit schemes. The impact of poor investment performance is very clear falling from €71.9 billion in 2006 to less than €50 billion at the end of 2010. Unfortunately there are weaknesses in the asset liability mix underpinning pension performance. Looking at the performance of pension fund assets we note a big dip in 2007/2008 recorded internationally. This in itself resulted in a large increase in the level of underfunding. Ireland, however, was one of the worst performing economies in terms of the returns in pension assets. A snapshot of OECD member investment returns is given in Figure 5 and this proves a very sorry picture of the level of performance for Irish funds in an international context. We have some evidence as to why Irish investments fared far worse than their OECD counterparts. First there was a heavy asset allocation to Irish based assets, and the performance of the economy of this time fed into a poor performance. However, the lack of international diversification is not the main cause of the decimation in value of the Irish pension assets.

INSERT FIGURE 5 HERE

The main problem for Irish pension funds was that there was a very heavy asset allocation towards equities and equity markets performed miserably in 2007/2008. It is important to note that figures on asset allocation (or on other issues for that matter) do not always square up when comparing alternative sources. However they do provide similar signals and it is clear from these that equity investment was very high in Ireland. To give you an example,

the Irish Pensions Board (2010) suggest that 54% of assets were in equities whereas the OECD (2011) report a 72% allocation for the year 2009.

On an international basis, these allocations towards equities deviate very much from the norm. To illustrate, Mercer (2011) reports that Ireland has the highest propensity to invest in equities in a comparison of the asset allocation strategies of European economies. Even if we were to take account of the different estimates of asset allocation by given sources, it is clear that Irish pension funds had a very large propensity for investing in risky assets, namely equities. In contrast the perceived safe assets of fixed income securities were very much overlooked. Combining the poor performance of equities, and especially Irish equities (the Irish equity market fell by 66% in 2008 (Irish Stock Exchange, 2011) and the asset allocation mix of Irish equities, it is no surprise to see pension assets fall and underfunding increase around this time.

It is very difficult to change these asset allocations and the culture that drives the weightings. However it is a key consideration in order to protect against the volatility in asset markets. It is also difficult to change the geographical allocation, but in terms of diversification it is vital that we start in this process.

One other component of pension assets is the level of contributions made by both corporate sponsors and by employees. Some recent evidence is outlined in Table 1. Given the economic pressures being put on companies, it is somewhat surprising that employer contributions have actually increased in monetary value since 2006. Whilst this is to be

welcomed in dealing with underfunding, it is not clear if this is sustainable to have further increases in future years. Nor is it clear that these increased contributions are of sufficient size in order to eliminate the large deficits that currently exist for Irish defined benefit schemes.

### **III. Rational for Government Sponsored Insurance Schemes**

We now turn to arguments that are put forward in favour of introducing government sponsored insurance schemes. We also have plenty of evidence on these schemes internationally and we discuss risks associated with their introduction.

#### **III.A Arguments to Support Government Sponsored Insurance Schemes:**

We discuss these under two headings, poor and incomplete design of the pension contract and a lack of diversification.

##### *1. Poor and Incomplete Design of the Pension Contract*

First, government guarantee insurance schemes are introduced as a response to some form of design weakness in the pension contract. Here there is an inefficient allocation of resources. Defined benefit pensions are part of the terms and conditions of an employment contract and represent deferred salaries. They represent an implicit contract between the corporation and employees (See Ippolito, 1985 for further details). As the employee is deferring current income for future income it is assumed that the future income will be paid. However this will not occur if the corporate sponsor has insufficient funding of their pension schemes and/or they are to become insolvent. The argument goes that without outside intervention, there is no real incentive for corporate sponsors to ensure that member plans are fully funded. By underfunding the plans they make the employees long term bondholders in the company that

are unsecured, that is, they agree to pay them at some future, distant, date. For employees, they do not have sufficient information and an understanding of the implications of their contract to change these conditions. They also suffer as they can be treated as having the same knowledge (certainly not better) as outside lenders. Thus they maybe defaulted upon and without having security will not be able to receive their full pension entitlements. If markets were well functioning and employees had full information they would not agree pension arrangements with sponsors who may go bankrupt or have underfunded schemes. Unfortunately employees suffer from this design weakness and the government intervention is aimed at addressing this.

Further employees exhibit myopia regarding pension provisions and this is understandable. There are so many elements to pension schemes and their design that are complex. For instance, it is very difficult to understand the calculations involved and the relevance of all terms and conditions. Mitchell (1987) found that missing and misinformation in relation to pensions was widespread. Thus the quality of the information that employees have on their pension schemes varies considerable from being very poor (and almost non-existent) to at best, mediocre. There is asymmetric information between the corporate sponsor and scheme members and this will result in sub-optimal decision making by employees and inappropriate pension schemes being signed up to.<sup>3</sup> The aim of a government guarantee insurance scheme is to provide some support against this lack of information and misinformation that employees have in relation to their pension entitlements.

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<sup>3</sup> The current literature on financial literacy regarding contracts entered into during the financial crises is an analogous example of a lack of information by parties resulting in sub-optimal decision making.

## 2. *Lack of Diversification*

The second argument is that there is a lack of diversification in employee pension schemes. Here employees receive current and future income from the same source, and it can be difficult for them to diversify from these risks.<sup>4</sup> Note often these schemes are mandatory so diversification out of these schemes is not an option. The contributions from employers are determined by the financial health of the company and the financial health of the pension plans. Unfortunately these are correlated. Corporations that have a high potential for insolvency are also more likely to have underfunded pension schemes. If the corporation does enter bankruptcy, current employers face the double effect of a loss of salaries and a loss of pension entitlements. Former employees face a loss of pension entitlements. The problem for employee pensions is accentuated as insolvencies are cyclical resulting in systematic risk for these schemes (see McCarthy and Neuberger, 2005). They note claims arise when firms become insolvent and the claim size actually depends on the level of under-funding. Since pension funds have a heavy equity exposure, under-funding is therefore worst after sharp falls in stock markets and these are strongly correlated to corporate insolvencies.

Note this diversification problem for claims relates to the pooling of pension scheme obligations which operates in the same way as insurance. Insurance works best where the risks covered by the insurer are specific or idiosyncratic risks, i.e., risks that are uncorrelated across claimants. This is because specific risks can be pooled and the insurance book is diversified. Insurance works less well if the risks assumed are systematic, that is, when claims occur together: in such cases there is little benefit from diversification. The lack of

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<sup>4</sup> In reality it is common for employees to go against diversification principles further by investing their own wealth and savings in the corporation either through stock options or through plain investments. Certainly it is unlikely that employees would have investment portfolios of sufficient size or the investment expertise necessary to hedge the risk of their pension assets.

diversification results in an insurance that does not operate to meet the claims and this may give rise to a role for government guarantee insurance schemes.

### **III.B Risks in Government Sponsored Insurance Schemes**

Although the contract design weaknesses and the lack of diversification are arguments used to support the introduction of government schemes, it is important to recognise the costs associated with these schemes. There are a number of risks associated with government sponsored insurance schemes and these are substantial. These schemes represent guarantees rather than promises. There are consequences of this including the introduction of adverse selection, moral hazard, systematic risk and political risk in the pension insurance scheme. Let us discuss these in more detail.

#### *1. Adverse selection*

Government sponsored (or any) insurance schemes involve a premium being paid in exchange for some agreed coverage. For private sector insurance schemes these represent promises of coverage but these tend to become guarantees for government backed schemes. Government backed schemes usually involve compulsory coverage allowing and requiring all firms to be members. In these schemes, it is very difficult to get the fair premium that would be assigned to each party insured. This results in mispricing where parties are not paying a fair premium for their potential bankruptcy, their funding levels and associated investment policy. Here some parties will end up subsidising other parties, and this is accentuated by not

being able to decline coverage to those who exhibit the highest risk of being insolvent.<sup>5</sup> This is the adverse selection problem.

Adverse selection is a classic insurance risk: only those most likely to claim take out insurance, and insurers try and protect themselves by increasing the price of the insurance to all clients. Given the levels of (under)funding of Irish defined benefit schemes this may be difficult to implement as the price of insurance may be too prohibitive for member firms. The extent and impact of adverse selection adds to the complexity of introducing any insurance scheme and is hard to magnify, but as with all forms of insurance, it involves an element of cross-subsidisation where strong schemes subsidise weak schemes.

If the cross-subsidies are too high, then strong firms will try and pull out of the schemes and so avoid paying the insurance premiums. (The incentive for weak schemes is to do the opposite and remain in the schemes.) The classic way to do this is for a strong firm to close down its defined benefit scheme and switch to a defined contribution scheme which will not be captured by the insurance scheme. This is a very real problem as there is no requirement that employers operate a defined benefit pension scheme at all. Even before contemplating introducing a government guarantee scheme in Ireland, and the associated premiums that will be required, the evidence is that firms are closing their defined benefit schemes in favour of defined contribution ones. For instance, the Green Paper on Pensions (Government of Ireland, 2007) notes that the ratio of defined benefit to defined contribution schemes has fallen dramatically from 4.5 to 1 in 1996 to 2 to 1 in 2006. Further, the IAPF (2010) identify

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<sup>5</sup> Contrast this with commercial insurance where much work is done trying to identify potential clients who have a high probability of claiming, and subsequently not insuring them.

defined contribution schemes as the most popular replacement schemes (72% of total) for closing defined benefit schemes. If firms are able to leave an insurance scheme, they immediately incentivize other strong firms to follow suit thereby further diluting the level of premiums available to support weaker firms. Exiting by strong firms reduces the overall pool of insurance as only financially weak sponsors are left in the scheme. The backer of the scheme, the Government, will be left in bailout territory. Thus any insurance scheme must remove the ability to walk away by financially strong firms.<sup>6</sup>

## *2. Moral hazard*

Another classic risk associated with insurance is moral hazard. Here the insurance schemes covered have an incentive to take on more investment risk once they have taken out cover. There are a number of ways in which moral hazard can impact on a government insurance scheme. For instance, once the Government provides a guarantee to meet a company's pension liability obligations, the firm can change its original investment strategy, and make it more risky. It is in the firm's interest to increase its risk-taking: the guarantee means that the insured no longer bears the downside of his/her risk-taking, but still benefits from the upside potential of that risk-taking. To be specific, if the fund takes more risks, the firm is still covered on the downside, but can expect to achieve a higher fund value on the upside, and the higher fund value means that the firm can expect to realise a higher surplus after it pays for the annuity at retirement. So the setting up of the insurance scheme results in moral hazard and increased allocation of pension assets in higher volatility investments. As we have seen,

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<sup>6</sup> An example of this is in the UK where a limit was imposed on a firm's ability to walk-away from a defined benefit scheme. On 11 June 2003 the UK government announced that solvent companies could not walk away from their DB obligations accrued before this date unless they were fully bought out by an insurance company by means of current and deferred annuities.



equity allocation is a major source of defined benefit underfunding in Ireland. So moral hazard could accentuate rather than reduce the funding problem inherent in Irish pensions.

One might argue that this type of moral hazard can be somewhat negated in the case of Ireland. As we have seen Ireland is very much skewed towards investment in risky assets, especially equities. Given that pension funds already invests more heavily in risky assets than any other country before the introduction of a government backed pension insurance scheme, it is hard to see how the level of risk taking might increase afterwards. Thus the introduction of a scheme might offer an opportunity to help reduce the risk taking. One possibility is to put a maximum ceiling on the equity weighting in an investment fund. This would help to reduce the very large losses that are underpinning the high levels of underfunding that exist.

However a word of caution is needed. The fact that Irish pension funds have invested in risky assets such as equity and real estate is no accident. It is going to be difficult to change the culture of asset allocation across the industry and for the firms sponsoring defined benefit schemes. In essence the introduction of an insurance scheme will have to rely on management discretion in terms of their choice of investment fund. Given the incentive to increase the risk taking emanating from the introduction of the insurance scheme it may be that management will use their discretion to do so. It can be difficult for the government scheme to monitor a fund's investment strategies so as to prevent them from increasing their allocation into equities and the like. So they are creating a moral hazard which they may not be able to control, resulting in a worsening of the funding situation.

Moral hazard may come in many other forms also. Other examples of irresponsible behaviour, and difficult to protect against once an insurance scheme is put in place, are as follows. The guarantee provides an incentive for financially weak companies to increase pension benefits rather than wage increases, since the latter have to be paid immediately, while the former might eventually be paid by the government, assuming insolvency occurs. This game might be pursued in the run up to bankruptcy where the firm has knowledge of the upcoming closure, unlike the administrator of the insurance scheme who has to cover the pension benefits. Further, firms can play other games such as how they deal with subsidiaries and their associated pension obligations. Subsidiaries can be thought of as being similar to off balance sheet items so firms can either remove them from being mandatorily required on a scheme or add them to a scheme if they are underfunded.

Note that on the level of (under)funding, much of this is dependent on the financial assumptions relating to pension assets and liabilities. It is quite easy to raise, for example, the discount rate used to get the present value of liabilities, and thereby 'reduce' underfunding. Firms can pressurise the scheme's actuary so a discount rate incorporating an equity risk premium is used rather than the lower risk free rate. This would allow the firm to reduce their contributions to the scheme.

### *3. Systematic risk*

Insurance operates on the basis of being able to protect against diversifiable risks. The ability of any pension insurance scheme to cover its costs is dependent on the level of correlation between the risks that it is providing protection against. Increased correlation implies lower

diversification effects and increased total risk associated with the insurance scheme increases. When risks are systematic there is little diversification opportunities. Unfortunately poor equity market performance and the associated level of pension underfunding are highly correlated with firm bankruptcies. The solutions dealing with these correlated risks are compromised. As we see in the case of Ireland, but also in other countries, pension funds have a heavy equity exposure, and under-funding is worst after sharp falls in stock markets and this is just when corporate insolvencies are likely to peak and thus there is a double impact from equity markets. One solution to protect against the level of underfunding, especially in periods of high claims, would be through higher contribution requirements, and this is the very time that the sponsoring firms can least afford it. In addition, firms try and reduce contributions when they are less healthy. The performance of these reduced levels of pension assets is poor especially if the allocation is towards equity markets underpinning the level of underfunding.<sup>7</sup> Furthermore these risks are highly correlated with macroeconomic dynamics as we see in the current economic crises. This makes it more difficult for ALL to come up with a scheme to ensure adequate funding. For example, the Irish government is dealing with financial problems on many fronts with reduced resources.

To illustrate systematic risk for UK pensions, McCarthy and Neuberger (2005) show that the risks relating to insolvencies of sponsor firms are cyclical as is the poor performance of equity markets. These cycles are positively correlated in a systematic manner. Thus, claims arise when firms become insolvent and the claim size depends on the level of under-funding. Since pension funds have a heavy equity exposure, under-funding is worst after sharp falls in equity markets and this is just when corporate insolvencies are likely to peak and thus there is

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<sup>7</sup> If there is a Government insurance scheme it needs to take heed of its investment allocation strategy. Also it should avoid following the risky policies of insolvent firms and underfunding schemes as these will not help to reduce the level of underfunding.

a double impact from the equity market. Pension funds are also becoming a more intrinsic part of the corporate capital structure and it is possible that this systematic risk will increase further where insolvent pension funds and firm bankruptcy become more strongly related.

Although difficult to quantify it is clear that systematic risk is important in the context of deciding whether to introduce a government defined benefit insurance scheme. Here the argument that is put forward is that systematic risk is the reason why private sector insurance schemes face an impossible situation in a commercial sense and hence makes government schemes necessary (Stewart, 2007). Systematic risks are potentially so large that it would not be able to operate based on the premiums that would be charged by private sector insurance companies. The argument then is that there is a need for governments to fill the void and ensure that schemes are able to meet their obligations. In many ways this argument is about how well functioning the market economy is. If insurance firms operate in markets that are able to develop financial products allowing for sufficient hedging of the risks associated with the pension schemes, there is very little need for government intervention. However, if the market is not functioning sufficiently with related financial products, government has to step in. This does not answer the question of whether government can and would provide insurance at reasonable rates, and if it can, are taxpayers willing to fund this. But without the government intervention defined benefit schemes will not be able to function in the face of systematic risk.

Any scheme (regardless of whether it is private or government backed) is trying to protect defined benefit schemes against both the performance of their investment strategy (especially so in the more volatile equity markets) and the performance of the sponsoring company's

themselves. The insurance premium is a complicated (and potentially too restrictive) levy trying to protect against the probability of both insolvency of the pension fund *and* the sponsoring company. In contrast, if these outcomes were uncorrelated then they could be pooled with a reduction in total risk, and this is how successful insurance schemes generally work. Thus, the risk of the insurance scheme and the price attached to protect against this risk is going to rise. If further companies decide to join, and if there is no restriction stopping them, then total risk, and the price of this total risk, would rise even further.

#### *4. Political Risk*

A final risk that should not be underestimated emanates from political sources. This risk is often related to the introduction of government pension insurance schemes in other countries. For example in the US the introduction of the PBGC in the 1970s was to support mature industries, whereas the PPF was more recently introduced following on from large scale underfunding resulting from the poor performance in equity markets and the bankruptcy of a larger number of scheme sponsors. Stewart (2007) provides an argument in support of political intervention, notwithstanding the market distortions that this may accompany. Here, if underfunding is more structural than cyclical due to higher volatility in financial markets, then the need for government backed schemes will increase in the future.

On the other hand political risk could impact on the ability of the insurance scheme to adequately deal with other risks such as moral hazard and adverse selection. Take moral hazard to illustrate. It is possible that financially weak companies exert pressures on politicians in the constituencies where they are located to press for a reduction in the premiums that they face. Furthermore, government may limit the required contributions into

the pension scheme in good economic times and in doing so limits the surplus that provides a cushion against later falls in equity markets. To illustrate, Michael Gordon, one of the key architects of ERISA pension legislation underpinning the PBGC, has written that the actuarial soundness of the scheme was deliberately sacrificed at its inception point in order to gain political support for the passage of the legislation (Ippolito, 2004). These types of political risks are hard to avoid as are their associated impacts on the working of any government insurance scheme.

#### **IV. Ways of Mitigating Risks of Government Pension Insurance Schemes:**

Now that we have identified a set of risks associated with the introduction and operation of a government pension insurance scheme let us look at ways of minimising these. A number of principles and practices may be adopted and we discuss their relative merits.

##### *1. Place Limit on Benefits:*

A key risk that must be minimized is moral hazard and placing limits on the benefits can help to do so. Certain benefits should be excluded from coverage. For example, the Pensions-Sicherungs-Verein auf Gegenseitigkeit (PSVaG) scheme in Germany does not allow for benefit improvements in the two years prior to corporate bankruptcy. Otherwise firms could offer pension improvements in lieu of salary increases, thus avoiding these and have the government make the pension payments. Similarly pension withdrawals, for example from company directors, should be excluded. A maximum pay-out should also be established so as to ensure that there is a ceiling put on the amount that would have to be paid out by government, and consequently funded by taxpayers. Several schemes do operate with a ceiling although there are certain features of these that are not necessarily desirable. For instance, the Pension Benefit Guaranty Corporation (PBGC) scheme in the US and the UK

based PPF have set respective thresholds. The US put a dollar amount on the ceiling of \$54,000 in 2010, whereas the UK pays 90% compensation up to a cap of £29,897.42 in 2011 for current employees. These ceilings make no link to pension assets or pension liabilities. A key issue to remember is that the pension benefits should be related to pension liabilities which in turn should be closely aligned to pension assets.

## *2. Prudential Asset Allocation:*

As we have seen in the case of Ireland there is a heavy weighting given to equities and other risky assets in the asset allocation strategies of pension funds, and even more so than other countries. Although Ireland is very much skewed away from safe assets, the general critique of many countries pension funds is that they have too much weighting in equities and related assets. So Ireland has a lot to do here to have investment strategies that will avoid large swings in funding levels. Limiting the asset allocation to equities and other risky assets is imperative. This would help to limit potential claims both in their frequency and magnitude. It would also help to make the pension insurance more affordable if introduced.

Furthermore, pension funds should operate on the basis of asset and liability matching. Pension liabilities are usually inflation linked so the assets should also be inflation linked. Investment should not be about chasing an equity premium, but rather, should be in assets that grow in line with inflation. Thus allocation should be towards fixed income securities, namely bonds, but other inflation priced assets should also be targeted. To encourage a change in asset allocation, higher premiums could be set for more risky investment strategies. In addition, benefits on offer could be linked to the investment allocation strategy where the ceiling on pension pay-outs is reduced if high risk allocations are followed.

Asset allocation of any government pension scheme must also be considered. For example, both the PPF and PBGC have very conservative investment strategies on the pension funds they take over with heavy concentrations in cash and bonds (PPF is approx. 70% in bonds and cash and PBGC is 75% in bonds). However criticism of both schemes relates to the duration of the bonds chosen with an emphasis on short rather than long dated securities, and also not trying to match duration of pension liabilities with bonds of similar duration. One other issue to bear in mind is that the investment strategy is to ensure that the asset allocation of the insurance fund is not highly correlated with the scheme that it is insuring.

On another sphere, pension deficit reduction should be done by increased contributions. In Ireland, Mercer (2008) has reported increases in average employer contribution levels from 16.8% to 18.0% between 2006 and 2008. Whilst this is to be welcomed, these increases go nowhere near trying to reverse the large pension deficits reported in those years.

### *3. Use Risk Based Pricing:*

The premiums charged should be linked to the level of underfunding. Higher levels of underfunding should be matched by higher level of premiums and this is seen as a way of dealing with moral hazard and adverse selection. Risk based pricing aims to charge premiums according to the present value of pension claims. Essentially it puts a price on the risks associated with the pension scheme. It should also reflect the likelihood that the corporate sponsor will default through bankruptcy and the risk of their pension balance sheet through any asset and liability mismatch. These should reflect both long and short term concerns with



the long run viability of the pension scheme being hindered if inadequate pension premiums are not imposed. Deviations from short run objectives can be allowed under exceptional circumstances only.

Criticisms of other schemes usually focus on inadequate premiums. There are generally two ways in which premiums can be charged: relating to the level of underfunding and relating to the level of pension liabilities. Schemes that follow the former include the Pension Benefit Guarantee Fund (PBGF) of Canada, the Pension Benefit Guaranty Corporation (PBGC) in the US and the PPF in the UK. Schemes that price pensions off the level of liabilities only include the sicherheitsfonds BVG in Switzerland, the Forsakringsbolaget Pensionsgaranti in Sweden and the Pensions-Sicherungs-Verein in Germany. All these schemes would require to an extent additional premiums based on some risk outcome. For instance, the Swedish scheme requires additional collateral if there was a high probability of corporate insolvency. In appendix 2 we discuss the operations of two of these schemes in more detail, the PBGC and the PPF.

Many features of these schemes are alike. It is vital to put a price on the risk based premium as this determines the potential viability and success of the pension scheme. There is a wide literature documenting the valuation framework used in pricing the premium of these schemes. These valuation frameworks are complex. Mainly the literature uses an option pricing framework applying contingent claims techniques to value pension insurance (see, e.g., Sharpe (1976), Treynor (1977), Langetieg, Findlay and da Motta (1982), Marcus (1987), Lewis and Pennacchi (1999a,b) and Blake, Cotter and Dowd (2011)) Most of these studies focus on the PBGC of the United States although Blake et al, Cotter and Dowd (2011)

examining the pricing of the PPF. This framework suggests that, for example, the PBGC acts as a put writer allowing the insolvent scheme to be replaced with the value that covers the pension shortfall. To be specific, these schemes offer the holder a Margrabe (also known as an Exchange) option as they receive an asset that replaces their pension liabilities and removes the pension underfunding (Blake, 1998).

The literature on risk premiums suggests that there is systematic underpricing. For instance, Vanderhei (1990) found that the insurance premiums charged by the PBGC significantly underestimated the true level of risk assumed by the PBGC, despite the fact that the basic premium had increased 30-fold since the PBGC was established. He found that the PBGC was undercharging on average (by a factor of 4.5), but also imposed significant cross-subsidies from strong to weak firms, thus worsening the problem of adverse selection. Hsieh, Chen and Ferris (1994) found that the PBGC approximately correctly charges over-funded pension plans but significantly under-charges underfunded ones. Blake, Cotter and Dowd (2011) find that undercharging is the norm in the UK under the PPF, and this is particularly severe for underfunded schemes, and these are very prevalent.

#### *4. Use a Funding Standard*

Moral hazard could be reduced by introducing tighter funding requirements. They also put a limit on the potential claims that can be made. There is a spectrum of these that can be followed. For instance, the Dutch government does not allow underfunding and as result does not need a risk based levy. In addition the pension schemes must hold reserves to cover issues like investment risk. They set a minimum threshold of 105% funding and if this is

breached remedial action is required. However it is unlikely that these funding levels could be implemented in Ireland, and especially in the current environment, with the deficits reported and the inability of firms to make increased contributions. More lenient rules such as a 90% funding target could be set which would then be re-examined in 5-year cycles, with the aim to increase funding targets in each cycle. Regardless, funding rules should be consistent and require quick action if they are not being met.

#### *5. Provide Sufficient and Independent Powers for the Supervising Body*

Political risk will only be reduced if the supervisory body charged with managing the government scheme is independent and has sufficient power. This is very difficult to achieve as it is common that politics is the driver of these schemes in the first place. Independence will ensure that political interference, such as trying to canvass on behalf of constituency firms to reduce premiums, is kept to a minimum. Sufficient powers are also important to ensure the smooth running of the guarantee scheme. Schemes with large deficits have to be watched and supervised closely. The supervisory body must ensure that the corporate sponsors of unfunded schemes continue to pay (increased) premiums, and make increased contributions to reduce the deficit. They need to be able to gather the necessary information to ensure they identify the correct level of deficits and have the powers to impose remedial action. Note this infrastructure may be difficult to put in place in practice.

#### *6. Placing a Lien on the Sponsors Assets:*

If pension deficits occur and the corporation is able to separate these from corporate financial structure in general then it has no incentive to remove these deficits. However if the pension balance sheet and the sponsors balance sheet are linked then it changes the behaviour of

sponsors and how they manage their pension asset and liabilities. Examples of where some claim is put on the corporation include the Canadian PBGF where they have included a lien on the assets of the plan sponsor. Also in Sweden, the Forsakringsbolaget Pensionsgaranti scheme requires collateral from the corporate sponsor if insolvency risk is high. In contrast, the introduction of the PPF in the UK did not include such a provision as the firm is both insolvent and underfunded when entering the government guarantee.

## **V Conclusion**

The focus of this paper is Irish defined benefit pension schemes. Led by inappropriate asset allocation strategies for pension assets and underpinned by increased pension liabilities due to longevity we report a high level of underfunding. The level of underfunding will result in promises made in pension schemes either not being fully met or in extreme cases, not being met at all.

As a potential solution we critically examine the role of government sponsored insurance schemes. Arguments put forward in their favour is that they can provide some defence against the poor and incomplete design of the pension contract and the lack of diversification associated with defined benefit schemes. They do, however, face a number of risks that can arise as a consequence of their introduction. These risks include adverse selection, moral hazard, systematic risk and political risk. However these risks may be mitigated. Drawing on the experiences of international government sponsored insurance schemes we report a number of lessons that need to be incorporated if the Irish government is to consider introducing such a scheme.

We note that the potential of moral hazard in any proposed Irish pension insurance scheme is high given the propensity to invest in assets with high investment risk, such as equities. Strong rules on asset allocation are vital to address this culture. In an international context, there is potential for Ireland to make inroads here so as to reduce the roller coaster ride it has in its funding of defined benefit pension schemes. The government would also have to be very careful in how they protect against adverse selection, where the strong schemes sponsors end up subsidising the weak schemes and try to opt out of the insurance mechanism as a result. The use of risk based pricing premiums is vital in this regard and this needs to be implemented without political interference.

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## Appendix 1: A Model of Pension Dynamics:

The balance on a defined benefit pension scheme is defined as the difference between the market value of the assets and the actuarial value of the liabilities:

$$(1) \text{ Balance} = \text{Assets} - \text{Liabilities}$$

The pension is in deficit (surplus) if Liabilities (L) exceed (are less than) Assets (A).

Assume the current pension is  $P_t$ . The pension paid at the end of the year will be uprated for inflation,  $p^e$  but there is some chance ( $q_t$ ) that the pensioner will die during the year. Suppose that the appropriate discount rate for pension liabilities is  $r_L$ . Then the expected present value of the pension liability is:

$$(2) \quad EPVL = \frac{E(P_{t+1})}{(1+r_L)} = \frac{P_t(1+p^e)(1-q_t)}{(1+r_L)}$$

The expected dynamics of the liabilities is given by:

$$(3) \quad g_L^e = \ln \frac{E(P_{t+1})}{P_t} \gg p^e - q_t - r_L$$

Assume the pension fund contains a single risky asset (call it a share) which has paid a current dividend of  $D_t$ . The dividend paid at the end of the year will grow by  $g$ . Suppose that the appropriate discount rate for pension assets is  $r_A$ . Then the expected present value of the pension asset is:

$$(4) \quad EPVA = \frac{E(D_{t+1})}{(1+r_A)} = \frac{D_t(1+g^e)}{(1+r_A)}$$

The expected dynamics of the assets is given by:

$$(5) \quad g_A^e = \ln \frac{E(D_{t+1})}{D_t} \gg g^e - r_A$$

The aim of the pension fund manager is to avoid shortfall risk:

$$(6) \quad g_A^e \geq g_L^e$$

A government guarantee insurance scheme has a number of objectives: 1) to minimise the chance of a pension fund sponsor becoming insolvent (and hence its pension scheme requiring to drawdown insurance), and 2) to minimise shortfall risk (6) once the pension scheme is getting support from government.



## **Appendix 2: Alternative Government Pension Schemes in operation.**

The discussion here follows closely Blake, Cotter, and Dowd (2007).

### **US Pension Benefit Guaranty Corporation (PBGC):**

The PBGC was created to encourage continuation and maintenance of defined benefit pension plans in the US, provide timely and uninterrupted payment of pension benefits, and keep pension insurance premiums at a minimum.<sup>8</sup> The PBGC is a federal agency that guarantees payment of private pension benefits when companies and plans fail. It provides extensive coverage. It protects some 44 million Americans in over 29,000 private defined benefit pension plans. For plans ended in 2011 workers who retire at 65 can receive up to \$54,000. PBGC pays benefits using insurance premiums and assets and other recoveries from plans and their sponsors. It followed on from a number of high profile corporate failures, for example the Studebaker auto company) and came into existence in 1974. Schemes that are covered tend to be from the old economy which tends to concentrate on defined benefit plans. Benefits are linked to factors such as final salary and length of pensionable service.

The PBGC has three main sources of income – pension levies, investment income and trustee assets. Note it is not government funded but is a government agency, and as such represents a contingent liability. Premiums are a combination of a flat rate fee and a variable component based on the level of (under)funding of the scheme. For the PBGC, the applied premium includes some risk based elements but excludes others. The pension levy is exposure related (i.e., related to the level of the claim in the event of insolvency) but is not

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<sup>8</sup> See <http://pbgc.gov/>.

higher for firms more likely to be insolvent. The variable element relates to the level of underfunding. Taking these together, and contrary to standard insurance principles, financially weak sponsors with underfunded schemes are not charged the full risk-adjusted premium, but charged a partial risk based premium. History suggests that the performance of the scheme has varied considerably from a surplus in 2007 to a deficit of \$23billion at the end of 2010. In recent years there has been extensive demands placed on the funding of the PBGC resulting in a poor performance. These have been driven by very large claims (as many company schemes were so underfunded they had to be taken over by the PBGC), relatively low premiums, widespread underfunding and political pressure against increasing premiums. For instance, the premium revenue was \$973 million in 2003 with associated payments of \$2.5 billion and a deficit for the year of \$11 billion. Much of the poor performance is down to asset liability mismatch on behalf of the funds that it eventually took over. Here corporations were investing very heavily in equities which really performed poorly reducing pension assets, reducing corporate contributions and increasing corporate bankruptcy. There is a straight forward message for Ireland here.

In lieu of premiums, member schemes receive financial protection in terminated plans through the coverage of their pension shortfalls. In particular, the PBGC provides a guarantee to cover the shortfall between the liabilities of a scheme through the value of insured benefits and the assets covering these benefits.<sup>9</sup> Three types of scheme terminations are supported.<sup>10</sup> The initial target once the PBGC has identified a potential transaction that could jeopardize the pension insurance programme is to avoid termination through meetings

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<sup>9</sup> Bodie (1996) compares the PBGC guarantee system with the collapsed US Federal Savings and Loan Insurance Corporation.

<sup>10</sup> These include a 'distress termination' where a company in financial distress may voluntarily terminate a pension plan; an 'involuntary termination' where the PBGC terminates a plan, for example for meeting minimum funding requirements; and a 'standard termination' where a plan may terminate if the assets are insufficient to satisfy all benefits.

with corporate representatives to negotiate additional contributions or security. It aims to work with the company to find a settlement appropriate for the financial feasibility of a company. The PBGC has an Early Warning Program used to monitor certain companies which are financially distressed or have underfunded DB plans to prevent losses before they occur, rather than waiting to pick up the pieces.

The PBGC will also contact a company if they feel the company has a high probability of insolvency and has a large pension plan. It also monitors transactions that substantially weaken the financial support for a pension plan such as the breakup of a controlled group, the transfer of significantly underfunded pension liabilities in connection with the sale of a business, or a leveraged buyout. Note the PBGC has developed specialized tools, technology, and financial expertise. Their staffs use financial information services and news databases and technology. It also relies on information sharing from the Department of Labor, Internal Revenue Service and the Securities and Exchange Commission. However, in the event of the company becoming insolvent and the PBGC taking over the plan's liabilities, the PBGC has a lien on upto 30% of the company's net worth to cover a deficiency in the plan.

### **UK Pension Protection Fund (PPF):**

The PPF was introduced in the UK in 2005 following the Pension's Act 2004.<sup>11</sup> The new scheme was introduced following a large number of pension cases, up to 65,000 workers, where full cover was not provided. The rationale behind the government scheme was to ensure that a guarantee system was in place, that no bail out of the system by taxpayers would

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<sup>11</sup> See <http://www.pensionprotectionfund.org.uk/Pages/homepage.aspx>

be required and that members of the PPF got adequate protection against future benefits.<sup>12</sup> Essentially a promise made by a scheme sponsor is being guaranteed by the PPF.

The PPF has a number of functions. It was required to pay compensation when a corporation was insolvent and it had underfunded its pension scheme. Once a scheme joins the PPF it is not allowed to leave. It is to finance this compensation by imposing levies on all pertinent defined benefit member schemes. The PPF is also aiming to ensure that the levies are not too onerous on member schemes. However, like the PBGC, it must be self-financing, and the government is not available to cover any losses. As well as calculating levies, the PPF is responsible for determining and executing the compensation to be paid on schemes and the investment strategy of the PPF. At its inception, its investment strategy was orientated towards investment in bonds and employed two external fund managers, Pimco and Insight Investments, to carry out this mandate. The PPF would take over the assets and liabilities of a scheme and the fund managers would then be mandated to invest in fixed income assets to match the liabilities.

The main funding of the PPF is through the levy it charges. It has a number of charges including an Administration levy that covers set-up and on-going costs of the PPF and a Fraud Compensation Levy. However the main element was the Pension Protection Levy which was to be risk based. In the first year a set levy of £15 for each member of an eligible scheme was charged, thereafter it introduced a risk based levy. The Pension Protection Levy has two elements, one risk based and the other scheme based. The latter depends on the number of members and the balance between active and retired members. The risk based

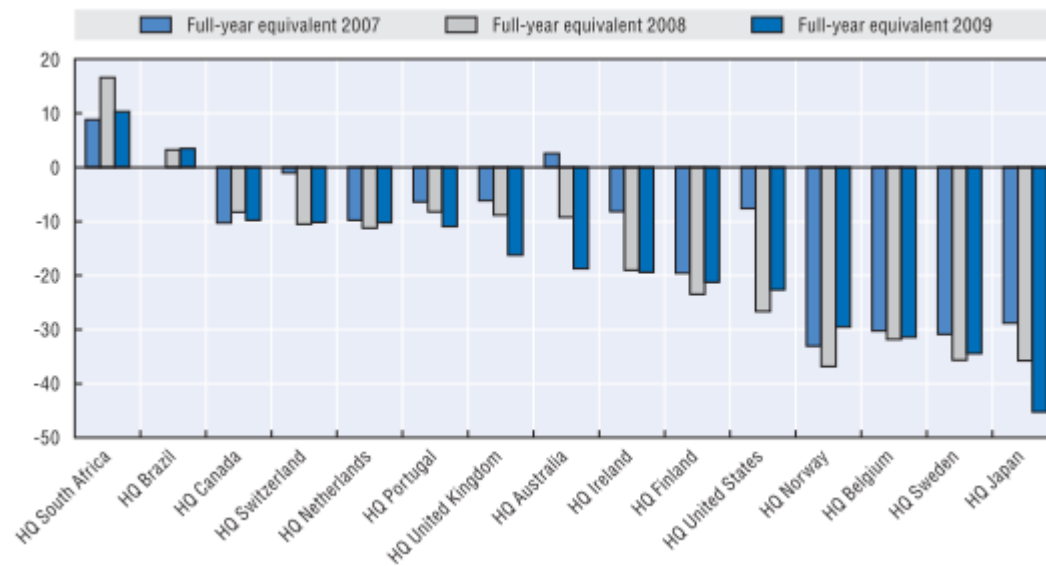
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<sup>12</sup> For instance, speaking at the Labour Party annual conference on 1 October 2003, the Chancellor of the Exchequer Gordon Brown said the government will 'legislate for a new statutory pension protection fund. In future every worker contributing to a pension will have their pension protected and be *guaranteed* their pension rights.<sup>12</sup> Note although there are some minor exceptions the vast population of private sector defined benefit schemes are covered by the PPF. Coverage is for over 12 million members (PPF, 2010).

element depends on the level of underfunding and the firm's insolvency risk. Insolvency probabilities are computed for the PPF by D&B. The setting of the levy is not easy as they are required to incorporate fairness that amounts to appropriate levies being charged across member schemes, simplicity in the collection and use of data in setting the levy and proportionality ensuring the correct amounts are charged across schemes. Although it claims to have world's first risk-based pension protection levy this is not necessarily fully true. The levy is currently capped at 0.75% of liabilities and this varies over time (for example it was 0.5% in its first year, rising to 1.25% in 2007/08). Further the risk-based levy factor represents 80% of the total charge whereas the scheme based element is 20%. The levy is charged annually based on valuations on a specific date, March 31.

Members of the scheme receive compensation based on the value of liabilities of a scheme as per Section 179 of the Pensions Act 2004. The PPF protects 100% of the pension for members above scheme pension age or already in receipt of a pension due to ill health or it being a survivor's pension, and 90% of the promised pension for the remaining members below scheme pension age (up to a current maximum of £29,897.42).

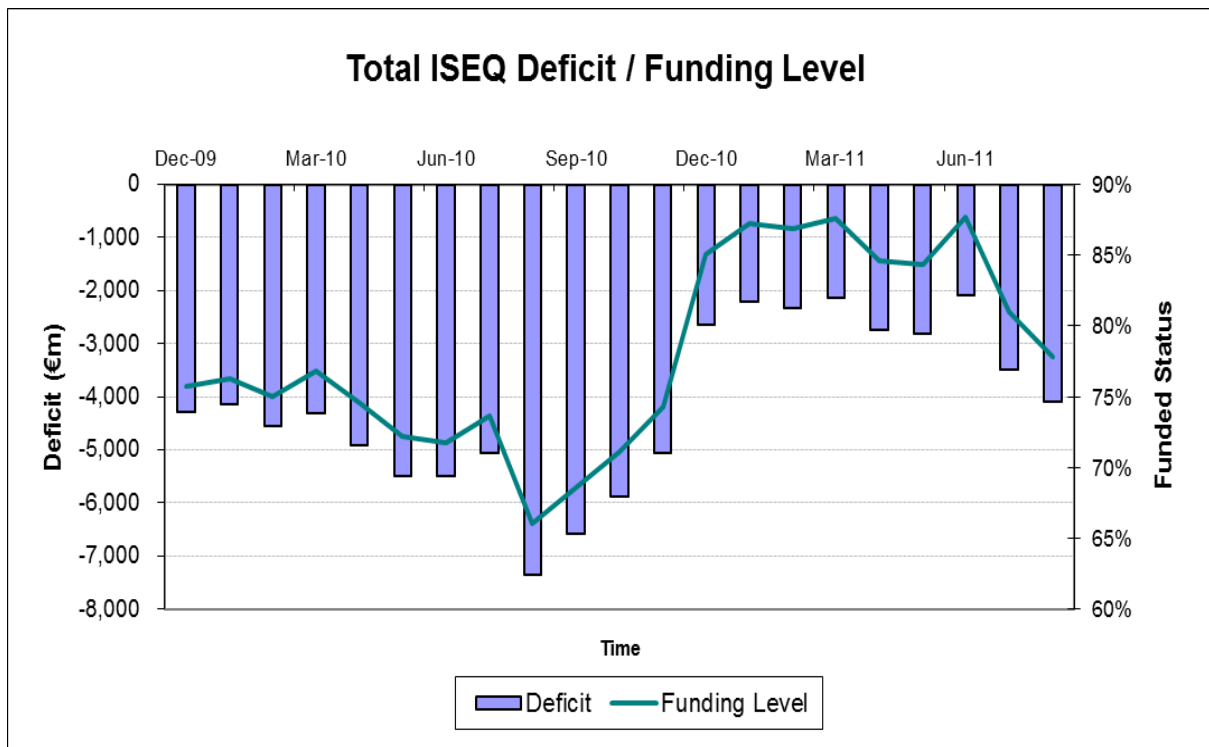
Figure 1: An International Comparison of Defined Benefit Funding Levels



Notes: Source OECD 2011.

The figure shows estimated median funding level of the aggregate defined-benefit obligations of 2100 publicly traded companies as published in their annual financial statements as of their fiscal years ending 2009, 2008 and 2007. Companies are grouped by country of domicile.

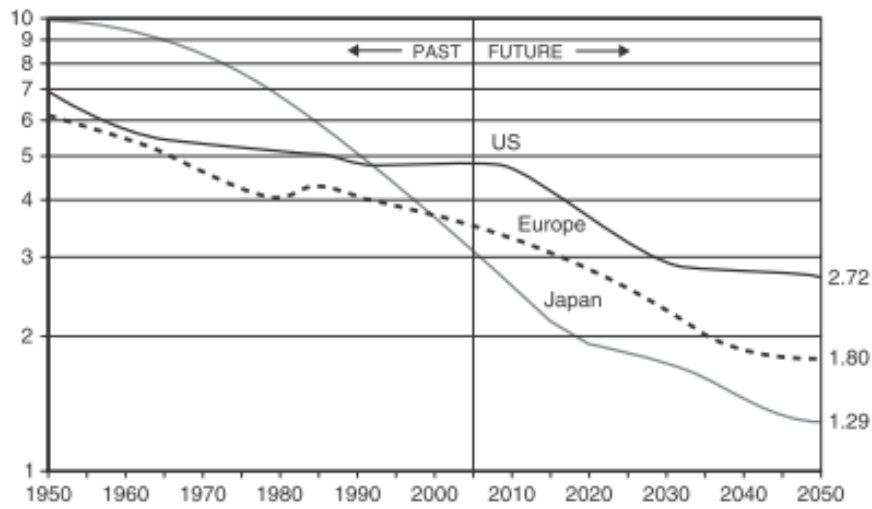
Figure 2: Defined Benefit Funding Levels in Ireland over Time



Notes: Data provided by Mercer.

The graph shows funding levels (%) that represent level of assets in relation to liabilities. It also shows the pension deficit which is the Euro difference between assets and liabilities. All ISEQ companies with defined benefit obligations, 29 in total plus 9 of the larger semi-states are included. Statistics for the December 2009 – August 2011 inclusive are shown. The intra annual report figures are obtained using a roll forward of scheme assets and liabilities (on an accounting basis).

Figure 3: Ratio of Population Aged 20-65 to Population Aged 65 and Over

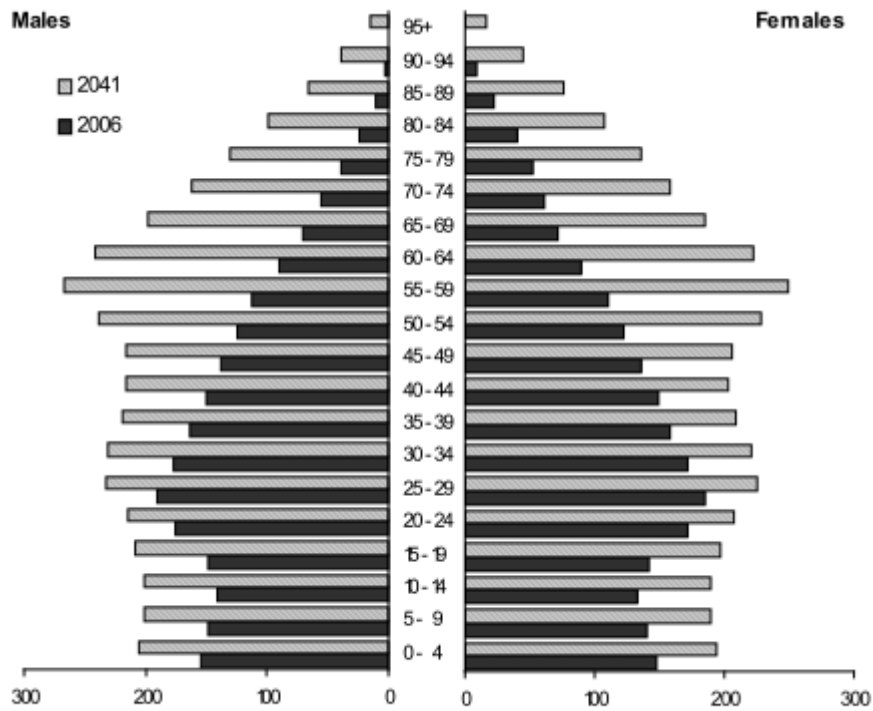


Notes: Source Bertochi, Schwartz, and Ziemba, (2009).

The figure shows the changing age distributions over time (1950-2050) in three regions, the US, Europe and Japan.



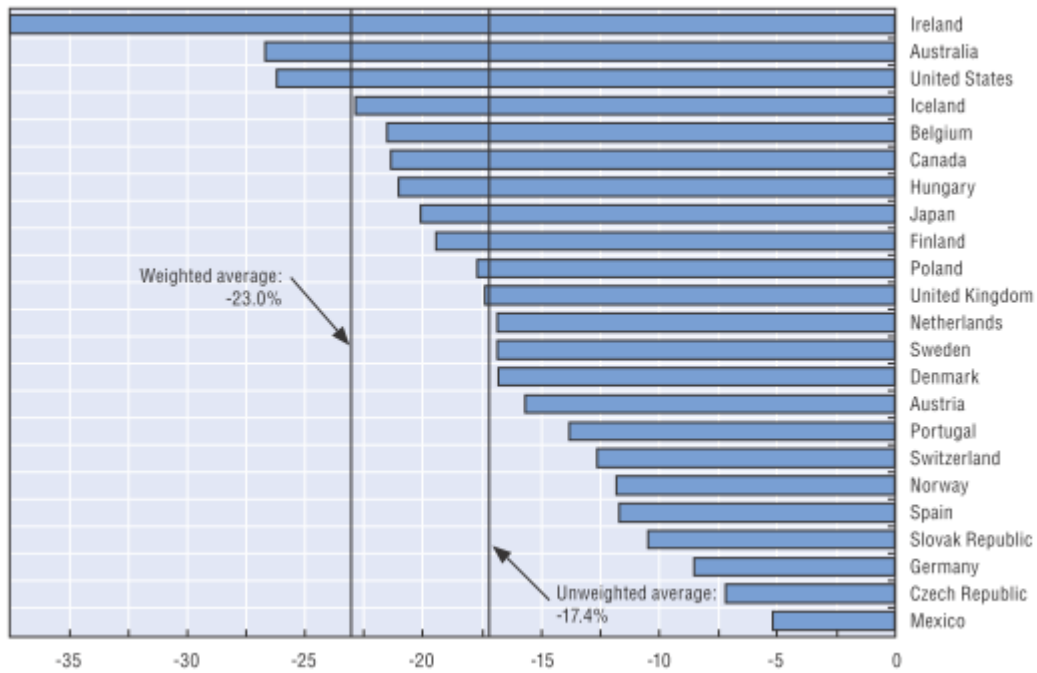
Figure 4: Population Dynamics in Ireland Present and Future



Notes: Source CSO (2008).

The graph illustrates the changing population structure by comparing the breakdown of the population by five-year age groups and sex in 2006 and 2041.

Figure 5: Pension Fund Investment Performance



Notes: Source OECD (2009).

The graph shows real investment returns in a number of OECD countries for 2008.

Returns are shown only for countries where pension-fund assets exceeded 4% of gross domestic product (GDP) in 2007. Data are from official sources for Austria, Belgium, Finland, Hungary, Ireland, Mexico, Norway, Poland, Slovak Republic, Spain and Switzerland. Where data on actual pension-fund performance were not available, investment returns were estimated using data on pension funds' asset allocation and the returns on different asset classes.

Table 1: Summary Details of Irish Pensions (2006-2010)

	2010	2009	2008	2007	2006
<b>Assets(€m)<sup>a</sup></b>	15110.8	13345.8	12368.1	16181.0	15609.4
<b>Liabilities(€m)<sup>a</sup></b>	17835.2	17691.9	16213.8	18228.6	18804.8
<b>Employer Contributions<sup>a</sup></b>	907.8	781.1	702.3	625.7	677.7
<b>Employee Contributions<sup>a</sup></b>	81.5	90.7	84.3	75.6	79.8
<b>No. Employees<sup>a</sup></b>	257114	259475	285014	280011	261775
<b>Total Pension AUM (€b)<sup>b</sup></b>	75.5	72.2	63.5	86.6	87.7
<b>DB AUM (€b)<sup>b</sup></b>	48.5	48.4	39.4	65.8	71.9
<b>DC AUM (€b)<sup>b</sup></b>	27.0	23.8	24.1	20.8	15.8
<b>Number DB Members<sup>c</sup></b>	550229	586488	579922	555244	522645
<b>Number DC Members<sup>c</sup></b>	259732	266909	272197	269465	255008

Notes: a) Source Mercer. The data is for all ISEQ listed companies with DB obligations and 9 of the larger semi-states giving a total sample of 38 firms. No. Employees are the numbers of employed in the sample of companies. Liabilities are calculated using the IBOXX discount rate and assuming a 15-year duration. b) Source IAPF Investment Surveys. Total Pension AUM measures the assets under management. c) Source Irish Pensions Board.