



# A utility-based comparison of pension funds and life insurance companies under regulatory constraints

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## ABSTRACT

This paper compares two different types of annuity providers, i.e. defined benefit pension funds and life insurance companies. One of the key differences is that the residual risk in pension funds is collectively borne by the beneficiaries and the sponsor's shareholders while in the case of life insurers it is borne by the external shareholders. First, this paper employs a contingent claim approach to evaluate the risk return tradeoff for annuitants. For that, we take into account the differences in contract specifications and in regulatory regimes. Second, a welfare analysis is conducted to examine whether a consumer with power utility experiences utility gains if she chooses a defined benefit plan or a life annuity contract over a defined contribution plan. We demonstrate that regulation can be designed to support a level playing field amongst different financial institutions.

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## 1. Introduction

Defined benefit pension funds and life insurance companies are both key annuity providers. Besides governments, they are important institutions in the world for arranging old age income provisions efficiently. Table 1, based on OECD data, shows the importance of pension funds and life insurers by the size of assets under management for North America, Continental Europe and the UK. In North America pension funds dominate life insurance companies, while in Continental Europe and in the UK life insurers appear to be more important.

Although they offer similar products, there are also distinct institutional differences between pension funds and life insurance companies, as illustrated in Table 2. Pension funds usually take the form of non-profit organizations or trusts. A defined benefit pension provides a life-long income after retirement based upon the years of service, salary and a certain accrual rate; see Bodie (1990). In a final earnings defined benefit scheme, pension accrual

is automatically indexed to the individual's salary. This formula provides preretirement inflation protection to the participant but can represent a higher cost to the employer. Therefore, these days career-average schemes are also common. In a career-average scheme pension accrual might be indexed to inflation or wages; see Bikker and Vlaar (2007). However, this indexation is often contingent on the funding ratio<sup>3</sup> of the pension fund; see Broeders and Chen (2010). In this paper we concentrate on conditionally indexed defined benefit schemes. Over their careers, part of the employees' labor compensation is contributed to a pension fund that manages the assets and the liabilities. Often the pension is legally independent of the corporate sponsor. The available surplus (the difference between the pension fund's assets and liabilities) can be regarded as the pension fund's equity. It acts as a risk buffer. The residual risk<sup>4</sup> is partly borne by the beneficiaries themselves through the conditional indexation feature and the fact that accrued benefits might be reduced if the pension fund is severely underfunded. In a continuum of overlapping generations also future participants participate in risk sharing; see e.g. Gollier (2008). New entrants to a pension fund might be confronted with losses (or gains) that accrued in the previous period. Often the

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<sup>3</sup> The ratio of assets over liabilities.

<sup>4</sup> Residual or net risk is the gross risk exposure minus risk mitigation procedures.

**Table 1**

Total size of funds under management by region; totals in USD billion for 2006.  
Source: OECD.

Region	Pension funds		Life insurers		Total
North America	10,400	72%	3,972	28%	14,372
Continental Europe	2,169	34%	4,301	66%	6,470
UK	1,831	42%	2,562	58%	4,393
Total	14,400		10,835		

company behind the pension fund is either explicitly or implicitly involved in risk sharing. For instance, in case of underfunding (or in case of overfunding) contributions to the pension fund can be increased (or decreased). In case of pension guarantee funds, like the Pension Benefit Guarantee Corporation in the United States or the Pension Protection Fund in the UK, the residual risk is also covered by these institutions. Specifically, if the corporation defaults, pension rights are protected by these guarantee schemes; see e.g. Bodie and Merton (1993). The pension fund's board typically consists of representatives of both employers and employees. The board decides on asset allocation, contribution rate and indexation policy. Beneficiaries can have some influence on this through the election of board members.

For-profit life insurance companies, usually in the form of incorporations (Inc), also provide annuities.<sup>5</sup> A life annuity is a financial contract in the form of an insurance product according to which a life insurance company makes a series of payments in the future to the buyer in exchange for an immediate lump sum payment. The payment stream continues until the date of death of the annuitant. The annuity might be increased with annual bonuses if the underlying investments deliver sufficient returns, a feature called "with profit"; see e.g. Ballota et al. (2006) and Kling et al. (2007a,b). The policy holders participate to a certain extent in the wealth of the life insurer. Here, the shareholders provide equity and accept the residual risk. E.g. a negative return on the insurance company's assets or an underwriting loss will be absorbed by the shareholders. On the other hand, if performance is above average the shareholders are entitled to participating in the surpluses. However, shareholders have limited liability. In case of default, the shareholders will not lose more than their initial investment. Being the owners, the shareholders decide on the investment policy, insurance premiums, the with-profit policy and capital structure. The consumers have no say in this.

In addition, there are distinct differences in investment policy between pension funds and life insurance companies. On average, pension funds run a larger mismatch risk compared to life insurance companies. Mismatch risk typically occurs if the risk profile of the assets is very different from the risk profile of the liabilities. This is shown in Table 3. Pension funds in the United States, Continental Europe and the UK invest more heavily in equities. Insurance companies are more focused on asset and liability matching and prefer fixed-income assets. This difference in investment strategy is probably best explained by the differences in risk preferences, which also appear in diverging regulatory procedures.

In order to make annuity payments, pension funds and insurance companies are generally subject to the, so-called, full funding requirement. This means that at all times the value of assets should at least be equal to the value of liabilities. In addition, European legislation requires a small margin, i.e. the funding ratio should always be in excess of 105%.<sup>6</sup> Some countries, like

the Netherlands, explicitly prescribe that pension funds should hold additional regulatory funds to be able to absorb short-term deviations in the funding ratio. The required surplus is usually a function of the level of mismatch risk between assets and liabilities. A high mismatch risk requires a large surplus, and in case of asset–liability matching the surplus can be kept to a minimum. Life insurance companies are also required to maintain sufficient capital. However, the required solvency margin currently does not depend on asset–liability mismatches. This will change in the future "Solvency II" framework for insurers.

Pension regulation nonetheless is less strict. The confidence level of 97.5%, e.g. for Dutch pension funds, is significantly lower than the 99.5% confidence level in "Solvency II". In addition, some countries allow substantial recovery periods for pension funds to restore sufficient funding; see Broeders and Chen (2010). Insurance supervision on the other hand is stricter. If the solvency ratio (the available over the required solvency level) is inadequate the supervisory authorities will react promptly and the life insurance company will be liquidated if there is no resurrection in the short run. This way, consumers are relatively certain that they do not lose significant value at liquidation. The differences in regulation may be justified by the additional policy instruments that pension funds possess, such as their ability to raise future contributions and cut back on indexation of pensions when necessary. As a rule of thumb, this greater flexibility should therefore reflect more or less the difference in confidence levels and recovery periods.

There are already several papers that discuss the similarities and differences between pension funds and life insurance companies. Blake (1999), for example, draws parallels to the long-term nature of liabilities and investment objectives. The not-for-profit pension funds do not attract funding in a competitive market, but seek to meet pension obligations at minimum cost to the scheme's sponsor. Typically, life insurance companies need to raise funding in a competitive market and as such have additional costs in the form of marketing expenditures. They are in the so-called "spread business" as they try to earn a spread on the return on assets and funding costs and on the underwriting of insurance risks.

Davis (2002) describes distinct differences in the risks that both institutions face, reflected in their investment strategies. Liabilities of pension funds are typically more uncertain than those of life insurance companies. Defined benefit pension liabilities are related to wage growth during the accumulation phase and often linked to inflation after retirement. These differences reflect in a more profound investment strategy. Pension funds favor real investment opportunities that keep track with the development of liabilities. Often, stocks and real estate are considered the best investment choice for that.<sup>7</sup> Life insurance companies often prefer bonds as the early surrender option can reduce the duration of liabilities significantly.<sup>8</sup> Next to diverging investment policies, Davis (2002) also argues there are enough reasons for different regulatory regimes. Having a greater need for real investment returns, pension funds require more flexibility on the asset side, while life insurance companies, operating in a competitive market, should be supervised more strictly.

<sup>5</sup> An insurance company can also take the form of a mutual. This is fairly comparable to a pension fund.

<sup>6</sup> For the purposes of calculating the minimum amount of the additional assets, the European Pension Directive (2003/41/EC) refers to Articles 27 and 28 of the Life Insurance Directive (2002/83/EC). The minimum amount is 4% of the technical provisions plus 0.3% of the capital at risk.

<sup>7</sup> Several papers challenge this conventional wisdom. Exley et al. (1997), Bader and Gold (2003) and Gold and Hudson (2003) all apply the no-arbitrage principle and the law of one price to show that the higher expected return on stocks reflects their greater risk in such a way that the risk-adjusted expected return on stocks is equal to the return on risk-free bonds. Bodie (1995) demonstrates that insurance against an overall return below the risk-free interest rate may be acquired by a "forward-strike" put option. The crucial insight is that the value of the put option is shown to increase with time to maturity and volatility.

<sup>8</sup> Early surrender is the right the policy holder has to cancel the contract prematurely.

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