Chapter 4

Can pension funds and life insurance companies keep their promises?

This chapter examines the potential impact of an environment of protracted low interest rates on pension systems and life insurance companies. It describes the mechanisms through which prolonged low interest rates can affect the solvency position of these institutions and uses available data to assess potential impacts. The outlook for the solvency position of pension funds and life insurance companies is of concern. Insofar as their promises are linked to evolving parameters or can be adjusted to the new environment of low interest rates, low inflation and low growth, these institutions may be able to weather the situation. However, there is a very serious concern for the financial outlook should these institutions become heavily involved in an excessive 'search for yield' in order to fulfil any fixed guarantee promises they may have made when interest rates were higher. Regulators and policy makers should remain vigilant.

Main findings

- An environment of prolonged low interest rates linked to ongoing low growth and falling inflation rates poses serious challenges to insurance and pension systems and in particular to defined benefit pension funds and life insurance companies offering long-term financial promises.
- The outlook depends foremost on the nature of the promises made by pension funds and life insurance companies and the potential for their adjustment or reversibility. The adverse effect of low interest rates is higher where the liabilities of these institutions consist of a fixed investment return or fixed benefit or pay-out promises.
- For pension funds and life insurance companies in particular, the outlook is troubling as their solvency positions will deteriorate unless they have actively adopted risk management strategies. Given problems being experienced by these institutions, some countries are already adjusting their regulatory framework on an exceptional basis, or otherwise maintaining measures adopted during the financial crisis to relax regulation while increasing monitoring.
- Potential solutions include increasing the duration of assets to be in line with that of liabilities, renegotiating promises and adjusting existing contracts, increasing contributions (for DB pension plans), and regulatory forbearance.
- The main concern is whether pension funds and life insurance companies have, or might, become involved in an excessive 'search for yield' in an attempt to match the level of returns promised earlier to beneficiaries or policyholders when financial markets were delivering higher returns. This might heighten insolvency risks.

Introduction

The financial crisis and ensuing environment of low growth and falling inflation have led to an environment of protracted low interest rates, amplified further by quantitative easing in several major economies that has spurred interest rate declines, with real yields turning negative in a number of countries. This environment of low interest rates, which is expected to prevail for the foreseeable future, poses serious challenges to insurance and pension systems, and in particular, to defined benefit pension funds and life insurance companies. Given the importance that these institutions play in mobilising large amounts of long-term capital, this could have serious implications for their role in successfully acting as long-term investors and potential stabilising forces within the global financial system.

The key concern is the extent to which the low interest rate environment has the potential to lead to a serious deterioration in the solvency position of pension funds and insurance companies that make long-term financial promises.

The outlook for pension systems, including defined benefits (DB) pension funds, and for life insurance companies is troubling since their solvency positions – the degree to which their current assets exceed current liabilities – will deteriorate in an environment of protracted low interest rates unless they have actively adopted risk management strategies.

In the first instance, this should have included immunisation of their investment portfolios against interest rate changes. The overall effect of protracted low interest rates depends on the nature of the promises made by pension funds and life insurance companies, the matching of duration of their liabilities with that of the assets backing these liabilities, the composition of their portfolio investments, and the extent to which these institutions have aggressively increased asset risk exposures in a 'search for yield'.[1]

The outlook depends foremost on the nature of the long-term promise made by pension funds and life insurance companies and the potential for adjustment or reversibility of the said promise. The adverse effect of low interest rates is higher where the liabilities of life insurance companies and pension funds consist of promised fixed investment returns, or fixed benefit or pay-out promises. Pension promises for current retirees and guaranteed promises in insurance contracts are fixed by nature. However, pension promises are parameter-dependent for members currently saving for retirement. These pension promises will depend on future wages; insofar as low interest rates are the result of macroeconomic conditions that lead to lower future wages, the pension promise will also adjust downwards.

The potential for fixed pension and guaranteed promises to undermine the solvency position of pension funds and insurance companies in an environment of protracted low interest rates can be partially offset by changing the terms of the promises. However, this solution is far from being simple or equitable. In the case of pension funds, the plan sponsor (e.g. corporation, public sector entity) is typically called upon to fund any shortfall, but instead efforts may be made to amend the structure of private pension plans to curtail benefits. Pension promises have been made more flexible in the last decade in many countries (e.g. the Netherlands), but not in all (e.g. the United Kingdom). Renegotiating the terms of insurance contracts has proven to be more difficult. Nonetheless, bankruptcy or its threat has led to a renegotiation of the terms of insurance contracts with high guarantees in some countries (e.g. Japan), while in other countries the structure of some of these contracts (group policies) appears to have made renegotiation easier (e.g. France).

Any significant mismatch between the duration of liabilities and assets is a cause for concern. Pension funds and life insurance companies typically hold long-dated bonds in order to meet future liabilities. However, their liabilities may have a longer duration due to the time horizon of their promises (e.g. life expectancy at age 65 can exceed 20 years). Therefore, life insurance companies and pension funds may face reinvestment risk unless they have developed asset-liability management (ALM) strategies to manage this risk. ALM strategies may require good quality debt instruments with long maturities; however, these instruments may not be available in sufficient quantities. Also, derivative instruments such as long-term interest rate swaps may need to be purchased in order to extend asset duration and ensure better ALM matching.[2]

The main concern for the outlook is whether pension funds and insurance companies have, or might become, involved in an excessive 'search for yield' in an attempt to match the level of returns promised to beneficiaries or policyholders when financial markets were delivering higher returns. Such a strategy might heighten insolvency risks. Insofar as the regulatory framework requires institutions which increase the risk profile of their investment portfolio to augment the reserves set aside to cover their promises or otherwise ensure adequate capital, the 'search for yield' should only be a moderate cause for concern as increasing capital reserves increases the costs of searching for yield, thus acting as a deterrent. Regulators should remain vigilant. While there is at present a lack of detailed

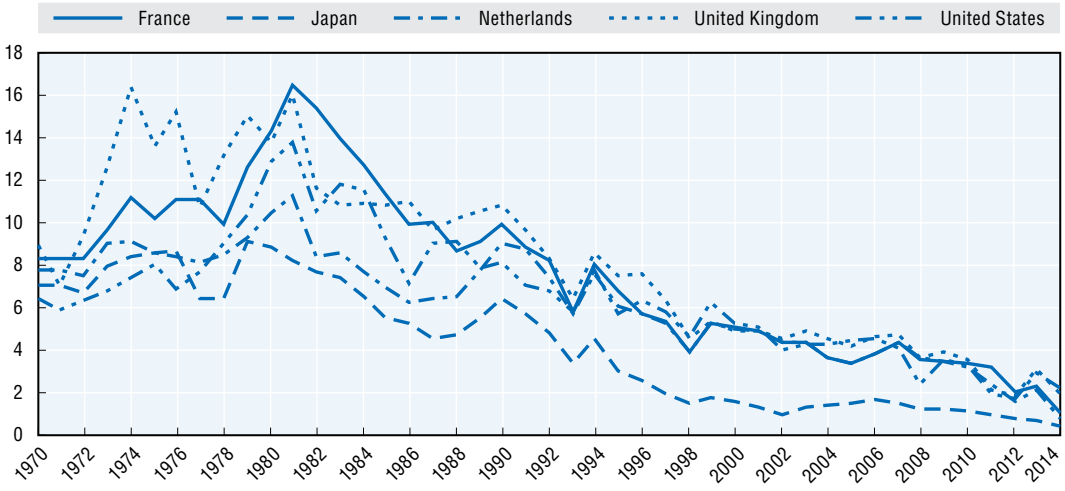
data on investment portfolios which might indicate an enhanced 'search for yield', such a shift may loom on the horizon.

Interest rates have had a long-term downward trend

Interest rates have been trending downwards over the past four decades. Figure 4.1 shows nominal yields on long-term (10-year) government bonds in a few OECD countries. They have fallen from two-digit rates in the late 1970s to 1980s to below 2% recently. Other interest rate measures confirm the downward trend in long-term interest rates (Figure 4.2).

Figure 4.1. **Nominal yields on 10-year government bonds in selected OECD countries, 1970-2014**

Percentage



Source: Datastream.

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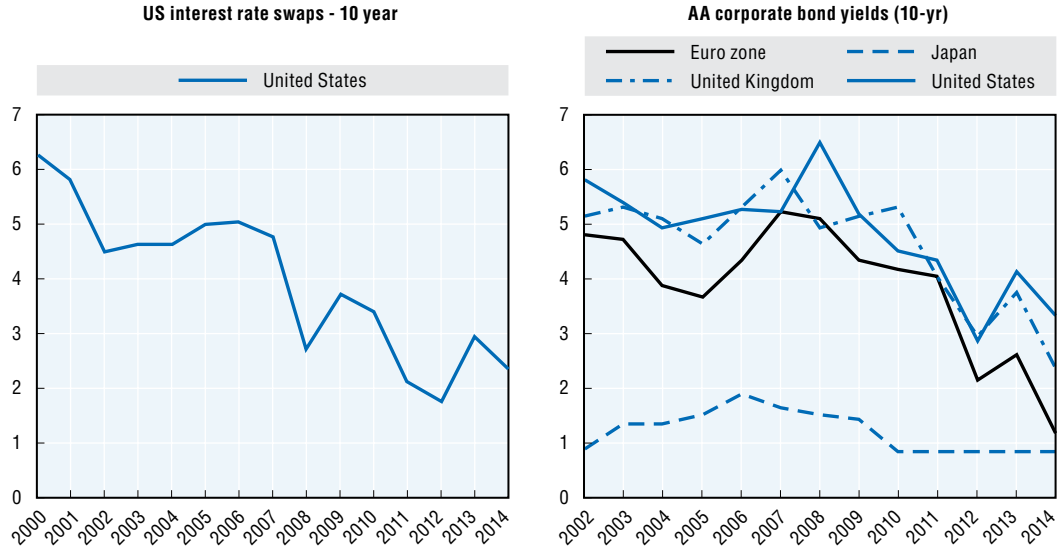
Figure 4.2. **Other measures of long-term interest rates, 2000-2014**

Percentage



Source: Datastream.

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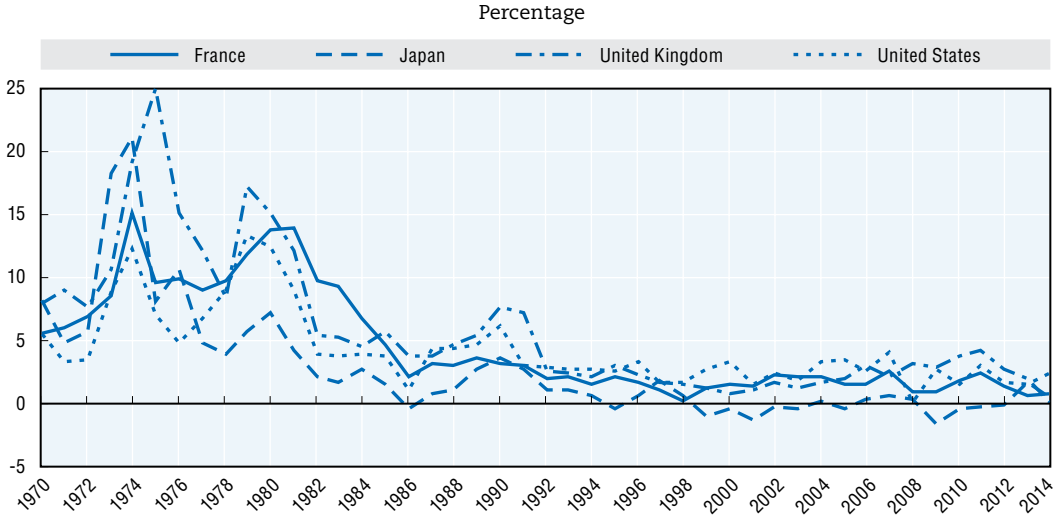
Protracted low interest rates appear to reflect economic conditions characterised by low inflation (in both prices and salaries) and low returns on investment. The fall in interest rates has occurred in conjunction with declining inflation rates (Figure 4.3). The correlation between 10-year government bond yields and inflation confirms this observation. For the period 1970-2014, this correlation ranges from 0.63 for the United States to 0.83 for France, with 0.69 for Japan and 0.79 for the United Kingdom (Figure 4.4).[3] Real yields on 10-year government bonds have also been trending downwards (Figure 4.5). While real yields do not affect pension liabilities, which are typically nominal promises, they do have an impact on assets as lower real yields entail lower potential accumulation of assets to back future liabilities.

Figure 4.3. **Annual variation of prices, Consumer Price Index, 1970-2014**



Source: IMF International Financial Statistics and OECD Main Economic Indicators databases, OECD (2015), *http://dx.doi.org/10.1787/data-00052-en*.

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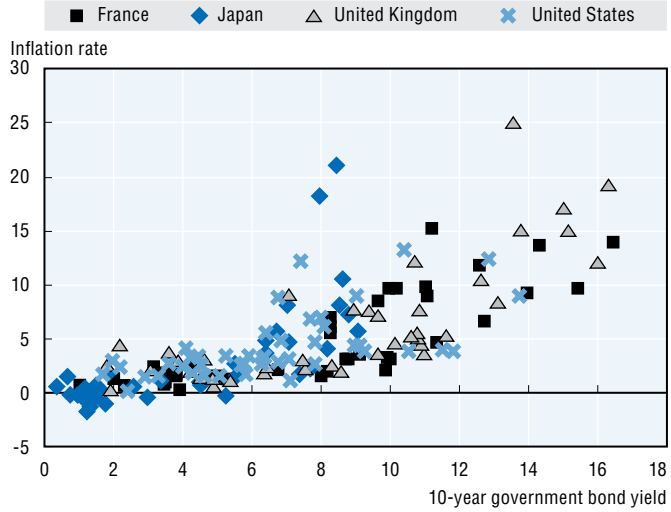
Figure 4.4. **Yields on 10-year government bonds and Consumer Price Index in selected OECD countries, 1970-2014**



Source: Datastream; IMF International Financial Statistics and OECD Main Economic Indicators databases, *http://dx.doi.org/10.1787/data-00052-en*.

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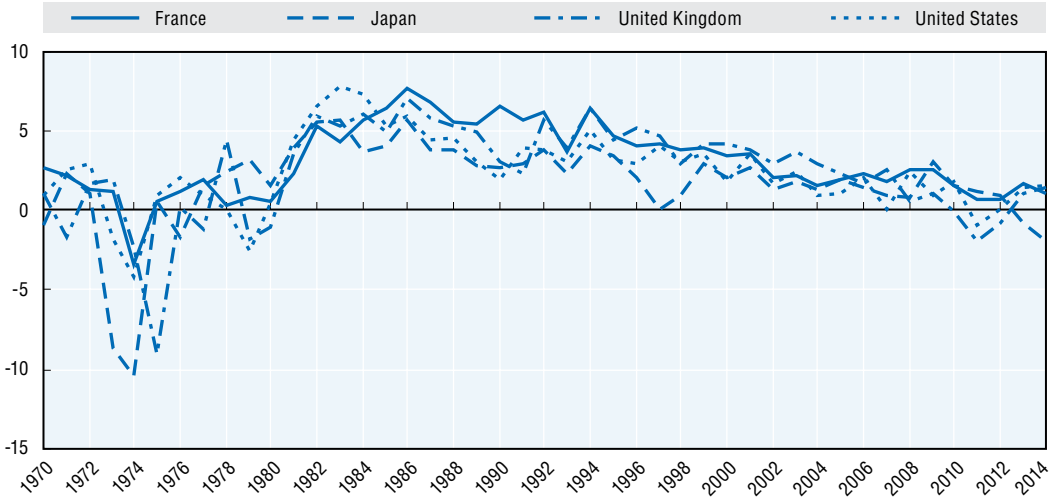
Figure 4.5. **Real yields on 10-year government bonds, 1970-2014**

Percentage



Source: Datastream; IMF International Financial Statistics and OECD Main Economic Indicators databases, *http://dx.doi.org/10.1787/data-00052-en*.

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The low interest rate affects both the asset and liability side of pension systems

The relationship between the liabilities of pension funds and annuity providers and the assets backing those liabilities (i.e. the funding ratio) determines the financial situation of these institutions, including their solvency. Interest rates play a role for both the asset and the liability side of the balance sheet of these institutions and understanding how interest rates affect both is essential to understanding the potential impact of low interest rates.

Low interest rates affect the liabilities of pension funds and annuity providers because the liabilities depend on the discount rate used to calculate the present value of future promises. The discount rate used to calculate the net present value is generally assumed to be the risk-free rate, usually the long-term government bond yield (e.g. the 10-year government bond yield). Other things equal, when government bond yields decline, the estimated value of future liabilities increases.

Low interest rates also affect the future value of savings, which is the assets accumulated at retirement, as fixed-income securities, including long-term government bonds, are often a large part of the investment portfolio. However, low interest rates going forward do not affect the current value of assets.

Therefore, to understand the potential impact of interest rates on pension systems, it is necessary to examine how assets accumulate to finance retirement in old age and how those assets are allocated to finance retirement.

Interest rates directly affect savings for retirement

Saving for retirement consists of putting aside a proportion of one's income while working to accumulate assets to finance retirement in old age. Those savings are invested and earn a return, thus leading to asset accumulation. The amount of assets accumulated (the future value of savings, Box 4.1) is a function of the contribution rate, the growth of wages (taking into account inflation and productivity growth) and the return earned on the portfolio. The return earned on the portfolio is a positive function of the returns earned on the different assets held within the portfolio.

Box 4.1. **The future value of savings (FVS) - assets accumulated at retirement**

The future value of saving accumulated during the individual's working life span is:

$$FVS = FVS(S, r, N) = \sum_{i=1}^{N} S_i \left(1 + r_i\right)^{N-i+1} \quad [1]$$

FVS is valued at the age of retirement, which is accumulated over N periods. N is the working life span or the period of accumulation, which is calculated as the difference between the retirement age (RA) and the age at which the individual began accumulating savings (EA). S_i is the amount saved in each period and r_i is the annual rate of return on investment (assume $r_i = r \forall i$ for simplicity). Assuming that the amount saved is a fixed share of current wages (i.e. a contribution rate, c), and wages grow from an initial wage W_0 according to inflation (*p*) and productivity (*pr*):

$$S_i = cW_i = c \cdot \left(1 + p\right)^{i-1} \cdot \left(1 + pr\right)^{i-1} \cdot W_0 \quad [2]$$

Contributions in the first year are paid from the initial wage W_0, in the second year they are paid from the new wage (W_1) that has grown according to inflation and productivity gains, i.e. they are paid from (1+p)*(1+pr) W_0. Contributions paid at year j are paid from wage $W_j = (1+p)^{i-1} \cdot (1+pr)^{i-1} W_0$, where i=j-EA.

$$FVS = FVS(S, r, N) = \sum_{i=1}^{N} c \cdot \left(1 + p\right)^{i-1} \cdot \left(1 + pr\right)^{i-1} \cdot W_o \cdot \left(1 + r\right)^{N-i+1} \quad [3]$$

Therefore, at retirement, the individual has accumulated assets A_N = FVS. At this point, given the amount of assets accumulated, A_N, and the length of the period expected to receive pension payments, the amount of retirement income the individual receives can be calculated, which determines how much s/he can consume.

The growth of wages depends, in equilibrium, on inflation and productivity growth. However, outside equilibrium, wages could grow above or below inflation and productivity growth if there are changes in the bargaining power of workers (unions) and/or employers, which may lead to changes in the wage share of the economy. The future value of saving (assets accumulated at retirement) is a positive function of wage growth, *w*, and the return on investment, *r*.

$$FVS = FVS(S, r, N) = \sum_{i=1}^{N} c \cdot \left(1 + w\right)^{i-1} \cdot W_o \cdot \left(1 + r\right)^{N-i+1} \quad [4]$$

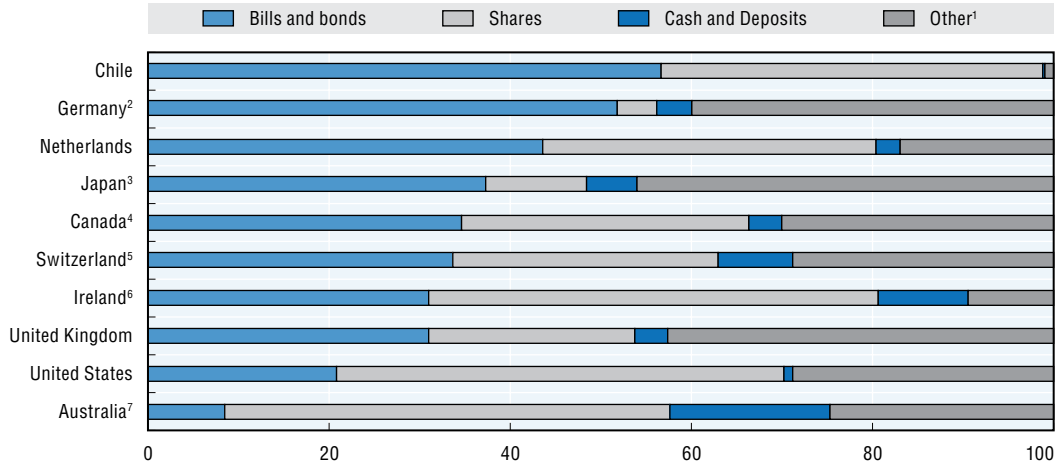
Lower interest rates lead to lower accumulated assets for retirement because of lower government bond yields

One of the key asset classes in any retirement portfolio is fixed-income securities, which include long-term government bonds. Lower interest rates (i.e. lower long-term government bonds yields) will therefore lead to lower accumulated assets to finance retirement. How much lower depends on the proportion of assets in the portfolio in the fixed-income category and in long-term government bonds.

Pension funds and life insurance companies have a large proportion of assets invested in fixed income securities. Indeed, Figure 4.6 shows that pension funds in many countries invest around 40% of their assets in fixed-income securities; that share implies that the impact of low interest rates on asset accumulation should be weighted by the proportion of assets invested in fixed-income securities.

Figure 4.6. **Pension funds asset allocation in selected investment categories, 2013**

Percentage of total assets



Notes: More detailed information on the data can be found in the descriptions provided in the GPS database, *www.oecd.org/pensions/globalpensionstatistics.htm*. Pension funds' asset allocation for other OECD countries can be found in the *OECD Pension Markets in Focus 2014*, *www.oecd.org/pensions/pensionmarketsinfocus.htm*. (1) The 'Other' category includes loans, land and buildings, unallocated insurance contracts, hedge funds, private equity funds, structured products, other mutual funds (i.e. not invested in cash, bills and bonds, or shares) and other investments. (2) The high value for the 'Other' category is driven mainly by loans (16% of total investment) and other investments of collective investment schemes (16% of total investment). (3) Source: Bank of Japan. The high value for the 'Other' category is driven mainly by outward investments in securities (21% of total investment) and accounts payable and receivable (19% of total investment). (4) The high value for the 'Other' category is driven mainly by other investments of collective investment schemes (17% of total investment). (5) The high value for the 'Other' category is driven mainly by land and buildings (direct and indirect investment in this category accounts for 17% of total investment). (6) Source: Based on data from the IAPF Pension Investment Survey. (7) Source: Australian Bureau of Statistics (ABS). Data refer to the end of June 2013. The high value for the 'Other' category is driven mainly by net equity of pension funds in life office reserves (14% of total investment).

Source: OECD Global Pension Statistics, *www.oecd.org/pensions/globalpensionstatistics.htm*.

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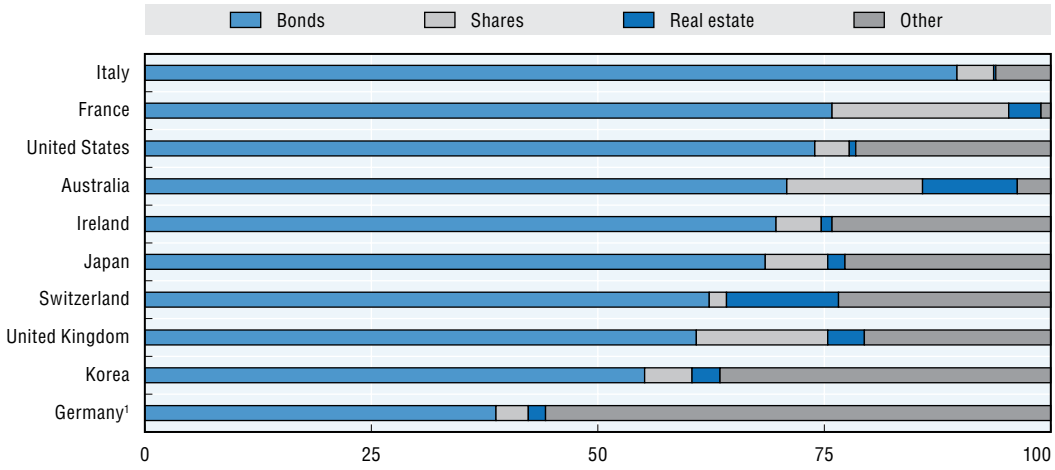
Figure 4.7 shows that life insurance companies have an even larger share of their portfolio invested in fixed income securities than pension funds, which means, other things equal, that the impact of low interest rates will be higher than for pension funds given the higher share of interest sensitive assets.[4]

The impact of a reduction in interest rates on the value of the assets backing the liabilities of these investors depends not only on the proportion of the portfolio invested in fixed income securities, but also on the valuation methods, and the maturity of those securities. A drop in interest rates may have an immediate impact on the current value of assets when mark-to-market valuations are applied. However, this drop could translate into an increase in the current value of assets as a drop in yields would be reflected in an increase in prices and therefore returns. However, the actual or face value of current assets might not change at all when pension funds and insurance companies hold their fixed-income securities to maturity. To the extent that interest rates remain low into the future and the fixed-income securities in the portfolio reach maturity, reinvestments into new fixed-income securities carrying lower yields would reduce the future value of assets, in proportion with the share of the portfolio invested in fixed-income securities. As a result of this lower future value of assets, pension funds' and insurance companies' assets might not be sufficient to back up their promises, unless the pension or payment promise is adjusted to the new environment of low interest rates, low inflation and low growth.

Figure 4.7. **Life insurers' asset allocation in selected investment categories, 2013**

Percentage of total assets



Notes: Data only refer to domestic direct insurers, and exclude assets linked to unit-linked products where risk is fully borne by policyholders. Life insurers' asset allocation in other OECD countries can be found in the report *Global Insurance Market Trends* 2014, *www.oecd.org/finance/insurance/globalinsurancemarkettrends.htm*. (1) The 'Other' category mainly comprises loans and mutual fund investments for which no look-through was available.

Source: Based on *OECD Global Insurance Market Trends 2014*, *www.oecd.org/finance/insurance/globalinsurancemarkettrends.htm*.

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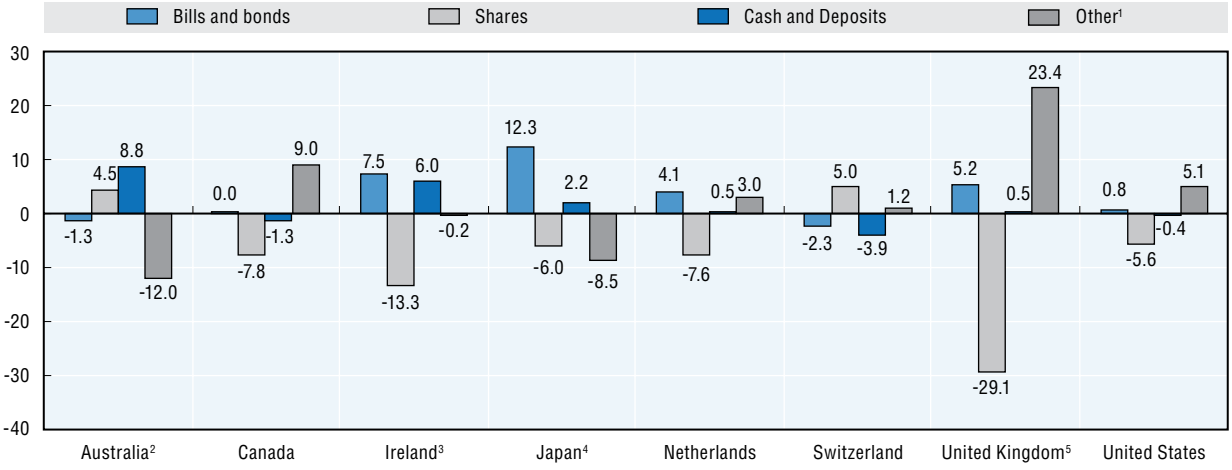
Figure 4.8. **Variation in pension funds' asset allocation between 2003 and 2013 in selected OECD countries**

In percentage points



Notes: (1) The 'Other' category includes loans, land and buildings, unallocated insurance contracts, hedge funds, private equity funds, structured products, other mutual funds (i.e. not invested in cash, bills and bonds, or shares) and other investments. (2) Source: Australian Bureau of Statistics (ABS). Data refer to the variation between end of June 2003 and end of June 2013. The 'Other' category includes net equity of pension funds in life office reserves. (3) Source: Based on data from the IAPF Pension Investment Survey. (4) Source: Bank of Japan. The 'Other' category includes outward investments in securities and accounts payable and receivable. (5) Data only refer to occupational pension schemes.

Source: OECD Global Pension Statistics, *www.oecd.org/daf/fin/private-pensions/globalpensionstatistics.htm*.

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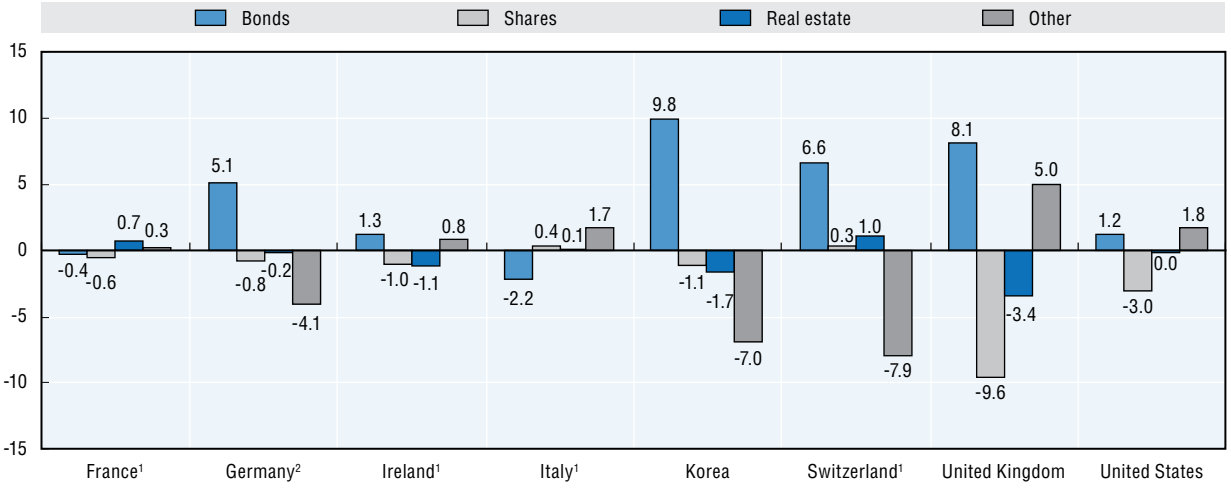
The share of fixed-income securities in the investment portfolio of pension funds in the main economies has not changed much in the past decade (Figure 4.8) while that for life insurers have increased (Figure 4.9).

Figure 4.9. **Variation in life insurers' asset allocation between 2006 and 2013 in selected OECD countries**

In percentage points



Notes: Data only refer to domestic direct insurers. (1) The shift is shown between 2009 and 2013. (2) The 'Other' category mainly comprises loans and mutual fund investments for which no look-through was available.

Source: OECD Global Insurance Statistics, *www.oecd.org/daf/fin/insurance/oecdinsurancestatistics.htm*.

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Some concern for investing in riskier assets in a 'search for yield'

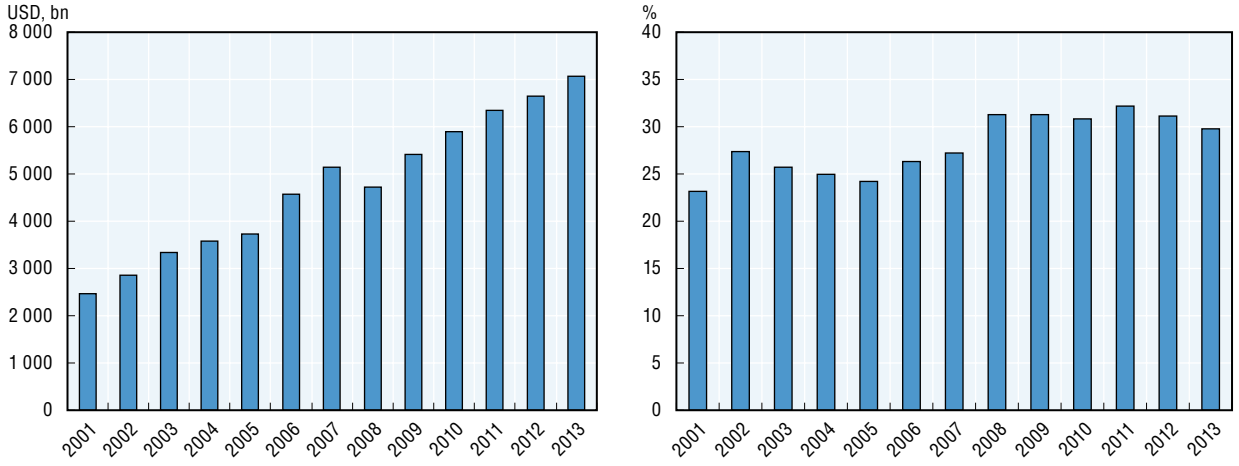
The extent to which pension funds and insurance companies engage in a 'search for yield' is the main concern for their outlook. Pension funds (and insurance companies) may shift their portfolio allocation towards investments that could potentially fetch higher returns but in exchange for an increased overall risk profile for their investment portfolio. As pension funds move into riskier investments in search of higher returns to fulfil their pension promises, they may be seriously compromising their solvency situation in the event of a negative shock (e.g. liquidity freeze).

The observed shift in portfolio composition to 'other assets' may be a sign of a 'search for yield' by pension funds. Figure 4.10 shows that the dollar amount invested by pension funds in 'other assets' has increased steadily over the past decade, thereby increasing the potential risk to pension funds and the potential risk to financial markets (Chapter 3). However, this may be just the result of a larger total investment portfolio. The category 'other assets' as a share of total portfolio investment has increased but much less so than the dollar amount would have suggested. Although the 'search for yield' remains one of the main worries for the outlook, available data do not show that it is happening on a large scale yet, except perhaps in the United Kingdom.

The data available for the United Kingdom show that pension funds may already be engaging in a 'search for yield' (Figure 4.11). There is a clear upward trend in the current value of investment in 'other assets', which include private equity, derivatives and structured products, as well as in the proportion of the total investment portfolio invested in those assets classes.[5]

Figure 4.10. **Total investment by pension funds in 'other assets', OECD countries**

Current values and as percentage of total investment



Source: OECD Global Pension Statistics, *www.oecd.org/daf/fin/private-pensions/globalpensionstatistics.htm.*

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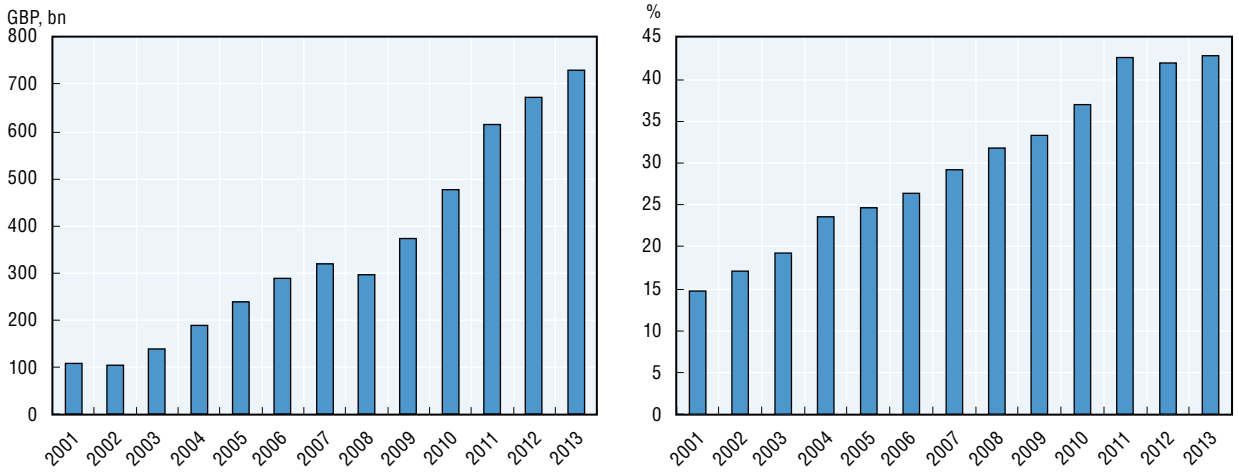
Figure 4.11. **Total investment by pension funds in 'other assets', United Kingdom**

Current values and as percentage of total investment



Source: OECD Global Pension Statistics, *www.oecd.org/daf/fin/private-pensions/globalpensionstatistics.htm.*

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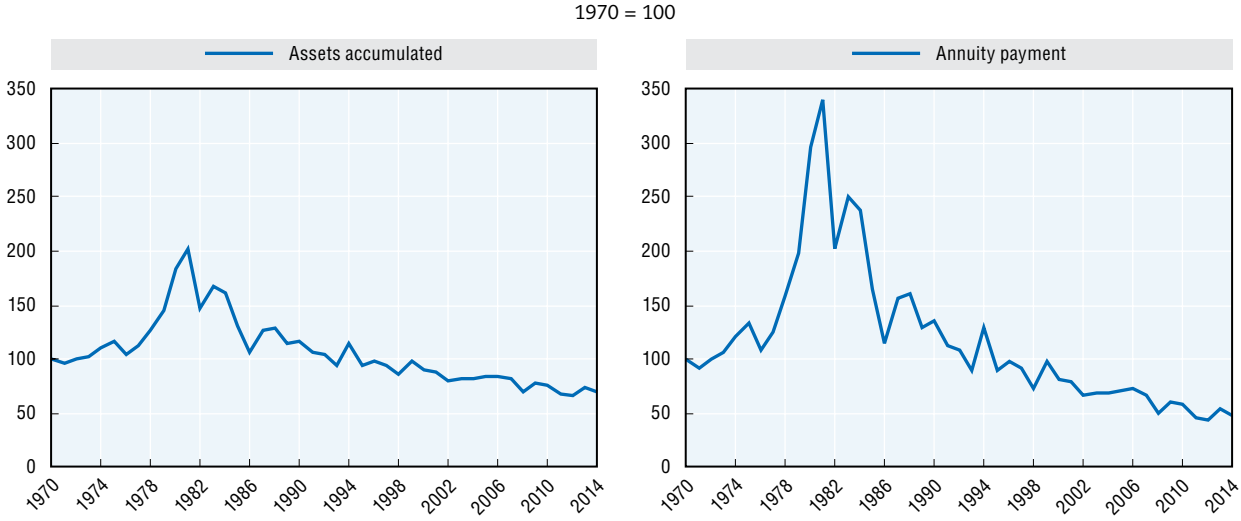
Low interest rates have a different impact on defined contribution (DC) and defined benefit (DB) pension plans[6]

Who bears the impact of low interest rates on assets depends on whether a plan is of the DB or DC type. In DB pension plans, pension funds take contributions, manage the assets, and in exchange promise a certain level of income at retirement. The impact of low interest rates on the people saving for retirement in DB pension plans is, in principle, negligible, as they are promised a certain level of income irrespective of the amount of assets accumulated. It is the DB pension fund which bears the risk of the assets accumulated being lower than needed to fulfill the income promise.

The impact of low interest rates on people saving in DC pension plans is a reduction in the amount of assets accumulated to finance retirement and an increase in annuity prices, which can affect the adequacy of their retirement income. In DC pension plans,

pension funds take in contributions and manage the assets, but they are not involved in providing retirement income. Individuals need to allocate the assets accumulated at retirement to finance old age in DC pension plans. One common way to allocate assets to finance retirement is to buy a life annuity. When an individual buys a life annuity at retirement, falling interest rates will reduce the amount of pension benefit payments that the assets accumulated can acquire.[7] Figure 4.12 shows the hypothetical impact of long-term interest rates trending downwards on assets accumulated and annuity payments using the actual rates reported in Figure 4.1. The decline in rates has a direct effect on the retirement savings of DC plan members through lower assets accumulated and lower pension income those assets can provide.

Figure 4.12. **Changes in retirement income as interest rates change**



Note: Assets accumulated and annuity payments are calculated for the same hypothetical individual contributing 10% of wages over a 40 year period and then retiring. The assets are invested in a portfolio comprising 60% of variable income and 40% of fixed income. The return on both asset classes used is 4.5% for the former and the historical yields for 10-yr government bonds, kept to maturity, for the latter. The assets accumulated are used at retirement to buy an annuity 20 years making payments for starting at age 65 and using the actual government bond yields for calculating the annuity premium. The only variable evolving over time is the yield on government bonds which is set equal to actual data. Therefore, the evolution of both variables represents the impact of interest rates trending downwards since the 1970.

Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/888933209673

On the other side of the transaction is the annuity provider, usually an insurance company, which takes the assets in exchange for a promise of regular, periodic payments during the retirement period. Once the annuity contract is in place and the promise made, the insurance company bears the risk of lower than expected interest rates, given annuity premiums and expected annuity payments (see Box 4.2).

This section has shown the impact low interest rates have on the future value of current assets and savings depends on the weight that fixed-income assets, and in particular long-term government bonds, have in the portfolio of pension funds. The section has also shown that low interest rates affect the asset side of the balance sheet of both DB and DC pension plans. In DC pension plans, individuals are negatively affected by low interest rates in their retirement as they receive lower retirement income for a given amount of assets when buying an annuity because the price references for annuities are based on long-term interest rates. In DB pension plans individuals are not affected because DB plans involve a promise. Employers and plan sponsors may have to come up with more resources. The main concern

for the outlook from the asset side of balance sheets is the degree to which pension funds and annuity providers attempt to meet their payment promises by shifting their portfolio composition towards investments with a higher return potential, a shift that results in an increased average risk profile for their portfolio. This 'search for yield' does not yet appear in the data except, perhaps, in the United Kingdom. The United Kingdom is a country with large defined benefit pension plans, most of them already closed, which may have already moved into riskier assets or investments to achieve higher returns and thus able to keep their pension promises. This may be the direction in which pension funds will move.

Box 4.2. **Annuity payments**

Consider a simple, immediate individual life annuity, for which the insurer pays a stream of regular, periodic payments to an individual for his lifetime in exchange for an upfront, lump sum premium payment. The price of this product for an individual should be the net present value of expected future cash flows. The insurer must take into account the discount rate, the expected survival of the individual and any expenses incurred by the insurer for offering the promised regular payment. The insurer must define appropriate assumptions for each of these variables to calculate a price which is expected to cover the future payments owed in order to avoid making a loss on the product.

A discount rate is assumed in order to account for the time value of money. Generally, the risk-free rate is the discount rate assumed, because, in financial markets, products with the same expected cash flows should be sold at the same price. The insurer could take a risk-free investment strategy for the term of the bond and invest the premium received in government bonds, which would pay coupons which could be matched to the payments owed to the annuitant.

If the discount rate used to price the annuity is higher than the risk-free rate, the insurer is obliged to invest in higher risk assets offering a higher return in order to meet the future payments. This investment strategy would then no longer be risk-free, as there is a chance that actual investment returns will be below the expected return and that the insurer will have to default on its future payments, exposing the annuitant to credit risk.

The expected survival of the individual must also be accounted for, since the annuity payments will be made for his/her remaining life. Thus when calculating the present value of expected future cash flows, the probability that the individual will survive to receive each cash flow has to be taken into account. These mortality assumptions generally vary by gender (unless regulation expressly forbids pricing by gender) and attained age. Improvements in mortality should also be assumed to account for the fact that mortality is expected to decrease over time (i.e. life expectancy is expected to increase).

The annuity factor will take into account the survival probabilities in each period. In this context, annuity factor = $1+p_{65}v +{}_2p_{65}v^2+ \ldots +{}_np_{65}v^n$, where ${}_np_{65}$ is the probability of surviving n periods at age 65, v = 1/(1+d), and d is the discount rate.

The impact of low interest rates depends on the nature of the promise of DB pension plans and annuities

The next step in the analysis is to assess the impact of interest rates on the liability side of the balance sheet. The focus is on pension funds that have some type of promises linked to retirement income (e.g. final salary DB plans) and insurance companies that take assets in exchange for a promised return (e.g. annuity products involving regular annuity payments).[8]

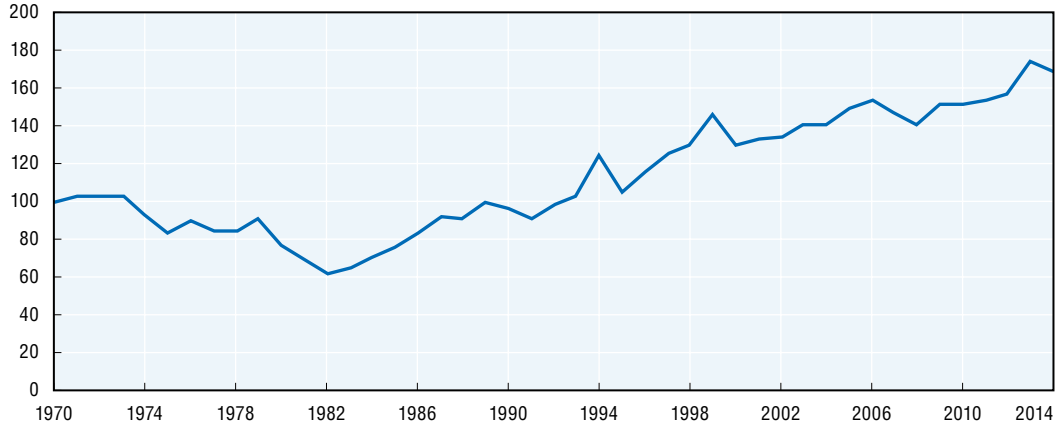
Current liabilities depend on the nature of the promise and the discount rate used to calculate the present value of those promises. The discount rate used to calculate the present value is generally a risk-free rate, usually the nominal long-term government bond yield. Lower discount rates translate directly into higher present value of liabilities for a given amount, all else equal.

The impact of interest rates also depends on whether the promise is fixed or not. The promise can be fixed or can be parameter dependent, whereby the promise is linked to certain parameters such as wages or inflation (e.g. DB pension funds). The nature of the promise would also depend on whether the pension or annuity payment promised is already incurred or is embedded in a new contract. In the case of DB pension funds with current retirees and insurance companies already engaged in a contract with the annuitant, low interest rates (lower than the interest rates assumed in their actuarial and pricing calculations) mean that the current assets backing those promises may not grow as much as was expected at the time the promise was made, thereby compromising their solvency position.

The impact of low interest rates will be highest when the promise is fixed in nature. As interest rates fall, resulting in a decline in the discount rate applied to calculate the present value of future pay-outs, the present value of a fixed promise or cash flow becomes bigger in the future. Figure 4.13 shows the evolution over the period 1970-2014 of the present value of a cash flow of 100 currency units payable for 20 years to approximate life expectancy at 65, using as discount rates the actual United States long-term government yield (Figure 4.1). The fall in interest rates over the period from 6.24% to 2.21% results in an increase of 69% in the present value of the liabilities.

Figure 4.13. **Evolution of the present value of an hypothetical fixed cash flow promise payable over 20 years when interest rates fall**

(First year present value = 100)



Note: The historical long-term US government bond yield is used to discount the cash flows. The yield in 1970 is used for the present value of the first year. The yield for 2014 is used for calculating the present value of the last year.

Source: OECD calculations.

StatLink http://dx.doi.org/10.1787/888933209684

The promise for people still saving for retirement depends on the evolution of various parameters. To the extent that protracted low interest rates accurately anticipate future economic conditions characterised by low growth, low inflation (in both prices and salaries) and low returns on investment, future pension benefits may also be lower. In the case of insurance companies offering life annuities, the low interest rates should be reflected in the new pricing.[9] Only when interest rates turn out to be lower than the rate used in

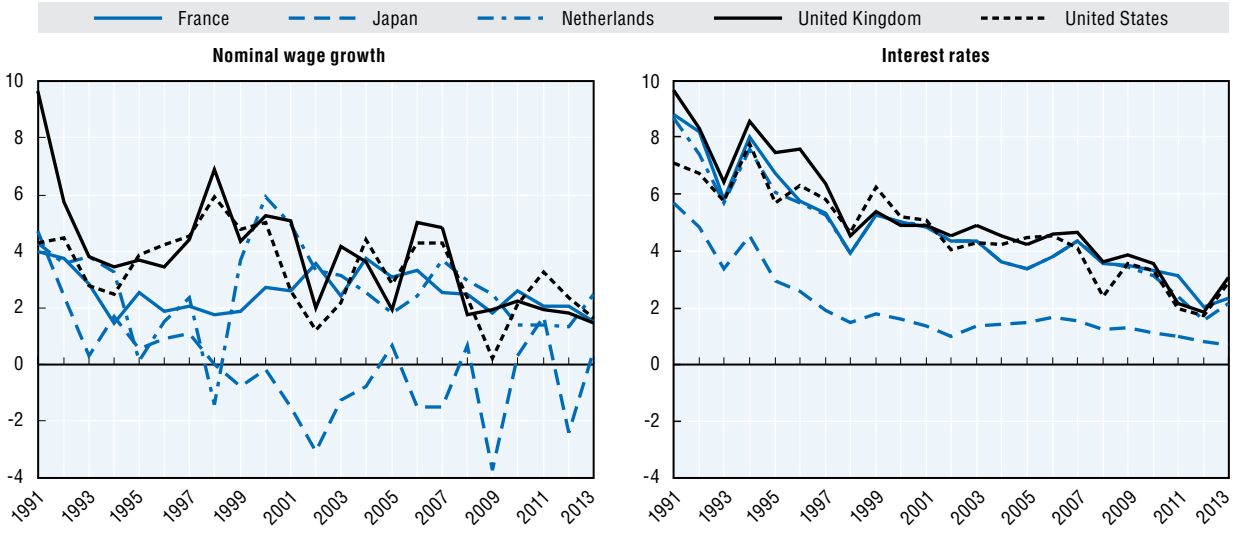
pricing life annuities might problems arise for insurance companies offering life annuities. Additionally, the low interest rates lead to annuity contracts that provide lower annuity income to the annuitant for a given amount of assets. This is similar to the problem discussed above for individuals in DC pension plans, whose retirement income adequacy will be negatively affected by low interest rates (Figure 4.12).

Consequently, the liabilities of DB pension funds should gradually adjust to reflect the new environment of lower interest rates. If low interest rates mean that for the foreseeable future inflation and wage growth will be lower, then the future promise will also be lower (the typical promise of a DB pension plan is the result of applying an accrual rate to a reference salary, e.g. final salary, and multiplying it by the years of service or contribution).

In short, the impact of low interest rates going forward for DB pension plans will depend on the relationship between the growth of the promise, which is determined by the future growth of wages (w in equation [4] in box 4.1), and the discounting of future liabilities. When both the value of the promise and the discount factor fall, the solvency position will deteriorate if the change in the growth of the promise, $\Delta(1+w)$, relative to the factor used to discount the future liabilities, $\Delta \sum_{j=1,n} (1+i)^j$, is greater than one. However, the worsening of the solvency position is less than if the promise were to remain constant and only the discount rate declined. Figure 4.14 shows that discount rates (given by 10-year government yields) have fallen a bit more than growth rates of nominal wages.

Figure 4.14. **Nominal wage growth and interest rates, 1991-2013**

Percentage



Note: The chart on the left-hand side shows the variation of economy wide nominal average annual wages growth for a full-time, full-year equivalent employee in the total economy. They are obtained by dividing the national-accounts-based total wage bill by the average number of employees in the total economy, which is then multiplied by the ratio of average usual weekly hours per full-time employee to average usual weekly hours for all employees.

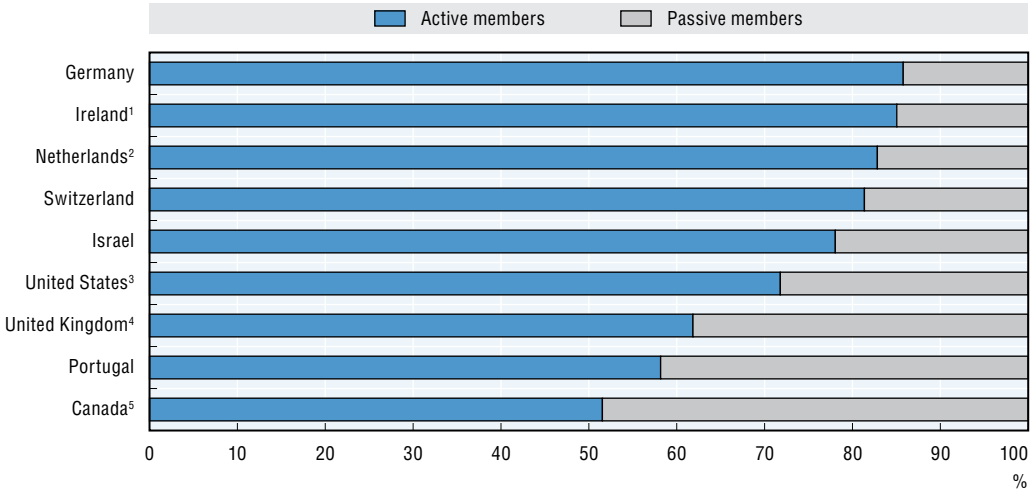
Source: «Average annual wages», OECD Employment and Labour Market Statistics (database); Datastream.

StatLink http://dx.doi.org/10.1787/888933209693

The percentage of members already retired relative to active members serves as a proxy for the potential magnitude of the problem, as the promise is fixed for those already retired and parameter dependent for those still active.[10] The higher the proportion of retired people in the membership of pension funds the larger is the part of the promise that is fixed relative to the promise that is parameter-dependent. The figure below clearly shows

that for countries like Canada and the United Kingdom, where the percentage of members of pension funds who are retired is close to 50% and 40% respectively, the problem is larger than for countries like Germany and the Netherlands where the percentage of retired people is only around 15%.

Figure 4.15. **Share of active and retired members of DB pension funds in selected OECD countries, 2013**



Notes: Active members are defined as persons at present accumulating benefits or who have accrued benefits in the past and are not yet retired. Passive members are members who are receiving benefits from the plan.

(1) Source: the Pensions Authority. Data refer to 2014, and to active and frozen DB schemes which are subject to the funding standard and which submitted an Annual Actuarial Data Return to the Pensions Authority at the end of 2014. (2) Data include members of occupational DC plans. (3) Data refer to 2011. (4) Source: The Purple Book 2014. Data refer to the end of March 2014. (5) Data refer to 2012.

Source: OECD Global Pension Statistics, *www.oecd.org/daf/fin/private-pensions/globalpensionstatistics.htm.*

StatLink *http://dx.doi.org/10.1787/888933209706*

Finally, the mismatch between the duration of liabilities and the assets backing those liabilities may enhance the solvency problems that an environment of prolonged interest rates may pose for pension funds and life insurance companies (Box 4.3). On the one hand, pension funds and life insurance companies may have to be invested in long dated bonds with high yields and hold them until maturity in order to meet future liabilities. However, due to the scarcity of good quality, very long-term government bonds, their duration may only be around 10 years. On the other hand, their liabilities may have a longer duration due to the time horizon of their promises (e.g. life expectancy at age 65 can exceed 20 years). This mismatch will cause insurance companies and pension funds to be exposed to re-investment risk. Their future long dated bonds may yield much less, reducing their capacity for meeting their payment obligations.

Box 4.3. **How changes in interest rates affect pension funds and insurers: the duration match between assets and liabilities**

In general, when calculating liabilities, defined pension funds and insurance companies discount future cash flows by using a discount rate linked to long-term interest rates. A reduction in long-term interest rates means that the liabilities, or the discounted value of future cash flows of a pension plan or an insurance company, would increase. At the same time, the value of pension fund and insurer asset portfolios would rise given the increased value of future cash flows.

Box 4.3. **How changes in interest rates affect pension funds and insurers: the duration match between assets and liabilities** *(cont.)*

The net effect depends on the duration of assets and liabilities. It can be expected that defined benefit pension funds and life companies with long-dated, interest-rate-sensitive liabilities will, unless they are hedged, have a negative duration gap, i.e. the weighted duration of liabilities exceeds the weighted duration of assets. Where there is a negative duration gap, an increase in interest rates will have positive effect. Thus, defined benefit pension funds and life insurers will be negatively affected by a reduction in long-term interest rates.

Where the duration gap is negative, a period of low interest rates poses challenges for asset-liability management in that current lower-yielding assets are expected to meet the return assumptions made in the past. Interest income falls as coupon payments from fixed-income instruments and the principal from maturing debt must be rolled over into lower-yielding debt. The extent of this reinvestment risk depends on the extent of the mismatch between the duration of the insurer's liabilities (its effective investment horizon) and the duration of the insurer's assets.

Further, when interest rates fall, insurance policyholders tend to stick to their (generous) contracts, unless insurers can convince them to do otherwise by encouraging them to switch to new contracts, which raises potential consumer protection issues.

The regulatory framework and valuation methods play a role in solvency

The regulatory framework also plays a role in the solvency position of pension funds and insurance companies as it sets the valuation approach for assets and liabilities. Moreover, the regulatory framework also establishes requirements for pension funds and insurance companies to fulfil in order to ensure a high likelihood that their promises are covered. For example, the regulatory framework requires pension funds and insurance companies to maintain a minimum funding or solvency ratio – that is a relationship between assets and liabilities – so that the likelihood of fulfilling their promises is adequately high. The regulatory framework also requires these institutions to manage the assets and associated risks affecting their ability to fulfill their promises.

The actual impact of low interest rates on reported DB funding ratios also depends on the regulatory framework and in particular on the required valuation method for liabilities and assets. Defined benefit plans can have several different funding levels depending on the purpose of the calculation: for financial reporting purposes; for regulation (to be used by supervisors in determining minimum required contributions, the regulatory solvency funding level); for tax reporting; and for termination purposes (to be used upon plan closing or the buy-out of accrued benefits by an insurance company). For example, the discount rate and other assumptions, the actuarial method for valuing liabilities, or the asset evaluation method could be different for each of these distinct purposes.

In some countries, the level of liabilities used to determine minimum required contributions (the regulatory solvency level) is calculated as if the pension fund were to be terminated as of the valuation date. In such cases, the cash flows promised would be fixed, based on salaries and indexation as of the valuation date; hence, the impact of protracted lower interest rates would be quite large (as there would be no downward adjustment to future expected cash flows due to lower wage growth and inflation expectations).

Some countries (e.g. plans for public sector employees in the United States and United Kingdom) set regulatory solvency levels for liabilities and minimum required contributions based on a fixed discount rate not explicitly linked to actual bond yields; as such, the effect of a drop in bond yields would not be immediately felt. Certain other countries, such Japan and the United States, also apply smoothing mechanisms to market rates when calculating the discount rate to be used in pension valuations. Canada also revised its measure for determining funding ratios in 2011. The solvency ratio for federally regulated plans is being calculated using a three-year average. In general, such smoothing measures would tend to limit or at least delay the effects of a low interest rate environment on reported funding values.

For accounting purposes, methodologies are much more consistent across countries than is the case for regulatory solvency purposes. For accounting, discount rates tend to reflect actual bond yields, while future salary growth is included in benefit estimations. The assumptions used for inflation and future salary growth are, however, usually adjusted only gradually. A lower discount rate would increase liabilities and charges to plan sponsors' profit-loss statements, but to the extent that inflation and salary growth expectations are adjusted downward over time, the impact of protracted lower interest rates would be reduced due to lower expected future benefits. In practice, the anticipated inflation and salary levels used by pension funds are not adjusted often. Small pension funds and annuity providers, for instance, may not have the resources to have a full actuarial model and to change the cash flows assumptions regularly. Instead, they would use their central bank's long-term inflation target to calculate liability levels (for example, the recent European Central Bank inflation target of 2%) and adjust their assumptions only when the central bank revises inflation expectations.

The OECD has argued that the regulatory framework should be flexible in times of distress (Antolin and Stewart, 2009). In this context, funding and solvency rules for DB pension plans should be counter-cyclical and regulatory and supervisory bodies should grant pension funds flexibility in meeting funding requirements. In permitting flexibility, they avoid 'pro-cyclical policies' and allow pension funds to act as long-term investors and thereby serve as potential stabilising forces within the global financial system. However, in allowing for this flexibility in meeting funding requirements it is important to distinguish between temporary impacts of the economic cycle on sponsor cash flows and long-term structural changes to strengthen the scheme sponsor. It is also important that solvency rules aim at increasing funding levels in good times, well above one hundred percent, to act as a buffer in bad times when they could be allowed to temporarily fall below one hundred percent. However, this may present consistency problems as flexibility in funding during difficult market conditions must be matched by a consensus to increase contributions during better economic times, which may be perceived later on as a drag on economic recovery or as depressing wage improvements.

In response to the financial and economic crisis, several countries have increased flexibility. Policy responses include the extension of the time required to submit recovery plans (e.g. the Netherlands, Ireland) and the lengthening of recovery period for pensions funds (e.g. Canada, the Netherlands, Ireland, the United States).

Additionally, the crisis has reopened the debate over accounting rules, in particular mark-to-market valuation rules versus book value. There is also an ongoing discussion about appropriate discount rates to be used (corporate triple-A bonds, government bonds or the swap curve). This discussion has been strong in countries such as the Netherlands, Sweden and the United Kingdom.

Funding ratios are affected by the low interest rate to some extent

The previous sections have discussed how an environment of protracted low interest rates may affect the liabilities and assets backing those liabilities of pension funds and annuity providers. They have also used actual data to highlight the different mechanisms through which this impact could evolve. The relationship between both the liabilities and the assets backing those liabilities provides a measure of the potential solvency problems that those institutions may have and face in a protracted low interest rate environment.

This relationship is generally accounted for by the regulatory framework by requiring pension funds to maintain certain funding ratios, which measure how much of the liabilities current assets would cover.[11] However, the way in which liabilities and assets are measured to calculate funding ratios differ across valuation methods and sometimes across countries.

The level of funding ratios permitted for pension funds also varies across countries. For example, in the Netherlands pension funds are advised to have a funding ratio above 115% and when it is below 105% pension funds have to provide a plan to bring funding ratios up again. The Pension Protection Act in the United States recommends pension funds to have funding ratios of at least 90%.

Funding ratios fell with the crisis and although they have recovered they remain slightly below pre-crisis levels in most countries (Figure 4.16), with the value of their assets failing to cover their pension liabilities. For example, funding levels in the United States remain below pre-crisis levels and well below the Pension Protection Act recommendation of bringing them to at least 90%. The Dutch regulator (DNB) and the Dutch Association of Industry-Wide Pension Funds (VB) reported that the coverage ratio in most pensions funds in the Netherlands dropped below 100% in 2008 (Figure 4.16). Funding levels in the United Kingdom dropped from around 94% to 85% in 2009. The same pattern can be observed in Canada and Switzerland.

Figures 4.16 and 4.17 also show the joint evolution of funding ratios with interest rates, and returns on pension funds' investments in selected OECD countries. Funding ratios seem to be more responsive to interest rates than to rates of return. The correlation of funding ratios and long-term interest rates, measured by the 10-year government bond yield, is relatively high in the six countries examined, ranging from 0.8 in the United States to 0.2 in the United Kingdom, with 0.8 for Canada and 0.6 for the Netherlands and Switzerland for the period 2006 to 2013. This is much higher than the correlation of funding ratios to returns. The relative improvement in funding ratios is nonetheless in part due to the improvement in pension funds' rates of returns (Figure 4.17).

Exposure to longevity risk is exacerbated in an environment of low interest rates

The present value of future liabilities of pension funds and annuity providers is also affected by the assumptions on mortality taken into account when calculating pensions' liabilities and annuity premiums. OECD work on Mortality Assumptions and Longevity Risk[12] highlights the potential longevity risk to which those institutions may be exposed, given the assumptions on mortality improvements used.

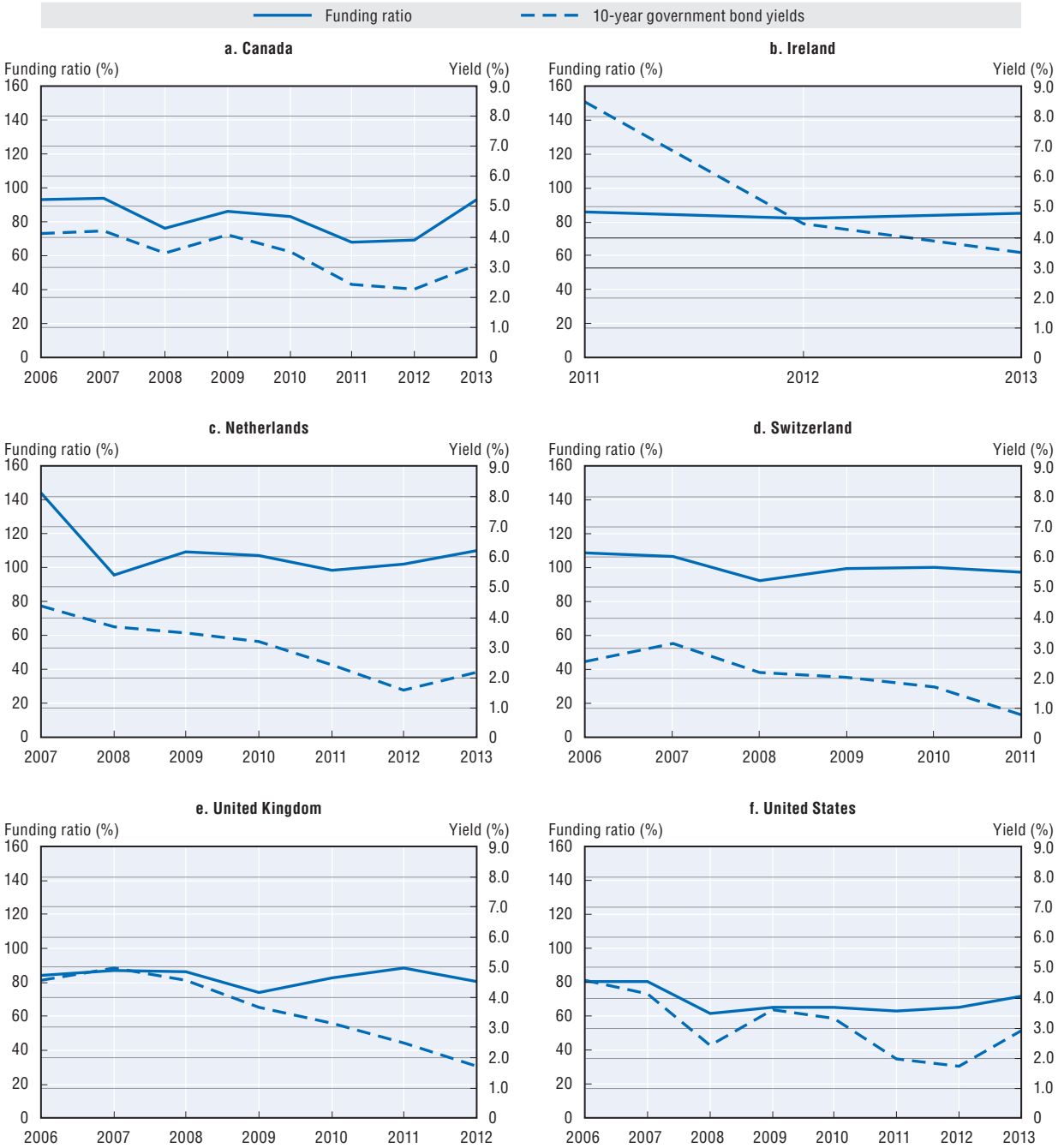
Low interest rates, when discounting future liabilities, increase the weight of future payments. Therefore, future deviations in mortality improvements from those assumed (longevity risk) become more problematic.

The exposure to longevity risk coming from different mortality assumptions used by pension funds and annuity providers is exacerbated in an environment of low interest rates. The graph below (Figure 4.18) shows the sensitivity to interest rates of the exposure

to longevity risk based on the different mortality assumptions used in different countries for pension funds and annuity providers. The grey bar shows the increase in this exposure associated with a fall in interest rates from 4.5% nominal assumed in the original calculation of the OECD work to 2%.

Figure 4.16. **Funding ratio of defined benefit (DB) pension plans and 10-year government bond yields in selected OECD countries, 2006-2013**

Percentage



Source: OECD calculations based on data from AON Hewitt; LCP Ireland, Pensions Accounting Briefing series; De Nederlandsche Bank (DNB); Swisscanto Pensionkassen-Monitor; The Pensions Regulator; Federal Reserve Board; Datastream.

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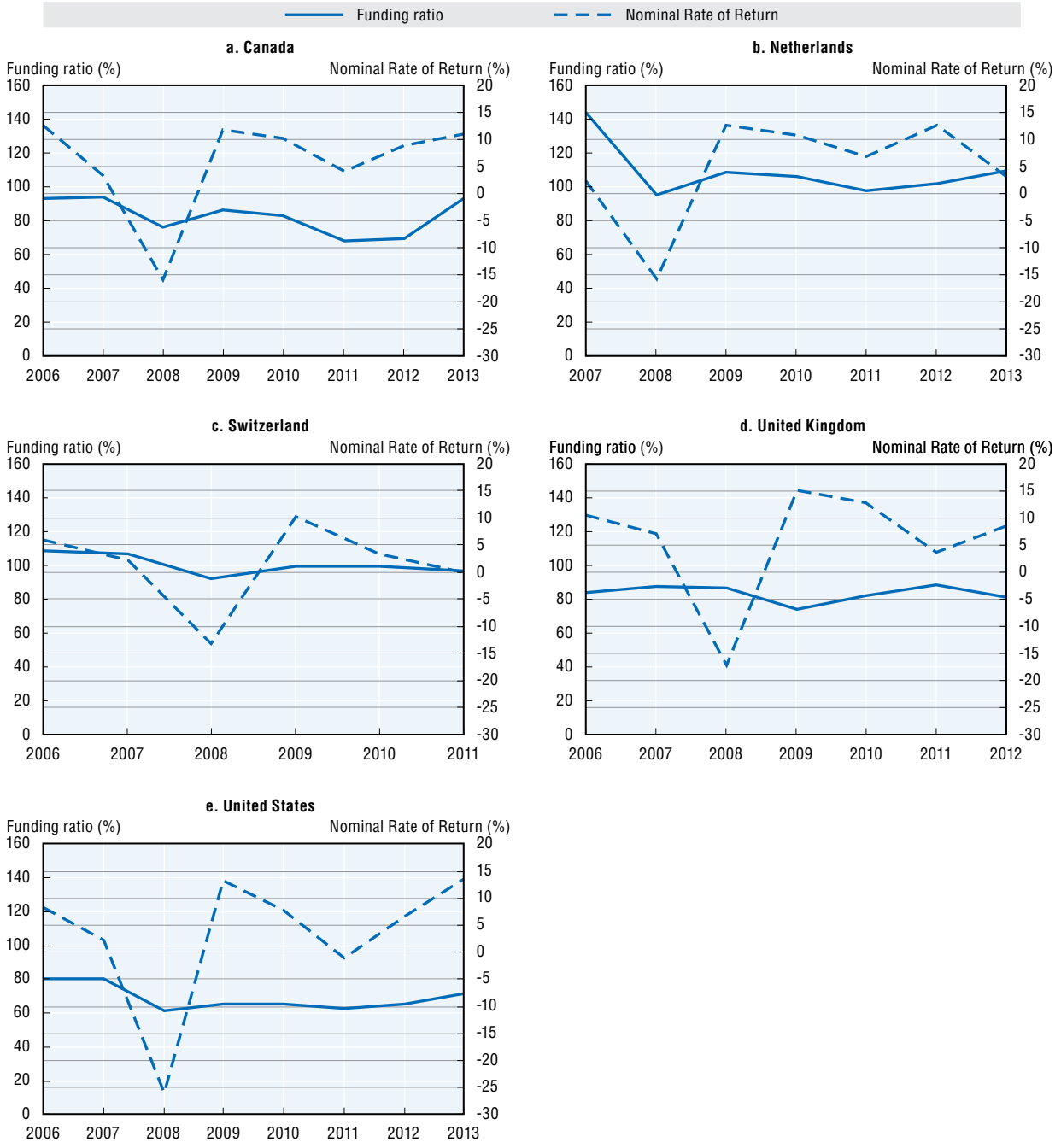
Figure 4.17. **Funding ratio of DB pension funds and pension funds' nominal average annual rate of return for all pension funds, 2006-2013**

Percentage



Source: OECD calculations based on data from AON Hewitt; De Nederlandsche Bank (DNB); Swisscanto Pensionkassen-Monitor; The Pensions Regulator; UBS Pension Fund Indicators 2014; and Federal Reserve Board; OECD Global Pension Statistics, *www.oecd.org/daf/fin/private-pensions/globalpensionstatistics.htm*.

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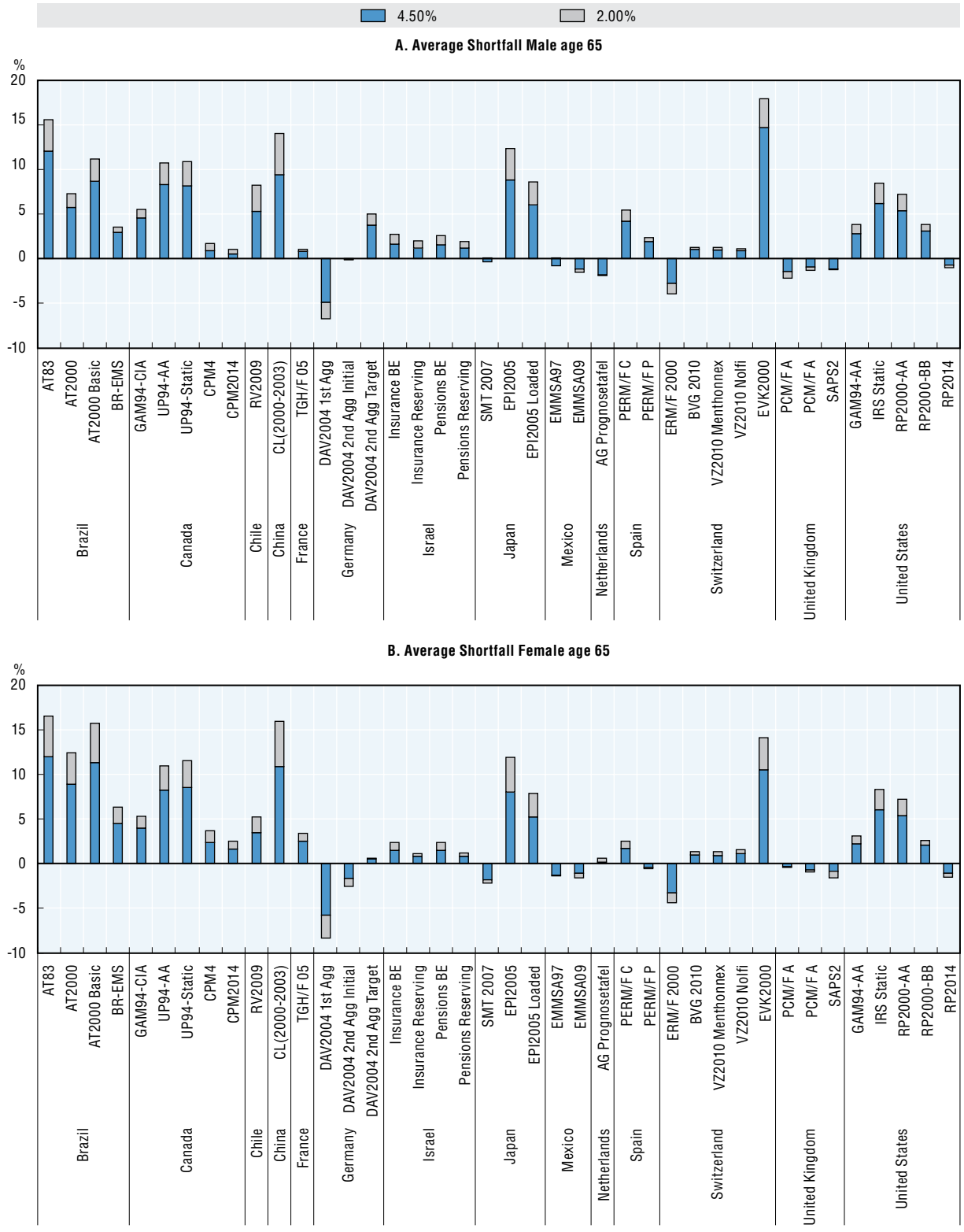
Figure 4.18. **Drop in interest rates increases exposure to longevity risk of mortality tables across countries, by gender**



Source: OECD calculations using OECD work on Mortality Assumptions and Longevity Risk *http://dx.doi.org/10.1787/9789264222748-en.*

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The low interest rate environment could impact life insurers through both their asset and liability sides

This section focuses specifically on the impact of prolonged low interest rates on life insurers. Previous sections have shown that this impact on pension funds and life insurance companies depends on the nature of the promise, the composition of the portfolio and the duration mismatch between assets and liabilities. The nature of the promise of life insurers is generally a fixed promise or guarantee related to interest rates, much more so than in pension systems. Previous sections have also stressed that the main risk for the outlook is the extent to which pension funds and insurance companies may be engaging in a 'search for yield' in an attempt to back their promises, but at a cost of increasing the risk profile of their portfolio. The search for yield may lead insurers and pension funds to enter new business activities, which could take the form of non-bank financial intermediation. Non-bank financial intermediation takes place when non-banks, such as insurers and pension funds, provide financing to areas which have traditionally been financed by banks. This could include, for example, SME financing. Insurers and pension funds may also seek higher returns by investing more in alternative investments, such as foreign assets, longer-term investments, and emerging market assets. As the yield curve of fixed-income securities shifts down, insurers and pension funds may invest in longer-dated instruments to gain greater yield. Returns on equities and possible revenue generation from non-bank financial intermediation would also affect the extent to which the shift into equities may influence the profitability of insurers and pension funds.

The nature of a life insurance promise will change how the promise can be addressed

Life insurance products with a minimum interest rate guarantee promise an *ex ante* level of guarantee to the policyholder, and in some cases an additional share in profits. Such contracts in Germany, for example, can have a savings accumulation period of over 40 years, although about half of the contracts are cancelled before maturity (Schmeiser and Wagner, 2014). In the United States, some policies and guarantees can last for more than 50 years. The guarantees are part of embedded options, which may include choosing between a single payment on expiry or a series of payments. In German-speaking countries, life insurance contracts with minimum guarantees have a participation in the annual return of the insurer's asset portfolio with the minimum guarantee provided on a year-by-year basis, cliquet style,[13] for the whole duration of the contract. On the liability side of insurers' balance sheets, these are accompanied by a bonus account, where an investment surplus is set aside in years with good investment return to be used to cover the annual guarantee in years when the investment return is lower than the guarantee.

Also, they may take the form of a participating policy (Italy) or a universal life insurance product (United States), which have a saving component with a guaranteed return, premiums that could be offset with investment returns, the possibility of borrowing against the cash value, and usually include a death benefit. Interest to participating policies is credited to the policy periodically. When the projected guaranteed returns cannot be achieved, the insurer has the possibility of reducing the cash value of the savings component to offset this in a universal life product. For a universal product, premiums are paid periodically.

The minimum guarantee established for guaranteed saving products with guaranteed interest-rate returns or guaranteed minimum income (annuity) streams cannot be changed during the lifetime of the contract in most cases. The natural implication of this product feature is the simultaneous existence in the insurer's portfolio of products with different

minimum investment returns. The low interest rate environment renders the provision of explicit or implicit yield guarantees on long-term savings products more costly. In addition, products with minimum guarantees in the existing stock of liabilities will become increasingly expensive to fund, as assets that come due are reinvested at a lower rate of return (Holsboer, 2000).

The surrender option embedded in many life insurance contracts can be a major challenge for insurers that provide products featuring such an option as policyholders, in times of volatile financial markets, may opt for more attractive investments, and giving incentive to life insurers to offer higher guaranteed returns, with a consequent increase in their interest rate risk exposure (Albizzati and Geman, 1994). When interest rates begin to rise, there is also a risk that policyholders will surrender their contracts, to migrate to contracts with higher guarantees. Uncertain market conditions may also discourage policyholders from lapsing, as there may be disadvantages in losing a pre-existing contract. Early death of or early surrender by policyholders – in terms of surrender and mortality risk – are significant drivers of insurers' default risk (Gerstner et al., 2008). However, in reality, longevity risk has exceeded forecasts which may give some relief to life insurers, although not for annuity products.

Life insurance products are subject to low yield …

The impact of the low interest rate environment has been discussed in the context of life insurers in terms of how it may affect the balance sheet of life insurers (Bergin and Grundl, 2014) and how they may react when interest rates begin to rise (Bruning, 2014). Other relevant research in this area has addressed investment sensitivity to lower interest rates (Sharpe and Suarez, 2013) and risks relevant to the low interest rates (Turner, 2014; Cooke and Gavin, 2014; van den End and Hoeberichts, 2014). The impact on annuities has been mentioned above, but otherwise products most at risk are those that have a promise that the insurer bears the interest rate or market risk.

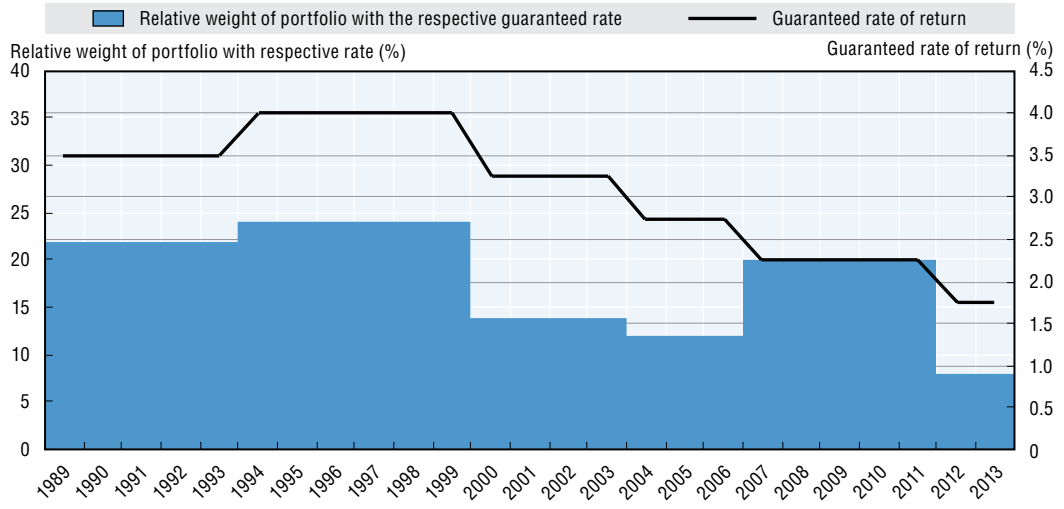
In terms of the relation between interest rate guarantees, solvency requirements, and asset allocation for life insurers, although the risk-free interest rate (i.e. government bonds) has approached the guaranteed interest rate, some insurers' are investing less in equity (Schmeiser and Wagner, 2012). This may explain why a number of countries tend to have a majority of bond holdings in their investment portfolio (Figure 4.7). The proportion of shares has decreased in all four countries, and has been substantial in the Netherlands and the United Kingdom. Some countries, such as the Netherlands and Germany, show a clear shift to other investments which includes any investments that do not fall in the other categories. The investment allocations of United States' life insurers remain similar to those levels in 2006 (Figure 4.9).

…and guarantees that may no longer be sustainable

In Germany, life insurers typically offer products with minimum investment return guarantees and minimum profit participation ratios. The average duration of life insurance contract in Germany is 28 years. Regulators decide on the maximum of the allowed minimum return according to the presently achievable interest rates. The minimum return set at contract inception cannot be changed during the lifetime of the contract. As a result, the estimated average weighted guaranteed return of life insurance contracts was 3.12% in 2013, and products with a guaranteed return of 4% account for approximately 24% of the

extant contracts (Figure 4.19). The Bundesbank estimates that if the current environment continues, 17% of life insurers by market share would not be able to fulfil their own funds' requirements by 2023 (Bundesbank, 2014).

Figure 4.19. **Proportion of the life insurance contracts with guaranteed returns in Germany**



Source: Based on estimates from Berdin and Gründl (2014).

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Low interest rates may be becoming a particular issue for life insurers in countries such as Germany, Italy, and the United States, where saving products with high guaranteed returns sold in the past represent a prominent share of the total portfolio of life insurers.[14]

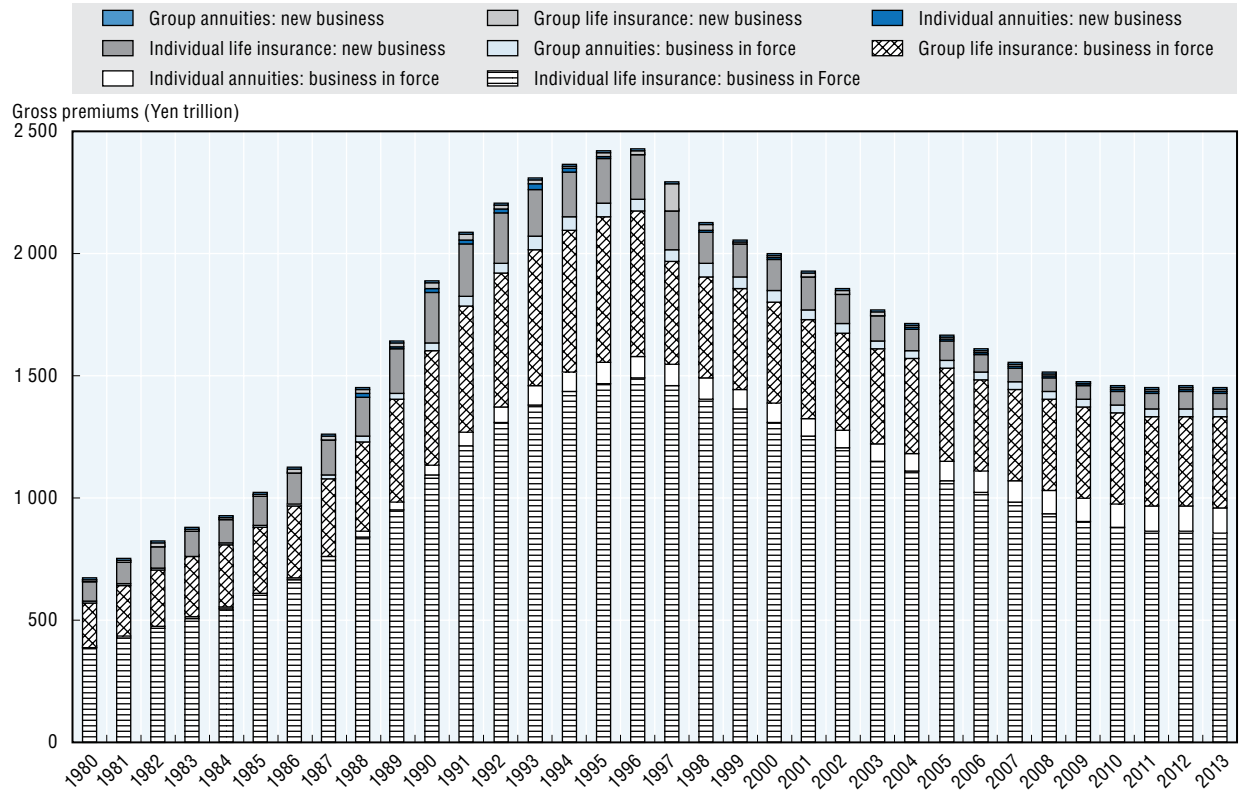
In the Netherlands, 60% of life insurers' portfolios are individual life contracts with guarantees and group life with guarantees, with the risk-free interest rate lower than the average level of guarantees since 2009. The average guaranteed rate is a little below 4% which is higher than many countries, with conditional profit-sharing (De Nederlandsche Bank, 2013).

To shed light on how legacy policies may be impacting life insurers it is useful to examine the proportion of policies which have a high guarantee promise. Using contract data for Japan and the United Kingdom (Figures 4.20 and 4.21), the amount of such contracts peaks in 1996 and 2007 respectively, and as for new business, the 1995-1996 period in Japan and 2007 in the United Kingdom witnessed the largest amount of new business. In Japan, contracts exchanged in the 1990s have a guaranteed interest rate of approximately 6%.

Further, as indicated earlier (Figure 4.19), the proportion of German life insurers' portfolio which has a relatively high guaranteed rate remains significant. For contracts issued between 1995 and 2000, the 4.00% guaranteed rate is applicable to 24% of the portfolio, a 3.50% guarantee to 22%, and a 3.25% guarantee on 14% of the portfolio. When looking at data on new business and business in force, the level of contracts for life insurance policies has remained remarkably the same (Figure 4.22) compared to the declining trend of Japan and the United Kingdom.

In France and the United Kingdom, similar guaranteed policies have been sold with interest rate guarantees between 0 and 1% (De Nederlandsche Bank, 2013).

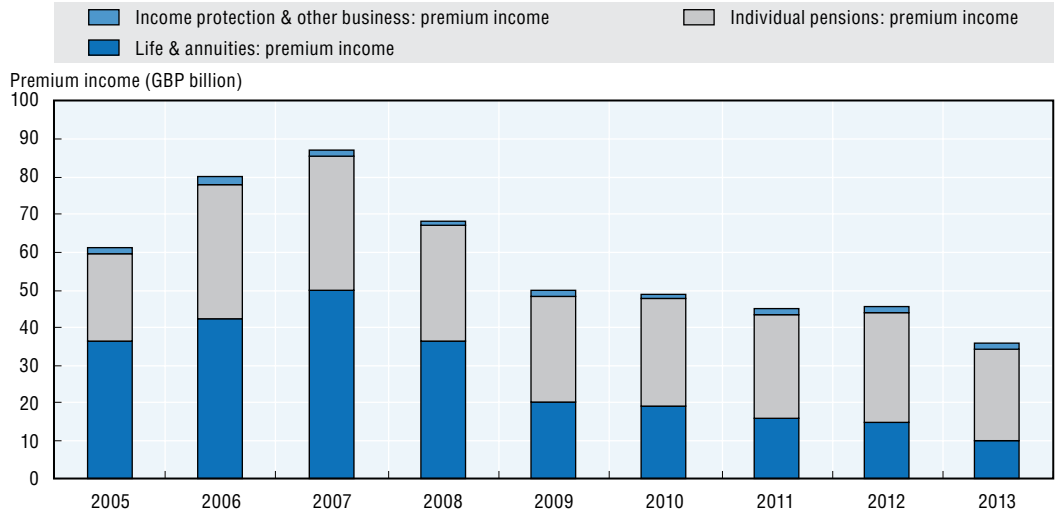
Figure 4.20. **Business in force and new business of the life insurance sector of Japan, 1980-2013**



Source: Japanese Life Insurance Association database.

StatLink http://dx.doi.org/10.1787/888933209751

Figure 4.21. **New business in life insurance, United Kingdom, 2005-2013**

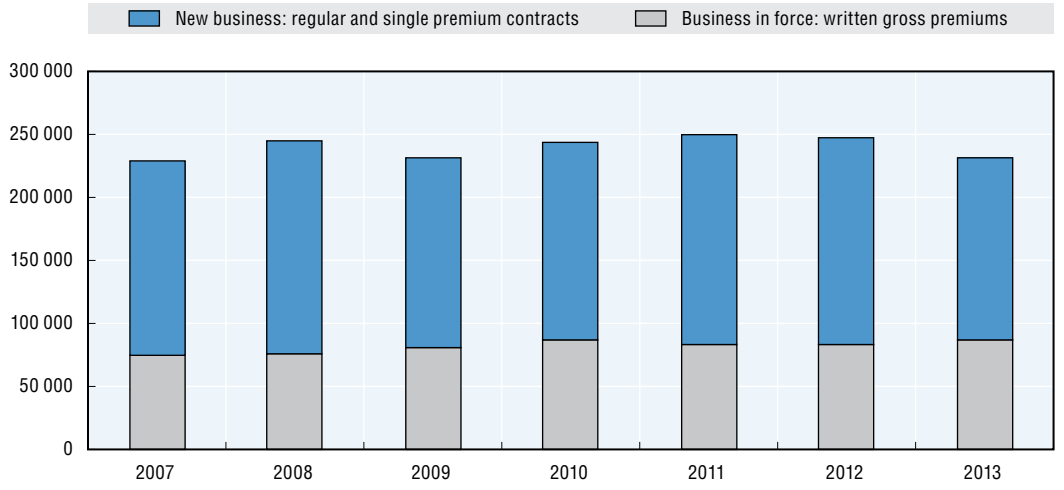


Source: Association of British Insurers, Annual long-term insurance for 2013: overview statistics.

StatLink http://dx.doi.org/10.1787/888933209760

There is some concern that, given the competitive pressures on insurers, life insurers may continue to offer high interest rate guarantees, from which the premium income gained could cover their fixed cost base. This may be at the detriment of capital buffers of life insurers, and increases their susceptibility to further falls in the short-term interest rate.

Figure 4.22. **Business in force and new business of the life insurance sector of Germany, 2007-2013**



Source: GDV, Statistical Yearbook of German Insurance, 2013 and 2012.

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The performance of life insurers remains relatively stable

The return on equity of life insurers as a measure of profitability, as well as the investment return of their portfolio, has not evolved in line with interest rates. Despite the real yield on long-term government bonds being lower than 2% for nearly a decade and despite the drop in 2008, the annual net investment return has not experienced a general downturn, and returns on equity appear to be more volatile but without a clear trend (Table 4.A1.2).

Japanese life insurers have been confronted with low interest rates

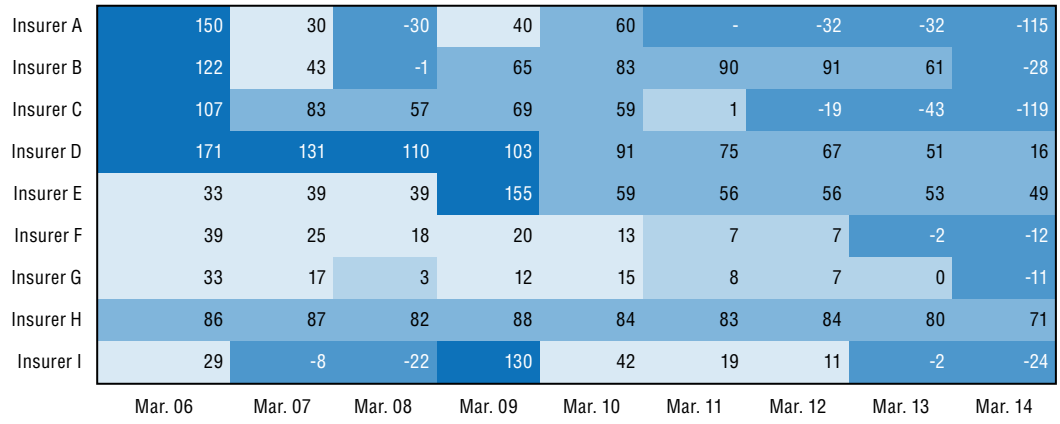
Japanese life insurance companies have been confronted with a situation of low domestic fixed income yields for some time now. Against the backdrop of guaranteed return promises to their policyholders, several small and also some mid-sized life insurers failed during the late 1990s and early 2000s as a result of declining interest rates and unfavourable equity and real estate price developments. Many surviving life insurance companies were able to rely on higher premium income from core business and cost-cutting to compensate for the effects of the so-called 'negative spread' on their overall profitability. Limits to further cost-cutting seem to have been reached at the beginning of this decade, however. As well, looking forward, premium income from new life insurance core business is unlikely to grow substantially given that the conditions for new policies effectively imply a form of cross-subsidisation from new to existing policyholders that benefit from more generous return guarantees.

A notable development during recent years has been that the 'negative spread' turned positive for many life insurance companies despite continuously low domestic bond yields (Figure 4.23). Japanese life insurance companies achieved higher yields on their portfolio

investments over recent years in part through their allocations to foreign securities, mainly bonds, as opposed for example to domestic bonds.[15] In fact, the share of foreign securities as part of the overall Japanese life insurance industry portfolio has varied over time and currently stands at close to 18%, which is fairly high by historical standards.[16] The change in that share from one year to another seems to be significantly determined by the yield differential between domestic bonds and those on foreign securities. Looking ahead, the current fairly substantial exposure of the life insurance sector to foreign securities raises the question of how vulnerable the recent investment return improvements are to sudden and rapid foreign exchange deteriorations, although it is likely that hedging strategies are being taken.

Figure 4.23. **"Negative spread" for selected Japanese life insurance companies, 2006-2014**

in JPY billion, each row representing a different company



Note: Numbers indicate the absolute amount of actual (negative) investment yield in JPY billion of the respective in given year (each row corresponds to one company; companies ordered starting from top row by size in terms of total assets). Positive numbers indicate a «negative spread», with guaranteed returns to policyholders exceeding actual portfolio return investments.
Colour-shading added for convenience.

indicates a positive spread;
indicates a negative spread between 0 and 10 billion yen;
indicates a negative spread between 11 and 50 billion yen
indicates a negative spread between 51 and 100 billion yen.
indicates a negative spread over 101 billion yen

Source: OECD Secretariat estimates based on selected life insurance company annual reports (data reported by Asahi Life, Dai-ichi Life, Daido Life, Fukuoka Life, Meiji Yasuda Life, Mitsui Life, Nippon Life, Sumitomo Life and Taiyo Life).

StatLink http://dx.doi.org/10.1787/888933209787

Another consideration is how Japanese insurers have been able to remain relatively profitable despite the low interest rate environment and high guarantees. As Japanese life insurers provide the breakdown of their profits, and while the negative spread is taken into account, the manner in which mortality risk is accounted for appears to be offsetting any investment return losses (Figure 4.24). Mortality profit is the difference between the actual amount of insurance claims and benefit payments on the one hand and the expected amount of insurance claims and benefit payments calculated using the occurrence rates of insurance events estimated at the time the premium was fixed on the other. It appears that the estimated level of claims on mortality were not realised, allowing the overall profit margin to remain positive. This was confirmed during discussions with the Japanese life insurers (see Box 4.4).

Box 4.4. **OECD Roundtable discussion on the impact of the low interest rate environment on life insurers (December 2014)**

The OECD's Insurance and Private Pensions Committee held a Roundtable with private sector participants on the impact of the low interest rate environment on insurers in December 2014. This box highlights the input provided from the private sector participants during the discussions that took place in the Roundtable. The input is mainly anecdotal, while highlighting the approaches that life insurers have been taking to adapt to this environment.

Given the ongoing low interest rate environment, in terms of profitability and capitalisation, life insurers have fared remarkably well. Life insurers have indicated that although the return on assets has decreased due to the low interest rates, capital gains from equity and bonds have supported profitability to some extent. In the United States, fixed-income investment, in particular in United States' corporate bonds, has allowed United States' life insurers to better cope with the low interest rates. French insurers have also increased their holdings of corporate bonds or reinvested in loans to SMEs. Some insurers have shifted their investment to relatively profitable securitised loans to SMEs and leveraged funds. Also insurance-linked securities, such as catastrophe and earthquake bonds, are being purchased by life insurers, as their returns are decoupled from the macroeconomic environment. In France, guaranteed rates were 3-4% in the 1990s, with the rates slowly decreasing over the years to 0-1% guaranteed rates in recent years.

Some insurers have taken measures to lengthen the duration of their investment (8-9 years), in particular by investing in infrastructure, although regulatory restrictions will limit their exposure to such asset classes in Solvency II. Lengthening duration also limits the reinvestment risks going forward, although it would increase the risk of an interest rate increase. Japanese life insurers have extended the average asset duration to 10.9 years for domestic public and corporate bonds.

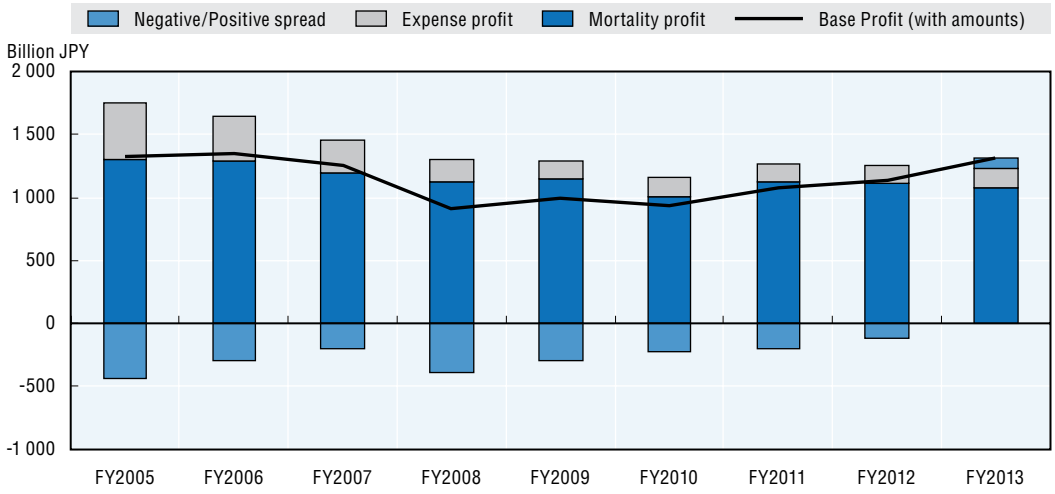
Life insurers have remarked upon the intentional shift of policies from guaranteed saving products to protection policies which do not entail interest rate risks. For French insurers, where a significant proportion of the guaranteed saving products were group contracts, some of these contracts have been renegotiated via trade unions to non-guaranteed contracts in exchange for greater profit sharing. In Japan, the single endowment saving policy is being retired, and the stable mortality profit base has assisted life insurers to remain profitable.

There were a number of life insurer insolvencies around the year 2000 in Japan. Eight insurers failed between 1997 and 2008. The insurer resolution system of Japan, while guaranteeing 90% of existing policyholder's interest at the time of the insolvency, adjusts future interest rates to the market rate. This has excused life insurers taking over insolvent insurers from having to take over contracts which are subject to the negative spread (see below for discussion on the negative spread).

However, the risks posed by life insurance saving contracts may continue to pressure the business of some life insurers regardless of the interest rate situation. Aviva France took over another insurer in 2002 which had contracts that policyholders could allocate their moneys in different investment funds offered by the insurer. Prices of the funds were published every Friday, with policyholders able to switch funds at those prices any time before the next price was published. This enabled customers to arbitrage the market, already knowing the movement of the market in the next week. In France, there are a number of ongoing litigations on the validity of these contracts, although the courts have been recognising policyholders' claims so far. If so, with the liability growing at 68% a year, for a contract that was exchanged in 1997, Aviva France may potentially be facing a €9.3 million pay-out in 2015, with the pay-out potentially growing to €234 billion by 2030. Further, as the contract is still valid, policyholders are able to add fresh capital to the savings component.

Source: OECD roundtable discussions with life insurers (4 December 2014). FTAlphaville, "Meet the man who could own Aviva France" (27 February 2015).

Figure 4.24. **Contributions to annual base profit at selected Japanese life insurers**



Note: Contribution of different types of business lines/activities to annual base profits in percentages at selected Japanese life insurance companies (average of data reported by of Daiichi, Meiji-Yasuda, Sumitomo and Mitsui Life). Japanese fiscal year starts in April and ends in 31 March the following year; e.g. FY2013 ends in March 2014.

- Base profits (indicated by continuous line) consist of mortality profit, expense profit and negative (positive) spread.
- 'Mortality profit' (dark blue-shaded) is the difference between the actual amount of insurance claims and benefit payments on the one hand and the expected amount of insurance claims and benefit payments calculated using the occurrence rates of insurance events estimated at the time the premium was fixed on the other.
- 'Expense profit' (grey-shaded) is the difference between the actual amount of business expenses and the expected business expenses calculated using the business expense rates estimated at the time the premium was fixed.
- 'Negative/positive spread' (light blue-shaded) is the spread between investment returns and yields guaranteed to policyholders at the time the premium was fixed.

Source: OECD estimates based on annual company reports.

StatLink http://dx.doi.org/10.1787/888933209799

Japan's life insurance market was dominated by long-term insurance products with high guaranteed returns, which led to negative spreads in the mid-1990s, whereby the guaranteed rate is higher than the investment return. The supervisor introduced the Standard Reserve Valuation System in 1996, which requires insurers to accumulate the minimum policy reserve using an interest rate prescribed by the supervisory authority which is based on 10 year Japanese government bonds yield. For new contracts with guarantees that are relatively higher than the prescribed interest rate, insurers are required to have additional reserves.

Valuation standards of life insurers are coming into play

EU countries will be transitioning to the Solvency II regime for implementation in January 2016, and countries such as Mexico, Switzerland and the United States have already transitioned to a risk-based capital regime. This is a period of major regulatory reforms in many countries, with life insurers more likely to be conservative in their asset and liability management to ensure compliance with the new requirements.

Solvency modernisation initiatives will have a large impact on how assets and liabilities are assessed, and this is apparent from countries that are in the transition phase. When countries adopt a risk-based capital regime, valuations for assets and liabilities shift, for the most part, to market-based values. For example, Switzerland's Swiss Solvency Test requires assets and liabilities to be market consistent, with strict requirements for valuation when an asset does not have observable prices. The United States' approach assumes that fixed-income assets will be held at amortised cost for a ten-year holding

period at a 95% confidence level. Such market consistent valuation limits the scope for insurers to invest in assets that cannot be mark-to-market, and may have the effect of discouraging investments in certain asset classes.

As accounting standards and regulatory capital standards shift to market-consistent value for liabilities, the low interest rate environment will have the potential to raise the level of liabilities and the need to increase regulatory capital. Solvency II does introduce volatility adjustments to address such interest rate risks, but this is primarily for the purpose of short-term fluctuations and not necessarily for long periods of low interest rates.

EU directives require that interest rate guarantees do not exceed 60% of the rate of return on government debt. In terms of regulatory actions taken to alleviate some of the issues caused by the low interest rate, the Swiss financial supervisor (FINMA), for instance, decided in 2012 to allow such alleviation for the valuation of liabilities for periods of low interest rates for the years 2013 to 2015. This permits an adjusted solvency capital requirement with an increased interest rate used for discounting of liabilities of in force business, which 2/3 of the Swiss life insurers have used. Germany has been requiring an additional premium reserve for life insurers to establish an additional buffer since 2011. In January 2015, the Life Insurance Reform Act was implemented in Germany which limits the sharing of valuation reserves with policyholders upon the expiry of their contract to only when the life insurers have sufficient reserves to meet interest rate guarantees. A new maximum interest rate is being applied as well from January 2015, reducing from 1.75% to 1.25%. In Japan, life insurers are required to accumulate additional policy reserves that correspond to the estimated future effect of negative spreads.

Conclusions

This chapter has discussed the challenges that an environment of prolonged low interest rates poses to life insurance companies and pension systems, in particular defined benefit pension funds. The financial crisis and ensuing environment of low growth and falling inflation have led to an environment of protracted low interest rates, amplified further by quantitative easing in several major economies that has spurred interest rate declines, with yields turning negative in a number of countries. This environment of low interest rates, which is expected to prevail for the foreseeable future, poses serious problems of adequacy of retirement income given current contributions and contribution periods to defined contribution pension arrangements.

It also poses serious problems to the solvency – the degree to which current liabilities are backed up by current assets – of defined benefit pension funds and life insurers.

The outlook for pension funds and insurance companies depends foremost on the nature of the promise made and the potential for its adjustment or reversibility. The adverse effect of low interest rates is higher where the liabilities of these institutions consist of a fixed investment return or fixed benefit or pay-out promises such as constant, annuity-type payments.

The outlook is troubling for pension funds and life insurance companies as their solvency positions will deteriorate unless they have actively adopted risk management strategies. Some countries are already adjusting their regulatory frameworks on an exceptional basis (or otherwise maintaining measures adopted during the financial crisis to relax regulation while increasing monitoring) given problems being experienced by these institutions.

The impact on the solvency position of pension funds and life insurance companies of a prolonged period of low interest rates also depends on the composition of their portfolio, in particular the proportion invested in long-term government bonds, and on the duration mismatch between assets and liabilities, which may bring in problems with re-investment risk, unless these institutions have developed risk management strategies such as ALM. However, the lack of good quality, very long-term financial assets in sufficient quantities poses serious problems to these risk management strategies.

Several options and instruments exist to address the risks posed by an environment of protracted low interest rates. Insurers and pension funds could increase the duration of their assets in order to reduce the duration gap between their assets and liabilities. Insurers could alter the contractual terms of new policies, for example by lowering the guaranteed rates, thereby progressively reducing liabilities, while pension plan sponsors could terminate existing plans and offer less attractive terms to new employees. DB pension plan sponsors, and plan members where relevant, could increase contributions to pension funds. Insurers and pension funds could also consider renegotiating or adjusting existing promises where this is feasible. Finally, proactive regulatory initiatives could be implemented. For example, policymakers should avoid putting excessive pressure on institutions to quickly correct solvency and funding deficits at a time of market weakness (regulatory forbearance).

Finally, the main concern for the outlook is the extent to which pension funds and insurance companies have, or might become, involved in an excessive 'search for yield' in an attempt to match the level of returns promised to beneficiaries or policyholders when financial markets were delivering higher returns, which might heighten insolvency risks. The regulatory framework and policy makers have an important role to play in this regard and need to remain vigilant to prevent excessive 'search for yield', especially on pension funds as life insurance companies make be deterred by higher capital reserves required by solvency regulations when increasing the risks profile of their portfolios.

Notes

1. Previous OECD work on this subject (Antolin et al., 2011) highlighted some of these factors.
2. Large volumes may lead to higher counter party risk.
3. Correlation is not necessarily causation.
4. Both figures report information on the major OECD countries in terms of pension funds' and life insurers' assets, respectively.
5. Office of National Statistics (ONS) data show that the rise of derivatives used by pension funds has been quite substantial in the last decade.
6. Pension systems involve defined benefit, DB, and defined contribution, DC, pension plans. In DB pension plans pension funds manage both the accumulation or saving phase, and the decumulation or pay-out phase. In DC pension plans, pension funds only manage the saving or accumulation phase, and the individual is left with an amount of assets accumulated when retiring that they need to allocate to finance retirement. They can buy a life annuity and shift the investment and longevity risk to the annuity providers, generally an insurance company. Therefore, when talking about the impact of interest rates on pension systems, the chapter looks at both.
7. Going instead for a phased withdrawal may not be much better because the individual retains the risk of outliving his/her resources (i.e. longevity risk), the investment risk, and is also exposed to the impact of low interest rates through the investment risk. The *OECD Roadmap for the Good Design of DC Pension Plans* argues that partial annuitisation of the assets accumulated at retirement is essential to have protection from longevity risk, *www.oecd.org/pensions/designingfundedpensionplans.htm*.

8. The analysis focuses on a few selected OECD countries, those with large amounts of assets in pension funds (in dollar terms and as a percentage of GDP) and with a large share of DB pension plans. See Figures 3, 4 and 7 in *OECD Pension Markets in Focus 2014*, *www.oecd.org/pensions/pensionmarketsinfocus.htm*.
9. However, competition pressures may push insurance companies to offer annuity prices that have been calculated using discount rates higher than the risk-free interest rate. This practice will increase their risk exposures and how they manage the risk that returns on their investments turn out to be lower than the interest rate promised or guaranteed in their pricing of annuity products.
10. Adjustment by age would be necessary to have a more accurate picture.
11. Annuity providers, insurance companies, are regulated differently. Solvency frameworks require them to keep certain levels of capital to make sure that they can fulfil the promises contracted, weighted by the level of risk.
12. See *www.oecd.org/pensions/mortality-assumptions-and-longevity-risk-9789264222748-en.htm*. OECD (2014).
13. Cliquet style means that the guaranteed return must be credited to the policyholder's account each year.
14. According to Swiss Re (2012), based on their product characteristics, Germany, Italy and the United States have the highest exposure to interest rate risk among major insurance markets around the world.
15. Investment yields realised by Japanese life insurance companies on domestic stocks have been fairly volatile; they have exceeded those on foreign (and domestic) bonds during fiscal year 2013, but were inferior to those on foreign bonds during the five preceding fiscal years (see *The Life Insurance Association of Japan*, 2014).
16. The proportion of the industry portfolio allocated to foreign securities was only 0.1% in 1975 and never exceeded 2.5% in any year during the 1970s. The ratio increased thereafter, reaching its historical peak of more than 19% in 2004. The proportion of the industry portfolio allocated to foreign securities seems to be a positive function of the difference between the yields on foreign securities (taking into account foreign-exchange effects) and domestic bonds. For example, a simple regression (using time series data from 1977 to 2013 available from the *The Life Insurance Association of Japan*, 2014) of that proportion (or, alternatively, the change in it) on a first-order autoregressive term plus the annual foreign-domestic return yield spread (which takes into account the effect of exchange rate variation) suggests that the spread is positively significant at the 5% level and that its addition to the regression greatly enhances the explanatory power of the regression.

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ANNEX 4.A1

Statistical tables and supplementary data

Table 4.A1.1. **Pension funds' real average net annual rate of investment returns in selected OECD countries**

	In per cent										
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Australia	-2.02	8.61	10.08	8.88	12.93	-11.49	-10.21	5.63	5.22	0.63	10.25
Austria	5.75	3.58	8.97	3.79	-1.77	-14.45	7.29	3.67	-5.98	5.47	2.94
Belgium	5.99	5.99	10.31	10.34	7.70	-22.27	13.43	4.43	-4.62	9.26	5.80
Canada	11.28	9.01	10.70	10.76	0.99	-16.89	10.29	7.58	1.82	7.88	9.76
Chile	10.13	8.13	4.98	14.38	4.40	-24.07	23.48	8.29	-5.98	5.07	3.55
Czech Republic	2.16	0.74	2.73	1.26	-2.11	-1.51	-0.62	0.69	0.53	0.21	0.19
Denmark	6.30	11.51	14.76	1.34	-3.28	5.08	1.22	7.12	12.13	5.40	-4.57
Estonia	2.88	3.66	7.24	2.18	-5.36	-32.43	14.85	2.13	-8.00	5.24	0.90
Finland (1)	-	-	-	-	-	-	-	-	-	5.23	5.96
Germany	3.42	2.66	3.61	3.34	1.08	0.52	4.02	3.76	1.07	2.73	2.81
Greece	-	-	-	-	-	2.34	0.27	-7.85	-5.57	5.01	7.37
Hungary (2)	-2.57	9.49	7.57	1.18	-3.88	-21.66	12.80	4.17	-	7.85	7.00
Iceland	10.35	9.56	11.84	8.75	0.36	-23.14	0.94	1.32	2.33	7.08	4.85
Ireland	-	-	-	-	-7.35	-35.74	-	-	-	-	-
Israel (3)	-	-	7.14	5.70	3.51	-16.29	20.09	6.95	-4.29	7.84	8.41
Italy	2.54	3.72	6.09	2.08	0.28	-5.33	5.34	1.21	-2.78	4.02	3.85
Japan	11.12	-7.46	9.15	-7.63	-4.09	-13.44	12.79	-5.09	-3.66	7.25	8.92
Korea	1.79	1.23	0.59	5.97	0.56	-2.71	-2.22	2.06	0.02	3.31	2.63
Luxembourg	-	-	-	4.89	-2.48	-11.35	6.51	0.68	-2.26	6.00	1.73
Mexico (4)	-	-	4.85	5.57	-0.13	-7.79	7.52	6.55	1.16	9.69	-1.45
Netherlands	8.74	8.45	10.92	6.77	0.57	-17.29	11.52	8.85	4.31	9.47	1.61
New Zealand	-3.86	8.65	4.31	8.78	5.02	-5.48	-9.50	10.54	3.09	1.61	9.52
Norway	11.45	7.45	9.22	7.36	3.14	-10.58	9.75	5.53	-0.12	6.06	7.91
Poland (5)	8.77	8.56	12.93	13.36	1.50	-17.33	8.93	7.16	-9.09	1.64	2.67
Portugal	7.31	6.62	7.06	7.12	5.50	-13.20	11.59	-2.98	-7.26	5.80	4.92
Slovak Republic	-	-	-	-	-0.11	-8.93	0.96	-0.01	-3.77	0.42	1.07
Slovenia	-	-	-	-	-1.01	-5.37	4.21	1.79	-1.79	4.51	2.47
Spain	-	-	-	-	-	-9.91	6.87	-2.22	-2.27	3.65	7.90
Sweden	-	-	-	-	-	-	-	-	-0.97	7.86	6.65
Switzerland	4.91	2.77	9.18	5.30	0.24	-13.81	9.88	2.78	0.62	7.53	5.89
Turkey (4)	-	-	22.08	1.44	13.24	0.94	17.58	1.89	-	9.61	-
United States (6)	13.24	2.52	1.63	5.76	-1.88	-26.07	10.25	6.26	-3.80	4.78	11.73

Note: Data have been calculated using a common formula for the average nominal net investment return (ratio between the net investment income at the end of the year and the average level of assets during the year).

Average real net investment returns have been calculated using the nominal investment rates of return (using the formula described above; for more information about this formula, see the *OECD Pension Markets in Focus 2014*) and the variation of the end-of-period consumer price index between 2012 and 2013 for all countries, except for Austria (2011,2012), Israel (all years), for which values have been provided by the countries.

The 2012-Q2 and 2013-Q2 consumer price index per year have been used for Australia, while 2012-Q1 and 2013-Q1 index have been used for New Zealand.

1. There is a break in series in 2011 is due to the exclusion of public buffer funds which were included before.
2. The break in series in 2011 corresponds to the pension reform leading to a decrease in the assets of mandatory pension funds in 2011.
3. Data refer to new pension funds only.
4. Data refer to personal pension plans only.
5. The financial result (i.e. the sum of result on investment and the realized and unrealized profits/losses on investment/valuation of investment and the income from the coverage of the deficit) is used as a proxy for net investment income. Since 2007, the financial result of occupational pension plans has been included (1% of pension funds total assets).
6. The revaluation of assets is taken as a proxy for net investment income. Only equity and mutual fund holdings have revaluations for the state and local and federal plans while the private plans revaluations also include gains on real estate and unallocated insurance contracts. There is no correction in the data for interest or dividend income, or capital gains on bonds or other securities.

Source: OECD Global Pension Statistics and other national sources.

StatLink http://dx.doi.org/10.1787/888933210432

Table 4.A1.2. **Average real net investment return of life insurers in selected OECD countries**

	In per cent				
	2009	2010	2011	2012	2013
Australia	4.87	3.28	-2.59	12.20	13.00
Belgium	4.08	-5.15	-6.47	2.33	3.57
Canada	5.34	-2.30	1.37	-	-
Chile	7.00	6.71	3.33	5.43	4.76
Czech Republic	0.40	4.78	0.16	-0.61	-0.04
Estonia	8.73	-1.59	-2.56	1.19	0.52
Finland	10.31	-	-	-	-
Germany	4.42	-1.24	1.49	3.00	4.02
Hungary	0.43	3.88	5.89	1.68	5.55
Iceland	8.18	6.87	3.46	-3.98	1.53
Ireland	7.55	-0.23	-	5.28	-1.44
Israel	-	-	-	-	-0.22
Italy	3.62	0.91	-2.07	3.23	3.26
Japan	3.52	2.12	1.41	3.29	0.77
Korea	2.22	-2.90	0.65	2.79	2.97
Luxembourg	2.84	1.64	0.01	-2.23	1.93
Netherlands	7.11	-	-	5.81	4.65
Norway	3.71	3.92	-	4.44	3.23
Poland	2.94	4.55	0.50	3.98	4.49
Portugal	2.90	0.35	-1.63	1.04	2.30
Spain	-	-	1.45	2.19	3.96
Switzerland	2.61	2.53	4.07	3.96	3.09
Turkey	-1.13	-1.98	-4.46	0.25	-0.68

Note: Average real net investment return calculations are based on nominal net investment return reported by countries and CPI figures.
1. The rates of return are nominal.

Source: OECD Global Insurance Statistics.

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