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Facing the interest rate challenge

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Executive summary

Interest rates have been falling for the last three decades and are now very low, putting stress on the insurance industry.

Over the last 20 to 30 years, interest rates have been trending downwards in many markets. 10-year government bond yields in the US, the UK, and Germany have fallen below 2%, and Japanese 10-year yields have been below 2% for more than a decade. While the current low levels of interest rates help over-indebted borrowers deleverage their balance sheets, not everyone benefits from low interest rates. Insurers – and life insurers in particular – are institutional savers that suffer from low investment yields. It is estimated that about USD 25 000 billion in funds (or some 12% of global financial assets) are managed and invested by the global insurance industry. Thus, a reduction of one percentage point in interest rates results in lost investment income of about USD 250 billion per year or about 6% of global premium income.

Low interest rates affect insurers only slowly.

The negative effects of low interest rates on insurers appear slowly because only current premium income, a fraction of total investments, is invested at market yields. This delayed impact on the investment portfolio gives insurers time to react but can also tempt them to wait, hoping for a reversal in interest rates and delaying required actions.

The outlook for interest rates is uncertain and insurers should be prepared to cope with various interest rate scenarios.

A look at the history of interest rates reveals that many interest rate scenarios are possible. These range from decade-long low interest rates, to a mean-reversion situation where interest rates fluctuate around their long-term averages and a sudden spiking of interest rates, driven by inflation. While insurers can usually cope very well with stable and mean-reverting interest rates, changes from one regime to another are a challenge.

Vulnerability depends on the importance of investment income and the ability to hedge interest rate risks. Life savings products are more sensitive to interest rates than life risk and non-life products.

While interest rates affect all insurers, not all lines of business are affected to the same degree. Short-term business can usually be re-priced on an annual basis, thereby making its sensitivity to interest rate fluctuations marginal. By contrast, interest rates have a huge impact on long-term lines of business where investment income is a major source of earnings. However, even the interest rate risk inherent in long-tail lines of non-life insurance (such as casualty) can be dealt with by prudent management of assets and liabilities, although long-tail business remains vulnerable to unexpected increases in claims inflation, which is often related to interest rate increases. Savings products are the most exposed to interest rate risks because investment income is a key source of profit and policyholder behaviour can foil insurers' hedging strategies that rely on reasonably accurate predictions of future cash flows.

Life insurance savings products that offer policyholders long-term guarantees, high flexibility, and high liquidity are the most problematic.

Even within the life insurance savings business, there are huge differences in interest rate sensitivity. An international comparison of savings products reveals that sensitivity is highest where guarantees are rigid and the duration of the business is high. In addition, certain policyholder options exacerbate insurers' sensitivity to interest rates, including the possibility of withdrawing money without penalty, increasing payments or sums insured at original terms, or extending the term of policies.

For life risk and non-life business, re-pricing products can help restore profitability.

How can insurers manage their profitability in today's low interest rate environment? Non-life insurers can periodically attempt to re-price their products as policies are renewed or replaced, thereby allowing them to restore profitability. For life insurers' in-force business, solutions are limited because policy terms cannot be changed, although they can optimise their asset management and hedging as well as streamline their operational costs. They can also offer to exchange existing policies for new products with similar benefits while being easier to hedge.

Product design will play an important role in the future.

While the road ahead is less thorny for non-life business, life insurers will need to envisage strategies that go beyond re-pricing policies and adjusting guarantee levels. New life insurance products should be designed in a way that interest rate risks can be effectively hedged. Regulators can help in facilitating this. Moreover, the life industry will need to address a fundamental question: how do the economic costs of guarantees offered compare with policyholders' willingness to pay for them? In a world in which the economic valuation of insurers' balance sheets is gaining in importance, pricing also needs to be market-consistent. This implies that guarantees that are difficult to hedge, yet create little value for customers at the point of sale, must be eliminated. The current low interest rate environment provides the opportunity to address these issues and create a win-win situation for both insurers and policyholders, ensuring that all parties are better prepared for any interest rate scenario in the future.

The history of interest rates since 1900

Nominal long-term government bond yields have been trending downwards for the last 30 years.

Real interest rates have also been trending downwards and have recently been negative.

There are differing views about what is pushing down real interest rates.

Increasing risk aversion may have recently caused further declines in real interest rates.

Interest rates are not low everywhere, because higher credit risk pushes up yields.

Nominal interest rates have been generally trending downwards over the last three decades. In the early 1980s, yields on 10-year government bonds peaked at around 15% in the US and about 11% in Germany, driven by oil price shocks and a loose monetary policy that led to a sharp increase in inflation.¹ It took years of very high central bank interest rates and a severe recession to bring inflation under control, finally leading to a sustained decline in inflation expectations and lower long-term government bond yields. Much of the decline in nominal bond yields over the last three decades can therefore be attributed to the sustained decline in inflation and a vigilant monetary policy.

However, real interest rates (nominal interest rates minus inflation expectations) have also trended downward in the last few decades (see Box: “What are interest rates?”). Real 10-year government bond yields in the US and the UK are estimated to have declined from levels of around 4% in the late 1980s and 1990s to close to zero recently (see Figure 1).

There is no consensus as to what have been the drivers behind the decline in real interest rates. The most frequently mentioned reasons include:

- *a savings glut*, in which an excess of savings (particularly from emerging economies) has faced a lack of global investment opportunities, leading to a decline in real interest rates. According to this line of argument, the decline in the real interest rate is seen as being a natural consequence of shifts in supply and demand that keep the market for funds in equilibrium.
- *a loose monetary policy*, in which very low central bank interest rates have prevented market interest rates from rising across the yield curve. In 2010 and 2011, for example, both the US Federal Reserve and the Bank of England tried to lower long-term government bond yields by purchasing bonds directly from private market participants. According to this view, the low real interest rates observed in financial markets are seen as being a deviation from the equilibrium or natural real interest rate.

In 2011 and the first half of 2012, increasing risk aversion as a consequence of the sovereign debt crisis may have exacerbated the decline in nominal and real interest rates of bonds issued by “safe-haven” governments, such as the US or Germany.

Of course, interest rates have not been low everywhere. For example, in the first half of 2012, Spanish 10-year government bond yields were between 5% and 7%, and Portuguese yields were between 10% and 15%. An increase in perceived credit risk elevated these rates.

¹ The term “interest rate” refers to a regular charge that a borrower pays to a lender (such as a coupon on a bond or a regular mortgage interest payment), whereas the term “yield” refers more broadly to the return on a bond investment. The yield may differ from the interest rate or coupon on a bond because the price of the bond may deviate from its face value. Nevertheless, interest rates offered on debt securities tend to be close to actual market yields.

An interest rate is the market price that keeps savings and investments in a state of equilibrium.

What are interest rates?

Lenders want to be compensated for the risks associated with lending and for deferring the use of their funds to the future. At the same time, borrowers agree to pay interest based on the expected return of their business ventures. As such, an interest rate is the market price that keeps savings and investments in a state of equilibrium. If the supply of funds exceeds demand, interest rates go down, and vice versa. There are many kinds of interest rates:

- *Nominal and real interest rates:* Investors demand a higher interest rate in an environment of high inflation expectations than in one where inflation is moderate. This is because investors seek to compensate for the loss in purchasing power of the nominal amount of money they lend out. Nominal interest rates are thus composed of a real interest rate and inflation expectations. Interest rates observed in the market are usually nominal interest rates. In some countries, there is a market for inflation-protected bonds from which real interest rates can be derived.
- *Short- and long-term interest rates:* Interest rates differ according to maturity periods. The difference between long-term and short-term interest rates is influenced by investors' expectations of the future course of short-term interest rates over the lifetime of a long-term bond. If market participants expect short-term interest rates to increase, long-term rates tend to be higher than short-term rates and vice versa. On top of expectations about short-term interest rates, long-term interest rates also contain a term premium, which is the excess yield that investors require in exchange for committing to hold a long-term bond instead of a series of shorter-term bonds.²
- *Risk-free interest rates and credit-risk-containing interest rates:* The credit quality of the borrower determines the size of the credit risk premium (or credit spread) a lender requires as compensation for the risk of not being paid back in full. Generally, governments are considered low credit risk borrowers because they can levy taxes or print money to repay a loan.³
- *Central bank and market interest rates:* Central banks can directly control the policy rate, which is the interest rate that commercial banks have to pay to access central bank money. Policy rates are usually very short-term in nature. By varying policy rates, central banks can influence banks' financing costs, thereby influencing their lending activities and the associated market interest rates. For example, central banks raise policy interest rates if they fear economic overheating. To offset higher financing costs, banks raise lending (or market) rates which, in turn, dampens credit expansion and economic activity. In a recession, policy rates are lowered to foster lending and stimulate economic demand.⁴

² A term premium is positive if financial market participants demand extra yield to hold a long-term bond instead of a series of short-term investments. However, a term premium can also be negative, for example, if institutional investors (such as pension funds) prefer to lock in a fixed rate of return over a long period of time. In such cases, investors may accept a lower yield to avoid the risks associated with rolling over short-term investments.

³ Obviously, there are limits to governments' ability and willingness to levy taxes or print money.

⁴ Not everywhere does monetary policy operate via setting short-term policy rates. In China, for example, the central bank controls monetary policy by setting deposit and loan rates directly, thus controlling lending activity more tightly.

The history of interest rates since 1900

Looking further back, the current low levels of nominal and real interest rates are not exceptional.

The adherence to the gold standard kept inflation and bond yields in check.

Moderate or negative inflation during the inter-war period resulted in fairly elevated real yields but the two world wars were associated with surging inflation and resulted in deeply negative real interest rates.

Both inflation and nominal interest rates began increasing in the mid-1960s.

A further look back at the history of interest rates reveals that the current low levels of nominal and real interest rates are not as exceptional as they might seem when compared to the past three decades. Figure 1 shows the development of nominal and real 10-year government bond yields for the US and the UK since 1900.⁵

The beginning of the 20th century was characterised by an uptrend in nominal bond yields, peaking at around 5.5% in 1920. Thereafter, bond yields declined gradually to reach their trough at 2% in 1946. Up until 1933 – and with the exception of the World War I period – the gold standard provided a monetary anchor, preventing inflation and therefore keeping inflation expectations and long-term bond yields in check.

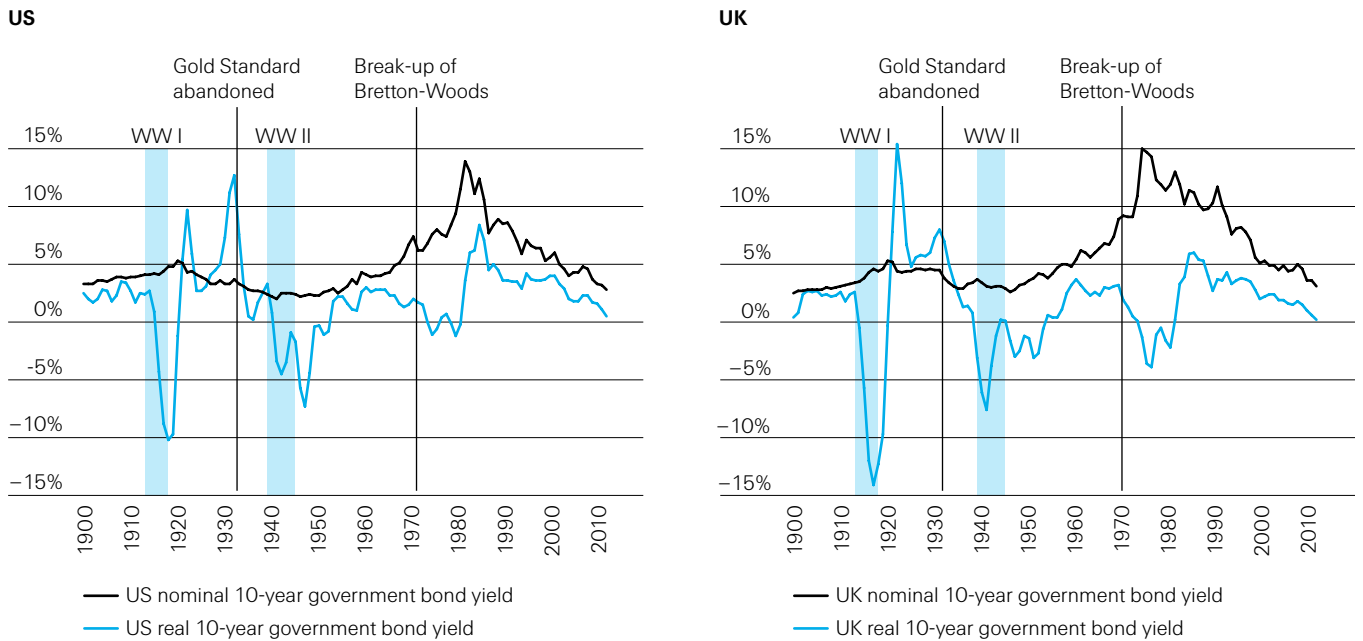
In the deflationary environment of the 1920s and early 1930s, real interest rates were in fact quite high despite moderate nominal bond yields. Even after the gold standard was abandoned in 1933, inflation remained moderate and kept real yields relatively high until the onset of World War II. Inflation surged during the two world wars, but bond yields did not skyrocket. Debt financing by central banks and the private financing of government debt on patriotic grounds succeeded in keeping bond yields low.⁶ As a result, real interest rates turned sharply negative.

The 1950s and early 1960s brought low nominal bond yields and moderate rates of inflation, resulting in moderate real interest rates similar to the levels observed today. Inflation only began accelerating again in the 1960s when fiscal spending in the US increased to finance the Vietnam War. At the same time, the general belief among economists that higher inflation would facilitate employment led to overly expansionary monetary policies. In 1973, the policy culminated in the break-up of the Bretton Woods fixed exchange rate system that had prevailed since 1944. Inflation soared, exacerbated by two oil price shocks in the 1970s. Nominal interest rates soared as of the mid-1960s and continued to surge until 1974 in the UK and until 1981 in the US. High nominal interest rates during the 1980s coupled with declining inflation resulted in the high real interest rates of the late 1980s and 1990s.

⁵ Real interest rates are based on information from traded, inflation-protected 10-year government bonds in recent years. Values going further back refer to nominal bond yields, deflated by inflation expectation estimates (calculated as centred, three-year moving averages of inflation at each point in time).

⁶ In 1917, the US issued two “liberty loans”, yielding 3.5% and 4% despite high inflation. See also Homer Sidney and Richard Sylla: A History of Interest Rates (New Jersey: Wiley Finance, 2005).

Figure 1:
**Nominal and real 10-year government
bond yields for the US and the UK
from 1900 to 2011**



Sources: Datastream; Homer Sidney and Richard Sylla, *A History of Interest Rates* (New Jersey: Wiley Finance, 2005); Swiss Re Economic Research & Consulting

There are no guarantees with regard to the future direction of interest rates.

The large variation in both real and nominal interest rates over the last century highlights the uncertainty surrounding the current outlook for both nominal and real interest rates. Unexpected developments such as wars or oil crises have often caused large swings in nominal or real interest rates, and it would be misguided to believe that the future will bear no such surprises. In fact, neither a scenario of a prolonged period of low (or even negative real) interest rates, nor a rapid increase in bond yields should be considered remote. Both scenarios would be normal by historical standards.

Insurers need to be prepared to cope with a variety of different interest rate scenarios.

Since future interest rate developments cannot be predicted with reasonable accuracy, insurers need to be prepared to cope with any interest rate scenario. As a first step, it is crucial to understand how interest rates affect demand for and pricing of different lines of insurance business. The effect of interest rates on policyholder behaviour and insurer profitability also need to be taken into account. Only with this understanding can insurers begin to define the strategies they need to manage the interest rate sensitivity of their business.

How interest rates affect insurers

Interest rates are important to insurance companies for a variety of reasons.

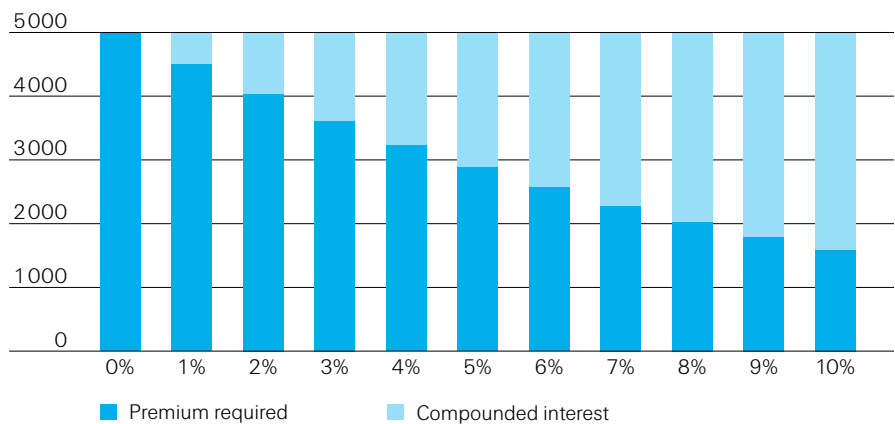
Interest rates are relevant for the price of insurance...

Interest rates are important to insurance companies for a variety of reasons. First of all, interest rates have an impact on insurers' balance sheets, investment income and premium rates. Demand for insurance is also affected by interest rates. Together, all these elements that are impacted by changes in interest rates determine insurers' profitability.

- **Impact on premium rates:** Insurance companies typically operate in a competitive environment and share investment income with policyholders through product pricing. In non-life insurance, premium rates can be reduced if interest rates rise because the discounted value of claims is lower, assuming that higher interest rates do not also mean higher inflation and claims costs (see Box: "Does inflation matter?"). In effect, the investment return pays part of the premium.

In life insurance, higher interest rates also reduce premiums for a set level of benefits, as can be illustrated via the following simplified endowment policy⁷ that pays a benefit of USD 100 000 in 20 years. Assuming a zero-percent interest rate, 20 annual payments in the amount of USD 5 000 would be required.⁸ If interest rates were at 3%, however, the company would be able to offer the same benefit with annual payments of USD 3 613 because compound interest rates would fund 28% of the benefit. Given a 5% investment return, annual payments could be reduced to USD 2 880, with 42% of the benefit paid out of interest rate income.

Figure 2:
Premiums required to fund a USD 100 000 benefit with a 20-year policy under different interest rate assumptions



Source: Swiss Re Economic Research & Consulting

...and they have an impact on the demand for insurance.

- **Impact on demand:** In general, lower interest rates make insurance products more expensive or reduce their benefits in the case of life insurance. For example, consider a payout annuity which offers a lifetime income to a buyer in exchange for a lump sum premium payment. When interest rates decline, the present value of the future payments increases and a higher premium is required to keep benefits at the same level, reducing people's incentive to buy annuities. In the UK, for example, where retirees have some discretion as to when to annuitise their pension savings, annuity sales were negatively impacted during the low interest rate years after 2008.

⁷ For an explanation of the life insurance product terms used, see the "Glossary of life insurance products" at the end of this *sigma*.

⁸ For simplification purposes, administration fees, mortality risks and other such factors are disregarded in the example.

However, declining interest rates do not always have a negative impact on insurance demand. First, some types of insurance are mandatory, so that price has no influence on demand. This is, for example, the case for motor liability insurance, or where banks require a term life insurance policy when selling a mortgage. Second, some types of life insurance savings products become more attractive when interest rates decline, as is the case if credited interest rates lie above market rates (see section on savings products later in this chapter). This effect was observed in Germany, France, and Italy in 2009 and 2010 when sales of new savings products rose sharply despite the economic crisis and low interest rates.

Interest rates also have an impact on the balance sheets of insurers...

- *Impact on the balance sheet:* From an economic perspective, changing interest rates do not impact the value of an insurance company (ie its equity position) provided that the duration of assets and liabilities are perfectly matched. In this case, the value of assets and liabilities rises or falls by exactly the same magnitude when interest rates change (see Box: “The sensitivity of fixed-income assets and liabilities to interest rates”).

However, many investors rely on accounting figures to make investment decisions, and assets and liabilities are often valued differently depending on local jurisdiction. For example, under US GAAP, assets are mostly marked to market, whereas liabilities are recorded at book value.⁹ Interest rate movements thus result in fluctuations in asset values, while liabilities remain unchanged. As a consequence, decreasing interest rates will temporarily inflate an insurer’s equity until interest rates increase again or bond portfolios approach maturity. This accounting mismatch occurs even when the duration of assets and liabilities is very well matched.

In reality, there are also often duration mismatches, when, for example, the duration of an insurer’s assets is shorter than that of its liabilities. Accordingly, a decline in interest rates reduces the economic value of the company because the value of its liabilities increases by more than the value of its assets. In fact, market-consistent valuations of life insurers show that company value usually decreases as interest rates decline.

...and they affect investment income.

- *Impact on investment income:* Because insurers are savers and typically invest most of their premium income in high quality bonds, they suffer from low interest rates. In both life and non-life insurance, any investment return in excess of the interest rate used for pricing can be distributed to shareholders. A higher-than-expected investment return therefore increases profits, and vice versa. The profitability of some life insurance products is highly sensitive to interest rates. However, falling interest rates translate only slowly into lower investment results for insurance companies. Likewise, profits only improve slowly as interest rates rise. This arises from the fact that only current premium income, which accounts for about 12% of life insurers’ and 43% of non-life insurers’ investments, is invested at market yields, meaning that the vast majority of investments stem from previous years.

Falling interest rates generally weaken the profitability of insurance companies.

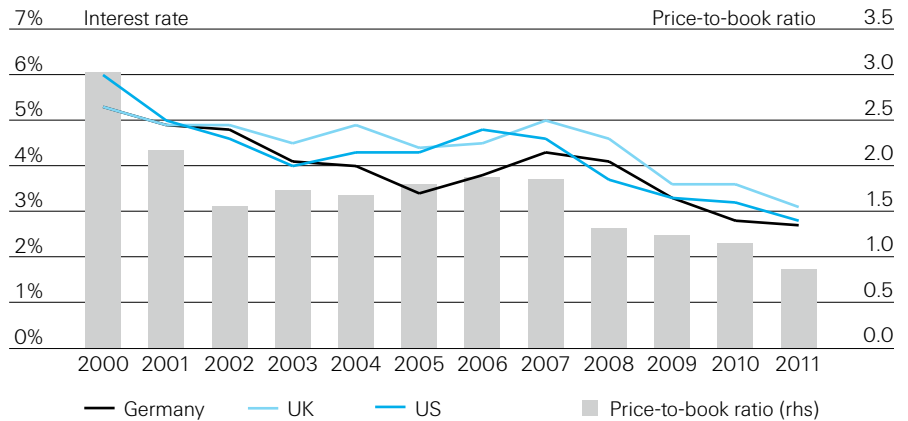
Declining interest rates generally result in higher prices and lower demand for insurance products, lower investment income and often a decrease in the economic value of insurance companies. In line with this, equity analysts tend to reduce their projections of insurer earnings as interest rates fall.

⁹ Under US GAAP, life insurance reserves are reported at book value (ie mortality, morbidity, expected investment yields, surrenders, and expenses assumed at the policy inception date remain fixed thereafter unless a reserve deficiency occurs). Non-life insurance reserves are undiscounted and hence immune to changes in interest rates. Under IFRS, no specific guidance on the valuation of insurance liabilities exists. Until IFRS 4 Phase 2 is implemented, companies are allowed to either report according to local GAAP or US GAAP.

Declining interest rates are associated with lower valuations of insurance companies.

These effects are also reflected in the market development of insurers' share prices. Figure 3 traces the changes in the average price-to-book ratio for a sample of global composite insurers and life insurance companies from 2000 to 2011. The price-to-book ratio represents a company's stock market value relative to its book value. The graph shows that insurer market valuations have fallen faster than book values as long-term interest rates have declined.

Figure 3:
Insurer price-to-book values and long-term interest rates



Note: The company sample includes Generali, Prudential PLC, Great-West Life, Aflac, Lincoln, Protective Life, Torchmark, Legal&General, Swiss Life, Allianz, AXA, CNP, Helvetia, Hartford, Met Life, and Sun Life.

Sources: Bloomberg; Swiss Re Economic Research & Consulting

Interest rates and the price of fixed-income securities (such as bonds) move in opposite directions.

The sensitivity of fixed-income assets and liabilities to interest rates

Fixed-income securities, such as bonds, generally have a nominal face value which is repaid at maturity. During the lifetime of a bond, fixed-interest payments (coupons) are paid to the lender at regular intervals. When market interest rates go up, the price of fixed-interest rate securities goes down.

As an illustration, consider, for example, that the government of a fictitious country, "Safe Haven", issues a bond with a face value of USD 100 million and a 10-year maturity period. Each coupon is worth USD 5 million, or 5% of the bond's face value. Supposing, however, that the market yield for comparable securities increases to 6% the day after the bond has been issued, Safe Haven would have to offer a 6% coupon in order to successfully issue another bond. Investors in the first bond would clearly want to earn the higher interest and exchange their 5% against 6% coupon bonds. The market value of the 5% bond would therefore fall, so that the overall yield (resulting from the USD 5 million coupon and the price return to par) would also be 6%.

Modified duration measures a bond's price sensitivity to changes in interest rates.

The degree to which a bond's price changes as a result of interest rate fluctuations (its interest rate sensitivity) can be expressed in terms of modified duration, measured as the percentage change in a bond price per one percentage point absolute change in market yield.¹⁰ The modified duration of the 10-year 5% coupon bond is 8.11. Thus, a one percentage point yield increase would cause the bond price to fall by 8.11% to USD 91.89 million.

A bond's modified duration, or interest rate sensitivity, depends on:

- *the maturity of the bond*: The higher the maturity, the higher the duration. For example, a 10-year bond has a higher duration than a 5-year bond.
- *the size of the coupon (for equal maturity)*: Duration decreases as coupon size increases. For a zero-coupon bond¹¹, the modified duration equals its maturity. Therefore, a 10-year zero-coupon bond has a duration of ten, and the price of the bond declines by 10% if interest rates increase by one percentage point (compared to a decline of 8.11% for the Safe Haven 5% coupon bond).
- *the market yield*: In a low yield environment, modified duration is higher. If the market yield increases from 5% to 6%, the modified duration of Safe Haven's 5% bond drops to 8.02% (and a further increase in market yield by 1% would result in only an 8.02% drop in price).

Insurance liabilities have an expected duration, which insurers try to match with assets in order to eliminate interest rate risk.

Insurance liabilities also have a duration. Insurance liabilities are the discounted value of future insurance payments. An increase in interest rates therefore leads to a decline in liabilities. The interest rate sensitivity of liabilities can also be measured using modified duration, which is naturally only an estimation because the timing and size of future payouts is not known precisely in advance and must be estimated. Insurers thus try to match the duration of their assets with the expected duration of their liabilities to "immunise" their balance sheets against interest rate movements.

How interest rates impact non-life insurers

Interest rates have little impact on short-tail lines of non-life business.

Insurance companies invest the premiums they receive up front until claims fall due. For some lines of business, such as property insurance, the time between the payment of premiums and claims is short. In such cases, insurers invest the money in short-term investments, such as Treasury bills, to match the expected claims payout. As a consequence, the importance of investment income for earnings is very limited and interest rates are not a major concern for short-tail lines of business (see Box: "The importance of investment income for non-life products").

Interest rate sensitivity in long-tail lines of non-life business can be dealt with by duration-matching.

In other non-life business, such as casualty, many years may pass between the time that premiums are received and claims are paid. In order to minimise reinvestment risk, insurers aim to match the duration of their assets and their liabilities. In an ideal world where liability duration can be perfectly anticipated and matched by asset duration, insurers would be immune to changes in interest rates.

¹⁰ Price sensitivity with respect to yields can also be measured in absolute (dollar) terms, and is often referred to as dollar duration.

¹¹ A zero-coupon bond is a bond that does not make any interest payments. Instead it is sold at a discount. The yield is the result of the price increase during the lifetime of the bond.

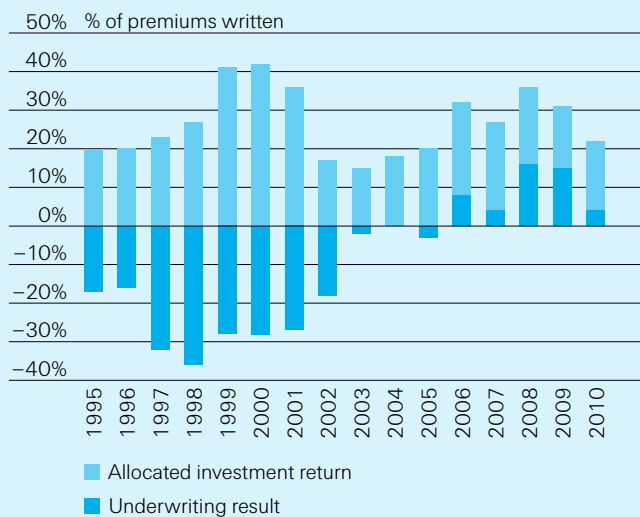
Long-tail, non-life business lines, such as general liability, are sensitive to interest rates.

The importance of investment income for non-life products

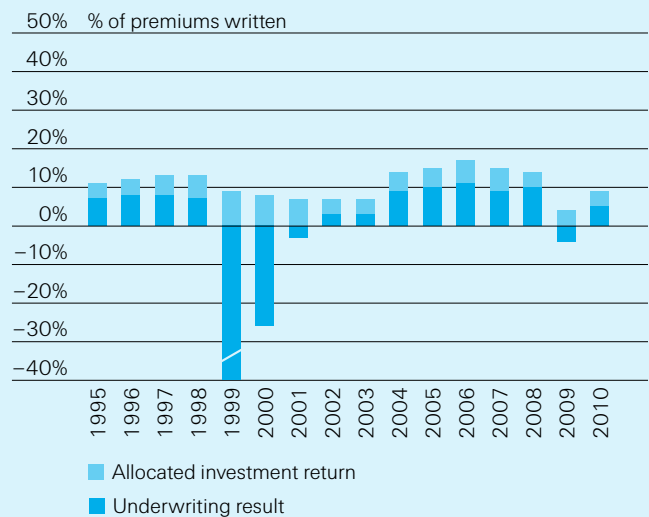
Figure 4 depicts the relative importance of investment and underwriting income for the profitability of long- and short-tail non-life business in France. The left panel shows general liability, which is a long-tail line of business where claims payments are spread over many years. As a consequence of the long payout pattern, claims reserves are substantial (general liability business accounts for only 5% of non-life premium income, while its reserves amount to 15% of total non-life reserves). Since the assets backing the reserves are invested, investment income becomes a significant component of total income. Because of its dependence on investment returns, general liability is exposed to fluctuations in financial markets including to changes in interest rates.

Figure 4:
The profitability patterns of long- and short-tail non-life business in France

General liability insurance (long-tail)



Property insurance (short-tail)



Sources: FFSA, Swiss Re Economic Research & Consulting

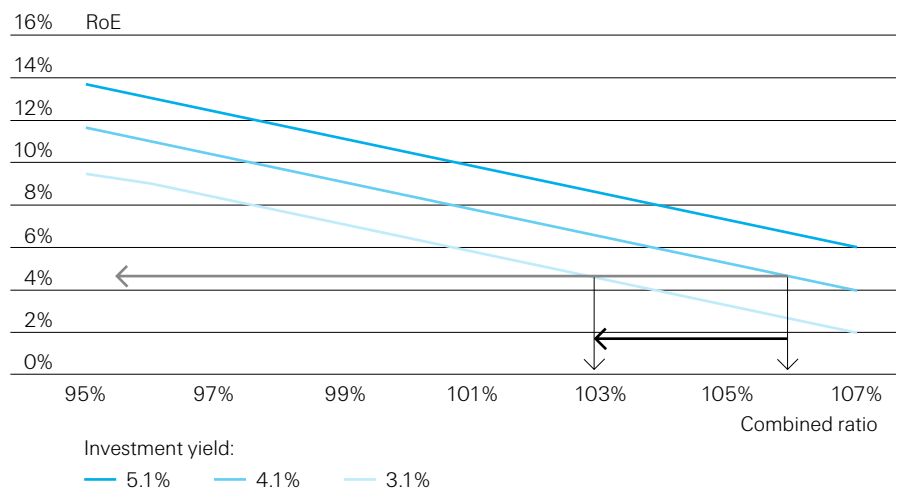
Short-tail lines of non-life insurance business, such as property, are much less sensitive to interest rates than long-tail lines.

The right panel depicts the profitability pattern of property insurance, which is a typical short-tail business. Its short-tail nature is reflected in its relatively low reserves (property business accounts for about 24% of non-life premium income, but only for about 17% of reserves). Therefore investment income is not as important for profitability as it is for long-tail business, and overall income depends more heavily on the underwriting result. As a consequence, this line of business is much less sensitive to financial market performance and interest rates than long-tail non-life business.

If investment yields decline, the combined ratio must fall to preserve profitability.

Non-life insurance companies use the combined ratio¹² to measure underwriting profitability. They report an underwriting profit if the ratio is below 100%, and make a loss if the ratio is above 100%. Figure 5 depicts the link between US non-life insurers' 2011 combined ratio, the interest return (yield) earned on investments and overall profitability (RoE). In the example, the non-life industry had a combined ratio of 106%, which, given an investment yield of 4.1%, resulted in an RoE of 4.8%.¹³ Were the investment yield to drop to 3.1%, the RoE would be around 3%, assuming an unchanged combined ratio. By aiming for a combined ratio of about 103%, non-life insurers could restore RoE to its initial 4.8%. This example illustrates that when interest rates fall (inflation unchanged), non-life insurers must raise premium rates to maintain the same RoE.¹⁴

Figure 5:
Link between combined ratio, investment yields, and overall profitability for US non-life business in 2011



Note: Based on US non-life insurance industry data for 2011.
Source: Swiss Re Economic Research & Consulting

In practice, non-life re/insurers tend to react slowly to declines in interest rates.

In practice, non-life insurers tend to be unable to fully adjust premium rates immediately when interest rates fall due to competitive pressures and market share considerations. Also, if the drop in the investment return is viewed as being temporary, insurers can absorb the impact of interest rates as an added service to shelter their customers from market movements. By doing so, they can retain customers and avoid the costs associated with their policyholders switching providers because of price fluctuations arising from interest rate movements.

A prolonged period of low interest rates is usually not favourable for non-life profitability

Because insurers' price adjustments to lower investment yields tend to be gradual and effected with a time lag, a prolonged period of declining interest rates is usually not favourable for non-life insurers' profitability.

... whereas rising interest rates improve profitability.

On the other hand, when interest rates increase, competition in the marketplace puts insurers under pressure to reduce premium rates. Those insurers who fail to adjust their prices run the risk of losing market share. Nevertheless, evidence shows that rising interest rates are associated with periods of improving profitability.

¹² The combined ratio is the sum of the non-life claims ratio and the expense ratio. The claims ratio is defined as the sum of claims paid, the change in the provisions for claims unpaid and the claim adjustment expenses in relation to premiums earned. The expense ratio is defined as the sum of acquisition costs and other operating expenses in relation to premiums earned.

¹³ The asset leverage was 312%, the tax rate 25% and the ratio of net written premiums to surplus was 77%.

¹⁴ This illustrates the relationship in the case of aggregate US non-life business. The picture looks different for long-tail non-life business, with its higher technical provisions to premium ratio. The distance between the investment yield lines are wider, reflecting higher interest rate sensitivity.

Unexpected inflation matters for long-tail lines of non-life business.

If interest rate increases are driven by inflation surprises, this can result in lower profitability for long-tail lines of non-life business.

Pricing in long-tail non-life business only needs to be adjusted to changes in real interest rates.

Does inflation matter?

Nominal interest rates can change either due to changes in the real interest rate or due to changes in inflation expectations (see Box: “What are interest rates?”). While inflation has no effect on claims that are fixed in nominal terms (as is usually the case in life insurance¹⁵), it does affect non-life insurance claims.¹⁶ This is because non-life claims are linked to goods and services, the costs of which increase with general price levels. For example, the cost of providing healthcare to a disabled person increases along with the wages of their care staff, hospital equipment costs and medication costs – all of which are affected by the general inflation rate.

This means that an insurer writing casualty business is immune to changes in interest rates as long as there are no sudden peaks or drops in inflation.¹⁷ However, if interest rates move because of unanticipated inflation, nominal claims costs will be higher than expected at the time of contract pricing.

When pricing new, long-tail non-life insurance contracts, it is important to know whether interest rate swings are due to changes in inflation expectations (keeping the real interest rate constant) or due to changes in real terms. If nominal interest rates drop due to lower expected inflation (ie there is no change in real interest rates), product pricing need not change since the lower investment return will be offset by lower nominal claims costs. However, if nominal interest rates fall without a concurrent drop in inflation expectations – as was the case when real interest rates dropped between 2009 and 2012 – the insurance price must be raised in order to maintain profitability.

Interest rate sensitivity depends on the significance of investment income, and the effectiveness of ALM and hedging.

How interest rates impact life insurers

The interest rate sensitivity of life insurance products depends on two key elements. First – as in non-life lines of business – it depends on the degree to which investment income is relevant for profit and, second, whether the risk related to interest rates can be reduced by managing assets and liabilities (Asset-Liability Management, or ALM) and through hedging. Managing interest rate risk with ALM and hedging is possible as long as the cash flows can be foreseen with reasonable precision (as is the case in non-life insurance). However, in life insurance, policyholder behaviour may be sensitive to changes in interest rates and other economic developments as well as psychological factors, which can undermine the insurer’s cash flow projections. This dynamic policyholder behaviour is a key challenge for life insurance companies.¹⁸ However, policyholder behaviour and investment income impact life insurance products in different ways.

¹⁵ For most life insurance products, the distinction between nominal and real interest rates matters little because the liabilities are usually fixed in nominal terms. For example, if a policyholder dies, a life insurance policy pays out a fixed amount of money – whether the general price level has increased in the meantime or not.

¹⁶ There is usually a difference between claims-specific inflation that matters for insurers and general consumer price inflation. For a detailed analysis on the impact of inflation on insurers, see Swiss Re, *sigma* No 4/2010: “The impact of inflation on insurers”.

¹⁷ Again assuming that the duration of assets and liabilities is matched.

¹⁸ See Ed Morgan and Jeremy Kent, ‘Dynamic Policyholder Behaviour – Analysis, Modelling and Management’, Milliman (2010), <http://ch.milliman.com/en/perspective/published-articles/pdfs/dynamic-policyholder-behaviour-presentation.pdf>.

Protection and payout annuity products

Protection products (such as term assurance, disability, health insurance and critical illness) and payout annuities¹⁹ are very similar to non-life products in terms of their interest rate sensitivity:

For protection and payout annuity products, policyholder behaviour is not sensitive to changes in interest rates and therefore not a major factor.

- *Policyholder behaviour* is usually not an issue for protection and payout annuity products, because policyholders are not very sensitive to moves in interest rates. The main policyholder behaviour risk is lapsing (ie policyholders cancelling their policies for more attractive offers in the market). When interest rates decline, lapsing tends to become less attractive because insurers can only offer contracts with higher premiums or lower benefits. When interest rates increase, insurers can offer more attractive terms on new contracts, so there may be an incentive for policyholders to exchange an existing policy for a new one. However, there is a counter-incentive stemming from the fact that many risk products offer level premiums, which means that risk charges are averaged over the contract's lifetime. At the beginning of the contract, risk charges are higher than the individual risk, while later, as individuals grow into higher mortality and morbidity age categories, risk charges fall below the individual risks. Hence, cancelling an existing policy to buy a new one results in higher risk charges – irrespective of interest rate moves. This effect becomes more pronounced with the age of the existing contract and provides an incentive against exchanging protection policies. Policyholder behaviour is not an issue for payout annuities because policyholders do not have the option of lapsing their policies.

Investment income does not play a big role for protection products.

- *Investment income* is not the main source of earnings and has no major effect on protection products (see Figure 5 in the Box: "The importance of investment income for life insurance products"). Hence, interest rate fluctuations are not necessarily the greatest threat to profitability. Investment income is important for payout annuity products, but interest rate risk can be effectively managed through ALM because policyholder behaviour is not relevant.

Therefore, similar to non-life insurance products, interest rate risks are manageable.

As in non-life insurance, interest rate risks for life protection products and payout annuities can be managed via prudent asset-liability matching techniques since policyholder behaviour is not a significant issue.

¹⁹ In some markets, payout annuities are known as immediate annuities (US), pension annuities (UK), or simply annuities. The term "payout annuities" is used in this *sigma* to emphasise that it is a decumulation product as opposed to an accumulation (savings) product.

The importance of investment income for life insurance products

Life insurance products range from pure risk protection to savings contracts.

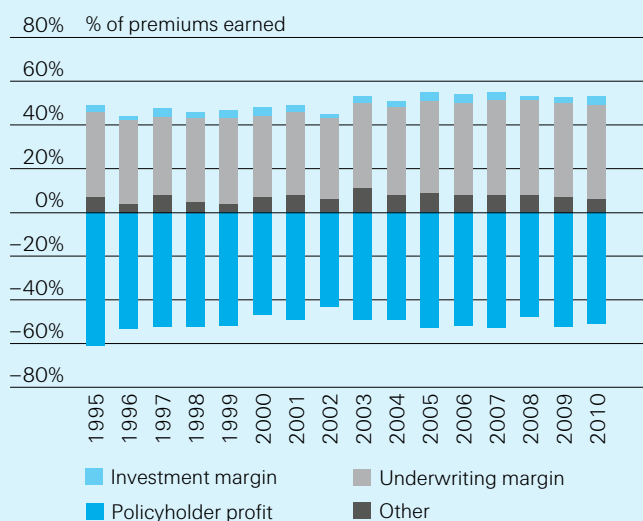
The main source of earnings for a term insurance product is life risk, whereas the bulk of earnings in a savings product stem from investment income.

Life insurers offer a wide spectrum of products ranging from pure life risk protection covering risks such as mortality and morbidity, to savings contracts that help individuals save for retirement. The various products are highly heterogeneous in terms of embedded risks and sources of earnings.

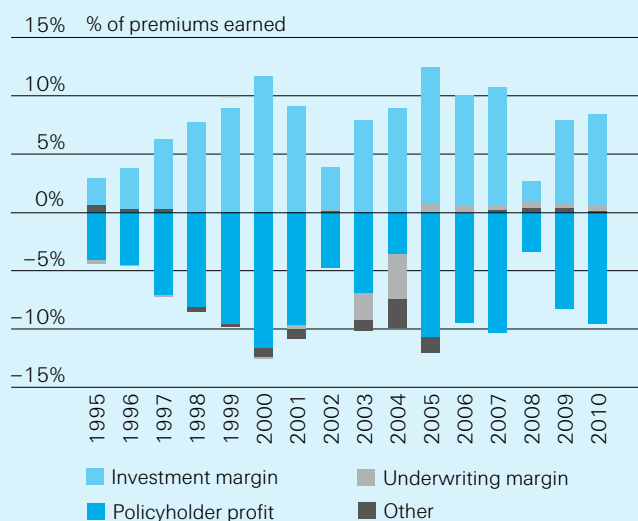
Figure 6 depicts the sources of profit for term insurance (a pure risk product, left panel) and endowment insurance (a savings product with death benefits, right panel) in Germany. There are striking differences between the two types of products in terms of how gross earnings²⁰ are generated. The main source of profit for the risk product is life risk (ie the amount by which premiums charged to policyholders exceed mortality payouts), with investment income adding only little to overall earnings. In the case of the endowment product, in contrast, the main source of earnings is investment income, with life risks making a minimal contribution to earnings. Obviously, the endowment insurance earnings pattern is linked to financial market performance and is hence much more volatile.

Figure 6:
Sources of profit for typical life risk and savings products, Germany

Term insurance (a typical risk product)



Endowment insurance (a typical savings product)



Sources: Bundesanstalt für Finanzdienstleistungen (BaFin), Swiss Re Economic Research & Consulting

The bulk of life insurance premiums stems from savings products.

Only about 15% (or USD 375 billion) of the USD 2 500 billion in global life insurance premiums are life risk premiums (including life risk premiums attached to savings business).²¹ The largest source of premium income for primary life insurers is savings business, and an even greater portion of assets is related to savings business.²² In addition, the bulk of life insurance profits and risks are also related to savings business, thereby making them very sensitive to interest rate risk.²³

²⁰ Gross earnings are defined as the profit before profit-sharing with policyholders.

²¹ According to Swiss Re Economic Research & Consulting estimates.

²² Because savings business has higher technical provisions per unit of premium income than pure risk products, the savings business accounts for far more than 85% of the global USD 15 000 billion in general account assets. Data for Germany indicates that the ratio of technical provisions to premiums is five times higher for savings business than for protection products. Applying these ratios to the global USD 15 000 billion in general account assets would result in more than USD 14 500 billion in assets backing savings contracts.

²³ According to QIS5, market risk accounted for 67% of the required solvency capital for European life insurers under Solvency II.

Savings products

Compared with pure life risk products, the effect of investment income and policyholder behaviour on savings products²⁴ is more significant.

Savings products rely heavily on investment income. ALM is therefore crucial.

- *Investment income* has a major impact on life savings products (see Box: “The importance of investment income for life insurance products”). The importance of investment income is compounded by the sheer volume of assets covering savings products and the fact that long-term guarantees are often set at the point of sale. If the duration of an insurer’s assets and liabilities is not properly matched, changes in interest rates can lead to significant balance sheet problems. For example, insurers that have backed their long-term liabilities with short duration assets have to reinvest a portion of their assets at a lower yield if interest rates decline and stay low. Life insurer liabilities often last 30 years or more, and in many markets assets with such a long duration are either unavailable or illiquid, thereby making proper ALM difficult (see chapter: “How can insurers mitigate interest rate risk?”). Such maturity mismatches hamper profitability when interest rates decline and can lead to solvency problems when interest rates stay low.

Policyholder behaviour can be a significant issue for savings products and affects profitability.

- *Policyholder behaviour* can be a significant issue for savings products because of the options and guarantees embedded in the products. For example, policyholders usually have the right to reduce or increase premium payments for regular premium contracts in later years and to withdraw money from both regular and single premium accounts. Another option sometimes granted to policyholders is the right, at maturity, to extend the duration of their contract under the original terms. Cash flows from life insurance savings-type business are therefore hard to predict, which gives rise to many challenges in managing interest rate risk.

A rapid increase in interest rates could lead to more lapses and force insurers to realise losses on fixed income portfolios.

For example, a rapid rise in interest rates can affect policyholder behaviour, causing problems for life savings business. In such a scenario, policyholders may lapse their savings policies and lock in better terms with a new contract. Due to the rise in interest rates, insurers realise a loss on their fixed-income investments to finance payments made to lapsing policyholders.

Life risk embedded in savings contracts is subject to anti-selection bias, thereby undermining underwriting profitability.

Interest rate-induced policyholder behaviour can, in turn, also affect the life risk embedded in savings contracts. Healthier policyholders are more likely to lapse than unhealthy ones, who are locked in because they would have difficulty finding risk protection at the price of their existing policies. This anti-selection bias deteriorates life underwriting results and exacerbates the negative impact of a rapid increase in interest rates on earnings.

Declining interest rates could lead to lower than expected lapses in savings business.

On the other hand, declining interest rates can reduce the incentive for policyholders to lapse their savings policies. As interest rates decline, embedded interest rate guarantees gain in value and attractive alternative investment opportunities for policyholders are in short supply. Conversely, policyholders may be inclined to increase premium payments or the sums insured, or to extend the contract beyond the original maturity date if the original interest rate is guaranteed. This generates a reinvestment risk for the insurer.

It is therefore important to note that not only higher than expected, but also lower than expected lapses can foil ALM and hedging strategies. Both interest rate increases and decreases may therefore alter the expected cash flows from life savings business.

²⁴ Savings business includes endowment and with-profits insurance, deferred fixed annuities, and universal and whole-life products.

An illustration of the impact of interest rates on savings business

Interest rates have an impact on demand, lapses and profits from investments.

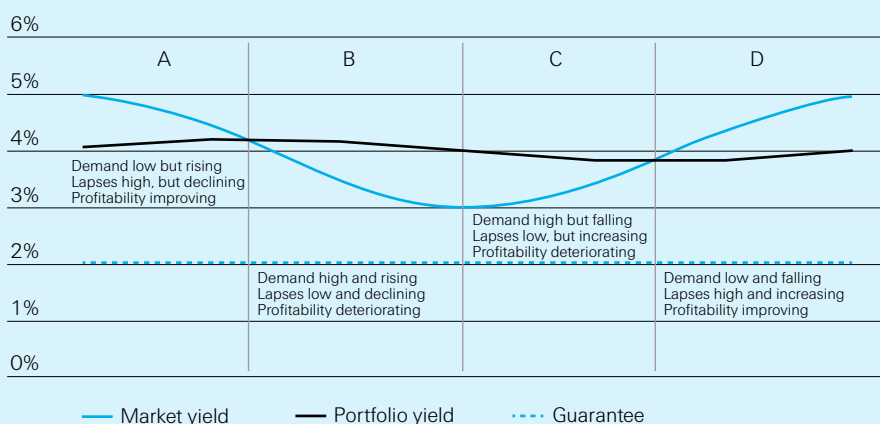
The figure below is a simplified illustration of the impact of interest rates on savings business. Supposing insurers offer policyholders a minimum guarantee of 2% interest and a bonus that depends on the investment return generated by the insurance asset portfolio. The insurer participates in the investment income above the guarantee level and because it invests premium income in fixed-income securities each year, the portfolio yield is an average of the market yield generated over the last few years.

In phase A, the market yield exceeds the portfolio yield. Hence, demand for insurance products is low and policyholders have an incentive to lapse their policies to reinvest at the more attractive market yield. However, the insurer can invest any premium income at a yield above the portfolio yield, leading to a gradual increase in the portfolio yield and thereby improving the insurer’s investment margin and thus profitability.²⁵

As the market yield falls, the incentive to lapse lessens and eventually disappears as the market yield falls below the portfolio yield (phase B). If they have the option to do so, policyholders are likely to increase premium payments. The favourable yield differential boosts demand for insurance, but the insurer must invest premium inflows at an interest rate below the portfolio yield, thereby reducing the investment margin and profitability.

As market interest rates increase again, demand falls gradually. As long as market interest rates remain below the insurer’s portfolio yield, the investment margin continues to deteriorate (phase C). Once the market interest rates exceed the portfolio yield (phase D), profitability improves, although demand weakens and lapsing becomes more attractive.

Figure 7:
A simplified illustration of the link between interest rates and life insurance savings business



Source: Swiss Re Economic Research & Consulting

Demand for insurance and insurers’ profitability are negatively correlated.

This illustration indicates that market yields and insurance demand are negatively correlated for savings business. It also implies that insurance demand and profitability are negatively correlated.

²⁵ In this simplified example, the potential negative impact of lapses on the insurer’s profitability is ignored. Lapses can impair an insurer’s profitability if its production and distribution costs are not yet recouped or if the insurer is forced to sell assets at a loss or reinvest them at a lower than expected yield. Insurers try to reduce this effect, for example, by introducing high surrender charges or by allowing lapsing only at market rather than book value.

The profitability of savings business is impacted asymmetrically by positive and negative interest rate moves.

Table 1 summarises the effect of interest rates on various traditional life insurance products.²⁶ Not only is savings business the most affected by changing interest rates, but is also the business where asymmetries between positive and negative effects are strongest. This is because life insurers only participate in interest income above the guaranteed rate, while they have to bear the total shortfall in investment income below these guarantees, and because policyholders can use options embedded in life products to the insurer's disadvantage.

Table 1:
The impact of interest rates on life insurance demand, policyholder behaviour and profitability

Interest rates	Protection products		Payout annuities		Savings products	
	decrease	increase	decrease	increase	decrease	increase
Demand	↓ Demand falls as the price for protection increases (possible opposite effect in mortgage-related term insurance)	↑ Demand rises as the price for protection decreases (possible opposite effect in mortgage-related term insurance)	↓↓ Demand falls, driven by less attractive annuity rates	↑↑ Demand rises, driven by more attractive annuity rates	↑ Demand rises if guarantees are adjusted with a time lag	↓ Demand falls if guarantees are adjusted with a time lag
Policyholder behaviour	↓ Lower number of lapses, driven by (1) higher market prices and (2) higher individual risk charges at age of surrender	↔ No major impact on lapses as lower market prices are (partially) offset by higher individual risk charges	↔ No impact as there is no lapse option	↔ No impact as there is no lapse option	↓ Policyholders tend to keep in-the-money interest rate options ↓↓ Policyholders may increase premium payments if they have the option to do so at original terms	↑ Increase in the number of lapses can be mitigated if attractive bonuses are credited and/or surrender charges are high
Profitability	↔ Likely minor negative impact on profitability as investment is not a key profit driver and demand is not very sensitive to interest rates	↔ Likely minor positive impact on profitability as investment is not a key profit driver and demand is not very sensitive to interest rates	↓ Profitability falls, driven by lower volumes (and possibly due to a lower investment result if duration not matched)	↑↑ Profitability increases, driven by higher volume (and possibly due to a higher investment margin on new business if the annuitization rate is adjusted with a time lag)	↓↓ Profitability falls due to lower investment margin ↓↓↓ Profitability falls sharply once the investment return falls short of the guarantee	↑ Profitability increases modestly because the insurer only participates to some degree in the investment return in excess of the guarantee

Key: (↑/↓) moderate increase/decrease, (↑↑/↓↓) strong increase/decrease, (↑↑↑/↓↓↓) very strong increase/decrease, (↔) no impact

Source: Swiss Re Economic Research & Consulting

Interest rates are important for all insurance lines, but they especially impact savings products.

Interest rates are a key parameter for insurance operations. Interest rates affect pricing, demand, investment income and hence profitability. However, the magnitude of the impact is as heterogeneous as insurance products. Non-life insurance is generally less interest rate sensitive than life insurance. But there are significant differences even within life insurance business itself. Savings business is the most affected because of the importance of investment income as a source of earnings, and because of policyholder behaviour, which makes duration-matching a challenge. Moreover, savings business deserves attention because it is life insurers' main business in terms of premium income, assets and profits. The next chapter thus takes a more detailed look at life insurance savings business in the major markets and highlights the key role played by product features in determining sensitivity to changes in interest rates.

²⁶ Traditional life insurance excludes unit-linked business.

Life savings products in key markets

Interest rate sensitivities vary greatly from one country to another.

The German life industry is particularly vulnerable to a prolonged period of low interest rates due to rigid guarantees and the long duration of its products.

In the US, deferred fixed annuities, whole life and universal life products are highly sensitive both to a decline

Overview of life savings product characteristics by market

The life insurance product landscape is highly diverse. Even within the category of savings products, which has been identified as being the most sensitive to interest rates, product features differ significantly from country to country. Product features, such as the level and flexibility of guarantees can, for example, be influenced by regulation or by the relative importance of various distribution channels. Moreover, tax legislation can impact product characteristics such as the minimum time a product must be held to qualify for tax exemption. In addition, social security can make insurance plans mandatory. The exposure of savings business to interest rate risk varies as a result.

The German life insurance market is significantly exposed to a prolonged period of low interest rates. Endowment insurance (Kapitallebensversicherung) is the mainstay, providing approximately 57% of life premium income.²⁷ The interest rate guarantee is set at inception and cannot be changed during the lifetime of the contract. The guarantee must be credited to the policyholder's account every year, thereby aggravating the interest rate sensitivity of the product as good years cannot compensate for bad years. Some relief comes from the fact that bonuses²⁸ allocated to policyholders in previous years can be used to offset periods of low investment yields.²⁹ The interest rate guarantee is currently at 1.75%, after having been as high as 4% between 1994 and 2000. During this period savings business accounted for about EUR 285 billion in premium income. To cash in the tax benefits, policies must be 12 years old, thereby providing an incentive against surrenders. However, despite the fact that the majority of these contracts would now qualify for tax benefits, the contracts are nevertheless likely to stay in force because of the high guaranteed interest rate. On certain occasions, such as marriage or when a child is born, policyholders are allowed to increase the sums insured at initial conditions. In today's low interest rate environment, this is an attractive option for policyholders but a problematic one for insurers, as old, in-force business will keep the average portfolio guarantee rate above the market yield for many years to come. Surrenders, however, are not a big issue for insurer profitability in Germany due to the tax incentive mentioned and because losses from lapsing are largely borne by the remaining policyholders.

In the US, deferred fixed annuities³⁰, universal life and participating whole life are the most interest rate sensitive products. These products accounted for about 70% of US life insurers' general account reserves in 2011. For these products, the regulator sets the minimum interest rate guarantee, which cannot be changed during the lifetime of the contract. The guarantee has recently been lowered from 4% to 2% for universal life and from 3% to 1% for deferred fixed annuities. The duration of whole life and universal life products is potentially very high as they can stay in force until the policyholder dies (or even longer for those policies where a couple buys insurance together). Deferred fixed annuities may have a lower duration on average, but policyholders can refrain from surrendering their old policies with high interest rate guarantees and opt to continue to pay premiums for a very long time. In addition, policyholders are allowed to increase premium payments for their universal life and deferred annuity policies at the guaranteed minimum rate (which is currently very attractive for old policies with high guarantees³¹), thereby compounding the risk these products face during a long period of low interest rates.

²⁷ The share was much higher in the past, but with a change in tax legislation in 2005 the product lost popularity, so technical provisions for these contracts are likely still much higher than 57%.

²⁸ There are strict rules as to how gross earnings are shared between policyholders and insurers. At least 90% of the investment result above the guarantee, 75% of the life risk surplus and 50% of the expenses surplus must be credited to policyholders as bonuses.

²⁹ A feature of the German life insurance industry is the "provision for premium refunds", or RfB (Rückstellungen für Beitragsrückerstattung), which consists of three parts. The first part comprises the credited guarantee and bonus which is transferred to policyholder capital in the following year. The second part of RfB is the terminal bonus pool, transferred to policyholder capital when the contract matures or is lapsed. Finally, there is a free bonus pool, whose funds are not credited to policyholders but must eventually be used for policyholder benefits. The terminal bonus and free bonus pool can be used to offset poor investment and underwriting results.

³⁰ Deferred fixed annuities are similar to savings plans. They may be, but are not usually, converted into a payout annuity.

³¹ Whole life insurance sums insured cannot be increased at initial conditions.

...and to a rapid increase in interest rates.

Were interest rates to increase rapidly, there would be significant lapse risk for all three products (deferred fixed annuities, universal life and participating whole life). Policyholders would have a high incentive to cancel their recently purchased policies and buy more attractive contracts with higher interest rate guarantees. This would be very costly for insurers, as policyholders are entitled to receive back the full book value (ie the premiums paid so far as well as the investment income already credited). Since these surrender values are not adjusted for market fluctuations, the insurer bears the market risk. However, there are surrender charges to prevent policyholders from lapsing. In the case of deferred fixed annuities, surrender charges only apply for a limited period that can be as low as three years or as long as 10 years, making these products very sensitive to a rapid increase in interest rates. For universal and whole life products, longer surrender charge periods may prevent policyholders from exchanging their policies should interest rates rise.

In Canada, universal life products are highly interest rate sensitive. The main threat stems from a long period of low interest rates.

In Canada, universal life policies are highly interest rate sensitive. Universal life accounted for about 40% of total individual life insurance in 2011. Premium payments in excess of the cost of insurance³² are invested in variable or guaranteed interest rate accounts, and in the latter case, the interest rate guarantee applies for the whole duration of the contract and may even increase after some fixed period of time. The guaranteed interest rate differs by company and is currently around 2%. As a result, universal life policies are problematic if interest rates remain close to or even below the guaranteed rate for an extended period of time. Additionally, policyholders can increase premium payments at their discretion and profit from the guarantees set at inception, which is an attractive option for policyholders in today's low interest rate environment, although it compounds the risk of investment income shortfalls for insurers. In contrast, the risk stemming from a sharp rise in interest rates is limited because guaranteed interest rate accounts entail a surrender charge, and surrender values are adjusted to reflect market developments.

In the UK, savings products have no interest rate guarantees and have been marginalized in the UK life insurance industry.

Life insurance business in the UK is not interest rate sensitive. Regular premium endowment insurance often taken out in conjunction with an interest-only mortgage, was a popular savings method until a few years ago. However, this type of product suffered from adverse publicity due to deteriorating investment returns on with-profits contracts, despite the fact that many policies that ran their full term lived up to policyholder expectations. Endowment insurance has no guaranteed interest rate and is therefore not sensitive to interest rate changes. Nowadays, few regular premium endowment policies are sold in the UK, and the role of life insurance as a form of regular savings has diminished over the years as other types of (non-insurance) products such as unit trusts and open-ended investment companies (OEICs) have become more popular.

In Italy, most life insurance business is with-profits savings business, which is exposed to a decline in interest rates....

In Italy, interest rate sensitive life insurance business includes with-profits endowment and whole life policies (polizze rivalutabili), most of which are single premium business. The maximum guarantee is fixed at 60% of the average Italian 10-year government bond yield. Between the end of 2008 and the end of 2011, the maximum guarantee level was typically 2.5% before increasing to 3%.³³ Recently, however, granted guarantees have been well below the maximum rates. The interest rate guarantee cannot be changed throughout the lifetime of the contract. Bonuses in addition to the guarantee are credited depending on the investment result. Some life insurers offer products with a cliquet mechanism, where the guarantee is paid out at maturity instead of annually. A guarantee at maturity allows for greater flexibility in dealing with low returns since poor investment years can be offset by better ones.

³² The cost of insurance (COI) is the risk premium for a death benefit. COI is level and guaranteed and ceases after age 100, or after the time specified in the contract.

³³ Note that the spread between Italian and German government bond yields increased significantly during the second half of 2011. At the start of 2012, the Italian 10-year government bond yield was almost 7% compared to about 2% for Germany.

... and to a greater extent to a rapid increase in interest rates.

For recurrent premium policies (which account for about 9% of with-profits business in Italy), premium payments may be increased at original terms, but the size of any additional payments can be limited in the policy terms. Surrender charges vary by company, but generally decrease with the duration of the contract. However, there is no adjustment for market value of the assets backing these policies, giving rise to the risk of a loss if interest rates surge.

Endowment business in Spain is sensitive to interest rates since insurers offer fixed guarantees.

In Spain, pure endowment policies (*capitales diferidos*) account for about 30% of life insurance premium volume. The guarantee is set by the regulator and cannot be changed during the lifetime of the contracts, making this business sensitive to declines in interest rates. For policies issued in 2012, the minimum guaranteed interest rate is about 3.4%. These policies usually have a long duration as they run until the policyholder retires. Policyholders have the option to increase premium payments, although conditions are adjusted according to the market situation. The fact that policies can be surrendered without a market adjustment leaves insurers vulnerable to lapse risk when interest rates rise. In addition, because these policies carry no tax advantages, there is no tax deterrent against lapsing. However, the lapse risk is mitigated by a surrender charge.

In some markets, interest rates are elevated due to high credit spreads, making credit risk more important than interest rate risk.

As in other southern European countries, interest rates are currently high in Italy and Spain. The main danger being faced by insurers in these markets is not low interest rates but that of their governments defaulting on their debts, because insurers invest heavily in government bonds. The depressed market values of sovereign bonds can also be a problem where policyholders have the right to lapse their policies without adjustment for market fluctuations.

In Japan, the most interest rate sensitive products are single premium whole life products. A rapid rise in interest rates might result in large losses for insurers from forced realised losses on bond portfolios.

In Japan, single premium whole life insurance contracts with low sums insured in the initial phase are currently the most interest rate sensitive life insurance products.³⁴ Interest rates are guaranteed over a policyholder's full lifetime, making these products sensitive to declining interest rates. Low lapse rates and persistently low investment yields are a challenge, especially for old books of business with high guarantees. The risks inherent in business sold over the last few years when interest rates and guarantees were already low is more limited. The main risk facing insurers with such contracts is surrender should interest rates increase sharply. Although surrender values during the first five or ten years are limited to the single premium, insurers are still at risk when interest rates rise and the market value of fixed income investments drops. In addition, surrender values increase rapidly after five or ten years, converging to face value over time. While statistics on these single premium whole life insurance products are not provided by regulators, it is estimated that sales have been substantial in recent years.³⁵

In France, life insurance savings products have been the main pillar of sales. They offer only short-term guarantees, largely mitigating interest rate risks.

In France, traditional savings business (*assurance vie – fonds général en euros*) accounted for about 67% of premium volume in 2011. The maximum guaranteed interest rate is linked to the government bond yield. If interest rates decline, the maximum guaranteed rate declines as well. In addition, the interest rate guarantees effectively offered by insurers – if there are any – are only valid for the subsequent year. Insurers are free to credit bonuses if investment performance allows. With a solid investment strategy, this ensures a positive spread and greatly reduces interest rate risk for the insurer. In addition, the duration of the contracts is shorter compared to other countries, with full tax benefits available after only eight years. At the time of surrender, the sum of net premiums paid plus accumulated profits is paid to the policyholder (partial surrenders are also possible). However, lapse risk is mitigated by strong tax incentives and by interest rate guarantees that are flexible and likely to increase along with market rates.³⁶

³⁴ The initial phase comprises 5 or 10 years, depending on the terms specified in the contract. One risk with single premium whole life is that early death may cause losses for the insurance company. This risk can be eliminated by deferring the full death benefit 5 or 10 years, which allows the insurer to offer policies at a lower price and/or earn a higher margin.

³⁵ In Japan, yen and foreign currency denominated fixed annuities and whole life insurance have also been very popular in recent years. However, these policies have a market value adjustment for surrender values, which greatly reduces the risk of a loss for the insurer when interest rates surge.

³⁶ The tax rate decreases with the duration of the contract since inception and ceases after eight years.

Interest rate risks in the US and German markets are significant, whereas they are manageable in France.

The exposure of life insurance products to interest rate risk varies significantly. Major product characteristics and their impact on interest rate sensitivity are summarised in Table 2. In some countries, such as Germany, low interest rates pose a serious challenge to the industry, while for some business segments in the US, for example, both low interest rates and their rapid rise would be problematic. Meanwhile, in France, life insurance savings products are relatively flexible and have been very successful in the last 20 years.

Table 2:
How product characteristics influence insurers' interest rate exposure in different markets

	German "Kapitallebensversicherung"	US "Deferred Annuities"	US "Universal Life"	US "Whole Life"	Canadian "Universal Life"	Spanish "Capitales Diferidos"	Japanese "Single Premium Whole Life"	Italian "Polizze Rivalutabili"	French "Assurance Vie – Fonds Général en Euros"	UK "Endowment Assurance"
Market relevance										
High premium share in total life market	High	High	Medium	Medium	Medium	Medium	Medium	High	High	Low
Product features that increase interest rate sensitivity										
Inflexible interest rate guarantee	High	High	High	High	High	High	High	Medium	Low	Low
Option to increase sums insured/accounts with initial interest rate guarantee level**	Medium	Medium	High	Low	High	Low	Low	Medium	Low	Low
No market value adjustment to surrender values	High	High	High	High	Low	High	High	High	High	Low
Insignificant, limited, or no surrender charge	Low	Medium	Low	Low	Low	Low	High	Medium	High	Medium
No tax benefit	Low	Low	Low	Low	Low	High	Low	High	Low	Low
Risk Scenario										
Interest rates decline or stay low for long	High	High	High	High	High	High	Medium	Medium	Low	Low
Interest rates surge	Medium	High	Medium	Medium	Low	Medium	High	High	Low	Low

* Sums insured in the first five to ten years are limited to the single premium payment.

** These options are available depending on the contract terms or only on special occasions such as marriage or the birth of a child.

Colour key:

- Results in high interest rate exposure for insurers
- Results in medium interest rate exposure for insurers
- Results in low interest rate exposure for insurers

Source: Swiss Re Economic Research & Consulting

In today's low interest rate environment, there are concerns that the global life insurance industry will suffer the same fate as Japanese life insurers in the late 1990s.

Losses in foreign currency holdings led to cutthroat sales of life insurance products and aggressive investment practices.

Life insurers clung to their high guarantees despite falling bond yields and deteriorating stock markets.

A loss of credibility triggered a spike in surrenders.

A Japan-style life insurance industry crisis? Not likely.³⁷

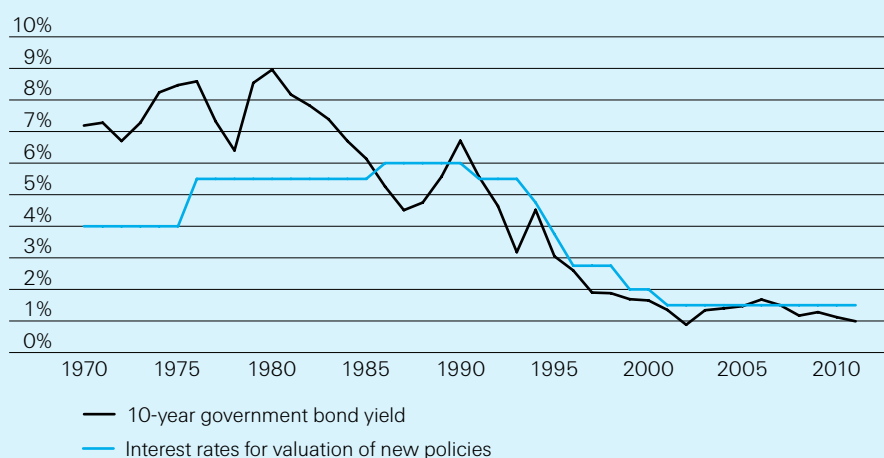
In April 1997, the bankruptcy of Nissan Mutual Life heralded the Japanese life insurance crisis, followed by another seven major life companies being liquidated or taken over by domestic or foreign companies by 2002. In the current low interest rate environment, there are concerns that what happened in Japan in the early 2000s could be the present fate of the global life insurance industry.

Between 1985 and 1986, Japanese life insurance companies suffered significant losses in foreign currency holdings as a result of the 50% appreciation of the yen. To make up for these losses, life insurance companies increasingly invested in the booming Japanese stock market and aggressively sold policies to increase assets under management, guaranteeing up to a 6% return for long-term life insurance savings products.

When it rains it pours. In 1990, the stock market bubble burst and, in the following years, equity returns and bond yields dropped significantly, leading to a further deterioration of balance sheets. However, insurers did not reduce guaranteed rates for new policies substantially until the mid-1990s, even though the guarantees were far above the market yields achievable in the deflationary economy. In other words, the life insurance industry was constantly operating in a negative spread environment.

Pressured to keep new business sales high in order to keep cash flows positive, insurers offered overly generous guarantees. However, money was attracted at high cost to pay out maturing policies and the credibility of the system eventually suffered. Because surrender values were guaranteed and there was no market value adjustment, surrenders skyrocketed and the system eventually reached breaking point.

Figure 8:
Interest rates for the valuation of new policies from 1970 to 2011



Sources: FSA, Fukao, and the Japan Center for Economic Research (2004)

³⁷ See also Kashyap, Anil K., 'Sorting Out Japan's Financial Crisis', Federal Reserve Bank of Chicago, Economic Perspectives, vol. 26, no. 4, 2002, pp. 42-52, 2012, http://www.chicagofed.org/webpages/publications/economic_perspectives/2002/4qpart4.cfm and Lacu, Cyrille, 'Life Insurance: The Other Dimension Japan's Financial Crisis', La Lettre du CEPII, no. 196, December 2000, <http://www.cepii.fr/anglaisgraph/publications/lettre/summary/2000/let196ang.htm>.

The life insurance breakdown in Japan was the result of an accumulation of many negative trends, including a decline in interest rates.

In the Japanese life insurance industry, a deteriorating macroeconomic environment, management failures, poor product design, risky asset management and regulatory and systemic weaknesses had accumulated over many years and resulted in the industry's desolate condition. By today's standards, many companies would have been technically insolvent much earlier, but at the time they were able to continue writing policies that could not be serviced. Low interest rates simply marked the tipping point that ended an already hopeless situation.

The loss burden was shared among insurer shareholders, policyholders and taxpayers.

As a result, the Life Insurance Policyholders Protection Corporation of Japan (PPCJ) was set up in 1998 and is now run under the auspices of the Financial Supervisory Agency of Japan (FSA). It was meant to manage the books of insolvent insurers until another company took the book onto its own balance sheet. Instead, PPCJ has had to be funded by both the insurance industry and the government. Policyholders also paid a price: for both individual and group insurance, policyholders faced a 10% haircut on their policy reserves. For policies with high interest rate guarantees, the sum insured and surrender value cuts were more drastic.

The Japanese life insurance industry has made significant progress since the crisis.

In Japan, significant progress has been made with respect to guaranteeing savings-insurance contracts, strengthening accounting rules and assessing policy risk. By lowering guarantee levels, life insurers were able to gradually improve spread margins. In recent years, spread margins have again come under pressure, but Japanese life companies also earn profits on their life risks and fees, helping to offset negative investment margins.

As the Japan case illustrates, life insurers can operate successfully in a low interest rate environment.

It is worth highlighting that the challenges that life insurers face stem from the transition from a high to a low interest rate environment, rather than from any specific level of interest rates. Once the transition to low interest rates is completed and products are adjusted, life insurers can successfully operate in a low interest rate environment, as the Japanese life insurance industry example shows.

Today's global life insurers are generally in better shape than Japanese insurers were in the 1990s.

Today's global life industry is in much better shape than Japan's life insurance companies were in the 1990s. Balance sheets are strong, risk management has improved, products have been re-priced and redesigned, and regulation is now more risk-based and provides better guidance. Despite the current low interest rate environment, another Japan-style industry breakdown is unlikely in the near future.

MCEV reports provide an indication of an insurer's interest rate sensitivity.

MCEV/EEV sensitivities vary significantly across regions.

Reported interest rate sensitivities

Market Consistent Embedded Value (MCEV)³⁸ reports show the economic value of re/insurance companies and how it changes over time. Unlike accounting reports, MCEV reports provide an economic view of the value of a life insurance company by valuing assets and liabilities on a market-consistent basis. The change in MCEV over a period of time (ie the economic profit) can be attributed to various factors, such as the amount of new business, mortality and morbidity experience, as well as to changes in the level or volatility of interest rates. Companies compliant with MCEV principles also report the sensitivities of different lines of business in terms of interest rates, equity markets, expenses, mortality/longevity and morbidity assumptions.

In Table 3, the interest rate sensitivities of 33 companies, for which MCEV and European Embedded Value (EEV) reports are available for the years 2009 to 2011, are grouped by country or region of origin.³⁹ The table shows that:

- companies domiciled in central and northern European markets, where guarantees are typically long term and rigid, are the most exposed to further declines in interest rates. Moreover, the interest rate sensitivity of companies in these markets has increased over time as interest rates have continued to decline, leading to an increase in the value of guarantees. At the end of 2011, a decline by another 100 basis points would have eliminated 56% of the MCEV.
- in Japan, life insurance company interest rate sensitivity is also high, but did not increase during this period. This is not surprising as interest rates in Japan have been low and on the stable side for a decade.
- in southern Europe and France, interest rate sensitivity is lower than in central and northern Europe. This lower sensitivity likely reflects more flexible guarantees and the higher government bond yields in the countries of southern Europe.
- in the UK, life insurance business is not very interest rate sensitive, due to the fact that the life insurance industry is increasingly focusing on business that is not sensitive to interest rates, such as unit-linked and protection products as well as payout annuities.
- life reinsurance, which is focused on risk business, is not interest rate sensitive. In contrast to primary life insurance companies, whose mainstay is savings business, the future profit of life reinsurers is only marginally impacted by lower interest rates. The positive interest rate sensitivity is due to the effect of discounting (ie future profits have a higher present value when discounted at a lower discount rate).
- interest rate sensitivities are asymmetric. A decline in interest rates typically affects MCEV more than an increase in interest rates, mirroring the fact that the downside – once interest rates are close to the guarantee level – is borne by the insurance company, while the upside is shared with policyholders.

³⁸ MCEV was developed by the European Insurance CFO Forum and succeeds the European Embedded Value (EEV) framework. The MCEV concept is described at http://www.cfoforum.eu/embedded_value.html.

³⁹ Many of the companies analysed have a strong international or even global presence and write business in countries with different product designs and interest rate sensitivities, which makes country-specific conclusions difficult. However, some companies provide market-specific MCEV figures in their reports.

Table 3:
MCEV/EEV sensitivities to a decline in interest rates by 100 basis points

	2009	2010	2011
Central and northern Europe ¹	-10.7%	-12.7%	-56.1%
Japan ²	-11.7%	-10.7%	-8.0%
Southern Europe and France ³	-5.2%	-3.9%	-7.9%
UK ⁴	1.2%	1.1%	-1.7%
Reinsurance ⁵	0.2%	0.7%	1.2%

- ¹ Aegon, Ageas, Allianz, Delta Lloyds, Eureko/Achmea, Munich Re (primary life insurance book), SNS REAAL, Storebrand, Swiss Life, UNIQA, Vienna, Zurich
² Sony Life, Himawari Life
³ AXA, CNP, Generali, Mediolanum
⁴ Aviva, Old Mutual, Phoenix, Resolution, SJP, Standard Life
⁵ Hannover Re, Munich Re (life reinsurance only), SCOR

Sources: company MCEV/EEV reports for 2009 to 2011

The accounting view: how a sharp rise in interest rates would affect equity capital

Accounting mismatches...

Accounting frameworks can lead to a distorted view of the impact of interest rate changes. For example, under US GAAP, assets are accounted at market prices, whereas liabilities are accounted at book value. These accounting mismatches also occur when companies reporting under IFRS apply US GAAP for valuing life insurance contracts.

...have recently boosted insurers' accounting capital.

As a result, insurers' equity capital reported in their accounting financial statements has been boosted by the significant drop in interest rates in the wake of the financial crisis. The boost occurred because the market value of their fixed-income assets increased, while insurance liabilities remained constant at their book values. Indeed, part of the improvement in insurers' equity capital in recent years can be attributed to accounting effects that are likely to disappear as interest rates rise or these fixed-income investments mature.

Insurers' accounting capital could decline by about 10% if interest rates rise by 100 basis points.

Insurance companies often state the interest rate sensitivity of their US GAAP or IFRS equity in their annual reports and presentations to investors. According to the stated interest rate sensitivity in 2011 reports, an increase in interest rates of 100 basis points could deplete about 10% of insurers' accounting capital.

Table 4:
The impact of a 100 basis point increase in interest rates on insurers' shareholder equity in 2011

Sample	Impact on shareholders' equity, net of tax
5 global primary insurers	-11.5%
4 large reinsurers	-10.5%

Note: The 5 global primary insurers are Allianz, Zurich, Generali, AVIVA, and RSA. The 4 large reinsurers are Partner Re, Munich Re, Swiss Re and SCOR.

Sources: Company financial statements, Swiss Re Economic Research & Consulting

Accounting effects matter and are likely to have an impact on market conditions.

Accounting mismatches matter because accounting financial statements, despite their well-known flaws, are the main way in which insurers communicate with investors. Therefore, accounting figures are still important for insurance companies, even though relying on them for decision-making may have awkward consequences. For example, some companies may decide to hedge the interest rate impact on their accounting balance sheet, making them vulnerable to economic mismatches.

How can insurers mitigate interest rate risk?

Managing interest rate risk

Insurers' asset management is driven by their liability structures.

Modern Portfolio Theory (MPT)⁴⁰ has in recent decades become best practice among asset managers. However, insurers must evaluate investments in the context of their insurance obligations and various regulatory restrictions, and MPT only partially meets their needs.⁴¹ Asset-Liability Management (ALM), in contrast, provides the broader perspective that insurers need when investing, with a framework for simultaneously managing multiple risks such as liquidity, inflation and interest rate risk. Interest rate risk management is done through duration matching of assets and liabilities. Were an insurer able to perfectly match the timing of its asset and liability cash flows, interest rate fluctuations would pose no economic risk. However, perfect matching is hampered by various factors.

A lack of long-term assets complicates insurers' ALM.

One challenge that makes it difficult for insurers to match the duration of their assets with their liabilities stems from the lack of sufficiently long duration financial instruments. Figure 9 plots the technical provisions of non-life and life insurers⁴² against outstanding government bonds in the major markets to provide an indication about the availability of long-term investments. In some markets, the sum of all government bonds with a maturity greater than five years falls short of technical provisions. In the US, the average maturity⁴³ of government bonds is a mere 6.1 years, in Germany 7.4 and in the UK 14.3. Not only insurers, but also pension funds, have a high demand for long-term investments, making the lack of long-term investment opportunities even more precarious.

Derivatives used for ALM have additional counterparty risk.

Apart from investing in bonds with different maturities, insurers also use derivatives for duration matching. However, the use of derivatives introduces the additional counterparty risk that the bank on the other side of the transaction will no longer be in a position to honour its payments when they come due, which could be significant in the context of long-term contracts.

Insurers may deliberately tolerate ALM mismatches.

Independent of the challenge of finding suitable long-term investments, insurers may not always seek to precisely match the duration of their assets and liabilities because such a strategy could be inflexible. In addition, many insurers deliberately choose to create a mismatch if such a strategy allows them to generate incremental returns.

Regulatory and reporting requirements could make ALM mismatches more expensive in the future.

In reality, duration mismatches are quite common, be it due to a conscious investment decision or to a lack of suitable investment opportunities. However, in the future, regulatory requirements such as Solvency II will make duration mismatches more expensive, and economic reporting requirements such as MCEV will make ALM mismatches more transparent, which will prompt insurers to increasingly seek to close such gaps.

⁴⁰ Modern Portfolio Theory is a theory of finance that attempts to maximise the risk/return profile of an investment portfolio. It was developed in the 1950s by Nobel laureates Harry Markowitz and William Sharpe.

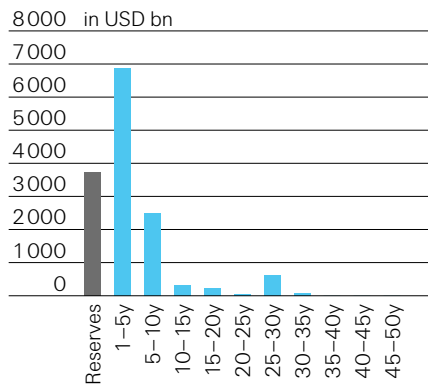
⁴¹ For a discussion of asset management in insurance, see Swiss Re, *sigma* No 5/2010, "Insurance investment in a challenging global environment".

⁴² Technical provisions for unit-linked products were excluded since policyholders usually bear the asset risk for these products and they often select investments that are geared towards equities.

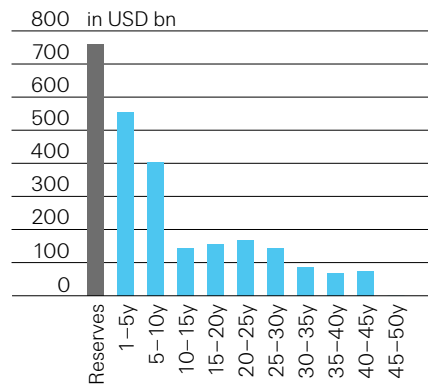
⁴³ Weighted by notionals.

Figure 9:
**The technical provisions of non-life
and life insurance companies versus
outstanding government bonds**

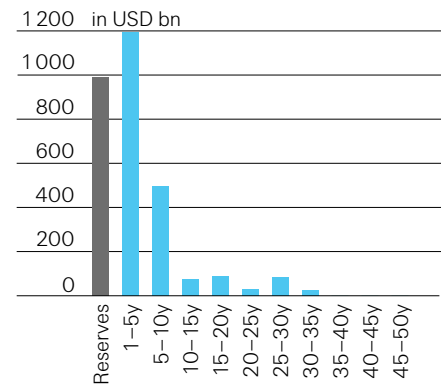
United States



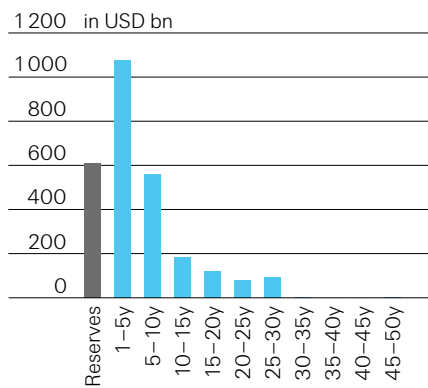
United Kingdom



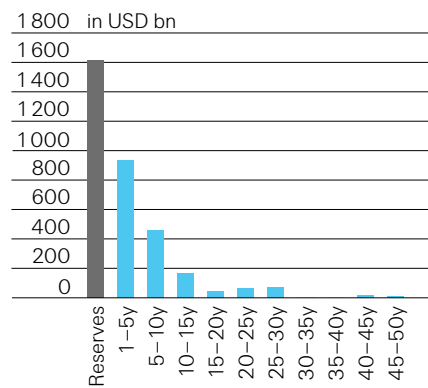
Germany



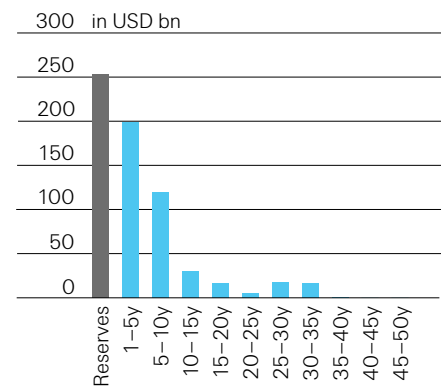
Italy



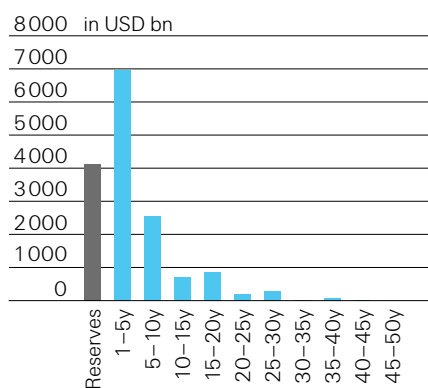
France



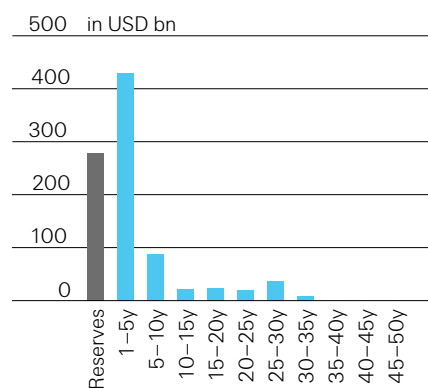
Netherlands



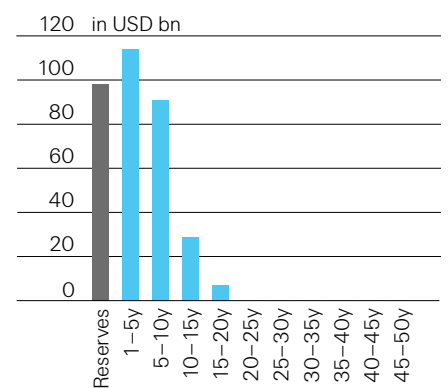
Japan



Canada



Australia



Notes: The scale of the Y-axis differs from market to market. The data shown excludes loans to governments that are not securitised.
Data for Germany includes debt securities of individual German states (Länder). Reserves backing unit-linked contracts are excluded.

Sources: Bloomberg, Supervisory Authorities, Insurance Associations, Swiss Re Economic Research & Consulting

Hedging policyholder behaviour risk is challenging.

Although policyholder behaviour analysis is key, it is likely not yet well understood.

“Dynamic hedging” entails additional risks.

Changing the product design provides an alternative to complex hedging strategies.

Hedging policyholder risk

Beyond the above-mentioned challenges, ALM is complicated by the fact that policyholder behaviour can increase the uncertainty surrounding future cash flows. Insurers have therefore designed hedging strategies to mitigate their exposure to interest rate risk arising from policyholder behaviour based on models designed to capture policyholder reactions to interest rates fluctuations. However, these hedging strategies face an uphill battle because:

- *policyholders may not react completely rationally to moves in interest rates*, for instance, because they are not aware of the economic value of their options, are not aware or forget that they could exercise them, or simply because of inertia.
- *policyholder behaviour may be driven by factors other than interest rates*. For example, developments in housing markets, concerns about the insurer’s solvency, or liquidity needs could also be important drivers of policyholder behaviour. These possibly interdependent factors would also need to be included in a comprehensive model.
- *incomplete information may mislead insurers about policyholder behaviour*. A lack of adequate historic data for modelling and data containing white noise makes policyholder behaviour difficult to analyse. Policyholder behaviour may also change in the future as financial literacy or information improves.

Policyholder behaviour analysis is clearly crucial for managing life savings products with embedded options for policyholders, but it is less clear how accurate the models are in capturing this behaviour.⁴⁴

Again, an additional challenge arises from the fact that the financial instruments required to implement such hedging strategies based on policyholder behaviour are often not available or are very expensive for long durations. Insurers therefore tend to use “dynamic hedging” strategies (ie buying a new hedge when the previous one expires), even though there is the risk that the hedges may be too expensive or not available when they need to be rolled over, as can be the case in times of financial turmoil.

Given the difficulties of hedging for policyholder behaviour arising from embedded options, the economic costs of such options clearly need to be weighed against the policyholder benefits. If the costs of certain options and guarantees exceed the price that policyholders are willing to pay, product features should be adjusted.

⁴⁴ See Jeremy Kent, Corinne Legrand, and Ed Morgan, ‘Dynamic Policyholder Behaviour Survey’, Milliman (2009), <http://de.milliman.com/pdfs/dynamic-policy-behaviour-survey.pdf>.

Mitigating policyholder risk through product design

Product design is key for managing interest rate risks.

Product features are the key determinant of the risk insurers eventually have to bear. As such, product design is the first step in risk management.⁴⁵ The life insurance product landscape differs from market to market. In some markets, savings products are the predominant offering, whereas in others they are less important; even within savings products, the characteristics can differ significantly across and even within markets. As a consequence, insurers' exposure to interest rate risk depends on which markets they are operating in and which types of products they offer.

Products need to strike a balance between policyholder options and insurer hedgeability.

Looking ahead, new product features should be designed in such a way as to effectively manage financial, life and policyholder behaviour risks. Attention should be paid to the strong link between financial guarantees and options and policyholder behaviour. A good product balances policyholder flexibility reflected in product options and the insurer's ability to manage the risks arising from those options. Since modern life insurance products combine life risks with financial risks, actuaries and asset managers must cooperate in product development.

Product features significantly affect the interest rate sensitivity of life insurance savings products.

Among savings products, there are a variety of design features that can reduce sensitivity to changes in interest rates. The most relevant are the:

- *level of the guarantee*: the lower the guarantee, the less likely market rates will breach the guarantee rate.
- *flexibility of the guarantee*: if guarantees are flexible upward and downward, the portfolio will be less sensitive to interest rate changes.
- *duration of the guarantee*: policies can offer an annual guarantee or a lifetime guarantee. Lifetime guarantees are more efficient because low yield years can be offset over time with high yield years.
- *duration of the business*: if life insurance contracts contain inflexible guarantees, contracts that run over decades are more exposed to interest rate moves than shorter ones. Moreover, in many markets duration-matching assets are not available for very long-term business.
- *surrender features*: since policyholder behaviour can foil effective ALM and hedging, surrender features are important. The higher the surrender charge, the less a policyholder is likely to lapse. Also, surrender at market value mitigates the risk of policyholders lapsing their policies once interest rates rise, which would result in a loss for the insurer.
- *right to increase payments/sums insured*: not granting the right to increase payments or sums insured eliminates the risk that policyholders increase their contract payments when interest rates are low, thereby improving hedgeability.

There are various examples of marketable product features that limit interest rate sensitivity.

There are examples of guarantees that are marketable and limit interest rate sensitivity. One such product feature is a guarantee with a limited term that is periodically reset according to prevailing market conditions, which greatly reduces the cost of the guarantee (this type of guarantee is common in France). Another kind is a guarantee due only at maturity to allow for more flexibility in investing and earning market risk, credit risk and illiquidity premia (this kind of product feature exists in Italy). Or, another example is a guarantee in which policyholders can surrender their policies but only at market values. This is because the insurer may realise a loss on the underlying assets if interest rates have risen and surrender values are not adjusted for market fluctuations.

Regulators and legislators need to consider the key role of product design.

Naturally, some product features are regulated or required by law and cannot be changed at the discretion of the insurer. Nevertheless, product design plays a key role in determining the risks for insurers. Regulators and legislators need to bear this in mind when setting the framework within which insurers operate.

⁴⁵ One obvious strategy to mitigate interest rate exposure is to adjust the business mix. Companies can attempt to write more non-life, unit-linked, and protection business. However, there are limits to this approach as these products are not perfect substitutes for traditional life insurance savings products.

To make products attractive, the benefits and costs of embedded options need to be balanced.

Economic valuation frameworks such as MCEV and Solvency II provide more transparency about the cost of guarantees and options.

In a simple guarantee product with no mortality protection or other options ...

... the cost of a fixed-interest rate guarantee increases disproportionately with the maturity.

Balancing the cost and benefits of insurance options and guarantees

A key area that deserves more attention is the economic costs of financial options and guarantees and policyholders' willingness to pay for them. Of course, policyholders would like to have interest rate guarantees for as many years as possible, and would also like other features such as generous surrender options. However, such guarantees and options come at a cost that is borne either by the policyholder or the insurer. The challenge is to strike a balance between the benefits of embedded options and their cost to make life insurance savings contracts more attractive to policyholders.

As a first step, insurers need to be aware of the costs of such options and guarantees. The cost of financial options and guarantees is becoming more transparent because regulatory and complementary reporting requirements are increasingly aligning with economic valuation standards. For example, MCEV requires insurance companies to consider dynamic policyholder behaviour and the associated costs.⁴⁶ Also, under Solvency II, the calculation of technical provisions should take significant policyholder options into account.⁴⁷ In a world where investors rely increasingly on market consistent valuation, the pricing of guarantees and options should also follow economic principles.

Figure 10 shows the upfront hedging costs of an interest rate guarantee for different maturities and guarantee levels.⁴⁸ The illustration assumes that the insurer invests in bonds with a 7-year maturity, reinvesting each year in new 7-year bonds as bonds mature, with the result that one seventh of the book is reinvested each year. The insured receives the portfolio yield, but no less than the guarantee. For reasons of simplicity, this is a pure financial product without any lapse options, mortality protection or administrative costs. In the illustration, the current portfolio yield of 7-year euro-denominated bonds is 3.3%, based on a trailing 7-year book of bonds.

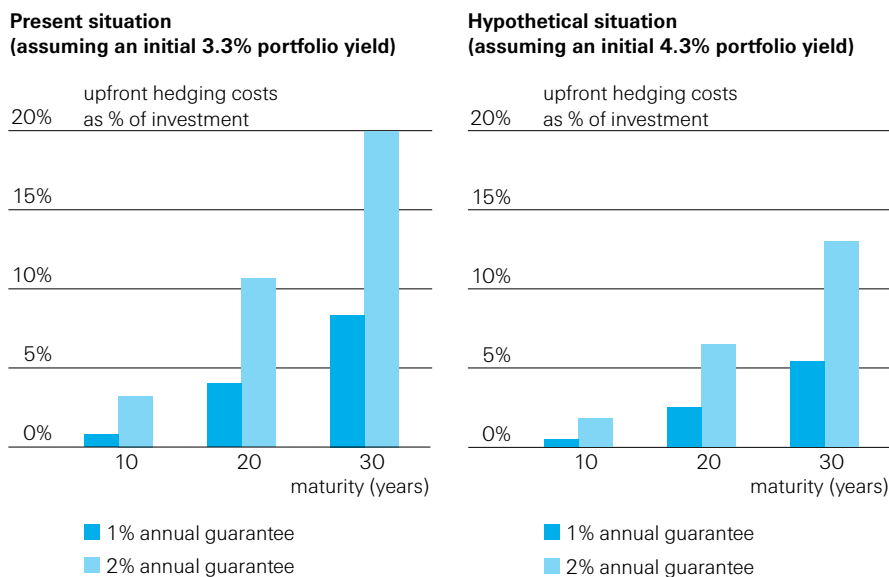
If a policyholder were to buy a contract with a 2% interest guarantee on a nominal value of EUR 1 000 for a 10-year period, the cost of the guarantee would amount to around 3% in the present market environment, and therefore EUR 30 would need to be spent upfront on hedging costs. For a 20-year contract, hedging costs would increase to about EUR 110 and for a 30-year contract, to about EUR 200. Hedging costs increase disproportionately with the duration of a guarantee. Even a 1% guarantee, a level that would have found no buyers only a few years ago, would cost about EUR 85 if granted for 30 years. In a higher interest rate environment (4.3% in the right panel of Figure 10), a 2% guarantee would still cost EUR 130 for a 30-year term, which is not an unusual duration for savings business.

⁴⁶ Technically, costs associated with policyholder behaviour are included in the time value of guarantees and options.

⁴⁷ In QIS4, dynamic policyholder behaviour must be considered, but only for calculating technical provisions. There is no explicit reference to policyholder behaviour for calculating the solvency capital requirement.

⁴⁸ Hedging costs depend on the market situation at the time of pricing and are hence subject to changes.

Figure 10:
The approximate cost of guarantees at different levels and maturities



Source: Swiss Re

Research about policyholders' willingness to pay for embedded options in life insurance products is still at an early stage.

There are some intuitive reasons why policyholders may not be willing to pay enough for certain options that are currently included in many contracts.

Flexible guarantees may be more attractive to policyholders due to the economic costs of fixed long-term guarantees.

Would policyholders be willing to sacrifice 20% of their premium payment for a 30-year guarantee or would they prefer a 10-year guarantee that is reset every decade according to a predefined function of market yields (eg 60% of a prevailing reference yield)? Although an analysis of policyholders' willingness to pay for contract-embedded guarantees and options is beyond the scope of this *sigma*, recent research indicates that individual willingness to pay for financial guarantees in insurance contracts would be below the production price of the guarantee.⁴⁹

Intuitively, there are reasons why customers would consider some commonly granted embedded options too expensive were they to see a price tag on them at the point of sale. For example, how much would policyholders be willing to pay for an option that allowed them to increase future payments at original terms? Would they realise the value of such an option or would they consider it as "nice to have"? In any case, if such options and guarantees were not correctly priced, insurers would incur a loss. If, however, these features were correctly priced but exceeded the customer's willingness to pay, the policy would not sell or policyholder money would be wasted.

While at first sight, guarantees appear more attractive when they are long-term, fixed, and at high rates, this is not necessarily the case when all the economic costs associated with them are taken into account. More flexible guarantees are less expensive than fixed guarantees and can therefore reduce the price of insurance for all parties involved. Moreover, flexible guarantees, such as those due at maturity instead of those credited annually, increase insurers' investing flexibility. This, in turn, can improve the investment return and allow insurers to pay out higher policyholder bonuses.

⁴⁹ See Nadine Gatzert, Carin Huber, and Hato Schmeiser, 'On the Valuation of Investment Guarantees in Unit-linked Life Insurance: A Customer Perspective', *The Geneva Papers on Risk and Insurance*, vol. 36, no. 1, 2011, pp. 3–29.

Interest rate scenarios

Whereas most forecasters expect interest rates to remain low over the short term, the outlook for interest rates over the medium to long term is uncertain. To better test the waters ahead, three distinct interest rate scenarios and their implications for the insurance industry are analysed below. The first scenario examines what happens when interest rates gradually rise and fall. The second looks at the impact of a period of prolonged low interest rates. The third investigates the effect of a sudden, inflation-driven surge in rates. As a starting point for each scenario, it is assumed that both nominal long-term government bond yields and inflation rates are around 2%. The first scenario is the standard business cycle model that seems to be implicitly assumed in many insurance operations. The other two scenarios describe situations that would entail severe challenges for the industry. They represent two extremes with a variety of possible other scenarios in-between.

Scenario one: a gradual cycle of rising and falling interest rates

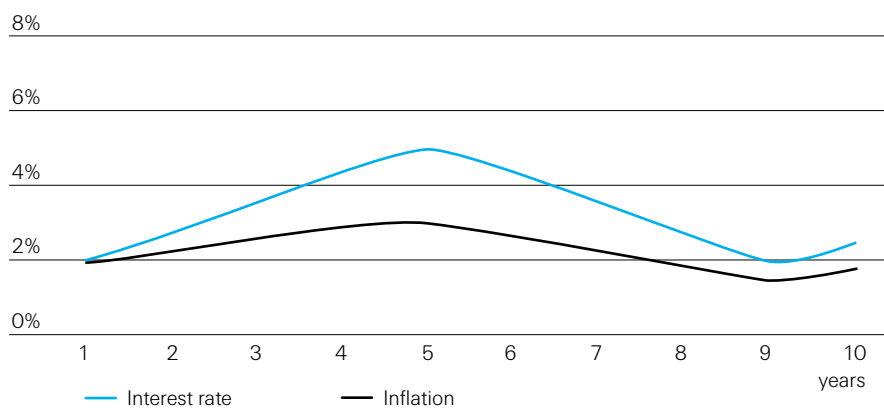
Scenario one: a gradual economic recovery leads to a gradual increase in both nominal and real interest rates.

In this standard business cycle scenario, the global economy recovers gradually. As markets start to anticipate that central banks will normalise policy rates from their current low levels, long-term interest rates begin to rise. Actual inflation and inflation expectations increase only moderately from their current levels of around 2% because central bank rate hikes are preventing the economy from overheating.

After a few years, a renewed economic slowdown lowers nominal and real interest rates again.

After a few years of economic expansion, the economy begins to show signs of a gradual slowdown, leading to a shift in market expectations and to monetary policy easing. Slower growth expectations and lower policy rates drive long-term interest rates downwards. After a few years of slower growth and a brief recession, interest rates bottom out and only increase again once central bank interest rates are low enough to foster positive economic expectations and allow for inflation to pick up.

Figure 11:
Interest rates and inflation in a standard business cycle scenario



Source: Swiss Re Economic Research & Consulting

Impact on life insurers

The mean-reverting scenario is a favourable scenario for life insurers.

This is the ideal scenario for life insurers. Demand and profitability may fluctuate with interest rates, but better and worse years offset each other over time. There is no pressure to adjust pricing and guarantees. Instead, life insurers shelter their policyholders from these market fluctuations. Policyholder behaviour is unlikely to deviate strongly from underwriting assumptions and can be managed by setting guarantees at relatively low levels while more emphasis is put on bonuses to reduce lapses during phases of rising interest rates.

Life insurers would nevertheless have to prepare for more unfavourable scenarios.

However, since such a scenario could always be followed by a sharp increase in interest rates or, alternatively, could eventually lead to a situation where interest rates remain low for an extended period, life insurers still have to revise their life insurance savings product features.

Impact on non-life insurers

Non-life business profitability would remain stable under this scenario ...

This scenario is also a good one for non-life insurers. Because rising interest rates would not be driven by an unexpected surge in inflation, claims would not exceed reserves and hence, profitability would not suffer (provided that assets and liabilities are duration-matched).

... while new contracts could be re-priced (although there are good arguments to keep pricing stable despite interest rate changes).

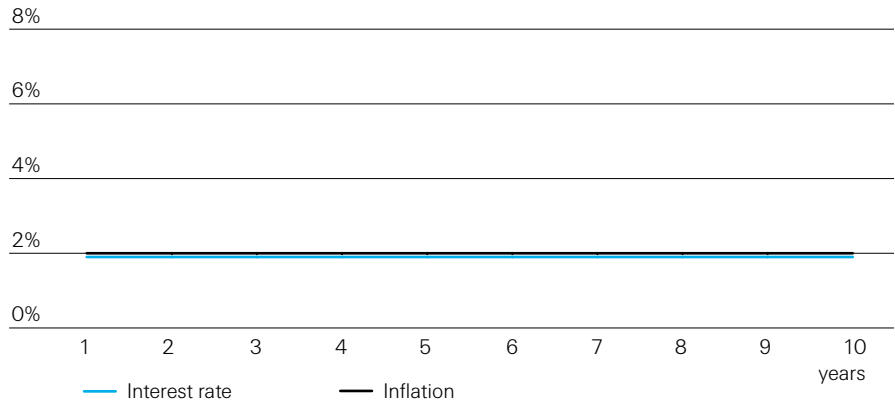
With periods of low interest rates alternating gradually with those of high interest rates, insurers are likely to only adjust premium rates marginally. Therefore, profitability improves as interest rates increase (relative to the average interest rate used for pricing and again assuming there is no unexpected inflation) and worsens as interest rates fall again. As in life insurance, good and bad years would offset each other over the cycle. Keeping prices relatively constant in such a scenario has its advantages if policyholders are informed and appreciate that insurers are sheltering them against interest rate induced premium changes.

Scenario two: interest rates remain low for a decade due to modest growth and inflation.

Scenario two: a prolonged period of low interest rates

In this scenario, interest rates and inflation remain around their current low levels for a decade. Low economic growth and very moderate inflation push central banks towards expansionary monetary policies. Monetary expansion does not lead to a rise in inflation because overly leveraged banks and consumers opt to reduce debt rather than lending or spending it, preventing the economy from overheating. As a consequence, long-term government bond yields remain close to their current levels for the next ten years.

Figure 12:
Interest rates and inflation under a scenario of a decade of low interest rates



Source: Swiss Re Economic Research & Consulting

Impact on life insurers

Under this scenario, life insurers with long-term rigid interest rate guarantees suffer as investment income falls short of expectations and policies stay longer than expected on their books.

Due to attractive interest rate guarantees, policyholders would likely stick to their policies and extend the duration of their contracts or increase the sums insured where possible. Insurers offering savings products may have difficulties honouring the guarantees on contracts written when interest rates were higher. The guaranteed interest rate may exceed the yield an insurer can earn in the market and would weigh on profitability, slowly eroding shareholder capital. In markets with high interest rate risk exposure, weak players could eventually face having to stop writing new business, restructure their balance sheets, go into run-off, or be taken over by competitors.

The life insurance industry would be able to operate profitably once the transition to low interest rates is over.

Life insurers could adjust the guarantee level and design more flexible products to prepare for the interest rate wave.

Non-life insurers would suffer from lower profitability, but they would be able to re-price the business more rapidly.

After the adjustment period from a high to a low interest rate environment is over, life insurance can operate profitably again, as evidenced by the example of the Japanese life insurance industry (see Box: "A Japan-style life insurance industry crisis? Not likely"). The absolute level of profitability may be lower, but this would be the case for many companies in almost all industries under this scenario. Insurers still demand their share of the investment return exceeding the guaranteed rate, but at a lower guarantee level.⁵⁰ Insurers are also likely to seek higher margins on the underwriting side, be it through risk selection, better underwriting, or higher risk charges. In such a low interest rate environment, policyholders would pay a higher premium to obtain the same level of protection or benefit, likely resulting in lower demand. Moreover, operational cost pressures would continue to increase.

The long period of low interest rates and profitability would likely lead to adjustments in the characteristics of the products offered. More flexible guarantees would be introduced and – ideally – surrender options would be adjusted. For example, contracts could be adjusted so that policyholders may lapse at any time, but there would be a market-value adjustment to surrender values. Or guarantees could be paid only at maturity. Such measures would reduce the risk of policyholders lapsing to benefit from higher market yields should rates begin to rise again.

Impact on non-life insurers

Non-life insurers profitability also suffers in an environment of persistently low investment returns. However, the period of low profitability would likely be only temporary as insurers would gradually raise premium rates to compensate for the ongoing low investment yields. Unlike life insurers, adequately duration-matched non-life insurers do not face legacy problems because policyholders are not able to extend their contracts at will (since contracts are usually re-priced annually). In addition, low inflation helps long-tail lines of business, such as casualty, if inflation was assumed to be higher when the contracts were priced. Therefore, claims reserves should prove to be more than sufficient.

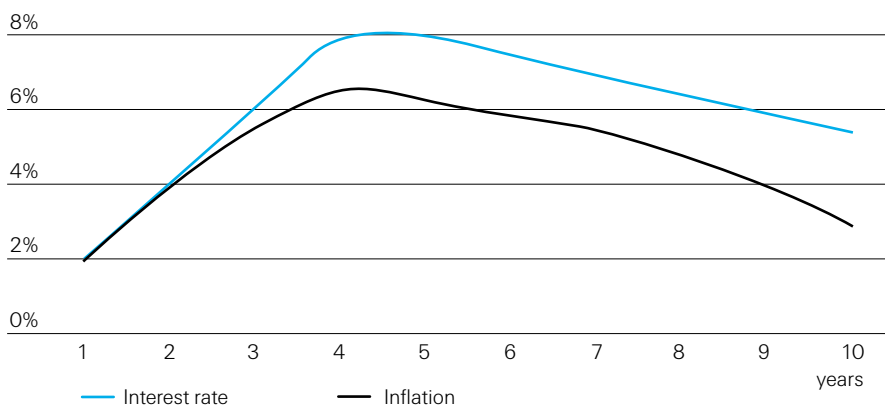
⁵⁰ In many markets, profit sharing is regulated anyway, meaning that insurers are allowed to take their share in investment income above the guaranteed rates.

Scenario three: an inflation spike leads to a surge in nominal bond yields.

Scenario three: an inflation-driven surge in interest rates

In this third scenario, the global economy recovers quickly, but central banks react too slowly to prevent a rapid rise in inflation. Increasing inflation expectations lead to a sharp rise in nominal bond yields. Inflation only stabilises once central banks start tightening monetary policy aggressively, albeit at levels that are clearly above central bank target rates. To bring inflation back on target, monetary policy remains very tight for several years. Over time, inflation and interest rates decline gradually.

Figure 13:
Interest rates and inflation under a scenario of an inflation-driven surge in interest rates



Source: Swiss Re Economic Research & Consulting

Impact on life insurers

This scenario would be very stressful for life insurers geared towards interest rate sensitive savings business.

This is a “when it rains, it pours” scenario for insurers with large, interest rate sensitive savings books. Policyholders with savings contracts promising low guarantees are inclined to surrender their policies and exchange them for new contracts offering higher interest rates. Life insurers are not only unable to recoup production costs for recently issued policies, but may also have to sell the fixed-income assets backing those liabilities at a loss (since bond values move down when interest rates increase).

Risk products would not be affected significantly.

Policyholders with risk products such as term insurance also have an incentive to surrender their in-force policies since new policies are likely to be cheaper. However, the higher the age of the policyholder, the higher the corresponding mortality charges would be, offsetting the benefit of higher interest rates. Most policyholders would therefore probably tend to keep their policies, with the result that life insurers with a focus on life risk products are only marginally affected.

Lapse risk would surge for savings business with generous lapse features.

The main risk that arises from this scenario lies in savings business. Since hedging for policyholder behaviour such as lapsing is difficult, insurers need to find measures to prevent policyholders from lapsing. For example, insurers can decide to increase policyholder bonuses to sweeten the yields on low-guarantee products. Naturally, this reduces profitability, but may nevertheless be preferable to tolerating a massive surge in lapses that could cause even higher losses.

For new business, product features would need to be adjusted.

In-force pension business would not suffer materially, but demand could increase on the back of more attractive annuity rates.

Non-life insurers with long-tail business would suffer from unexpected inflation that drives up claims costs.

For new long-tail business, higher investment yields would be offset by higher inflation.

Insurers need to prepare for a variety of interest rate scenarios.

Product redesign and the re-pricing of features will be the key to success.

For new savings business, adjusting product features can be an effective way to mitigate policyholder behaviour risk going forward. This could be done by increasing surrender charges or by allowing lapsing only at market value. Also, offering more flexible interest rate guarantees would mitigate the lapse risk.

Lapsing is not an option for payout annuities. Life insurers specialised in payout annuities would therefore not be negatively affected. On the contrary, in the current low interest rate environment, many prefer to wait for annuity rates to improve and will be ready to buy as soon as rates move up again. With higher interest rates, the lifelong income stream will be higher for a given lump sum payment, resulting in higher demand.⁵¹ This would likely be the case in the UK, where people have to annuitise their pension savings, but can wait until the age of 75.

Impact on non-life insurers

Since rising interest rates are driven by a sharp, unexpected increase in inflation under this scenario, non-life insurer profitability would suffer. This is because high rates of inflation that were not accounted for at the time of pricing force insurers to revise their claims reserves. However, once inflation declines again, casualty profitability would rebound, assuming that prices have adjusted upward due to higher inflation. Property lines would be less affected because they are usually re-priced annually.

For new casualty business, the higher investment yield would not result in significantly lower prices because it is (partially) offset by higher expected claims in a high inflation environment.

Of course, today we can only speculate which of these scenarios could materialise. Given that all three (and many more) are possible, insurers will need to be prepared to cope with any of them. This is a major challenge. In today's low interest rate environment, asset management and duration-matching has turned out to be even more challenging than under normal circumstances. Adhering to a strict duration-matching approach bears significant risks, especially in markets where products have generous lapse features. While insurers are eager for attractive investment opportunities that allow them to earn a decent return on their risk and avoid spread compression, the investment world is full of pitfalls and investment strategies alone are unlikely to solve the issues embedded in some of today's existing books of business.

Looking ahead, redesigning products and re-pricing their features will be the key to success. Risk management, and especially interest rate risk management, begins with product development. Insurers must make sure that the guarantees and options they sell can be hedged effectively and at a reasonable cost.⁵²

⁵¹ However, higher inflation reduces the purchasing power of future annuity payments, thus undermining the value proposition of annuities. High inflation could therefore offset the positive effect of high annuitization rates on the demand for annuities.

⁵² More economic solvency regulation and reporting will also exert pressure on insurers to rethink their investment and product strategies.

Conclusion

All insurance products contain interest rate guarantees.

While virtually everyone is affected by interest rates, the insurance industry is exceptionally exposed because its products contain significant interest rate guarantees. These guarantees can be explicit, as in life insurance savings products, or implicit through the discount rate used for pricing. If the discount or guarantee rate cannot be earned with investment income, insurer profitability falls short. Hedging these interest rate risks is a core task for an insurer, but a difficult one.

Non-life insurer interest rate risk exposure can be minimized with a solid investment strategy and product re-pricing.

Non-life insurer interest rate risks seem to be manageable. First, short-tail business profitability is only marginally influenced by interest income. Moreover, the short-term nature of the business allows insurers to re-price products at short intervals. Long-tail non-life business relies more on interest rate income, but interest rate risk exposure can be contained by means of a proper investment strategy. The biggest threat to non-life business is unexpected inflation, which is often, but not always, related to changes in nominal interest rates. Unexpected inflation renders claims reserves insufficient.

Life insurers are more exposed to interest rate risks due to unpredictable policyholder behaviour.

Life insurance is more exposed than non-life insurance because interest rate risks are difficult to hedge for many life insurance products. Interest rate risk is affected by policyholder behaviour. Policyholders often enjoy generous options, such as the right to withdraw money or terminate a contract, or the right to suspend or increase premium payments at predefined conditions. Because policyholder behaviour is difficult to forecast, future cash flows cannot be predicted with reasonable accuracy, resulting in non-hedgeable interest rate risks.

Uncertainty surrounding future interest rate developments is high – insurers must be able to cope with every possible scenario.

While a rise in interest rates to levels that are more comfortable for insurers appears unlikely over the short term, history provides us with the reminder that interest rates can be highly volatile. It would be foolish to believe that interest rates can be predicted with any reasonable precision – particularly over a span of many years or even decades, which is a common duration for many life insurance policies. As a result, life insurers need to be prepared for all possible interest rate scenarios.

Improving efficiency and reducing costs are ways to offset lower investment margins in in-force life savings business.

Life insurers have limited room for action to contain the negative effects of the current low interest rate environment on their in-force business promising high guarantees. This business cannot be undone, nor can the rules be changed while the game is under way. The longer interest rates stay low, the higher the losses in this business segment will be. The best options available are to further improve asset management and hedging and to reduce operational costs. Life insurers can also offer policyholders the option of exchanging their existing policies for new policies that are less interest rate sensitive. Naturally, an upfront bonus to policyholders would be required, resulting in a one-time loss. Nevertheless, this latter option may be more favourable than holding a legacy book that could weigh on profitability for many years to come.

Re-pricing is a quick fix for new business, but the life insurance industry should weigh the economic costs of guarantees against the benefits to policyholders.

Insurers have more room for manoeuvre in managing the interest rate risks inherent in new business. As an immediate response, interest rate guarantees and product prices should be adjusted to reflect low interest rates. Nevertheless, a longer term, comprehensive, and sustainable approach will be needed, especially for life insurance savings products. Improved product design will be key. Products must be designed so that the embedded interest rate risks can be effectively hedged. And, the costs of the embedded guarantees and options should carefully be weighed up against the value they create for policyholders and hence the price that they are willing to pay.

More flexible guarantees will improve insurers' ability to manage interest rate risks while still offering attractive insurance to policyholders.

Building on this cost-benefit analysis, the industry should review the guarantees and options embedded in life insurance products and adjust them where necessary. Some guarantees provide little value to customers at the point of sale but may imply material costs to insurers later on. This challenge of balancing economic costs with customer willingness to pay for guarantees is also about striking a balance between security and flexibility. Surprisingly, lower guarantees can improve both insurers' risk/return profiles and the trade-off between costs and benefits for policyholders. There are various examples of life savings products featuring moderate guarantees whose embedded interest rate risks are manageable for insurers and are valuable for policyholders at the same time.

Glossary of life insurance products

Annuity: a contract that promises to make a regular series of payments over a person's lifetime or for a fixed time period. It can be purchased with either a single payment or a series of payments. Annuities come in many varieties to meet the needs of retirees, some of which are listed below⁵³:

- *Deferred annuity:* an annuity that pays out once the beneficiary has reached a specified age or retirement age.
- *Immediate/payout annuity:* an annuity whose payout begins immediately upon purchase.
- *Fixed annuity:* an annuity whose payout is set at inception.
- *Variable annuity:* an annuity whose payout is linked to the performance of an investment portfolio.

Endowment insurance: a life insurance product where the benefit is due not only during the policy period if the policyholder dies, but also at the end of this period if the policyholder survives. Endowment insurance hence combines pure endowment insurance (payable only at the end of a fixed term) and term insurance (payable at death). The amount payable may be a fixed, guaranteed amount or a minimum guaranteed amount that increases according to investment conditions. Endowment insurance is used for a variety of purposes, including as a security for house loans, as a tax-efficient capital accumulation tool and for lump sum payments upon retirement.

Permanent life insurance: a form of life insurance that provides coverage for the policyholder's entire life, where the payout is assured at the end of the policy (assuming the policy is kept current) and the policy accrues cash value. Permanent life insurance stands in contrast to term life insurance, which is purchased for a specified period and a death benefit is only paid to the beneficiary if the insured dies during that period.

- *Whole-life:* a type of permanent life insurance where the premium is usually paid annually throughout life. In some cases premium payments may cease after a given number of years or at a given age, depending on the contract terms. Alternatively, a single premium may be charged. Proceeds are payable when the policyholders dies.
- *Universal life:* a type of permanent life insurance with flexible premiums and flexible face amounts. The charges for mortality risk, interest and expenses are listed separately in the policy. Also, the policyholder can request an increase or decrease in the face value of a policy and decide upon the level of premiums within set limits.

Term insurance: a type of life insurance product under which benefits are only paid if the policyholder dies during the policy term. Unlike permanent life insurance, term life insurance does not accumulate cash value, ie it is not a savings vehicle, and if the policyholder survives the cover period, the contract expires without payment. The duration and conditions of term life policies vary considerably, from one to forty or more years with a constant, increasing, or decreasing benefit, and with or without the option to renew the cover or convert it to permanent life insurance.

With-profits insurance (or participating policy insurance in the US): an insurance contract linked to the profits of a life insurance company. Often there are profit-sharing rules that define what proportion of the profits goes to policyholders, and what amount can be distributed to shareholders. Most Continental European endowment policies are of the "with-profits" type.

⁵³ A comprehensive description of annuities can be found in Swiss Re, *sigma* No 3/2007, "Annuities: a private solution to longevity risk" and *sigma* No 4/2008, "Innovative ways of financing retirement".

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