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Gauging the impact of a low-interest rate environment on German life insurers

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Abstract

A low interest rate environment can pose a key risk to the life insurance sector. A deteriorating return on investment holdings jeopardizes the guaranteed return on life insurance contracts. In this paper, we examine the effect of low interest rates on German life insurers by applying various adverse scenarios to a simple model of life insurers' balance sheets. A low return on investment can lead to a depletion of the bonus and rebate provisions. As a result, life insurers resilience may deteriorate. By way of this analysis, we can model approximately when the bonus and rebate provisions will be depleted.

Keyword: life insurance, low-interest rate environment, financial stability

JEL: G14, G21, G28

Non-technical summary

Interest rate risk constitutes the greatest individual source of risk for life insurance companies. It is the risk that, in the event of unfavorable market developments, income from investments may be insufficient to make contractually guaranteed payments to policyholders and to fulfil any additional profit participation commitments. This risk can increase considerably when funds are continuously invested in a low-interest rate environment.

When interest rates recede and a sustained low-interest rate environment ensues, the bonus and rebate provisions (which serve to finance policyholders' profit participation shares) shrink, as they originate principally from investment income. A decline in investment income could lead to withdrawals from the bonus and rebate provisions in excess of allocations. As a result the bonus and rebate provisions would shrink weakening the life insurers' capital base as part of the provisions are recognized as own funds. Furthermore, policyholders' profit participation shares would be at risk. The most important adverse effect of the diminished capital base, however, would be a reduction in the insurance companies' resilience.

We set up a simple model in which the developments in the bonus and rebate provisions are simulated for various interest rate scenarios. In the model, the withdrawal and allocation amounts are calibrated so that the developments in the bonus and rebate provisions can be approximated. When the BRPs are depleted they can no longer serve as a buffer for profit participation. In this situation, if investment income were to remain lower than the profit participation level, the companies would ultimately be forced to plunder their assets and to tap into further own funds.

We consider three interest rate scenarios in our simulations. In the most severe scenario, the BRPs would be exhausted in 2018. The model calculations thus show that insurance companies can cope with a pessimistic scenario over the medium term. Moreover, owing to the extreme assumptions made, the critical point may be expected to occur at an even later stage than suggested by the model-generated time path. In fact, if there is not a dramatic decrease in the net return, life insurers will not have to deal with diminishing BRPs. In the two less severe scenarios, the BRPs would gradually increase given that the simulated net return on investment

is above the guarantee return.

Overall, the result should serve as a warning that the BRPs can be depleted over the medium term under admittedly extreme but not unrealistic assumptions. More specifically, life insurers' situation could become difficult if the net return on investment were to remain below the level of the guaranteed return over a protracted period of time. In this case, the life insurance companies would have to use more own funds, which would undermine their resilience.

Nicht-technische Zusammenfassung

Das Zinsrisiko stellt im Allgemeinen für Lebensversicherer das größte Einzelrisiko dar. Es besteht darin, dass die Erträge aus den Kapitalanlagen bei einer ungünstigen Marktentwicklung eventuell nicht mehr ausreichen, die den Kunden zugesagten Garantieleistungen und darüber hinausgehende Überschusszahlungen zu erfüllen. Erfolgt die Neuanlage dauerhaft in einem Niedrigzinsumfeld, steigt das Risiko erheblich an.

Bei sinkenden Zinsen und einem sich anschliessenden lang andauernden Niedrigzinsumfeld schmilzt die Rückstellung für Beitragsrückerstattung (RfB) ab, die der Finanzierung der Überschussbeteiligung der Versicherten dient, da sich die RfB überwiegend aus den Kapitalerträgen speist. Gehen diese zurück, könnten die Abflüsse aus der RfB die Zuflüsse übersteigen. Das Abschmelzen der RfB würde die Kapitalausstattung der Lebensversicherer schwächen, da Teile der RfB als Eigenmittel angerechnet werden. Darüber hinaus wäre die Überschussbeteiligung der Versicherten gefährdet. Die verringerte Kapitalausstattung würde jedoch vor allem die Risikotragfähigkeit der Versicherungsunternehmen reduzieren.

Zur Analyse des Zinsrisikos wird in diesem Papier ein Modell entwickelt, mit dem die Entwicklung der RfB bei verschiedenen Zinsszenarien simuliert werden kann. Dabei wird die Höhe der Zu- und Abflüsse der RfB so kalibriert, dass der Verlauf der RfB abgeschätzt werden kann. Sollte die RfB vollständig abgeschmolzen sein, ist der Puffer für die Überschussbeteiligung aufgebraucht. Würden die Kapitalerträge dann die gewährte Überschussbeteiligung weiterhin unterschreiten, wären die Unternehmen letztlich gezwungen, ihre Substanz anzugreifen und weitere Eigenmittel aufzuzehren.

Drei verschiedene Szenarien wurden in der Modellrechnung untersucht. Im schärfsten Szenario wäre die RfB im Jahr 2018 aufgebraucht. Die Modellrechnung zeigt, dass die Unternehmen mittelfristig sogar ein pessimistisches Szenario verkraften könnten. Zudem dürfte aufgrund der extremen Annahmen der tatsächliche kritische Zeitpunkt gegenüber dem modellgenerierten eher später zu erwarten sein. In den beiden anderen Szenarien würde die RfB allmählich ansteigen, weil die erwartete Nettoverzinsung nie unterhalb der erwarteten Garantieverzinsung liegt. Wird kein

dramatischer Abfall der Nettoverzinsung angenommen, kommen die Unternehmen nicht in die Situation, dass die RfB erheblich abschmilzt.

Gleichwohl kann das Ergebnis als Warnung dienen, dass zwar bei extremen aber nicht unrealistischen Annahmen, die RfB möglicherweise bald aufgezehrt sein könnte. Sollte über diesen Zeitpunkt hinaus die Nettoverzinsung weiterhin unterhalb der Garantieverzinsung liegen, würde die Situation für die Unternehmen schwierig. In diesem Fall müssten die Unternehmen weitere Eigenmittel verwenden; die Risikotragfähigkeit würde weiter geschwächt.

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1 Introduction

The importance of monitoring the insurance sector in terms of its impact on financial stability was forcibly demonstrated during the financial crisis. The growing interaction between insurance companies, financial markets and other financial intermediaries makes the insurance sector an important element for ensuring the stability of the financial system. The example provided by AIG, in particular, shows that the interlinkages between insurance companies and the financial system have grown in recent years.[2] As a consequence, conditions in the financial markets play an increasing role for the financial health of insurance companies.

In this paper, we assess the risks emanating from a low interest rate environment for German life insurers. Concern about this issue has already been voiced by Trichet (2005) who argued that in a low-interest rate environment insurance companies tend to invest in riskier products, which makes them more vulnerable to market shocks, thus possibly raising overall systemic risk. A tendency to take risk can arise when the return on the investment portfolio is insufficient to meet the profit participation commitments in life insurance contracts. As a consequence the bonus and rebate provisions (BRPs), which serve as a safety buffer for profit participation, will be depleted. In the extreme, the persistence of a low interest rate over a prolonged period can ultimately lead to an insurance company's distress.[3] In the light of the

[1]We are grateful to Christoph Memmel and Wolfgang Rippin for their helpful comments and suggestions. The paper represents the authors' personal opinions and not necessarily those of the Deutsche Bundesbank. All remaining errors are of course our own.

[2]A high rating allowed AIG to participate in swaps (CDS and CDO) without posting collateral. A downgrade led to a liquidity crisis and to the largest government bailout in corporate history (see Stolz and Wedow (2010)).

[3]The risk from a general low interest rate environment differs importantly from the risk arising from interest rate changes. A decrease in interest rates leads to unrealized gains on the asset side of insurers balance sheet when the value of the bonds held increases. An interest rate decrease has a negative effect on liabilities because of the lower discount rate. As the technical reserves exceed the securities portfolio the negative impact on the liability side can outweigh the positive effect on the asset side (see European Central Bank (2010)). Given that the net impact of an interest decrease is negative further downward pressure on long-term interest rates can lead to a deterioration in the balance sheet when the net present value of future liabilities rises. This is particularly relevant for companies that service long-term contracts with high guaranteed returns such as life insurers.

currently prevailing low interest rates, a more detailed analysis of this risk to the stability of the insurance sector is clearly warranted. We thus use a simple model of a life insurer's balance sheet to assess when the stability of this sector is at risk. For this purpose, we employ various adverse interest rate scenarios to gain a comprehensive picture of this risk for German life insurers. The most severe scenario is the Japan-scenario, in which we assume that the companies will earn a very low return on investment for an extended period. [4]

In the next section, we will briefly discuss the structure of the insurance sector in Germany and the profit allocation mechanism which is key to understanding the effect of interest rates on life insurers. The third section develops a simple model of a life insurer's balance sheet and the fourth section evaluates when the BRPs are insufficient to cover the profit participation of policyholders. The fifth section assesses the robustness of the model. The final section concludes and provides some policy recommendations.

2 The German life insurance sector

2.1 Market overview

Life insurance business represents the predominant part of the German insurance sector. The relevance of the life insurance sector is reflected in its share of both total premium income and capital investment holdings.

Figure 1 shows that total premium income has increased over the past two decades from EUR 70 billion to almost EUR 168 billion. The findings by Li et al. (2007) for the OECD countries suggest that increasing income, product market characteristics and socioeconomic factors are the major elements that determine the consumption of life insurance. In 1990, more than 39 per cent of total premium income originated in the life insurance sector. This share consistently rose over the period to almost 49 per cent in 2009. While the share of premiums for health insurance also grew (from 14 per cent in 1990 to almost 19 per cent in 2009), the share of

[4] The Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin), the German supervisor for insurance companies, carried out a forecast regarding the guaranteed return up to the end of 2009 using a fairly similar scenario.

premium income in non-life insurance declined from more than 47 per cent to less than 33 per cent. Total premium income more than doubled over this period.[5]

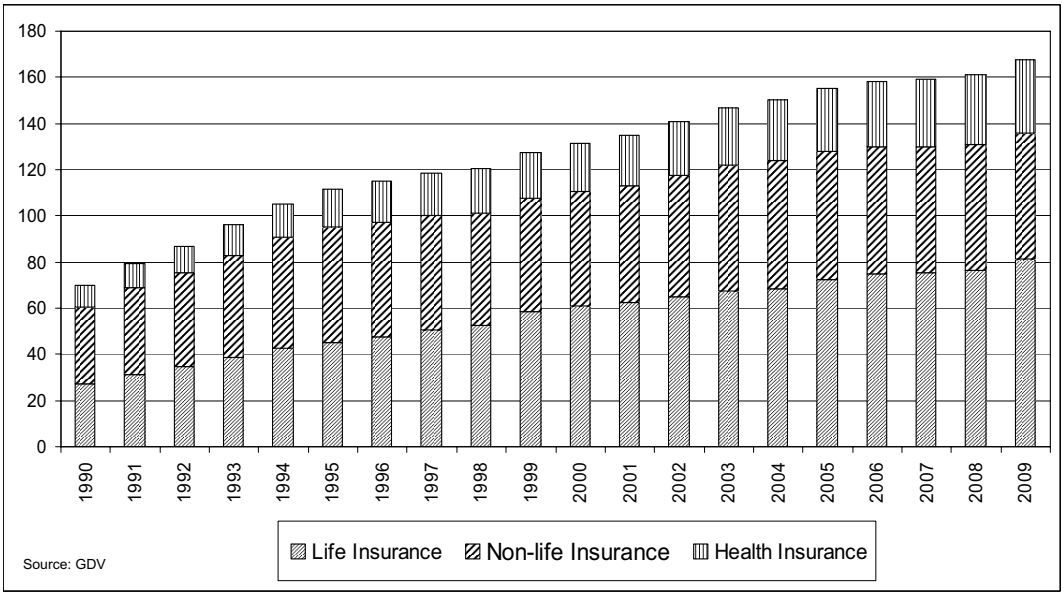

Figure 1: Premium income of German primary insurers in EUR billions

The importance of life insurance business is also reflected in its share of capital investment holdings. As shown in Figure 2 life insurers hold the largest share of the insurance sector's total investment holdings. This share remains relatively constant at around 63 per cent which currently amounts to EUR 726 billion.[6]

The substantial security holdings shown in Figure 2 highlight the importance of life insurers as institutional investors and signal their potential impact on the stability of the financial system. To assess their stability, it is thus paramount to gauge the impact of important sources of risk for life insurers. Therefore, this paper examines the impact of a sustained low-interest rate environment on the stability of life insurance. German life insurers typically offer their policyholders a similar degree of profit participation. As a consequence, all insurers would be similarly affected by a low interest rate environment and the simultaneous distress of several insurers could endanger the stability of the financial system. In the next section, we discuss the general framework for life insurance profit allocation in Germany which is key to understanding the risk emanating from low interest rates.

[5]See Gesamtverband der Deutschen Versicherungswirtschaft e.V. (2010).
[6]See Bundesanstalt für Finanzdienstleistungsaufsicht (2010).

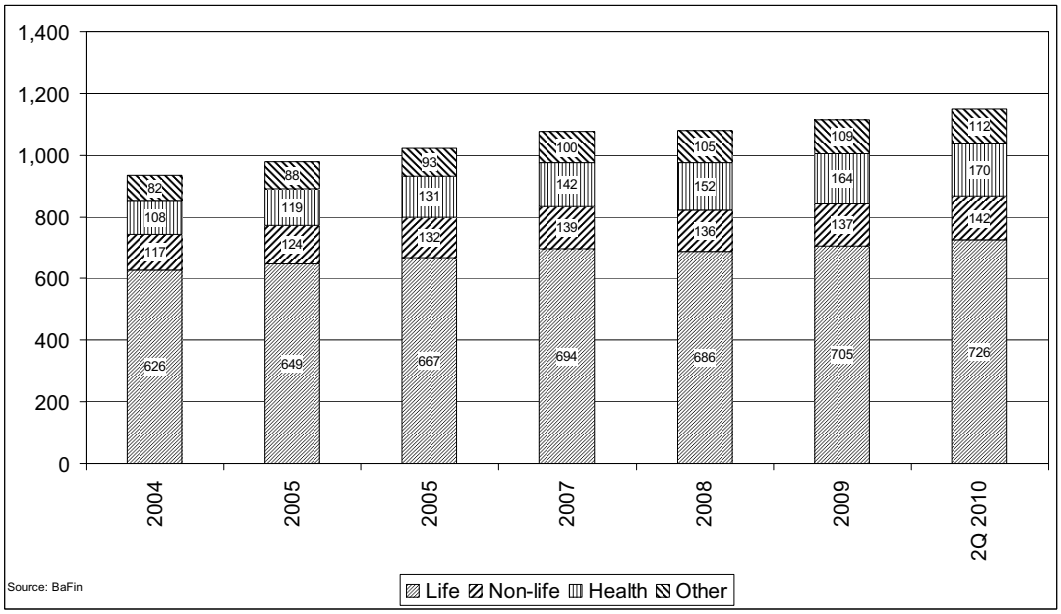

Figure 2: Capital investment holdings of German primary insurers in EUR billions

2.2 Profit participation in German life insurance

In general terms, the profit participation commitment in German life insurance contracts ensures that policyholders participate adequately in the insurer's profits.[7] Profit participation corresponds to the current return on policyholders' credit balances, which consists of three elements.

First, the guaranteed return represents a fixed base return for the duration of the insurance contract. The Federal Financial Supervisory Authority (BaFin) and the German association of actuaries (Deutsche Aktuarvereinigung e.V., DAV) provide the Federal Ministry of Finance with recommendations concerning the guaranteed return for new contracts every year. The guaranteed return is calculated on the basis of the average current yield of ten-year federal government debt securities. The maximum guaranteed return may not exceed 60 per cent of this average pursuant to §65 (1) of the German Insurance Supervision Act (Versicherungsaufsichtsgesetz). Based on this recommendation, the Federal Ministry of Finance determines the regulatory maximum guaranteed return for new contracts every year. However, the

[7]Kling et al. (2007) examine the impact of different surplus distribution mechanisms on the risk exposure of life insurance companies with a cliquet-style interest guarantee. They show that a mechanism that allows the surpluses generated in one year to be used as a shield against underperformance in other years leads to significantly lower default risk.

Ministry is not bound by the recommendations when making its decision.[8]

Figure 3 shows the trend in the guaranteed return over the period from 1982 to 2009.

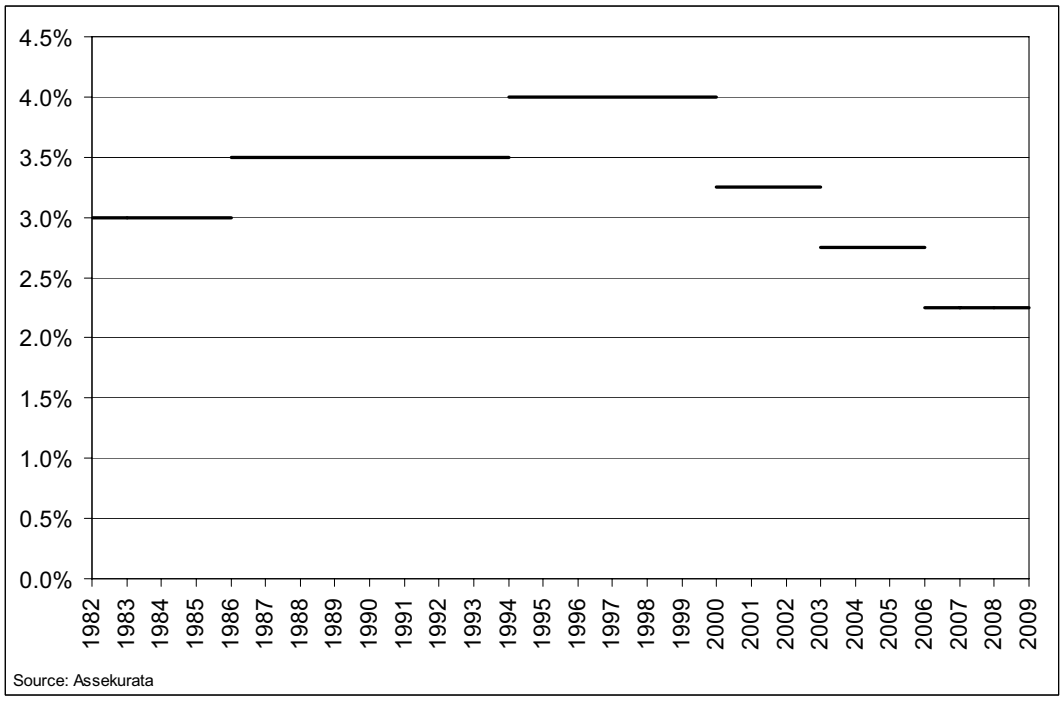

Figure 3: Guaranteed return under German life insurance contracts

It should be noted that changes to the guaranteed return are applicable only to new contracts. As a consequence, the guaranteed return under existing contracts is not affected by any changes to the guaranteed return. For this reason, insurance companies hold contracts with different guaranteed returns some of which are above the current ceiling. In 2009 the average guaranteed return across all life insurance contracts was 3.36 per cent, well above the guaranteed return for new contracts. Contracts with a guaranteed return of 4 per cent account for almost 30 per cent of all contracts.[9] Figure 4 shows the average guaranteed return over the period 2004 to 2009.[10] It also shows the net return on investment. The difference between the net and the guaranteed return provides a first indication of potential difficulties for life insurers. The difference describes the margin available for insurers to grant a return above the guaranteed minimum return and to create provisions for the future. This difference declined from a fairly healthy 1.7 percentage points in 2005 to a low of

[8] See www.aktuar.de.

[9] See Assekurata (2010).

[10] A longer time series for the average guaranteed return is not available.

0.15 percentage points in 2008. It should be noted that, whereas the net return is earned on total investments holdings, the guaranteed return has to be paid on a subset of investment holdings. Therefore, a lower net return on investment can be sufficient to provide the guaranteed return. This aspect will be discussed further in the following sections.

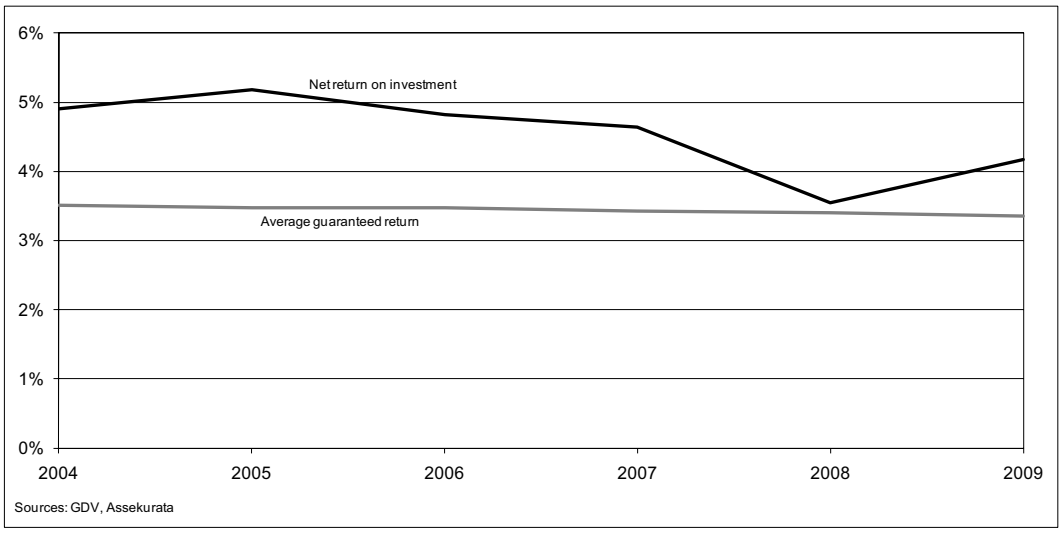

Figure 4: Net return and average guaranteed return under German life insurance contracts

The second component of the current return is the direct credit amount paid to policyholders. The direct credit amount was granted from the mid 1980s onwards. Under life insurance contracts concluded before 1994, the insurance company had to provide policyholders with a direct credit amount of at least 5 per cent, including the guaranteed return. By providing a direct credit amount, policyholders were allowed to participate directly in the companies profits. However, this rule no longer applies to life insurance contracts concluded since 1994.

The third component of the current return is the current surplus, which is the part of the current return granted by the insurer in excess of the guaranteed return. Every year, each insurance company announces the current surplus for the following year based on internal calculations. Once the current surplus for a specific year has been announced it cannot be altered.

In 2010, the current return on policyholders' credit balances is, on average, equal to 4.19 per cent for all German insurance companies and types of life insurance

contracts.[11]

More formally, the current return (cr_t) can be expressed as:

$$cr_t = gr_t + dc_t + cs_t \tag{1}$$

where gr_t is the guaranteed return, dc_t is the direct credit amount and cs_t is the current surplus at time t. Generally, gr_t is fixed for the whole duration of the individual contract while the overall guaranteed return varies owing to a change in the composition of contracts with different guaranteed returns. The insurer has to generate the guaranteed interest rate from the net return on investment capital ni_t. Hence, the payment of the guaranteed return is conditional on the survival of the insurance company. Life insurers regularly grant their customers a participation in the profits in excess of the current return inter alia owing to valuation reserves. However, these reserves are only granted when the contract expires and are revocable before the expiration of the contract. In our model, we assume that, from 2010 onwards, excess profit participation from valuation reserves will be zero. Therefore, we potentially underestimate the decline in the BRPs.

Also, given that most contracts concluded before 1994 have now expired or been terminated, the direct credit amount is negligible and we thus do not consider this component in our model. The current surplus cs_t is taken from the BRPs, which are also fueled by the net return on investment. The following subsection describes the BRPs in greater detail and explains their importance for German life insurance companies.[12]

2.3 The bonus and rebate provisions (BRPs)

The BRPs are an actuarial reserve on the insurer's balance sheet that are used for policyholders' profit participation.[13] As mentioned earlier, the current surplus is taken from the BRPs. In a sustained low-interest rate environment, the returns on

[11] See Assekurata (2010).

[12] Only aggregated data can be examined. Statements for individual insurers cannot be made owing to a lack of individual data.

[13] See Heimes (2003).

the capital investment holdings may be insufficient to provide the guaranteed return. Under these circumstances, the BRPs have to be used to maintain the guaranteed return. However, given that the BRPs are themselves fueled by the net return, the net flow into the BRPs will eventually turn negative and a lasting drain on the BRPs will deplete this buffer. As a consequence, profit participation becomes untenable.

Furthermore, the insurer's stability is directly related to the BRPs since these are part of its capital. Hence, a reduction in the BRPs simultaneously leads to a deterioration in the insurer's solvency. Given that equity capital is typically a very small component of an insurer's balance sheet, the BRPs represent an important buffer against adverse shocks. As a result, the financial stability of the life insurance sector can deteriorate when the BRPs decline, ultimately leading to a reduction in equity capital. In addition, once the profit participation buffer is depleted, the insurer has eat into equity capital. A subsequent insolvency can ultimately become inevitable if the insurer does not adjust its profit participation level in good time. Therefore, in the following model, we examine the impact of a low-interest rate environment on the BRPs.

2.4 Surplus origination and distribution in life insurance

Having illustrated the importance of the BRPs for the stability of life insurers, we will next shed light on the origination and distribution of profits in life insurance. Life insurance companies, in principle, generate three different types of income: the return on investment capital holdings, the mortality result and the other result. The mortality result is the difference between calculated risk costs and actually accrued risk charges. The other result contains the cost result, which is the difference between calculated costs and actual costs.

In order to ensure that policyholders adequately participate in the companies' profits, a minimum level of allocation to the BRPs is required. A minimum transfer level from the different results is laid down by law. The minimum allocation amount from investment income is 90 per cent after deduction of the guaranteed return, although life insurers can also choose a higher level. Any remaining income not allocated to policyholders accrues to equity holders. The minimum allocation

amount from the mortality result is 75 percent and 50 per cent from the other result.[14]

3 The model

Having provided a brief market overview and an explanation of the relevant balance sheet components of German life insurance companies, we will next introduce the model to simulate the developments in the BRPs. The main driver of the BRPs is the net return on investment, which presents the most important source of revenue for life insurance companies. We apply various scenarios for the net return trend over the next few years. The output of the scenario analysis is a point in time when the BRPs are depleted. If from this point onwards, the net return is insufficient to provide profit participation, the companies will ultimately have to use their equity capital.

The BRPs can be expressed as follows:

$$\Delta BRP_t = a_t - w_t \tag{2}$$

where ΔBRP_t is the absolute change in the bonus and rebate provisions at time t. The allocations to the BRPs a_t and the withdrawals from the BRPs w_t are calibrated to estimate the trend in the provisions.

3.1 Assumptions for allocations to the BRPs

As described in subsection 2.4, the return on investment, the mortality result and the other result contribute to the BRPs. Owing to a lack of data for the mortality result and the other result, the allocations to the BRPs in our model consist only of the return on investment, which can be equated with the net return on investment. As the other components are neglected the allocations to the BRPs represent a lower bound estimate.

[14] A direct credit amount, which is assumed to be zero in our model, is usually deducted from the total minimum allocation amount pursuant to the German Minimum Allocation Regulation (Mindestzuführungsverordnung).

The allocations can be illustrated with the following equation.

$$a_t = \alpha_t(ni_t inv_t - gr_t 0.8 inv_t) \tag{3}$$

where α_t stands for the minimum supply at time t, which by law has to be at least 0.9 ($\alpha_t \geq 0.90$), ni_t is the net return on investment, gr_t is the guaranteed return and inv_t is the capital investment holding.

Whereas the net return on investment is earned on total capital investment holdings, we assume that the guaranteed return has to be granted only on approximately 80 per cent of total investments.[15]

In sum, the allocations to the BRPs are determined by the net return on investment, the guaranteed return, capital investment holdings and α_t which is partially at the discretion of the insurance company.

3.2 Assumptions for withdrawals from the BRPs

In subsection 2.2, we explained the different components of profit participation. While the guaranteed return stems from the net return without previous assignment to the BRPs the current surplus is deducted from the BRPs.

The following equation is used:

$$w_t = (cr_t - gr_t)0.8 inv_t = cs_t 0.8 inv_t \tag{4}$$

By using equations (3) and (4), equation (2) can be converted as follows:

$$\Delta BRP_t = \alpha_t(ni_t inv_t - gr_t 0.8 inv_t) - (cr_t - gr_t)0.8 inv_t \tag{5}$$

Therefore, the level of the BRPs does not change if equation (5) equals zero. Equation (5) can then be converted as follows:

[15]Bank of America Merrill Lynch assumed that the minimum guarantee relates to only about 90 per cent of investments, because the remainder of investment backs shareholder's equity and other non-participating reserves (see Bank of America Merrill Lynch (2010)). We assumed a lower bound to analyze a more conservative scenario. However, in subsection 5, we discuss this aspect further.

$$ni_t = 0.8gr_t + \frac{0.8}{\alpha_t}(cr_t - gr_t) \tag{6}$$

4 Scenario analysis

For our simulations, we use various scenarios for the development of the net return on investment ni_t to estimate the change in the BRPs with equation (5). In 2009, the aggregated BRPs of German life insurance companies amounted to approximately EUR 55.4 billion. As a first step, we calculate the BRPs for 2010 by using the BRPs for 2009 and adding the allocations and subtracting the withdrawals for 2010.

From 2010 onwards, we assume that insurers contribute 90 per cent of the net return on investment less the guaranteed return to the BRPs, i.e. $\alpha_t = 0.9$. If the net return falls short of the guaranteed return, the shortfall is deducted from the BRPs. We analyzed three different scenarios for the development of the net return on investment.

In order to develop the different scenarios, we started by analyzing which yield return best describes the observed net return on investments of German life insurers. As German life insurers hold a very large share of their investment portfolio in fixed income securities (see Figure 10), we used the yield of German government bonds with various maturities as an explanatory variable of the net return. We obtained the best fit as measured by the coefficient of determination R^2 using the yield of government bonds with a remaining maturity of six years.[16] Based on this finding, we use forward returns of government bonds with a maturity of six years to estimate the development of the BRPs. This is justified when insurers are forward looking and adjust their portfolios in line with arbitrage free forward rates implied by the yield curve. We obtain forward rates by using the yield curve parameters suggested by Nelson and Siegel (1987) and further developed by Svensson (1994). We assume that the insurer annually replaces about 10 per cent of its maturing investment portfolio with newly issued ten-year government bonds. This amounts to using forward rates with a six-year maturity as an average over 10-years. This average forward interest rate represents our baseline-scenario I.

[16]The coefficient of determination R^2 for this regression amounted to 0.85.

To develop two more extreme scenarios, the "Japan scenarios", in a first step we perpetuated the yield of the observed government bonds with a remaining maturity of six years with interest rates actually observed in Japan during the 1990s. In a second step, we approximate the interest rate from 2010 onwards by calculating the moving average of the generated time series for six years. Using the spread between the net return on investment and the moving average of German government bonds with a remaining maturity of six years, we developed two scenarios. In scenario II, we added the average observed spread over the years 1998 to 2009, which amounted to 1.07 percentage points. In scenario III, we deducted the minimum spread observed which amounted to -0.09 percentage points.

Figure 5 shows the interest rate under the different scenarios and the development of the guaranteed return. The guaranteed return is calculated on total investments to make the interest under the different scenarios comparable with the guaranteed return. As a result the guaranteed return in Figure 5 is less than the declared guaranteed return for 2009 of 3.36 per cent.

Under scenario III the net return on investment falls below the guaranteed return in 2013. The allocations to the BRPs turn negative at the intersection of the net and the guaranteed return. In other words, the net return on investment is insufficient to provide the guaranteed return. The BRPs are then used to ensure payment of the guaranteed return and for any current surplus. Under scenario II the net return is marginally lower than the guaranteed return for three years. Under scenario I, the mildest scenario, the net return does not fall below the guaranteed return.

The following description illustrates the calculation of the BRPs in the subsequent years under scenario I. To calculate the BRPs for 2010, the allocations and withdrawals have to be estimated. Under scenario I, the net return on investment ni_t for 2010 amounts to 3.56 per cent, while total capital investment holdings inv_t amount to EUR 726.8 billion. In all scenarios, we assume that the capital investment holdings inv_t, on which the net return on investment is earned, increase by 2.75 per cent. This rate corresponds to the compound annual growth rate observed over the years 2001 to 2009.

From 2010 onwards, the companies allocate 90 per cent of the return on investment to the BRPs, thus $\alpha_t = 0.90$. The guaranteed return gr_t for 2010 amounts to

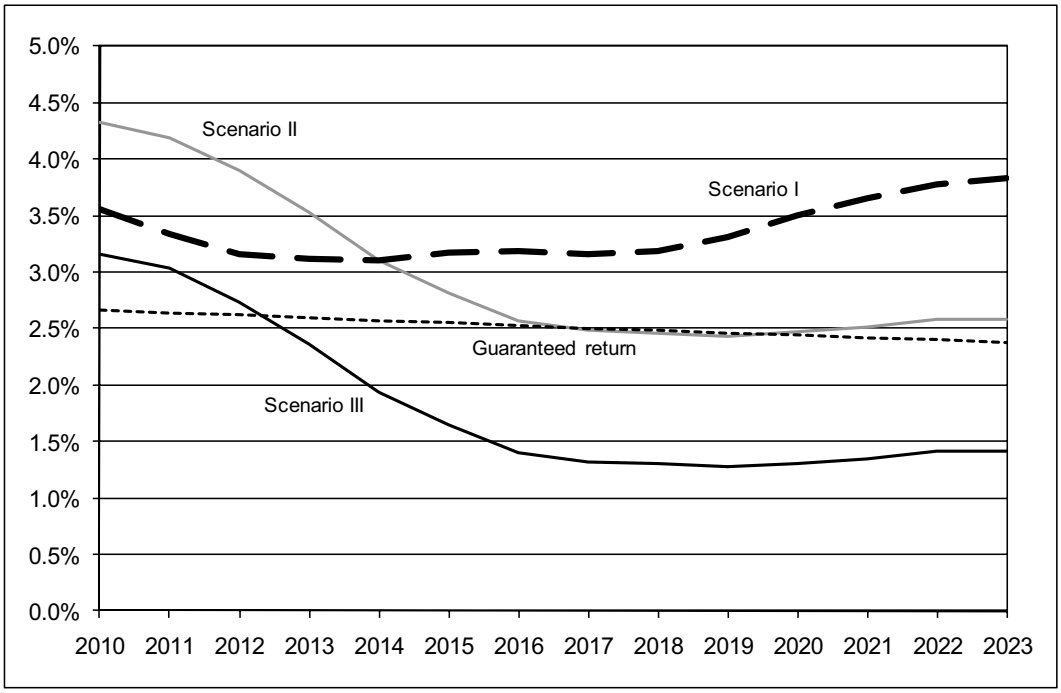

Figure 5: Development of the net return on investment in the different scenarios

3.33 per cent.[17] We assume that the guaranteed return gr_t decreases at a compound annual growth rate of -0.87 per cent, which was the actual decline observed over the years 2004 to 2009. This moderate reduction is plausible given that contracts with guaranteed rates above the current level of 2.25 per cent still represent the majority of contracts, but this volume will slowly decline.

The current return cr_t for 2010 amounts to 4.19 per cent. The current return and further profit participation is determined by the companies themselves. Our working assumption here is that the current return is lowered by 3 per cent annually until the guaranteed return is reached.[18] From this point onwards, profit participation stays constant at the rate of the guaranteed return. Life insurers could reduce the current return by more, but conventional competitive aspects provide incentives to offer a return above the minimum floor provided by the guaranteed return.

According to equation (3), in 2010, EUR 5.8 billion will be added to the BRPs while almost EUR 5.0 billion will be taken from the BRPs in line with equation (4).

[17] Calculated on total investments the guaranteed return amounts to 2.66 per cent, as shown in Figure 5.

[18] The highest reduction in the aggregate current return observed during the years 2004 to 2010 was approximately -2.5 per cent. We assume that, in a sustained low-interest rate environment, the companies will tend to lower the current return more sharply.

As allocations exceed withdrawals, the BRPs increase from EUR 55.4 to EUR 56.3 billion from 2009 to 2010. The BRPs for the following years are then estimated in a similar way. The BRPs are calculated analogously under the alternative scenarios. Except for the net return on investment, all assumptions are maintained.

Figure 6 shows the development of the BRPs under the different scenarios. Under scenario III, BRPs would be exhausted in 2018. Once the BRPs have been used up, the insurance company will have to use equity capital to ensure the guaranteed return. In scenario I, the BRPs increase substantially while, under scenario II, the BRPs remains stable over the period. In scenario II, this is caused by the net return, which fluctuates around the assumed guaranteed return.

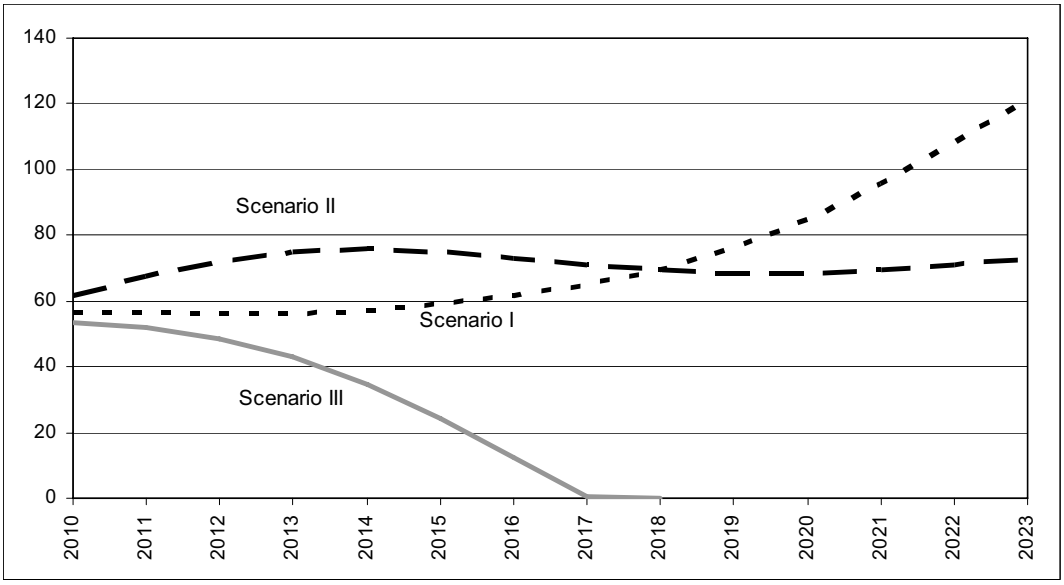

Figure 6: Development of the BRPs in EUR billions

In sum, the simulations establish that, under scenario III, profit participation could be at risk by around 2018 at the earliest, while remaining robust under scenario I and II. In the light of the results, we next explore the robustness of the model.

5 Robustness

First, we assess the robustness of our results under the assumption that the companies have to pay the guaranteed return on only 80 per cent of capital investment holdings. This can be an important driver of our results and may vary depending

on the actual share of guaranteed versus non-guaranteed contracts. Assuming that the guaranteed return has to be paid on 85 per cent of capital investment holdings, the critical date under scenario III shifts by one year, as shown in Figure 7. Under scenarios I and II, the level of the BRPs decreases, but remains at a comfortably elevated level. To sum up, an increase in the basis for the guaranteed return of 5 percentage points moves the critical date forward by about one year.

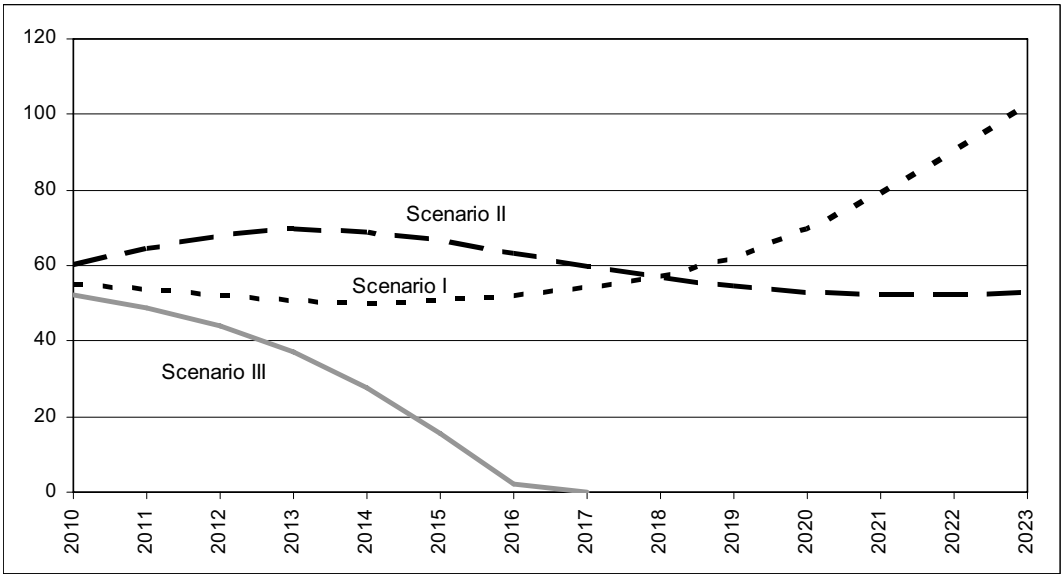

Figure 7: Development of the BRPs in EUR billions when the guaranteed return has to be paid on 85 per cent of capital investment holdings

In contrast, when we assume that the guaranteed return has to be paid on 75 per cent of capital investment holdings, the critical date in scenario III shifts backward by one year, as shown in Figure 8. The level of the BRPs under scenarios I and II increases even further.

Our second robustness test examines the assumption that capital investment holdings rise at a compound annual growth rate of 2.75 per cent. However, given demographic change and the consequent divestment by a rising proportion by those reaching retirement age, a rise in investment holdings may not be deemed to be adequate. We thus tested the impact of this assumption by assuming a constant level of investment holdings. The results displayed in Figure 9 show that this altered assumption does not change the critical date in scenario III. In contrast, the level of the BRPs will be increased. In scenarios I and II, the level of the BRPs will be

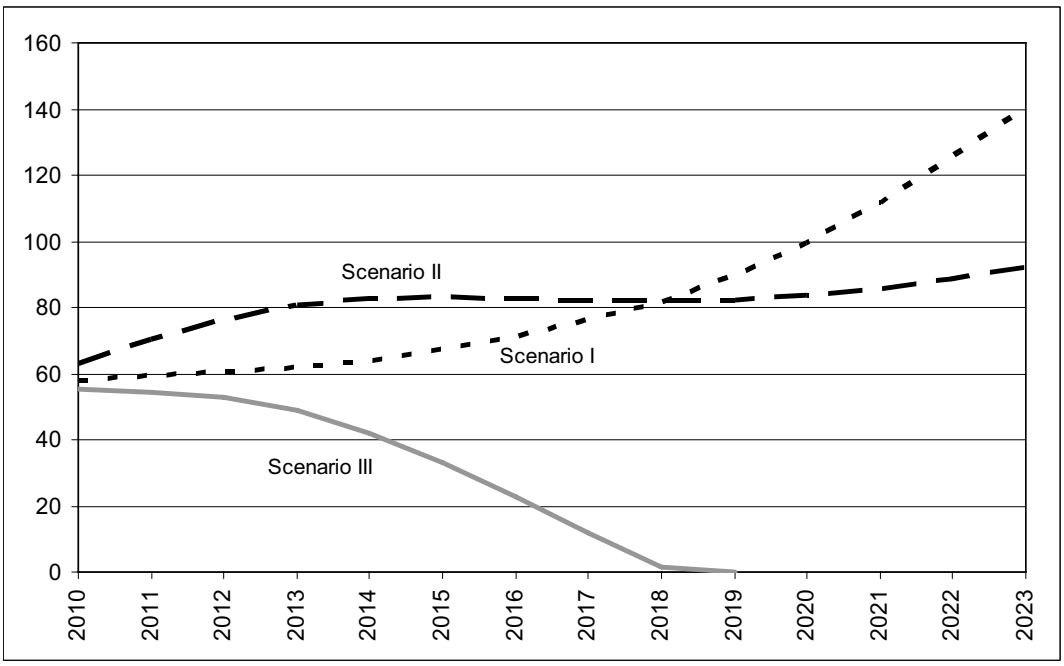

Figure 8: Development of the BRPs in EUR billions when the guaranteed return has to be paid on 75 per cent of capital investment holdings

lowered.[19]

Finally, we estimate the net return that stabilizes the BRPs, i.e. $\Delta BRP_t = 0$. Using equation (6), we are able to calculate the necessary ni_t. Such an estimate provides an insight into what is necessary in terms of portfolio adjustment to stabilize the life insurance sector and potential risk-taking. Assuming that α_t stays at 0.9, profit participation cr_t is lowered by 3 per cent each year and gr_t decreases by about 0.87 per cent each year, life insurers will need to generate an average return of at least 3.17 per cent over the next six years. This is about 1.18 percentage points above the yield for government bonds with a remaining maturity of six years as of October 2010. As the actual average spread of German life insurers amounted to 1.07 percentage points (used for scenario II), this appears to be manageable for life insurers without excessive risk-taking.

[19]We again assume that the guaranteed return is paid on 80 per cent of capital investment holdings.

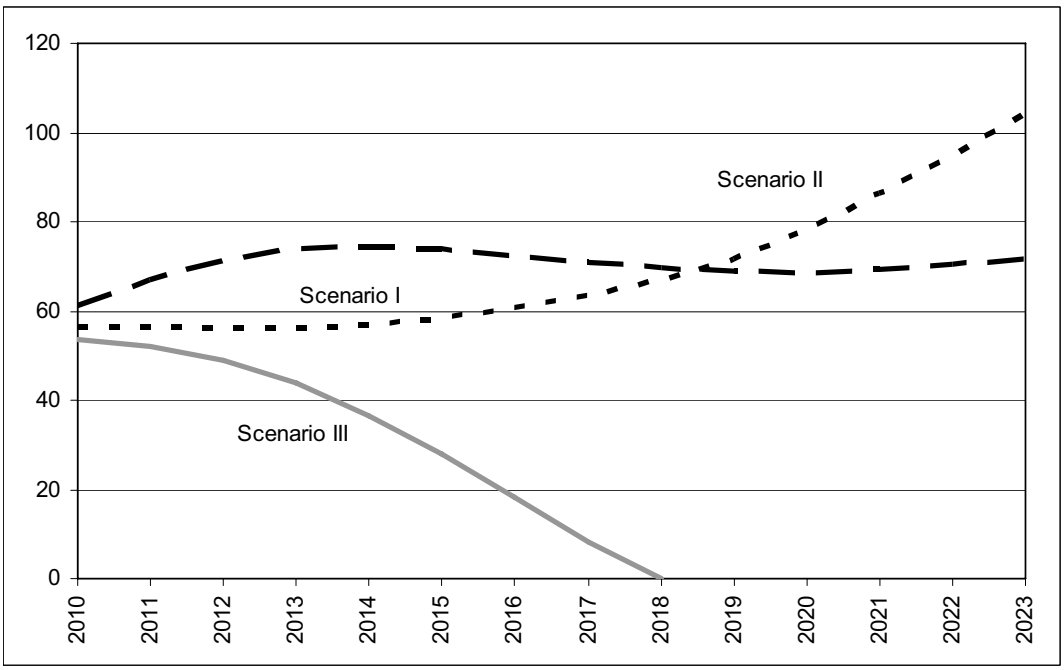

Figure 9: Development of the BRPs in EUR billions when capital investment holdings remain constant

6 Conclusion

In this paper, we show that a low-interest rate environment can have a destabilizing effect on life insurers under an admittedly adverse scenario. The analysis shows that, using strict assumptions, policyholders' profit participation could be at risk by around 2018. However, there is considerable uncertainty with regard to the precise date on which a low interest rate would impact the insurance sector. Our assumptions, e.g. for the simulations, have been inevitably simple given the data limitations and, thus, our estimates probably represent a lower bound. Moreover, we only considered the aggregate insurance sector. It should be noted that the critical point in time will potentially vary between individual insurers. In any case, the results point to the risk that a low-interest rate environment poses to the life insurance sector. However, our alternative scenarios I and II also highlight the fact that the challenges posed by low interest rates appear quite manageable for life insurance companies, i.e. that they will be able to generate sufficient income to honor insurance contracts and to maintain the BRPs at a comfortable level.

Moreover, based on recent data, the current situation appears to have calmed somewhat. Whereas in 2008, life insurers generated an average net return on invest-

ment of only 3.54 per cent, the net return on investment rose to 4.17 per cent in 2009.[20] It is important to monitor whether this development is sustainable. A potential concern is that the rise in the net return reflects higher risk taking by insurance companies within the legal limits for capital investments. However, based on available data on the portfolio structure, as shown in Figure 10, there is no indication of a rise in risk i.e. as seen by a shift in exposures to more risky counterparties. On the contrary, life insurers have increased their investments in government fixed-income securities over the past seven years. While this portfolio shift is reassuring, it needs to put into perspective against the background of the sovereign crisis. However, due to the current low-interest environment, it is likely that the net return on investment for 2010 will decline again.

Furthermore, life insurers could also increase the net return on investment by extending the maturity of the investment portfolio. However, this option could only marginally raise the net return given the relatively flat end of the yield curve. Nevertheless, as the asset side duration is lower than the liability side duration in the case of life insurance companies this strategy would reduce the asset-duration mismatch.

As an alternative strategy, life insurance companies could lower profit participation further, in the extreme even ceasing to offer new contracts. This would constitute an important limitation for households in terms of protecting themselves against risks and accumulating savings for retirement provisioning.

In the light of an even remote solvency issue in the life insurance sector, the provisions for a safety net deserve some discussion. Generally, the insolvency of a life insurer can involve two major types of costs in the absence of a safety net. First, owing to substantial security holdings, an insolvency can cause severe market disruptions. Second, an important part of household' savings could be lost. For example, an impending insolvency may induce customers to terminate contracts even if they have to accept a low surrender value. With regard to the specific safety net in Germany, the Protektor Lebensversicherungs-AG represents the Guarantee Fund that takes over insolvent insurers to protect policyholders' interests.[21] All life insur-

[20] See Gesamtverband der Deutschen Versicherungswirtschaft e.V. (2010).

[21] In 2003 one company was taken over and has since been managed by Protektor.

ers that do business in Germany make annual contributions to the Guarantee Fund. These are equivalent to 0.02 per cent of the net technical reserves of German life insurers (12/2008: approximately EUR 0.136 billion) until the total capital accumulated amounts to 0.1 per cent of the net technical reserves (12/2008: approximately EUR 0.68 billion). The maximum capital level is expected to be reached by the end of 2010. In the event that the Guarantee Fund's resources are insufficient an additional special contribution equal to 0.1 per cent of the net technical reserves can be collected (12/2008: approximately EUR 6.8 billion). The decision to transfer an insurer's portfolio to the Guarantee Fund is taken by the Federal Financial Supervisory Authority (BaFin). The insurance contracts remain unaffected and all rights agreed upon are maintained and fulfilled by Protektor. Only when the Guarantee Fund's resources prove insufficient can BaFin reduce the commitments under the contracts by up to 5 percent of the guaranteed benefits. Should this reduction and additional contributions by members also be insufficient to reorganize the portfolio, the members can agree on a voluntary basis to contribute up to 1 per cent of the net technical reserves of German life insurers including contributions previously made.[22]

This safety net is an important buffer against an insurance company defaulting. However, it is the last line of defense and, in fact, can only support a limited number of defaults in the insurance sector. Given that low interest rates affect all life insurers simultaneously, the successive failures of more than one insurer cannot be dismissed as impossible in view of the fact that the risk scenario affects all institutions equally. Against the background of the possible repercussions for the remaining financial sector, the monitoring of the stability of the insurance sector and, specifically, life insurers, is warranted. A possible avenue for policy makers to explore is to require life insurers to lower the policyholders' profit participation levels to the guaranteed return in advance.

[22] See www.protektor-ag.de.

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7 Appendix

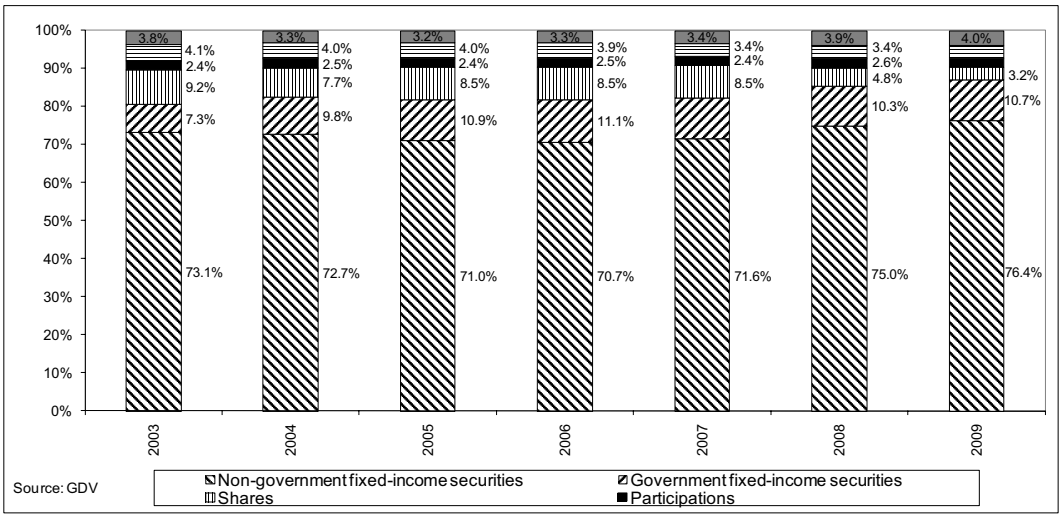

Figure 10: Portfolio structure of German life insurers

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