

# **Securing Lifelong Retirement Income: Global Annuity Markets and Policy**

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## Chapter 8

# **The Private Life Annuity Market in Germany: Products and Money's Worth Ratios**

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*Barbara Kaschützke and Raimond Maurer*

Buying a payout annuity is a decision that can shape financial well-being for many decades to come; moreover, it is usually irreversible so it is important to make sure that such a decision is a well-informed one. We focus here on the question of whether annuities deliver an adequate value for money, applying the money's worth methodology to the German voluntary annuity market. After reviewing international research, we examine the German voluntary annuities market. We describe the main product groups, the insurer's crucial statutory obligation to distribute a substantial part of its annual profits to the insured. Then, factors determining the money's worth ratios are represented and scrutinized, and results compared to those of other countries.

### **Money's worth methodology**

Our objective is to verify whether German annuities are delivering an adequate value for money, by applying the money's worth methodology pioneered by Warshawsky (1988) and refined by Mitchell et al. (1999). The main goal is to calculate the value of life annuities to the (prospective) retiree, and make this value comparable across different annuitant ages and product structures. The money's worth ratio (MWR) is based on the calculation of the expected present discounted value of annuity payouts, relative to the purchase price of the annuity. The MWR is calculated according to the following formula:

$$\text{MWR} = \frac{1}{\text{Premium}} \sum_{t=1}^T \frac{p_t \times A_t}{(1 + i_t)^t} \quad (1)$$

where  $i_t$  denotes an appropriate interest rate for a  $t$ -month investment to discount future payouts,  $p_t$  stands for the survival probability to period  $t$  given the retiree is alive in  $t = 0$ ,  $A_t$  represents the monthly payouts to

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the annuitant as actually quoted by insurance companies in  $t = 0$ , and *Premium* is the amount charged by the annuity provider in exchange for the benefits promised to the annuitant.  $T$  stands for the maximum age as per the respective mortality table.

An MWR of unity means that for every Euro invested in an annuity today, the annuitant can expect to receive 1 Euro back in today's terms, so the insurance company calculates the premium on an actuarially fair basis. More generally, the premium charged by the insurance company exceeds the actuarial present value of future payouts (i.e.,  $MWR < 1$ ) which implies transaction costs. These transaction costs may include administrative and distribution costs incurred by the insurance company, corporate overhead, additions to contingency reserves, costs of equity capital, and costs of adverse selection. Adverse selection may result from the fact that prospective annuitants live longer than the population. An MWR of less than 1 is common, as even in well-functioning markets insurance companies must cover the abovementioned costs at least in the long term. Yet, this does not mean that the retiree does not receive an adequate value for money: Mitchell et al. (1999) report that for an MWR of 0.8, rational individuals (without a bequest motive) would still prefer to buy an annuity, rather than to follow an optimal consumption and investment strategy without having access to the annuity market.

The interpretation of MWRs above unity is not straightforward. Poterba and Warshawsky (2000) argue that MWRs equal or greater than unity are implausible, at least in the long term, because of the administrative costs. James and Song (2001) claim that costs incurred by insurance companies can be covered by the spread between the risk-free rate, on which the MWR calculations are mostly based, and the higher rate they earn on their actual riskier portfolio.<sup>1</sup> Also, in case of immediate annuities, insurance companies receive the whole premium at once but pay out only a fraction over a long period of time. MWRs in excess of 1 may also be a result of optimistic assumptions underlying the calculations of the insurance company in a surveyed period, and for that reason, only short-lived. Indeed, for countries with established life and annuity insurance markets, in absence of regulatory requirements regarding the annuitization rate and for surveyed periods longer than one, the MWRs tend to be below unity.

### **International empirical evidence on money's worth ratios**

Since the introduction of the MWR methodology, it has been used to assess the annuity markets in a number of countries such as Australia, Canada, Chile, Israel, Singapore, Switzerland, the United Kingdom, and the United

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States. Table 8.1 is sorted by country surveyed and shows the main studies, time periods, as well as the type of products analyzed. The minimum and maximum MWRs are reported for nominal level annuities, quoted for 65-year-old individuals.

Thus far, the research has mainly focused on two countries – the United Kingdom and the United States. Surprisingly little research has been conducted for countries with well-developed insurance markets such as France, Germany, Italy, and Switzerland. The latter countries are similar in that the standard annuity products allow annuitants to participate in insurer profits, and thus the structure of the main products is different from the structure of main products observed for the United Kingdom and the United States. Only two studies (James and Song 2001; Bütler and Rüschi 2007) deal with the annuity markets in Switzerland, only one with the annuity market in Germany (von Gaudecker and Weber 2004), and to our knowledge, so far none deals with annuity markets in France and Italy.

All studies published to date have found that the MWRs for nominal annuities calculated using annuitant mortality tables are relatively high, usually in a range between 0.90 and 1.10. When the money's worth analysis is performed using general population mortality tables, the results are smaller, being approximately 10 percentage points less and lying between 0.80 and unity. Independent of mortality assumptions used, the MWRs differ depending on male and female, being usually somewhat higher for women due to their higher life expectancy. The difference between MWRs resulting from using annuitant versus the population mortality tables is often considered to be a measure of adverse selection in annuity markets. The presence of adverse selection, however, does not indicate that annuity markets are not functioning properly. When a range of annuity products and a freedom of choice are given, such effects can be eliminated by self-selection, meaning that people can buy annuity products which are particularly well suited to their subjectively estimated mortality risk. For example, escalating annuities will be favored by those with low mortality risk and annuities with high initial payments or period-certain guarantees by those with estimated average or high mortality risk.

In what follows, we extend prior literature in several ways. First, the approach introduced by Mitchell et al. (1999) is used to calculate the MWRs for the German voluntary life annuity market during a ten-year period (1997–2006). This is the most comprehensive time span since the deregulation of German insurance markets in 1994, a change that placed the responsibility for and control over the terms and conditions of insurance contracts as well as the design, structure, and pricing of insurance products directly with insurance companies. Second, we comment on the development of observed MWRs over time in connection with the influence of major changes in interest rates, legislative factors, and mortality assumptions.

TABLE 8.1 Main studies on money's worth ratios (MWRs), surveyed countries, and time periods

Country surveyed	Author and publication year	Period	Annuity market	Type of annuity	Min/Max MWRs for nominal level annuity <sup>a</sup> , annuitants	Min/Max MWRs for nominal level annuity <sup>a</sup> , population
Australia	Knox (2000)	1999	Voluntary	Nominal fixed, indexed, period certain	0.85–0.99	0.85–0.96
Australia, Canada, Chile, Israel, Singapore, Switzerland, the United Kingdom, the United States	James and Song (2001)	1999	Mandatory, voluntary	Nominal fixed, escalating, indexed, period certain, joint	0.91–1.08	0.86–1.08
Australia, Canada, Chile, Israel, Singapore, Switzerland, the United Kingdom, the United States	James and Vitas (1999)	1998–9	Mandatory, voluntary	Nominal fixed, joint, escalating, indexed, period certain	0.9–1.25	0.91–1.02
Australia, Singapore	Doyle et al. (2004)	1999	Voluntary	Nominal fixed, period certain	0.89–0.9 (A) 0.95 (S)	0.83–0.87 (A) 0.95–0.96 (S)
Chile	Thorburn et al. (2007)	1999–2005	Voluntary	Nominal fixed, joint, period certain	0.99–1.12	—
Germany	von Gaudeker and Weber (2004)	2003	Voluntary	Nominal fixed (with profit participation), period certain	0.97–1.01	0.86–0.94
Singapore Switzerland	Fong (2002)	2000 2000–5	Voluntary Mandatory	Nominal fixed	1.01 0.89–1.24	1.01 —

The United Kingdom	Bütler and Rüsçh (2007)	1957–2002	Voluntary	Nominal fixed, single/joint	0.95 <sup>b</sup>
The United Kingdom	Cannon and Tonks (2004)	1957–2002	Voluntary	Nominal fixed, period certain	0.98
The United Kingdom	Cannon and Tonks (2008)	1957–2002	Voluntary	Nominal fixed, period certain	0.98 (1957–2002) 0.93 (2001–7)
The United Kingdom	Finkelstein and Poterba (2004)	1981–98	Mandatory, voluntary	Nominal/real fixed, escalating	— 0.91–0.99
The United Kingdom	Finkelstein and Poterba (2004)	1998	Mandatory, voluntary	Nominal/real fixed, escalating, period certain	0.94–0.99 0.85–0.9
The United States	Mitchell et al. (1999)	1985–95	Voluntary	Nominal fixed	0.83–0.91 0.75–0.81
The United States	Warshawsky (1988)	1918–84	Voluntary	Nominal fixed	0.88–1.01 —

<sup>a</sup> Money's worth ratio calculations using Treasury yield curve; quotes for 65-year-old males and females, without period-certain guarantees.

<sup>b</sup> Based on products with five-year period-certain payouts over 1972–2002.

Source: Authors' calculations from cited sources; for full citations see references.

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### **Specifics of German annuity markets in money's worth context**

Germany is a country with well-developed insurance markets: in 1980, it was second only to the United States in terms of insurance premiums per capita and third after the United States and the United Kingdom in terms of insurance penetration. Since that time, the country has lost its position and currently lies below the G7 average, partly due to the fact that in many other countries, insurance products have shifted from public social security (especially in the pension and health sector) to private contracting, whereas the German social security system still provides generous benefits. The situation is changing, however, as it is becoming difficult to maintain public social security benefits at generous levels, and more incentives are given to provide privately for old age.<sup>2</sup> The economic basis for a sustainable development of German insurance industry and especially the life insurance industry is the availability of adequate fixed income assets, and to a lesser extent, equity capital markets, as well as the long tradition of observing the population's mortality and creating both population and annuitant mortality tables.<sup>3</sup>

The German insurance industry is one of the largest insurance markets in the world, with respect to the premiums written, with life insurance being by far the biggest sector. Assets under management of the life insurance sector amount to more than EUR 681bn. The number of insurance contracts in the life insurance sector surpasses 93 million with insured amounts of more than EUR 2.452bn for a country with a total population of approximately 82 million. Annuity business is an integral but still relatively small part of the life insurance sector (GDV 2007). The main difference between life insurance products and annuity products is their mirror image treatment of mortality risk. Both product categories are subject to the same legislation and are similarly regulated in Germany. In fact, many life insurance contracts contain the option to convert the insured sum into a stream of annuity payments, instead of the lump sum payout, whereas many deferred annuity contracts contain the option for a lump sum payment at the end of the accumulation phase.

Currently, traditional insurance contracts which pay out benefits as an annuity represent approximately 22 percent of the in-service contracts and 13 percent of the paying-out contracts (measured by the number of contracts). This corresponds to approximately 18 percent of the amount insured for in-service contracts, and 15 percent of the paying-out contracts. The abolition of tax privileges in 2005, however, led to the dramatic increase in the popularity of annuity contracts and with time may result in the complete change of patterns. For example, annuity contracts accounted for approximately 50 percent of all new contracts for the year



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2007 as measured by the number of contracts, and for 30 percent of all new contracts as measured by amounts insured (GDV 2007).

The standard product in the German market is the single life nominal participating annuity, consisting of a guaranteed portion and a profit participation portion. The guaranteed part is calculated using an interest rate defined by legislation; it must be paid out to the insured independent of actual profits of the insurance company during the whole lifetime of the insurance contract.<sup>4</sup> The profits of the insurance companies stem from the net investment results during the relevant period as well as from cost and mortality experience. Both cost and mortality experience tend to remain quite stable during long time periods, making net investment results the main source of insurer profits (Maurer and Somova 2007). A considerable portion of the surpluses must be distributed to the annuitants, and the supervisory authority ascertains that all insurance companies adequately honor this legislative requirement annually.<sup>5</sup> Such non-guaranteed profit participation can be considered as a quasi-inflation adjustment to the annuity payment, which is otherwise fixed in nominal terms.

There are two main profit participation schemes in the German annuity market: a dynamic participation scheme and a so-called flexible (also termed 'constant') participation scheme. Both offer a guaranteed payout, the minimum amount of which is calculated according to legislative requirements regarding the interest rate. The participation scheme defines the form in which profits are allocated on top of the guaranteed amount, and in this way it determines the total payout the annuitant can receive annually. When the dynamic participation scheme is chosen, the periodic payment starts from a level only insignificantly above the guaranteed payout, and it increases annually depending on the actual profits of the insurance company. Once the annual increase has taken place, the achieved payout level cannot be reduced, even if the insurer were to earn lower profits in subsequent years. On the signing of such an annuity contract, the insurer guarantees the payout during the first year and provides projections regarding expected payouts for up to fifteen years thereafter. Such projections for periods longer than one year are, however, not legally binding and can be revised anytime if the calculation basis of the insurer changes. The major advantage of this payout scheme is that the insured is protected against outright reductions in annuity payments, and benefits will most probably increase with age. The main disadvantage is that payouts from this product start relatively low, thus delivering lower cash flows immediately after retirement when life expectancy is high and financial needs may also be high, compared to more advanced ages. The annual increase of payments in the dynamic profit participation scheme depends mainly on the net interest earned by the insurance company during the

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period under consideration, and the guaranteed constant interest rate valid at the time of the contract's signing (which by legislation must be applied to its whole lifetime).

The flexible (or constant) profit participation scheme anticipates insurers' future profits from the beginning of the payout period. Thus, benefit payments start at a level considerably above that of the guaranteed payout<sup>6</sup> and remain constant unless the company decides to change the profit participation. The absolute payment amount above the guaranteed payout is not guaranteed on an annual basis in this format;<sup>7</sup> rather, it can be reduced if the insurer's profits fall below a certain level. The advantage of this participation scheme is that it delivers higher payouts at the beginning of the annuity contract's lifetime, offering possibly more financial flexibility for retirees when they are younger. The main disadvantage is that, during periods of low interest rates, payment levels can be reduced.

The partly dynamic participation scheme combines the features of the two schemes described earlier. Herein, payments early in the payout period are higher than with the pure dynamic participation scheme, and annual increases are lower. The payout level, however, cannot be reduced.

In the German market, it is also possible to obtain period-certain guarantees for a range of periods, giving the retiree a surety that the pension would be paid for a set time horizon (e.g., ten years independent of whether the insured person is alive). Another modification of the annuity agreement offers protection for dependants, called the 'premium refund' scheme (*Beitragsrückgewähr*). When this form of guarantee is chosen, the annuitant's heirs are entitled to a payout of the difference between the total contributions paid prior to the start of annuity payments, and the annuity payments so far received.

Independent of the availability of any guarantee, the annuitant can elect a dependent protection option, in which case the insurance company will pay the widow's benefit to the heirs. In case the premium refund option was in place, the heirs can choose either the lump sum payout or a dependent's pension. Both guarantee forms incur costs to the annuitants, making their life annuities more expensive. All abovementioned payout and guarantee options are available for both immediate annuities (which are further analyzed later) and deferred annuities.

Insurance companies are not obliged to offer all annuity products and are free to compile their own product range. Our review of the German market suggests that many companies are more willing to offer quotes for products with guarantees as well as dynamic participation schemes, versus those offering flexible participation schemes. Table 8.2 summarizes the characteristics of typical annuity products in the German market, extending the typology introduced by Poterba (2001).

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TABLE 8.2 Structure of the typical annuity product in the German market

Attribute	Structure
Nature of payouts	Nominal fixed
Number of lives covered	Single
Payout guaranteed	Yes, calculation inputs defined by legislation
Profit participation form	Dynamic/flexible/partly dynamic
Waiting period for the start of benefits	Immediate/deferred
Method of premium payment	Single/gradual
Duration of payouts	Lifelong
Period-certain guarantee	Yes, usually 5/10/15 years or premium refund

*Source:* Authors' calculations; see text.

**Setup of the money's worth analysis for German voluntary annuity market**

*Annuity quotes*

We have gathered data for the period 1997–2006 on the monthly payouts for an immediate, single life annuity costing EUR 100,000 in the voluntary market. (Prior to the introduction of the Euro,<sup>8</sup> a purchase price of DM 100,000 was used.) Quotes were obtained from the database 'LV-Win' provided by Morgen and Morgen (2010). This database covers about 90 percent of German annuity product providers, although not every insurance company offers the entire range of annuity products.<sup>9</sup>

Our data on payouts distinguish between annuity payouts for males and females, and then by age; we analyze quotes for 60-, 65-, and 70-year olds.<sup>10</sup> Within the product groups, we first look at those offering no guaranteed payment periods, and then those which offer a period-certain guarantee for the first ten years. For both categories, with and without the period-certain payment, we consider a nominal fixed annuity and then distinguish between the guaranteed payout and two different forms of participation, as described earlier. Table 8.3 summarizes the structure of the sample.

For MWR calculations, it is necessary to model the development of payouts over a period of several decades. Guaranteed payouts remain certain during the lifetime of an annuity contract, but it is necessary to develop a method of determining the applicable annual profit participation rates. For the dynamic profit participation scheme, we follow the conservative approach in Albrecht and Maurer (2002), which uses as a proxy the net investment return of insurance companies. For the years 2001–6, where it was possible to obtain actual data on average profit participation rates for the annuity business (Assekurata 2004, 2005, 2007,

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TABLE 8.3 Structure of the data sample for calculation of money’s worth ratios in the German voluntary annuity market

Attribute	Time span	
	1997–2001	2002–6
Purchase amount	DM 100,000	EUR 100,000
Annuitant’s characteristics	Male/female single life	Male/female single life
Period-certain payments	0 year/10 years	0 year/10 years
Profit participation form	Only guaranteed payment/ flexible/dynamic	Only guaranteed payment/ flexible/dynamic
Purchase age (years)	60/65/75	60/65/75

Source: Authors’ calculation using data from Morgen and Morgen (2010); see text.

2009), we calculate the so-called ‘dynamization factor’ as a difference between the reported market average profit participation rate and the guaranteed interest rate applicable to the year the contract was signed. For years prior to 2001, we estimate the dynamization factor as the difference between 90 percent of the net investment returns reported for the year of contract signing, and the guaranteed interest rate applicable to the corresponding year.<sup>11</sup> For the dynamic profit participation scheme, annual payouts after the first year increase on a yearly basis by the dynamization factor. The annual dynamization rates obtained by both methods are more conservative than those implied by the projected annuity payments as quoted by insurers for the fifth, tenth, and fifteenth year of the annuity contract’s lifetime.<sup>12</sup>

For the flexible scheme, we use the amount paid during the first year, since the change in profit participation rate is at the insurer’s discretion. German insurance companies have sought to avoid reductions in the profit participation rates, but in 2001–3 some of them actually reduced benefits for products with flexible profit participation. For both dynamic and flexible participation schemes, our procedure for modeling profit participation is similar to that in von Gaudecker and Weber (2004). It is important to note that, outside the framework of the minimum guaranteed payouts and the payouts for the first year, the total annual payouts in each subsequent year are not certain. To account for this, the adjustment either of the cash flows or of the interest rates is required.

Figure 8.1 displays the time series of annuity rates by sex. For example, a monthly quote for a EUR 500 payout for life in exchange for a purchase price of EUR 100,000 gives the (annual) annuity rate of 6 percent ( $500 \times 12/100,000 = 0.06$ ). Panels (A–C) of Figure 8.1 show the time path of

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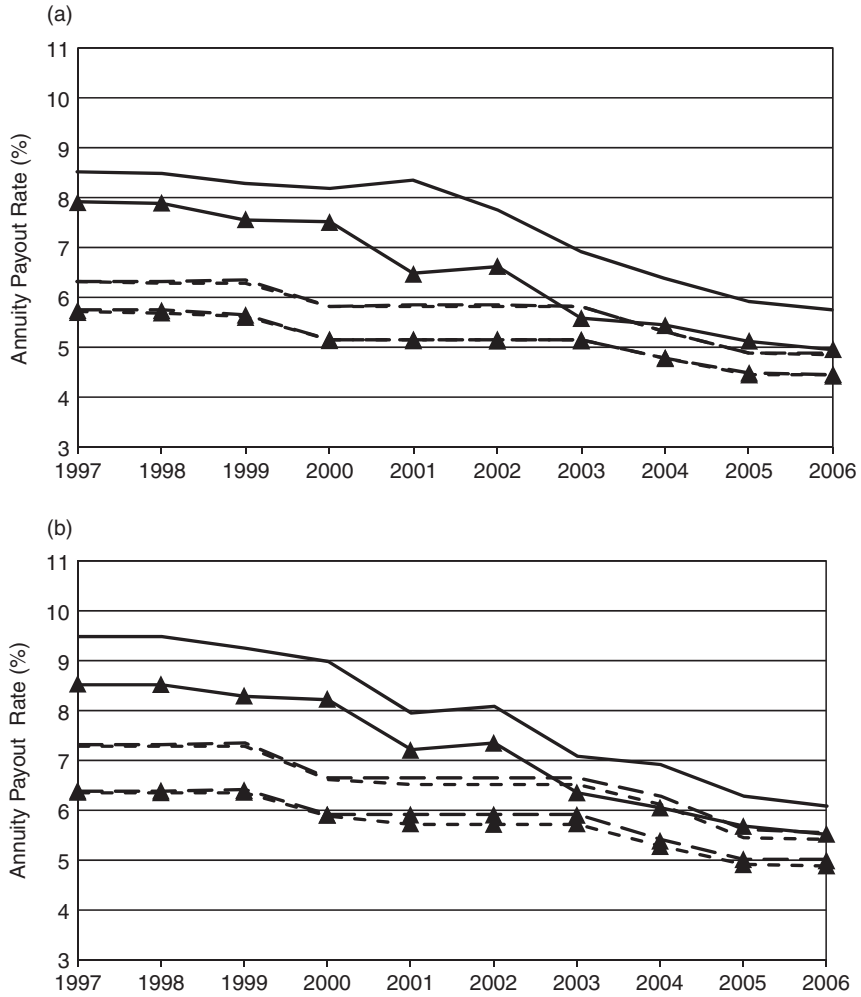


Figure 8.1 Development of average annuity payout rates for German voluntary single immediate life annuities 1997–2006. Panel (A): age 60, without period-certain payout guarantee; Panel (B): age 65, without period-certain guarantee; Panel (C): age 70, without period-certain guarantee; Panel (D): age 70, with period-certain guarantee. *Source:* Authors' calculations; see text.

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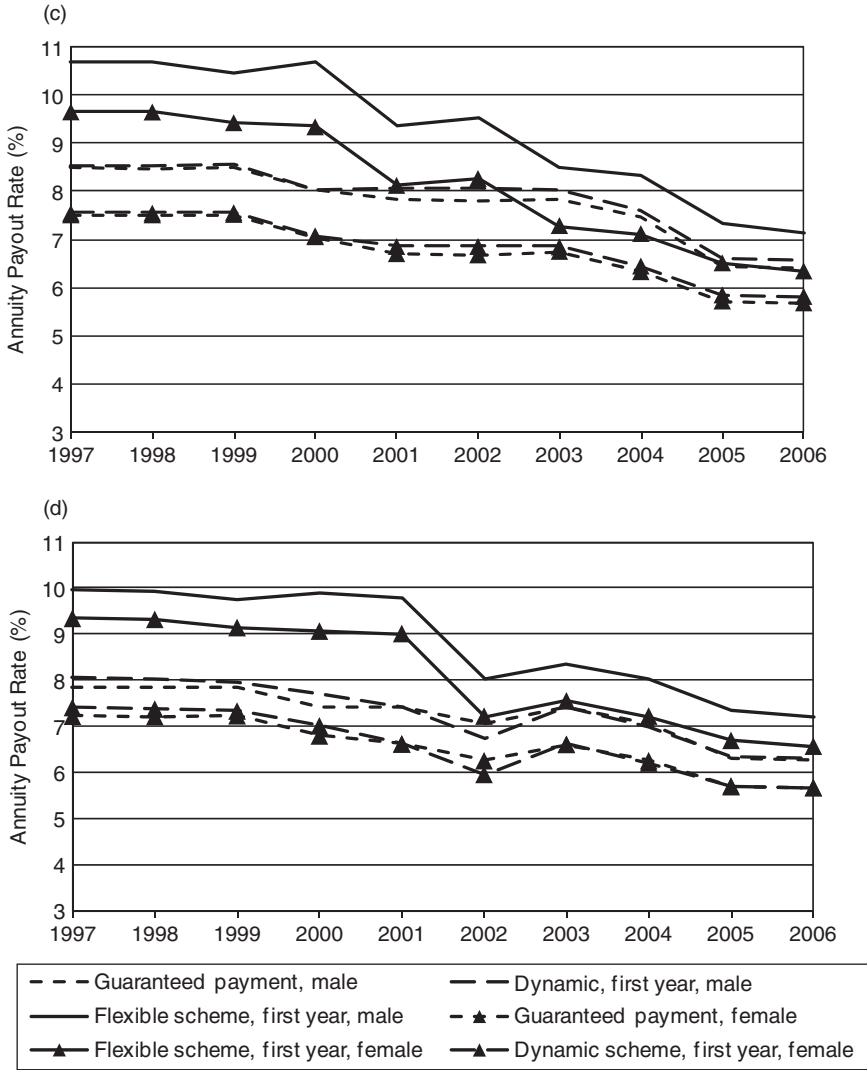


Figure 8.1 *Continued*

average annuity rates for products without a period-certain guarantee, for 1997–2006.

The annuity rates for all age groups and product categories over the period lie between 4 and 11 percent, higher at the beginning of the period and lower toward the end. This pattern is in line with the trend in long-term government bond interest rates, since insurance companies in

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Germany predominantly invest in fixed income securities and their guaranteed interest rate is linked to interest rates on government securities. By comparison, the yield for ten-year government bonds moved over the same period from approximately 6 percent in 1997 to under 4 percent in 2006 (German Bundesbank 2007). Looking across the age groups, we see that annuity rates rise for older buyers, consistent with the rising mortality with age; this results from leading mortality credits for surviving annuitants as ages rise. For example, in 1997, the average rate for the guaranteed payment part of the annuity for a 60-year-old male was slightly above 6 percent, while for a 70-year-old male, it was more than 8 percent. By 2006, the rates were about 5 and 6.5 percent, respectively. During the whole surveyed period, annuity rates for males (lines without markers) were higher than annuity rates for females (lines with markers), reflecting females' higher life expectancies.

Figure 8.1 also reports the with-participation rates for the first year of the annuity contract guaranteed by the insurance company at the time the quotes were obtained. Changes over time follow interest rate trends. Rates for the dynamic scheme, shown as first-year quotes, are only slightly higher than the rates for the guaranteed payouts due to the structure of annuity products with dynamic participation schemes (where the latter offer higher payouts as the contract matures). Within a single product category and year, we see considerable differences between insurer quotes. Understandably, those differences are relatively small for the guaranteed payouts, and they become bigger when profit participation is considered. The standard deviation of the offers ranges between 1 and 2 percent of the average for the guaranteed payouts, and from 5 to 9 percent of the average for the schemes having with-profit participation. This translates into potentially huge differences in the payment amounts: the difference between the minimum and maximum quoted monthly payment within a single product category varies in the range of EUR 15–20 for the guaranteed payout, and over EUR 100 for products having with-profit participation. A possible explanation for this dispersion in annuity payouts across firms may be the financial capacity of the company selling the annuities (Mitchell et al. 1999). In addition, insurance product pricing depends on each firm's product strategy and business policy.

The guarantees on the period-certain payments reduce annuity payouts depending on the entry age and sex of the annuitant. In our data, the annuity payments without period-certain payment were 1–5 percent lower, on average, than for the same annuity without a guarantee. The differences between the quotes with and without period-certain payments are bigger for men than for women, due to women's lower mortality. They also increase with entry age, being the highest (up to 8 percent difference) for a 70-year-old male. Across all ages, price differences between the pro-

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ducts with and without the period-certain guarantees declined over time. Panel (D) of Figure 8.1 illustrates the developments of the quotes on the example of 70-year-old males. While quotes for products without period-certain guarantees were in the range of 7.5–10.5 percent in the year 1997, they declined to approximately 6–7 percent in the year 2006. The difference between products with and without period-certain guarantees was about 1 percentage point in 1997, and almost nonexistent in 2006.

Relatively small and declining differences in prices of products with and without guarantees may be explained by different mortality assumptions underlying the insurer's price calculation. Figure 8.2 traces survival probabilities for annuitants who purchased at age 60 and 70, based on the DAV 2004R mortality table.<sup>13</sup> For 60-year-old annuitants, the probability of being alive ten years after the start of annuity payments is 95 percent (women) and 91 percent (men) as indicated in Panel (A). This means that, even without a guarantee period, the insurance company almost surely expects to pay benefits during the first decade. Survival probabilities decline by 11 and 17 percent for females and males respectively at age 70 (Panel B). This means that insurers still expect to be paying approximately five (four) out of every six female (male) annuitants at the end of the ten-year guarantee period.

### *Interest rates*

We use as discount rates the yields of government bonds observed in the year the respective annuity was priced, with maturities ranging from one to twenty years.<sup>14</sup> In doing so, we follow the approach in Mitchell et al. (1999), von Gaudecker and Weber (2004), and Cannon and Tonks (2008), among others. After the first twenty years, we assume a flat interest rate structure at the level achieved in year 20. Our procedure is justified because observed differences are small between the yields for maturities over twenty years on German government securities, and also because the estimation error for maturities longer than twenty years is high as there are not many relevant securities in the German bond market. The choice of default-free discount rates in our analysis is justified by the fact that little company risk has been observed in the German life insurance market due to strong regulation. For instance, Maurer and Somova (2007) report that since World War II, there has been only one insurer insolvency. The security of annuity and life insurance payments and the credibility of insurance obligations are also supported by the industry's solvency arrangements.<sup>15</sup> Studies for other countries such as the United States and the United Kingdom also perform the analysis using both government and corporate bond yields, but insurance company insolvency is observed there more often.<sup>16</sup>



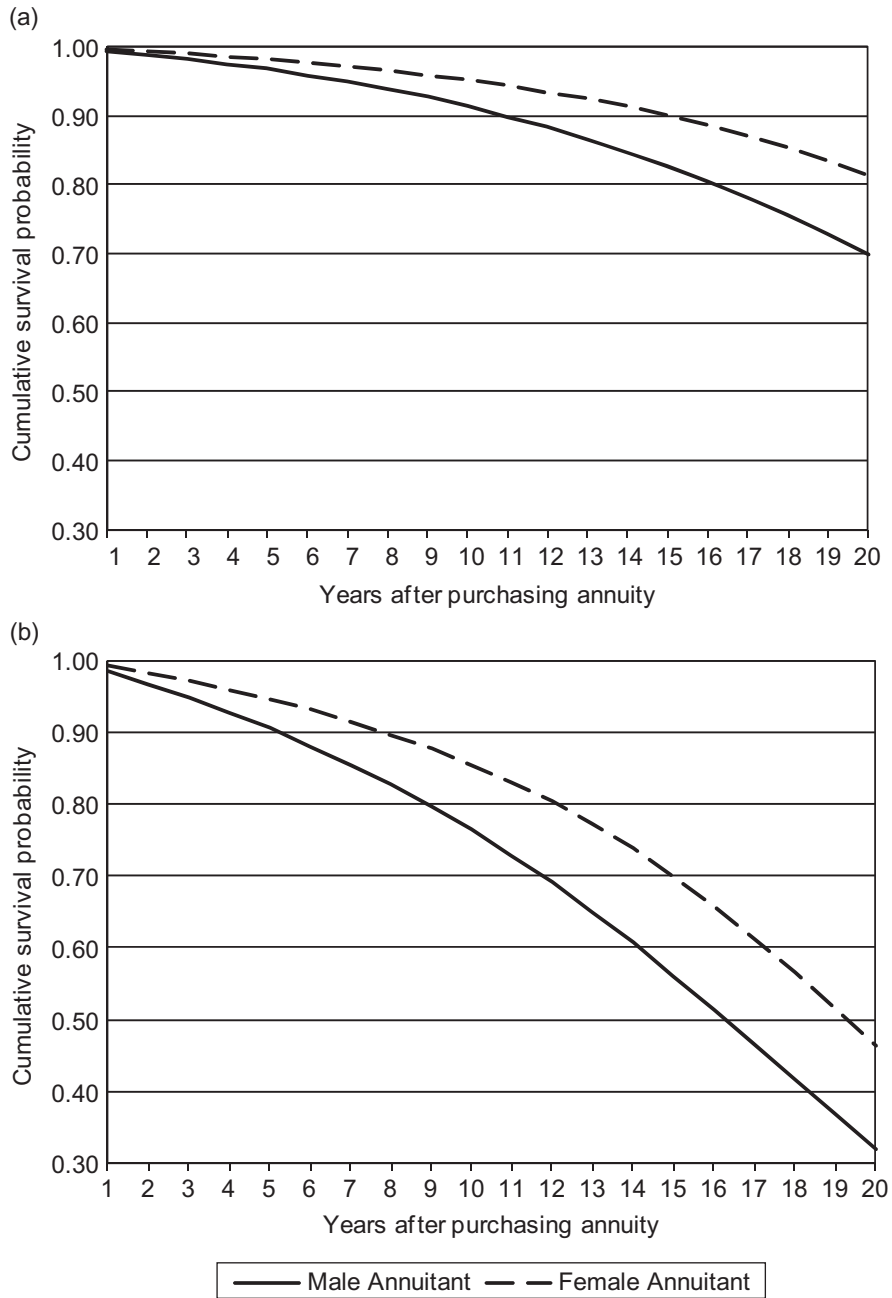


Figure 8.2 Survival probabilities for annuitants aged 60 and 70. Panel (A): annuity is purchased at age 60; Panel (B): annuity is purchased at age 70. *Notes:* In Panel (A), the survival probability ten years after annuity purchase for males is 0.91 and for females is 0.95. In Panel (B), the survival probability ten years after annuity purchase for males is 0.76 and for females is 0.85. *Source:* Authors' calculations based on DAV 2004R German annuitant mortality table.

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### *Mortality assumptions*

We use both annuitant and population mortality tables to assess selection effects in the market and to shed light on the thin market for voluntary annuity purchase. The German Society of Actuaries (DAV) recommended the DAV 1994R for 1997–2004, and for the years 2005 onward, the DAV 2004R table. The general population mortality tables are published by the German Statistics Office every three years, the last one currently available being the 2005–7 table (Statistisches Bundesamt 2008). As is expected, survival probabilities in annuity mortality tables are higher than those in the population mortality table, reflecting both insurer loads and adverse selection.<sup>17</sup> Also for both tables, the mortality rates for females are, on average, lower than for males.

To describe the differences between actuarial tables in Germany, we compute the ratio of actual to expected mortality as in McCarthy and Mitchell (2002).

$$\frac{A}{E} = 100 \times \frac{\sum_x^T w_x q_x^*}{\sum_x^T w_x q_x} \quad (2)$$

Here,  $q_x^*$  is the probability of an individual of age  $x$  dying within the next year according to the mortality table in question, and  $q_x$  is the probability of an individual of age  $x$  dying according to a benchmark table. The weights  $w_x$  are set so that the initial population is 100,000 and  $w_x = w_{x-1}(1 - q_{x-1})$ .  $T$  is the terminal age of the benchmark table.  $A/E$  is a usual metric used by actuaries and demographers to express the number of deaths in a population with a given age structure using one table, and relating it to the expected number of deaths in a population of the same size using a second mortality table. The ratio is multiplied by 100. A value of 100 implies that the number of deaths is equal irrespective of which mortality table is used while a value of less than 100 means that the number of deaths in the benchmark table is bigger.

We compare annuitant mortality tables DAV 2004R and DAV 1994R starting from the age of 65 until the terminal age of the benchmark mortality table, in this case DAV 1994R. The  $A/E$  ratio in this case is 96 for both males and females, meaning that on average, the mortality for individuals aged 65 according to the DAV 2004R table is only 4 percent lower than in the DAV 1994R table. This observed relation changes over time, however. Until the age of 90, mortality according to the DAV 2004R table is substantially lower than according to the DAV 1994R. it is bigger up to a factor of 1.5 after the age of 90, the increases being especially pronounced for males. These differences most probably reflect the incorpora-

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tion of the new statistical observations in DAV 2004R, and the use of different statistical methods to estimate mortalities at the end of the mortality table, where real mortality observations are relatively scarce. The  $A/E$  ratio is 69 (67) for males (females) when the annuitants table DAV 2004R is compared to the 2005–7 population table (benchmark table), in line with the results reported by McCarthy and Mitchell (2002) for the United States and the United Kingdom, especially males.<sup>18</sup>

Assessment of mortality improvements in the general population during the surveyed decade also delivers interesting insights. The comparison between population tables 2005–7 and 1995–7 results in an  $A/E$  ratio of 70 for males and 65 for females, and the strongest mortality improvements are observed for the time span of 65–75 years. These mortality trends should influence insurers' calculation of annuity rates, and the calculation of MWRs by the prospective retirees.

### Main results for the German voluntary annuity market

Results show that over our ten-year period, annuities without a period-certain guarantee deliver a good value for money using annuitant mortality tables (see Table 8.4). Average values for all ages mostly lie slightly below unity when profit participation is accounted for. For the guaranteed payout part, the values are lower due to the conservative assumptions used in the calculation. The values of slightly below 80 percent are also broadly in line with international experience, however (Warshawsky 1988; James and Song 2001). Table 8.4 also shows, for products including profit participation, that the money's worth values are slightly higher for females than males, reflecting female's higher survival probabilities. The difference in MWRs benefiting females stems from the profit participation, since for the guaranteed payouts only, the figures are slightly higher for males. This is due to the fact that insurance companies typically offer lower rates to females because they are expected to benefit longer from the annuity payments, while they distribute profits independently of the sex of the purchaser.

There are few differences by age group for products having with-profit participation. For only the guaranteed part, the ratios slightly increase with age, being the highest for the 70-year-old buyer; this supports the observation that survival credits increase with age. It should be noted that MWRs for products including profit participation are very sensitive to the assumptions about the participation structure and the development of the profit participation over time. The standard deviation of MWRs during the surveyed period across all age groups is very stable for the guaranteed payouts, being approximately 5 percentage points. It is between 8 and 10 percentage points for the flexible participation scheme, and between 10 and 12

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TABLE 8.4 German voluntary annuity market money's worth ratios averages from 1997 to 2006 for products with and without period-certain guarantees

	Without guarantee period			With ten-year guarantee period		
	Guaranteed payment	Flexible scheme	Dynamic scheme	Guaranteed payment	Flexible scheme	Dynamic scheme
<b>A. Annuitant mortality table</b>						
<i>Average quotes, age 60</i>						
Male	0.771	1.001	0.989	0.770	0.989	0.988
Female	0.760	1.011	1.004	0.756	0.993	0.998
<i>Average quotes, age 65</i>						
Male	0.789	0.994	0.981	0.791	0.987	0.982
Female	0.779	1.004	0.995	0.778	0.991	0.993
<i>Average quotes, age 70</i>						
Male	0.812	0.992	0.978	0.816	0.992	0.982
Female	0.805	1.001	0.993	0.806	0.994	0.993
<b>B. Population mortality table</b>						
<i>Average quotes, age 60</i>						
Male	0.688	0.894	0.855	0.770	0.989	0.988
Female	0.698	0.928	0.891	0.756	0.993	0.999
<i>Average quotes, age 65</i>						
Male	0.689	0.868	0.829	0.791	0.987	0.981
Female	0.702	0.903	0.864	0.777	0.991	0.993
<i>Average quotes, age 70</i>						
Male	0.694	0.847	0.808	0.816	0.991	0.982
Female	0.704	0.874	0.836	0.806	0.994	0.993

Source: Authors' calculations; see text.

percentage points for the dynamic scheme (see Figure 8.3). When a population mortality table is used, the MWRs become approximately 10 percentage points lower across all product groups and age categories (see Table 8.4). This is consistent with Mitchell et al. (1999), Finkelstein and Poterba (2002), and von Gaudecker and Weber (2004), and it results from the lower life expectancy of the general population compared to that of buyers of voluntary annuities. The other conclusions drawn for the guaranteed payouts, flexible, and dynamic participation schemes are similar, independent of mortality table used.

The mortality advantage of female annuitants becomes more visible when the general population tables are used to calculate MWRs. This can be explained by the fact that survival probabilities have to be assessed using forecast models since data are not available for the very advanced ages typical of annuitant mortality tables. The use of forecast models usually

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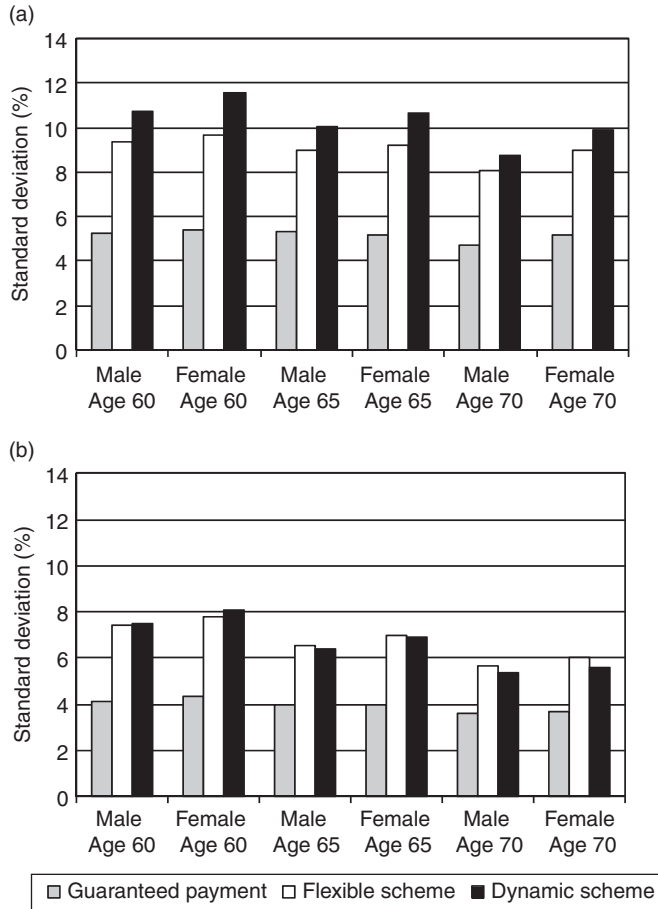


Figure 8.3 Standard deviation of money's worth ratio averages, products without period-certain guarantees, German voluntary annuity market, range of entry ages, 1997–2006. Panel (A): annuitant; Panel (B): population. *Source:* Authors' calculations; see text.

results in a reduction of the male–female differences until a crossover point, when female mortality at advanced ages surpasses male mortality.<sup>19</sup> A slight convergence of mortality rates in advanced ages is also observed for German general population mortality tables. It is pronounced toward the end of the DAV 2004R (annuitant) mortality table, and a complete crossover is observed in the annuitant's mortality table DAV 1994R. The annuitant longer life expectancy may also be driving the higher standard deviation of MWRs calculated with annuitant mortality

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tables, versus using the population table (compare Panels (A) and (B) of Figure 8.3).

Offering a period-certain payout of ten years makes the annuities more expensive to purchase; thus quotes for period-certain products are lower than for the same products without any period guarantees. Nevertheless, the period-certain annuities may be a useful product for older annuitants and for those with average (or below average) life expectancy. When the annuitant mortality table is used to calculate the money's worth, the effects of the guaranteed payment period are not very pronounced. For instance, for the 60-year olds, the MWRs are slightly reduced, while for the age groups of 65- and 70-year olds a slight increase is observed in comparison to products without guarantee.

The use of a population mortality table highlights the advantages of the guaranteed payment period. Table 8.4 illustrates the described results. Now, the MWRs are similar to those observed using the annuitant tables, coming close to unity for both profit participation schemes. In other words, the differences arising from the use of annuitant versus population tables are eliminated by the payout guarantee. Individuals at advanced entry ages (65 and 70) tend to benefit more from the guaranteed payout period.<sup>20</sup>

### *Trends during the surveyed period*

As noted earlier, the MWRs declined after 2003 for all age groups in the German market. After that year, they were about 90 percent for products with profit participation, and about 75 percent for the guaranteed part only. Figure 8.4 shows the annual results by product category and mortality table used, for an entry age of 65. Results are similar for the other age groups.

Values for males appear in Panels (A) and (B) for products without and with period-certain guarantee, and in Panels (C) and (D) for females. The lines with markers use population tables. As is clear, results depend, to a large extent, on capital market developments experienced during the period. When interest rates declined considerably, this reduced both insurer existing values and new investment opportunities; in turn, this produced a pronounced decline in the net interest earned by insurance companies since German insurance companies predominantly invest in domestic fixed income securities.<sup>21</sup> During 1997–2000, the net interest earned by insurance companies was relatively stable, averaging approximately 7.5 percent. However, in 2001 and 2002, it fell to 6 percent and then to 4.6 percent, after which the net interest remained at the level of approximately 5 percent.

This persistent decline in interest rates affected annuity markets in several ways. First, insurance companies had to reduce the guaranteed

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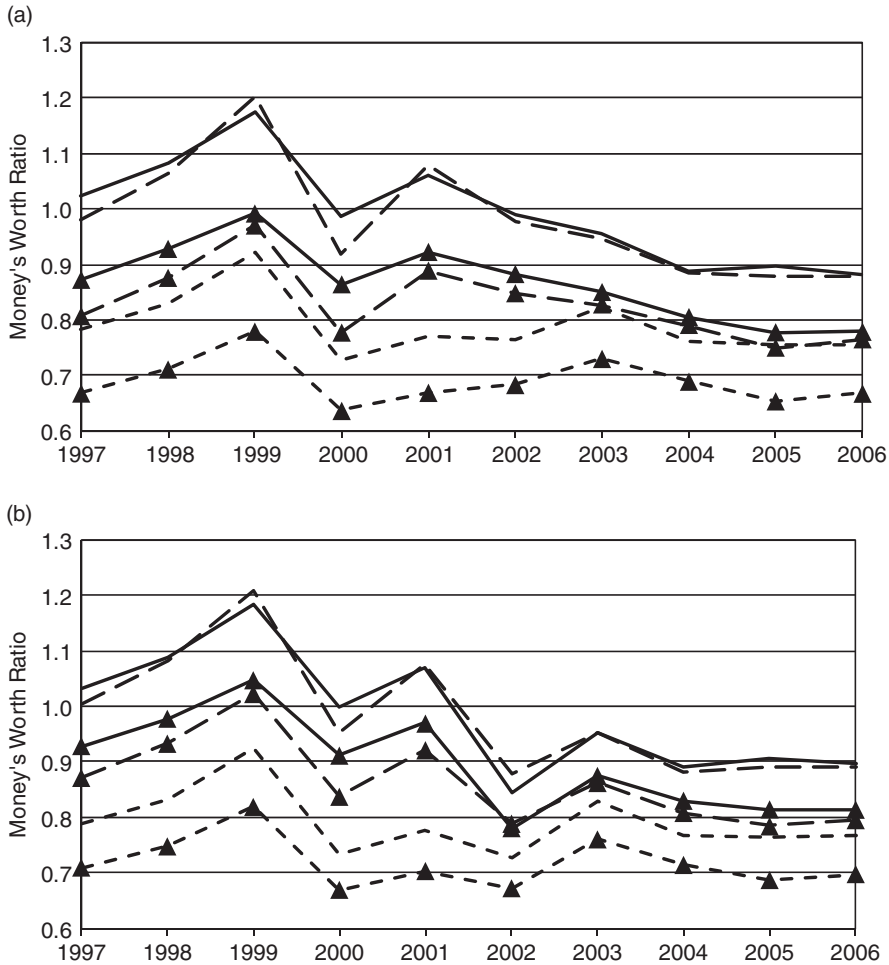


Figure 8.4 Year-by-year development of money's worth ratios for 65-year-old annuitants in the German voluntary annuity market. Panel (A): male aged 65 without period-certain guarantee; Panel (B): male aged 65 with period-certain guarantee; Panel (C): female aged 65 without period-certain guarantee; Panel (D): female aged 65 with period-certain guarantee. *Source:* Authors' calculations; see text.

interest rate for new contracts from 4 percent in 1997–2000, to 3.25 percent in 2001–3, and 2.75 percent in 2004–6.<sup>22</sup> By legislation, this guaranteed interest rate cannot exceed 60 percent of the average yield on government securities during the last ten years.<sup>23</sup> Second, the actual profits of insurance companies available for distribution to the annuitants and expectations

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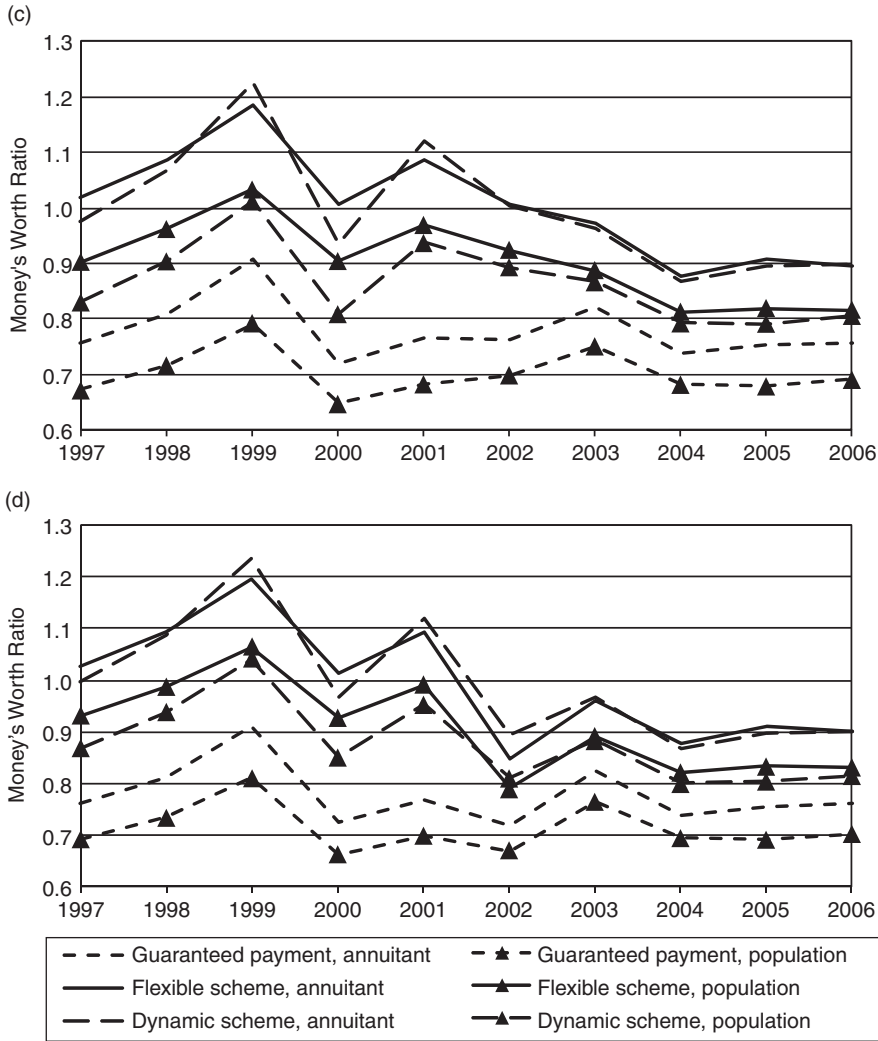


Figure 8.4 *Continued*

about their future profits declined.<sup>24</sup> In 2001, the industry average profit participation rate was about 7 percent; it declined by approximately 40 percent to 4.34 percent by 2006. This reduced offered and projected profit participations rates, which in turn influenced the quotes in our calculated MWRs.

Despite this reduction in MWRs over the surveyed period, recent levels remain relatively high compared to voluntary markets in Australia, the



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United Kingdom, and the United States (see Warshawsky 1988; Mitchell et al. 1999; Doyle et al. 2004; Finkelstein and Poterba 2004). In addition, our results in this study for 2003 are close to those by von Gaudecker and Weber (2004: 402) for the same period, the MWRs of this study being on average 2–3 percent lower for males and 6 percent lower for females.<sup>25</sup>

Results obtained using annual market averages differ from those using the sample minimum and maximum quotes; Table 8.5 illustrates this using a 65-year-old retiree for the year 2006. Calculations were performed using annuitant life tables by sex and product type as well as by using the population life expectancy. We show that the with-profit-participation MWRs for annuitants are close to 1 or even slightly above it (0.91–1.01) when the maximum market quotes are used, but they never exceed 0.86 using the minimum market quotes. The use of average rates results in

TABLE 8.5 Money’s worth ratios for the year 2006, based on minimum, average, and maximum quotes

	Without guarantee period			With ten-year guarantee period		
	Guaranteed payment	Flexible scheme	Dynamic scheme	Guaranteed payment	Flexible scheme	Dynamic scheme
A. Annuitant mortality table (age 65 in 2006)						
<i>Minimum quotes</i>						
Male	0.739	0.831	0.832	0.749	0.841	0.847
Female	0.742	0.839	0.863	0.748	0.842	0.858
<i>Average quotes</i>						
Male	0.757	0.881	0.880	0.767	0.896	0.890
Female	0.758	0.895	0.899	0.761	0.902	0.900
<i>Maximum quotes</i>						
Male	0.773	0.972	0.908	0.783	0.990	0.947
Female	0.775	1.001	0.934	0.779	1.009	0.961
B. Population mortality table (age 65 in 2006)						
<i>Minimum quotes</i>						
Male	0.653	0.734	0.723	0.681	0.764	0.757
Female	0.677	0.765	0.773	0.690	0.777	0.778
<i>Average quotes</i>						
Male	0.668	0.778	0.765	0.697	0.814	0.795
Female	0.691	0.816	0.806	0.702	0.832	0.815
<i>Maximum quotes</i>						
Male	0.683	0.858	0.789	0.712	0.900	0.846
Female	0.707	0.913	0.837	0.719	0.931	0.871

Source: Authors’ calculations; see text.

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MWRs between 0.88 and 0.90. For the population life expectancy, the MWRs range between 0.72 and 0.78 for minimum and 0.79 and 0.93 for the maximum market quotes. These differences are relatively small for the guaranteed part of the product due to the binding legal requirements in force. The variation becomes considerable, ranging between 8 and 18 percent of the average figures when the profit participation is accounted for, being understandably more pronounced for products with period-certain guarantees.

### **Conclusion**

This chapter explains products on offer in the German voluntary annuity market, where insurers allow annuitants to participate in the profits of the insurance company, and we show the value for money that prospective retirees can expect, based on the long-term record. We advance the literature by closely examining the long-term developments in such a market, where, besides the guaranteed fixed payment, the distribution of the insurer's annual profits is required by legislation and is thus an important part of the annuity product. We also consider the influence of different profit participation forms, guarantees, and entry ages. Finally, we explain the influence of interest rates and mortality assumptions on the long-term development of MWRs.

Previous studies have found that MWRs for nominal annuities calculated using annuitant mortality tables are relatively high, usually between 0.90 and 1.10. If the calculation is performed using general population mortality tables, the results are typically lower by approximately 10 percentage points, lying between 0.80 and 1.0. Our analysis of the German voluntary annuity market proves that this market is in line with international experience. On average, MWRs for all age categories mostly lie slightly below unity when profit participation is accounted for. Regarding the guaranteed payout part only, the values are lower, at approximately 0.8. Across all age categories for products including profit participation, the money's worth average values are slightly higher for females than males. Interestingly, there are no considerable differences between age groups for products with profit participation. Our analysis indicates that products with period-certain guarantees provide good value for money in Germany, especially for those having average life expectancy. The slight decline of the MWRs in the recent past does not stem from weaker insurance markets but rather it mirrors the development in the capital markets. In sum, payout products for life annuities in Germany deserve a role in the retirement portfolio.

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### Notes

- <sup>1</sup> This argument may have only a limited validity for Germany, as German insurers mainly have conservative bond investments in their portfolios.
- <sup>2</sup> See Maurer and Somova (2007: 309–15) for details on the role of insurance in Germany.
- <sup>3</sup> In Germany, the first scientific mortality observations date back to the late seventeenth century, while the first official population mortality table covers the years 1871–81 (Statistisches Bundesamt 2008).
- <sup>4</sup> Under the German Insurance Supervision Law, the interest rate which should be used to calculate the guaranteed part of the product is called the guaranteed interest rate and is limited to 60 percent of the average yield on the government securities during the last ten years. Since 2007, it has been 2.25 percent.
- <sup>5</sup> §81 VAG (German Insurance Supervision Law).
- <sup>6</sup> In the available sample, the first payouts with the flexible participation scheme are currently 15–20 percent above the guaranteed payment level. In past periods of high net investment returns, the quoted payouts were even 30–40 percent higher.
- <sup>7</sup> The monthly payouts remain constant during the year.
- <sup>8</sup> The Euro was first used in 2002.
- <sup>9</sup> See Maurer and Somova (2007). The top ten life insurance companies account for approximately 60 percent of the market, as measured by the gross written premium.
- <sup>10</sup> Our research suggests that it may be difficult to obtain quotes for immediate life annuities for individuals older than age 85.
- <sup>11</sup> By legislation, German insurance companies are obliged to pay out the lion's share of the profits to the annuitants. Net investment returns of life insurance companies are taken from statistics published by GDV (2007).
- <sup>12</sup> For products with a dynamic participation scheme, in their quotes insurers guarantee the absolute amount paid during the first year, and give nonbinding projections for the years 5, 10, and 15. These projections can be used as a marketing tool, however, and later revised downward to the extent the guaranteed payout and the rules of the participation scheme allow.
- <sup>13</sup> DAV 2004 is recommended for use in the calculation of annuity products since the year 2005 by the German Society of Actuaries.
- <sup>14</sup> The data was provided by German Bundesbank (2007).
- <sup>15</sup> The life insurance company *Protector* was created in 2002 by the insurers, members of the German Insurance Association, representing more than 97 percent of gross insurance premiums in the German life insurance market. This company is financed from the members' contributions and has the purpose of taking over the existing insurance contracts of an insolvent insurer, leaving the benefits unchanged. So far, the services of *Protector* were used only once in 2003 (for Mannheimer Lebensversicherung). See Maurer and Somova (2007: 338–9) for more details.

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- <sup>16</sup> For example, BarNiv and Herschbarger (1990) report that during 1975–86 more than seventy life insurance companies failed in the American insurance market.
- <sup>17</sup> See Mitchell et al. (1999) and McCarthy and Mitchell (2002) for discussion on the subject.
- <sup>18</sup> McCarthy and Mitchell (2002) report that the  $A/E$  ratio for UK males is 67.5, for US males, 65.3; for females they are 73.5 (the United Kingdom) and 73.6 (the United States).
- <sup>19</sup> Statistisches Bundesamt (2008).
- <sup>20</sup> Similar results have been obtained in other studies such as James and Song (2001), Finkelstein and Poterba (2002), and von Gaudecker and Weber (2004), while the results in Knox (2000) depend on the underlying mortality tables.
- <sup>21</sup> Almost 70 percent of life insurance companies' investment portfolio consists of fixed income securities (Maurer and Somova 2007).
- <sup>22</sup> The reduction continued in 2007: the guaranteed interest rate was further reduced to 2.25 percent for new contracts (Assekurata 2009).
- <sup>23</sup> The reduction of the guaranteed interest rate is suggested by the nongovernmental body German Society of Actuaries (Deutsche Aktuarvereinigung, DAV). The decision, however, is made by the Ministry of Finance in cooperation with Ministry of Justice, which are responsible for drafting the necessary legislation. The legislation is implemented by the BaFin (Federal Financial Supervisory Authority).
- <sup>24</sup> The so-called non-guaranteed surplus depends on the performance of the investment portfolio and on the insurance company experience with mortality and expenses. §81 VAG ensures that a considerable portion of surplus is distributed to the insured. Both mortality and expenses remained quite stable during the surveyed period (Maurer and Somova 2007).
- <sup>25</sup> Given the similarity of procedure, the differences can be explained by the fact that the annuity quotes for the year 2003 used in this study are lower for all product categories, and especially for females, as compared to the averages reported by von Gaudecker and Weber (2004).

## References

- Albrecht, Peter and Raimond Maurer (2002). 'Self-Annuityization, Consumption Shortfall in Retirement, and Asset Allocation: The Annuity Benchmark,' *Journal of Pension Economics and Finance*, 1: 269–88.
- Assekurata (2004). *Marktstudie 2004: Die Überschussbeteiligung in der Lebensversicherung, Köln 2004*. Köln, Germany: Assekurata. [www.assekurata.de/](http://www.assekurata.de/)
- (2005). *Marktstudie 2005: Die Überschussbeteiligung in der Lebensversicherung, Köln 2005*. Köln, Germany: Assekurata. [www.assekurata.de/](http://www.assekurata.de/)

## The Private Life Annuity Market in Germany 157

- (2007). *Marktstudie 2007: Die Überschussbeteiligung in der Lebensversicherung*, Köln 2007. Köln, Germany: Assekurata. [www.assekurata.de/](http://www.assekurata.de/)
- (2009). *Marktstudie 2009: Die Überschussbeteiligung in der Lebensversicherung*, Köln 2009. Köln, Germany: Assekurata. [www.assekurata.de/](http://www.assekurata.de/)
- BarNiv, Ran and Robert A. Herschbarger (1990). ‘Classifying Financial Distress in the Life Insurance Industry,’ *Journal of Risk and Insurance*, 57(1): 110–36.
- Bütler, Monika and Martin Rüsç (2007). ‘Annuities in Switzerland.’ World Bank Research Paper 4438. Washington, DC: The World Bank.
- Cannon, Edmund and Ian Tonks (2004). ‘U.K. Annuity Rates, Money’s Worth and Pension Replacement Ratios 1957–2002,’ *Geneva Papers on Risk and Insurance*, 29: 371–93.
- (2008): *Annuity Markets*. Oxford, UK: Oxford University Press.
- Doyle, Suzanne, Olivia S. Mitchell, and John Piggott (2004). ‘Annuity Values in Defined Contribution Retirement Systems: Australia and Singapore Compared,’ *Australian Economic Review*, 37(4): 402–16.
- Finkelstein, Amy and James Poterba (2002). ‘Adverse Selection in the Annuity Markets: Policyholder Evidence from the UK Annuity Market,’ *Economic Journal*, 112: 28–50.
- (2004). ‘Adverse Selection in Insurance Markets: Policyholder Evidence from the UK Annuity Market,’ *Journal of Political Economy*, 112: 183–208.
- Fong, Wai Mun (2002). ‘On the Cost of Adverse Selection in Individual Annuity Markets: Evidence from Singapore,’ *Journal of Risk and Insurance*, 69: 193–207.
- von Gaudecker, Hans-Martin and Carsten Weber (2004). ‘Surprises in a Growing Market Niche: An Evaluation of the German Private Life Annuities Market,’ *Geneva Papers on Risk and Insurance*, 29: 394–416.
- German Bundesbank (2007). *Data on the Government Bond Yield Curves for the Time Span 1997–2006*. Personal communication to authors on 8/1/2007 sent to EWU-zinsstatistik@bundesbank.de
- Gesamtverband der Deutschen Versicherungswirtschaft (GDV) (2007). *Die deutsche Lebensversicherung in Zahlen*. Berlin, Germany: Geschäftsentwicklung.
- James, Estelle and Xue Song (2001). ‘Annuities Markets Around the World: Money’s Worth and Risk Intermediation.’ SSRN Working Paper. Chicago, IL: Social Science Research Network.
- Dimitri Vitas (1999). ‘Annuities Markets in Comparative Perspective: Do Consumers Get Their Money’s Worth?’ World Bank Research Paper 2493. Washington, DC: The World Bank.
- Knox, David (2000). ‘The Australian Annuity Market.’ World Bank Research Paper 2495. Washington, DC: The World Bank.
- Maurer, Raimond and Barbara Somova (2007). ‘The German Insurance Industry: Market Overview and Trends,’ in David Cummins and Bertrand Venard, eds., *Handbook of International Insurance*. New York, NY: Springer, pp. 305–46.
- McCarthy, David and Olivia S. Mitchell (2002). ‘Estimating International Adverse Selection in Annuities,’ *North American Actuarial Journal*, 6(4): 38–54.
- Mitchell Olivia S., James Poterba, Mark Warshawsky, and Jeffrey R. Brown (1999). ‘New Evidence on the Money’s Worth of Individual Annuities,’ *American Economic Review*, 89(5): 1299–318.

## **158 Securing Lifelong Retirement Income**

- Morgen and Morgen (2010). *LV-Win Database*. Hofheim am Taunus, Germany: Morgen and Morgen.
- Poterba, James (2001). 'A Brief History of Annuities in the United States,' in Jeffrey Brown, Olivia S. Mitchell, James Poterba, and Mark Warshawsky, eds., *The Role of Annuity Markets in Financing Retirement*. Cambridge, MA: MIT Press, pp. 23–56.
- Mark Warshawsky (2000). 'The Costs of Annuitizing Retirement Payouts from Individual Accounts,' in John B. Shoven, ed., *Administrative Aspects of Investment-Based Social Security Reform*. Chicago, IL: University of Chicago Press, pp. 173–206.
- Statistisches Bundesamt (2008). *Berechnung von Periodensterbetafeln*. Methodische Erläuterungen zur Berechnung von Periodensterbetafeln für Deutschland 1871/81 bis 2005/2007. Wiesbaden, Germany.
- Thorburn, Craig, Roberto Rocha, and Marco Morales (2007). 'An Analysis of Money's Worth Ratios in Chile,' *Journal of Pension Economics and Finance*, 6: 287–312.
- Warshawsky, Mark (1988). 'Private Annuity Markets in the United States: 1919–1984,' *Journal of Risk and Insurance*, 55: 518–28.