Price efficiency in the Dutch Annuity Market

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Abstract

We provide the first analysis of annuity rates in the Netherlands for the period 2001-2012. During this period, the number of annuity providers was high and stable and we find that falls in annuity rates can be explained entirely by changes in yields and life expectancy. We show that annuitants could have increased their annuity income by about 5%, by shopping around and purchasing their annuities from alternative providers. Money's worth calculations show that the market is efficient by international standards, with a money's worth above 0.9 for the whole period and close to unity by the end of the period. We present conflicting evidence on the existence of adverse selection because although we find money's worths are inversely related to age of purchase, we find they are positively related to size of purchase.

Introduction

Annuity markets around the world are playing a growing rôle in pension provision as defined-contribution personal pension systems are introduced and mature (World Bank, 1994; Holzman and Hinz, 2005; European Commission, 2009). In the UK, defined contribution pensions with compulsory annuitization are likely to replace occupational defined benefit pension schemes altogether in the next few decades (Pensions Commission, 2004, chapter 3) and large annuity markets such as those in the UK and Chile have been analysed extensively (e.g. Cannon and Tonks, 2011; Ruiz and Mitchell, 2011). In much of continental Europe, however, generous public pensions are likely to dominate pension provision for a significant period and defined contribution pensions are being introduced to complement existing pension schemes (and to compensate for existing schemes being less generous). For example, Germany has a small voluntary annuities market (Kaschützke and Maurer, 2011) but DC schemes are growing due to the Riester reforms of 2001 (Schnabel, 2004). In Italy the TFR reforms of 2004 have resulted in the birth of a small DC pension system with compulsory annuitization of at least part of the pension wealth on retirement (Aben, 2011; Rinaldi, 2011) and there is continued discussion about how the annuitization option could be improved (Paci *et al*, 2010). Holzmann and Hinz (2005) describe how many countries in central and eastern Europe introduced defined contribution pensions to complement existing state pensions after the collapse of communism.

Despite theoretical reasons for believing that annuities can be utility enhancing (Yaari, 1965; Sheshinski, 2008), it is well known result that where annuities are purchased voluntarily the market tends to be small (Brown *et al*, 2001). Cannon and Tonks (2008) suggest that plausible reasons for this market failure are either that adverse selection prevents a market equilibrium or that individuals do not fully understand how an annuity works (since annuity purchase is a once-and-for-all decision there is no opportunity for agents to learn about the product). A possible solution to these problems is to make annuitization compulsory, preventing moral hazard, namely individuals deliberately falling back on state benefits, and is a reasonable *quid pro quo* for tax relief which has been received in the accumulation phase. However, compulsion does not remove all problems and may create additional ones if the market is imperfect (Mackenzie, 2006).

Nearly all of these analyses accept that the annuity decision depends upon the institutional details of the annuity market and other features of the pensions system. A corollary of this is that studies of different annuity markets allow economists to get a better idea of what is likely to work in practice and in different contexts. Mitchell, Piggott and Takayama (2011) survey ten countries' annuity markets in various stages of development. They draw a distinction between countries with compulsory annuitization (UK, Sweden), countries with mandatory accumulation plans but without compulsory annuitization (Australia, Chile, Switzerland), and other countries in which retirement income depends on traditional social security in which the annuity market is small (Germany, Japan). The Dutch system lies between these, with a pay-as-you-go first pillar and a well-established mandatory occupational second pillar, much like Switzerland (Bütler, 2009), but with only a small annuity market more like Germany (Kaschützke and Maurer, 2011), even though in the Netherlands annuitization of the small DC pension market is compulsory. Life insurers providing DC pensions and annuities, are also typically involved with the management of the occupational second pillar, so that even though the annuity market is small, these providers will have a sufficient large pool to make idiosyncratic longevity risk negligible.

In this paper we provide the first empirical analysis of prices in the Dutch annuity market.[1] Although this market is growing, it is currently a good example of a small mature annuity market existing alongside a large defined benefit public and occupational pension system. As with the UK, annuitization of personal pensions is compulsory, although participation in a personal pension is voluntary, making it more similar to the system enacted in Italy from 2004 In section 1 we introduce the Dutch pension system and describe the institutional and qualitative features of the annuity market. Section 2 reports annuity price data for the Netherlands in the last decade and section 3 reports our money's worth calculations.

[1] For Dutch attitudes to pension provision and annuitisation see Alessi, van Rooij and Lusardi (2011) and Teppa (2011).

1. Description of the Dutch Annuity Market

The Netherlands has a three-pillar pension system. Pensions in the Netherlands are financed by a PAYG scheme for the state pension and capital-based schemes for the mandatory occupational pension and voluntary retirement savings. The aim of many employees is to have a gross replacement rate at retirement of approximately 70 per cent, which is approximately a net replacement rate of 90 per cent due to tax incentives. The Dutch have a long history in saving for retirement, with the first private pension funds founded in the nineteenth century.

The first pillar is the state pension (General Old Age Pension Act, or AOW) with a yearly premium income of €21 billion in 2011, financed on a Pay As You Go basis. Eligibility for benefits is based on residence and is independent of working history. After living in the Netherlands for 50 years (between age 15 and 65) every citizen receives a full state pension (€1,501 per month for couples and €1,085 per month for individuals in 2013).[2] The retirement age is due to increase gradually to 66 by 2019 and 67 by 2023.[3]

The second pillar is the mandatory collective occupational pension scheme, which is based on work history. This second pillar is funded. The yearly premium income of pension funds was €30 billion in 2009 and in 2010 there were a total of 514 pension funds. Pension funds can either manage the pension fund and portfolio management themselves or contract it out to an external implementing body, usually a specialized pension scheme administrator or an insurer. In 2010, 93 per cent of pension fund members belonged to a defined benefit pension scheme. Only 4.5 per cent of members had a defined contribution scheme and 2.3 per cent of members had a combination of a defined benefit and a defined contribution plan. Dutch law prohibits the commutation of pension entitlements, except for small entitlements (€417 per annum in 2009) which is due to the relative high administrative cost associated with it. Members in DC pension plans are required to use their DC pension capital to purchase annuities, i.e., a lump sum withdrawal is not allowed.

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[2] http://www.svb.nl/int/en/aow/hoogte_aow/bedragen/index.jsp

[3] http://www.pensioenkijker.nl/home/aow-anw/verhoging-aow-leeftijd. There are further proposals to bring these changes forward to 2018 and 2021.

The third pillar is voluntary pension insurance, mainly provided through insurers, although since 2008 tax-exempt accrual pension saving has also been possible through a bank, called "banksparen".[4] Individuals purchase a capital sum insured before retirement and then convert this to an annuity upon retirement. In the last years of the past decade some of the capital sum insured products received negative press coverage because of high costs, especially for the included insurance components. After public and political pressure the insurers reached an agreement with the insured to pay back the excessive fees which had been charged. Another noteworthy change was the introduction of the tax favoured "Levensloop" scheme in the Netherlands in 2005. This scheme allowed for a reduction in savings during periods of low income arising from being in education or having to take care of one's dependant, etc. Although indented otherwise, in practice it was mainly used to finance early retirement through this scheme, which led to regulatory changes to the scheme to reduce that possibility in 2012. Those schemes were mainly managed by pension funds.

Life insurance companies play a rôle in the Dutch pension system in both the second and the third pillar. Insurance companies manage approximately 20 per cent of the pension contracts. The third pillar has been managed by insurers only. The yearly gross life insurance premium income is given in Figure 1.1., and has been around €25 billion during the past decade.

Figure 1.1 about here

Of the €21 billion gross direct life premium business income around €15 billion was from individual policies, and around €6 billion was from group policies. These group policies are mainly due to the management of second pillar pensions. Although the total value of the annuities is almost €36 billion (about four per cent of GDP), it is much smaller than the total sum of capital sum insured, which was €658 billion in 2009. Over €29 billion of the annuities are in group insured contracts, of which 44 per cent is unit-linked and 56 per cent is euro insurance. For individual contracts the value of the annuities was over €6 billion Euros in

[4] Article 1.7 Wet inkomstenbelasting 2001 (income tax law 2001) is applicable to pension decumulation via banksparen and via insurance products. The law mandates that an individual should purchases a product which provides a lifelong income with certain constraints on the level of payments. For banksparen, because it has no insurance element in it, this lifelong income has been interpreted as an income for at least 20 years. .

2009, of which only 11 per cent was unit-linked, the other 89 per cent was euro insurance.

The Dutch life insurance market is dominated by 6-8 insurance concerns, which have a market share of around 85 per cent. Figure 1.2 illustrates the market share of the premium income of the largest insurance concerns during 2002-2007. During that period there have been two mergers between large insurance concerns, namely in 2004 the insurance part of Rabobank merged with Achmea to form Eureko and in 2007 SNS Reaal took over SwissLife. Aside from these mergers, the fluctuations in the share of premium income do not fluctuate too much.

Figure 1.2 about here

In Figure 1.3 the distribution of the market share of premium income of the top 25 life insurance companies in the Netherlands is given from 2002 to 2009. From this we see that the top 10 life insurance companies have 70-80 per cent of the market share and the top 25 have a combined market share of 88-94 per cent. Moreover, we see that the market share is becoming more concentrated, suggesting the possibility of increased market power.

Figure 1.3 about here

2. Description of Annuity Price Data

All of the annuity prices we analyse here are from the Dutch compulsory purchase market and are for men only (data for women are unavailable). The data were provided by Money View, which is an organisation collecting annuity rates for price comparisons. (see http://www.moneyview.nl/). Annuity prices are reported for a total of 32 different named companies throughout the period, but because some of the companies merged or changed name the total number of actual companies is only 28 and one of these (Univé) only quoted for a short period: the total number of price quotes that we have is illustrated in Figure 2.1.

Figure 2.1 about here

For each firm we have data on purchase prices for men aged 60 and 65 for amounts of €50,000 and €125,000. There are two small structural breaks in 2002 and 2010: before 2002 the annuity rates were for purchase prices in Dutch Guilders, with purchase prices of ƒ100,000 (€45,378 given an exchange rate of

2.20371) and *f*250,000 (€113,445); in mid-2010 the annuity rates change from annuities paying quarterly to annuities paying monthly. Annuity rates are conventionally defined as the annual payment relative to the purchase price and so we use the relevant definitions that

$$\text{(1)} \qquad \text{annuity rate} \equiv \begin{cases} \dfrac{4 \times \text{quarterly annuity payment}}{\text{annuity purchase price}} & \text{up to July 2010} \\ \dfrac{12 \times \text{monthly annuity payment}}{\text{annuity purchase price}} & \text{from August 2010} \end{cases}$$

The annuity rates before and after the two potential structural breaks are almost identical, so we do not make further adjustments.

Many life insurance company quotes two prices, an internal price for annuitants who have also saved their pension fund with the company (called "maatschappij") and another external price for annuitants who are transferring their pension fund from another company (called "elders"). With annuity prices for two ages, two purchase prices and two types of purchase this means that we have eight annuity prices per firm.

Figure 2.2 about here

Annuity rates for internal purchase for a 65-year old man with a purchase price of €50,000 are illustrated in Figure 2.2; the analogous annuity rate for a 60-year old man is almost identical except for being about one percentage point lower.[5]

Two issues are how annuity rates depend upon the purchase price and internal/external purchase. For each firm we calculate the ratio of the larger purchase price to the smaller and the ratio of the internal to the external purchase price and we summarise the corresponding ratios in Figure 2.3. The dashed lines show the average ratio across all firms: for the whole period a larger purchase price typically results in an annuity rate about one per cent higher (not one percentage point) with a similar but smaller effect for internal versus external purchase. However, until about 2005, some firms offered much higher annuity rates for larger purchase prices or for internal purchase. After this time, however, the variation in annuity rate by purchase price became much smaller. This

[5] Figures for 60-year olds and figures containing other information can be found in the Appendix.

appears to be due to the opening of the pension administrator market to other European institutes. The IORP directive (2003/41/EG), accepted in the European Parliament in June 2003 and had to be implemented before 23 September 2005, resulted in the "Pensioen en Spaarfondsenwet" at 8 February 2006. This led to an increase in competition between the pensions administrators.

Figure 2.3 about here

From Figure 2.2 it can be seen that the range of annuity rates on offer at any point in time was about one percentage point, suggesting that the difference between the best and worst pension income available was quite significant: an annuitant at the company with the lowest annuity rate would have had a pension income up to one-sixth higher if they had been at the company offering the best annuity rate, translating into a difference of €1,250 per year for the larger purchase price. Of course, to move to another annuity provider would have meant facing the external price rather than the internal price. For a 65-year old with an annuity purchase of €50,000 the average benefit over the period from moving company would be €202 per year on a pension income of €4,159; for a corresponding annuitant with an annuity purchase of €125,000 the increase would be €488 on an income of €10,494. This suggests that there are significant benefits from moving company for many annuitants.

We do not have data on the volume of business transacted by the different companies, so we are unable to calculate a weighted average of annuity rates. The fact that firms frequently change rates is *prima facie* evidence of competition. There are two further indirect ways that we can judge the competitiveness of the Dutch annuity market.

One measure of the competitiveness of a market is the proportion of time that individual firms' annuity rates are high or low compared to the market as a whole. If the relative prices of different firms never changed then that might be taken as evidence that the market was sclerotic, since firms would never be attempting to improve their relative position. Our chosen measure of a firm's relative price is the quartile of prices that the firm's price is in at a given point in time. Figure 2.4 shows the proportion of the time that companies were at different points in the ranking of annuity rates (companies with very few observations were omitted and companies involved in mergers, takeovers or name changes were treated as one

company). The firms are ranked by how often they are in the top five: since some companies leave the industry they sometimes have no ranking The most competitive firm (on the left of the diagram) had a top-five annuity rate in the top for about 63 per cent of the time, but it withdrew from the market altogether in 2011. Clearly some firms were consistently at the top or the bottom of the distribution. However, in the middle of the diagram there are a number of firms whose position changes considerably over the period: a jostling for position which may be indicative of competitive behaviour. With the exception of firm 1, firms with annuity rates that were poor value tended to drop out of the market.

Figure 2.4 about here

Another measure of competition is the extent to which firms offer better annuity rates to annuitants coming from other companies (external purchase or "elders expirerend kapitaal"), which we have already illustrated in Figure 2.3. Since the internal rates tend to be higher than the external rates, this is evidence against firms competing for additional purchases.

3. Money's Worth Calculations

A key determinant of the annuity rate, especially when considering short run movements in annuity rates, is the interest rate. Formally the annuity rate should be compared to the whole term structure of interest rates, since it consists of contingent payments made at a variety of points in the future. However, for a first look at the data we compare the annuity rate to the ten-year government bond yield, with data on Dutch long-term interest rates taken from Bloomberg. The Bloomberg data is based on interest rate swaps which provide a good indicator of the hypothetical yield on a pure discount bond issued by the Dutch government. Unfortunately these data are available for only two isolated observations in the first few years, so we supplement our data with yields based on ten-year coupon bearing bonds: where a comparison is possible the swap rate is a bit higher. We graph the data for long-term interest rates and selected annuity rates in Figure 3.1.

Figure 3.1 about here

The difference between the annuity rate for 60-year olds and the ten-year bond yield is fairly constant at about 3 percentage points. This is unsurprising: interest rates do not change a huge amount over the period and we should not expect large

increases in life expectancy over the relatively short period of ten years. The sudden drop in yields in the autumn of 2010 coincides with a sudden drop in annuity rates at the same time, so the co-movement is strong at high frequencies.

Apart from data availability, our justification for using the swap curve is based on the regulatory framework in the Netherlands, which is described in Actuariel Genootschap and Actuarieel Instituut (2009). From about 2003 the swap curve became the official yield curve for valuation of pension fund liabilities under Section 126(2)(a) of the Pension Act. This was because the swap market was highly liquid and rates on swaps were only marginally higher than those on Dutch government bonds (typically 0.1 to 0.2 per cent), resulting in a consensus between the financial regulator and the insurers to use this curve. However, AG&AI (2009) argue that the financial crisis at the end of 2008 led to the swap curve becoming unreliable. Premia on swaps relative to the government curve became highly variable (daily movements of up to 0.5 per cent) and deficient supply of long-dated swaps led to swap yields being lower than bond yields (AG&AI, 2009, Figure 2, suggests the implied yield on swaps was 0.75 per cent lower than on bonds at a term of thirty years). For this reason the Dutch Central Bank allowed firms to use alternative discount factors from 2009 onwards.

A formal comparison of annuity rates requires the use of the money's worth, which compares the expected present value of the annuity payments to the purchase price. The money's worth is defined as:

$$(2) \qquad MW_{t,x} = A_t(x)\sum_{i=1}^{\infty} R_t(i)\,S_t(x+i \mid x)$$

where t is the date at which the money's worth is being measured, x is the age of the annuitant, $A_t(x)$ is the annuity rate, $R_t(i)$ is the discount factor (taken from the yield curve) relevant at time t for a payment at period $t + i$, and $S_t(x+i \mid x)$ is the probability that someone alive at age x in period t will live another i periods.

In our analysis we use survival probabilities based both on data for the population as a whole and also for pensioners (who are a select group). In each case survival probabilities are based upon predicted one-year death probabilities from the formula

$$(3) \qquad S_t(x+i \mid x) \equiv \prod_{j=1}^{i} \left(1 - q_{t+j}(x+j)\right)$$

where $q_{t+j}(x+j)$ is the probability of someone aged $x + j$ in period $t + j$ dying in that period (equivalently, the probability that someone aged x in period t who survives to period $t + j$ then dying in that period). Since survival probabilities are a non-linear function of the mortality, the expected survival probability is not quite the same as the survival probability calculated from the expected mortalities (Cannon, 2009), but we follow standard actuarial practice in ignoring this issue. To calculate the money's worth we need to evaluate equation (3) using the best information available at time t but retrospectively it is not always clear precisely when new data became available, nor how life assurance companies adjusted publicly available information in the light of their own mortality experience.

One possible indicator of the survival probabilities we should use is the fact that the Money View data include an internal rate of return calculation to evaluate annuities (called the "effectieve rendement"), which is based on population mortality tables GBM9500 (Actuarieel Genootschap, 2002), which is a simple period life table, so that the money's worth is calculated using

$$(4) \qquad S_t^P(x+i \mid x) \equiv \prod_{j=1}^{i} \left(1 - q^*(x+j)\right)$$

where $q^*(x+j)$ is the one-year death probability for someone aged $x + j$ in period t (not period $t + j$) and the super-script P emphasises that this is thus a period table. On this basis the life expectancy for a 60-year old man would be 78 years, 8 months; the life expectancy for a 75-year old man would be 79 years, 10 months. Our hard copy of the GBM9500 table is dated March 2002, although life assurers may have started using this table before or after that date. On the basis of an international survey, Watson-Wyatt (2006) reports that defined-benefit pension schemes were still using this table at the end of 2005. This is some anecdotal evidence that this is the appropriate table, at least for the beginning of the period under consideration. In Figure 3.2 we report our money's worth calculations based on this population table. The money's worth has declined over the period, although, some of the apparent decline is due to using different interest rate data early on: recall that we have only two observations of yield data from swaps for the period 2001-2003, which are denoted by the black squares in the figure.

Figure 3.2 about here

Recall that the money's worth is the ratio of the expected present value of the payouts compared to the purchase price, so in a utopian world the money's worth would equal one. In fact the money's worth should be less than this, both because there are real costs to providing annuities and annuity providers must provide reserves to allow for the possibility that mortality might fall faster than expected. In addition the results in Figure 3.2 are subject to two additional problems: they are biased down because we have not taken into account the likelihood of mortality improvements; and they are biased down because annuitant life expectancy is likely to be longer than population life expectancy: annuitants tend to have a higher life expectancy than the population, since individuals with a pension tend to be richer and healthier than average.

Figure 3.3 about here

In Figure 3.3 we use alternative one-year death probabilities which take account of projected increases in life expectancy. The first set of death probabilities are taken from the CBS 2000 Statistics Netherland table. This table is based upon population mortality but has official projections of death probabilities for years 2001-2049. We cannot say with certainty when the information in any of the life tables became available to life insurers (note that life insurers have private information on their own pensioners which is available earlier than official publications) and so use rough guesses. There was very little change between the CBS 2000, CBS 2002 and CBS 2004 tables and so the calculated money's worths are nearly the same for all three tables. Compared to the GBM9500 table the money's worths are about five percentage points higher, due to the incorporation of mortality improvements.

The money's worth is initially in the range 0.95 to 1.0, declining to between 0.90 to 0.93 in 2004-6. However, using updated mortality table CBS 2006 the money's worth rises to 0.95 and the switch to CBS 2008 results in a further rise of the money's worth to about (or even above) unity. These results are similar to those of Cannon and Tonks (2013), where apparent falls in the money's worth based on a particular life table are then revealed to be due to increases in projected life expectancy when a revised life table is published. Furthermore, the fall in the money's worth almost invariably anticipates the publication of the new table,

suggesting that life insurers' annuity pricing is based on private information which arrives earlier than publication of official data.

The final life table that we use is labelled GP 2008, which is based on CBS 2008 with explicit adjustments to allow for longer life expectancy of pensioners than the whole population. Using this life table the money's worth is substantially above one, averaging 1.04 and with a maximum of 1.06, suggesting that life insurers are making a loss. There are two possible explanations for this. First, life insurers may be able to earn higher rates of return than on government bonds, perhaps because they are holding corporate bonds, in which case we would be using too low a discount rate in calculating the money's worth. As an ad hoc approach to this problem, we re-calculate the money's worth with a discount rates 0.5 per cent higher. This would result in the average money's worth for this period falling to an average of 0.99, with a maximum value of 1.01. Although this still seems very high, James and Song (2001) note that many countries have high money's worths for annuity products. James and Song (2001) hypothesise that this is due to firms being able to arbitrage risk by holding risky assets (corporate bonds or even equity) against less risky annuity liabilities and recover the risk premium as profit. This is consistent with regulatory constraints if annuity providers have sufficiently large and diversified portfolios.

Alternatively it may be that insurance companies sell annuities as a loss and cross subsidise the product from profits earned in the accumulation phase of the private pension. This would be consistent with many firms offering lower annuity rates to external purchase as firms would only wish to cross-subsidise existing customers.

To see the effect of purchase price and age on the money's worth we report annual average money's worths in Table 3.1: to save space we only include calculations for selected years and we omit calculations for the CBS 2002 and 2004 tables (as they are almost identical to CBS 2000). The money's worth of an annuity purchase price €125,000 is about one per cent higher than for €50,000, which follows directly from the fact that annuity rates are about one per cent higher for the larger purchase prices as illustrated in Figure 2.3. The money's worth for 60-year olds is always higher than for 65-year olds, but rarely by more than one per cent, consistent with what Cannon and Tonks (2008) report for the UK, but inconsistent with other results where money's worth declines significantly with age (e.g. Finkelstein and Poterba, 2002).

Table 3.1 about here

Summary and Discussion

In this paper we have described the workings of annuity markets in the Netherlands and analysed the pricing of annuity products. Unlike the markets in Germany and Switzerland but like the UK, the Dutch market is a compulsory market in that pension wealth must be annuitized. Unlike the UK market, the Dutch market complements a large funded occupational pension sector and a relatively generous first-pillar pay-as-you-go state pension. The Dutch market is not very large but it is mature and within the context of a large and modern financial sector.

Annuities are purchased out of individual pension funds from life insurance companies and pensioners have the option to move their fund from the company with which the fund was accumulated to an alternative company (an external purchase). Our analysis of prices shows that companies do not offer higher rates to external purchases and so do not appear to be actively competing for business, although there is enough inter-company variation in prices that some pensioners would benefit by moving to a different annuity provider: on average a 65-year old with a pension fund of only €50,000 could still benefit by about €200 per year by moving to the provider with the highest external annuity rate.

Annuity rates move over time with the long-term government bond yield and are typically four percentage points higher. A formal evaluation of annuity rates using money's worth calculations depends upon the assumptions made about life expectancy. Over the period 2002 to 2010 projected life expectancy for a Dutch 65-year old male has risen from 15 years and 11 months to 18 years and 4 months, an increase of almost two-and-a-half years, or a 15 per cent increase in the amount of annuity payments that would have to be made. In addition to this, life expectancy of a 65-year old male pensioner is 11 months greater than for an average 65-year old male.

Our money's worth calculations suggest that Dutch annuities are fairly priced, with the money's worth being above 0.9 for the entire period. During the period 2008 to 2010 the money's worths appear to be greater than one. This may be an artefact of using new mortality tables before they were used by Dutch annuity providers or it may be that Dutch insurance companies felt confident that they

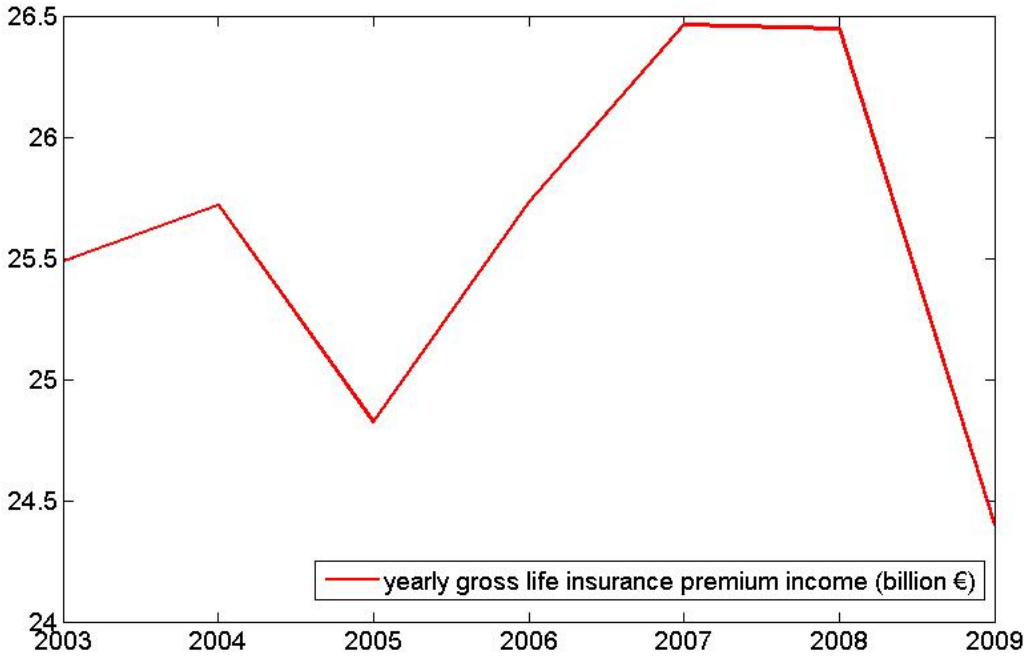
could earn higher rates of return than on government bonds, consistent with explanations for high money's worths suggested by James and Song (2001). Mitchell et al. (2011) report that MWs in Switzerland and Chile are high which in part explains the large size of the voluntary annuity market in these countries, though Bütler and Staubli (2011) also emphasise that behavioural factors – such as an emphasis on the consumption-frame (Brown et al., 2008) - are also important. In contrast, the market for annuities in Australia has disappeared, and Bateman and Piggott (2011) argue that this is in part due to a framing effect where financial advisors are incentivised to promote investment-style products. But high money's worth does not guarantee a large demand for annuities. The voluntary markets in the UK (Cannon and Tonks, 2011), Sweden (Palmer and Larson, 2011) and Germany (Kaschützke and Maurer, 2011) are small even though the money's worth of voluntary annuities in each of these countries is high. Our finding of high money's worths in the Dutch annuity market is not surprising in light of this international evidence, though what is more surprising are the sudden jumps in the money's worths when a new life-table is introduced for the second half of the period. We note from the time series patterns that annuity rates and interest rates are declining smoothly and move closely together. So any jumps in money's worths with a new mortality table must be due to revised mortalities being lower. Cannon and Tonks (2008) suggest that as mortality improves, companies continuously update annuity rates, and so money's worths calculated using a given table will appear to decline (because the researcher continues to use an old table); following the introduction by the researcher of a new table reflecting lower mortalities, the money's worth will jump up. For the Netherlands, however, although we observe this pattern for the switch from CBS 2004 to CBS 2006, in the case of the switch from CBS 2006 to CBS 2008 annuity rates, money's worths do not decline in anticipation of the new table. Further, the money's worth appears to increase after the introduction of the new table. This suggests that Dutch annuity providers failed to incorporate new mortality projections in a timely manner in 2008.

We do not have data on a wide variety of annuity types, but what information we do have provides conflicting evidence for the existence of asymmetric information in the Dutch annuity market. Finkelstein and Poterba (2002) suggest that the theory of adverse selection predicts money's worths should be lower at higher ages and for larger purchases; on the basis that older persons have better estimates of

their own mortalities, and individuals who expect to live longer will annuitize a larger percentage of their pension wealth. Finkelstein and Poterba (2002) find this pattern for UK annuity rates in 1998, although time-series studies for Germany (Kaschütze and Maurer, 2011), for the UK (Cannon and Tonks, 2013) and for Chile (James et al, 2006) report a positive relationship between money's worths and age. In these data for the Netherlands, we find that money's worths are higher for larger purchases - in contrast to the adverse selection prediction; although we do find lower money's worths for higher ages - supporting the asymmetric information assumption. So although these data do not allow us to perform powerful tests for adverse selection, what little evidence that they might provide is conflicting.

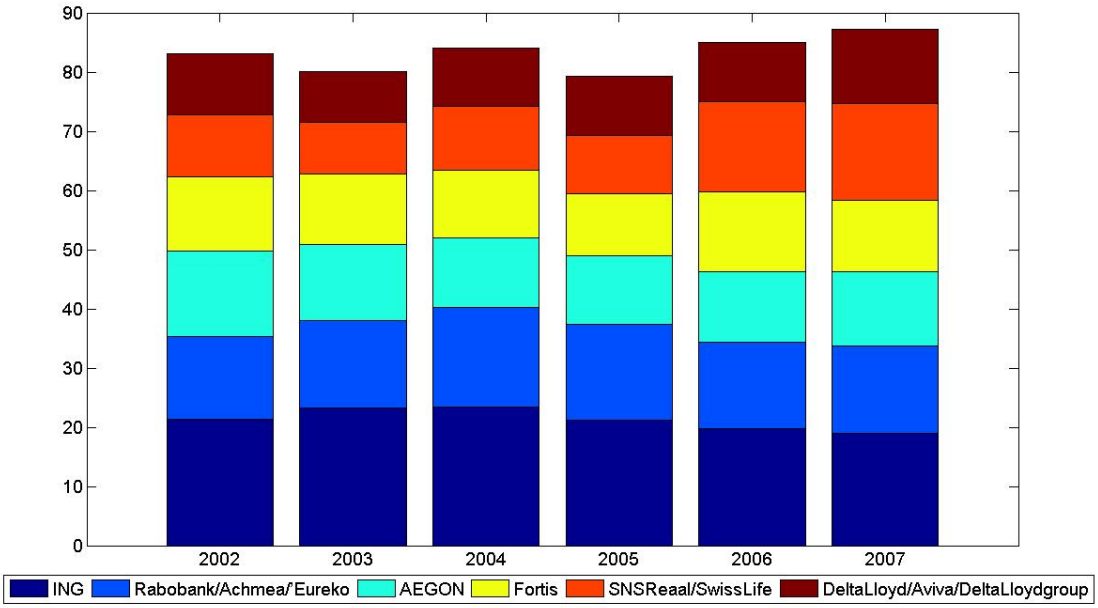
Figures and Tables

Figure 1.1: Yearly gross life insurance premium income.



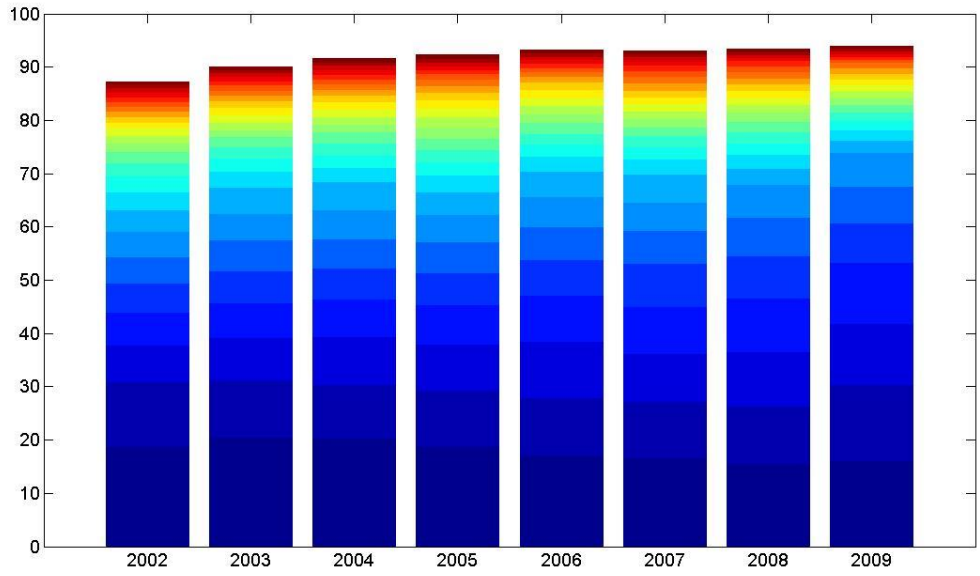
Source: Dutch insurance industry in figures, 2005-2011, Dutch Association of Insurers.

Figure 1.2: Market share of the premium income of the largest insurance concerns.



Source: AM Insurance Magazine, Dutch Central Bank

Figure 1.3: Market share of premium income of the top 25 life insurance companies.



Source: Dutch insurance industry in figures, 2005-2011, Dutch Association of Insurers

Figure 2.1: Number of firms quoting an annuity rate.

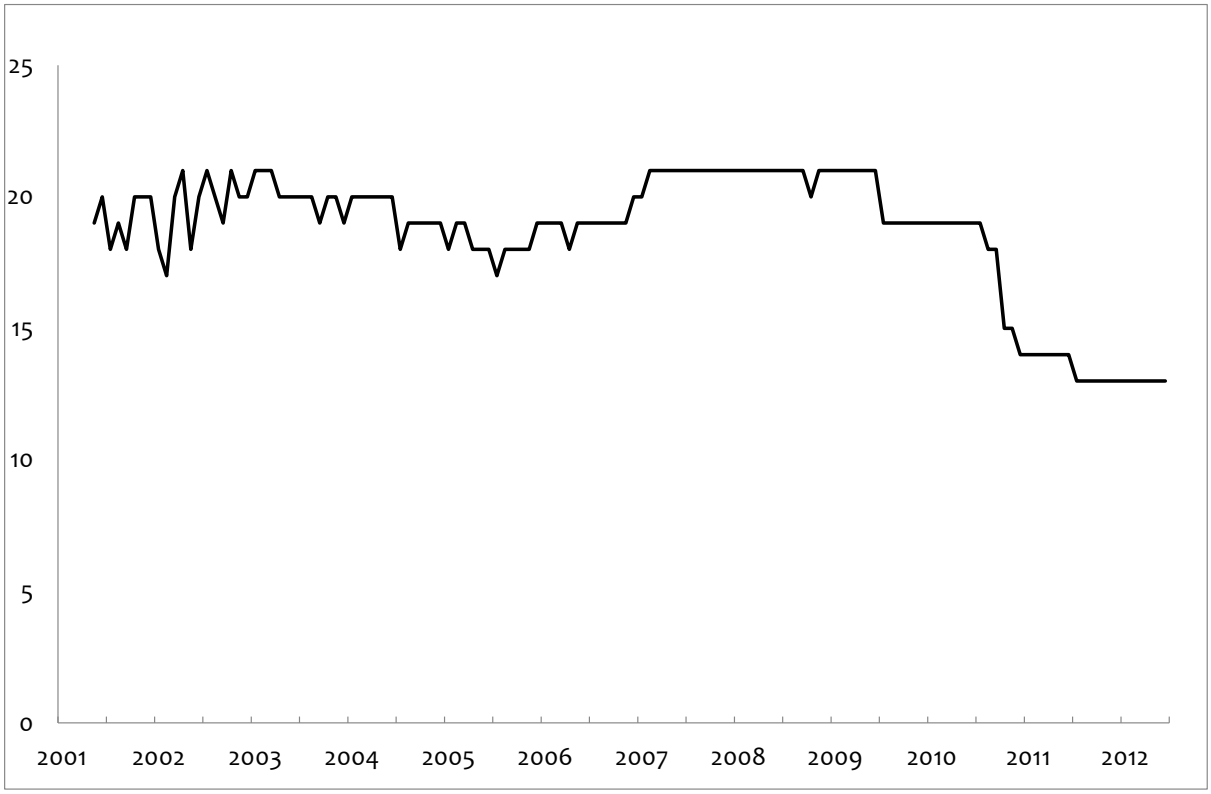


Figure 2.2: Annuity rates, Male 65, internal purchase (maatschappij): €50,000 purchase price (annuity payments quarterly until 2010, thereafter monthly)

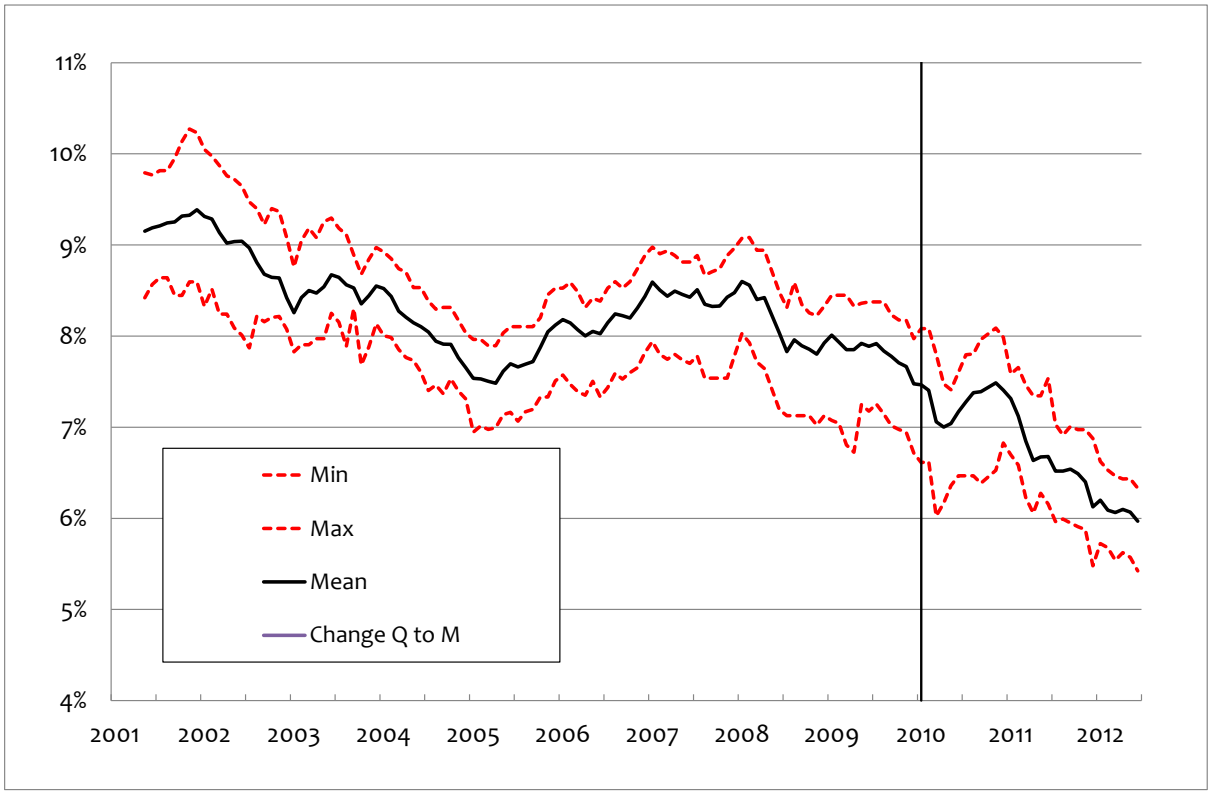


Figure 2.3: Comparisons of firms' different annuity rates

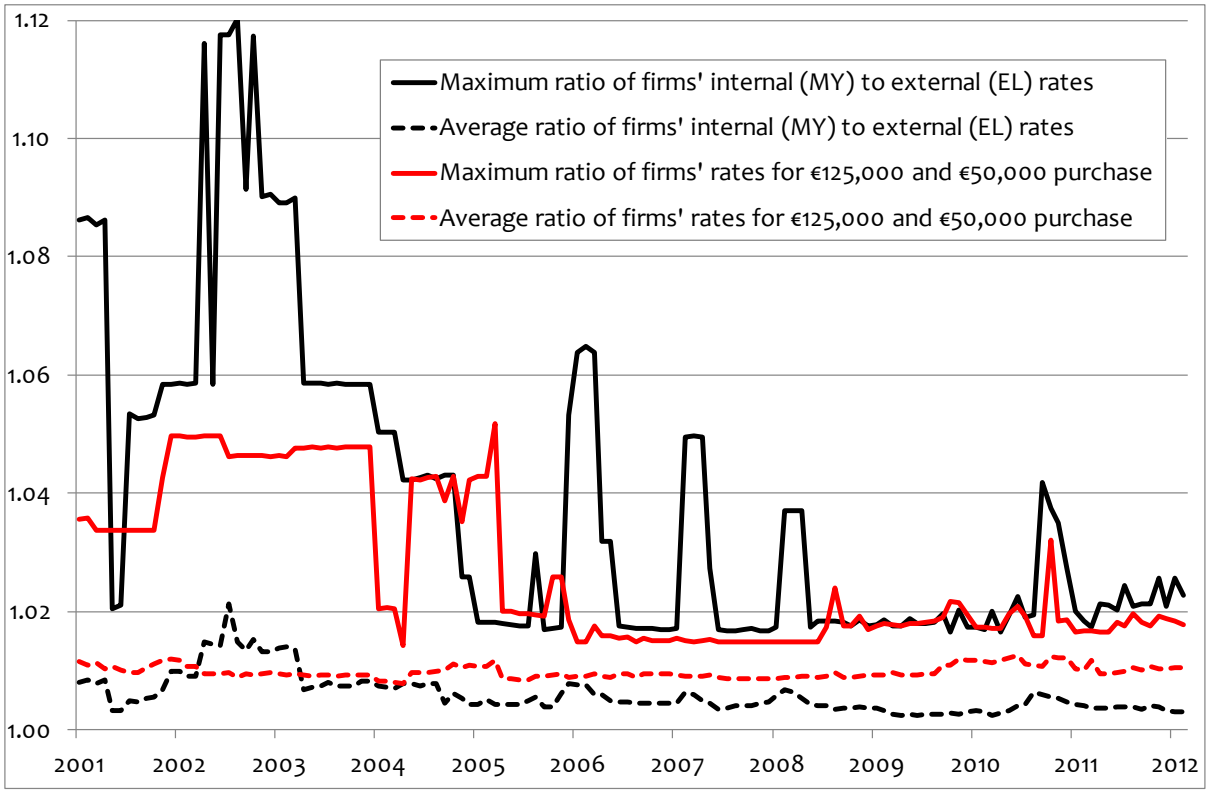


Figure 2.4: Firms' competitiveness and survival

Graph shows the proportion of time that a firm's annuity rates were in a given position relative to the whole market.

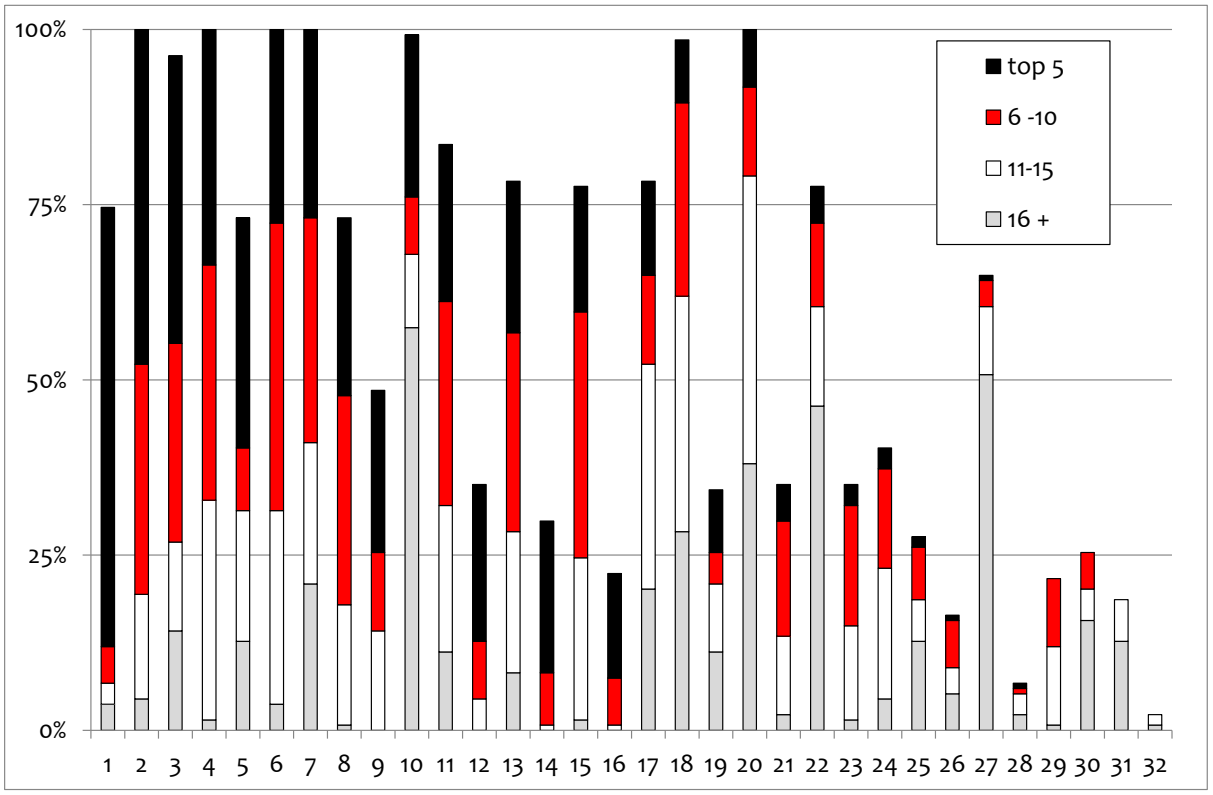


Figure 3.1: Comparison of annuity rates and long-term interest rates. Source: authors' calculations and Bloomberg.

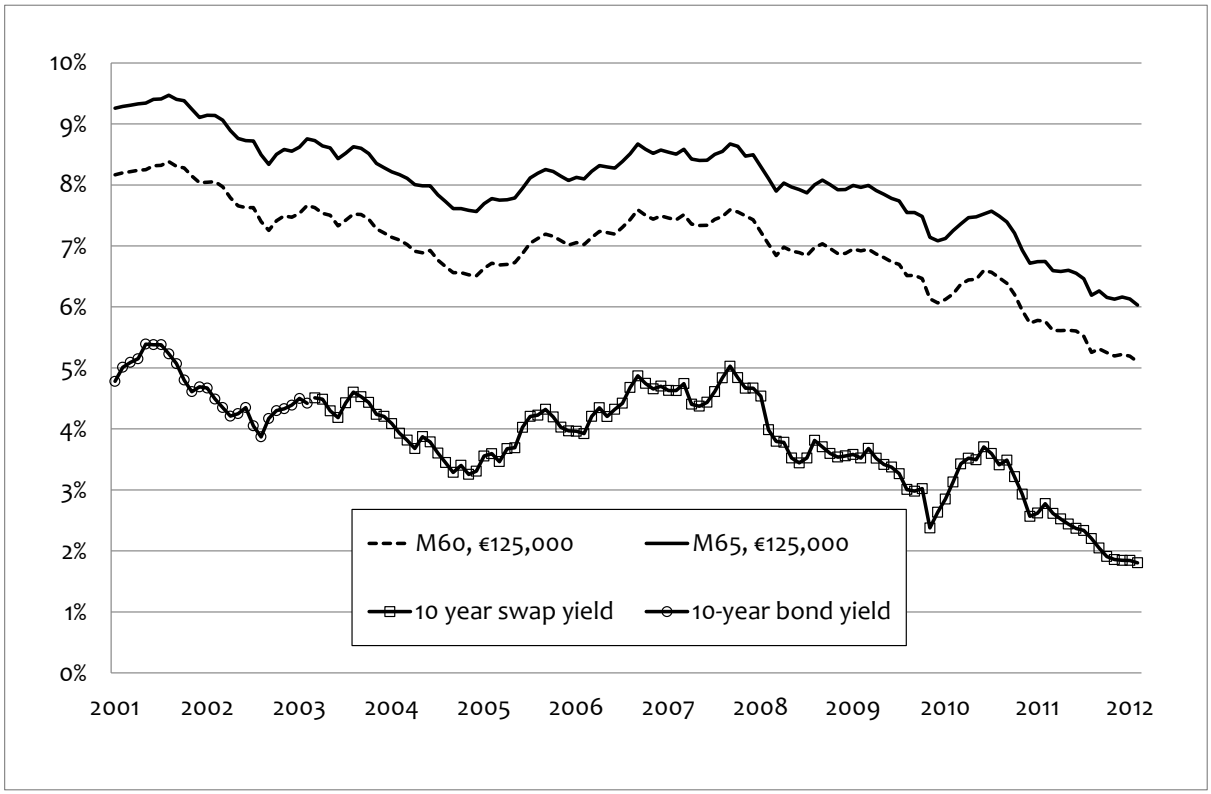


Figure 3.2: Money's worths based on constant GBM9500 mortality table.

Calculations based on the Male 65, €125,000, average internal purchase.

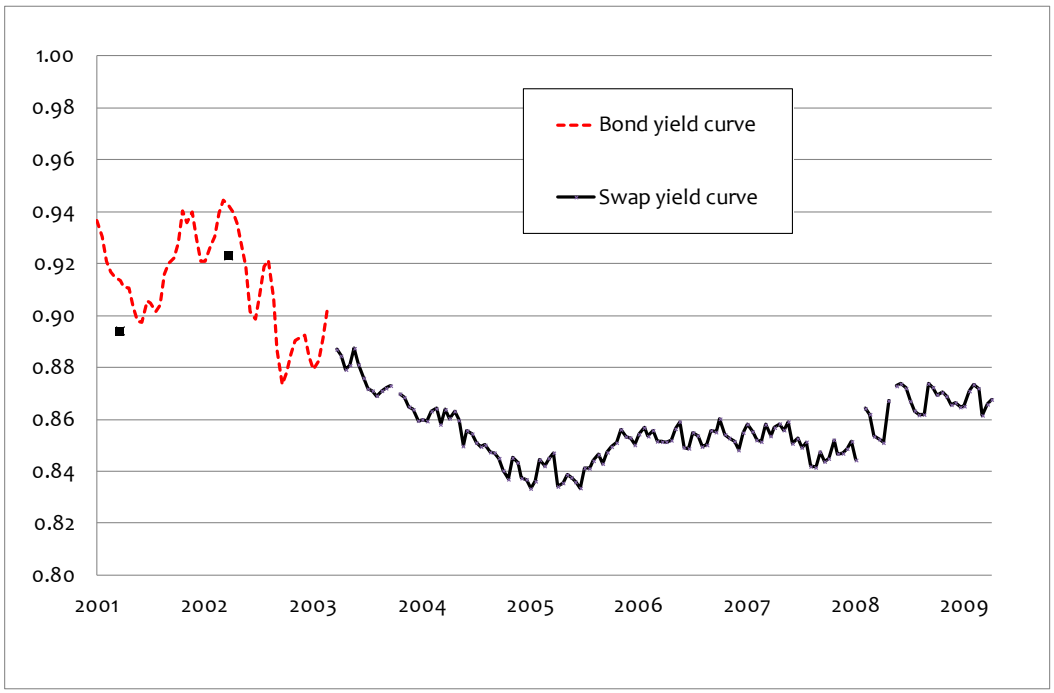


Figure 3.3: Money's worths based on mortality tables with projected improvements in life expectancy.

Calculations based on the Male 65, €125,000, average internal purchase.

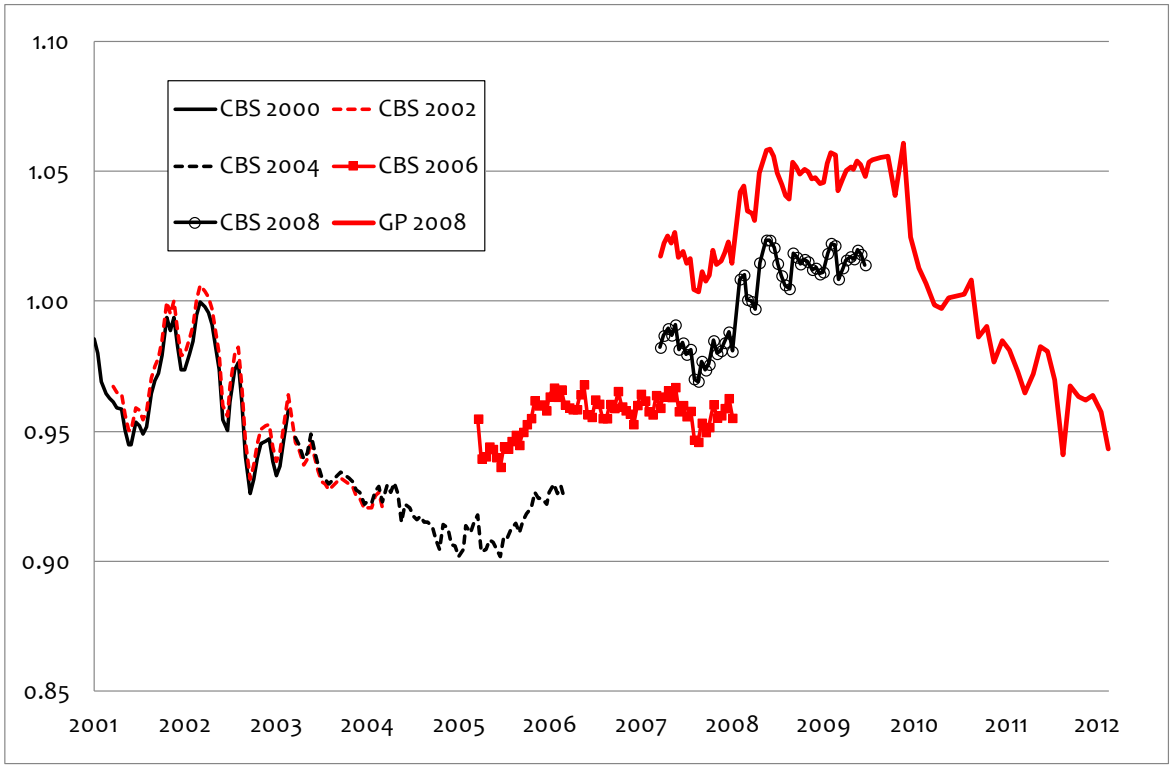


Table 3.1 Annual average money's worths using different mortality tables.

	M60, €50,000	M65, €50,000	M60, €125,000	M65, €125,000
CBS 2000 Life Table; Bond Yield Curve				
2002	0.939	0.930	0.950	0.940
2003	0.975	0.966	0.988	0.976
CBS 2000 Life Table; Swap Yield Curve				
2004	0.918	0.917	0.927	0.925
2005	0.902	0.899	0.911	0.908
CBS 2006 Life Table; Swap Yield Curve				
2006	0.946	0.943	0.956	0.952
2007	0.954	0.951	0.963	0.960
2008	0.956	0.952	0.965	0.960
CBS 2008 Life Table; Swap Yield Curve				
2008	0.977	0.976	0.987	0.985
2009	1.008	1.005	1.018	1.014
GP 2008 Life Table; Swap Yield Curve				
2008	1.012	1.011	1.021	1.019
2009	1.043	1.039	1.053	1.048
2010	1.043	1.040	1.054	1.050
2011	0.980	0.980	0.993	0.991
2012	0.954	0.954	0.966	0.964

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