

Supply challenges to the provision of annuities*

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Abstract

This document represents work on a project examining the supply constraints faced by life insurance companies when offering annuity products. Special emphasis is given to the risk management issues involved with this line of business.

We begin by examining the relevant literature on the challenging issues faced by annuity suppliers. The various types of annuities are described, as well as the basics of pricing an annuity. Risk management issues are then treated, exploring the risks posed by interest rates, human longevity and other factors, and their possible solutions. Finally, the literature review examines some of the alternatives to annuities.

We then present four case studies of annuity providers, treating life insurers in Australia, the U.S., the U.K. and Germany. These studies address the following issues:

1. A description of the companies' involvement in the domestic annuities market, including the type of products offered, their costs and benefits.
2. A description and evaluation of the risk management structures annuity providers have in place, addressing issues such as asset-liability structure and interest rate, currency and mortality risk.
3. A qualitative assessment of the supply challenges faced by the annuity provider based on conversations with company executives.

The final section of the report draws implications for policymakers and notes various issues within the regulatory framework which could be improved.

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1 Literature review

1.1 Introduction

Much has been written about the demand for annuities worldwide: why consumers should demand annuities; that consumers have surprisingly small demand for annuities; why consumers only demand small amounts of annuities.¹ While this literature has been developing, it has increasingly become apparent that annuity providers face a variety of constraints and are not necessarily innovative and enthusiastic suppliers of their product (Milevsky 2004, Wadsworth 2005). With the likelihood of a significant increase in the demand for annuities worldwide, this report aims to delve into the supply challenges involved in the provision of annuities.

Annuity types

Two main types of annuities exist: income annuities and accumulation annuities.

Income annuities Income annuities are the traditional form of annuity, and in their simplest form pay a periodic amount (usually monthly) to an annuitant for as long as that person lives—after receipt of a single premium.

A variety of terms are used to describe the various forms of income annuities. An *immediate* annuity is an annuity which begins its payment stream immediately (typically one month following receipt of the single premium by the provider). *Deferred* annuities, on the other hand, begin payments at some future date, often well after the premium is paid.

The payments from *certain* annuities are made over a fixed term, regardless of the survival of the annuitant. They provide no longevity insurance. *Life* annuities, however, continue payments as long as the annuitant survives, and thus providing longevity insurance.

Life annuities can include a certain or guarantee period. That is, they continue regardless of the survival of the annuitant for the term-certain, with payments thereafter being conditional on survival of the annuitant.

Joint and last survivor annuities continue payments as long as at least one of two people survives. *Reversionary* annuities are also dependent on the status of two lives, but only commence payment when one specific life has died.

¹For a synthesis of this literature see, for example, Brown, Mitchell, Poterba & Warshawsky (2001) and Bateman, Kingston & Piggott (2001).

Indexed annuities defining characteristic is that the annuity payments increase over time in some defined way, typically in response to changes in a consumer price index. These inflation-indexed annuities provide real levels of income protection to annuitants.

Accumulation annuities Accumulation annuities are typically a tax-advantaged saving vehicle, involving the accumulation of premiums with interest over time to a maturity date, and which point policyholders have the right to annuitise their accumulated funds, securing an income annuity, usually at guaranteed single premium rates. Most accumulation annuities are in fact surrendered for cash—few are annuitised, even though the associated guaranteed annuity rates may be highly attractive, particularly if mortality has improved in the interim and interest rates have fallen (Atkinson & Dallas 2000).

As the focus of this report is on life-long income receipt, little attention is given to accumulation annuities.

Pricing annuities

Annuities have a long history, dating back to the earliest written records of humanity. What is believed to be the first annuity table (really what was probably a table of expectations of life) appear around 200 A.D. (Franklin 2001, Milbrodt & Helbig 1999). The Roman achievement was remarkable, as in the ensuing mediaeval times annuities were sold with little regard to the age of the annuitant. They became important during this period due to the Church prohibition against lending money at interest (usury). The sale of life annuities became an important source of government revenue, and it became important to value them correctly.² In 1671, following Graunt's publication of a mortality table, the Dutch prime minister (and capable mathematician), Jan de Witt, determined the appropriate way to price an annuity was to calculate its expected present value (Hald 1987). Thus, the value of life annuity of \$1 per year to a life aged x at issue in an economy with a flat yield curve at level i p.a. and probabilities ${}_t p_x$ of a life aged x surviving t years into the future is given by

$$a_x = \sum_{t=0}^{\infty} \frac{{}_t p_x}{(1+i)^{t+1}} \quad (1)$$

²Pedoe (1964) points out the British government sold life annuities up till 1962. At that time the Canadian government still sold annuities, having started the practice in 1908 to aid the less well off in providing for their old age.

where a_x represents the expected present value of this \$1 annuity. The valuation of annuities and the practice and control of annuity provision came in time to be part of the professional work of the actuary or insurance mathematician. A modern account of actuarial mathematics, including the mathematics of pricing annuities, is given, for example, in Bowers, Gerber, Hickman, Jones & Nesbitt (1997).

1.2 Risk management issues

Annuity providers face a complex constellation of risks. A former Life Manager and Actuary for Canada of The Prudential Assurance Company Limited (Pedoe 1964, p. 146) has remarked

Annuity business is one of the most difficult businesses in the world to transact and only time will tell whether it can be transacted at all without heavy loss.

For annuity providers, the ready availability of adequate financial instruments to hedge the risks they face would greatly reduce the difficulty of the task they face. Indeed, the lack of availability of such instruments forces annuity sellers to ‘... build up reserves, to protect themselves, and the cost of this will be passed on to the purchaser’ (Bateman et al. 2001, p. 113). Embrechts, Blum & Neslehova (2005, p. 19) elaborates on this point, noting that hedging insurance liabilities not only provides economic protection to the parties involved, but also provides the best possible deal in terms of transparency of pricing and efficiency of solution. It releases statutory capital held for solvency purposes, allowing investment in new business. It may achieve benefits with respect to ratings agencies view of the insurer’s business. Practically, they note the hedging solution needs to be fully admissible under valuation regulations. These authors further note that the issue of hedging not only encompasses availability of instruments to hedge insurance risks, but also the development of techniques and tools to hedge these risks. They point out that researchers working in insurance and modern financial mathematics still have much to offer in this latter area.

In this section, we investigate the risks annuity providers face and report on the tools and techniques available to mitigate them. Equation (1) above immediately gives two important factors affecting the value of an annuity portfolio—the rate of interest and survival probabilities. Interest rate risk and longevity risk issues are consequently treated below. Cairns, Blake & Dowd (2005) remark

... there is a huge gap in the tools available to model these two types of risk. On the one hand, the theory and practice of inter-

estate modelling is very well developed. On the other hand, the state and practice of mortality modelling is relatively primitive.

Interest rate risk

The cash flow associated with the issue of an annuity is a stream of regular future payments which can stretch for a long distance into the future. The value of this liability to the annuity provider—or, more precisely, its expected present value, following from equation (1)—is thus directly affected by future interest rates. Should they rise, liabilities fall; should they fall, liabilities rise.

Managing interest rate risk

Ideally, the insurer should match the size all future (negative) liability cash flows with (positive) asset income flows. In this way net cash flows are zero at each future event date, and the insurer has no interest rate risk. This is, unfortunately not the normal state of affairs.

It is well known that annuity providers and pension funds have a significant mismatch between their assets and liabilities (The Economist 2006*d*, Bowie 2004). If this is the case then the value of the mismatch is given by $S(i)$, the insurer's surplus,

$$S(i) = A(i) - L(i) \tag{2}$$

where $A(i)$ is the value of assets and $L(i)$ is the value of liabilities. All terms in equation (2) are functions of interest rates, and movements in the rate of interest will move the value of $S(i)$ through negative and positive ranges. The insurer now needs tools to manage interest rate risk.

Fortunately, a well developed theory of interest rate immunisation exists.³ To protect the insurer for interest rate movements, all that is required is to set $dS(i)/di$ to zero. Furthermore, to ensure that small changes in the rate of interest result in positive changes in surplus, we also require d^2S/di^2 to be positive, i.e., that it is a convex function. These requirements produce requirements for duration and convexity matching in assets and liabilities, and this is what insurance companies seek to do with their assets and liabilities. Clearly, neither exact matching nor immunisation (duration and convexity matching) are possible if sufficient long duration securities are not available. In this case, approximate asset-liability matching techniques are necessary.

³See, for example, Gajek, Ostaszewski & Zwiesler (2005) or Atkinson & Dallas (2000) for clear discussion of these issues from a life insurer's point of view. Fabozzi (2001) is a detailed reference.

Problems and solutions When only approximate asset-liability matching is possible, more extensive, complicated, and expensive analysis is necessary. Examples of this sort of asset and liability modelling is extensively described in Ziemba & Mulvey (1998); see also Dempster, Germano, Medova & Villaverde (2003) for a presentation of this material from a defined contribution pension fund's point of view, and Asay, Bouyoucos & Marciano (1993), Briys & de Varenne (2001) and Atkinson & Dallas (2000) for a life insurer's (and annuity issuer's) point of view. The costs of this modelling are necessarily passed on to the annuity purchaser, reducing final payouts to annuitants.

The duration of annuity liabilities is necessarily long—a 65 year-old may live 30 years or more. In order to facilitate asset-liability matching to back annuity liabilities, similar long-dated bonds are necessary, otherwise the insurer is exposed to reinvestment risk (Blake 1999). Wadsworth (2005) points out that the inadequate supply of long duration bonds and related financial instruments is currently a major concern in the UK. It is felt this is a major constraint on the supply of annuities in a market that is set to face a period of considerable demand growth as baby-boomers retire. Bateman et al. (2001) and Riemer-Hommel & Trauth (2005) note that the lack of liquid assets with long-term durations is a problem in many countries. The solution to this problem thus requires an increase in the supply of long bonds and other long-dated instruments.

Without adequate supplies of long-duration assets to back annuity liabilities, providers may have to turn to non-traditional financial instruments to support annuities (The Economist 2006*d*). This can provide higher returns, but also introduces other elements of risk. While insurers may be able to access long-dated bonds in other countries for their liabilities, the long term nature of the instruments then introduces expensive long currency swaps. A well functioning domestic market for long bonds is clearly preferable.

The problem of finding assets to back indexed life annuities, which introduces real interest rate risk, parallels that of interest rate risk. While pricing of such liabilities is more complicated (Huang & Cairns 2004), the hedging of interest and price risk requires both long dated nominal and *real* bonds—and here the problem is thus more pronounced. Again, a liquid market in both long nominal and *indexed* bonds would go a long way to reduce the risks, and costs, of indexed annuities (Bateman et al. 2001).

Longevity risk

The effect of declining mortality for an annuity issuer is akin to that of falling interest rates in the case of bonds. Increased longevity—declining

mortality—leads to higher values for annuity liabilities, reducing insurer profitability and possibly affecting solvency. While actuaries and demographers develop scales of mortality improvements when developing their life tables (Australian Government Actuary 1999, Committee on Annuities 1996), and actuaries use such scales when pricing annuity products (Mitchell, Poterba, Warshawsky & Brown 1999), longevity risk arises when these improvements are in fact surpassed by insured experience.

Longevity risk is becoming a significant issue for insurers. Throughout the twentieth century we have watched human mortality improvement exceeding expectations on almost all occasions. Oeppen & Vaupel (2002) report that in the 160 years since 1840 record female life expectancy from around the world has grown steadily at a rate of nearly three months per year—from 45 (Swedish women in 1840) to nearly 85 (Japanese women in 2000).⁴ Mortality rates for annuitants have been revised downwards in many countries recently. Cohen (2004) reports on new mortality tables released by the UK Government Actuary's Department which imply significantly higher life expectancies. Compared to previous projections, the new tables predict a 10% increase in life expectancy for a 65-year old male in 2041 to 20.7 years; an 80-year old male in that year can expect to live 10.2 years (an increase of 13% over the previous prediction). Similarly, in Germany a comprehensive study of insured lives data and population mortality tables prompted a major revision of the mortality table used for annuity business there (Pasdika & Wolff 2005). Lin & Cox (2005) note that in the US, the force of mortality for a 65-year old male has fallen from 0.0222 (based on the US 1963 IAM Table) to 0.0111 (based on the US 1996 IAM Table).⁵

Lin & Cox (2005) point out that with the completed mapping of the human genome we are uncovering increasing amounts of knowledge about the most basic components of human life. Identification of the genes associated with ageing may lead to drugs to slow the ageing process; some experts predict this is a not long way off. Indeed, just as the mapping of the human genome has occurred faster than expected, an 'elixir of youth' may well be available sooner than expected.

Riemer-Hommel & Trauth (2005) argue that longevity risk was not a major concern for the insurance industry until relatively recently. They point out longevity products made up only a very small portion of life insurers' business. In addition, in the past insurers have been able to mitigate increases

⁴The authors note that 'The four-decade increase in life expectancy in 16 decades is so extraordinarily linear [$R^2 = 0.992...$] that it may be the most remarkable regularity of mass endeavor ever observed.' See Lee (2002) for a discussion of Oeppen & Vaupel and the mortality assumptions of the US Social Security Administration.

⁵IAM is an acronym for 'insured annuitant mortality.'

in longevity with investment returns, as annuities and pensions are combined savings and longevity-risk products. The authors note these points no longer hold true, showing both the increasing importance of annuity and pension products in insurers' portfolios⁶ as well as shrinking investment margins, arising from worldwide deregulation and liberalisation of markets leading to increasing competitive pressure in the insurance industry.⁷

Modelling human longevity The major model used by demographers for projecting human longevity is that of Lee & Carter (2002), a trend extrapolation method. Lin & Cox (2005) discuss different opinions about mortality trends, while Oeppen & Vaupel (2002) make strong points in favour of extrapolation techniques. Lin & Cox also discuss a variety of models used by actuaries to project mortality. Actuaries have made extensive use of spline techniques (Currie, Durban & Eilers 2004, Continuous Mortality Investigation 2005).

Demographers and statisticians have worked towards improving the Lee & Carter model (Lee & Miller 2001, Booth, Maindonald & Smith 2002). In two interesting developments, Hyndman & Ullah (2005) and de Jong & Tickle (2006) have developed more general models that each yield the Lee & Carter model as a special case, the former using a functional data analysis approach and the latter using Kalman filtering. Each method offers more robust forecasting, as well as particular advantages, over the original Lee & Carter approach, including allowing for constraints and integrating estimation and forecasting.

While the above literature treats forecasting mortality, Riemer-Hommel & Trauth (2005) has examined studies that seek to quantify the effect of medical breakthroughs eliminating certain diseases on overall life expectancy. They note that Wilmoth (1998) believes extrapolation and other detailed modelling show medical advances are unlikely to lead to major changes in future mortality decline. Winkler & Mattar (1999) are more cautious. Although they give calculations to support Wilmoth's view, having calculated the impact of the eradication of a number of diseases (including AIDS and heart disease) which leads to a maximum three year increase in life expectancy at birth, they believe that mere extrapolation does not yield a solid basis for in-

⁶Pasdika & Wolff (2005) reports since the publication of the last annuitant table by the German Actuarial Society, annuity sales have boomed. They believe annuities will be one of the German life insurance industry's major products in the future.

⁷Asher (2005) and Blake, Cairns & Dowd (2006) note some UK insurance companies have reported significant losses on their annuity business in recent years; the latter authors indicate some companies are covering themselves against the possibility of continued longevity improvement by quoting for annuity business on uncompetitive rates.

surers to reliably cover longevity risks. Stallard (2002) points out successes in treating heart disease, cerebrovascular diseases and malignant neoplasms (the three top causes of death) have not led to success in treating other diseases. In addition, for there to be large shifts in mortality following new biomedical developments there must also be a capacity to distribute these benefits widely throughout the community—Olshansky (2004) notes this could well be difficult to achieve.

Some American actuaries specialising in the annuities area (Lebouf & Abels 2005, Junus, Hart & Sondergeld 2004) have recently expressed the view that mortality improvements are reasonably well accounted for in current US actuarial tables. They point to a study of companies offering immediate annuity products and found many were happy to use current annuitant mortality tables, either without or with a small allowance for mortality improvement. The authors believe that mortality improvements will slow down and agree wholeheartedly with the limited lifespan paradigm.

Adverse selection

Insurer's problems with longevity risk are compounded by adverse selection, an issue with which actuaries have been familiar for hundreds of years (de Jong & Ferris 2005). Skwire (1997, p. 79) quotes from an 1811 novel of the renowned British author Jane Austen: '...people always live for ever when there is any annuity to be paid them... An annuity is a very serious business, and there is no getting rid of it.' Individuals expecting to die soon will be unwilling to buy an annuity—it is primarily the long-lived who will enter such a contract. Bateman et al. (2001) discuss a number of studies from a variety of countries which have found evidence of adverse selection in the annuities market.

In addition, research (Barn, Berry, Brien, Bui, Burgess, Chan, Clarke, Hui, Knight, Longden, Mak, Service, Turner & Whittaker 2004, Bernheim, Forni, Gokhale & Kotlikoff 2003) has found wealthier, healthier individuals tend to buy larger life insurance policies—a factor which contributes to the profitability of this line of business. For the annuity provider, however, these two effects will combine to produce losses.

The development of an 'impaired' or 'enhanced' market for annuities (Blake 1999, Junus et al. 2004, Wadsworth 2005), where a market for homogeneous annuities is replaced with annuities which are priced to risk, mitigates some of the burden of adverse selection on the shorter-lived individuals. Thus, individuals with shorter expectations of life (e.g., smokers, or those with a fatal illness) are offered more appealing annuity rates. Following Rothschild & Stiglitz's (1976) classic analysis of the problems of adverse se-

lection, we see the replacement of a ‘pooling’ equilibrium with a ‘separating’ equilibrium and consequent welfare improvement.

It should be noted that the issue of adverse selection is less of a problem with pension annuities where participants are required to participate in the pension scheme.⁸ The absence of choice means the pool of risks is varied, and more favourable annuity rates can be offered. This characteristic is reflected in the variety of annuitant tables available, for example GAM (group annuitant mortality) and IAM (individual annuitant mortality) tables in the US.

The need for appropriate and accurate mortality tables is pointed out by Lin & Cox (2005). They explore some of the reasons why American data on life annuity experience is flawed and suggest improvements.

Riemer-Hommel & Trauth (2005) argue moral hazard is also present in annuity markets, as behavioral change—leading to longer life—may result from longevity insurance. They cite research by Philipson & Becker (1998) which finds annuities, by raising retirement income and allowing change of lifestyle, diet and sanitation, may enhance life expectancy. This line of reasoning suggests that poorer countries, where pensions and annuities will substantially impact on individual welfare, will see more pronounced effects on longevity.

Managing longevity risk

Longevity risk is clearly a multi-faceted and difficult problem. At first glance, one would think that reinsurance and/or hedging this risk would enable its satisfactory management. Deeper reflection reveals that this is not the case. Below we explore the problems of reinsuring and hedging this risk and some possible solutions.

Problems and issues

Reinsurance For a primary insurer, an important motivation for seeking reinsurance is to achieve better diversification of insurance risks by accessing the reinsurer’s pool of risks. Longevity risks, however, are highly likely to be common across all relevant annuity markets, thus removing the value of reinsurance. Wadsworth (2005) cites reinsurers’ views in the UK who describe the standard annuity market as ‘dangerous’ and who believe existing longevity risks are ‘just too toxic’.

Wadsworth (2005) also points out that some primary insurers and reinsurers in the UK have very different perceptions of the extent of future longevity

⁸This is often a condition of employment.

risks, and consequently very different views on the level of capital needed to support an annuity business. Market participants point to this lack of consensus as one reason why capital markets have had trouble in transferring longevity risk.

Riemer-Hommel & Trauth (2005) note that a moral hazard problem exists between reinsurers and direct writers, and needs careful control to foster good insurance outcomes. In addition to the typical problem of the primary insurer underwriting carelessly once reinsurance is secured, they point out that management incentives may work against the prudent pricing of longevity risk. This is due to the length of time involved in revealing the depth and scope of longevity risks, which is beyond the career of the annuity provider executive. The temptation to succumb to short term goals and leave the emerging problems for future managers and shareholders is real.

Riemer-Hommel & Trauth (2005) point out reinsurers may be able to exploit the hedging possibilities that arise from insuring not only portfolios exposed to longevity risk, but also those exposed to mortality risks (portfolios of life insurance products). Thus, should annuity or pension payments be higher than expected levels due to improved mortality, then this loss can be mitigated by exploiting the lower than expected payments on term and other life insurance products.

In general, however, such a fortunate correlation of payouts does not occur as the characteristics of the two groups of policyholders are too different. Wadsworth (2005) points out that experience in the UK is such that the main component of life insurance purchases are by those younger than the annuitant population (half or more written in association with mortgages) which does not reliably hedge the annuitant longevity risk.

Hedging If primary insurers cannot diversify away or hedge their longevity risks, then provision of annuities must occur with the longevity risk priced into annuity rates. Under competitive pressures, this increased annuity price may be reduced by searching for better investment returns from non-traditional assets. Indeed, though the search is continually on for higher returns (The Economist 2006*d*), taking on riskier assets can expose the business to other financial risks.

The internal hedging of longevity risks on an annuity portfolio by exploiting the primary insurer's exposure to mortality risk on its life insurance business (as discussed above with respect to reinsurance), or 'natural hedging' (Cox & Lin 2004) is one way an insurer can deal with its longevity risk. Cox & Lin (2004) provide US evidence that insurers who are able to utilise such hedging are able to offer lower annuity prices. The lack of internal

hedging options need not be the end of an insurer's risk management search. Riemer-Hommel & Trauth (2005) point out that there may be external hedging possibilities if counterparties exist who benefit from increased longevity and wish to hedge against the risk of poor or no longevity increase. We expand on this further below.

Solutions

Reinsurance Riemer-Hommel & Trauth (2005) reviews a number of proposals for finite reinsurance solutions to transfer longevity risks and help insurers more effectively manage any emerging reserve increases. They examine a proposal by Strasser & Keil (1999) for a 'structured finite risk contract' which develops a supplementary fund that can be drawn on to finance any required reserve increases should mortality improve. Some reinsurance proposals of Pitacco (2002) are also reviewed. He offers three suggestions: surplus reinsurance, which cedes a portion of large annuities; an excess-of-loss arrangement, with the reinsurer paying the final stream beyond a stated term (e.g., after age 85); stop-loss reinsurance, with an objective of covering the required portfolio reserve.

Reporting on the current limited secondary market for pooling longevity risk in the UK, Wadsworth (2005) notes that annuity prices may need to rise (particularly at younger ages) to close the 'perception gap' between reinsurers and direct writers on the extent of longevity risk.

Capital markets For annuity providers unable to exploit the internal hedging opportunities offered by 'natural hedging' (discussed above), Cox & Lin (2004) describe how to implement a mortality swap between an annuity provider and life insurer in order to achieve the same outcome. They argue such products potentially offer more flexible and cheaper coverage for both mortality and longevity risk than traditional reinsurance and other derivatives. Dowd, Blake, Cairns & Dawson (2006) further explores the issue of survivor swaps.

Apart from reinsurance, another method for managing longevity risk that has received a lot recent interest is the possibility of securitising these risks and offering them to the (much deeper) capital markets of the world. Cowley & Cummins (2005) provide a wide-ranging discussion of these issues. The successful issue of a mortality risk bond by Swiss Re in December 2003 and stimulated enormous interest.⁹ The bond was similar to a 'catastrophe bond'

⁹See, for example, Cowley & Cummins (2005), Blake et al. (2006), Friedberg & Webb (2005), and Lin & Cox (2005).

(Hommel & Ritter 2005), with coupon and capital at risk if a specified mortality index increased too rapidly over the bond's lifetime. Its success allowed Swiss Re to pass off some of its extreme mortality exposure to world capital markets.

Riemer-Hommel & Trauth (2005) point out securitisation of insurance risks involves a balance between basis risk and moral hazard. Basis risk emerges through differences between the losses incurred by the insurer and the payment of investors, while moral hazard concerns of investors arise from the possibility that the insurer may not diligently underwrite the underlying risks.

A less successful survival (or longevity) bond was mooted by BNP Paribas in November 2004, and was to be issued by the European Investment Bank with Partner Re as the reinsurer of the longevity risk. The bond was aimed at annuity providers and pension funds and its coupon was designed to track the survivorship of a specified cohort of lives. Blake et al. (2006) give an extensive account of this remarkable security and analyse why it was never issued. They believe basis risk was an important factor in investor disinterest, and suggest design improvements for future survivor bonds.

Cairns et al. (2005) develop a theoretical framework for pricing longevity derivatives based on the existing theory of interest rate derivatives, using an arbitrage-free (or risk neutral) valuation methodology.

In Blake et al. (2006) the authors survey a extremely wide range of (mostly hypothetical) longevity and other mortality-linked securities that could be harnessed to deal with the problem of longevity risk. With the existence of mortality bonds, like the Swiss Re bond above, and longevity bonds, like the EIB/BNP bond above, they discuss a universe of hypothetical mortality-linked securities: zero-coupon longevity bonds, geared longevity bonds and longevity spreads, deferred longevity bonds, principal-at-risk longevity bonds, mortality swaps, annuity futures, longevity futures, survivor caps and floors and annuity futures options. Such an array of mortality-linked securities could potentially prove a enormously powerful arsenal for combatting the problems of longevity risk.

Other risks

While interest rate risk and longevity risk are of greatest concern to issuers of traditional annuities, other risks are also relevant. Issues with credit risk may become increasing important if insurers turn increasingly to nontraditional financing sources to back their annuity liabilities. Liquidity risk is a very important issue with respect to accumulation annuities. Liability option risk has is also very important for both income and accumulation annuities—Hardy

(2003) gives much of the detail. An exhaustive list of the risk management issues life insurers face is given in Atkinson & Dallas (2000).

1.3 Alternatives to annuities

Life annuities defining characteristic is the provision of longevity insurance—individuals are insured to the very tail of the distribution of human lifetimes. We conclude our literature review with a discussion of some alternative vehicles for providing longevity insurance.

“Participating” annuities

Participating annuities, like participating life insurance contracts, allow annuitants to share in the interest and mortality experience of the issuer. This contrasts to the traditional income annuity, where the survivorship benefits are fixed by the mortality rates used at issue. Blake, Cairns & Dowd (2003) and Wadsworth, Findlater & Boardman (2001) discuss annuity schemes offering survivor credits to annuitants based on the experience of the pool of surviving members. Drawing on the features of the variable annuity, Piggott, Valdez & Detzel (2005) describe Group Self Annuitisation, where, in addition to annuity payments being adjusted for market rates of return (like a variable annuity), payments are also adjusted in line with mortality experience. The American TIAA-CREF variable annuities are similar in nature.

Wadsworth (2005) suggest a reviewable rate annuity which permits annuity rate changes reflecting shifts between actual and expected mortality over a review period (say every five years). They argue this product would be more acceptable to reinsurers and also facilitate securitisation.

Reverse mortgages

Creighton, Jin, Piggott & Valdez (2005) review reverse mortgages as means of providing retirement income streams from owner-occupied housing. These allow owners to borrow against the value of their homes with no repayments of principal or interest until sale of the property or death of the borrower. Funds from this arrangement may be paid as a lump sum, a line of credit or a traditional annuity arrangement. An attractive feature of typical reverse mortgages is that the loans are non-recourse in nature and so lenders cannot claim borrowers’ assets should property values be less than total borrowings.

Self-annuitisation

Self-annuitisation involves a retiree investing their funds and periodically drawing down amounts for consumption. Individuals are then exposed to longevity risk, as well as shortfall risk (through poor investment returns). They gain substantial consumption flexibility and may be able to bequeath a large sum. Schmeiser & Post (2005) discuss a family strategy, where heirs contract with the retiree—the heirs receive the retiree’s wealth on his or her death, but this is in return for a commitment to finance the retiree if the retirement funds are exhausted. The family strategy is devised so retirees are never in a position worse than had they received a life annuity.

In this intra-family set up the self-annuitisation/life annuity decision is shifted from the retiree to the heirs. If multiple heirs exist, the advantage of risk pooling means the severity of shortfall is reduced. In addition, the solution reduces adverse selection and transaction costs as heirs have a good idea of the retiree’s health. The authors argue it has large upside potential with low shortfall risk.

2 Methodology

The methodology for the report on supply challenges to the provision of annuities involved a literature review of this area, interviews with life insurance company executives responsible for annuities and an analysis of the interview findings. We draw implications for policymakers and give recommendations for improving the regulatory framework surrounding annuities.

In total, four interviews of up to one hour were conducted. The interviewees were life insurance executives in four countries: Australia, the U.S., the U.K. and Germany. The interviews were held on 23 March, 5 April (by telephone), 11 May and 12 June 2006, respectively. All interviews covered the following issues: the company’s annuity business (the extent of its involvement in the domestic annuity market, the products it offers); the risk management structures it has in place for its annuity business (perceptions of the important risks in the annuity business, hedging approaches, reinsurance approaches); the supply challenges the interviewee feels exist for annuity providers (perceptions of current and future conditions, current and future innovations and how conditions in the annuity business can be improved).

3 Case studies

3.1 Australia

Our interview partner in Australia was from AMP, one of the largest and oldest life insurers there. Originally established as a mutual life insurance company in 1849, it listed on the Australian and New Zealand Stock Exchanges in 1998. AMP has more than 3.4 million customers and over \$104 billion in assets under management. One in six Australians are AMP customers.

Products

The market for life annuities in Australia is decidedly small.¹⁰ Last year only a total of \$27 million dollars of business was written.¹¹ In 2005, AMP wrote \$17 million of annuity business. In all, probably only four life insurers issue life annuities in Australia, and one of those may not issue indexed annuities.

The AMP offers a variety of products designed to provide retirement income streams, including annuity products (AMP 2005). In addition to lifetime annuities, they offer term annuities, allocated pensions (a draw-down scheme, described below) and market-linked income streams.

Lifetime annuities The AMP offers a wide variety of lifetime annuities. Customers can choose to supplement the standard ‘plain vanilla’ lifetime annuity with

- capital protection: in the event of premature death, annuities are available with a minimum guaranteed payment period, which continue payment following death in the guaranteed payment period until this guaranteed period expires. Alternatively, purchasers can opt to have a capital sum (up to the amount of the annuity’s purchase price) paid to their estates.
- inflation protection: purchasers have the option to have their annuity payments indexed to increases in the Consumer Price Index (CPI),

¹⁰Australia’s annuities market has been reviewed by Cardinale, Findlater & Orszag (2002) and Knox (2000), among others.

¹¹The year before it was \$280 million. We were told that 2004 was uncharacteristic; laws concerning social security eligibility were changed that year, with people seeking to take advantage of the existing 100% assets test exemption of lifetime annuities in calculating state age pension eligibility. The following year the exemption fell to 50%, in line with other decumulation vehicles for retirement assets.

thus protecting the real value of their annuity payments. Alternatively, payments can increase by a flat rate each year, up to maximum of 5% p.a.

In addition, joint life annuities, which provide a continuing income stream to a surviving spouse, are available.

In administering its the annuity products AMP allows annuitants to receive their payments monthly, quarterly, half yearly or yearly. Instead of receiving a regular cheque, annuitants can opt to be paid by electronic funds transfer to their financial institution. The AMP also offers taxation assistance, with the option to have any income tax liabilities regularly deducted from payments (if applicable), as well as a summary of income tax payments to assist with completion of yearly income tax assessments.

AMP does not offer an impaired/enhanced annuity. Our interview partner was not aware of such products being available in Australia.

AMP has a network of over 1900 qualified financial planners. For the younger planners, who are used to working with market linked products, annuities are a very different product. They find annuities a hard sell, too. Their clients are perplexed that payments cease on death, and they may not get the value of what they paid for the annuity back. Market linked products are not like that and have an estate planning benefit. The value of inflation protection is not at all appreciated by clients as Australia has enjoyed a low inflationary environment for many years. The lack of liquidity is also seen as major minus. In purchasing an annuity, clients surrender their capital to AMP, and should they need to access it later, they can only do so in certain specified circumstances, and in such instances the commutation of the annuity will be done on a far from generous basis. Thus an annuity locks clients into AMP—and this is different to other decumulation products, where one is able to commute and move to another provider.

Benefits A lifetime annuity protects one against investment and longevity risk, offering considerable peace of mind. If the option to have annuity payments indexed to CPI is taken, it also protects against inflation risk. AMP also argues it is easy to understand. In the Australian context, it can also offer certain tax and social security benefits. AMP also points out that some \$23 billion of assets from AMP Life's Statutory No. 1 Fund stand behind its annuity business, giving customers strong grounds to believe their benefit streams will all be paid.

Balanced against these positive features are a number of less desirable characteristics. Level and frequency of income payments are fixed at initiation and cannot be changed. If one dies shortly after annuitising, and either

no guarantee has been selected or the guarantee period is short, the total income received from annuity payments may be considerably less than their purchase price. The lack of liquidity—discussed above—which locks clients into AMP is also an undesirable feature. Payments from a life annuity are also not necessarily tax free.

In current market conditions, life annuities are not perceived as being ‘value for money’—returns from many other forms of financial assets appear better. Thus, the value of the investment risk protection is not valued by clients. Also, the value of inflation protection provided by the CPI indexation option is not at all appreciated by clients, as discussed above.

Costs In table 1 we present the lifetime income streams that would result from the annuitisation of \$100 000 by AMP into its various annuity products by a 65-year old male and a 65-year old female. One can explain the results. The cheapest annuity is given by a standard annuity paid to the male (as male life expectancy is lower than female life expectancy). The cost of the options progressively increase the cost of the annuity. The joint life annuity with a ten year guarantee and CPI indexing is almost twice the cost of the plain male life annuity.

At the time these annuity quotes were taken, short term interest rates were around 5.7% in Australia. The U.S. yield curve lay beneath that of Australia and the U.K. yield curve was slightly lower than that of the U.S. Thus one would expect annuity payments to be the most generous in Australia, for comparable mortality. Examination of table 2 (U.S. quotes) shows this is true. It is also true for most of the U.K. quotes (table 3). Differences here may be explained by differential mortality (AMP does adjust U.K. mortality to reflect Australian experience) or other factors such as expenses.

Annuity risk management

Our AMP interview partner pointed out that for such a small volume of sales, a lot of work is involved in running the annuity business. Investment markets must be continuously monitored, and monthly meetings are held to check assets and liabilities are sufficiently matched. The principle risks that the AMP identified stemmed from interest rates, inflation, longevity and currency. If these risks cannot be readily hedged, then other more expensive measures must be taken to manage them, leading to a more costly and less attractive final product.

Interest rate risk A major problem in the Australian market is a lack of good quality assets to match liabilities. In recent years the government has

Table 1 AMP annuity quotes following the investment of \$100 000.

Annuity type	Male \$	Female \$	Joint ^a \$
1. Life (non-escalating)	7 136.67 ^{bc}	6 648.00	6 359.33
1. + 10-year guarantee	6 915.33	6 541.33	6 283.33
1. + 10-year guarantee, payments increase at 3% p.a.	4 910.67	4 563.33	4 295.33
1. + 10-year guarantee, payments increase with CPI	4 491.33	4 156.00	3 910.331

^aMale is the primary life; a 100% survivor's pension is paid to the surviving female.

^bThis annual amount will be paid in monthly instalments.

^cQuote prepared on 20 March 2006. No allowance has been made for commission.

been running budget surpluses, and as the government moves more and more into surplus it is generating less and less debt. The result is a lack of good quality long term debt to back annuities.

The problem of a lack of good supporting assets is particularly evident in the supply of indexed debt. While many AMP annuity customers are interested in linking their lifetime annuity payments to CPI increases, indexed debt is hard to find—particularly at longer terms. The government has issued ten year indexed bonds in the past, but seems little interested in continuing to issue indexed debt. Annuity providers must then assume that after 10 years they will earn very low returns on the assets backing lifetime annuities, which materially hurts the attractiveness of the product.

Longevity risk AMP recognises the problems posed by longevity risk. About three years ago, senior executives took a careful look at the risks posed by increased longevity and improved genetic knowledge, after which AMP's annuity business was carefully reviewed. They seriously considered withdrawing from the market, but decided to stay. With around 150 years of experience in the annuities business in Australia they feel they can reasonably manage longevity risk. They estimate longevity risk and price it into their lifetime annuities.

Up till a few years ago, reinsurance for longevity risk had been available in Australia. AMP looked into using it to manage its risks, but it was felt to be too expensive. It is no longer available. One can understand its expense—unlike the AMP, with years of annuitant mortality data, reinsurers would have little Australian annuitant data to draw on. AMP, on the other hand, is able to use its data to modify existing U.K. annuitant mortality tables

(rates and improvement factors) to reflect its annuitant experience.

Our interview partner noted that the current lack of reinsurance has led to at least one less annuity provider in Australia. Challenger Life withdrew from the life annuities market when it could no longer source reinsurance for its longevity risks. Beginning its corporate life as an annuity provider, Challenger hedged its interest rate risk by innovative means. The company bought large tracts of property in Canberra, Australia's national capital, and then leased these back to the government using long term leases. In this way, the company synthesised an indexed government bond which it could use to offset the interest and inflation risk associated with indexed lifetime annuities. Challenger dealt with longevity risk by reinsuring this with a major overseas reinsurer. Challenger withdrew from the lifetime annuity market in 2004 after the reinsurer ceased reinsuring longevity risk. They still offer term annuities, but have indicated their financing methods have changed, relying more on equity market participation to support their liability structure.

Currency risk The shortage of longer term debt, both nominal and indexed has made AMP look overseas for supply. This exposes them to currency risk. To manage this risk they engage in currency swaps, which must be periodically renewed (like a reinvestment risk). This adds to the costs of lifetime annuities.

Other issues

Our interview partner was not at all optimistic about the future of lifetime annuities in Australia. On the supply side, because of a lack of long term debt instruments, both nominal and indexed, and longevity risk, annuity providers aren't able to offer attractive products.

On the demand side, retirees are much more interested in income draw-down arrangements or fixed-term annuities than life annuities. Australia's baby boomers seem prepared to bear the investment and longevity risk of such products. They are fortunate to have access to an income floor in the form of the old age pension—and governments which have shown no inclination towards withdrawing from providing this benefit. Furthermore, many older Australians own their own house, and reason that should things really go wrong, they could always sell their home—or, with a developing market for reverse mortgages, access an income stream in that way. The reduction in some of the social security benefits associated with life annuities has also impacted on demand.

There are still some older financial planners who believe life annuities are a wonderful product, offering their clients a worry free retirement. But

with a more financially astute group of retirees these loyal planners find theirs is a minority view. Our interview partner remarked that it's a little like watching the death of traditional life insurance business (endowment and whole of life) some years ago—a group of older, loyal supporters sadly watching their clients streaming towards market oriented products with more risk, but higher returns.

3.2 United States of America

Our interview partner in the U.S. was a representative from AXA Equitable Life Insurance Company. Formerly The Equitable Life Assurance Society of the United States (established in 1859), AXA Equitable is a member of the global AXA group, which serves over 50 million clients worldwide in 50 countries, and as at the end of 2004 had over 1.1 trillion U.S. dollars under management.

Products

Statistics on its size would, at first glance, give one the impression of a vast and deep annuities market operating within its borders—the American Council of Life Insurers reported \$301 billion U.S. dollars flowed into annuities in 2004 (ACLI 2005).¹²

However, one has to bear in mind that this includes the enormous market for tax-sheltered *deferred* annuities, the overwhelming majority of which will never be annuitised, and thus serve only as asset accumulation vehicles. Upon reaching a specified age 'annuitants' can withdraw the full value of their accumulation as cash.¹³ Experts estimate 2–3 billion U.S. dollars are annuitised each year (Blake 2001). In 2004, \$2.063 billion were paid out by life insurance companies to life annuitants (ACLI 2005).

When we asked our interview partner about the size of AXA Equitable's annuity market we were told they expect to receive around \$10 billion U.S. dollars from annuity sales in a year. Again, annuity sales here means both deferred and immediate annuities—with deferred annuity sales far dominating those of immediate annuities. In terms of combined annuity sales, AXA Equitable is not a big market player, ranking 5th or 6th in terms of market share. The top market players, like Met Life, have a very large share of the market.

¹²The U.S. annuities market has been reviewed by Brown et al. (2001) and Mitchell et al. (1999), among others.

¹³Blake (2001) gives this age as 59.5.

Lifetime annuities In addition to a plain immediate life annuity, AXA Equitable offer a life annuity with period certain and a life annuity with refund certain. These last two products are very much like the AMP's capital protection options described above. For a life annuity with period certain, the period certain is limited to the client's life expectancy at the time of purchase. In the case of a life annuity with refund certain, however, the payout is available only as a fixed annuity. Its amount is limited to the difference between the annuity payments received prior to death and the purchase price of the annuity.

As with the AMP products, payments are available on a monthly, quarterly, semiannual or annual basis. The standard immediate life annuity and the two options are available on both a single life or joint and survivor life basis.

In contrast to other U.S. life insurers, AXA Equitable does not offer immediate annuities which increase in uniform amounts from year to year, nor does it offer annuities whose payments are indexed to the rate of inflation. Our interview partner indicated that its share of the increasing annuity market was quite small, and with low profit margins it decided to focus on its other annuity products.

Variable immediate annuities provide regular fluctuating lifetime payments. The payment amounts reflect the performance of the equities in which they are invested.

There is only a small market for impaired/enhanced annuities in the U.S.

Benefits The benefits and disadvantages of the above annuity products are similar to those given for the AMP products above, with clients receiving investment and longevity guarantees for the fixed products. In respect of liquidity potential, however, AXA Equitable clients are warned that the immediate annuities have no cash values. Only those payments guaranteed under the contract will be paid.

The variable immediate annuity does not offer investment guarantees, as payments can fluctuate with the value of the underlying assets. Annuitants have access to upside potential, but must bear the risk of poor investment returns.

Costs In table 2 we present the lifetime income streams that would result from the annuitisation of \$100 000 by AXA Equitable into its various annuity products by a 65 year old male and a 65 year old female. At the time these annuity quotes were taken, short term interest rates were around 4.8% in the U.S. The yield curve lay below that of Australia, and the lower annuity

Table 2 AXA Equitable annuity quotes following the investment of \$100 000.

Annuity type	Male	Female	Joint ^a
	\$	\$	\$
1. Life (non-escalating)	6 610.00 ^{bc}	6 250.00	5 610.00
1. + 10-year guarantee	6 470.00	6 150.00	5 610.00

^aMale is the primary life; a 100% survivor's pension is paid to the surviving female.

^bThis annual amount will be paid in monthly instalments.

^cQuote prepared on 20 April 2006. No allowance has been made for commission.

values reflect this. Although the U.S. yield curve was slightly above the U.K. yield curve, the U.S. annuity values are not higher, but uniformly lower, than those of table 3. This can be explained by the lighter U.S. mortality: expected lifetime at age 65 for males and females using U.S. Annuity 2000 mortality tables is higher than the U.K. IMA92 and IMF92 Annuity mortality tables.¹⁴

Annuity risk management

The U.S. is fortunate to have a good supply of long dated bonds to match life annuity liabilities. Our interview partner was also confident about dealing with longevity risk. Concerns for AXA Equitable in the annuity market arise mainly on the demand side, with issues of public education of the benefits of an annuity and concern over estate planning laws flagged.

Interest rate risk Our interview partner indicated that AXA Equitable develops fairly sophisticated asset-liability models to manage its interest rate risk. Treasury yield curves are constantly scrutinised, and their own economists develop forecasts for use with the modelling. Financial derivatives are also used to hedge interest rate risk.

In the U.S. there are few concerns over a lack of quality long-dated securities. There is a deep market in long-dated corporate paper, and with the re-emergence this year of 30-year treasury bonds, long-dated government bonds are also available.

In the U.S. pension fund (and annuity) benefits are not usually indexed to inflation (unlike in the U.K.). Nevertheless, U.S. Treasury issues index-linked government bonds (with terms of up to twenty years) are available to match inflation indexed liabilities.

¹⁴We chose these U.K. tables after noting that the authors of the newly developed German annuity tables compared their new rates with these U.K. rates (Krüger & Pasdika 2006).

Longevity risk As elsewhere, U.S. actuaries build mortality improvement factors into their mortality models. They keep on top of long term trends by doing regular mortality studies, often keeping a close eye on past five to seven year rolling averages of mortality rates to see how improvements are evolving. Resulting changes are factored into their models.

We were told that the general consensus is that at this stage there is not a great deal of concern about longevity risk in the U.S. market.

Reinsurance of longevity risk in the U.S. occurs to a small extent; it is not common. Our interview partner viewed it of little interest to AXA Equitable.

Other issues

With adequate long dated securities, and a general feeling adequate allowance has been made for longevity risks, our interview partner was not concerned about supply constraints to the provision of annuities in the U.S. market. With uncertainty growing over the future of social security benefits, there is a belief that demand for life annuities will grow. Again, our interview partner express no concern about the ability of annuity providers to match that demand.

3.3 United Kingdom

Our interview partner in the U.K. was from Norwich Union, an Aviva Company. Aviva is the largest insurance group in the U.K. serving 30 million customers worldwide and with over £291 billion of assets under management. A leading provider of life and pension products in Europe, it is the world's sixth largest insurance group (in terms of gross worldwide premiums).

Products

The U.K. is the world's largest market for immediate lifetime annuities.¹⁵ Currently individual annuities bring in annual new business premiums of around £9 billion. The principle driver for this large market size is compulsory annuitisation of tax-efficient defined contribution personal pension plans at retirement.

In addition, around £3 billion of bulk purchase annuity business was written last year. This refers to annuity contracts bought by the trustees of defined benefit pension schemes. In total, then, £12 billion of lifetime annuity business was written in the U.K. last year. Future growth in both these

¹⁵The U.K. annuities market has been reviewed by Cannon & Tonks (2006) and Cardinale et al. (2002), among others.

markets is likely to be very strong—and it is here that supply constraints could impact on growth potential. In the ten years from 2002 to 2012 the central forecast for demand for annuities from defined contribution schemes saw it double, while the central forecast for bulk purchase annuity growth was a staggering 38% (compound) p.a. (The Association of British Insurers 2005).

This clearly indicates the importance of occupational pension schemes to issues of annuity supply and demand. Their liabilities are also naturally affected by interest rate and longevity movements, which in recent years have caused enormous problems to their sponsors, leading to widespread underfunding (The Economist 2004, The Economist 2006c, The Economist 2006a).

Lots of U.K. life insurance companies offer annuities, but probably only five are felt to be serious players with good value products. Norwich Union is among those five. It offers all the standard life annuity products, as well as a with profits pension annuity, income draw-down products, and even reverse mortgages.

Lifetime annuities In addition to the usual, unadorned, life annuity, Norwich Union offer options for guarantee periods—with installments continuing to the end of the guarantee period should the annuitant die early. We were told about 75% of Norwich Union’s annuities have either a five or ten year guarantee, with the five year guarantee being more popular. For relatively young people in their 50s and early 60s it is a relatively inexpensive option.

Customer can choose annuities which increase over time, either by fixed amounts or according to increases in the RPI (Retail Price Index—a measure of inflation). Level annuities are more popular with customers than escalating annuities, as clients put a lot of emphasis on maximising their short term income. It is quite likely that some customers don’t understand the long term effects of inflation and what their income needs might be twenty years after retirement.

As with the AMP and AXA Equitable products, payments are available on a monthly, quarterly, semiannual or annual basis. The standard immediate life annuity, the guarantee options and the increasing payment options are available on both a single life or joint and survivor life basis. Our interview partner believes that for the U.K. life annuity market in general, not as many people as one would expect buy joint life annuities, and are thus not providing for their spouses.

Norwich Union also offer a with profits pension annuity. This product allows annuitants to participate in the company’s With-Profits Fund. This means annuity payments now receive a bonus payment, which reflects the

profits and losses of the With-Profits Fund. Customers thus enjoy the investment and survivorship profits (or losses) of this Fund. They give up a portion of the investment and longevity guarantees under a conventional annuity, but only a portion, as the with profits annuity has a guaranteed minimum level (below that of the standard life annuity with no option). Thus, they take on some downside risk in return for some upside potential.

A customer is able to influence the starting level of her annuity payment—she does this by anticipating a bonus rate. If she anticipates a relatively high bonus rate, for example 4 per cent, then her starting income stream is higher. If she anticipated no future bonuses then her starting rate would be lower. Following each year on year analysis of the With-Profits Fund fund, Norwich Union calculates the bonus due on that policy—if the realised bonus was lower than the anticipated bonus, the deficit is deducted from the next bonus. Alternatively, if the realised bonus was higher than the anticipated bonus, then the excess is credited to the next bonus. Thus, if a client chooses a low anticipated rate (she didn't anticipate future bonuses, or small levels) then her annuity is much more likely to increase. A client who anticipated a higher rate of bonus faces a higher risk that her annuity won't increase, or may even decline—if bonuses are less than that anticipated. More details on the with profit annuity are given below.

The with profits annuity is relatively small in terms of market sales, making up around 2% of sales of Norwich Union's annuity sales—and a similar level U.K. wide. This may well reflect the preferences of customers for the certainty of conventional products, as well as the bad reputation with profits contracts have suffered in the U.K. following the scandal involving Equitable Life (Davis 2004). On the other hand, sales for with profits annuities grew by between 30 to 50% in 2005. Our interview partner believes that with investment markets picking up, sales have started to pick up.

Neither conventional or with profits annuities have any cash value. A with profits annuity may be converted into a conventional annuity, should the client wish. Both products are typically sold after seeking advice from a financial adviser.

Norwich Union sell an annuity for people with medical impairments. It is aimed at people who have suffered a heart attack, cancer or stroke and whose life expectancy at retirement is probably no more than half that it would be for someone who is in good health at that age. At the moment only small volumes of this product are sold, however within the market they are growing in popularity. In our interview partner's view, annuity pricing is likely to become more sophisticated in the future. Apart from the impaired market, the vast majority of annuities are broadly priced on age, sex and the size of the investment. In the future it may well be the case that many more

rating factors are taken into account and there ceases to be one standard rate that applies to the vast majority of people.

Benefits The benefits associated with the conventional annuity products offered by Norwich Union are similar to those of AMP and AXA Equitable, discussed above.

The with profits annuity, however, does not protect the purchaser from investment and longevity risks—some is borne by the customer, as annuity payments can vary over time in accordance with investment returns and mortality experience. It is attractive, though, if customers have an appetite for some risk and they believe the long term investment returns from investing in a with-profits fund, which has property investments, equities as well as bonds, is going to lead to a better position. It also has the advantage that purchasers can use it to maximise their income in the short term by anticipating a high bonus rate.

The with profits annuity does not guarantee to protect the real value of annuity payments. However, Norwich Union argues that it does offer a cheaper alternative to a conventional RPI indexed annuity. With the short supply of long dated nominal and indexed bonds, and little corporate bonds available, RPI indexed annuities have become expensive. While the with profits annuity does not guarantee to match inflation, the issuer argues that modelling likely economic outcomes suggests there is a reasonable chance that one would do at least as well with a with profits annuity as compared to an RPI indexed annuity—and maybe even better. The with profits annuity certainly does provide a much better starting level of income (see table 4 below). It appears to offer the customer a more affordable option to an RPI indexed annuity, with some downside risk, but also with some upside potential.

As mentioned above, with profits products are tainted at the moment in the U.K. Our interview partner believes that the two key challenges to improving the market profile of the with profits annuity is to make it more understandable and more transparent to customers. Customers find the concept of bonus rates hard to understand. Also, they find the practice of smoothing investment returns—smoothing bonus rates—perplexing. They find it difficult to accept that in conditions where investment markets are growing reasonably strongly that the bonus rate has not really responded—the principle that the with profits fund is smoothing returns over time and the insurer is allowing for past investment returns is hard to understand. On the other hand, when investment markets fall sharply and the bonus rates don't fall sharply, customers tend not to understand that is when they are

Table 3 Norwich Union annuity quotes following the investment of £100 000.

Annuity type	Male £	Female £	Joint ^a £
1. Life (non-escalating)	7 122.00 ^{bc}	6 684.00	6 010.44
1. + 10-year guarantee	6 912.00	6 534.00	6 001.20
1. + 10-year guarantee, payments increase at 3% p.a.	4 917.96	4 485.96	4 048.92
1. + 10-year guarantee, payments increase with RPI	4 523.04	3 980.04	3 741.84

^aMale is the primary life; a 100% survivor's pension is paid to the surviving female.

^bThis annual amount will be paid in monthly instalments

^cQuote prepared 20 May 2006. No allowance has been made for commission.

getting the benefit of smoothing—they tend to expect that and not give the product credit for what it is doing under those circumstances.

Costs In table 3 we present the lifetime income streams that would result from the annuitisation of \$100 000 by Norwich Union into its various annuity products by a 65 year old male and a 65 year old female. At the time these annuity quotes were taken, short term interest rates were around 4.7% in the U.K. The yield curve lay below that of Australia (table 1), and the lower annuity values over most of the table reflect this. As we explained above, although the U.K. yield curve was slightly below the U.S. yield curve, the U.K. quotes are higher than those of the U.S. (table 2) because of the heavier U.K. mortality.

In table 4 we give quotes for Norwich Union's with profits annuity. Note that, regardless of the anticipated bonus rate chosen, the guaranteed minimum life annuity is always that corresponding to a zero anticipated bonus rate. Thus, the guaranteed minimum life annuity for the 65-year old male is £4 807.80 in both cases; for the female it is £4 752.72 in both cases. The projected value in any year t , y_t , is given by $y_{t-1}(1 + g - e)/(1 + ABR)$, where g is the projected investment return on the With-Profits Fund, e is its projected expense charge, and ABR is the customer's anticipated bonus rate.

It is interesting to note that this U.K. guaranteed minimum life annuity lies below that offered by a German firm (table 6). While German annuitant mortality rates are somewhat heavier than those of the U.K. (Krüger & Pasdika 2006), suggesting the U.K. annuities should be lower, the German yield curve lies below that of the U.K., which has the opposite effect.

Table 4 Norwich Union with profit annuity quotes: projected annuity payments following the investment of £100 000 for 65-year olds of differing genders and anticipated bonus rates (*ABR*).

Year	Male		Female	
	<i>ABR</i> = 0% £	<i>ABR</i> = 4% £	<i>ABR</i> = 0% £	<i>ABR</i> = 4% £
1	4 807.80 ^{abc}	7 371.84	4 752.72	7 285.80
2	5 014.54	7 393.10	4 957.09	7 306.82
3	5 230.16	7 414.43	5 170.24	7 327.89
4	5 455.06	7 435.82	5 392.56	7 349.03
5	5 689.62	7 457.27	5 624.44	7 370.23
10	7 022.72	7 565.45	6 942.26	7 477.15
15	8 668.16	7 675.20	8 568.85	7 585.62
25	13 205.95	7 899.49	13 054.66	7 807.29

^aFor each case, the With-Profits Fund is projected to grow at 5%, with an expense charge of 0.7%. Expenses include administrative costs, investment costs, and differences between actual and projected mortality.

^bThis annual amount will be paid in monthly instalments.

^cQuote prepared on 22 June 2006. No allowance has been made for commission.

Annuity risk management

Our interview partner identified three main areas of risk management that are important for annuities: interest rate risk, longevity risk and credit risk. Of these risk areas, it was felt that interest rate and credit risks can be managed down to acceptable levels; longevity risk, on the other hand, could well deliver nasty shocks in the long term.

Interest rate risk At Norwich Union interest rates are monitored on a daily basis. Practically, interest rate risk is managed by using well established techniques of duration management. This involves a mixture of appropriate cash flow matching, duration matching, plus interest rate swaps or other derivative instruments to manage any cashflow and duration mismatch down to acceptable levels. For example, if appropriate and sufficient bonds are available, cash flow matching can be used to cover the first ten to fifteen years of annuity liabilities, with duration matching used to cover the mismatches that exist later on, and derivatives then used to deal with any remaining mismatching that is of concern. Should there be a shortage of appropriate instruments for pure cash flow matching, then more swaps and derivatives have to be used to manage interest rate risk to tolerable levels. Clearly an

adequate supply of long dated fixed interest investments enables one to match off liabilities more effectively and efficiently.

In managing the interest rate risk on new business, premiums are invested so as to match liability duration to investment duration as accurately as possible. Annuity business investment plans drawn up at the beginning of the year not only include sales targets, but also include requirements for investments, both in terms of volume, the amount of return required for the investments and also the duration of the investments.

The sensitivity of the annuity portfolio to interest rates and the relationship between assets and liabilities are monitored at very regular intervals.

Deferred annuity business presents more of a problem. While only very small volumes of this business are written on an individual basis, the strong growth in the bulk annuity market means increasing volumes of deferred annuities are coming in to annuity providers now. Managing the interest rate risk on these products is much more difficult, as the liabilities are much longer in duration than an immediate annuity to a 65-year old. Greater amounts of longer long dated investments are needed to manage this risk, and currently in the U.K. there is not an adequate supply of such instruments. Long dated inflation indexed bonds are also needed, as this pension business often includes inflation indexed liabilities. The dimension of the shortage of long dated bonds can be seen in the January auction for 50-year U.K. government bonds where demand was strong enough to push real yields down to 0.5% p.a.—at that time long term real yields in the U.S. were around 1.5% (The Economist 2006*b*).

The inflation protection for conventional RPI indexed annuities is currently very expensive in the U.K. Our interview partner pointed out this is due to the shortage of both long dated government securities (both nominal and indexed) and corporate bonds. To alleviate some of this pressure, the U.K. government issued 50-year inflation indexed bonds last year for the first time, but demand still outstrips supply. Inflation risk exposure can also be managed by derivative instruments, such as inflation swaps.

Longevity risk Norwich Union performs regular investigations of its mortality experience. Usually a very detailed investigation is performed once a year, which would include a lot of reflection on the statistics—analysing trends and forecasting likely future developments. During the course of the year mortality is also monitored with less detailed studies, but sufficient to determine whether mortality experience is above or below expectation, together with calculation of high level indicators as to which parts of the portfolio are perhaps diverging from what was expected. In its mortality

investigations it will segment its portfolio into relevant blocks to examine patterns of results over a number of years, although it is often difficult to get very clear statistically significant signals coming through.

The company actively follows any mortality publications and general information from the Continuous Mortality Investigation bureau (CMI) of the Institute and Faculty of Actuaries. The company does its own work as well, and will adjust the publications of the CMI on mortality improvement factors or standard tables to suit its own experience. It follows research on longevity and medical advances from institutions from all over the world, from reinsurers to universities.

This process of review culminates in a formal annual review of assumptions the firm will make for valuing its liabilities and pricing new business. During the year, through ongoing dialogue, it is aware of where its going and what the driving influences are, so sudden changes of assumptions do not occur at any particular time during the year.

Our interview partner's personal view is that both the U.K. market and U.K. actuarial profession have come a long way in the last five to seven years in terms of understanding longevity risk. Although they have a much better understanding of the problem, and know a range of possible answers and underlying drivers that may be leading to improvements, it is still an area of great uncertainty.

In our interview partners words:

... the interest rate risk we talked about earlier is one where with a certain approach you can manage those risks down to tolerable levels and it's only in quite severe circumstances, which you can identify and quantify and put a probability against, that you'll get a really nasty shock. I think longevity is not so tame a beast as that. And it is still, despite all the research we've done, and all that we know, and all the data we've got. It can still deliver us a nasty shock.

Longevity risk also has a practical administrative dimension. In running an annuity portfolio one has to think carefully about many issues. For example, the issue of late notified deaths—how do you validate whether an annuitant is still alive? Do you use certificates of existence? if you so, do you do it for all annuities or only for annuities of a certain age or a certain amount? Are there ways of validating whether a customer is alive without having to write to her?

Our interview partner indicated that although annuity providers are able to obtain reinsurance for their longevity risk, it is not easy to obtain. Although there have been recent signals that there is an increasing appetite

from reinsurers in the U.K. the widespread view is that there is limited reinsurance capacity for annuities. Most major reinsurers operating in the U.K. either have no appetite for longevity risk or are extremely cautious. Often annuity providers have to look further afield—worldwide—to find reinsurance for annuities. Often the reinsurance that is available is limited, with reinsurers being very clear how much longevity risk they want to take on board.

Norwich Union has found that it is much harder to reinsure a stream of new business in real time—as you write the new business you reinsure it straight away. Slightly easier is to go back and reinsure a block of business written several years ago, where one can present a number of years of mortality evidence to the reinsurer.

When asked about the value of ‘natural hedging’ for life insurers, our interview partner noted that most major writers of life insurance protection use substantial amounts of reinsurance, and the mortality exposure they carry is actually relatively small. Thus, the benefits of increasing survival probabilities will not show through in the short term; in the long term this will emerge as the reinsurer prices such developments into the arrangements. Furthermore, the protection business in the U.K. is generally bought by people between the ages of 25 and 50, usually for mortgage protection. The mortality improvement trends in this group of insureds is materially different to what is happening to annuitants in their 70s, 80s and 90s. For these reasons it is not apparent that there is much of a ‘natural hedge’ between the life insurance and annuity business. While the effect may emerge in the long term, it is likely that for considerable periods of time there will be little or no hedging effect. Our interview partner commented that businesses are generally not known to be patient and wait 20 years to see what may emerge—their reporting framework and the demand for performance is over a much shorter time period.

Norwich Union does not make any links between its pricing of its protection and annuity business. So, a large sales target for protection business in a particular year would have no influence on the size of the annuity business target. It is possible, however, that with the move towards risk based capital assessment there may be some recognition of some hedging between these two lines of business, thus influencing capital management, but our interview partner was not at all sure whether this would be the case.

Credit risk The third main risk that Norwich Union needs to manage for its annuities portfolio is that of default risk on its investments. The widespread belief that annuities in the U.K. are provided by companies in-

vesting in government bonds is not actually true—there is a substantial degree of investment in corporate bonds and other financial instruments to provide a better financial return. This brings with it default risk.

Default rates are monitored on a monthly basis. Should a default event transpire, immediate action is taken. This will depend on the circumstances. In some cases, the investment may be sold before it gets too bad. In other situations sale might not be possible and one may have to work with the borrower to negotiate an appropriate outcome.

On an annual basis the company formally reviews its default experience, analysing trends and revising assumption for pricing and for valuing liabilities. Our interview partner believes default risk is probably similar to interest rate risk, in that the magnitude of the risk can be reasonably quantified, and is thus not as great a concern as longevity risk. It differs from interest rate risk in that it can be more ‘lumpy’—often one or two defaults are followed by large number, after which one may have years of good experience.

Other issues

Our interview partner felt the supply challenges facing annuity providers were threefold: firstly, the uncertainty around future mortality improvements; secondly, the lack of supply of long dated fixed interest investments to enable the effective and easy matching of liabilities, particularly deferred annuities; and thirdly, the capital requirements for an annuity business. We have discussed the first two points above, and so turn to the third point below.

The capital required to write annuity business is quite substantial. This is not unsurprising as the contract involves a genuine transfer of investment, longevity and expense risk (and sometimes inflation risk) to the annuity provider. It is a capital intensive business, and any company’s appetite for annuities will be limited in part by the amount of capital they have available. In a market which faces potentially huge demand, and with mortality and investment problems that are difficult to cure, our interview partner wondered if capital management issues could be examined to reduce constraints on the industry.

The capital required for an annuity business consists of actuarial reserves plus a 4% solvency margin. In addition, companies have to perform a risk-based capital assessment which, if it leads to a higher capital requirement, must be adopted. Now, in the process of firstly determining actuarial reserves, assumptions are made about mortality, investments and expenses which build in prudence and margins and thus lock up a good deal of additional capital to meet these prudential requirements. To this gets added the further 4% solvency margin—or more (Norwich Union puts aside around

6% of reserves). In end effect, in addition to the actuarial reserve there is a substantial amount of extra capital being locked up in the business. In a very competitive annuity market, with relatively low yields now compared to previous years, the cost of that capital is eventually borne by the consumer through pricing. If one could find ways of reducing the cost of capital, more value could be passed back to the consumer.¹⁶ This is indeed a challenge, as an adequate level of capital needs to be in place to protect consumers.¹⁷

In addition to discussing the challenges to annuity supply in the U.K., our interview partner also commented on possible developments in the market. Longevity bonds are of interest to annuity providers. Importantly, any developments will both have to work within the regulatory framework—purchasers need recognition of the bonds from a capital adequacy standpoint—and be offered at the right price. In a highly price competitive annuities market the bond needs to deliver returns equivalent to what providers are achieving on investments.

There is also scope for product innovation in the annuities market. The conventional annuity is a product with a remarkable level of protection—it offers the best of everything in terms of guarantees: guaranteed investment return, guaranteed inflation protection (if chosen), and a guarantee against longevity risk. It may well be possible to design a product that did not transfer quite so much risk from customer to insurer and at the same time allowed the market to operate more effectively. The overall result for customers who choose such a product would be a feeling of better value, even though they are getting a less certain income. With profit annuities do not fulfill this role at the moment, with investment markets not performing at the moment, in addition to the tainted nature of with profit business in the U.K. following Equitable Life's financial difficulties. Other investment linked annuity products tend to be very complex, and many investment annuities are only suited for people with much larger fund sizes and appetite for risk—not products for the mass market.

Our interview partner speculated that a draw-down product that offers both value, with charges that aren't too penal, and sufficient protection, with

¹⁶As an example, our interview partner suggested a radical solution would be to allow annuity providers to invest with more freedom and flexibility. It is currently not cost effective to put equities into an annuity portfolio—but is it possible to develop regulations that would allow providers to tap into these investment returns while operating in a well capitalised environment with a good risk governance framework?

¹⁷The U.K. regulator has been examining the possibilities of a less regulated and capital intensive framework for the bulk annuities market (Felsted 2006). Investment banks, entrepreneurs and private equity funds have been watching these developments with great interest.

investment options that are secure enough, may be better suited for the mass market. Such a product could be an alternative to a conventional annuity. Alternatively, it may enable customers to defer buying an annuity until they are at a more advanced age. Annuities purchased by people at older ages of 75 or 80 certainly offer fewer headaches to suppliers as concerns over longevity risk and the challenge of finding matching assets are substantially reduced. It is also likely that more annuity providers would enter the market because the risks that have to be charged for are less.

3.4 Germany

In Germany, our interview subject was a representative of the Hamburg-Mannheimer Versicherungs-AG. The Hamburg-Mannheimer is a member of the ERGO Insurance Group, which with over 16 billion Euro in premium income, is Germany's second largest primary insurer. The ERGO Insurance Group is made up of Victoria, DKV Deutsche Krankenversicherung, D.A.S. and KarstadtQuelle Versicherungen, in addition to the Hamburg-Mannheimer. Throughout Europe it has over 30 million customers. It is majority owned (94.7%) by Munich Re.

Products

The German annuities market is markedly different to the those we have considered above.¹⁸ The standard annuity form in Germany is a participating (with profits) annuity, which is widely offered by life insurers. Level life annuities appear to exist (Schmeiser & Post 2005). von Gaudecker & Weber (2004) produce a table (partially reproduced in table 5) to show over the period 1998 to 2001 total payouts from life annuities rose by 58%, a growth rate of 16.4% p.a. Our calculations, using data from Gesamtverband der Deutschen Versicherungswirtschaft e.V. (2005*b*), from 1998 to 2004 give a (compound) growth rate over the period as 13.9% p.a.—still strong growth. The authors remarked that this strong growth is likely to continue following reductions in public pension payments and pension reform measures creating tax incentives to save in private pension plans (deferred annuity plans) and annuitise the accumulations. From von Gaudecker & Weber's (2004) table, we can see that annuity payments made up 6.7% of all main insurance benefits paid by life insurers in 1998; in 2001 the figure rose to 7.7%. Our calculations show that in 2004 this figure stood at 10.1%.

¹⁸The German annuities market has been reviewed by Schnabel (2002) and von Gaudecker & Weber (2004), among others.

Table 5 Private annuities and insurance benefits in Germany, 1998–2001, from von Gaudecker & Weber (2004).

Year	1	2	Ratio 1/2
	Life annuities paid by insurers € million	Main insurance benefits paid by insurers € million	
1998	1 732	25 841	6.7%
1999	2 053	29 402	7.0%
2000	2 457	32 804	7.5%
2001	2 725	35 429	7.7%

We were not able to find statistics on the amount of new immediate life annuities written by German insurers in a year. Gesamtverband der Deutschen Versicherungswirtschaft e.V. (2004) documents the strong growth of private pension plan business in various dimensions from 1976 to 2003. In 2003, new business to private pension plans consisted of €6.695 billion of single premium business and €3.794 billion of fixed annual (periodic) premium business. Similar to the case of the U.S., these statistics do not yield any information on immediate annuities, as they represent funds accumulating over time—which may, or may not, be paid out as lifetime annuities. It is clear that private pension business has grown in recent years at the expense of the traditional endowment business of life insurers (Gesamtverband der Deutschen Versicherungswirtschaft e.V. 2005*a*). Despite the changes introduced by the Retirement Income Act at the beginning of 2005, endowment insurance—whose maturity values may be annuitised—remains the most popular vehicle for providing for retirement.

Lifetime annuities Our interview partner agreed that private pension plan business has grown and will continue to grow, but pointed out that it is not clear at this stage that a large proportion of the accumulated funds will be annuitised, with consequent heavy demand for lifetime annuities. The Hamburg-Mannheimer has a large agency force, and like other insurers, has used the uncertainty surrounding the size of future public pension payments to best effect in promoting private pension plans. While these agents are comfortable selling these products, we were told they are not used to selling immediate annuity business and find it harder. In the five months to the end of May, the Hamburg-Mannheimer received €48.2 million in capital funds for annuitisation. These funds generated €2.4 million per annum of annuity payments.

Many of the characteristics of participating annuities offered in Germany are similar to those described in our discussion of the U.K. with profits annuity. Options are available to add a survivor benefit or to add a guaranteed payment period. Annuitants can also opt to be able to access the capital value of their product. After three years they may access all (or part) of the initial capital they paid for the annuity, less annuity payments to date. In the case of death this value may be paid to beneficiaries in one lump sum.

The payment stream of the participating annuity is also flexible. In addition to a guaranteed minimum annuity,¹⁹ customers receive yearly bonuses. The shape of these bonuses can be varied: they can produce an increasing annuity; they can be paid at a flat level for the first five years, then rise; they can start at a high level and decrease (reflecting the fact that the capital funds of an annuity are largest at its inception, and are then gradually run down).

German insurers have smoothed profit-sharing rates over time. This is made possible by the book value accounting system in Germany, which allows the build up of hidden reserves. These surpluses may be accumulated, but with the limitation that 90% of a year's surplus be distributed within five years.

Our interview partner told us there were no inflation indexed annuities in Germany. We were also told that life insurers in Germany did not offer impaired annuities; if they exist at all they may be sold by insurance brokers.

Private pension plans enjoy tax advantages if annuitised. Annuity payments (considered to be composed of interest and capital) are only taxable on the interest component, and this is done at favourable rates.

In addition to private pension plans, two forms of government supported retirement saving are available: the Riestert-Rente (or Zusatzrente) and the Rürup-Rente (or Basisrente). These products offer tax and social security benefits, but offer much less flexible benefits. To enjoy the benefits of these products, accumulations must be annuitised. Riestert contracts have enjoyed good sales growth, with strong sales in 2005 prior to the introduction of unisex rating on these contracts in 2006 (Gesamtverband der Deutschen Versicherungswirtschaft e.V. 2005a).

Benefits The advantages and disadvantages of participating annuities are outlined above in our section dealing with the U.K. In addition, German life insurers point to the benefit security afforded by the establishment of Protektor AG, a guarantee fund to protect policyholders from insurer insolvency

¹⁹German law requires a minimum annuity must be guaranteed. This is discussed further below.

Table 6 Hamburg-Mannheimer participating annuity quotes: projected annuity payments following the investment of €100 000 for 65-year olds of differing genders and survivor benefits. No guarantee period or refund option has been included.

Year	Male		Female	
	Single life €	Joint life ^a €	Single life €	Joint life ^b €
1	5 873.40 ^{cd}	5 076.12	5 201.64	4 859.16
2	5 993.88	5 180.28	5 308.32	4 958.88
3	6 116.76	5 286.48	5 417.16	5 060.64
4	6 242.16	5 394.96	5 528.28	5 164.44
5	6 370.20	5 505.60	5 641.68	5 270.40
10	7 050.84	6 093.84	6 244.44	5 833.44
15	7 804.20	6 745.08	6 911.40	6 456.60
25	9 560.52	8 263.32	8 466.72	7 909.92

^aA 60% survivor's pension is paid to the surviving female.

^bA 60% survivor's pension is paid to the surviving male.

^cThis annual amount will be paid in monthly instalments.

^dQuote prepared on 15 June 2006. No allowance has been made for commission.

(Stefanidis 2006).

One clear benefit—for annuity providers—that emerged from discussions with our interview partner is that as an insurer's entire portfolio of annuity business is participating in nature, it has far more flexibility and correspondingly less risk management concerns for the business than if annuity streams were guaranteed across all dimensions. Problems, for example, emerging from higher than expected longevity can be dealt with by reducing bonus rates.

Costs In table 6 we give quotes for the Hamburg-Mannheimer's with profits annuity. Note that, the guaranteed minimum life annuity for the male and female is the first value in each column. Thus, the guaranteed minimum life annuity for the 65-year old male is €5 873.40 in the single life case and €5 076.12 in the joint case; for the female they are €5 201.64 and €4 859.16. These guaranteed values lie above those of the U.K. with profits annuity in table 4. While the heavier German annuitant mortality rates go some way to explaining this (Krüger & Pasdika 2006), the lower German yield curve produces an opposite effect.

Annuity risk management

One defining characteristic of the German annuities market is the legal requirements imposed on these products. A mandatory fixed actuarial interest rate is set, which is used to determine the guaranteed nominal level of an annuity, and must be met each year it is in payment. Currently this rate, the *Rechnungszins*, is 2.75% p.a., and is set to fall to 2.25% at the beginning of next year. For business written before July 2000 it was 4%; for business written between that time and 2004 it was 3.25%. Insurers must also use mortality rates and expenses rates applicable at contract commencement. These rates, together with the guaranteed interest rate—all fixed at the beginning of a contract—are used in determining the surplus on a annuity contract in any year of its existence. This requirement to meet a successive stream of annual guarantees has important consequences for the asset-liability management of German life insurers (Albrecht & Weber 2005).

Interest rate risk The regulation of life insurers mentioned above effectively shortens their investment horizon in respect of annuity business to one year. This is despite the long term nature of the liabilities and the nature of participating insurance, which aims to trade off a riskier portfolio for higher returns.²⁰ A traditional immunisation approach is no longer appropriate, as the process of duration matching focuses on the interest rate sensitivity of the present value of liabilities and will not ensure the successive yearly guarantees are also met. Thus, any traditional immunisation must be supplemented with procedures to achieve these successive yearly guarantees.

In an ever changing investment market, the ability to constantly meet annual guarantees requires a particular business model. German life insurers have used book value accounting for assets together with hidden reserves (the difference between the market value and book value of assets) to create a buffer whereby they can enjoy a high degree of confidence in meeting guaranteed minimum interest rates. Insurers point to the success of this business model in the recent dramatic German stock market crash. Between 2000 and 2003 the market lost over 70% of its value and, in the face of this once in a hundred year event, only one of the hundred or so life insurers became insolvent (Stefanidis 2006).

Longevity risk Our interview partner strongly believes in carefully monitoring mortality trends. We were told about the development of a new Ger-

²⁰It is interesting to note that currently German insurers hold only 8% of their assets in shares. They are permitted to hold 30% (Stefanidis 2006).

man annuity valuation table, DAV 2004 R. The reasons for the development of the new table are given in Krüger & Pasdika (2006):

With the increasing importance of annuity business, the statutory valuation requirements, the low interest-rate environment and the long-term guarantees given in annuity business, insurance companies have a growing vested interest in using adequate mortality rates for pricing and evaluating annuity business. In 2002/2004, a committee of the German Actuarial Society (DAV) thus re-examined the question of whether a new mortality table was necessary for annuity business

The committee came to the conclusion that the post-2000 DAV 1994 R mortality improvement trend assumption did not appropriately reflect the mortality improvements in the last three decades of the twentieth century. The development of a new table, called DAV 2004 R, was therefore decided.

Our interview partner felt that with the constant monitoring of mortality, and appropriate reactions to the results, German annuity providers working within a participating annuity market have little to fear from longevity risk. Consequently they would have little interest in reinsurance of this risk or longevity bonds to hedge it. We were told that reinsurers would find this risk very difficult to model and price. Any resulting product would be short term and expensive, reflecting its risk and the stringent capital requirements placed on reinsurers.²¹

Other issues

Our interview partner could not see serious supply constraints emerging in the German annuity market. The nature of participating annuities allowed a degree of flexibility to providers which made them better able to weather adverse investment and longevity developments. In addition, though there was strong growth in the deferred annuities market, it was not clear at this stage that this would translate into future heavy immediate annuity demand.

The regulatory environment has proved sufficiently flexible to adapt to changing economic conditions thus far. Regulators, under pressure from life insurers, have allowed the guaranteed interest rate to fall with falling market returns. Insurers have noted the improved longevity of their clients and have developed new annuity tables to deal with it.

²¹Blake et al. (2006) point out that one of the problems with the development of longevity bonds is the difficulty to get reinsurers to participate. They also note the burden of capital requirements on reinsurers.

The life insurance market in Germany is however entering a period of change. The current regulatory system would not work in its current state if insurers were to move to market value based accounting in line with international norms. Albrecht & Weber (2005) point out that such a change would require interest rate guarantees to move to much lower levels if the solvency of insurers was not to be adversely affected. The federal attorney general, Brigitte Zypries, announced a draft for a new insurance contracts act earlier this year. A long running high court battle between life insurers and a policyholder group over the entitlement of policyholders to the hidden reserves of insurers ended last year, in favour of insurers. Following this ruling, new standards have to be introduced regarding these reserves. On top of all of this, there is continued pressure for further reform of state provision for the aged with many proposals in circulation. With this amount of change set to impact the industry, it will be interesting to see how annuities fare over the years to come.

4 Discussion

Our interviews with four annuity providers in four different countries raised numerous important issues regarding supply constraints to the provision of annuities. The two most important items impacting on the ability of annuity providers to offer attractively priced annuities are the availability of suitable nominal/indexed bonds and the uncertainty surrounding longevity risk. Issues of product design and capital requirements were raised. Interestingly, all four interviewees raised the issue of education of consumers and/or financial advisers on annuities. None of the interviewees had any specific recommendations for improving the regulatory framework.

All interviewees indicated the importance of a good supply of quality bonds, especially long-dated bonds. Bond prices (and the term structure) impact directly on annuity pricing. Lack of supply requires substitution with costly alternatives: from overseas (introducing currency risk), interest rate swaps and other financial derivatives. A lack of quality instruments introduces credit risk, which also has to be priced into the final product. In the U.K. and the U.S. governments have shown themselves willing to offer much longer term bonds, with markets in the U.K. asking for more (ecnmst). The Australian government, with an eye towards public debt management issues, has been less forthcoming.

Our U.K. interview partner nominated longevity risk as the most difficult risk to manage. Our other interview partners, with materially smaller annuity markets, felt it was a risk they could manage. Germany, which offers only

with profits annuities, has a natural mechanism to deal with longevity risk with the ability to reduce bonuses. All insurers could benefit from better and more cost effective ways of managing this risk. We were told that reinsurance is not providing this alternative.

Longevity risk is an area where lot more work is needed. Practitioners and academics have recently been investigating this area in earnest. Promising developments, like the longevity bond, have emerged. More work is necessary into the reinsurance possibilities of longevity risks, either as supporters of longevity bonds or as providers of traditional reinsurance cover. The strict capital requirements imposed on reinsurers was mentioned to us as an issue. Government and regulators can support this work; government can support further research and modelling.

All the interviewees indicated the importance of continually monitoring mortality. This points to the importance of maintaining good quality complete mortality data. While national actuarial bodies work hard to produce mortality tables for insurers, other researchers have a valuable contribution to make in analysing these data. Making more data available to more researchers and in a timely manner would aid the careful analysis of longevity risk.

Product design emerged in all our discussions. The traditional immediate annuity is a highly engineered product, containing guaranteed protection over several dimensions of risks. Other successful annuity products exist, which offer less guarantees. And many more designs are possible, with tremendous scope for innovation. Governments need to consider whether such developments are desirable, and if so, regulators need to support the resulting products with legal frameworks that accommodate them. Dialogue between these bodies and insurers (or other providers) is vital.

Our U.K. interview partner raised the issue of capital controls on annuity providers as a supply constraint. Government and regulators need to consider whether relaxing aspects of these requirements is possible, without compromising consumer protection. Any reduction in the cost of capital would allow more value to flow on to annuity purchasers.

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