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Australia's disappearing market for life annuities

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Australia's disappearing market for life annuities *

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Abstract:
We analyze the small and disappearing market for life annuities in Australia by estimating the net benefits of annuitization. The costs of annuitization are derived from estimates of the money's worth of Australian annuities. The benefits are measured using a utility-based metric of a lifecycle consumer's valuation of longevity insurance. In an extension to previous analysis we incorporate a consumption floor into the lifecycle consumer's utility function, to recognize the importance of a minimum consumption stream to retirees. As well, we account for pre-existing annuitization in the form of Australia's means-tested age pension. We find that despite the large decrease in the money's worth of Australian annuities, and the withdrawal of tax-transfer incentives to encourage annuitization, it would still be optimal for Australian retirees to annuitize all or at least part of their retirement wealth. We suggest that the very thin and fading market for life annuities in Australia may be due to lack of consumer awareness of the risks of not annuitizing, as well as supply-side constraints. Our findings raise questions about Australia's retirement income policies which may leave many older retirees exposed to inadequate retirement incomes.

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1. Introduction

Australia, Chile and Switzerland were the pioneers of mandatory private retirement saving. All three had introduced systems of mandatory private individual accounts as the focus of their retirement income arrangements long before they were advocated by the World Bank in its seminal report 'Averting the Old Age Crisis' (World Bank 1994). Chile was first in 1981 when it replaced its public pay-as-you-go defined benefit pensions with a multi pillar system centered on contributions made to individual accounts managed by private sector pension funds (AFPs) (Diamond and Valdes-Prieto 1994, James *et al* 2006). Switzerland followed in 1985 with the mandation of its long standing and high coverage system of occupational pensions (Butler and Ruesch 2007) while Australia first mandated the inclusion of privately managed individual accounts in industrial awards in 1987 and then extended this to all employees in 1992 under the Superannuation Guarantee (Bateman *et al* 2001). By 2007 Australians held over $A1 trillion of assets in pension (superannuation) funds[1] and almost all Australian workers were covered. Unlike many other converts to mandatory private individual accounts, the systems in Australia, Chile and Switzerland are now mature enough to allow for credible comparisons of retirement benefits.

The accumulation phase is remarkably similar in all three systems. Mandatory contributions are made into individual accounts in privately managed pension funds at rates of 10 per cent of income in Chile, 9 per cent in Australia and between 7 and 18 per cent of income in Switzerland.[2] The contributions are invested in a range of assets and the accumulated benefits can be accessed after reaching a statutory eligibility age.

[1] In Australia pension funds are called superannuation funds.
[2] The Chilean contribution rate is net of administrative charges and insurance premiums and Australia's mandatory minimum contribution rate is gross of taxes, administrative charges and any insurance premiums, In Switzerland the contribution rate is determined by age: 7% (age 25-34), 10% (age 35-44), 15% (age 45-54) and 18% (age 55-65).

However, the similarities stop at retirement. Chilean and Swiss retirees favor retirement benefits in the form of life annuities, while Australian retirees have a longstanding preference for non-annuitized benefits – originally lump sums and more recently phased withdrawal products (known in Australia as account-based pensions). The demand for life annuities in Australia is very low and falling. In the 1st quarter of 2008 only 19 life annuities were purchased by Australian retirees (Plan for Life 2008)

In Chile retirees can choose a life annuity sold by insurance companies or a phased withdrawal sold by the pension funds (AFPs). Small lump sums are available in restricted circumstances. All annuities are indexed and must be paid at a fixed rate. Joint annuities are mandatory for married men (and other men and women with dependents). So far around two thirds of Chilean retirees have annuitized. Reasons advanced for this high rate of annuitization include the limited range of payout options available, particularly for early retirees; the absence of a public defined benefit pension (except for the minimum pension guarantee); and the provision of a government guarantee for life annuity payments. These incentives are reinforced by price competition among the 17 companies offering life annuity products. (James *et al* 2006).

Swiss retirees have the choice of a life annuity or a lump sum. Neither phased withdrawals, nor term annuities are available. All annuities are nominal and must be paid at a fixed rate. Married retirees, both men and women, must purchase reversionary joint annuities. Around 80 per cent of Swiss retirees take lifetime annuities from their second pillar retirement savings and around 50 per cent of retirees have a combination of a life annuity and a lump sum (Butler and Ruesch 2007). The high rate of annuitization in Switzerland is attributed to tradition (as the pre existing system of voluntary occupational pensions had only paid defined benefit pensions), and structural issues such as the close links and cross subsidization between the accumulation phase and decumulation in the form of a life annuity.

In Australia, retirees have a wider choice of benefits. Australian retirees can convert their retirement accumulation into one or more of a lump sum, a phased withdrawal product (currently called an account-based pension[3]), a term annuity or a life annuity. As well, from time to time, hybrid products have been marketed in response to regulatory incentives.

As compared with both Chile and Switzerland, the demand for life annuities by Australian retirees is very small. In 2007 only 374 life annuities were sold with a total value of $A36 million by the 4 life insurance companies currently in the market. To put this into context, of the $A41.1 billion of superannuation assets converted to retirement benefits in 2006-07 (APRA 2008), 45 per cent of these assets were taken as income streams, of which less than 0.2 per cent was used to purchase life annuities.

It is well known that economic theory provides a strong justification for lifetime annuities. The seminal paper by Yaari on the theory of a life-cycle consumer shows that an expected utility maximizer with additively separable utility who faces no uncertainty other than the time of death will annuitize all their wealth provided the individual has no bequest motive and the market for annuities is actuarially fair (Yaari 1965). This result was further extended by Bernheim (1991) and Davidoff *et al* (2005) who show that complete annuitization still holds in a more general setting.

That few retirees buy annuities has long been a puzzle to economists. Despite considerable analysis, there is no clear explanation for the low demand for annuities (Brown 2007). Possible reasons include: the desire to leave an inheritance (Friedman and Warshawsky 1990 and Bernheim 1991); concerns about the loss of access to capital for unexpected health or aged care expenses (Palumbo 1999, Mitchell and Turra 2004, Nardi *et al* 2006 and Yogo 2008); substitutes for life annuities in the form of public pensions, other private defined benefit pensions or intra family risk sharing (Kotlikoff and Spivak 1981,

[3] Previously called an allocated pension.

Brown and Poterba 2000, and Brown 2001); the high price of life annuities due to adverse selection and/or administrative loadings (Mitchell *et al* 1999, James and Song 2001 and Doyle *et al* 2004); or perhaps timing issues which make it optimal to delay annuitization (Milevesky and Young 2002, Kingston and Thorp 2005, and Milevesky and Young 2007). Recent research has advocated behavioral hypotheses, such as retirement saving being framed in terms of an investment rather than a potential consumption stream (Brown *et al* 2008).[4]

We consider two possible explanations for the annuity puzzle in the context of Australian retirement income provision. These are, firstly the net impact of loadings on the demand for life annuities after taking account of the value of the longevity insurance provided by annuitization, and secondly, the impact of pre-existing annuitization in the form of Australia's means tested public age pension.

It is often argued that the low demand for life annuities is due to the high price of (or low returns from) annuities. The standard metric for assessing the monetary value of a life annuity is the money's worth ratio (MWR) which is calculated by taking the expected present discounted value of the annuity payments as a percentage of the price of the annuity. A positive relationship between the demand for life annuities and the money's worth ratio is supported by the international evidence. The high price (or low money's worth) of life annuities is attributed to the loading – that is, the difference between the purchase price of the annuity and its expected present discounted value. The loading is attributed to administration costs, operating costs, profit margins and the costs of adverse selection. Countries with a low demand for life annuities such as the United States and the United Kingdom have relatively low money's worth ratios and large loadings (Finkelstein and Poterba 2002, Brown *et al* 1999), while Chile and Switzerland with high rates of annuity demand have relatively high money's worth ratio estimates, often exceeding 100 per cent (James *et al* 2006, Thorburn *et*

[4] As well the thin market for life annuities may be due to supply side constraints (Purcal 2006, Mitchell *et al* 2006).

al 2007, Rocha *et al* 2008, Butler and Ruesch 2007). These results are of course consistent with the standard adverse selection story.

Previous analysis of the low demand for life annuities in Australia has focused on the estimation of money's worth ratios. For example, Doyle *et al* (2004) reports a money's worth ratio of around 90 per cent (or a total loading of 10 per cent) for a life annuity purchased by an Australian male at age 65 in 2000 with roughly 50 per cent of the loading due to adverse selection. However, the money's worth ratio is only a partial measure of the value of a life annuity. It measures the cost, but not the benefits, of longevity insurance. Mitchell *et al* (1999) quantified the benefits of an annuity using a utility-based metric which estimates how much a retiree would be prepared to pay in order to receive longevity insurance. Using this methodology, they showed that, under reasonable assumptions, the utility gains from annuitization in the US market in the mid 1990s outweighed the loadings associated with annuitization. It follows that the loadings on life annuities (the costs of annuitization) are important only to the extent that they are not offset by the utility gains from annuitization as measured by the insurance value (the benefits of annuitization). So far there has been no estimation of the insurance value of Australian annuities to place the money's worth estimates in context.

The aim of this paper is to understand better why the market for life annuities in Australia is so small, as well as to contribute to the ongoing quest to solve the annuity puzzle. Our focus is an estimation of the insurance value of Australian life annuities. In an extension to previous analysis, we specifically recognize that retirees, more so than individuals at other stages of the lifecycle, value a minimum consumption stream. We invoke Hyperbolic Absolute Risk Aversion (HARA) preferences in the specification of the retiree's utility function. As well, we account for pre-existing annuitization by including Australia's means-tested age pension in our utility estimates.

Our results show that, under reasonable assumptions and despite the large decrease in the money's worth of Australian annuities over the past decade and a withdrawal of the tax-transfer incentives for life annuities, the benefits of annuitization (as measured by the utility-based insurance value of annuities) outweigh the costs of annuitization (as measured by the loadings) for all illustrative annuities. As well, pre-existing annuitization in the form of Australia's public age pension does not significantly diminish the insurance value associated with the annuitization of private retirement saving. In other words, the solution to Australia's annuity puzzle must be sought from elsewhere.

Our findings raise questions as to why Australian retirement income policy leaves retirees exposed to late life retirement income inadequacy. Those who outlive their non-annuitized income stream will become reliant on the means-tested public age pension, which at its maximum pay a pension of 25 percent of average male earnings.

The paper is set out as follows. The next section provides an overview of the market for retirement benefits in Australia. In section 3 we commence our search for an explanation of the very low demand for life annuities in Australia. The loadings on annuities in Australia are estimated by calculating the money's worth ratio (MWR). These money's worth estimates are placed into context in section 4. The insurance values of Australian annuities are estimated using a utility-based measure of a life-cycle consumer's valuation of annuities specified with HARA preferences and incorporating the pre existing public age pension. The final section concludes.

2. Overview of Australian retirement benefits

Retirement income in Australia comprises a public age pension, mandatory private retirement saving in individual accounts (the superannuation guarantee) and voluntary retirement saving through superannuation, housing and other financial assets.

The public age pension is non-contributory, paid from general revenues and is available to males from age 65 and females from age 63.5[5] subject to comprehensive income and assets means tests and residency requirements. The payments are indexed to the greater of the growth of the consumer price index (CPI) and male average earnings and provide a replacement rate of around 25 per cent of male average earnings for single retirees and around 40 per cent for a retiree couple. Net replacement rates are higher at closer to 33 per cent for single retirees as the age pension is exempt from income tax. In other words, the public age pension has the features of a lifetime indexed annuity, for those retirees who qualify for payments under the income and assets means tests.

The superannuation guarantee was introduced in 1992. Employers are required to make contributions of at least 9 per cent of earnings on behalf of their employees to individual accounts in private superannuation funds. The resultant accumulation can be accessed from age 55[6], although benefits are tax free if access is delayed to age 60.

Voluntary superannuation includes employer superannuation contributions in excess of the mandatory 9 per cent, personal superannuation contributions and government contributions under the co contribution arrangements (whereby the government matches voluntary contributions for individuals who satisfy statutory income requirements), as well as other saving in the form of housing and financial assets. Tax concessions to encourage voluntary superannuation were first introduced in 1914 and were recently strengthened in the 2006-07 Commonwealth budget.[7]

Prior to the introduction of the superannuation guarantee, Australia had a two pillar retirement income system based on the public age pension and voluntary occupational and personal superannuation. Less than 50 per cent of workers were covered by voluntary

[5] The female age pension age is gradually increasing to age 65 by 2014.
[6] Gradually increasing to age 60 by the year 2025.
[7] For more detail on Australian retirement income arrangements see Bateman *et al* (2001) and Bateman (2007).

superannuation and most retirees took their retirement benefits as a lump sum.[8] For most retired Australians the public age pension served as both the safety net and the main source of retirement income. However, the role of the means tested age pension is likely to decline as a greater proportion of Australians retire with a working lifetime of superannuation (private pension) coverage.

The decision to mandate private retirement saving under the superannuation guarantee did not include (and has not subsequently included) mandatory retirement incomes. Instead, Australian retirees can elect to take their retirement benefits as one or a combination of a lump sum or a retirement income stream. Retirement income streams currently available include account-based pensions (a form of phased withdrawal product) and immediate annuities. From time to time, hybrid products are marketed in response to tax or other regulatory incentives. A recent example is a product called a term allocated pension (TAP) which was available from 2004 to 2007.

The immediate annuities sold in Australia include term certain annuities and life annuities. A particular type of term annuity is a life expectancy annuity which has a term equal to the life expectancy of the annuitant. Life expectancy annuities became popular in the 1990s in response to tax and age pension means test incentives. Immediate annuities are available with a wide range of features including escalation (including CPI indexation), guarantees, return of capital, single or joint, and with and without reversion. Life annuities insure retirees against investment risk and longevity risk, and possibly inflation risk (where they include an escalation feature). However, it is often argued that they fail to insure retirees against replacement risk due to the size of the associated loadings (Doyle *et al* 2004).

Phased withdrawal products were first introduced in Australia in 1985 and were given regulatory approval as 'allocated pensions' in 1992. In 2007, allocated pensions were

[8] With the exception of public sector defined benefit arrangements which often paid superannuation pensions.

superseded by a generic product called an account-based pension. Phased withdrawal products allow retirees to invest their retirement accumulation in an investment portfolio according to their risk preference and to decide how much income they want to receive annually. The initial ‘allocated pension’ required the annual income (drawdown) to be within minimum and maximum statutory limits.[9] The new account-based pension has a minimum annual drawdown requirement only. Other conditions include no residual capital value and transfer only upon death. Where these conditions (called minimum standards) are satisfied, the earnings on the underlying assets are free of tax. The minimum drawdown payments are defined as a percentage of the remaining account balance and vary by age as summarized in Table 1 below. Account-based pensions are now the most popular form of retirement income benefit.[10]

<insert Table 1 about here>

Hybrid products have also arisen from time to time in response to regulatory incentives. Term allocated pensions (TAPs), also known as market-linked income streams, were introduced in September 2004 in response to changes in the tax, age pension means test and regulatory requirements. TAPs had a similar account structure to allocated pensions, but a similar term structure to a life expectancy term annuity. However, TAPs are no longer marketed following further changes to the tax and regulatory requirements in September 2007.

Under these phased withdrawal products, investment risk is borne by the retiree and the retirement income will vary over time depending on the investment performance of the underlying assets. The term of the product is not fixed and payments cease when the account is depleted. Therefore, the retiree is not insured against either investment risk or longevity

[9] The maximum limit ensured that the retirement accumulation lasted until at least age 80 years, while the minimum limit ensured that some capital existed until the retiree reached the oldest age on the life expectancy tables.

[10] Account-based pensions are analyzed in Bateman and Thorp (2008).

risk. However, retirees have the possibility of higher retirement incomes (than annuity products) as the underlying assets are likely to be invested in portfolios with higher expected returns.

In the absence of compulsory retirement income streams, the approach of the Australian policymakers has been to use tax, age pension means test and regulatory incentives to encourage the take-up of income streams with particular characteristics.

Prior to 1983 the tax system favored lump sums, with only 5 per cent of the total amount of the lump sum included in taxable income. By comparison, all annuity income (including the return of capital) was included in taxable income, and the full annuity purchase price and the full amount of annual annuity income were assessed under the age pension assets and income tests. However, following the adoption of award based superannuation in 1987 and the introduction of the superannuation guarantee in 1992, the tax and age pension means test rules were altered to provide some concessions for retirement income streams.

Initially lifetime annuities received the greatest concessions. In the years following the introduction of mandatory private retirement saving, incentives were introduced to encourage the purchase of life annuities at retirement. These included: exemption from tax of the assets underlying life annuities; no taxation of the return of capital on an annuity product; a 15 per cent annuity rebate to offset any remaining taxation of the annuity payments; a doubling of the reasonable benefit lump (as compared to lump sums) whenever at least 50 per cent of the retirement accumulation was taken as a life annuity; full (and then partial) exemption from the age pension assets test; and return of capital excluded from assessable income under the age pension income test.

However, these specific incentives were gradually dissipated as similar concessions were extended to a wider range of income stream products, including non annuitized products such as allocated pensions (now called account-based pensions) in the 1990s, to life expectancy term annuities in 1998 and to TAPs in 2004. A policy rationale was to enhance the familiarity of retirees with the idea of retirement income streams.

Following the most recent changes announced in the 2006 Commonwealth Budget and implemented throughout 2006 and 2007 the dissipation of specific incentives in favour of life annuities is complete. All retirement benefits – whether taken as a lump sum or an income stream – are now exempt from tax if retirement is delayed to age 60 or over[11] and the age pension income and assets tests apply equally to all types of retirement income streams. That is, the taxes on lump sums have been removed, annual retirement income stream payments are excluded from assessable income and the reasonable benefit limits (which provided considerable tax preference to life and life expectancy annuities) and the 15 per cent annuity rebate have been abolished. As well, the exemption from tax of the income underlying life and life expectancy annuities has been extended to account-based pensions which meet minimum standards. The government justified these changes as a means of simplifying the tax, age pension means tests and regulatory arrangements for retirees. But, in simplifying the regulations surrounding retirement income streams, all incentives to purchase life annuities – the only form of retirement benefit which insures against longevity risk – have been removed. (see Bateman and Kingston 2007 for more details).

Despite the availability of a range of different retirement benefits and the suite of tax and age pension means test concessions offered to life and life expectancy annuities over the past 20 years or so, Australian retirees still express a strong preference for non-annuitized retirement benefits. Initially this meant lump sums, although there has been a gradual shift towards account-based pensions. After remaining fairly constant since the 1990s, at 20 per cent of the total value of retirement benefit payments, the share of annual payments due to

[11] Where the benefits are paid from a so-called taxed superannuation fund. This represents the vast majority of superannuation fund.

income stream products is finally increasing. In 2006-07, income stream payments accounted for over 40 per cent of retirement benefits paid (APRA 2007), although this has not translated into an increase in the demand for life annuities.

Figure 1 reports new purchases of income streams available in the Australian market from 1999 to 2007. Over this period, account-based pensions have not only been the most popular type of retirement income product, but their popularity has been increasing. The market share of new purchases of account-based pension products increased from around 64 per cent in 1999 to around 88 per cent of retirement income streams by the end of 2007. By contrast, the market share of term annuities has fallen to less than 6 per cent, down from 30 per cent in 1999. And, despite the tax and age pension means tests concessions discussed earlier, new purchases of life annuities accounted for only 6 per cent of the market in 1999, falling to a miniscule 0.15 per cent by end 2007.

<insert Figure 1 about here>

The nature of the small and shrinking market for life annuities in Australia is further revealed in Table 2 which reports summary data on annuity purchases over the period 2001 to 2007. Only 374 life annuities were sold in Australian in 2007 with a total value of $A36 million, compared with 1,927 life annuity contracts worth $A166 million in 2001. Not only has the demand for life annuities fallen to minute levels, but the number of annuity providers has also fallen from 11 in 1998 to only 4 in 2007.

<insert Table 2 about here>

We now seek an explanation for the very low and falling demand for life annuities in Australia. We start by estimating the loadings on life annuities and then ask whether the loadings are large enough to offset the utility gains from annuitization.

3. The money's worth of Australian annuities

Our starting point is to estimate a metric used to assess the money's worth of an annuity - the money's worth ratio (MWR). The money's worth ratio is estimated as the expected present discounted value (EPDV) of the annuity as a proportion of the purchase price of the annuity, as follows:

$$\text{Money's worth Ratio} = \frac{\text{EPDV(annuity)}}{\text{Purchase price}} \qquad \Leftarrow (3.1)$$

The money's worth ratio tells us the present value of returns one could expect per $A1 of annuity premium. In other words, a life annuity with a money's worth ratio of 0.95 implies that the annuitant is expected to receive 95 per cent of the present value of his investment during his life time. The 5 per cent of the present value he does not receive can be viewed as the cost of longevity insurance. This is called the loading. The loading comprises administrative costs, operating costs, profit margins and costs of adverse selection.

The standard formula used to calculate the EPDV for the simplest annuity, a nominal single life annuity, paying monthly income is:

$$\text{EPDV(Nominal)} = \sum_{t=1}^{(\omega-x)\times 12} \frac{A_{nom} \times {}_{t/12}p_x}{(1+i_t)^{t/12}} \qquad \Leftarrow (3.2)$$

where: A_{nom} is the monthly annuity payment, ω is the maximum age a person is expected to live (assumed to be 110), ${}_{t/12}p_x$ is the probability of survival until age $t/12 + x$ by an individual who is currently aged x, i_t denotes the annual nominal interest rate for maturity of t months and r_t denotes the annual real interest rate for maturity of t months.

In the Australian market a variety of life annuities is offered, including nominal annuities and annuities with escalation[12] (including CPI indexation), single and joint annuities,

[12] Provide protection against inflation by annually increasing annuity payments by a flat rate (usually up to 5 per cent) or inline with the annual inflation.

annuities with or without reversion, annuities with or without a guarantee[13] and annuities with or without the return of capital (RCV).[14] The EPDV and therefore the money's worth ratios for these alternative annuities can be estimated using modifications of the standard formula in Equation 3.2.

As indicated in Equation 3.2 above, the estimation of the EPDV and therefore the money's worth of annuities requires realistic annuity payments, estimates of the term structure of interest rates, and estimates of survival probabilities. Repeating this exercise using estimates of survival probabilities for both the general and annuitant populations allows for an estimation of the costs associated with adverse selection.

Annuity payments

The annuity payments used here are the actual annuity quotes provided by the four life annuity providers in Australia for a $A100, 000 purchase price in 2006.[15] The average payout for a variety of annuity types available in the Australian market is reported in Table 3.

<insert Table 3 about here>

There is a considerable variation in annuity payouts among the four annuity providers.[16] One explanation for this dispersion is the difference in mortality and interest rate assumptions used by companies to price their annuities. Another explanation is the lack of readily available annuity quotes. Lack of pricing information makes it difficult for customers

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[13] A guarantee provides insurance against loss of capital due to premature death. If the primary annuitant dies within the guarantee period, income will continue to pay to a nominated beneficiary or the estate until the end of the guarantee period.

[14] Annuities with RVC are not considered in our analysis as regulatory arrangements discourage their purchase for retirement income purposes.

[15] Currently there are four life offices providing regular quotes on life annuities. They are AMP, AXA, CommInsure and MLC. This is down from 11 companies in 1998 (Doyle *et al* 2004).

[16] Similar observations have been made for the UK by Friedman and Warshawsky (1988) and for the US by Mitchell *et al* (1999).

to compare prices, which leads to less competition and price dispersion among companies.[17] We used the average monthly payouts for each type of annuity.

Interest rates

The money's worth estimates also require estimates of the term structure of interest rates. There has been some debate as to whether the estimated term structure should be based on corporate bonds or government bonds. We use government bonds as this excludes risk and reflects the opportunity cost more accurately (Thorburn *et al* 2007). Specifically, we apply the Vasicek (1977) interest rate model to estimate the term structure of Australian interest rates using Australian Commonwealth Treasury Bonds and Bank Bills of varying durations.[18] The resultant estimated term structure, illustrated in Figure 2, clearly shows that as at December 2006 Australia was experiencing an inverted yield curve.[19]

<insert Figure 2 about here>

Survival probabilities

The final input required for the money's worth estimates are survival probabilities for both the general and annuitant populations. [20]

The survival rates for general population are computed using period life tables published by the Australian Government Actuary (AGA). The AGA updates their life tables every five years after the national census. The latest available are the Australian Life Tables (ALT) 2000-02. These are based on the mortality of Australians over the three year period centered on 2001 Census of Population and Housing (AGA, 2004). In order to calculate the

[17] James and Vittas (1999) undertake an international comparison of annuity payouts and point out that price dispersion is least in countries where on-line price information is available.
[18] The underlying methodology is summarized in Ganegoda and Bateman (2007)..
[19] Generally an inverted yield curve is considered to be a predictor of an economic recession. However this may not be the case in Australia. Ford and Taylor (2005) argue there could be other factors affecting the yield curve such as the structural decline in inflation and inflationary expectations, excess global savings (the 'global savings glut' hypothesis) and changes in the portfolio preferences of investors that put downward pressure on long term bond yields.
[20] The annuitant population is a sub population in the general population who voluntarily purchase annuities.

money's worth of annuities in 2006, the 2000-02 period life tables were aged up to 2006 and transformed into cohort life tables using 100-year future mortality improvement rates as reported in ALT 2000-02.[21]

Annuitant life tables are the mortality tables used by annuity providers in pricing their annuities. We construct two mortality tables for Australian annuitants. One is based on the solvency standard set out by the Life Insurance Actuarial Standards Board (LIASB), which from here on will be referred to as 'Annuitant table (SS)'.[22] The other is based on assumptions used by one of the main annuity providers, which from here on will be refereed to as 'Annuitant table (IS)'.[23] Some difference in the annuitant mortality rates is observed under these two assumptions. Assuming the Australian industry knows better, we suggest that estimates based on the IS tables would provide a more accurate account of the mortality of Australian annuitants.

The money's worth ratio estimates

The money's worth of Australian annuities based on the annuity payments, term structure of interest rates and mortality rates as derived above are estimated for six different types of annuities purchased by males, females and jointly by a couple. We assume an inflation rate of 3.1 per cent (the average inflation rate for the five years 2001-2006) and any pre 2007 taxes on annuity payments are ignored.[24] The results are summarized in Table 4.

<insert Table 4 about here>

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[21] Details of this transformation can be found in Ganegoda and Bateman (2007).

[22] According to the solvency standards established under the Life Insurance Act 1995, the LIASB assumes that the mortality experience of Australian annuitants can be estimated by taking a percentage of the IM/IF80 ultimate tables compiled by the Society of Actuaries in the United Kingdom. (See Ganegoda and Bateman 2007, for more details)

[23] Annuitant table (IS) is based on assumptions used by AMP, Australia's largest annuity provider. In their 2005 Annual Report, AMP report that they assumed 72 per cent of the IM/IF80 C10 life table compiled by the Society of Actuaries, UK for pricing purposes in 2006.

[24] See Bateman and Kingston (2007) for pre 2007 tax rules.

The money's worth of annuities for a typical 65 year old retiree with average mortality prospects is derived by using the population mortality tables. As reported in the top line of each panel in Table 4, the resultant money's worth ratios range from 0.65 to 0.77 for single annuities purchased by 65 year old males, from 0.67 to 0.78 for single annuities purchased by 65 year old females and from 0.65 to 0.78 for last survivor annuities with 85 per cent reversion purchased jointly by a 65 year old male and a 60 year old female. These money's worth ratios are considerably lower than previous estimates for Australian annuities for the year 2000 (Doyle *et al* 2004), and as compared to international experience. Recent Australian and international experience is summarized in Table 5.

<insert Table 5 about here>

There has been a considerable fall in the money's worth of Australian annuities over the past six years. Using the general population mortality tables, the money's worth ratio has fallen from 0.88 in 2000 to 0.77 in 2006 for a 65 year old male, and from 0.90 to 0.78 for a 65 year old female. Similarly, the money's worth ratio using the annuitant population tables has fallen from 0.94 to 0.81 for a 65 year old male and from 0.94 to 0.80 for a 65 year old female.[25] The source of this large fall in money's worth can be explained by a combination of lower annuity payments (or a higher price due to administrative and operating costs and profit margins), and/or the term structure of interest rates (which has inverted since 2000) and/or the population and annuitant mortality tables. Figure 5 summarizes movements in Australian interest rates and annuity rates over the period 2000 to 2007.

<insert Figure 5 about here>

As Figure 5 shows, the annuity payment for the illustrative lifetime annuity with a purchase price of $A100,000 for a 65 year old male, with 2 per cent escalation and a 10 year guarantee has fallen from $A7,266 in the March quarter 2000 to $A5,843 in the December

[25] Doyle *et al* (2004) used the equivalent of 'Annuity Table (SS)'.

2007. By comparison, the 10 year bond rate was lower in 2007 than 2000, and the 90 day bill rate was higher in 2007 than 2000. A possible explanation for the increase in the loading could be the prevailing negative yield curve and the decline in bond yields since 2000. Bateman *et al* (2001, p.113) explains how loading costs increase when annuity providers build up their reserves to protect themselves in the absence of adequate financial instruments to transfer their risk. As well, there has been a considerable reduction in competition in the market for life annuities, with the number of providers falling from 11 in 1998 to only four at end 2007, and anecdotal evidence of reduced cross-subsidization towards life annuity products.

Loadings on Australian annuities

The estimates summarized in Table 4 also provide insights into the overall loadings on the different types of annuities and the impact of adverse selection. The total loading is the difference between the purchase price and the EPDV and is therefore equal to 1 – MWR. It is attributed to administrative costs, operating costs, profit margins and the costs of adverse selection.. Table 6 summarizes the total loadings on the illustrative annuities per dollar of premium for 65 year old Australians in 2006.

<insert Table 6 about here>

The total loadings on Australian annuities purchased in 2006 range from 19 cents to 35 cents per dollar of annuity premium, depending on the type and characteristics of the annuity. For the average retiree from the general population, the total loading on a nominal life annuity purchased by a 65 year old male is estimated at 24 cents per dollar of annuity premium. This then increases with the addition of features such as guarantees and escalation. For example the loading on the nominal annuity for the 65 year old male increases to 33 cents per dollar premium where the annuity has a 10 year guarantee and 5 per cent escalation.

The CPI indexed annuity has the largest loading, reflecting the extra cost individuals should face in order to receive protection against inflation. Life annuities with minimum guarantee periods offer slightly better deals compared to their counterparts without a guarantee period, as the guarantee eliminates the uncertainty involved in payments up to end of the guarantee period.

Finally, the loading on a single life annuity purchased by a 65 year old male in the general population is higher than the loading faced by the same male who purchases a last survivor annuity with a 60 year old female (except for the case with 5 per cent escalation and a guarantee period).

The total loadings on Australian annuities are high compared with international experience. For example, the estimated loading on a life annuity purchased by a 65 year old male in 2006 in Australia of 24 per cent, compares with a 14 per cent loading estimated for a male in general population in the US, around 13 per cent in the UK, 10 per cent in Switzerland, 5 per cent in Singapore, and just about zero in Chile – see Table 5. However these estimates are highly sensitive to movements in the yield curve. Under IS annuitant table a 1 per cent positive shift in the yield curve will decrease the loading for a nominal life annuity by 15 per cent and a 1 per cent negative shift will increase the loading by 18 per cent.

Estimates of adverse selection

Finally, the amount of the total loading attributed to adverse selection is estimated by taking the difference between the MWR based on the mortality table for the general population, and the MWR based on the mortality table estimated for the annuitant population. The cost of adverse selection for Australian annuities purchased in 2006 is summarized in Table 7.

<insert Table 7 about here>

Adverse selection is significantly higher for annuities purchased by males than for females or for jointly purchased annuities, for all types of annuities. For example (using the IS annuitant table), for a nominal life annuity purchased by a 65 year old male, 3.7 cents per dollar of premium can be attributed to adverse selection, compared with 1.6 cents per dollar of premium for females and 1.8 cents per dollar for joint annuities.

The cost of adverse selection has dropped significantly over recent years. Money's worth results reported by Doyle *et al* (2004) for Australian annuities purchased in 2000 (using the SS annuitant table) suggested that roughly 50 per cent of loading for a 65 year old male in the general population purchasing a nominal annuity with a 10 year guarantee was due to adverse selection, and 36 per cent for a 65 year old female in the general population. Our estimates for the same annuities purchased in 2006 (using the SS annuitant table) indicate that this has dropped to 20.4 per cent and 12.5 per cent for 65 year old male and female retirees respectively. A possible reason behind this drop is that prevailing low interest rates are putting pressure on annuity providers to use competitive mortality assumptions in order to stay in business.[26]

These estimates suggest that the cost of adverse selection for Australian annuities is significantly lower than in other countries with similarly thin annuity markets (see Table 5 for the US and the UK), but higher than countries with high annuity conversion rates (see James and Vittas 1999, James and Song 2001, Butler and Ruesch 2007).

In summary, under the money's worth metric Australian annuities represent very poor value for money. Compared with previous Australian and international estimates, the money's worth ratios of Australian annuities are lower and the total loadings are higher.

[26] For example, according to their 2006 Annual Report, AMP made changes to their mortality assumptions and provided annuities using annuitant mortality rates much closer to population mortality rates.

However, adverse selection is not a major contributor to the total loadings on Australian life annuities.

4. The insurance value of Australian life annuities

In the previous section the loadings on illustrative life annuities in the Australian market, or in other words the cost of longevity insurance, was quantified. We now take the analysis one step further to investigate how much retirees would be willing to pay in order to receive longevity insurance. This is referred to as the insurance value of annuities. We can then compare the cost of annuities (as indicated by the loadings) with the benefits of annuitization (as indicated by the insurance value).

Background

We estimate the insurance provided by annuities against longevity risk using a utility-based metric of a life-cycle consumer's valuation of annuitization. Following Mitchell *et al* (1999) and Brown (2001) we define the insurance value of annuities as λ, the proportion of non-annuitized wealth an individual would be prepared to pay to gain access to the annuity market

$$\lambda = 1 - W_0/W_{NA} \qquad (4.1)$$

where W_0/W_{NA} is the wealth equivalence between annuitized and non-annuitized wealth, W_0 is initial retirement wealth and W_{NA} is the retirement wealth required to equate the utility of an individual with assets of W_0 who did not have access to annuitization, with the utility of the same individual who purchased an actuarially fair nominal annuity.[27]

We make two variations to the previous methodology. First, when deriving our utility-based metric, we specify a utility function with a consumption floor. We consider that retirees, more so than individuals at other stages of the lifecycle, would value a minimum

[27] A related concept is annuity equivalent wealth (AEW) = W_{NA}/W_0, first introduced in Brown and Poterba (2000) and Brown (2001) and utilized in Butler and Teppa (2008), which measures the additional initial wealth required in the absence of annuitization (ΔW) to provide the same level of utility as an annuitized income stream purchased with initial wealth W_0.

consumption stream (which would generate a minimum retirement replacement rate) throughout their retirement.[28] Second we specifically take account of pre-existing annuitization by integrating Australia's actual means-tested public age pension into the optimization problem

Specifying the utility function

In order to take account of a retiree's desire for a minimum consumption stream, we invoke Hyperbolic Absolute Risk Aversion (HARA) in the specification of the utility function. We assume that individual retirees have an additively separable utility function of the following form

$$U(C_t) = \frac{\left(C_t - C^{/}\right)^{1-\beta} - 1}{1-\beta} \quad \text{for} \quad \beta > 0 \text{ and } C_t > C^{/} \qquad \Leftarrow (4.2)$$ [29]

where, β is the curvature parameter, which defines the magnitude of relative risk aversion, C_t is annual real consumption at time *t* and $C^{/}$ is the consumption floor.

Most of the previous literature – including Mitchell *et al* (1999), Brown (2001), and Mitchell and Turra (2004) - have assumed constant relative risk aversion (CRRA) in the specification of the utility function. One of the advantages of CRRA utility is that it links the intertemporal elasticity of substitution with the risk aversion coefficient. Another advantage is that the optimal solution derived using CRRA is independent of the initial wealth level. However, an advantage of using a HARA utility function, as specified in Equation 4.2, is the inclusion of a consumption floor $C^{/}$. Here, utility goes to zero and marginal utility approaches infinity as consumption falls closer to $C^{/}$. Thus, HARA utility reflects the individual's motivation to keep their consumption (and therefore their standard of living) above a predetermined level

[28] We follow Kingston and Thorp (2005) who recognize the importance of a consumption floor for retirees.

[29] Equation 4.2 is undefined at $\beta = 1$ and is equal to $\ln\left(C_t - C^{/}\right)$ in the limit.

throughout retirement. Under the CRRA alternative the optimal consumption path can fall to levels close to zero (or the age pension, if available) in later years of life.

A second rationale for HARA utility is that it allows for behavioral changes related to risk aversion, while the CRRA specification assumes constant relative risk aversion. For example, consider relative risk aversion for the utility function as specified in Equation 4.3 as

$$\text{Relative Risk Aversion } = \beta \frac{C}{C - C^{/}} \qquad \Leftarrow (4.3)$$

As C increases, relative risk aversion decreases for a positive $C^{/}$. This captures the fact that individuals are willing to take more risk as their consumption moves away from the subsistence level.

Importantly, by setting $C^{/} = 0$, (that is, a zero consumption floor) the utility function in Equation 4.2 becomes a CRRA specification.

Estimating the insurance value of Australian annuities

The estimation of the insurance value of annuities, λ, proceeds in two stages. In both stages we consider an individual who retires at age 65, with initial retirement wealth of W_0, who follows an optimal consumption path derived by solving a dynamic stochastic optimization problem for lifetime consumption.

In the first stage, we assume that the retiree has access to an actuarially fair annuity market. We assume an additively separable utility function and estimate the maximum expected utility (U^*) an individual could obtain by annuitizing an optimal amount of his wealth with the purchase of a nominal life annuity. In other words we solve Equation 4.4 below subject to wealth and consumption constraints, using a dynamic stochastic optimization algorithm, as follows

$$V_t(W_t) = \underset{\{c_t\}}{Max}\, E_t\left[\sum_{t=1}^{45} \frac{U(C_t)}{(1+\rho)^t}\right] \qquad \Leftarrow (4.4)$$

Subject to constraints:

$$W_0 = \text{Initial Retirement Wealth} - \text{Purchase Price of Annuity}$$
$$W_t \geq 0, \quad \forall t$$
$$W_{t+1} = (W_t + Y_t + A_t - C_t)(1+r), \quad \forall t$$

where $V_t(W_t)$ is the present discounted value of expected utility of the optimal consumption path at time *t* given that non-annuitized wealth for that period is W_t, C_t is the annual real consumption at time *t*, and ρ is the utility discount rate or in other words the individual rate of time preference. Individuals receive income annually from both the age pension and an annuity, where Y_t is the annual real income from the public age pension at time *t* - calculated for each year using the assets and income tests - and A_t is the annual real income from a nominal annuity at time *t*. The individual does not need to consume all his income for each period. He may save a portion at the risk free real interest rate *r*.

In the second stage, we assume that the retiree has no access to an annuity market. The amount of retirement wealth W_{NA} needed to achieve $U*$ by following the retirees optimal consumption path is estimated by using numerical search algorithm to find W_{NA} which satisfies Equation 4.4. In this stage, $W_0 = W_{NA}$, and $Y_t = 0$ for all *t*.

In both stages we assume that retirement wealth comprises untaxed superannuation benefits only, all income is received and consumption is made at the end of each year, the public age pension (Y_t) is indexed annually to inflation, is paid annually at the end of the year, and annually means tested against income and assets[30], non-annuitized wealth can only be

[30] In reality age pension is indexed against the greater of the growth of the consumer price index (CPI) and male average earnings twice yearly and paid fortnightly. For convenience here we assume age pension is indexed annually against inflation and paid annually at the end of the year.

invested at the risk free rate, the retiree cannot borrow against future age pension or annuity income, the retiree cannot invest the income from an annuity or age pension in additional actuarial notes and there is no bequest motive.

Once W_{NA} is estimated using the above methodology, the wealth equivalence between annuitized and non-annuitized wealth can be calculated using W_0/W_{NA}. Finally the insurance value, λ, can then be calculated as 1 - W_0/W_{NA}.

Results

We compute estimates of the wealth equivalence between annuitized and non-annuitized assets for an Australian aged 65 in 2006 (W_0/W_{NA}). This allows us to then estimate the insurance value of Australian annuities, defined as 1 - (W_0/W_{NA}), for a range of assumptions relating to gender (male; female), retirement or initial wealth ($A150,000; $A300,000; $A600,000), levels of risk aversion ($\beta = 0.6; 1; 2$) and the magnitude of the consumption floor ($C^{/}$ = the amount of the full age pension; $A20,000; 0). The $A20,000 per annum consumption floor approximates estimates of the minimum amount required to fund a reasonable lifestyle in retirement. For example, the December 2007 Westpac ASFA Retirement Standard indicate that a single Australian would need $A18,920 per year and a retiree couple $A26,531 per year to ensure a modest lifestyle in retirement. As well, we report the estimates incorporating the public age pension rules before and after the elimination of the tax-transfer incentives to annuitize in 2007. Our results are summarized in Table 8.

<insert Table 8 about here>

The results indicate that for all combinations of our assumed parameters, it would be optimal for the 65 year old retiree to annuitize all of their wealth, provided the retiree has access to life annuities. More specifically, if we consider the case of initial retirement wealth of $A300,000 and a consumption floor of $A20,000, under the pre 2007 age pension rules, a 65 year old male would accept a reduction of between 50 per cent and 55 per cent in his initial retirement wealth (as β increases from 0.6 to 2) in order to receive protection against longevity risk. A 65 year old female would accept a reduction of between 47 per cent and 52 per cent in her wealth. Under the new rules, which have applied since July 2007, the 50 per cent assets test exemption for life annuities was abolished and the assets test taper was reduced from a $A3 to a $A1.50 reduction in the fortnightly age pension for every $A1,000 of assets above statutory thresholds. Keeping everything else constant, the age pension changes reduced the insurance value of life annuities to 46 to 52 per cent for the above mentioned 65 year old male and 41 to 45 per cent for the illustrative female.

The results then vary across gender, level of initial retirement wealth, level of risk aversion and the dollar amount of the consumption floor. As one would expect, the fraction of wealth individuals would be prepared to forgo is increasing with their risk aversion and the dollar amount of the consumption floor. Interestingly, the fraction of wealth a male would be prepared to forgo is significantly higher than the fraction for an illustrative female, for all corresponding wealth levels and levels of risk aversion. These findings are robust when estimated with alternative assumptions for real interest rates (r) and the utility discount rate (ρ). Results not reported here indicate that a higher real interest rate would reduce the insurance value of annuities, while an increase in the utility discount rate would have the opposite effect.

Importantly, the insurance value increases with initial retirement wealth level up to around $A200,000 and decreases thereafter. This could be explained by the fact that retirees with less retirement wealth depend on the means tested public age pension as their primary income source. Since the age pension is itself a real annuity, these retirees already have access to a lifetime indexed annuity, and therefore place less value on the longevity insurance received from life annuities purchased in the private market. As initial wealth increases, retirees are bound by the age pension means tests, receive less age pension and depend more on private retirement savings. They are therefore more willing to annuitize in order to maintain a minimum level of consumption. However further increases in wealth reduce the insurance value of annuities because wealthier retirees have enough wealth to insure themselves against longevity to comfortably maintain consumption above the minimum floor through their life.

Finally, by setting the consumption floor equal to zero we can derive estimates for a utility function specified with CRRA preferences. We find that allowing for a consumption floor in the specification of a retiree's utility function significantly increases the estimated insurance value of annuitization, even where retirees already have access to a lifetime indexed annuity in the form of the public age pension. For a 65 year old male, with initial retirement wealth of \$A300,000, the estimated insurance value of annuitization of private wealth under HARA preferences ranges from 46 to 52 per cent as β increases from 0.6 to 2, while the estimated insurance value of annuitization for the same retiree under CRRA preferences ranges from 33 to 40 per cent.

Setting a zero consumption floor also allows for comparison with previous estimates. We find that our results are similar to those reported by Mitchell *et al* (1999) for the US annuity market where a 65 year old male with a pre-existing real annuity worth 50 per cent of wealth at retirement would be willing to forgo between 27 and 30.5 per cent of their wealth in order to receive protection against longevity risk. Our results indicate that the same 65 year old male with access to the Australian age pension would be willing to forgo between 26 and 40 per cent of their wealth.

Overall, across all assumptions, we conclude that a 65 year old male would accept a reduction of between 23 per cent and 52 per cent in his wealth in order to receive protection against longevity risk, while a female would accept of reduction of between 18 per cent and 45 per cent in her wealth. These estimates of the insurance value of annuities can be compared with the estimates of the total loading on life annuities computed earlier of 24 per cent for a 65 year old male and 22 per cent for a 65 year old female. In other words, under reasonable assumptions, we conclude that it would be optimal for Australian retirees to annuitize all (or at least some) of their retirement wealth. Importantly, these results hold under a utility function specified with both CRRA and HARA preferences, and where pre-existing annuitization in the form of the public age pension is incorporated into the optimization.[31]

5. Discussion and Conclusions

The demand for life annuities in Australia has always been very small. Despite incentives in both the tax system and under the age pension means tests, life annuities accounted for only six per cent of new purchases of retirement income streams in the late 1990s. However, following the gradual dissipation of these incentives in the 2000s this market share has fallen further, reaching less than 0.2 per cent of new retirement income purchases by end 2007. This paper provides some insights into the diminishing market for life annuities in Australia, while also contributing to the quest to solve the annuity puzzle.

We evaluate the net benefits of annuitization in Australia. The costs of annuitization are derived from money's worth estimates, while the benefits are measured using a utility-based metric of a lifecycle consumer's valuation of longevity insurance. In an extension to previous utility-based estimates of the insurance value of annuities, we recognize the importance of a minimum consumption stream to retirees, and integrate a consumption floor

[31] However, these results must, of course, be qualified by the underlying assumptions, including the use of flat rates of interest and inflation, that non-annuitized wealth can only be invested in the risk free interest rate, and the failure to take account of the bequest motive. It is possible that the insurance value of annuitization is overestimated.

into the lifecycle consumer's utility function. As well, we take account of pre-existing annuitization by incorporating Australia's actual means-tested age pension into our insurance value estimates.

Our main findings are that:

- The total loadings on Australian life annuities have almost doubled over the last six years and are significantly higher than the loadings reported for life annuities sold in other countries. Total loadings are estimated in the range of 23 per cent to 35 per cent of the purchase price of the annuity for a 65 year old male and 22 per cent to 33 per cent for a 65 year old female in the general population.

- The increase in the total loadings on Australian life annuities since the previous estimates for the year 2000 (Doyle *et al* 2004) are due to higher administrative costs, operating costs and profit margins, rather than costs associated with adverse selection. Prevailing low interest rates and the reduction in competition between annuity providers can be seen as the main reasons behind the increase in loadings on annuities.

- The utility-based estimates of the insurance value of annuitization indicate that a 65 year old male would accept a reduction of between 23 per cent and 52 per cent in his initial retirement wealth in order to receive protection against longevity risk, while a female would accept of reduction of between 18 per cent and 45 per cent in her initial retirement wealth.

- For a wide range of scenarios for 65 year old males and females with differing amounts of initial retirement wealth, levels of risk aversion and assumed consumption floors, the estimates of the value of longevity insurance provided by annuitization are high enough to compensate for the estimated loadings on life annuities.

Therefore, although the loadings on Australian annuities have increased significantly and are high compared to international experience, our estimates suggest that they are not high enough to offset the estimated benefits of annuitization. These results also hold following the withdrawal of the tax-transfer incentives to purchase life annuities from 2007.

However, our finding that the benefits of longevity insurance provided by life annuities more than offsets the costs of annuitization, even when account is taken of pre existing annuitization (in the form of Australia's means tested age pension) adds to, rather than solves the annuity puzzle. What is even more puzzling is the failure of Australian policymakers to ensure that Australian retirees are insured against late life retirement income inadequacy.

The analysis in this paper suggests that we need to seek alternative explanations for the miniscule demand for life annuities in Australia. Some blame for the disappearing life annuity market could be attributed to the supply-side – that is, the insurance companies themselves – who appear to be reluctant participants in the market. However, with the long standing preference for non-annuitized retirement benefits, and the focus of policymakers, superannuation funds, financial planners and the media on the size of the retirement accumulation, rather than the consequent consumption stream, the answers may lie in the realms of behavioural finance.

Table 1: Account-based pensions - minimum drawdown by age

Age	Per cent of account balance
under age 65	4
65-74	5
75-79	6
80-84	7
85-89	9
90-94	11
95 and over	14

Source: Superannuation Industry (Supervision) Amendment Regulations 2007 (No.1), Schedule 3.

Table 2: Annuity purchases in Australia

	Number of annuities		Value of annuities $m		Average annuity purchase price $	
Year	**Life**	**Term**	**Life**	**Term**	**Life**	**Term**
2001	1,927	11,072	166	794	86,144.27	71,712.43
2002	1,750	15,004	154	1,096	88,000.00	73,047.19
2003	1,477	18,606	200	1,357	135,409.60	72,933.46
2004	2,801	37,296	281	2,758	100,321.30	73,948.95
2005	293	7,233	27	548	92,150.17	75,763.86
2006	341	6,565	29	530	85,043.99	80,731.15
2007	374	7,327	36	787	96,256.68	107,410.90

Source: Plan for Life Research, The Pension and Annuity Market Research Report, Quarterly 1999-2007.

Table 3: Annuity quotes in dollars for a $A100, 000 purchase price at end 2006

	Annuity Types					
Company	**Nominal**	**Nominal (10yr guarantee)**	**5% esc**	**5% esc (10yr guarantee)**	**CPI Index**	**CPI Index (10yr guarantee)**
Males						
AMP	6,891	6,679	3,610	3,530	4,518	4,397
AXA	6,639	6,397	3,678	3,573	4,728	4,577
Colonial	7,885	7,632	4,616	4,498	5,057	4,916
MLC	7,301	7,029	4,134	4,015	na	na
Monthly Average	598.25	577.85	334.13	325.33	397.31	385.83
Females						
AMP	6,388	6,286	3,259	3,223	4,126	4,069
AXA	5,932	5,814	3,166	3,119	4,025	3,957
Colonial	7,243	7,123	4,072	4,020	4,519	4,455
MLC	6,662	6,534	3,599	3,548	na	na
Monthly Average	546.35	536.60	293.67	289.79	351.94	346.69
Last Survivor						
AMP	6,622	6,452	3,360	2,624	4,283	4,190
AXA	5,112	5,080	2,428	2,418	3,190	3,174
Colonial	6,270	6,266	3,160	3,158	3,589	3,587
MLC	5,868	5,828	2,872	2,859	na	na
Monthly Average	497.33	492.21	246.25	230.40	307.28	304.19

Source: Retirement Income League Tables - Quarterly Statistics, ending December 2006 (DEXX&R, 2006)

Table 4: Money's worth ratio estimates for Australian annuities in 2006 – per dollar of premium

Mortality Table	Nominal	Nominal (10yr guarantee)	5% esc	5% esc (10yr guarantee)	CPI Index	CPI Index (10yr guarantee)
	Annuity Types					
Males						
Population	0.76	0.77	0.66	0.67	0.65	0.67
Annuitant table (SS)	0.81	0.81	0.73	0.74	0.71	0.72
Annuitant table (IS)	0.79	0.80	0.71	0.72	0.70	0.70
Females						
Population	0.78	0.78	0.69	0.70	0.67	0.68
Annuitant table (SS)	0.80	0.80	0.74	0.74	0.71	0.71
Annuitant table (IS)	0.79	0.79	0.71	0.72	0.69	0.70
Last Survivor						
Population	0.78	0.78	0.69	0.65	0.68	0.68
Annuitant table (SS)	0.81	0.81	0.74	0.69	0.71	0.71
Annuitant table (IS)	0.80	0.80	0.72	0.68	0.70	0.70

Notes: The table shows the expected present discounted value of the annuity payouts per dollar of annuity premium for Australians aged 65 in 2006. Last survivor annuities are assumed to be jointly owned by a 65 year old male and a 60 year old female, with 85 per cent reversion to the survivor.

Table 5: Money's worth ratios – recent Australian and international experience

Author	Country	Year	Annuity type	MWR General population	MWR Annuitant population
Thorburn, Rocha and Morales (2007) [(a)]	Chile	2005	Indexed annuity		
			Single male, 65		1.067
			Single female, 60		1.083
			Joint life – male 65 and female 60		1.069
Doyle, Mitchell and Piggott (2004)	Australia	2000	Nominal annuity, 10 year guarantee		
			Male, 65	0.879	0.939
			Female, 65	0.903	0.938
	Singapore	2000	Nominal annuity		
			Male, 55	0.945	0.947
			Female, 55	0.945	0.964
Mitchell, Poterba, Warshawsky and Brown (1999)	USA	1995	Nominal annuity		
			Male, 65	0.814	0.927
			Female, 65	0.854	0.927
			Joint and survivor, 65	0.868	0.929
Finklestein and Poterba (2002)	UK	1998	Nominal annuity		
			Male	0.87	0.99
			Female	0.85	0.94
Cannon and Tonks (2004)	UK	1972-2002	Nominal annuity, 5 year guarantee		
			Male, 55	0.956	0.985
Butler and Ruesch (2007)	Switzerland	2005	Nominal annuity		
			Male (single), 65	0.891	
			Female, 65	1.039	
			Male (married), 65	1.055	

Notes: (a) Discounted at the risk free rate and the RV-04 mortality table for the annuitant population. These are higher than the MWRs estimated in James *et al* (2006).

Table 6: Total loadings on Australian annuities in 2006 –per dollar of premium

	Annuity Types					
Mortality Table	**Nominal**	**Nominal (10yr guarantee)**	**5% esc**	**5% esc (10yr guarantee)**	**CPI Index**	**CPI Index (10yr guarantee)**
Males						
Population	0.24	0.23	0.34	0.33	0.35	0.33
Annuitant table (SS)	0.19	0.19	0.27	0.26	0.29	0.28
Annuitant table (IS)	0.21	0.20	0.29	0.28	0.30	0.30
Females						
Population	0.22	0.22	0.31	0.30	0.33	0.32
Annuitant table (SS)	0.20	0.20	0.26	0.26	0.29	0.29
Annuitant table (IS)	0.21	0.21	0.29	0.28	0.31	0.30
Last Survivor[#]						
Population	0.22	0.22	0.31	0.35	0.32	0.32
Annuitant table (SS)	0.19	0.19	0.26	0.31	0.29	0.29
Annuitant table (IS)	0.20	0.20	0.28	0.32	0.30	0.30

Notes: The table shows the total loading per dollar of annuity premium for Australians aged 65 in 2006. Last survivor annuities are assumed to be jointly owned by a 65 year old male and a 60 year old female, with 85 per cent reversion to the survivor.

Table 7: The cost of adverse selection for Australian annuities in 2006 – cents per dollar of premium

	Annuity Types					
Mortality Table	Nominal	Nominal (10yr guarantee)	5% esc	5% esc (10yr guarantee)	CPI Index	CPI Index (10yr guarantee)
Males						
Annuitant table (SS)	0.049	0.040	0.073	0.065	0.059	0.051
Annuitant table (IS)	0.037	0.029	0.051	0.045	0.043	0.036
Females						
Annuitant table (SS)	0.027	0.022	0.042	0.039	0.033	0.030
Annuitant table (IS)	0.016	0.012	0.022	0.019	0.018	0.015
Last Survivor[#]						
Annuitant table (SS)	0.026	0.024	0.046	0.041	0.035	0.033
Annuitant table (IS)	0.018	0.016	0.027	0.024	0.022	0.020

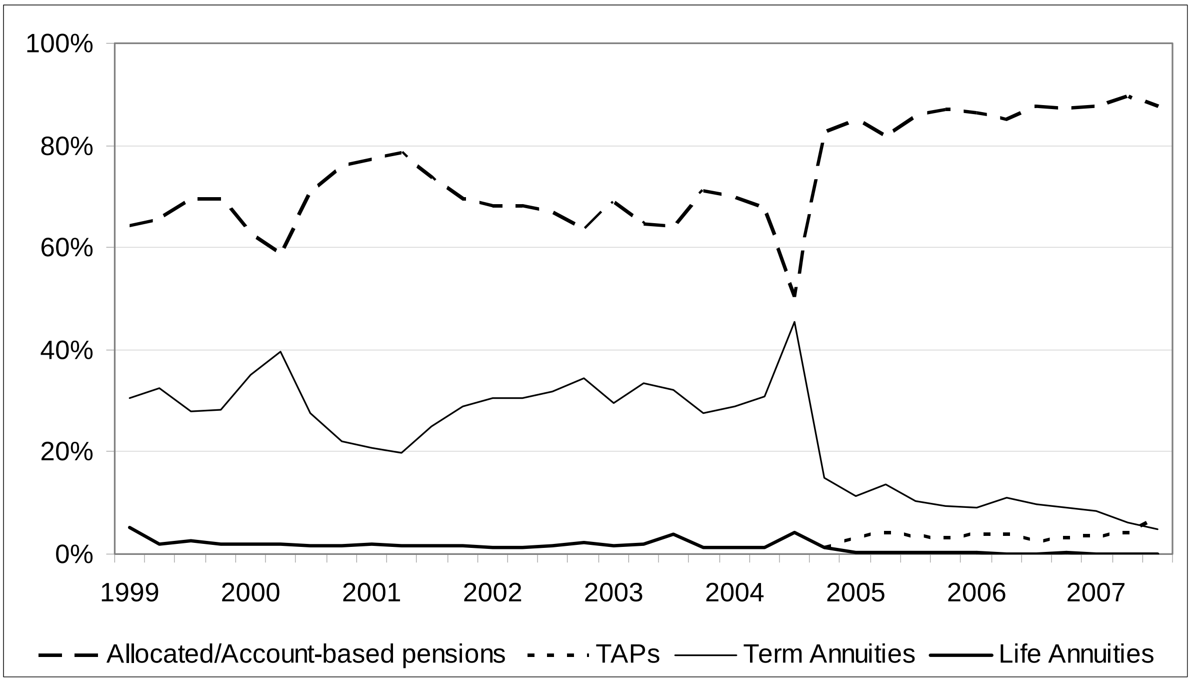
Notes: The table shows the cost of adverse selection per dollar of annuity premium for Australians aged 65 in 2006. Last survivor annuities are assumed to be jointly owned by a 65 year old male and a 60 year old female, with 85 per cent reversion to the survivor.

Table 8: Insurance value of annuities for a 65 year old in 2006.

	Age pension rules pre 2007 Life annuities 50% asset test exempt			**Age pension rules from 2007** Life annuities 100% asset test exempt		
Initial Wealth	β **= 0.6**	β **= 1**	β **= 2**	β **= 0.6**	β **= 1**	β **= 2**
Parameters ⇒ r = 2.6%, inflation = 3.1%, ρ = 1%, Mortality = General Population						
			Consumption Floor = 20,000			
Male (Total loading = 0.24)						
150,000	0.490	0509	0533	0.437	0.444	0.453
300,000	0.496	0.534	0.553	0.455	0.484	0.516
600,000	0.415	0.445	0.480	0.376	0.410	0.451
Female (Total loading = 0.22)						
150,000	0.394	0.405	0.417	0.336	0.339	0.343
300,000	0.465	0.488	0.519	0.405	0.429	0.452
600,000	0.388	0.402	0.429	0.324	0.353	0.385
			Consumption Floor = Age Pension (13,314.6)			
Male (Total loading = 0.24)						
150,000	0.328	0.367	0.439	0.399	0.338	0.392
300,000	0.396	0.449	0.512	0.350	0.404	0.472
600,000	0.365	0.408	0.460	0.322	0.370	0.428
Female (Total loading = 0.22)						
150,000	0.255	0.293	0.347	0.339	0.269	0.308
300,000	0.370	0.417	0.473	0.303	0.349	0.410
600,000	0.344	0.369	0.412	0.272	0.314	0.364
			Consumption Floor = 0 (CRRA Utility)			
Male (Total loading = 0.24)						
150,000	0.239	0.269	0.322	0.330	0.256	0.299
300,000	0.331	0.377	0.444	0.385	0.328	0.396
600,000	0.326	0.367	0.423	0.378	0.323	0.386
Female (Total loading = 0.22)						
150,000	0.190	0.210	0.248	0.181	0.199	0.231
300,000	0.305	0.347	0.407	0.341	0.377	0.335
600,000	0.297	0.331	0.378	0.229	0.268	0.323

Note: the wealth equivalence between annuitized and non-annuitized wealth (W_0/W_{NA}) is the reciprocal of the insurance value $\lambda = 1 - W_0/W_{NA}$.

Figure 1: New purchases of retirement income streams – market share (1999-2007)



Source: Plan for Life Research, The Pension and Annuity Market Research Report, Quarterly 1999-2007.

Figure 2: Estimated term structure of Australian interest rates

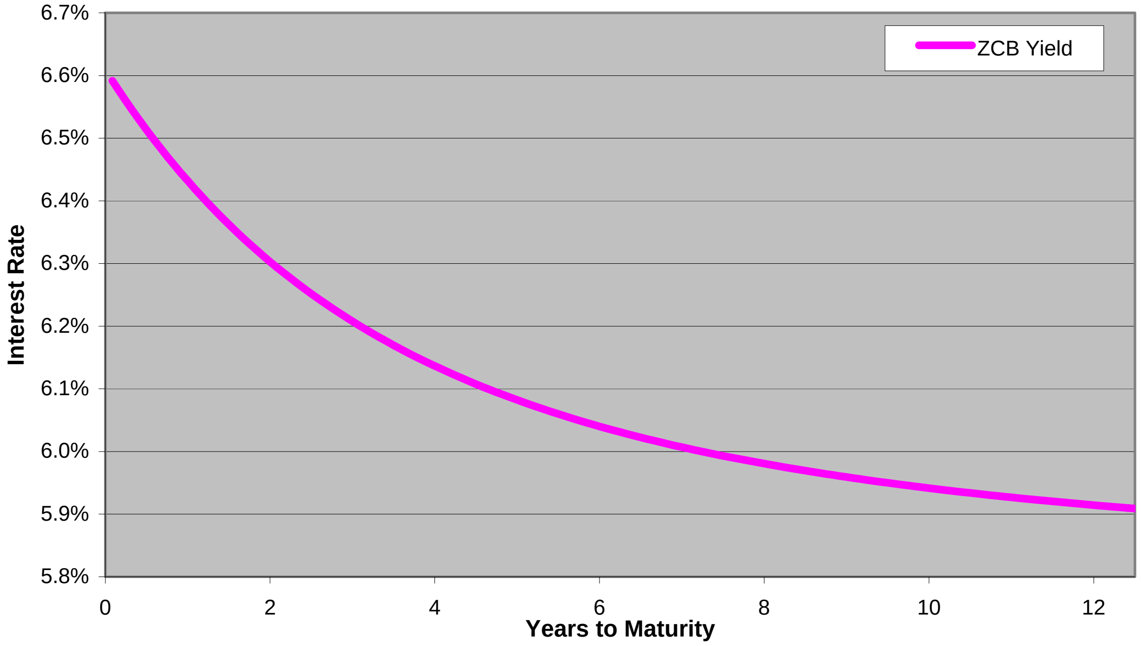
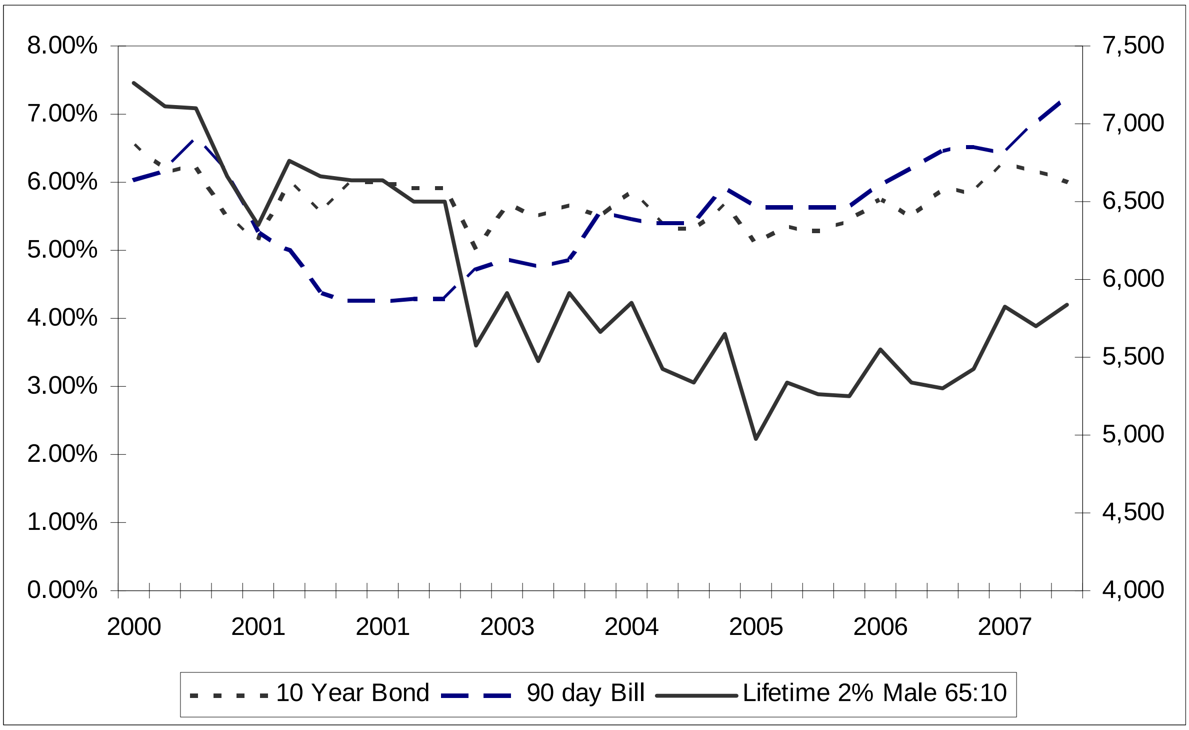


Figure 3: A comparison of Australian interest rates and annuity payments 2000-2007



Source: Plan for Life Research, The Pension and Annuity Market Research Report, Quarterly 1999-2007.

Notes: The annuity payment is for a life time annuity with a purchase price of $100,000 for a 65 year old male, with 2% escalation and a 10 year guarantee, purchased from AMP. The two interest rates are the 10 year bond rate and the 90 day bill rate.

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