Netspar

Network for Studies on Pensions, Aging and Retirement

Netspar PANEL PAPERS

Edmund Cannon and Ian Tonks

Annuity Markets: Welfare, Money's Worth and Policy Implications

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CONTENTS

PREFACE

Netspar stimulates debate and fundamental research in the field of pensions, aging and retirement. The aging of the population is front-page news, as many baby boomers are now moving into retirement. More generally, people live longer and in better health while at the same time families choose to have fewer children. Although the aging of the population often gets negative attention, with bleak pictures painted of the doubling of the ratio of the number of people aged 65 and older to the number of the working population during the next decades, it must, at the same time, be a boon to society that so many people are living longer and healthier lives. Can the falling number of working young afford to pay the pensions for a growing number of pensioners? Do people have to work a longer working week and postpone retirement? Or should the pensions be cut or the premiums paid by the working population be raised to afford social security for a growing group of pensioners? Should people be encouraged to take more responsibility for their own pension? What is the changing role of employers associations and trade unions in the organization of pensions? Can and are people prepared to undertake investment for their own pension, or are they happy to leave this to the pension funds? Who takes responsibility for the pension funds? How can a transparent and level playing field for pension funds and insurance companies be ensured? How should an acceptable trade-off be struck between social goals such as solidarity between young and old, or rich and poor, and individual freedom? But most important

of all: how can the benefits of living longer and healthier be harnessed for a happier and more prosperous society?

The Netspar Panel Papers aim to meet the demand for understanding the ever-expanding academic literature on the consequences of aging populations. They also aim to help give a better scientific underpinning of policy advice. They attempt to provide a survey of the latest and most relevant research, try to explain this in a non-technical manner and outline the implications for policy questions faced by Netspar's partners. Let there be no mistake. In many ways, formulating such a position paper is a tougher task than writing an academic paper or an op-ed piece. The authors have benefitted from the comments of the Editorial Board on various drafts and also from the discussions during the presentation of their paper at a Netspar Panel Meeting.

I hope the result helps reaching Netspar's aim to stimulate social innovation in addressing the challenges and opportunities raised by aging in an efficient and equitable manner and in an international setting.

Henk Don
Chairman of the Netspar Editorial Board

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ANNUITY MARKETS: WELFARE, MONEY'S WORTH AND POLICY IMPLICATIONS

Abstract

This panel paper explains the operation of annuity markets within the context of pension policy in countries around the world. The paper describes time-series properties of annuity rates in the UK and the Netherlands. Following an overview of money's worth calculations in global annuities markets, the paper concludes that the money's worth tends to be very high almost everywhere. Given the welfare benefits of annuitisation, the fact that annuity demand is typically low constitutes the "annuity puzzle". The paper proceeds to examine various reasons to explain this puzzle. An examination of various policy issues concerning annuities wraps up the study.

Executive Summary

A life annuity enables an individual to convert a stock of wealth (paid to an annuity provider in a single premium) into an income stream that is received with certainty until the end of life. The advantage of such an annuity is that it insures the annuitant against outliving their wealth in the event of living longer than expected. Annuities represent the decumulation phase of a defined contribution (DC) funded pension scheme, and form a large and growing part of pension systems around the world. There are three ways of accessing accumulated retirement funds by the newly retiring pensioner: a) as a lump sum, without any restriction on their usage; b) phased withdrawals, with limits on the amounts of the funds that the pensioner can access; and c) annuitisation, where the accumulated pension funds are converted into an income stream for life. Of these three retirement income choices, only an annuity provides longevity insurance.

Following Yaari (1965), this paper uses a stylised two-period model to demonstrate the welfare advantages of annuitisation. These welfare properties suggests that demand for voluntary annuities should be strong, since (conditional on the individual remaining alive) an annuity provides a higher return than a standard savings product (because the annuity is an insurance product in which individuals who die early cross-subsidise those who survive – a phenomenon called *mortality drag*). This paper describes the operation of annuity markets within the context of

pension policy in countries around the world. We describe time-series properties of annuity rates for both the UK and Dutch compulsory purchase markets. The compulsory pension annuity market in the UK had total premiums of £11.5 billion in 2010. The following factors can be identified as determinants of annuity prices: the value of the promised annuity payment; interest rates at the time the annuity is purchased; information about the life expectancy of the annuitant, (including age at time of purchase, gender and health); the size of the premium paid for the annuity; the type of annuity purchased; and the mark-up paid to the life insurer to cover its costs and profits.

After calculating the money's worth of annuities in both the UK and the Netherlands, and providing an overview of money's worth calculations in global annuities markets, we conclude that the money's worth tends to be very high almost everywhere.

The paper proceeds to examine various policy issues concerning annuities. Given the welfare benefits of annuitisation, the fact that annuity demand is typically low constitutes the "annuity puzzle". Reasons for the annuity puzzle include the following: bequest motives, necessary expenditures in old-age (such as health costs and long-term care provision), the option value of deferral (since annuity rates may be lower than equity returns at early ages), optimal decumulation strategies, habit formation or other more exotic preferences. These explanations for the annuity puzzle suggest that it may be

appropriate for individuals to avoid annuitisation, and imply no need for any policy interventions. There are, however, two additional sets of factors that would have implications for policy. Additional reasons for annuity aversion may be behavioural factors, and forms of irrationality. Also, the existence of social welfare payments that may be claimed by individuals on low incomes might induce individuals to run down their retirement capital. These behavioural and moral hazard explanations would support a policy of compulsory annuitisation.

The paper considers a number of other policy issues related to annuities. The relatively small number of annuity providers raises concerns about abuse of market power, although the money's worth evidence does not suggest that monopoly pricing is a problem in this market. Annuity providers match the durations of their liabilities with suitable assets by investing annuity premiums in long-term bonds. The government's issuance of long-term government bonds can ensure that there are sufficient long-term government bonds available to minimise the risks of an asset-liability mismatch. The small number of providers also means that the cohort longevity risk is highly concentrated in a small number of firms, and there is a question whether these providers have the capacity to absorb the extra risk associated with increased annuity demand. If this limited number of firms were not able to bear the total longevity risk, then mechanisms would need to be found for this risk to be held elsewhere. Possible candidates include individual investors or

other financial institutions, which would hold mortality bonds (issued by reinsurers) in a diversified portfolio; the government and other bond issuers (by issuing longevity bonds); or the annuity holders themselves (by making the annuity payments conditional on cohort survival rates).

1. Pensions and Annuity Markets

There is a well-documented global trend away from unfunded pay-as-you-go and funded defined benefit (DB) pension schemes towards individual-based defined contribution (DC) schemes.[1] Examples of such schemes are the US's 401(k) pension plans, the UK's personal pensions and proposed National Employment Savings Trust (NEST), Germany's Reister plans, Australia's Superannuation system, and New Zealand's KiwiSaver scheme. Any DC scheme requires instruments to convert the accumulated capital into a retirement income stream. This is what an annuity accomplishes. A life annuity converts a stock of wealth at retirement into a flow of income that is payable to the beneficiary (called an annuitant) until death. An annuitant pays a premium to a life insurance company, which then undertakes to pay an agreed income to the annuitant, usually on a monthly basis. Because the life annuity is paid until the annuitant dies, it insures that person against longevity risk—insuring him or her, in other words, against running out of savings to support consumption expenditure in old age. As countries switch to individual-based DC schemes, it is likely that the global demand for annuity products will increase; investigating the operation

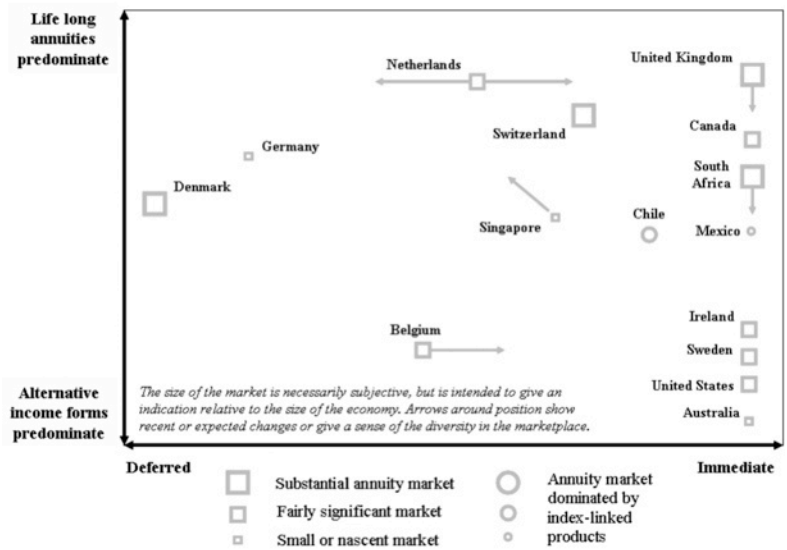
1 Table 1 in European Commission (2009) notes that some type of voluntary individual DC pension savings plan exists in almost all European countries, and a number of countries, such as Bulgaria, Estonia, Latvia, Lithuania, Hungary, Poland, Slovakia and Sweden, have switched part of their social security pension system into private funded schemes.

and effectiveness of existing annuity markets is thus important for pension policy.

Annuities are nearly always purchased as part of a pension scheme. In the standard life-cycle model, individuals make labour supply and consumption/savings decisions during the early part of their life to maximise permanent lifetime income. Individuals may choose to save in a tax-efficient pension scheme (the accumulation phase). From retirement onwards, individuals cease working and consume by running down their savings (the decumulation phase). There are three ways of accessing these retirement funds by the newly retiring pensioner: a) as a lump sum, whereby the accumulated funds are simply withdrawn by the pensioner, without any restriction on their usage; b) in phased withdrawals, where there are limits on the amounts of the funds that the pensioner can access; and c) through annuitisation, where the accumulated pension funds are converted into an income stream for all (life annuity) or part (temporary or term- or partial annuity) of the remainder of the pensioner's life. An important distinction between an annuity and a phased withdrawal is that the former provides insurance against exhausting one's wealth, whereas the latter offers no longevity insurance. In a DB group scheme, the annuitisation may take place implicitly within the pension fund; in a DC scheme, the annuitisation takes place explicitly through a contract with an annuity provider.

The provision of private annuities and the size of the annuity market in a particular country typically depend on the structure of retirement provision in that country. James and Vittas (1999) observed that developed countries with large state-pension provision (Germany, France, Japan, Italy) typically have small annuity markets, whereas countries in which the value of the state pension is small (US, UK, Chile, Switzerland, Singapore) have more developed annuity markets, in which compulsion plays an important role (UK). On the other hand, developing and under-developed countries with low state-pension provision (India, China) also have poorly developed annuity markets. Rusconi (2008) described three categories of annuity markets: 1) Immediate annuity markets (purchased at retirement), converting a lump sum into a lifetime income (in the UK, the US, Canada, Chile and South Africa; 2) Guaranteed deferred-annuity markets typically purchased during the working years, with a relatively low guaranteed return throughout the accumulation and payout phase but with bonuses added as investment returns emerge (in Denmark, Belgium, Germany and the Netherlands); and 3) Small annuity markets (in Hungary and Mexico), and those with unusual characteristics (in Switzerland and Singapore), for example. Figure 1 characterises international annuity markets along three dimensions: the size of the market; the range of immediate versus deferred annuity products; and the type of income provided.

Figure 1. Schematic representation of selected annuity markets



This figure characterises international annuity markets in three dimensions: the size of the annuity markets; the range of immediate versus deferred annuity products; and the type of income provided.
Source: Rusconi (2008)

Most developed countries have adopted a public policy towards pensions, typically taking the form of some compulsory savings or taxation, subsidies, and the provision of state retirement income payable until death. World Bank (1994) provided a classification of three tiers or pillars of pension provision in operation: The first tier is classified as a mandatory state scheme, which is normally unfunded and pays a flat-rate subsistence pension. The second tier is mandatory, and is related

Table 1: Private pension funding in selected countries 2001–2009

	Total investments of pension funds			
	In percent of GDP			US$ billion
OECD Countries	2001	2005	2009	2009
Australia	75.2	80.4	82.3	835.9
Canada	52.5	58.2	62.9	806.3
France	n/a	1.2	0.8	21.9
Germany	3.4	4.0	5.20	173.8
Japan	14.2	6.6	n/a	302.0**
Netherlands	102.6	121.7	129.82	302.0
Switzerland	102.5	117.0	101.15	497.0*
UK	72.0	78.6	64.30	1,698.8*
US	71.5	74.8	67.70	9,603.6

* denotes 2008 data; ** denotes 2005 data
Source: OECD Pension Statistics

to earnings over the employee's life. The third tier represents all forms of voluntary private pension provision, of which there are two basic types: group (including occupational) schemes and individual pension schemes. These third-tier schemes are usually funded.

Comparing funded pension schemes across countries, we find that only a few countries actually have sizeable funded pension schemes. Table 1 shows the stock of pension assets for major developed countries in 2009. The US, the UK and the Netherlands have large amounts of pension fund assets relative to GDP in their economies, reflecting the importance of funded schemes in

these countries.[2] In contrast, major economies such as Japan, France and Germany have a relatively small percentage of pension fund assets, reflecting the fact that pension schemes in these economies are predominantly unfunded pay-as-you-go systems. Figures 2 and 3 show the rankings of OECD and non-OECD countries by the size of pension fund assets relative to GDP. The Netherlands, Iceland, Switzerland, and the US stand out amongst the OECD countries as having very high ratios (and importance) of pension assets to GDP. For non-OECD countries, South Africa, Hong Kong and Jamaica have relatively large amounts of pension fund assets.

Any country that switches all or part of its pension system to a funded private pension provision will ultimately need to decide on the methods that will be used to convert the capital that has been accumulated in the pension funds into retirement income streams. That country's pension policy will need to identify which of the three retirement income streams (lump-sum, phased withdrawal, or annuitisation)—or combination of these policies—it intends to adopt.

Where annuities are purchased voluntarily, the annuity market tends to be small (Brown, et al., 2001). Not surprisingly, when

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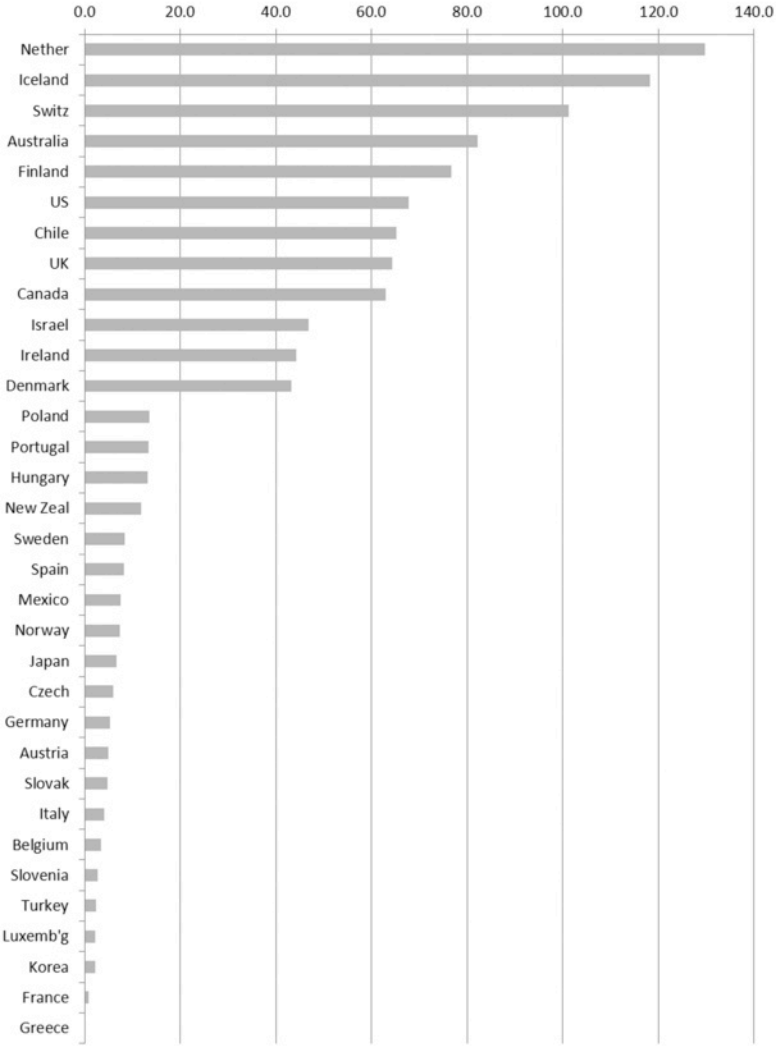
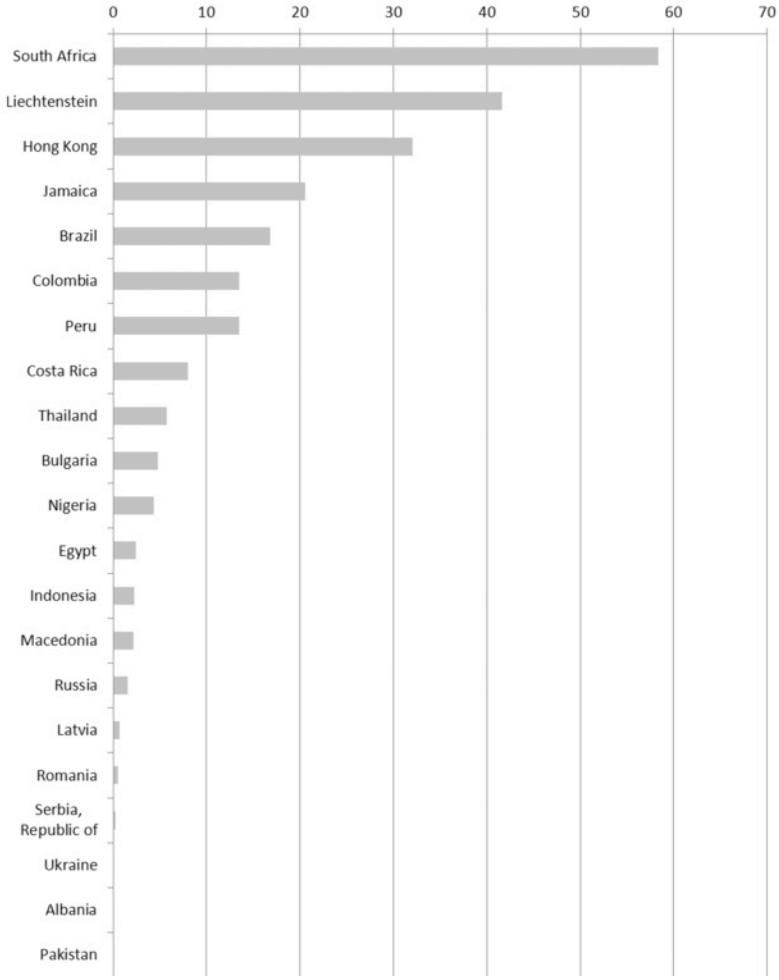
2 Palacios and Pallares-Miralles (2000) identified these countries, and Australia, South Africa, Switzerland and Iceland, as being countries with significant private pension fund assets. A combination of generous tax allowances on pension contributions (Dilnot and Johnson, 1993) and a liberal regulatory regime for pension investments (Davis, 1995) probably explains the dominance of funded pensions in these countries.

Figure 2: Pension fund assets in selected OECD countries, 2008/9 (percent of GDP)



Source: OECD Pension Statistics

Figure 3: Pension fund assets in selected non-OECD countries, 2008/9 (percent of GDP)



Source: OECD Pension Statistics

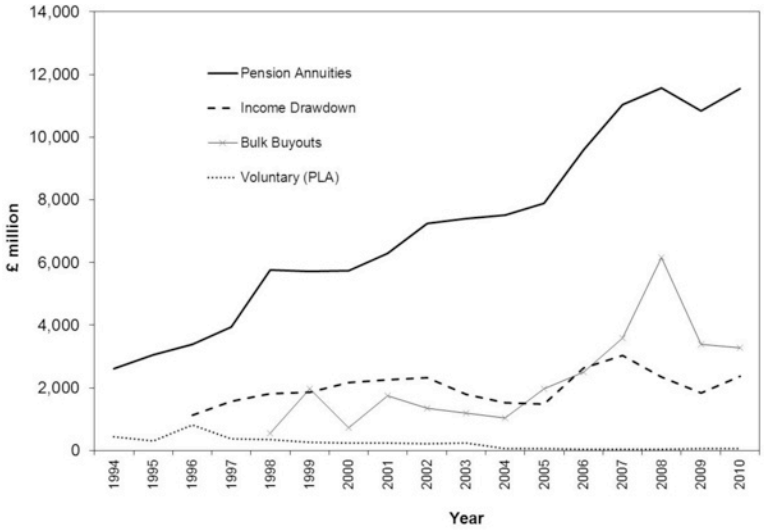
annuity purchase is compulsory the size of the market is much larger. Figure 4 shows the pattern in sales of retirement income products in the UK, which has the largest annuities market in the world. The UK annuities market is so large (£11.5 billion in 2010[3]) because it is compulsory to use a portion of pension wealth to purchase an annuity at or shortly after the point of retirement. Compulsory-purchase annuities are those purchased by individuals who have saved in a personal pension fund that has received tax privileges: contributions to the scheme are made before deduction of income tax, and all investment returns are also tax-free. UK regulations effectively require anyone who has saved in a tax-privileged private pension to annuitise 75 percent of their pension wealth at retirement.[4] Typically, the pension fund is managed by a life insurance company during the accumulation phase: the value of the fund at retirement is then used by the pensioner to buy an annuity—either from the life insurer with whom they accumulated the fund or from another life insurer (the open market option).

The UK's compulsory purchase rule still offers considerable flexibility to the annuitant. First, the definition of an annuity includes products where some of the wealth is not in annuity

3 Source: Association of British Insurers.

4 The UK government is proposing to relax the compulsory annuitisation requirement from April 2011 for persons who can demonstrate that they have pension income above the MIR (Minimum Income Requirement) set at £20,000 per annum. The number of people with pension income above the MIR is small, and is unlikely to have a large effect on the size of CPA market.

Figure 4: Growth in UK Annuity Sales 1994–2010



Source: Association of British Insurers

form. A 'guaranteed' annuity of five or ten years is one in which the initial payments are paid, regardless of whether or not the annuitant is alive (if the annuitant dies, then the payments are made to the heirs). Secondly, it is not necessary to annuitise, since persons can access pension wealth through phased withdrawal (referred to as 'capped-' or 'flexible' drawdown). The maximum amount of pension wealth that can be taken as income through capped drawdown is 100 percent of the best single-life annuity payment for the relevant age and sex. If Individuals who are able to demonstrate that they have pension income above the MIR of £20,000 per annum can access the

Table 2: Scenarios for the size of the UK annuity market, (estimated annual flows: £ billion)

	2002	2012		
		Low	Medium	High
Individual annuities	7.2	16.6	18.1	19.7
Drawdown	2.3	5.3	5.8	6.3
Bulk buyout	1.4	1.5	35.4	128.1

Source: Pension Commission (2005, Figure 5.16)

remainder of their accumulated pension wealth through flexible drawdown.

Figure 4 shows the growth in UK annuities and drawdown products over the period 1994–2010. By 2010, the compulsory (CPA) market had grown to £11.5 billion worth of annuity premiums. In contrast, the voluntary (PLA) market only amounted to £72 million worth of sales, and the diagram shows that the PLA market has shrunk as the CPA market has grown, probably reflecting some substitution between compulsory and voluntary annuities. The bulk annuity market has been volatile, with a peak in 2008, representing transfers from DB schemes to bulk buyouts. Drawdown continues to represent a significant alternative to annuitisation. The Pensions Commission (2005, 2006) noted the trend for pensions in the UK to be provided through DC schemes, and as a consequence that there will be an increased demand for life annuities. Watson-Wyatt (2003) and Wadsworth (2005) examined a number of scenarios for the growth of annuity demand over the ten-year period 2002–2012,

reproduced in Table 2. According to the Pension Commission's Second Report, and reiterated in HM Treasury (2006), the main driver in these estimates is the maturity of individual and company DC schemes. Table 2 suggests that the demand for annuities could increase from about £7 billion in 2002 to between £16–£20 billion by 2012. But these numbers could increase dramatically if existing DB schemes are closed and replaced by bulk buyouts of annuities. The bulk annuity market is where an annuity provider acquires a package of individual pension liabilities, typically from the closure of a DB occupational scheme. Depending on the extent of this switch, the demand for annuities in the UK could increase by up to £128 billion. The Pensions Commission (2005) estimated that if the proposed national pension savings scheme (NEST) successfully targets that group of the population who currently are not provided for, this will represent (in the steady state) an additional annual demand for annuities of £13 billion by the year 2040 at current earnings levels. All of this evidence suggests that the demand for annuities in the UK will continue to rise substantially in the coming years. The Pensions Commission noted that any capacity problems in the annuities market could be eased by allowing a relaxation of income drawdown rules, or by facilitating later retirement.

2. Welfare Properties of Annuity Markets

In order to illustrate the welfare properties of annuity markets (Yaari, 1965), this paper illustrates the benefits of annuitisation following Kotlikoff and Spivak (1981) by considering the consumption problem faced by a retired individual in a two-period model with and without annuity markets.

2.1 Retirement consumption problem without annuity markets

Consider the consumption problem of an individual i who has just retired with pensions wealth W_0 and who must allocate this wealth over the two remaining periods of his life (c_0, c_1). There is uncertainty, however, over whether the individual will be alive in the second period. In the absence of an annuities market, individual i maximises expected utility (1) subject to a budget constraint (2)

$$\max \frac{c_0^{1-\gamma}}{1-\gamma} + \delta p_1 \frac{c_1^{1-\gamma}}{1-\gamma} \quad , \quad (1)$$

subject to

$$c_1 = (W_0 - c_0)(1+r) \quad , \quad (2)$$

where p_1 is the probability of surviving into the second period (p_0=1); δ is the rate of time preference, and r is the rate of return on savings. The budget constraint is identical to a certain world case, and says that initial wealth must be no less than the present value of consumption over the consumer's lifetime. In

the special case where r = 0 and $\delta = 1$, without annuities, the consumption solution simplifies to

$$c_0 = \frac{W_0}{1 + p_1^{1/\gamma}} \text{ and } c_1 = \frac{W_0 p_1^{1/\gamma}}{1 + p_1^{1/\gamma}}.$$

Thus, if $p_1 = 0$ (there is no probability of living until next year), then $c_0 = W_0$ and $c_1 = 0$; and the consumer spends all of his wealth in the first period. On the other hand, if $p_1 = 1$ (certainty of living until next year), then $c_0 = c_1 = W_0/2$ – and since there is no discounting, the consumer splits consumption equally between the two periods. For intermediate values of p_1, the individual will tilt consumption between today and tomorrow, depending on the probability of survival and his degree of risk aversion. For example, if $p_1 = 0.5$; and $\gamma = 1$, then $c_0 = 2W_0/3$ and $c_1 = W_0/3$. So the individual with a 50:50 chance of living to the second period will consume more in the first period, and less in the second. This, however, is inefficient—for two reasons: first, consumption is not the same in each period for those individuals that survive; second, consumption in the second period is left unconsumed for those individuals that die.

2.2 Retirement consumption problem with annuity markets

Now suppose that an annuities market with fairly priced annuities exists. An annuity contract is offered by an insurance company to an individual such that in return for a payment ($W_0 - c_0^A$) in the first period (called the annuity premium (or

annuity price)) the insurance company will pay out an income y_1 in the second period—if the individual survives, but will pay out nothing if the individual dies. This contract is fairly priced if the insurance company breaks even, so that the price of the annuity contract equals the expected annuity payment $(W_0 - c_0^A) = p_1 y_1/(1+r)$. Then the budget constraint facing the individual becomes

$$c_0^A + \frac{p_1 c_1^A}{(1+r)} = W_0 = y_0 + \frac{p_1 y_1}{(1+r)}$$

and the individual uses the promised annuity payment to fund second-period consumption,

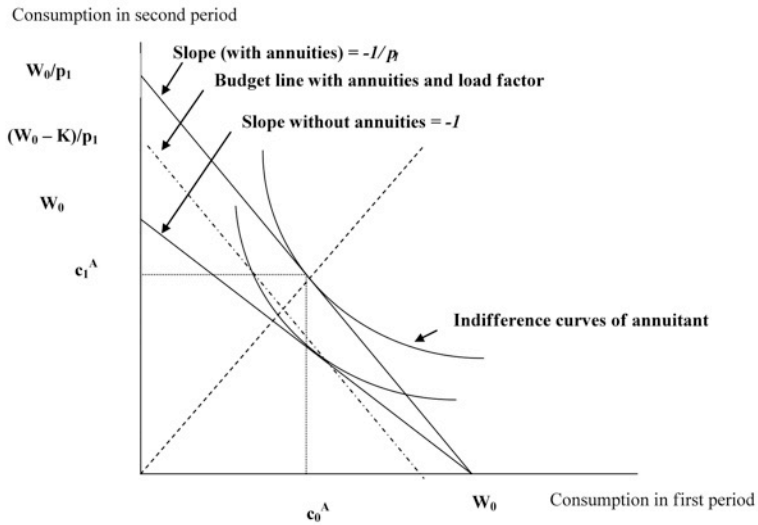
$$p_1 c_1^A = (W_0 - c_0^A)(1+r) \quad (3)$$

So the budget constraint changes according to the equality of wealth and the expected value of consumption: the individual exchanges wealth for a promise from the insurance company to pay out an income stream y_t as long as the annuitant lives. The term $p_t/(1+r)^t$ can be thought of as a price; since

$$\frac{p_t}{(1+r)} < \frac{1}{(1+r)}$$

and the existence of an annuity market is equivalent to, no-annuity market but with lower prices of future consumption. So access to the annuity market increases utility by expanding the budget frontier. With fairly priced annuities, the solution to the consumers' maximisation problem, again for the special case where $r = 0$ and $\delta = 1$, becomes

Figure 5: Impact of an Annuities Market on a Consumer's Budget Constraint



$$c_0^A = \frac{W_0}{1+p_1} \text{ and } c_1^A = \frac{W_0}{1+p_1}$$

Optimal consumption in each period, with and without annuities, is illustrated in Figure 5, and we can make a number of observations from this diagram:

- With annuities, $c_0^A = c_1^A = W_0/(1+p_1)$, and consumption is exactly the same in each period: pure consumption smoothing.
- Annuities do not make any difference to consumption when the consumer knows for certain that they will live into the next period.

- We suggested above that if $p_1 = 0.5$; and $\gamma = 1$, then $c_0 = 2W_0/3$ and $c_1 = W_0/3$. When annuities are available, the comparable consumption profile is $c_0^A = c_1^A = 2W_0/3$. This case clearly illustrates that consumers are better off with access to annuities markets.
- Even if an individual has a very low probability of surviving, he is still better off annuitising his wealth: with the implication that all individuals should annuitise.

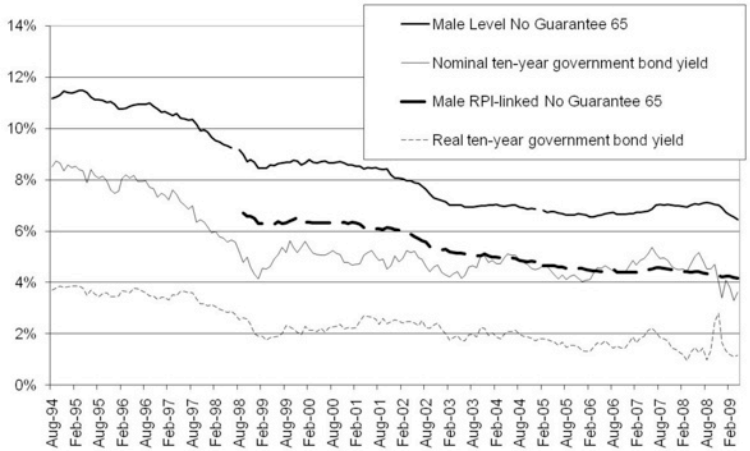
3. Time Series Properties of Annuity Rates

This section provides some descriptive statistics on rates in the annuity markets of both the UK and the Netherlands. Annuity prices are usually quoted in the form of an annual annuity payment of £X per £10,000 purchased, which will be referred to here as an annuity rate of X/100 percent. In the UK, legislation allowing for individual tax-efficient pension accounts was passed in 1956, but the market for compulsory annuities was initially small since it takes time for pension funds to accumulate sufficient demand. *Money Facts* provide data on the CPA market from 1994 onwards. Between 20 and 25 companies were quoting at the beginning of the period: by the end, only nine were quoting. Figure 6 illustrates the evolution of the simple average annuity rate for nominal and real annuities. The FSA returns reveal that 62 companies were selling compulsory annuities in 2005.[5] The five-firm concentration ratio is 72 percent, and the largest firm, the Prudential, supplied over 23 percent of new business. The annuity rates in the *Money Facts* database represent all of the major providers.

Figure 6 also provides a comparison of annuity rates in the compulsory market with long-term interest rates. It compares the nominal annuity rate for 65-year-old males with the United Kingdom government ten-year bond yield. It can be seen that

5 Insurance companies in the UK are regulated by the Financial Services Authority (FSA) and are required to submit to the regulator annual returns, which are publically available.

Figure 6: UK Annuity rates and UK bond yields in the compulsory market (male aged 65)



Source: Authors' calculations (annuity data from Money Facts; interest rates from Bank of England)

the two series clearly move very closely together, although the annuity rate is slightly smoother. The figure also plots the inflation-adjusted annuity rate in the real annuity market and the corresponding real government bond yield. Descriptive statistics on annuity rates in the compulsory market for males and females aged 65 are presented in Panels A and B of Table 3.

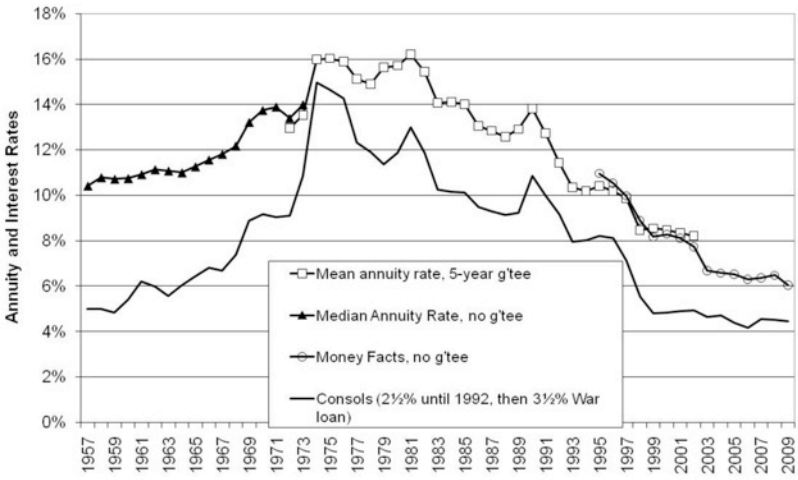
The UK also has a voluntary annuities (purchased life) market, which is small but interesting because it has existed for a much longer time period, allowing us to identify the long-run effect of mortality improvement on annuity rates. Cannon and Tonks (2004b) collected data for 1957-2002 from a variety of sources:

Table 3: Time-Series Properties of UK and Netherlands Annuity Rates and Bond Yields

Annuity rates							Government Bond yields			
	Male 65 mean	Male 65 stdev	Female 65 mean	Female 65 stdev	corr between Male and Female	diff between Male and Female	mean	stdev	corr with Males 65	Diff from Male 65
Panel A: UK Compulsory Market - Nominal										
1994-2009	8.33%	1.60%	7.51%	1.32%	99.79%	0.83%	5.43%	1.35%	92.00%	2.90%
2002-2009	6.96%	0.34%	6.41%	0.29%	98.00%	0.55%	4.58%	0.39%	49.08%	2.38%
Panel B: UK Compulsory Market – Real (indexed to UK's RPI)										
2002-2009	4.76%	0.44%	4.22%	0.38%	99.30%	0.53%	1.78%	0.39%	69.67%	2.97%
Panel C: UK Voluntary Market - Nominal										
1957-2009	11.57%	2.98%					8.37%	3.22%	91.74%	3.20%
1972-1993	14.09%	1.68%	12.97%	1.65%	99.80%	1.12%	11.54%	2.10%	92.09%	2.56%
1994-2009	8.04%	1.76%	7.29%	1.41%	99.56%	0.75%	5.57%	1.46%	94.96%	2.47%
Panel D: Netherlands Compulsory Market - Nominal										
2001-2009	8.31%	0.48%					4.22%	0.53%	90.24%	4.09%

Source: Authors' calculations from data supplied by MoneyFacts (UK) and MoneyView (Netherlands).

Figure 7: UK Annuity rates and UK bond yields in the voluntary market



Source: Cannon and Tonks (2004b) and authors' calculations (annuity data from Money Facts; interest rates from Bank of England)

using data from Money Facts we up-dated the series here to 2009. During the 1950s and '60s it was common for about 70 companies to be quoting in the voluntary market, but by 2009 this had declined to just four firms. Figure 7 plots the time series for the simple average of all annuity rates of 65-year-old males, together with the interest rate payable on consols (government perpetuities). Long-term interest rates are very similar at the end of the period to the beginning, but annuity rates are much lower: this narrowing of the gap illustrates the impact of increased life expectancy. Descriptive statistics on annuity rates

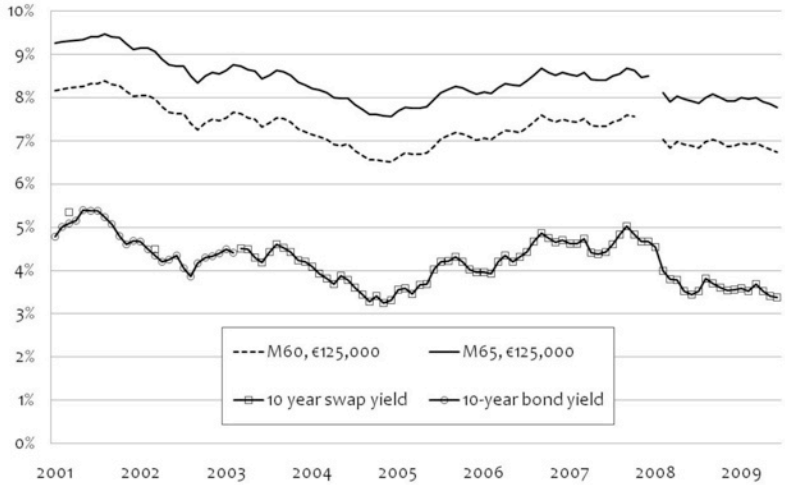
in the UK's voluntary market for males and females aged 65 appear in Panel C of Table 3.

Dutch annuity data were provided by Money View, which is an organisation collecting annuity rates for price comparisons, (see http://www.moneyview.nl/). The Dutch annuity market is a compulsory purchase market.[6] Data were provided fortnightly between 2001–2009 for annuities for males only aged 60 and 65 for purchase prices of €50,000 and €125,000. Before 2002, the annuity rates were for purchase prices denominated in Dutch Guilders, with purchase prices of *f*100,000 and *f*250,000. Since the exchange rate was 2.20371, this corresponds to purchase prices in 2001 of €45,378 and €113,445. Many companies quoted two prices: an internal price for annuitants who had also saved their pension fund with the company (called "maatschappij") and another external price for annuitants who transferred their pension fund from another company (called "elders"). Annuity prices are reported for a total of 32 different named companies throughout the period—but because some of the companies merged or changed name, the total number of actual companies is only 28 (and one of these (Univé) only quoted for a short period).

We compare the annuity rate to the ten-year Dutch government bond yield, with data taken from Bloomberg. The

6 Brown and Nijman (2011) provide details of the compulsory market for annuities in the Netherlands.

Figure 8: Dutch annuity rates and interest rates in the compulsory market



Source: Authors' calculations (annuity data from Money view; interest rates from DNB and Bloomberg)

Bloomberg data are based on interest rate swaps, which provide a good indicator of the hypothetical yield on a pure discount bond. Unfortunately, these data are available for only two isolated observations in the first few years, so we supplement our data with yields based on ten-year coupon-bearing bonds: where a comparison is possible, the swap rate is a bit higher. We graph the data in Figure 8. The difference between the annuity rate for 65-year olds and the ten-year bond yield is fairly constant at 4.09 percentage points. Descriptive statistics on annuity rates in the Netherlands' compulsory annuity market for males aged 65 are presented in Panel D of Table 3.

4. Pricing Annuities: Measuring the Money's Worth

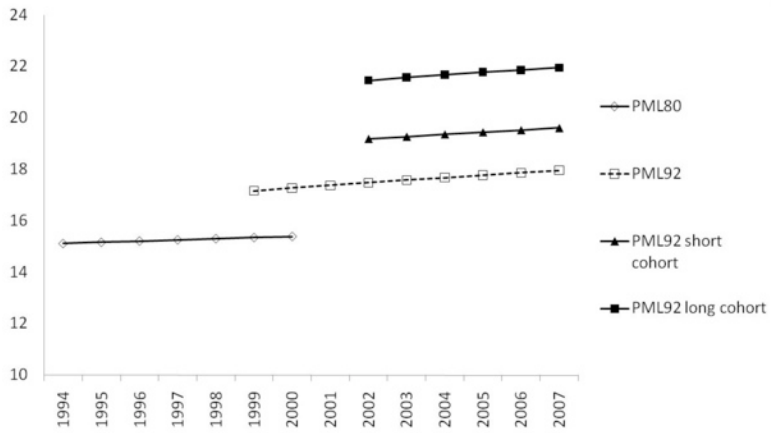
The conventional measure of assessing the value of an annuity is the money's worth, which is the ratio of the expected present value of the payments to the premium paid for it (Brown et al., 2001). Define the annuity rate A as the annual annuity payment to be received by an individual as part of the annuity contract agreed in year t. For a level annuity with no guarantee period, the expected value of these payments is

$$EPV_t = A_t \sum_{i=1}^{i=T} \pi_{t,t+i} (1 + R_{t,t+i})^{-i},$$

where $\pi_{t,t+i}$ is the probability of someone living i more periods, believed in period t. Notice that the survival probabilities depend upon the age, gender and type (compulsory or voluntary) of annuitant. T is chosen so that $\pi_{t,t+T} \approx 0$ and $R_{t.t+i}$ is the appropriate discount rate in period t for payments received in period $t+i$, expressed at an annual rate: typically this is the rate on government bonds.[7] To calculate EPV_t in year t it is necessary to estimate the yield curve for that year and the most up-to-date mortality table for the relevant annuitant type that was available. The choice of mortality table is usually the most problematic issue, since it involves projecting mortality

7 Finkelstein and Poterba (2004) used the return on corporate bonds instead of government bonds. From the data in Figure 7, the difference between yields on UK commercial bank bonds and ten-year government bonds averaged 0.44 percentage points over the period 1994-2009.

Figure 9: Changing Life Expectancy over Time in the UK



PML80 refers to Pensioner Male Lives from the 80 Tables, PML92 Pensioner Male Lives from the 92 Tables, Pensioner Male Lives from the 92 Tables with short and long cohort interim adjustments, and Personal Pensioner Males from the 00 Tables using a long cohort interim adjustment.
Source: Authors' calcuations based on data from the Institute of Actuaries.

improvements into the future. In the UK the *Institute of Actuaries* and in the Netherlands the *Actuarieel Genootschap* and *Actuarieel Instituut* collect data and produce projections of mortality tables; these data were used in our calculations.

These mortality tables are projections of future survival (or death) probabilities. The Continuous Mortality Investigation Committee (CMIC) of the UK's actuarial professional organisations publishes actuarial projected-life tables for each year, and these same tables are used internationally, with country-specific adjustments. The tables differ from life tables for the general population, and represent the life experience of individuals

purchasing the particular insurance contracts. Figure 9 illustrates the magnitude of the changes due to revisions to projected mortality. In 1994, the remaining life expectancy of a 65-year-old man was forecast to be just over 15 years using the PML80 Table; by 1999, using the PML92 Table, a 65-year-old's life expectancy was 17 years and two months; by 2002, it was 19 years using the short cohort adjustment, and 21 years using the long cohort adjustment. On a less regular basis, CMIC publishes a statistical analysis of the data and proposes new standard tables that include projections of future improvements in mortality. It has not proved practicable to produce projections based on causal models of death, and most projections consist of extrapolations in trends in existing data.[8]

4.1 Money's worth: International evidence

An international comparison of money's worth was first provided by James and Song (2001), who constructed consistent money's worth figures across a number of countries, and a summary of their results and other country-specific studies are presented in Table 4. The surprising aspect of this table is that although annuity payments differ widely across countries, and by gender, the money's worth numbers are very similar and very high. This

8 The Board of Actuarial Standards (2008) emphasised the fact that there is no consensus on the best type of model to use for projecting future changes in mortality. Pitacco et al., 2009 surveyed recent theoretical advances in projection methods based on time series econometrics and finance theory.

Table 4: Summary of International Evidence on Money's worth and Selection Effects in Annuity Markets

Panel A: 65-year-old males

Study	Data	Type of Annuity	Australia		Canada		Chile		Germany		Netherlands	Singapore*		Switzerland		UK		US	
			Pop.	Ann.	Pop.	Ann.	Pop.	Ann.	Pop.	Ann.	Pop	Pop.	Ann.	Pop.	Ann.	Pop.	Ann.	Pop.	Ann.
Butler & Ruesch (2007)	2000-05	Level												98.2					
		Joint												114.7					
Cannon-Tonks (2004)	1972-2002	Level + 5YG														95.6	98.5		
Cannon-Tonks (2011a)	1957-2009	PLA level															98.0		
	1994-2009	CPA level															89.2		
	1994-2009	CPA real															80.6		
Cannon-Tonks (2011b)	2002-10	CPA level									86.1						87.2		
Finkelstein-Poterba (2002)	1998	Level														86.5	98.8		
	1998	Escalating (5%)														80.4	97.2		
Fong (2002)	2000	Level										98.6	99.7						
James-Song (2001)	1999	Level	91.1	101.0	91.4	98.1								91.6	108.2	91.2	98.3	85.8	97.4
	1999	Real					86.5	96.7								81.7	89.4		
Knox (2000)	1999	Level	91.4	98.6															
	1999	Real	89.3	101.6															
Mitchell et al (1999)	1995	Level																81.4	92.7
	1995	Joint																86.8	92.9
Rocha & Thorburn (2006)	1999-2005	Level					106.7												
		Joint					103.2												
von Gaudecker and Weber (2004)	2002	Level							88.7	98.0									

Table 4 (continued): International Evidence on Money's worth and Selection Effects in Annuity Markets

Panel B: 65-year-old females

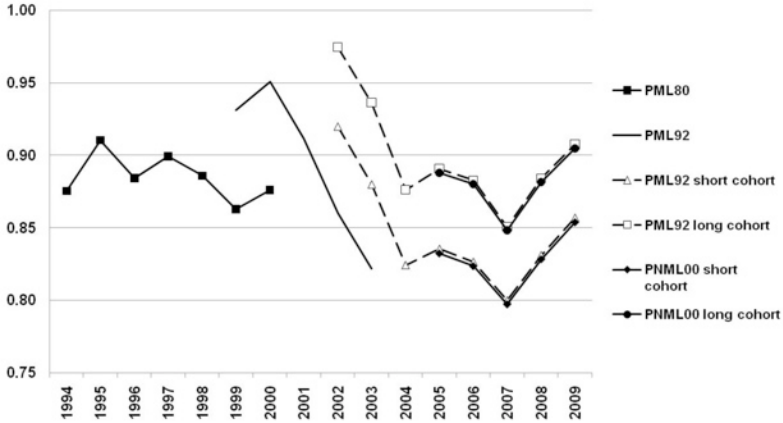
Study	Data	Type of Annuity	Australia		Canada		Chile		Germany		Netherlands	Singapore**		Switzerland		UK		US	
			Pop.	Ann.	Pop.	Ann.	Pop.	Ann.	Pop.	Ann.	Pop	Pop.	Ann.	Pop.	Ann.	Pop.	Ann.	Pop.	Ann.
Butler & Ruesch (2007)	2000-05	Level												114					
Cannon-Tonks (2011a)	1994-2009	CPA level															89.8		
Finkelstein-Poterba (2002)	1998	Level														85.3	93.9		
	1998	Escalating (5%)														79.3	91.1		
Fong (2002)	2000	Level										100.9	101.4						
James-Song (2001)	1999	Level	91.5	98.4	95.0	97.6								96.9	105.7	92.6	97.4	87.1	95.4
	1999	Real level					86.1	94.9								81.3	86.7		
Knox (2000)	1999	Level	91.4	97															
	1999	Real	88	97.9															
Mitchell et al (1999)	1995	After-tax Level																85.4	92.7
Rocha & Thorburn (2006)	1999-2005	Level					108.34												
von Gaudecker and Weber (2004)	2002								93.9	101.3									

The table summarises a series of studies that have examined the money's worth of different types of annuities in a number of countries, using population (Pop) and annuitant (Ann) life tables. * denotes 62 year old female; ** denotes 55 year old male and female. The annuitant life table is not always the life experience of the actual relevant annuitants, but is proxied for it in a number of ways. CPA denotes compulsory purchase annuities; and PLA denotes voluntary purchased life annuities.

suggests that any dispersion in annuity payments can be explained by differences in the appropriate discount rates, and differences in mortality assumptions. Money's worth values using annuitant mortality experience are typically around 97 percent in all categories (except for index-linked). Switzerland appears to have the highest value-for-money annuities, with money's worth above 100 percent. The one category that does feature a lower money's worth is indexed-linked annuities, and this might be explained by the difficulty of matching these promised payments with index-linked assets, since the supply of such assets is limited.

Warshawsky (1988) suggested that differences in the money's worth calculation from using population life tables and annuitant life tables is a measure of adverse selection in annuity markets. Individuals who expect to live for a long time are more likely to purchase annuities, and the annuity providers recognise these incentives, and price annuities to incorporate these adverse selection problems; in the process, however, annuities are priced relatively high and may exclude from the annuities market some low-risk (short-lived) individuals. Table 4 includes money's worth calculations using the survival probabilities of both the general population and annuitants, providing evidence on the extent of selection effects in a number of international annuity markets for males and females aged 65 years.

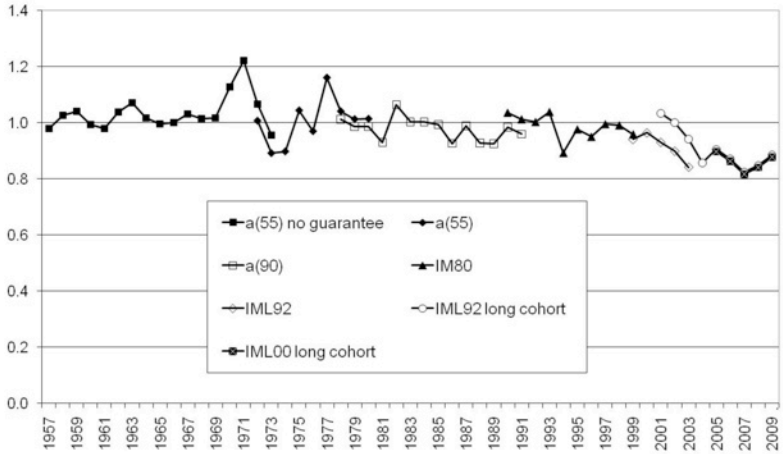
Figure 10: Money's worth for UK compulsory annuities for a 65-year-old male



Source: Authors' calculations from Cannon and Tonks (2011a)

Focusing on the compulsory market in the UK, the money's worth for the base case of 65-year-old men averaged 89.2 over the period 1994-2009; the results for women are similar, with the money's worth for 65-year-old females averaging 89.9. Mortality projections were repeatedly revised during this period, so Figure 10 plots the pattern in money's worth for 65-year-old males, for alternative sets of mortality tables. Irrespective of the mortality tables used, the money's worth appears to be falling in the period 2002-2009. Figure 11 plots the pattern in money's worth in the voluntary market over a much longer time period, from 1957-2009. To obtain a single statistic on the money's worth over the sample 1957-2009, we splice together the guaranteed

Figure 11: Money's worth for 65-year-old males in the UK voluntary market

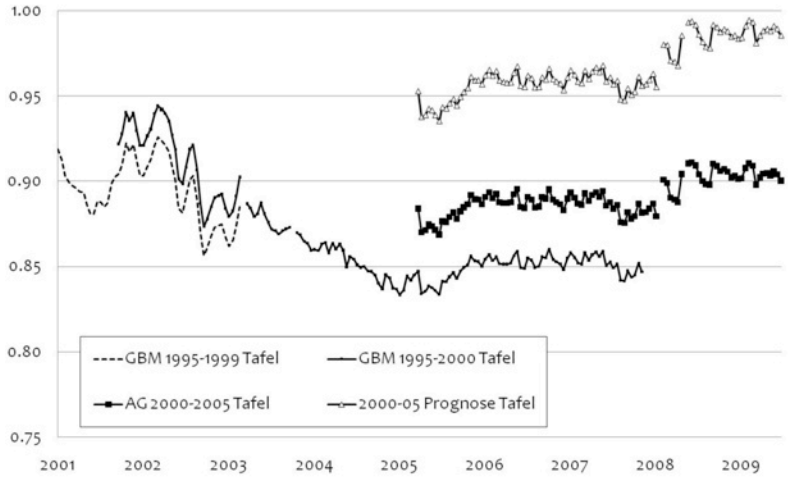


Source: Cannon and Tonks (2004a, 2011a). Data obtained from: Money Facts (annuity rates); Bank of England (yield curve); Institute of Actuaries (mortality data)

and non-guaranteed annuity series to obtain an overall average of 0.98, which is not significantly different from unity (statistically or economically). As in the compulsory market, there appears to be a decline in the money's worth towards the end of the period.

Figure 12 reports the money's worth in the Dutch compulsory market over the period 2001-2009. As in the UK, mortality tables were revised during this period, and we illustrate the money's worth based on different tables. There appears to be a decline from 2002 to 2005, but this may be due to annuity providers anticipating the longer life expectancies found in the

Figure 12: Money's worth for 65-year-old males in Dutch compulsory market



Source: Cannon and Tonks (2011b)

AG2000-2005 Table, which we calculate only from 2005 onwards. The AG2000-2005 Table includes an explicit set of projections of future mortality ("prognosetafel") that suggest that the money's worth is about 0.99 at the end of the period.

The conclusions from Table 4 are that annuities seem to be a remarkably good value for consumers in all annuity markets. In fact, given the very high money's worth ratios that are observed across international annuity markets, once we take into account administration costs of running an annuity business, it appears that insurance companies are losing money on the annuity business that they write. James and Song (2001) argued that the

only way insurance companies can make positive profits is on the spread between the risk-free rate and the returns on an equity portfolio: insurance companies invest the annuity premiums received in a portfolio of risky assets. They then engage in risk-reducing and risk-shifting strategies to lock in the higher returns.

4.2 Evaluating the money's worth

Is the money's worth good value? Given the presence of unavoidable transaction costs, we should certainly expect a money's worth less than one, but it is difficult to know how much less than one—as the magnitude of transaction costs is commercially sensitive information and not revealed by life insurers. Real annuities have a lower money's worth, although this may be because insuring against inflation is more costly for life insurers. One possible benchmark for the money's worth of annuities is the analogous figure for other forms of insurance: namely, the ratio of the value of claims paid by insurance companies to the value of premiums received. Using information provided by the Association of British Insurers for the period 1994-2006, we calculate average figures of 0.79 for motor insurance, 0.60 for domestic property insurance and 0.57 for commercial property insurance. These figures are much lower than for the money's worth of nominal annuities and comparable to that for real annuities: except for motor insurance

in 1997 and 1998, the insurance products we consider were always less of a good value than nominal annuities were.

An alternative benchmark would be other long-term investment products. James (2000) examined the cost of investing in a variety of retail investment products in the UK, and found that to get the market rate of return on £1, a consumer would have to invest £1.50 in a managed fund, and between £1.10 and £1.25 in an index tracker. These figures imply a money's worth of 0.66 for a managed fund, and less than 0.91 for a tracker. Again, these figures are comparable or lower than the money's worth on annuities. They also suggest that it is during the accumulation phase—and not in the decumulation phase—that charges from the insurance companies have a significant reduction on the effective rate of return.

A final measure of the worth of an annuity would use an economic model to calibrate the utility gain from the insurance provided by an annuity, sometimes referred to as annuity equivalent wealth. Cannon and Tonks (2008) reviewed the existing literature and provided additional calculations based on a variety of economic models of consumer behaviour. Their results suggest that £1 invested in an annuity typically gives the same utility as between £1.10 and £1.50 in non-annuity form, so that any annuity with a money's worth of greater than 0.9 improves utility.

5. The Annuity Puzzle

Yaari's theoretical work suggested that an annuity is the best way for an individual with uncertain lifetime to obtain a secure income. However, empirical work by Brown (2001) and Inkmann, Lopes and Michaelides (2007) determined that annuity markets are very thin, and of limited size. Brown (2001) analysed the relationship between the value of an annuity and the probability of annuity purchase, using a sample of 869 households in 1992 in the US Health and Retirement Study (HRS), where the head of the household is aged between 51 and 61 years. He used this information to calibrate the annuity equivalent wealth for each individual household, and compared the likelihood of the household annuitising their wealth as a function of four basic characteristics: mortality risk (proxied by gender), risk aversion (from a series of questions), fraction of total wealth that is pre-annuitised, and marital status. Brown (2001) found that differences in annuity equivalent wealth can partly explain the probability of annuitising balances in DC pension plans. These results give some comfort to the basic life-cycle model of savings/consumption behaviour. Inkmann et al. (2007) examined the determinants of voluntary annuity demand in the UK, using a sample of 5,233 retired persons from the English Longitudinal Study of Ageing (ELSA) panel dataset for two waves: 2002/3 and 2004/05. They found that only 4% of initial sample voluntarily purchased annuities (5.9% in 2004/2005), which is confirmation of the annuity puzzle. They found that the

annuity purchase is positively related to stock ownership, subjective survival probabilities, education, being single and male, and wealth.

The failure of Yaari's theory to match the evidence constitutes the "annuity puzzle", and Poterba (2001) and Brown (2001) suggested a number of explanations for under-annuitisation. The list of suggested reasons is rather long, and some of the possible causes have more obvious policy implications than others. This section concentrates on the causes suggesting that annuitisation may not be optimal; the next section focuses on reasons that suggest more obvious government intervention, bearing in mind that the relative importance of different reasons for low annuitisation is likely to vary between different countries, due to other institutional factors.

Poor rates of return on annuities (due to administrative costs, unfair annuity prices or adverse selection) comprise perhaps the most obvious reason for low annuity demand. However, the previous section on the money's worth suggests that this is one of the less important factors: money's worth values are high, and the utility value of insurance exceeds any load factors or transaction costs.

5.1 Bequest motives

When individuals have a strong bequest motive they may not wish to annuitise all of their wealth. However, there is contradictory evidence concerning the relevance of bequests.

Research by Bernheim (1991), Laitner and Juster (1996) and Wilhelm (1996) indicates that individuals consciously leave wealth to their heirs, whereas Hurd (1997, 1989) and Brown (1999) suggested that the bequest motive is unimportant. Brown (2001) assessed the importance of the bequest motive by examining whether the decision to annuitise is affected by whether the household in the HRS sample has any children. If the bequest motive is important, then we would expect to see the decision to annuitise would be negatively related to the number of children. In fact, Brown finds there is little relation between the annuitisation decision and the number of children, which suggests that bequests are unimportant. In contrast, the Inkmann et al. (2007) paper suggested that being single increases the probability of purchasing a voluntary annuity, which is consistent with bequest motives being relevant.

Rowlinson and McKay (2005) undertook a survey of attitudes to inheritance in Britain using a nationally representative sample of 2,000 people. They concluded that although inheritance is important to most people, it has not become entrenched either as an expectation or a duty. Most people are willing and intend to use their assets for themselves, and the bequests are a residual at the time of death. Overall, there is conflicting evidence on whether bequests are important or not to individuals.

5.2 Necessary expenditures in old age

One problem with Yaari's (1965) model is that it emphasises longevity risk at the expense of all other forms of risk. Bodie (1990) claimed that risk in retirement also arises from the following: the riskiness of social security payments, the riskiness of investment returns during the accumulation phase and riskiness in the annuity rate. These risks may turn out to be equally important to longevity risk.[9] Davidoff, Brown and Diamond (2005) considered the effect of some of these potential problems and extended their analysis to look at imperfect credit markets and habit formation. They concluded that it is optimal to annuitise less than 100 percent of one's wealth, but that the optimum is still very high.

Yaari's (1965) result relied upon either a continuous spot market where agents can both buy and go short in the annuities market or a complete choice of annuity instruments including both temporary and deferred annuities. A typical annuity (i.e. a stream of payments which is constant in real terms) is appropriate only if agents actually wish their expenditure to follow the same pattern (i.e., to be fairly constant over time). However, elderly people may have substantial lumpy health-related costs, which would result in the need for non-smooth consumption paths. Davidoff et al. (2005) discussed formally the circumstances when conventional bonds will be preferred to

9 It is possible that longevity risk (unlike the other risks) can be insured through the extended family (Kotlikoff and Spivak, 1981).

annuities when the only annuity product available is one providing a constant real stream of income payments. They noted that there are various instances where consumers will not desire smooth consumption paths, in which case agents may prefer to under-annuitise when annuity markets are imperfect (clearly, no issue arises if markets are perfect). However, in many countries the most lumpy or largest expenditures (health costs and long-term care provision) are subsidised or provided by the state, so sufficient insurance may be available.

If there is inflation uncertainty, and index-linked annuities are not available, then a level annuity does not insure an individual against unanticipated high rates of inflation, and individuals may prefer to invest in other assets that provide a better hedge against inflation. This is not such a problem in the UK, where RPI-indexed annuities are well developed, based on a large market for RPI-linked government bonds. Elsewhere, inflation-linked bond markets are much smaller.

5.3 The option value of deferral

Annuitisation is a single and irreversible decision. This means that timing of annuitisation is important, especially if alternative investment opportunities are available: individuals do not just choose to consume or save but must also decide how to allocate their savings (or wealth) between different asset classes. In Yaari (1965), the choice was simply between investing in a bond and investing in an actuarial note. Milevsky and Young (2002)

suggested that if a third asset (equity) is available, this may mean that there is value in deferring annuity purchase. The intuition for this rests on two simple observations. First, the mortality risk for people who have just retired is quite low (typically, only 1 percent), so the value of insuring mortality risk is actually relatively low at the point of retirement (it rises thereafter). Second, the expected rate of return on equity is much higher than can be explained by risk aversion alone: the *equity premium puzzle* is well documented both internationally and historically by Dimson, Marsh and Staunton (2002).

An individual aged 65 has the choice of annuitising immediately or waiting one more year and annuitising at aged 66. Since the rate of return on a conventional annuity is almost identical to the rate of return on a bond, and since the equity premium is observed to be larger than is necessary to compensate for risk aversion, it follows that the option value of waiting must be positive and that the agent should wait at least one year. Furthermore, the same logic will follow for any individual with a relatively low mortality rate—and therefore it is worth delaying annuitisation until one is relatively elderly. The optimal strategy defers annuitisation until the implicit return on an annuity exceeds the return on equities, when the mortality drag exceeds the equity premium (Milevsky, 1998), and then it becomes optimal to annuitise remaining wealth. Using life tables from the US, Milevsky and Young (2002) find the optimal ages for annuitising to be 78 for women and 73 for men. These figures are

based on a constant relative risk aversion parameter of 2, and the assumption that the average return on risky assets is 12 percent (and a 20 percent standard deviation), compared with an implied 6 percent internal rate of return on annuities. It is noteworthy that although there are gains to be had by delaying, the chances of doing worse by following this strategy are quite high.

5.4 Optimal decumulation strategies

In the absence of annuities markets a retired person will have to decide on a strategy in retirement to run down assets that have been accumulated during their working life. A number of studies have shown that the optimal decumulation investment strategy is highly complex (Blake et al. (2003), Gerrard et al. (2004) and Blake et al. (2009)). It will depend on factors such as anticipated investment returns, attitude to risk, life expectancy, health status and the desire to make bequests.

Blake, Cairns and Dowd (2003) considered three types of decumulation distribution programs: a purchased life annuity at 65 (PLA), an equity-linked annuity (ELA) with a level annuity purchased at 75, and an equity-linked income drawdown (ELID) with a level annuity purchased at 75. They found that for relative risk aversion coefficients of less than 1.25, the best program is ELA with 100 percent in equities. For higher risk aversion coefficients, the ELA still dominates—but with a greater proportion of the pension fund invested in bonds, until it

eventually approaches the PLA. Blake et al. (2003) suggested that at higher levels of risk aversion an individual would annuitise earlier. An interesting question is how risk aversion changes along the life cycle. In the standard life cycle model, Samuelson (1969, 1989) found that it is optimal to invest a fraction of wealth in risky assets that are independent of age. This is a counter-intuitive result, and many pension products have a "lifecycle" asset allocation [Blake et al. (2006)]. There are a number of ways around this surprising result, including endogenous labour supply, mean reversion, but also changing degrees of risk aversion along the life cycle. In experimental work, Barsky et al. (1997) found for a sample of 'over-50s' that the relation between relative risk aversion and age has an inverse U-shape; whereas Guiso and Paiella (2001) found a positive relation between risk aversion and age. Powell and Ansic (1997), Jianakoplos and Bernasek (1998), and Schubert et al. (1999) all found that women are more risk averse than men in a number of financial decision-making contexts. Haleck and Eisenhauer (2001) found greater relative risk aversion for women and the elderly. Riley and Chow (1992) found that relative risk aversion decreases with age up to 65, but they then found greater relative risk aversion for the elderly.

As shown above, the optimal strategy might not involve the immediate purchase of an annuity at retirement, especially if risk aversion is low or the desire to make a bequest is high. In this case, the optimal strategy is income drawdown. Another

strategy is to annuitise gradually. Although the studies cited here considered optimal investment strategies at high ages, they did not take into account the cognitive problems that elderly people can face when dealing with investments. As FSA rules recognise, drawdown products are risky, and are only suitable for relatively wealthy individuals.[10]

5.5 Habit formation and other utility functions

We already discussed the fact that annuitisation makes individuals better off by shifting their budget constraint out, so that the specific functional form of their preferences does not affect the Yaari (1967) result that full annuitisation is optimal when annuity markets are perfect. Davidoff et al. (2005) examined this further by considering a more general functional form, and Cannon and Tonks (2008) and Horneff, Maurer and Stamos (2008) extended this to Epstein–Zin preferences. Whereas these simulations all suggest that the rational amount of annuitisation is very high, they take no account of the issues of health care and welfare payments raised above.

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10 The FSA MoneyMadeClear Guidelines on Income Withdrawal (January 2009) and the latest FSA guide to pension annuities and pension fund withdrawal emphasise that "Income withdrawal plans are complex and not suitable for everyone, for example if you have a small pension fund and no other assets or income to fall back on" (April, 2010). Earlier versions of the FSA guides to pension annuities recommended that "Income withdrawal involves extra costs and extra investment risk compared with buying an annuity straight away. For this reason, it is usually suitable only if you have a pension fund of over £100,000 (after taking any lump sum) or you have other assets and sources of income to fall back on" (January, 2004).

6. Failure in Demand for Annuities and Policy Implications

The previous section reviewed several reasons why it may be appropriate for individuals to avoid annuitisation, and implies no need for any policy interventions, since the original welfare benefits of annuitisation did not allow for these factors. This section considers additional reasons for the annuity puzzle, which do have policy implications. First, it may be irrational not to annuitise, so we review the evidence for irrationality, and suggest a number of behavioural explanations for annuity aversion. A related reason is that the elderly population, in particular, may have cognitive difficulties in managing their financial affairs. Second, while it may be rational for an individual to avoid annuitisation, it might not be socially optimal, because avoidance is a form of moral hazard. Most developed countries have systems of social welfare payments that may be claimed by individuals on low incomes. Individuals may then have an incentive to run down their retirement capital in order to be eligible for social welfare payments. These explanations for the annuity puzzle provide two independent motives for compelling individuals to annuitise.

6.1 Behavioural factors

The discussion so far has assumed that agents are rational utility-maximising agents with risk-averse preferences. Recently, economists have become aware that these assumptions may be inadequate descriptions of actual behaviour, and current

research is more devoted to the insights that can be learned from economic psychology (Rabin, 1998). Much of this research suggests that actual behaviour is frequently irrational and that departures from rationality are both consistent across a range of behaviours and reliably correlated with other factors. Some recent work on behavioural economics and pension provision has been collected in Mitchell and Utkus (2004).

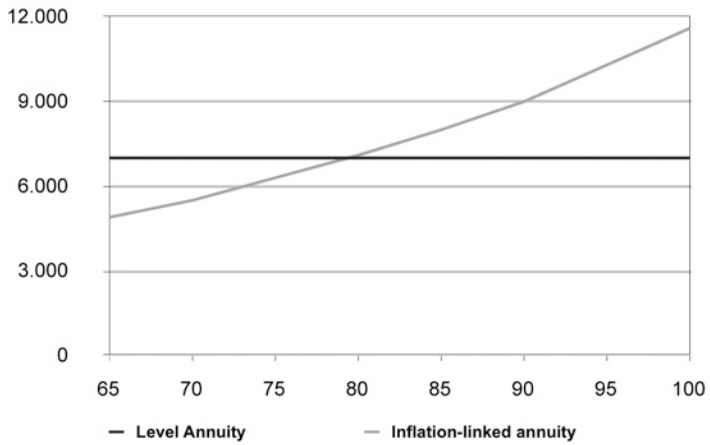
Framing Effects occur when individuals' behaviour depends not upon the choices available but upon the way in which they are presented. An example is the difference between DB and DC schemes. Members of DB schemes who receive a pension and a tax-free lump sum do not lobby to be given their entire pension benefits as a lump sum, but members of DC schemes who are required to annuitise their pension fund do appear to resent the annuitisation requirement. Again this is not a pure framing effect, but it does appear that being given explicit information about the size of the pension fund biases individuals from wanting a pension. This clearly relates to our discussion of how to characterise reference or endowment points under the heading of loss-aversion.

The Pension Research Forum (2004) found evidence of a pure framing effect when purchasing different types of annuity. In a sample of about 5,000 workers in large corporations, respondents were asked whether at age 65 they would prefer an annuity that paid a constant £7,000 per year or one that was initially £4,900, but rose in line with inflation. The sample was

Group A

Age	Level Annuity	Inflation-linked annuity
65	7,000	4,900
70	7,000	5,500
75	7,000	6,300
80	7,000	7,100
85	7,000	8,000
90	7,000	9,000
95	7,000	10,300
100	7,000	11,600

Group B



split into two parts: both groups received exactly the same textual question, but one group (Group A) was shown a table of numbers and the other (Group B) a graph. Of the group that was shown the table, 65 percent chose the level annuity and 26 percent the inflation-linked, whereas of those shown the graph the figures were 48 percent and 41 percent, respectively. These

discrepancies are due to visual impact that the different forms of presentation have.

Other framing effects occur when the range of options is increased. For example, the choice between two options, A and B, may be affected by whether a third option C is also available. The Pensions Commission (2004) cited the Benartzi and Thaler (2001) result that the percentage that people invest in equity is determined by the proportion of equity funds in the choice set. Another possibility is that people prefer to avoid extremes: while agents may choose A over B (and A may be objectively superior to B), if an alternative C is added so that B is intermediate between A and C, then the most likely choice is B, because it is more "average". The number of choices also matters with a greater variety leading to more confusion, potential worry and greater likelihood of avoiding any decision at all.[11]

Overconfidence is often cited as a possible reason for peculiar forms of behaviour among professional investors, especially during times of bubbles. Individuals systematically overestimate their own individual ability: even professionals who believe in the efficient markets hypothesis also believe that they will (uniquely) be able to beat the market. Among pensioners who wish to control their own pension funds rather than hand them

11 Schwartz (2003) argued that agents would be happier at the point of decision if they had fewer choices and attempted merely to satisfice (i.e. aim for some easily achievable target level of utility) rather than maximise (i.e., aim for the maximum possible level of utility); in addition, the presence of fewer choices would lead to less delay in decision making.

over to an insurance company, this could be a major barrier to annuitisation.

6.2 Cognitive problems of the elderly

This section extends the idea brought up in the previous section, that individuals might be irrational, to consider the possibility that the elderly are particularly vulnerable or that there might be problems in selling financial products.

Recently, there have been a number of examples of 'mis-selling' in the UK financial services industry. Three important examples involved mortgage endowments and pensions mis-selling (Financial Services Authority, 2000, 2002)[12] and the sale of payment protection insurance.[13] The scale of the pensions mis-selling was enormous: "Offers (in relation to pensions mis-selling between 1988-1994) have been made to over one million consumers amounting to nearly £9 billion" (Financial Services Authority, 2002). The FSA took disciplinary action against 345 firms, which involved fines amounting to £9,507,250. The pensions mis-selling did not end in 1994. As late as 2008, the

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12 The personal pensions mis-selling scandal took place between 29 April 1988 and 30 June 1994. Individuals who would have been financially better off at retirement in their employer's pension scheme were advised to leave their employer's scheme and transfer their pension benefits to a personal pension plan instead.

13 The court case by the FSA was announced (20 May 2011) as we wrote the final draft of this report. Current estimates in the UK press suggest that the total cost in compensation payments will be about £9 billion.

FSA was forced to announce, "The FSA is taking action to improve the quality of advice given to customers to switch into a personal pension or self-invested personal pension (SIPP), following a review which found variable standards across a sample of 30 firms" (Financial Services Authority press release, 5 December 2008). This followed an FSA review, which found that 16 percent of 500 transfers into a new SIPP constituted poor advice.

A key point about the above mis-selling cases is that the people involved were still in work and many of them were relatively young. They could, therefore, have been expected to be relatively financially aware of the implications of the decisions they were being persuaded to take. But clearly this was not the case. An FSA (2006) survey of financial capability found that in a financial literacy quiz, the under-40s performed worse than their elders, but that the over-70s performed worst of all age groups. The problem is compounded when it involves elderly people who are unable to return to work in order to rectify the financial consequences of any mistakes they make. Older adults with cognitive impairment are particularly prone to financial abuse, and may be more susceptible to the influence of family members and third parties (Reed, 2005; Lee and Eaton, 2009).

Banks (2010) discussed the issues in financial literacy and financial outcomes particularly at older ages. Jappelli (2010), presenting an international comparison of economic literacy, found that there is substantial heterogeneity of financial competence across countries. Cannon and Tonks (2008) noted

that the unpopularity of annuities may relate to a lack of understanding of the annuitisation process. Overman and Stoudemire (1988) found that older adults can lose the capacity to manage their financial affairs effectively as their cognitive abilities decline. Financial decision making is a cognitively complex activity that comprises a broad range of conceptual, pragmatic, and judgmental abilities important to the independent functioning of older adults (Marson, Sawrie et al., 2000) and may be particularly vulnerable to dementia and cognitive decline (Willis, 1996). Agarwal et al. (2009) examined the effect that cognitive impairment had on financial decision making and found that the susceptibility to dementia doubles every five years after age 60. They discovered that around 50 percent of people in their 80s experienced significant cognitive impairment (including dementia)—and this prevented them from making sensible financial decisions.

Older adults also show a marked decline in "numeracy", the quantitative skill necessary to understand the meaning of numerical information such as percentages and probabilities (Donelle, Hoffman-Goetz and Arocha, 2007). This means that older people have considerable difficulty with comprehending even simple measures of risk. For example, when invited to say which of the following involved the greatest risk of getting a disease, 1 in 10, 1 in 100 or 1 in 1000, 29 percent of a sample of 65-94 year-olds gave an incorrect answer (Peters, 2008). Older adults with cognitive problems often have difficulties paying bills

and handling basic financial tasks, (Overman and Stoudemire, 1988) and are at risk of making decisions that endanger assets needed for their own long-term care or intended for distribution to family members (Spar and Garb, 1992)

As an illustration of the confusion that people can face when making annuity decisions, consider the framing study of Brown et al. (2008). The study involved 1300 people over the age of 50 who were asked to select between one of two choices designed to have the same actuarial value:

- an annuity paying $650 a month for life
- a savings account containing $100,000 and paying 4 percent interest.

Half of the sample of participants in the study were offered the two options in a "consumption" frame in which the annuity was explained as a vehicle for providing a secure income of $650 a month for life. Around 70 percent of this subsample chose the annuity. The other half were offered the two choices in an "investment" frame in which the annuity was explained as an investment generating a return of $650 a month. Just 21 percent of the second subsample chose the annuity. This is because the annuity now appeared to be a risky investment, since it would be lost if the individual died early: the option of having the $100,000 "invested" in the savings account was now interpreted as a much safer investment, even though the savings account will not hedge an individual's longevity risk.

6.3 Social welfare payments

The standard optimisation problem at retirement is the allocation of a stock of wealth to finance consumption over several periods. In practice, virtually nobody faces this choice, since most elderly people receive some form of income, often in the form of state pensions or welfare payments (and some individuals have occupational pensions).

Whether described as pensions or not, any welfare provision is itself a form of annuity since it is paid while the agent is alive, thereby insuring against longevity risk. So the choice facing most individuals is how much additional lump-sum wealth to annuitise, given the value of their pre-annuitised wealth. Under most reasonable assumptions the marginal utility from annuitising each extra pound of wealth is diminishing. This means that the gains from purchasing an additional annuity might be relatively small. Quantitatively, the amount of pre-annuitised wealth is important: in the UK, the Pensions Commission (2004: 210) reported that only those individuals whose labour income exceeds about £25,000 have a significant amount of their total wealth in assets other than their state

pension.[14] Bütler, Peijnenberg and Staubli (2011) quantified the effect of state benefits on annuitisation for Switzerland.

It is important to remember that at the point of retirement a large part of an individual's wealth may have been accumulated due to tax privileges, since pension saving is often tax-exempt. The reason for providing tax exemptions is precisely so that the pensioner will not fall back upon the state for additional welfare payments. In the UK, this has been seen as the rationale for making it compulsory to purchase an annuity—although this only applies to pension wealth, and 25% can be taken as a tax-free lump sum.

The debate over compulsory annuitisation has a long history in the UK.[15] Hannah, (1986, p.115) noted that at the turn of the last century, occupational pensions in the UK varied widely in whether they paid a pension as a lump sum or as an annuity. There were arguments that suggested a lump sum would ease the progression from working to retirement (consumption smoothing), but against this was the concern that a lump sum

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14 These figures were confirmed by Banks, Emmerson, Oldfield and Tetlow (2005); Banks, Blundell and Smith (2003) provided a US-UK comparison. Attanasio and Emerson (2003: 827) reported that 60% or people in the British Retirement Survey have financial wealth less than £3,000. Of course, many individuals hold additional wealth in their house, which is not annuitised wealth, but does insure against other forms of risk (such as inflation).

15 In the US, President Obama has raised the issue of compulsion and there are proposals and pilots; see http://www.annuitydigest.com/forum/compulsory-annuitisation and http://www.annuitydigest.com/news/annuities-401k-plans-under-consideration-obama-administration

would be flitted away. The Radley Commission on the Civil Service said in 1888 "The payment ... of a lump sum is open to the obvious objection that in the event of improvidence or misfortune in the use of it, the retired public servant may be reduced to circumstances which might lead to his being an applicant for public or private charity". Under the Finance Act 1921 (¶ 32), superannuation funds (occupational pension funds) were allowed exemption from any income tax on their investment income. The definition of a superannuation fund was clarified (¶ 32 (3)b) as "has for its sole purpose the provision of annuities for persons employed in the trade". This Act introduced the principal that exemption from income tax during the accumulation of the pension was linked to the provision of an annuity at retirement. When the Finance Act 1956 introduced tax-exempt DC pensions for the self-employed, this same principal was upheld (¶ 22), with individuals required to annuitise their pensions wealth between the ages of 60 and 70. The Finance Act 1976 extended this upper age limit to 75.

The Retirement Income Working Party (Blake and Hudson, 2000) suggested that, given the unpopularity of compulsory annuitisation, it should only be necessary to require individuals to annuitise up to a Minimum Retirement Income. As part of its proposals to relax the compulsory annuitisation requirement, HM Treasury (2010a, 2010b) have set the Minimum Income Requirement (MIR) at £20,000 to ensure that a pensioner does not "exhaust their pension savings prematurely and

subsequently fall back on the state" (2010a, ¶ 3.2). This calculation was based on assumptions about the future growth of state pensions and means-tested benefits. Blake, Cannon and Tonks (2010) discussed a variety of issues in how to calculate the MIR based on the original proposal that pensioners would have to buy a real annuity (that is, inflation indexed).

The key issue in the UK context is that pensions and benefits are currently indexed to the minimum of inflation or earnings—which means that the MIR must be set at a high level to ensure that a pensioner does not receive benefits in the future. The simple rule used is that a pensioner buying an annuity should not be unlikely to receive benefits until they are 100 years old. The probability of a 65-year old man living to be more than 100 is currently projected to be 8 percent, and the probability of a 65-year old woman living to 100 is currently projected to be 26 percent: there is an 8 percent probability that the woman could live to 107. Blake, Cannon and Tonks (2010) showed that there is both considerable uncertainty about the future of welfare payments and considerable chance that the government will have to make more welfare payments than currently anticipated.

6.4 Compulsory annuitisation

The previous discussion suggests that there are a number of arguments in favour of compulsory annuitisation. First, annuities insure against longevity risk, and ensure that retirement income is maximised. These welfare benefits mean that it is in people's

best interests to annuitise, and if people will not do this voluntarily for whatever reason (the annuity puzzle), the state takes a paternalistic approach and requires compulsory annuitisation. Second, tax relief is given on pension contributions into the pension fund during the accumulation phase (and on investment income generated), with the aim of ensuring that the individual has a pension in old age—and that compulsion is the quid pro quo of this arrangement. Third, market failures of moral hazard and adverse selection can be overcome by compulsion to annuitise. In the absence of the annuitisation requirement, individuals may deliberately run down their pension wealth and then claim means-tested state benefits (moral hazard or "Double-dipping").

It has long been recognised that there are selection effects in annuity markets (Economist, 1954 (p. 554); Shalijean, 1957; Poterba, 2001), leading to the problem of adverse selection. Individuals who expect to live for a long time are more likely to purchase annuities, and annuity providers recognise these incentives, and price annuities to incorporate any selection problems in a pooled equilibrium in which the low-risk (short-lived) individuals cross-subsidise their high-risk (long-lived) counterparts. In doing so, annuities are priced relatively highly and may exclude from the annuities market some very low-risk (short-lived) individuals (Abel, 1986; Eckstein, Eichenbaum, and Peled, 1985). However, these selection effects may be passive rather than active (Finkelstein and Poterba, 2002). Active (or

adverse) selection occurs when annuitants purchase annuities because they have private information on their life expectancy that is not available to the insurance company. In contrast, passive selection reflects the characteristics and preferences of people who purchase annuities being different from the general population—and long life expectancy may be correlated with the underlying characteristics. For example, people who purchase annuities tend to be relatively wealthy, and Attanasio and Emmerson (2003) found that wealth is correlated with life expectancy.

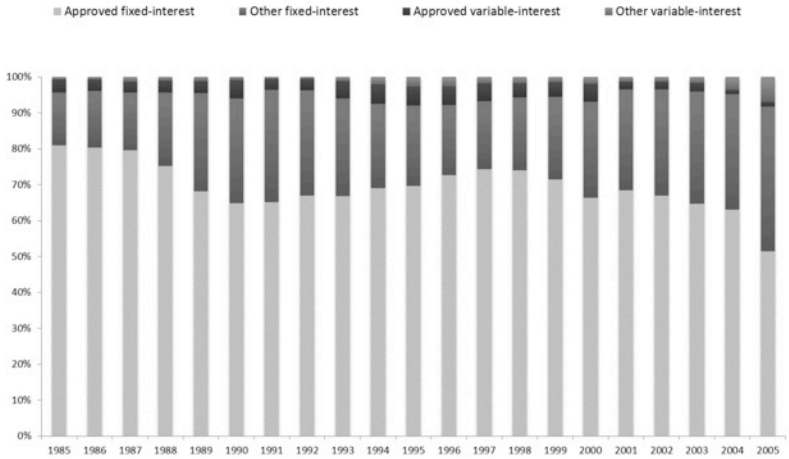
7. Further Policy Issues

7.1 Risk management and supply of government bonds

Interest rate risk is the risk that interest rates will change, rendering the present value of the assets less than the present value of the liabilities. Insurance companies may avoid this risk by exactly matching the profile of the assets with the profile of the liabilities. In practice, insurance companies use a combination of existing long-, medium- and short-term government bonds, as well as other financial instruments (including swaps and other derivatives) to immunise the portfolio of liabilities against interest rate risk.

Data from the FSA insurance returns show how annuity providers manage their annuity liabilities, illustrated in Figure 13. The most important asset class is long-dated government bonds. When the yield curve slopes up (as it usually does), then life insurers can take advantage of the higher yields on longer dated debt. Other important asset classes are commercial bonds and commercial mortgages. When valuing these assets, companies are required to make explicit risk adjustments in the FSA returns, and it is clear that the regulator effectively prevents life insurers from investing in risky assets. Figure 13 shows that the mixture of government and corporate bonds has shifted over time: in 1985, life insurance companies held five times as many government bonds as corporate bonds; by 2005, this ratio was almost one—although over most of the sample (1989 to 2004) the

Figure 13: Composition of life insurers' assets



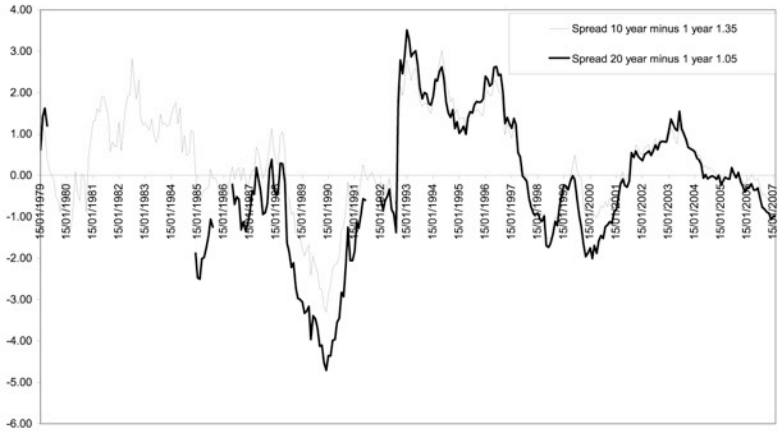
Source: Authors' calculations based on data provided by Synthesis (2005).

percentage of debt instruments that were government bonds lay between 60 and 70 percent.[16]

Figure 14 shows the monthly term spread on 10-year over 1-year maturity government bonds, and 20-year over 1-year bonds from 1979-2007, and it can be seen that since the late 1990s the yield spread has been negative, suggesting that the term structure is 'humped'. These data would be consistent with some investors desiring to hold long-term bonds, but there being insufficient supply—resulting in yields on long-term bonds being low.

16 The UK and the US are the only countries with a really large indexed bond market. The recent experience of Irish government debt illustrates that sovereign debt is not always risk-free.

Figure 14: Spreads between monthly bond yields of different maturities



Source: Bank of England website

Following calls from the pensions industry during 2004 for more and longer-dated debt, the UK's Debt Management Office (DMO), issued a new 50-year maturity conventional gilt in May 2005, with a new 40-year conventional gilt following in May 2006. The first 50-year index-linked gilt was issued in September 2005. There has been a changing composition of the UK Government's gilt issuance, with an increasing emphasis on longer-term gilts: the percentage of index-linked and conventional bonds above 15 years' maturity has increased from less than 30 percent in 1990/91 to nearly 50 percent in 2009/10.

There are a number of other alternatives to long-term government bonds: corporate bonds, overseas bonds and mortgage-backed securities. However, Wadsworth (2005)

reported on a survey by Watson Wyatt of company treasurers, which finds there is no general desire by company treasurers to issue long-term index-linked bonds. Specific sectors, such as the utility industries, have issued long-term index-linked bonds. In February 2006, United Utilities Water plc issued £50 million of 40-year index-linked bonds, and predicted that other utility companies would follow suit, depending on the regulators' response to utilities taking advantage of low long-term yields.[17] Overseas bonds carry currency risk, and sometimes they are not even available. For example, one of the largest potential issuers, the US Treasury, stopped issuing bonds dated more than ten years in 2001 (Bank for International Settlements, 2001). Elsewhere in the Eurozone, government bond issues are also more frequent in the short- and medium segment. European governments do issue some long-term issues, but they constitute a limited share of total issuance. According to Holmans, Karley and Whitehead (2003), strong growth has taken place in the securitization of mortgages since 1998. However, a potential problem with mortgages as an asset for insurance companies is that most UK residential mortgages are variable interest, with the holder of the mortgage suffering the potential of prepayment risk when interest rates fall.

The Pensions Commission (2005) suggested that the projected demand for annuities in the UK might be constrained by the

17 OFWAT/OFGEM (2006) issued a consultation paper concerning the financing of UK network utilities.

capacity of the annuity supply, and in particular with the development of markets to pool longevity risk. The Pensions Commission (2004) distinguished between different types of longevity risk. First, 'Specific longevity risk post-retirement' relates to an individual at retirement who does not know his exact length of life. Second, 'average cohort longevity risk post-retirement' relates to the uncertainty as to the length of life of the cohort of persons retiring. These first two risks are typically absorbed by the pension provider, whether a DB pension scheme or an annuity provider for DC schemes. Insurance companies efficiently insure individuals against this first type of idiosyncratic risk, but also bear the average cohort risk of mis-predicting the overall position of the distribution. An important question is who bears this cohort longevity risk.[18]

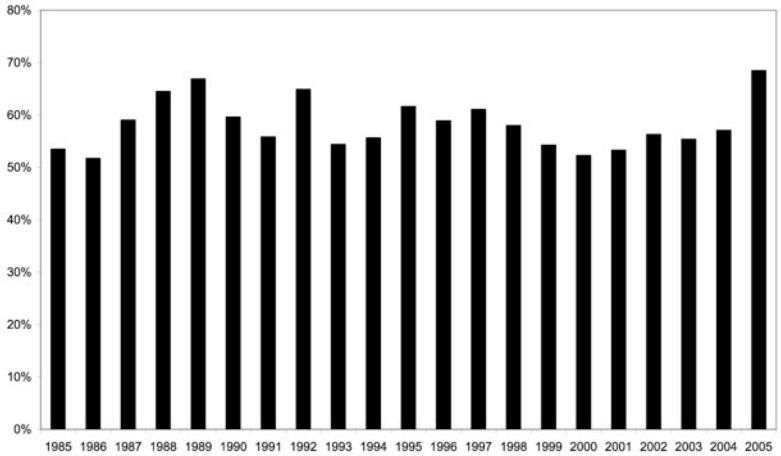
The standard risk-management technique is for the insurance company to invest annuity premiums in an asset that matches the properties of the liabilities: asset-liability management. The trick is to identify assets with the same properties as the liabilities. Insurance companies operate an annuity portfolio, and given the characteristics of the annuitants in the portfolio,

18 A third type of longevity risk is 'Long-term average longevity risks pre-retirement', which relates to the fact that projections of life expectancy for the current employed who will retire in the future are very uncertain. In the case of DB schemes, this risk is borne by the DB providers and by the government when they agree to a pension contract that will apply to the current working population. In DC schemes, however, individuals bear this risk through changing annuity rates.

are able to estimate the likely future annuity payouts from the portfolio. Prudential risk management dictates that the insurer will invest the pool of annuity premium proceeds in assets whose payouts and risk profile closely match the pool of expected future annuity payouts in order to minimise the risk to the insurance company that it will not be able to fund the annuity contract. An ideal matching asset would be a longevity bond (Blake, 1999; Blake and Burrows, 2001). In the absence of such a matching asset, the annuity provider may choose to re-insure these longevity risks (Borsch, 1962), or securitize them through issuing mortality bonds (Lin and Cox, 2005; Cox and Lin, 2007) or mortality swaps (Lin and Cox, 2005; Blake, Cairns and Dowd, 2006).

If the government is unwilling to underwrite this cohort longevity risk through issuing longevity bonds, or if neither re-insurers nor individual investors are willing to bear this cohort longevity risk, then the only people who can bear this risk are the pensioners themselves. This could be achieved either by premiums rising to the point where re-insurers or investors are willing to enter the market, or by annuity payments being linked to cohort mortality. The latter solution involves pensioners receiving annuity payments that are dependent upon cohort survival rates, so that annuities only insure the annuitants against their idiosyncratic mortality risk and not the cohort mortality risk (Piggot, Valdez and Detzel, 2005; Valdez, Piggott and Wang, 2006; Stamos, 2008)

Figure 15: Six-firm concentration ratio in the compulsory purchase market



Source: Authors' calculations based on data provided by Synthesis (2005).

7.2 Competition and market shares

The total number of life insurance companies in the UK has fallen since the Second World War, due to mergers and acquisitions (Cannon and Tonks, 2004b), and many insurance companies no longer actively promote annuity products. Information from Money Facts data and the FSA website suggest that only about ten companies are actively marketing annuity products in the compulsory market (with even fewer in the voluntary market), and confirmation that the industry is heavily concentrated is provided by Figure 15. This shows the six-firm concentration ratio has averaged around 55 percent for the last 20 years. Although there are relatively few large providers, a significant number of

potential entrants are present, as there are many firms who still sell small numbers of annuities and could presumably expand their operations fairly quickly if they thought it profitable to do so. The FSA comparative tables provide information on annuity rates in the compulsory market, which enables consumers to find the best prices. So, although the small number of annuity providers is a potential cause for concern, there is no evidence that it is a cause of the low money's worth.

7.3 Insurance regulation and Solvency II

Standard welfare economics suggests that industries are candidates for regulation under several circumstances: first, if there is abuse of market power; second, if there are externalities in the market; third, if there is asymmetric information; and fourth, if consumers are not fully rational As Davis (2004) noted, the supply of annuities is heavily regulated, because in annuity markets around the world all of these situations are likely to apply. As Figure 15 illustrates for the UK, and as reported in Cardinale, Findlater and Orszag (2002) for other countries, the annuity industry is highly concentrated. Even if there is no evidence of market power affecting prices, some life insurers may be "too big to fail", and so the government must be worried about the solvency of individual companies. The Equitable Life case illustrates that assumptions made by one annuity supplier can impact the rest of the industry. We have previously discussed selection effects and information asymmetries in annuity

markets. Annuities are complex financial products, the characteristics of which are not easily understood by consumers, so that like 'treatment goods', it is only long after the event of purchase (approximately, if the annuitant lives for longer than his or her life expectancy) that annuitants appreciate the benefit of an annuity product. Annuity markets appear to satisfy each of these criteria for regulation.

Life insurers in the UK are regulated by the Financial Services Authority (FSA), which incorporates the EU Life Directives for the insurance industry. Prudential requirements are at the basis of insurance regulation; the regulations require insurance companies to have sufficient financial resources to provide for their liabilities. The FSA's General Prudential Sourcebook implements the minimum EU standards for the capital resources required to be held by an insurer undertaking business that falls within the scope of the Consolidated Life Directive (2002/83/EC), the Reinsurance Directive (2005/68/EC) or the First Non-Life Directive (1973/239/EEC) as amended. In 2007, these EU Life Directives set the base capital at €3.2 million, and the percentage of capital that must be set against technical reserves to cover four risk components: death risks (0.3 percent); expense risks (1 percent); market risks (3 percent) and health risks. In the case of annuities, there are no death risks or health risks, and so the amount of capital set aside to cover liabilities is a total of 4 percent of the mathematical reserves. Booth et al. (2005) provided a summary of the general principles and purposes of

the provision of technical reserves (i.e., liabilities) for insurance products.

The EU has announced changes to insurance regulation enshrined in 'Solvency II', which will take effect in November 2012. Solvency II is intended to apply to the insurance industry the risk-sensitive regulatory approach adopted in the Basel-2 reforms for the banking industry. There are three regulatory pillars. The first consists of risk-responsive capital requirements; the second pillar represents additional capital requirements imposed by the regulator following individual company risk assessments; the third pillar relates to disclosures to ensure that market disciplines can operate.

As illustrated in Figure 13, annuity providers typically back annuities with a mixture of safe government bonds and riskier (but higher yielding) corporate bonds. Under Solvency II, annuity providers will be required to hold additional funds to cover these risks (see Telford, 2010). In anticipation of these changes, the FSA has proceeded with its own risk-based solvency requirements (FSA 2003, 2005). This new regime is likely to have increased the regulatory cost associated with providing annuities, by imposing higher levels of regulatory capital on annuity providers. An additional incentive came directly from the regulator. In April 2007, the FSA sent a 'Dear CEO' letter to chief executives of annuity providers, reflecting on the debate over future annuitant longevity improvements. The letter recognised that companies would usually make assumptions based on their own

mortality experiences: "However, if this is not possible we would expect firms to consider the different industry views in this area and to err on the side of caution" (FSA Dear CEO letter, April 2007). In other words, annuity providers, according to the regulator, should price annuities conservatively to reflect the risk of mortality improvements.

7.4 Impaired lives and selection effects

It is possible to buy 'enhanced' annuities or annuities on 'impaired lives'. These offer better rates to smokers or to individuals with health problems such as diabetes. Since the annuity rate offered depends upon the circumstances of the individual, these are often sold through specialist brokers. These annuities form an increasingly large part of the market. A consequence of this is that the remaining annuities sold are increasingly sold only to relatively healthy individuals.

According to Quinton (2003), there was a 23 percent increase in the impaired life market between 2001 and 2002. In 2005, the Synthesis database reported that of £8.5 billion sales of CPA annuities in the UK, only £386 million (4.5 percent) were impaired life. This growth in the impaired-life market would have resulted in the remaining annuitants in the conventional market having higher average life expectancy, which would mean that life insurers would have to lower annuity rates to remain profitable. Our estimates of money's worth above make no allowance for any growth in the impaired-life market, since the

life tables that we use are unable to distinguish between impaired and non-impaired lives. This means that our money's worth calculations would be based on annuitants systematically different from those buying in the non-impaired market, biasing our results downwards.

Traditionally, the only health-related predictors of longevity risks used to price annuity contracts have been age and gender, although annuity providers do have information on causes of death of annuitants (CMI, 2009). More recent developments in annuity provision have, however, incorporated a wider range of medical markers correlated with longevity risk (Telford, 2010). For example, from 2007, some life insurers also started to price annuities based on the annuitant's address (postcode), since this is a good predictor of life expectancy and the variations by location are large (up to ten years). The largest companies now price annuities on this basis. Other examples include the following: lifestyle (the simplest example is the Smoker annuity); enhanced markers (blood pressure, cholesterol); and impaired life (Diabetes). These trends presage the development of 'full' medical underwriting of longevity risk, with extensive questionnaires including disease or condition-specific extensions. Cannon and Tonks (2008) distinguish between time-series models and causal models for forecasting longevity. Girosi and King (2008) suggested that using a wide range of social, behavioural and medical factors to forecast mortalities could improve forecasting accuracy, leading to reduced uncertainty

about mortality projections, and allowing life insurance companies to hold less regulatory capital—which is becoming increasingly important in light of the proposed Solvency-II regulations (FSA, 2008).

More accurate pricing will affect life insurers' aptitude for risk, and hence the supply of annuities. An interesting feature of such separating equilibria is that annuitants with long life expectancy (generally, the more wealthy) will face higher annuity prices than those with lower life expectancy (generally, the less well-off). In contrast to a pooled equilibrium in which the poor cross-subsidise the rich, the separating equilibria will represent a transfer from the rich to the poor. There will be welfare gains to society from such a transfer.

7.5 Unisex annuities

In March 2011, the European Court of Justice ruled that insurance policies within the EU could not be sold at different prices based on gender discrimination. This has implications for annuity policies, since annuity providers up until now have been able to offer males higher annuity rates than females on the basis that female life expectancy is longer than that of males. The new gender-neutral annuity contract will be a pooled equilibrium in which we might expect that unisex annuity rates are a weighted average of those in the current separating equilibria, assuming that both genders continue to purchase annuities in the same proportions. Within compulsory purchase annuity markets, the

assumption of no effect on demand is reasonable, but at the margin with the MIR, some males might now find drawdown more attractive, and some females might now be inclined to choose annuitisation over drawdown—though this will also depend on income and substitution effects.

8. Conclusions

This paper has provided an overview of the importance of annuity markets in the general context of pension policy around the world. We have described the operation of annuity markets, demonstrated the welfare benefits of annuitising pension wealth at retirement, and provided estimates of annuity rates in UK and Dutch markets over time. A comparison of international evidence suggests that money's worth numbers using annuitant mortality experience, are typically around 97 percent for single-life 65-year-old males. In contrast, money's worth using population life tables is around 88 percent, suggesting selection effects of 9 percent.

The paper has also examined the factors that determine annuity prices, and showed that the price of annuities depends on interest rates, projections of life expectancy, size of the pension fund, type of annuity and the annuity providers' mark-up. The seminal paper by Yaari (1965), which demonstrates the welfare benefits of annuitising one's wealth to insure against longevity risk, sits rather uncomfortably with the fact that voluntary annuity markets are small. We considered a range of factors that could explain this puzzle. These included bequests, habit formation, the existence of state pension benefits, means-testing, selection effects, deferred annuitisation and behavioural aspects. Combinations of these factors may explain why the demand for annuity products is low.

A number of policy issues are thus open to debate: The number of annuity providers is relatively small, which raises concerns about abuse of market power (although the money's worth evidence does not suggest monopoly pricing is a problem in this market). The small number of providers also means that the cohort longevity risk is highly concentrated in a small number of firms, and there is some question whether these providers have the capacity to absorb the extra risk associated with increased annuity demand. If this limited number of firms would not be able to bear the total longevity risk, then mechanisms would need to be found for this risk to be held elsewhere. Possible candidates include the following: individual investors or other financial institutions, who would hold mortality bonds (issued by reinsurers) in a diversified portfolio; the government and other bond issuers, by issuing longevity bonds; or the annuity holders themselves, by making the annuity payments conditional on cohort survival rates. Annuity providers are better able to minimise the risks of an asset-liability mismatch, by the availability of long-term government bonds. Governments should ensure that there are sufficient quantities of corporate or government debt to satisfy the demand by annuity providers.

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SUMMARY OF DISCUSSION

By Tim Boonen

Annuity Markets: Welfare, Money's Worth and Policy Implications
By Edmund Cannon (University of Bristol) and Ian Tonks (University of Bath)
Discussants: Kim Peijnenburg (Tilburg University and Netspar) and Alwin Oerlemans (APG).

Kim Peijnenburg stressed the importance of the annuitization decision. There is extensive literature on this subject, and the topic has considerable policy implications in various countries. The paper by Cannon and Tonks describes the annuity markets in the United Kingdom and the Netherlands in detail. A suggestion would be to expand the research to other countries. There are country-specific arguments that may solve the "annuity puzzle". For example, the role of benefits tested against personal income is relevant in Switzerland. Furthermore, it is important to distinguish between voluntary and mandatory annuitization.

Another recommendation by Peijnenburg would be to extend the list of annuity puzzle explanations if possible to specific countries. Even though the paper by Cannon and Tonks summarizes many possible explanations, there are also other considerations, such as family composition, the scope of benefits tested against income, default risk of the insurer, health cost risk and incomplete annuity markets.

The calculations of money's worth included in the paper yield surprisingly high results. This implies that the price of annuities is very low and quite close to their actuarial fair price. However, the money's worth is not the only unit to measure the value of an annuity. Even annuities with a low money's worth can generate welfare, since welfare gains for risk-averse consumers are substantial.

The discussion by **Alwin Oerlemans** focused on the relevance of annuities for pension funds. For pension funds, the money's worth is remarkably high. One suggestion would be to spend more time on examining the importance of annuities for pension provisions in general. The Netherlands, where annuities are mandatory, is a good example of a country where annuities generate welfare.

The results presented by the authors depend heavily on the underlying assumptions, and some sensitivity analysis would be advisable. Also, a key question is: who bears the risk in a pension fund? The issue of risk sharing in pension funds is that it pays to sell off risk. Communicating how the risk is transferred is a challenge. Understanding how risk is transferred in a pension plan enables participants to take responsibility for their decisions regarding savings. The returns generated from savings are highly important during both the accrual phase and the annuitization phase.

In the United Kingdom, pension funds are widespread. However, the number of defined contribution (DC) pension plans is considerably higher there than defined benefit (DB) plans. One suggestion would be to discuss which system is optimal, how DC plans can be improved, and whether DB is sustainable.

In the Netherlands, there is room for pension funds to take on more risk. The Dutch system should allow for greater flexibility in the second and third pillars. Selection effects are not very pronounced since participation in the second pillar is mandatory for most individuals. The size of the first pillar (the state pension) is very high and already constitutes a large part of the pension wealth of most individuals. Also, inflation-linked bonds are recommended to hedge inflation risks.

The plenary discussion focused on three issues. First, it was unclear how the money's worth was calculated. The fact that an estimate of money's worth depends on a fixed moment in time leads to further uncertainty as to its value. Second, it was argued that the annuity conversion risk is underestimated. Third, it was suggested that the individual should bear longevity risk by making the retirement age flexible and dependent on mortality developments.

Cannon and Tonks responded as follows. The estimated welfare gains are much larger than the money's worth suggests. In nearly every plausible scenario there are utility gains of about

20%, which more than compensates for the fact that the money's worth is less than unity. (The paper does not discuss this in detail due to lack of space). The authors clarified that their analysis had covered the compulsory annuity market in the UK and that the voluntary market was negligible.

The authors provided some further details on the UK situation. From their discussions with government officials they concluded that there is virtually no chance that the UK government would issue longevity bonds since it considers itself to bear sufficient longevity risk already. They also confirmed that the underwriting of annuities in the UK was highly sophisticated (using postcodes to price annuities). Because of this, and also because few annuity-recipients are women, the UK annuity industry does not appear very concerned about the ECJ ruling that annuities may no longer be priced on gender.

The authors agreed that an international comparison would be worthwhile. They stated, however, that this would be difficult in practice due to the small number of countries available for analysis and the complexity of pension arrangements. They argued that the main driver of the demand for annuities in a particular country is whether annuitization has been declared mandatory or not. According to the authors, it is difficult to include conversion risk in a lifecycle model. Moreover, as there are no longevity bonds or cohort risk in pension contracts, there is wide discussion on how to approximate longevity risk. Proper risk-sharing is needed to hedge longevity risk.

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23. *Illiquidity: implications for investors and pension funds* (2011)
    Frank de Jong and Frans de Roon
24. *Annuity Markets: Welfare, Money's Worth and Policy Implications* (2011)
    Edmund Cannon and Ian Tonks

Netspar

Annuity Markets: Welfare, Money's Worth and Policy Implications

In this Panel Paper, Edmund Cannon (University of Bristol) and Ian Tonks (University of Bath) describe the operation of annuity markets within the context of pension policy in countries around the world. They focus in particular on the UK which has the world's largest annuity markets, and describe time series properties of annuity rates in both the UK's compulsory and voluntary annuity markets. Furthermore, they provide an overview of money's worth calculations in global annuities markets in this paper.