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The value for money of annuities and other retirement income strategies in the UK

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Summary

In the last few years, and especially since the financial crisis, a number of stakeholders have suggested that the annuities market was not working well. We investigate one important aspect of the market by looking at the 'value' of annuities, and compare the potential outcomes for a retiree purchasing an annuity with alternative strategies.

An annuity is an insurance contract where a person (the annuitant) pays a premium upfront to obtain a stream of future payments until his or her death. To assess the value of an annuity, we calculate the ratio of the expected present value of annuity income to the annuity premium – this is known as the Money's Worth (MW). The MW takes into account the expected average longevity of annuitants and the interest they forego on their pension pot by buying an annuity. Using this approach, our findings are that:

- On average between January 2006 and June 2014, an annuitant with a £50,000 pension pot can expect to receive back 94% of the premium paid when purchasing an annuity in the open market. MW is reasonably stable over this period.
- Annuities bought with smaller pension pots give proportionally worse value.
- Annuities bought on the open market give better value than annuities bought from the pension accumulation provider.
- The fall in interest rates and increase in life expectancy has had a significant impact on annuity rates.

We compare the income generated by an annuity to selected alternative ways in which the pension pot can provide a retirement income, whereby a retiree has flexibility in how much income he or she can draw at any point of time during retirement. Such strategies may be available in the future, given the greater flexibility allowed by the 2014 Budget announcement.

Our results suggest that an annuity gives good value for money when purchased using the Open Market Option compared to other strategies, because annuities allow a relatively high level of consumption while protecting the retiree from exhausting the pension pot. We find that where retirees do not accept investment risk, the income available to consumers is greater from an annuity rather than from the alternative strategies, apart from one strategy that comes with a significant risk that the retiree exhausts their pension pot.

If retirees are willing to invest in risky assets, they may achieve higher levels of consumption than under an annuity; however, they also have to bear additional risk of exhausting the pension pot.

Overview

Purpose

In the last few years, and especially since the financial crisis, a number of stakeholders have suggested that the annuities market was not working well.

In this paper we contribute to the FCA's investigation into whether or not the annuities market is working well by looking at the 'value' of annuities, and compare the potential outcomes for a retiree purchasing an annuity with alternative strategies.

Understanding the past will be helpful in assessing what could happen in the future and will help the FCA decide if and where to intervene.

Background

An annuity is an insurance contract where a person pays a premium upfront in exchange for a stream of future payments until his or her death. Historically, mainly for legal and regulatory reasons, the market for 'at retirement' products was dominated by annuities. In the last few years, and especially since the financial crisis, a number of stakeholders have suggested that the annuities market is not working well. The Financial Services Authority (the FSA – our predecessor regulator) first and then the FCA shared some of these concerns and conducted a Thematic Review that resulted in a market study being launched in February 2014.

In this paper we investigate one important aspect of the market by looking at the 'value' of annuities, and compare the potential outcomes for a retiree purchasing an annuity with the outcomes of alternative strategies.

The first questions we consider are the following: i) what is the average 'value' of an annuity? and ii) has the value of an annuity changed over time?

The Money's Worth framework

Focusing on the evolution of annuity rates in isolation can give a misleading picture of the market. To assess the value of annuities more objectively, the academic literature has established a methodology to calculate the ratio of the expected present value of annuity income to the annuity premium – this is known as the Money's Worth (MW).

The MW of annuities depends on three sets of parameters:

- annuity rates
- the rates used to discount future annuity payments, and
- expected future mortality rates

It is the combination of these three factors that determines the value that retirees get from annuities.

We use the risk-free rate to calculate the present value of future payments for a number of reasons:

- First, the risk-free rate approximates the preference of retirees for consumption today compared to consumption in the future.
- Second, it proxies the opportunity cost of buying an annuity. Retirees could buy a portfolio of government bonds to obtain a certain stream of future payments.
- Third, it is easy to obtain reliable estimates of risk-free rates by using the term structure of nominal and real interest rates published monthly by the Bank of England.

Assumptions on life expectancy are a very complex issue. They are constantly debated in the actuarial and academic community and play a crucial role in the pricing strategy of annuity providers. Every annuity provider uses its own mortality assumptions. Since our work is intended to assess the value of annuities at the time of purchase of the annuity, our assumptions on life expectancy reflect assumptions that would have been applied by insurers at the time the annuity was sold.

If annuity providers are expected to return all annuity premiums to consumers, MW should be equal to 100%. However, MW is typically less than 100% as firms have to cover administrative and operational costs and they are remunerated for bearing credit and longevity risks. It is theoretically possible that MW could be greater than 100%, and on some rare occasions it is, because life insurers may invest in risky assets, rather than risk-free bonds, that give higher yields. If these higher yields are partially passed through to consumers it may result in the MW being greater than 100%.

The MW analysis contributes to the FCA's investigation into whether or not the annuities market is working well by looking at the expected present value of future payments an annuitant would get back on average as a proportion of the premium paid. This analysis assesses annuities from a consumer point of view. It cannot be used in isolation to assess whether providers are earning extra profits but it does provide an indication of whether competition has changed over time.

Main results

Our calculations show that for a 65-year-old male who buys a level standard annuity using the Open Market Option with a £50,000 pension pot, the ratio of the expected present value of annuity income to the annuity premium, or Money's Worth, is 94% on average between January 2006 and June 2014. In other words, he can expect to receive back on average 94% of the premium paid, taking into account the expected average longevity of annuitants and the interest annuitants forego on their pension pot by buying an annuity.

This suggests that annuities bought in the open market represent good value for money because consumers get the vast majority of their premium returned to them in income. This amount, or MW, is reasonably stable between 2006 and 2014, and this suggests that competition has not materially changed over this period.

Annuities bought using smaller pots have lower MW (i.e. a male annuitant with a £10,000 pension pot expects on average an MW around 87% over the same period). A lower MW could be expected given that the administrative costs of setting up an annuity will be similar regardless of the pot size.

While annuities bought in the Open Market provide reasonably good value for money, annuities bought internally from the pension accumulation services providers give a lower MW. This

reinforces the findings of the Thematic Review on annuities on the importance of shopping around and the use of the Open Market Option.

The Decision of the European Court of Justice to ban discrimination based on gender in insurance pricing had a visible impact on annuity rates and MW. Consequently, from December 2012, the annuities rates offered to men and women were equalised. Given the different life expectancy, MW for male annuitants worsened while for female annuitants improved.

Impact of low interest rates environment and improvements in life expectancy on annuity rates

Annuity rates have fallen substantially in recent years. Consequently, consumers and other stakeholders have the perception that annuities have become poor value products. However, interest rates are currently very low and life expectancy has increased, and these have both pushed annuity rates down. We analyse separately the impact of interest rates and mortality assumptions on an annuity available in the Open Market in June 2014 for a 65-year-old male annuitant.

First, if life expectancy for a 65 year old in June 2014 was equal to life expectancy in January 2006, providers in June 2014 would offer on average around 7% more income per year. As annuitants are expected to live longer than in 2006, annuity providers have compensated for having to pay income for longer by reducing the income offered to new annuitants.

Second, if interest rates in June 2014 were equal to interest rates in January 2006, providers in June 2014 would on average offer around 11% more income per annum. This means that recent low interest rates have significantly impacted on annuity rates and more so than the impact of improved longevity. The comparison stands out even more if we take as reference point the interest rates in January 2000, when interest rates were higher than in 2006. This contributes to the perception that the value of annuities has declined.

Comparison among different types of annuities

We also compare different types of annuities. While income from a guaranteed annuity are always lower than for annuities without, our results suggest that guaranteed annuities offer higher MW than non-guaranteed annuities for 75-year-old annuitants, but we do not see this for younger ages. There are two possible reasons why guarantees for older annuitants appear to offer better value. First, it is possible that annuitants who buy annuities with a guarantee have shorter than average life expectancy and providers adjust for that. Second, guaranteed annuities are by definition less risky products for the insurers compared to level annuities, so they are able to offer a better rate. This is because during the period of the guarantee all payments are certain rather than dependent on annuitants' mortality. Further, as annuity payments after the guaranteed period are lower, the impact of annuitant living an extra year is smaller than compared to a level annuity. For younger annuitants, guarantees cover periods when retirees are relatively less likely to die and therefore there is a smaller difference in rates and Money's Worth.

Moreover, level annuities appear to offer better value for money than 5%-escalating and inflation linked annuities, potentially because of the risks in forecasting future inflation and the cost of matching inflation-linked assets and liabilities. Another explanation could be that providers face greater risk from escalating annuities compared to level annuities, as payments increase over time and a greater proportion of income is paid further into the future. This increases uncertainty and therefore risk.

Finally, we also compare annuities bought at different ages; based on only our MW calculations, there does not appear to be an optimal age to buy an annuity.

Value for money of alternative drawdown strategies

In the second part of the paper we investigate the potential risks in the future landscape which could help us understand when early FCA intervention would be warranted to avoid the crystallisation of bad outcomes for retirees. Following the reforms to pension incomes announced in the 2014 Budget, consumers will have significantly greater freedom on how they draw an income from their retirement pot. Consumers may use different strategies other than annuities to drawdown income, and therefore we have analysed possible ways in which consumers could do this to assess the potential risk they face from these alternatives.

Essentially there are two main risks that could be present in the future landscape. The first is that retirees may exhaust their pension pot if they do not buy an annuity and the second is that they could buy a low-value product. We therefore ask the question: do alternative strategies for pension decumulation provide a better solution for consumers compared to annuities? We investigate the income that consumers could receive compared to the annuity and the probability that consumers may exhaust their pension pot. Assuming that retirees do not accept investment risk i.e. they purchase government bonds, we look at four different alternative strategies:

- **self-annuitise** (take the same income as the average annuity quote for a level annuity)
- amortise to 85 years old (take the a constant nominal income each year until 85 years old, at which point funds are exhausted, hereafter '**amortise to 85**')
- amortise to 100 years old (take a constant nominal income each year until 100 years old, at which point funds are exhausted, hereafter '**amortise to 100**')
- consume each year a fraction of the retirement pot depending on life expectancy at that time (i.e. consume 1/20th of the pot if you expect to live 20 years, hereafter '**1/LE**')

We also consider two of these strategies (self-annuitise and the drawdown strategy based on life expectancy) where retirees take on investment risk, in this case by investing in the FTSE 100.

Risk-free investment

We find that where retirees do not accept investment risk, the income available to consumers was greater from an annuity rather than from the alternative strategies apart from the 'amortise to 85' strategy. However, this latter option comes with a significant risk that retirees exhaust their pension pot. For example, the highest income available is provided by the 'amortise to 85' strategy but there is a 65% chance that the retiree will exhaust their pension pot.

As explained previously, the MW of internal annuities bought from the pension accumulation services providers is on average lower than annuities bought on the Open Market. The income generated by an internal annuity is also lower (around £2,500 per annum (p.a.) compared to £2,897 p.a.). So internal annuities also look worse than an external annuity when we compare them to other drawdown strategies. An external annuity gives a higher income than the drawdown strategies at any period in time that do not have high risks of exhausting the pension pot, but an internal annuity is only slightly better than the 'amortise to 100' strategy (which gives approx £2,350 p.a.), while an external annuity is considerably better. This reinforces the findings of the Thematic Review on the importance of shopping around and the use of the Open Market.

Investment risk

Where a retiree instead takes on investment risk, higher (on average) investment returns mean consumers may be able to take income at the same level as an annuity but not exhaust their pension pot as higher returns mean that the pot does not shrink to nothing in retirees' lifetimes. However, taking on investment risk leaves retirees vulnerable to volatility in investment returns and so face the risk that poor investment performance will mean they exhaust their pension pot. This is the trade-off consumers make when investing their retirement pots in risky assets.

We assessed the probability that consumers will exhaust their pension pot by modelling the impact volatile investment returns may have on consumers' pension pots over time. We find that, in the absence of fees, for 65-year-olds using the self-annuitise strategy, there is approximately a 65% chance of the pot being larger than £50k after 20 years but a one in ten chance that someone using this strategy runs out of money by age 85.

Fees have a substantial impact on consumers' outcomes (e.g. investment management fees and administration costs). Where fees are taken in to account, the risk the consumer exhausts the pension pot increases. If fees total 1% of the pot size then the probability of the pot being larger than £50k in 20 years is 54%. 11% of the time retirees using this strategy exhaust their pension pot by age 83 and 24% of the time retirees will have exhausted their pot even before they would have if they had invested in risk-free bonds.

Summary of key findings

To assess the value of an annuity we calculated the Money's Worth (MW) of annuities. The MW is defined as the ratio of the expected present value of annuity income to the annuity premium. MW depends on three sets of parameters: the annuity rates, the rates used to discount future annuity payments and the expected future mortality rates. It is the combination of these three factors that determines the value that retirees get from annuities. Focusing on the evolution of annuity rates in isolation can give a misleading picture of the market, while the MW framework combines these aspects in a single factor.

Main results

- The MW of a level standard annuity for a male annuitant with a £50,000 pension pot is 94% over the period January 2006 and June 2014.
- MW was reasonably stable over the period between 2006 and 2014 suggesting that competition has not materially changed over this period.
- Smaller pots have lower MW (a 65-year-old male annuitant with a £10,000 pension pot expects on average an MW around 87% over the same period).
- Annuities bought internally from the pension accumulation services providers give a lower MW.
- The Decision of the European Court of Justice to ban discrimination based on gender in insurance pricing led to the annuities rates offered to men and women being equalised. Given the different life expectancy, MW for male annuitants worsened while for female annuitants improved.

Impact of low interest rates environment and improvements in life expectancy on annuity rates

We analyse separately the impact of interest rates and mortality assumptions on an annuity available in the Open Market in June 2014 for a male annuitant with £50,000 pension pot.

- First, if life expectancy in June 2014 was equal to life expectancy in January 2006, a provider in June 2014 would offer around 7% more income per year.
- Second, if interest rates in June 2014 were equal to interest rates in January 2006, a provider in June 2014 would offer around 11% more income per annum.

Value for money of alternative drawdown strategies

We investigate the income that consumers could receive from drawdown strategies compared to the annuity and the probability of exhausting the pension pot. Assuming that retirees do not accept investment risk i.e. they purchase government bonds, we look at four alternative strategies:

- **Self-annuitise** (take the same income as an the average annuity quote for a level annuity);

- Amortise to 85 years old (take the a constant nominal income each year until 85 years old, at which point funds are exhausted, hereafter '**amortise to 85**');
- Amortise to 100 years old (take a constant nominal income each year until 100 years old, at which point funds are exhausted, hereafter '**amortise to 100**');
- Consume each year a fraction of the retirement pot depending on life expectancy at that time (i.e. consume 1/20th of the pot if you expect to live 20 years, hereafter '**1/LE**').

The table below reports our findings on the analysis comparing alternative retirement income strategies with an annuity.

Comparing alternative retirement income strategies with an annuity

Strategy	Description	Assets invested in	Income levels	Risk of exhausting the pension pot	Bequests
Self annuitise	Draw same income from pot as that paid by the average level annuity available in the market	Risk-free assets (Government bonds)	Same as annuity	Pre-determined date for exhausting the pension pot. Significant proportion of retirees will exhaust their pension pot	Expect to leave a small proportion of the pot to estate at death
Amortise to 85	Draw a constant income until exhausting the pension pot at 85	Equities (FTSE-100)	Same as annuity	Significant risk of exhausting the pension pot	Potential to leave more than initial pot value to estate at death
Amortise to 100	Draw a constant income until exhausting the pension pot at 100	Risk-free assets (Government bonds)	Higher than annuity	Likely to exhaust their pension pot	Most likely will not leave a bequest
1/LE	Draw income related to life expectancy	Risk-free assets (Government bonds)	Lower than annuity	Small but not insignificant chance of exhausting the pension pot	Expect to leave less than half of pension pot as bequest
		Risk-free assets (Government bonds)	Lower than annuity and income falls as time passes	Exhausting the pension pot extremely unlikely	Expect to leave less than half of pension pot as bequest
		Equities (FTSE-100)	On average income expected to be more than annuity but significant fluctuation in income and risk that annuity will provide higher income	Exhausting the pension pot extremely unlikely	Potential to leave more than initial pot value to estate at death but may also leave only a fraction of the pot to estate

1. Introduction

An annuity is an insurance contract where a person buys a stream of future payments that are conditional on the person being alive at the time at which future payments are due. Historically, mainly for legal and regulatory reasons, the market for 'at retirement' products was dominated by annuities. As such, gaining an understanding of the performance of annuities is particularly important to assess how well retirees have been served by the market in the past. Furthermore, understanding the past will be helpful in assessing what could happen in the future and will help the FCA decide if and where to intervene.

In the last few years, and especially since the financial crisis, a number of stakeholders have suggested that the annuities market was not working well. For instance, the Financial Services Consumer Panel published a position paper in December 2013 arguing in favour of regulatory reforms (Financial Services Consumer Panel, 2013)¹ and the Investment Management Association published a discussion paper back in 2008 (Investment Management Association (IMA), 2008)². The FSA first and then the FCA shared some of these concerns and conducted a Thematic Review that resulted in the present market study being launched in February 2014 (Financial Conduct Authority (FCA), 2014)³.

In this paper we contribute to the FCA's investigation into whether or not the annuities market is working well by looking at the 'value' of annuities, and compare the potential outcomes for a retiree purchasing an annuity with alternative strategies.

In the first part of this paper we analyse the evolution of the Money's Worth of annuities⁴ since before the financial crisis (in 2006) and up to June 2014 to shed some light on the evolution of the annuities market in recent years.

To assess the value of an annuity we calculate the present value of the expected payments promised by the firm and we compare it to the amount of money paid by the retiree to the firm. In the academic literature there is an established methodology to calculate the value of an annuity which is known as the Money's Worth (MW) of annuities. This depends on three sets of parameters: annuity rates, the rates used to discount future annuity payments (linked to gilt yields) and expected future mortality rates. It is the combination of these three factors that determines the value that retirees get from annuities. Focusing on the evolution of annuity rates in isolation can give a misleading picture of the market, while the MW framework combines these aspects in a single factor.

In the second part of the paper, we compare annuities to other strategies that might be used to fund a person's retirement. We analyse other strategies that retirees can adopt when they retire that approximately mimic the choices that are available to them in the future market

1 www.fs-cp.org.uk/publications/pdf/annuities%20position%20paper%2020131203.pdf

2 www.investmentfunds.org.uk/assets/files/press/2008/20080311-02.pdf

3 www.fca.org.uk/news/tr14-02-thematic-review-of-annuities

4 See below for an intuitive definition of the MW of annuities and Section 3 for a formal definition.

landscape. The reforms to pension incomes announced in the 2014 Budget⁵ will give retirees greater flexibility and wider choice in how to consumer the pension pot. We compare a number of metrics for various strategies such as the amounts that can be consumed each year, the probability of exhausting the pension pot in old age and the likelihood of recovering the initial amount. We also incorporate different levels of fees in our analysis when strategies involve investment risk as they are particularly important in understanding what outcomes can be achieved.

1.1 Research issues

We consider several questions in the first part of this report. The first and more important one is: do we observe a deteriorating pattern in terms of the value that annuity products provide to retirees? To answer this question we have calculated the MW of annuity products over the period 2006 to 2014. In addition to that, we calculate the impact of changes in interest rates and mortality assumptions on the annuity payments. Moreover, we compare the MW across different products and consumer profiles and between annuities bought in the Open Market and annuities bought from the pension accumulation provider. Finally, we perform some sensitivity analysis to see how much MW changes as a result of a change in the discount rates and in the mortality assumptions.

In the second part of the paper, we assess risks in the future landscape to understand when early FCA intervention would be warranted to avoid the crystallisation of bad outcomes for retirees. Essentially there are two trade-offs that consumers will make in the future landscape if they do not purchase an annuity. The first is that retirees may face the risk of exhausting the pension pot (e.g. living longer than their funds last or when investing in risky assets of suffering poor investment returns so that they exhaust their funds sooner than expected). Second, consumers may draw a smaller, or more volatile, income than could be gained under alternative strategies, including annuities.

We therefore ask the question, do alternative strategies for pension decumulation provide a better solution for consumers compared to annuities? We investigate the income that consumers could receive compared to the annuity and the probability that consumers may exhaust their pension pot. We also looked at whether the annuity is purchased on the open market or from the pension accumulation provider significantly affects the results of this comparison. We looked at four different alternative strategies:

- **self-annuitise** (take the same income as an the average annuity quote for a level annuity)
- **amortise to 85** years old (take the a constant nominal income each year until 85 years old at which point funds are exhausted, hereafter 'amortise to 85')
- **amortise to 100** years old (take a constant nominal income each year until 100 years old at which point funds are exhausted, hereafter 'amortise to 100')
- consume each year a fraction of the retirement pot depending on life expectancy at that time (i.e. consume 1/20th of the pot if you expect to live 20 years, hereafter ' $1/LE$ '⁶)

⁵ www.gov.uk/government/news/budget-2014-support-for-savers-announced

⁶ Under a drawdown strategy, if the retiree has a life expectancy of 20 years then they will draw 1/20th of their pension pot as their annual income. The following year they will do the same based on their new remaining life expectancy. If their life expectancy was 19.5 years then they will draw 1/19.5th of their pension pot as income in the following year.

We also consider two of these strategies (self-annuitise and the drawdown strategy based on life expectancy), where retirees take on investment risk, in this case by investing in the FTSE 100.

1.2 Background

In 2013 UK consumers bought around 350,000 annuities for a total of approximately £11.9bn. The value of annuity sales fell by 15% in 2013 compared to 2012 and it is expected to decrease further in 2014. In the first half of 2014 £4.3bn of annuities were sold. Average premium increased from around £25,000 in 2008 to more than £33,000 in 2013. Table 1 shows the number and the value of annuities sold between 2008 and 2014. The median pension fund in 2013 is around £20,000.

Table 1: Annuities sold by number and value between 2008 and 2014⁷

	2009	2010	2011	2012	2013	2014H1
Number of annuities sold	462,000	426,000	393,000	420,000	353,000	121,000
Value of annuities sold	£10.8bn	£11.0bn	£11.3bn	£14.0bn	£11.9bn	£4.3bn
Average pension fund	£23,375	£25,874	£28,714	£33,455	£33,671	£35,389

1.2.1 Age of annuitants

In the first quarter of 2014, 62% of annuitants bought an annuity before they turned 65 and 24% bought an annuity when they turned 65. These figures are similar for 2013. Table 2 shows the age of annuitants in 2013 and first quarter 2014.

Table 2: Age of annuitants in 2013 and first quarter 2014⁸

	2013	2014Q1
Under 65	61.8%	61.9%
65	24.5%	23.6%
Above 65	13.7%	14.5%

1.2.2 Proportion of enhanced annuities

Enhanced annuities have become more popular over the years. Table 3 shows the increase in enhanced annuities since 2008.⁹

Table 3: Value of standard and enhanced annuities sold between 2008 and 2012

	2008	2009	2010	2011	2012
Standard annuities	£9.6bn	£8.9bn	£8.2bn	£7.6bn	£8.9bn
Enhanced annuities	£1.5bn	£1.5bn	£2.2bn	£3.0bn	£4.5bn

⁷ Data taken from ABI website: www.abi.org.uk/

⁸ Data taken from ABI website.

⁹ Data taken from ABI website. The difference between total market size and standard plus enhanced annuities volumes represents the volume of with profit and investment-linked annuities.

1.2.3 Proportion of annuities bought in the Open Market

Here we compare the proportion of value of annuities bought internally (i.e. from the pension accumulation provider) against the annuities bought using the Open Market Option (OMO). The value of pension funds of annuitants opting for the open market increased every year between 2009 and 2012. Table 4 shows the trend.

Table 4: Proportion of pension funds of people opting for the open market, by value¹⁰

	2009	2010	2011	2012
Internal annuities	50.1%	46.2%	43.4%	39.6%
OMO annuities	49.9%	53.8%	56.6%	60.4%

1.2.4 Type of products

Annuities come in a variety of shapes. The simplest is a single-life level annuity. It provides a fixed regular payment until the annuitant dies. There are a number of different ways in which the annuity can be altered from this standard product and these changes can be combined. These differences include:

- **joint life** – the annuity payments are dependent on two lives rather than one (sometimes payments fall on the death of the primary annuitant)
- **escalating** – the payments increase each year in line with some predetermined formula (e.g. the rate of RPI or a fixed percentage) and
- **guarantees** – a guarantee annuity guarantees the payments for a pre-agreed number of years (usually five or ten years). If the annuitant dies before the guaranteed period ends, the payments go their estate.¹¹

1.3 Regulatory environment and recent changes

HMRC sets the rules for pension providers and individuals with regard to the specific divestment options and timings available to them. Before the 2014 Budget announcement, individuals could choose to take their entire pension as a lump sum if their total pension holdings were worth £18,000 or less and they were over 60 years old, under 'trivial commutation'. The threshold amount for trivial commutation is set by the Treasury on an annual basis. Individuals can also choose to take individual pensions pots accrued at different providers, if they are worth £2,000 or less. Only 75% of the lump sum was taxable at standard income tax rates (usually at the basic rate). Even if individuals do not use trivial commutation, they could choose to take up to 25% of their pension pot as a tax-free lump sum.

Under tax rules people are able to access their pension from the age of 55. The tax rules do not set an upper age limit on when consumers must start taking their pension, although individually pension agreements may do so. Some pension agreements include automatic annuitisation at the age of 75. This is likely to be a legacy issue from previous tax rules that meant that individuals must 'secure an income' by age 75, either through purchasing an annuity, or through income drawdown.

¹⁰ Data from ABI website: www.abi.org.uk/

¹¹ See the Glossary for a definition of the different types of annuities.

In 2011 the Government relaxed the compulsory annuitisation requirements for individuals who could demonstrate that they had a guaranteed minimum income in retirement of £20,000.

The 2014 Budget announcement allowed greater flexibility to retirees. Retirees with a pension pot up to £30,000 will be able to take it entirely as cash under 'trivial commutation' (as opposed to under £18,000 before the Budget). Individuals with multiple pots will be able to take up to three pensions worth £10,000 each as cash as opposed to two worth £2,000 or less. Moreover, retirees who opt for income drawdown will be able to take larger sums.

In addition to the Budget announcement, a number of recent regulatory interventions may have had a significant impact in the market.

The FCA's Retail Distribution Review (RDR) changed, among other things, the way advisers charge for advice. The RDR increased transparency requiring financial advisers to disclose upfront the cost of the advice. The RDR has been in place since the start of 2013 (Financial Conduct Authority (FCA), 2012). We note that the RDR only applies to advised sales, and commission can still be paid on non-advised sales.

The European Court of Justice ruled that in order to guarantee equal treatment between men and women, the use of gender as an actuarial factor must not result in differences in premiums and benefits for insured individuals. Consequently, from December 2012, the annuities rates offered to men and women were equalised. We assess the impact of this ruling in section 4.1.

Solvency II is the new prudential capital requirements regime for insurers. It is expected to come into effect in January 2016, replacing the previous ICAS regime. According to analysis by the Prudential Regulation Authority, in CP16/14 suggests no material changes in capital are expected compared to the current regime and market expectations (Prudential Regulation Authority, 2013, p. 44).

In February 2014, the FCA published a Thematic Review into the annuities market. It found that most consumers could get a better deal on the open market and considered the potential drivers of provider and consumer behaviours.

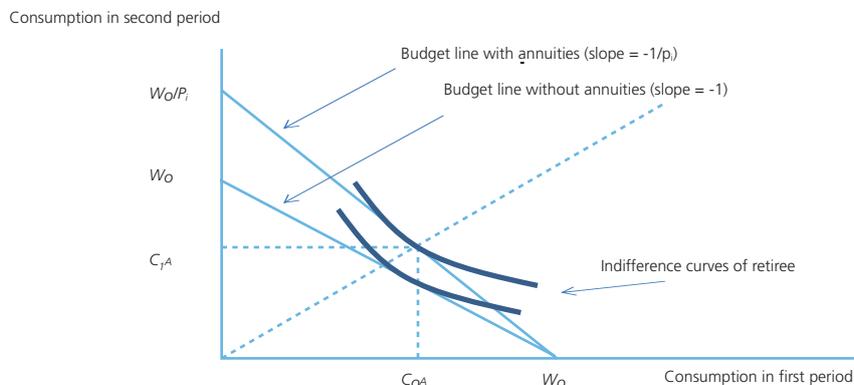
2. The theoretical framework

2.1 Economic benefits of annuities

From an economic perspective annuities are an insurance product that protects retirees from the 'risk of living too long' or, more precisely, the risk of outliving their assets. The reason why annuities can contribute to economic welfare is that by pooling the individual risk across large cohorts of retirees they can reward those retirees that survive with higher returns than they could otherwise obtain on the market. In other words, those people that survive enjoy a mortality premium generated by the fact that only a subset of the cohort will continue to receive payments at future dates. This is still true in a market with individual underwriting (which is becoming more and more popular) as retirees still benefit from pooling their risk with other retirees possessing similar characteristics.

The benefit of an annuity can be illustrated with a simple example (Cannon & Tonks, Money's Worth of pension annuities, 2009). Consider the decision problem of a person who has just retired and has accumulated an amount of wealth W_0 . She must now decide how much to consume over the two remaining periods of her life (let us call c_0, c_1 the consumption in period $t = 0$ and in period $t = 1$.) However, the retiree does not know whether she will be alive in the last period or not with certainty. The probability of individual i surviving is p_i . For simplicity, assume that, if she knew with certainty that she would survive in the last period, she would like to consume the same amount of wealth each period i.e. $c_0 = c_1 = W_0/2$ and that it isn't possible to invest wealth so that it grows over time.

Figure 1 illustrates the decision problem of the retiree (Cannon & Tonks, 2009). The horizontal axis represents consumption in the first period and the vertical one consumption in the second period. The budget constraint is represented by the line W_0 as the retiree could consume all her wealth in one of the two periods. In the absence of an annuities market, let us consider the situation where the retiree consumes more than $W_0/2$ in the first period, given that it is possible that she may not be alive and the rest of her wealth would therefore be 'wasted'. This solution is inefficient though. Those retirees that survive will not consume the same amounts in the two periods (as they would like to do) and for those retirees that do not survive part of their wealth will remain unconsumed.

Figure 1: Economic benefits of annuities

If a market for annuities exists, however, overall welfare increases. The retiree would pay an annuity premium $W_0 - C_{0^A}$ to the annuity provider and consume the rest of her wealth in the first period. If the retiree is alive in the second period then she will receive an income C_{1^A} from the annuity provider while she would not receive anything if she does not survive.

If the contract is fairly priced, so that the annuity provider distributes to the retirees that survived all the premiums it collected, it follows that $W_0 - C_{0^A} = p_i C_{1^A}$. Given that $p_i < 1$, it is clear that consumption for surviving retirees is unambiguously higher in both periods.

As illustrated in the figure, access to the annuities market expands the possibility of consumption for all retirees and therefore, when there is uncertainty about surviving in the second period retirees are always better off participating in the annuities market, all else being equal.

2.2 How much of their wealth should people annuitise?

The stylised example discussed above highlighted that annuities have the potential to increase welfare for retirees. However there are stronger results that are found in economic literature. A particularly well-known result is that, under restrictive conditions, upon retirement consumers should annuitise all of their savings (Yaari, 1965). More recent contributions remove many of the restrictive conditions that were part of the initial contributions and show that, although full annuitisation is not always optimal, it is very difficult to obtain scenarios in which retirees should not annuitise at least two thirds of their wealth.

Another paper discusses a number of scenarios and demonstrates the following results (Davidoff, Brown, & Diamond, 2005).

First, if markets are complete (i.e. they exist for all types of assets and future dates) and retirees have no bequest motives, full annuitisation is optimal as long as the net rate of return of annuities is higher than the return on an asset with the same financial risk, given that retirees that survive can rely on the mortality premium associated with the death of other retirees.

Second, if markets are not complete, it is still optimal to annuitise part of a retiree's wealth. This result is robust to many definitions of 'incompleteness' and applies to incomplete annuity markets (e.g. a market in which only level annuities are available while inflation-protected ones are not) or to incompleteness of other markets (e.g. it is impossible to insure against lumpy expenditure such as an unexpected medical bill).

Third, the presence of bequest motives reduces the attractiveness of annuities but does not eliminate it.

Many of the reasons why full annuitisation may not be optimal are linked to the desired consumption pattern of retirees. For instance, a retiree that is hit with a large medical bill would 'desire' higher consumption at that time while another retiree may want to consume more in the early years of her retirement when she expects to be more active relative to later years. Davidoff et al conduct various simulations assuming different desired consumption patterns and calculate the optimal share of wealth that should be annuitised. Even with the most extreme assumptions, they cannot generate results in which less than two thirds of wealth should be used to purchase an annuity.

Using a different framework, very similar results have been obtained (Peijnenburg, Nijman, & Werker, 2013a) (Peijnenburg, Nijman, & Werker, 2013) by examining the decision problem of a person who is about to retire and faces uncertainty about the timing and amount of health expenditure and the probability that the annuity provider might default on its obligations. These people have access to actuarially fair annuities and can have different preferences about bequests.

The authors conclude that full annuitisation remains optimal in many circumstances and that partial but substantial annuitisation is always optimal. Interestingly, these authors include calculations that show the optimal level of annuitisation for people that have different levels of wealth at retirement. Even in circumstances that reduce the attractiveness of annuities (in their setting, when health costs can be high in the initial years after retirement) they show that people with a 'moderate' amount of wealth (up to \$300,000, including state pension benefits) should annuitise two thirds of their wealth when they retire. People with lower levels of wealth should annuitise more than this fraction and people with higher levels less. In all cases however, the optimal amount to be annuitised is above 50%. However, the importance of out-of-pocket health expenses is considerably larger in the US than in the UK and so the effects highlighted in the paper are somewhat less important in our context.

The economic literature is therefore quite clear: for the vast majority of people, annuitising a substantial part of their wealth at retirement is very likely to be the right choice under a number of scenarios. The conclusions are strongest when annuities are fairly priced, if many different types of annuities exist in the market so that different preferences can be catered for and if health costs (or any unexpected and uninsurable expenditures) are unlikely to be high in the years that immediately follow retirement.

A report, published in 2009 by the European Fund and Asset Management Association (EFAMA) (Maurer & Somova, 2009), argues for a plurality of products at retirement; other authors reach similar conclusions, especially for older annuitants. They suggest that full annuitisation is not optimal at retirement, as retirees would benefit from staying invested in risky assets and reaping the rewards, but they also suggest that full annuitisation becomes optimal once retirees reach age 85-90. For less wealthy retirees annuities become optimal earlier.

2.3 When should people annuitise?

There is a vast literature that attempts to answer the question of when people should buy an annuity and to identify the drivers of this choice. For example, Boardman¹² argues that, given that the chances of dying at age 65 are very low, the mortality premium for the annuitants who survive will consequently be low as well. For this reason, an annuitant may delay annuitisation. This is a viable strategy if the retiree employs drawdown or has other sources of income and it bears the risk of the interest rates decreasing. Gerrard, Højgaard and Vigna¹³ consider the problem of a defined contribution pensioner who defers annuitisation of the pension fund and decides on investment allocation, consumption strategy and time of annuitisation. They find the reasonable result that deferring annuitisation is optimal if either there are large expected rewards for taking risk¹⁴ or the pensioner has low risk aversion.

Another study (Dushi & Webb, 2004) argues that annuity demand should be higher for single individuals than for couples, and therefore individuals would decide to annuitise after the death of their spouse. Finally, Blake, Cairns and Dowd investigate the optimal age of buying an annuity and the optimal exposure to equities. They find that the optimal age to annuitise depends on the bequest utility and the investment performance of the fund during retirement¹⁵.

The literature shows there are lots of factors that will affect the optimal time to annuitise and therefore there is not a simple rule to determine when this time is.

2.4 The importance of costs

The stylised discussion summarised in Figure 1 is based on the assumption that annuities are 'actuarially fair' i.e. that all the premiums collected from the retirees that do not survive in the second period are distributed to those that do. The results of the economic literature briefly summarised above also stress the importance of actuarially fair annuities.

In practice, however, actuarially fair annuities are unlikely to exist: annuity providers incur administrative costs and bear risk associated with annuity business and as such cannot distribute all the premiums collected to surviving retirees. For instance they are exposed to the risk that their estimate of future mortality rates is wrong or the returns on the assets in which the premiums are invested may be lower than expected. In addition, insurers hold reserves and regulatory capital, which increase the cost of an annuity. Finally, providers also take decisions that are influenced by the overall functioning of the market and, if competition is not working properly, they may be able to charge prices that are above the competitive level. All these factors can reduce the economic benefits that annuities can provide.

In addition, there are other factors such as bequest motives and different preferences for consumption at different points in time that become more important for retirees when deciding how much of their wealth to annuitise. Understanding how close to the 'actuarially fair' benchmark annuities available in the UK have been in the past (and currently are) would help us analyse whether the overall performance of annuities has deteriorated in recent years.

¹² See (Boardman, 2006).

¹³ See (Gerrard, Højgaard, & Vigna, 2012)

¹⁴ Specifically the paper states that deferring annuitisation is optimal when the Sharpe ratio is high.

¹⁵ See (Blake, Cairns, & Dowd, 2003).

3.

The Money's Worth framework

The MW framework brings together the different elements that make up the value of an annuity: future mortality projections, annuity rates and discount rates for future payments. In practice it entails calculating the ratio between the expected present value of expected future payments and the value of the initial payment (i.e. the annuity premium). It is conceptually equivalent to the claims ratios that are calculated for general insurance products: a measure of what share of the premiums collected are repaid to those customers that make a claim on the insurance policy.

$$\text{Money's Worth} = A_t \sum_{i=1}^T \frac{\pi_{t,t+i}}{(1 + R_{t,i})^i}$$

For the simplest annuity contract of a level annuity with no guarantee the MW can be calculated as follows:

Where t is the time of purchase, A_t is the annuity rate¹⁶ at time t , $\pi_{t,t+i}$ is the probability that a retiree will live i more periods, $R_{t,i}$ is the discount rate applying between time t and $t + i$,¹⁷ and T is chosen so that there is a negligible probability that the retiree will be alive at time T .

Clearly annuity rates would differ for annuitants of different ages¹⁸ and so would the probability of surviving i periods. Therefore the MW has to be calculated with reference to specific ages and gender.

If discount rates can be identified unambiguously and the survival probabilities can be estimated correctly then the only parameter that affects the MW would be the annuity rate. MW is typically lower than 100%. A 100% MW means that providers expect to return all premiums to consumers in incomes, without covering any costs of providing the annuity or without taking into account any potential cross selling of other products.

This is true if life insurers invest in the same assets (government bonds) that we are using to discount payments. However, while life insurers do invest in government bonds they invest in corporate bonds and sometimes in equities as well, providing them higher yields. Consequently, if these higher yields are partially passed through to consumers it may result in the MW being greater than 100%, if future annuity payments are discounted back at the risk-free rate. Further, firms may expect mortality to be higher than our projections and this may generate MW greater than 100%. Other factors that may affect MW are interest rates shocks for which insurers do not adjust quickly enough, and the lack of ability to price on gender.

¹⁶ The annuity rate is simply the annual income received from the annuity divided by the premium. So if a retiree were to receive £1,000 per year for every £10,000 she would pay the annuity provider the annuity rate would be 10%.

¹⁷ At any point in time t we use the whole yield spot curve.

¹⁸ Until December 2012 rates would have been different for male and female annuitants, but this is now illegal in the EU.

If reliable data were available on the size and components of the costs faced by annuity providers, one could assess how much of the gap between calculated MW and 100% could be attributed to these costs and how much to other factors. In practice, however, it is particularly difficult to estimate the magnitude of these costs. First, nearly all annuity providers are active in a number of other market segments (e.g. life insurance, saving products, etc.) and apportioning the costs relevant to the annuity business is no trivial job. Furthermore, an annuity provider may have a different cost of capital from its competitors because of its size and specific asset profiles.

In practice, there are also disagreements on the appropriate discount rates to use and establishing a consensus view on future mortality rates is particularly complex. For example, insurers may not be able to purchase assets that perfectly match the cash flows that they need to pay to annuitants, and therefore face interest rate risk. As such, it is not easy to determine whether any deviation from 100% MW is due to market specific features, such as excessive administrative costs or lack of competition. It is possible that the deviations could be due, at least in part, to the survival probabilities and discount rates being wrongly specified.

However, clearly it will still be informative to look at the development over time of MW estimates as they would be less dependent on particular assumptions and a sensitivity analysis can be carried out to establish how large the uncertainty due to different survival probabilities and discount rates would be.

For other types of annuities such as guaranteed, joint or escalating¹⁹ ones the formula needs to be modified to take different characteristics into account. However, the underlying framework is the same: to obtain the present discounted value of the future payments, adjusting for the probability that these payments will be made (see the Glossary for a formal definition).

3.1 Previous assessments of the MW of annuities in the UK

The MW approach has been extensively used to analyse annuities in various countries around the world. In the UK there are a number of studies that estimated the MW of annuities.

One of the first studies (Finkelstein & Poterba, 2002), using data from August 1998, showed that the MW of annuities was 90% for a £10,000 pension pot and 91% for a £50,000 pension pot (65-year-old annuitant). It also showed that the MW declined with age so that buying an annuity when younger offered better value for money.

A DWP report documented a reduction in the MW from 95% in 2000 to 85% in 2007 for a 65-year-old male retiree with a £10,000 pension pot (Cannon & Tonks, 2009). It suggested that life insurers were pricing improvement in life expectancies into annuities which were not yet reflected in the mortality tables that were publicly available. It concluded that over the considered period, annuities represented good value for money. It also suggest that the MW over the same period did not decline with age, once mortality improvements are taken into account and that buying an annuity became better value as people age.

Another study provided (Cannon & Tonks, 2013) more recent estimates of the MW and show that between May 2004 and April 2012 MW of level annuities for a 65-year-old male retiree with a £10,000 pension pot was on average 86%.

¹⁹ For a definition of the different types of annuities available in the market, see the Glossary.

3.2 Data sources and methodological issues

3.2.1 Annuity rates

Our source for the data on annuity rates is Moneyfacts. It gave us a very comprehensive dataset of annuity quotes from January 2006 up to June 2014. Quotes are provided for a large number of annuity contracts. Single life and joint annuities (with and without reduction on the first death); annuities with and without a guarantee; different ages of the annuitant(s); two different pot sizes (£10,000 and £50,000) and standard and enhanced annuities are included. Quotes are available for a number of providers on the open market and Moneyfacts also calculates the best, worst and average quote available on the market. Quotes are presented as the yearly payment that can be obtained by buying an annuity. Even taking into account only the mean, best and worst quote we have in excess of 2,000 quotes for every month.

One thing that should be noted is that annuity providers may compete more fiercely (and therefore offer better rates) for pension pots that amount to a rounded number (i.e. £10,000 and £50,000). This is because such pots may be used as a reference to compare firms and may end up in price comparison websites. Consequently, the MW calculated using these quotes may be a slight overestimate of the MW that can be obtained with different pot. Table 5 and Table 6 below present an example of standard OMO quotes we have.

Table 5: Moneyfacts quotes for June 2014, £50,000 pot (income per year payable monthly in arrears for single life, standard annuities available on the open market)

Annuity type		Age				
		55	60	65	70	75
Level, not guaranteed	Best	£2,460.00	£2,689.00	£3,016.00	£3,432.00	£4,029.00
	Average	£2,324.81	£2,544.23	£2,878.84	£3,253.12	£3,849.10
Level, guaranteed 5 years	Best	£2,456.76	£2,682.00	£3,003.00	£3,402.00	£3,993.12
	Average	£2,322.44	£2,540.43	£2,869.84	£3,234.26	£3,800.10
Escalating 5% per year	Best	£1,059.48	£1,271.88	£1,589.04	£2,010.84	£2,625.60
	Average	£969.28	£1,178.12	£1,491.89	£1,851.01	£2,420.88
RPI linked	Best	£1,224.56	£1,418.88	£1,781.73	£2,185.33	£2,932.91
	Average	£1,170.73	£1,386.89	£1,715.33	£2,083.13	£2,665.58

Table 6: Moneyfacts quotes for June 2014, £10,000 pot (income per year payable monthly in arrears for single life, standard annuities available on the open market)

Annuity type		Age				
		55	60	65	70	75
Level, not guaranteed	Best	£448.08	£496.00	£561.00	£643.56	£804.24
	Average	£423.54	£470.28	£535.72	£608.84	£727.62
Level, guaranteed 5 years	Best	£447.60	£495.00	£559.00	£638.04	£788.04
	Average	£423.05	£469.27	£533.74	£604.64	£716.44
Escalating 5% per year	Best	£195.36	£240.96	£296.88	£377.04	£525.24
	Average	£173.40	£215.57	£275.33	£347.94	£461.00
RPI linked	Best	£221.64	£268.56	£338.40	£440.52	£593.64
	Average	£210.88	£255.01	£317.26	£392.40	£508.11

To make the analysis manageable we have therefore focused on a subset of quotes. We have decided not to focus on enhanced annuities given that the definition of 'enhanced' varies across companies and time, that we could not obtain information on mortality that is specific for annuitants in ill health, and that it is very difficult to obtain quotes that are truly comparable. Moreover, we are not aware of any study that estimates the MW of enhanced annuities. We focus instead on standard annuities and focus our analysis on single life contracts with different shapes.²⁰ The growth of the enhanced annuities market will have resulted in fewer annuitants in poor health purchasing standard annuities and therefore those purchasing standard annuities will have lower mortality than the average annuitant. We are not making any specific assumptions to deal with the growth of the enhanced market.

3.2.2 Discount rates

Previous studies have used two sets of data to discount the future payments of annuities: 'risk-free' rates calculated on the basis of government bond yields and risky rates based on the yield of corporate bonds. The higher the discount rates used in the analysis, the lower the MW will be (all other things being equal). This is because the present value of future payments will be lower as they will be discounted at a higher rate.

Given that we are mainly interested in assessing the development over time of the MW rather than its specific level the choice is not crucial for our purposes: provided that the same methodology is applied consistently across time the observed trends would not be materially affected. What would be affected is the level of the MW.

In our view it is more appropriate to discount future payments using risk-free rates for a number of reasons:

- First, the risk-free rate approximates the preference of retirees (and society more generally) for consumption today compared to consumption in the future. As such it is more appropriate to discount payments that will occur with certainty (conditional on the annuitant being alive).

²⁰ By 'shape' we mean the profile of the payments of the annuity. For example, escalating or level annuities, or annuities with guarantees.

- Second, it proxies the opportunity cost of buying an annuity. Retirees could buy a portfolio of government bonds to obtain a certain stream of future payments.²¹
- Third, it is easy to obtain reliable estimates of risk-free rates by using the term structure of nominal and real interest rates published monthly by the Bank of England.
- Fourth, it avoids many complications on determining an ‘appropriate’ risk premium both in terms of deciding which bonds to include in a risky portfolio and on the best way to estimate the premium.
- Finally, there aren’t many corporate bonds that have a maturity of more than 10 or 15 years that could be matched to the profile of annuities. Corporate bonds are also quite illiquid and retirees could not easily buy or sell them in the UK, even if they wanted to.

A risky yield, however, can provide us with useful information on whether the market has been operating at a level close to the competitive one. Annuity providers can clearly obtain yields in excess of the risk-free rate and, at a minimum, should be able to obtain an illiquidity premium by investing in less liquid bonds and holding them to maturity. One should therefore expect the price of annuities to reflect these higher yields. Coupled with a reliable estimate of the operational costs of the annuity business the MW calculated in this way could give us an idea of how far from the competitive benchmark the market is operating. However, any trend present in the MW should be materially unaffected by the yields used and obtaining meaningful estimates of operating costs is particularly complex. We therefore present some sensitivity analysis that uses a risky rate to discount future payments.

3.2.3 Survival probabilities

The estimation of survival probabilities is a very complex issue and it is constantly debated in the actuarial and academic community. In this study we focused on the future survival probabilities of people that bought an annuity in the period 2006 to 2014. Survival probabilities are estimated on the basis of an assessment of (future) mortality rates.²²

Mortality assumptions are typically broken down into two components: base mortality rates and rates of mortality improvement. Base mortality rates are those that are assumed to apply at the relevant date. Rates of mortality improvements are the expected changes in mortality rates in the future as a result of improvements in lifestyles, medical science, etc. It is generally assumed that mortality improvements will (in aggregate) be ‘positive’, i.e. mortality rates will decrease and survival probabilities will increase as time goes on.

As a starting point for base mortality rates we have used the ‘life office pensioner’ category of the tables produced by the Continuous Mortality Investigation (CMI) of the Institute and Faculty of Actuaries. These tables reflect the mortality experience of pensioners insured under life office pension schemes (such as DC schemes administered by life insurers) and are therefore a good match for our purposes. An alternative would have been to use Office for National Statistics (ONS) mortality tables, but these reflect the experienced mortality of the population as a whole and are therefore deemed less suitable. In addition, ONS tables only include mortality information up to 100 years of age while the CMI tables include ages up to 120.

21 In practice retirees would incur costs that are likely to be significant (especially for smaller pot sizes) to adopt this strategy so the risk-free rate is probably an overestimate of the opportunity cost. For instance buying gilts directly from the Debt Management Office incurs a 0.7% fee for purchases below £5,000 and 0.375% for any amount exceeding £5,000. The same fees apply if investors want to sell the bonds.

22 See the attached appendix on ‘Mortality assumptions for value for money calculations’ for a detailed description of the assumptions used.

It is generally acknowledged that the growth of the enhanced annuity market will have resulted in a selection effect in the mortality rates of those purchasing standard annuities. Put another way, those DC pensioners who were in ill health were more likely to purchase an enhanced annuity, meaning that the mortality rates of those purchasing standard annuities are likely to be lower than the average DC pensioner. The effect of the 2014 Budget announcement on enhanced annuity is uncertain. However, if those more retirees in ill health purchase fewer standard annuities as a consequence of the increased flexibility, this will exacerbate the adverse selection effect against standard annuity. However, no data is publicly available with which to directly measure this impact, and this effect is likely to have varied significantly during the period under consideration. We can expect that the retirees who decide to annuitise will live on average longer, which will have a negative impact on annuity rates. The effect on MW is difficult to estimate, because it will be a combination of annuitants living longer (which has a positive impact on MW) and lower annuity rates (which has a negative impact on MW). No formal attempt has been made to allow for this anti-selection effect explicitly in the MW calculations.

Unfortunately, the dataset of life office pensioners does not provide data that can be easily used to generate mortality trends for annuitants. Therefore we have to rely on alternative sources to estimate future mortality improvements. Standard industry practice is to treat improvements in population mortality rates as a proxy for improvements in the mortality rates of the group of lives that are of interest.

To reflect the fact that industry practice in this area changed multiple times over the period that we are analysing we use different assumptions on mortality improvements for purchases before and after 2010. For purchases before 2010, for males, mortality improvement assumptions are in line with the CMI's Medium Cohort projection (with an appropriate underpin) from the PCML00 and PCMA00 tables, which was common practice amongst practitioners at that time. For females, mortality improvements are assumed to be in line with 75% of the Medium Cohort (with an appropriate underpin) from the PCFL00 and PCFA00 tables. This is because females have historically exhibited lower rates of mortality improvement than males, and using 75% of the Medium Cohort table to reflect this was common practice in the industry.

For purchases before 2010, we adjust longevity improvements using an 'underpin' of 1% for males and 0.75% for females. This ensures that improvements never fall below 1% p.a. (0.75% p.a. for females), and is broadly in line with observed market practice at the time.

For purchases in 2010 and beyond, mortality improvements are taken from an appropriate iteration²³ of the CMI's mortality projections model. This is a model that projects future rates of mortality improvement by blending a statistical projection of historical England and Wales' population improvements into a long-term rate of improvement that is specified by the user.

All mortality improvement assumptions are deemed to apply from 30 June 2000, which is the effective date of the base mortality tables being used. Annex B summarises the assumptions used.

3.2.3.1 *Lives and amounts*

The life office pensioner tables are split into tables that are 'lives-based' and 'amounts-based'. Amounts-based tables weight the mortality experience by the pension amount of the individual, and therefore the mortality rates of those retirees with large pension amounts contribute

²³ The mapping of purchase dates onto an appropriate mortality improvement assumption is an approximate exercise based on an estimate of approximate periods during which industry practice evolved. Actual approaches to mortality improvements will have varied widely between firms.

proportionally more to the overall mortality rates than those retirees with smaller pension amounts. In our following analysis, we used 'lives-based' mortality estimates for £10,000 pension pots and 'amount-based mortality' for our baseline scenario with £50,000 pension pots.

4. Results of the Money's Worth analysis

4.1 Central scenario

We have calculated the MW for a number of different annuity contracts, ages and time periods. To present the results of our analysis, if we do not specify otherwise in the text, we refer to a 65-year-old male annuitant with a £50,000 pot as our 'baseline profile'. We choose this profile because ABI data suggest that 24% of UK consumers buy an annuity when they turn 65 and that the median pot size is around £20,000 and the mean pot size is around £35,000 in 2014. This has steadily increased in recent years.

As explained in the previous section, the MW is based on three pieces of information: annuity rates, interest rates to discount future payments and future longevity assumptions. We first show the evolution of each of these sets of data separately, and then we present the results on MW.

It is clear that annuity rates have declined over the relevant period and this can be a factor that drove the perception that annuities are poor value for money. However the decline in annuity rates was accompanied by a decline in interest rates and an increase in estimates of life expectancy. As such, it is difficult to say what has happened to the MW of annuities only on the basis of annuity rates.

Figure 2 shows the annuity rates and the life expectancy for a 65-year-old annuitant over the relevant period and the fall of annuity rates is contemporaneous with the increase of life expectancy.

Figure 2: Average annuity rates available for a 65 year old with £50,000 pot and the life expectancy projection, January 2006 to June 2014²⁴

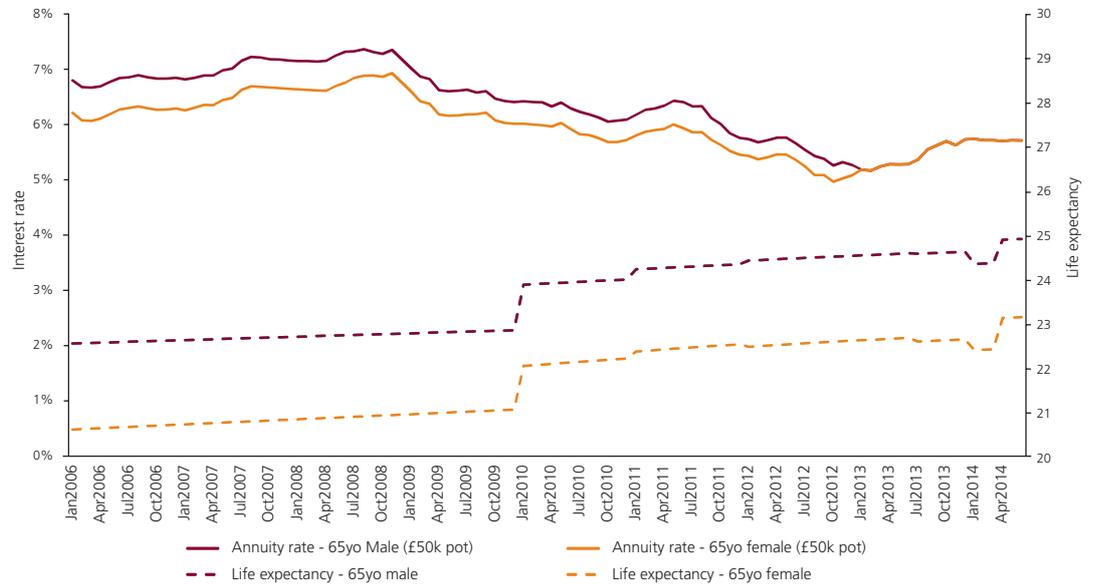


Figure 3 shows the evolution of a 10-year gilt and it illustrates how interest rate fell over the relevant period until mid-2012 and how it increased after May 2013. The evolution of a 10-year gilt could be seen as a reference point for the investment returns a firm may achieve and it therefore affects the rates annuity providers can offer. The yield of a 10-year gilt increases starting from July 2012 and it can be noted that annuity rates increase at the beginning of 2013.²⁵

Figure 3: Yields of a 10-year gilt

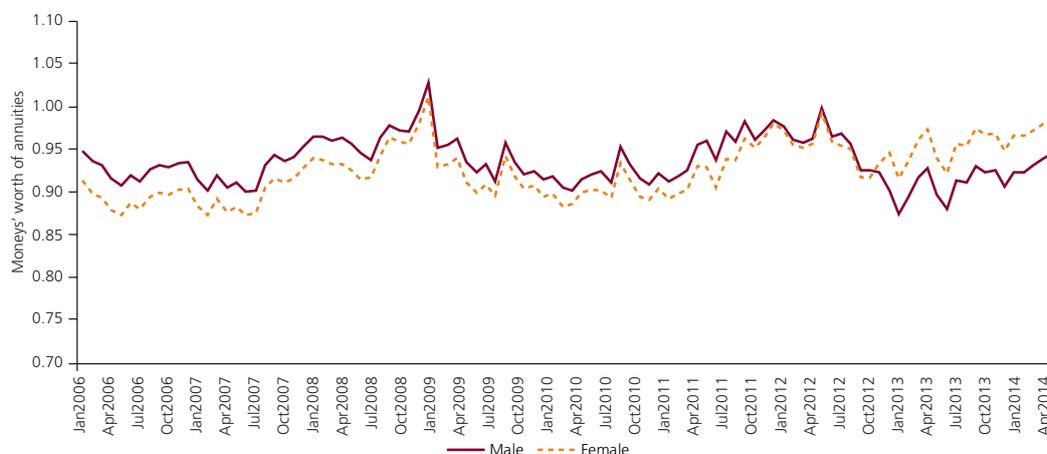


²⁴ The jumps in the life expectancy data are the result of updating our model for new mortality information which takes place at discrete points in time.

²⁵ To calculate the MW of annuities we used the whole spot curve and the 10-year gilt is shown here exclusively to illustrate the trend.

Figure 4 reports the calculated MW for a level annuity without a guarantee for our baseline profile. Inspection of the graphs suggests no increasing or decreasing trend is present in the data: the MW of annuities remained approximately constant. For our baseline profile approximately 94% of the premiums gathered by insurance firms are handed back to retirees throughout the period (after adjusting for the time value of money). This amount, or MW, is reasonably stable between 2006 and 2014. Moreover, our calculations show that smaller pots return a lower MW of annuities. Figure 5 shows that for annuities bought with £10,000 pots this percentage is lower at around 87%.

Figure 4: MW of annuities, 65-year-old annuitants buying with £50,000 pot²⁶



Another way of looking at MW is to measure the reduction in yields required for consumers to get their premiums back (see Annex D). Over the period, on average, annuitants with a £50k pension pot are receiving 0.65% a year less than would be expected given the rates available on government securities. This could be viewed as a hypothetical annual management charge for the annuity. This does not seem large when compared to the costs that are levied other forms of investment and given that consumers are also transferring their mortality risk to the annuity provider.

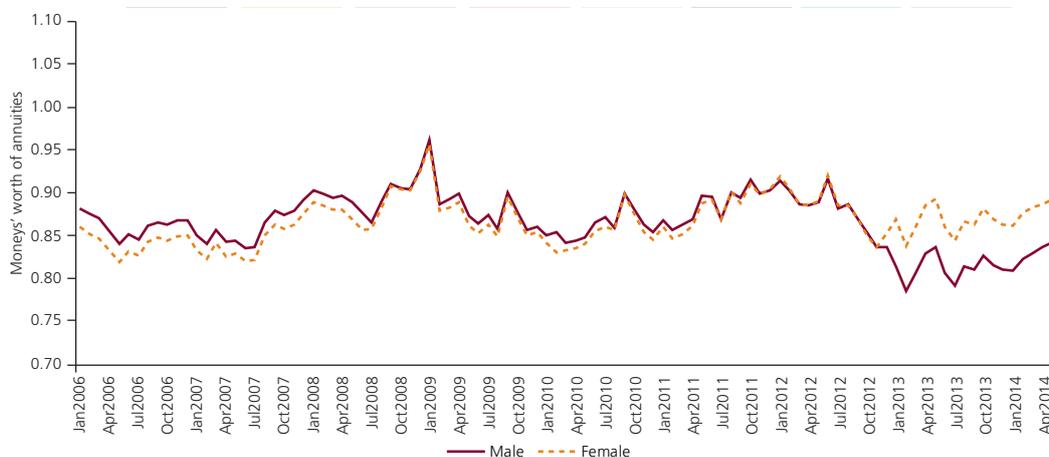
These calculations suggest that annuities represent good value for money. Consumers get the vast majority of their premium returned to them in income.

To put our results in context with recent academic research, we have compared our results with other recent estimates of MW (Cannon & Tonks, 2013). The most recent estimates found the MW of a level, no guarantee annuity to be around 86% for a 65-year-old male with a £10,000 pension pot, over the period 2004 – 2012.

The MW of annuities purchased with different pots size may differ significantly for several reasons. First, we are using different mortality assumptions for the two pot sizes. As explained above, mortality tables are split into tables that are 'lives-based' and 'amounts-based' and, as a result, retirees with larger pension pots are assumed to live longer than retirees with smaller pension pots. Second, fixed costs are proportionally higher for small pots and have therefore a larger (negative) impact on MW.

²⁶ Note that the spike in the MW at the beginning of 2009 is due to a significant reduction in interest rates. Between December 2008 and March 2009 the Bank of England reduced the official rate from 3% to 0.5%.

Figure 5: MW of annuities, 65-year-old annuitants with £10,000 pot



The charts report separately the MW for male and female annuitants. MW for male annuitants is similar to MW for female annuitants over the relevant period up to December 2012. The impact of the European Court of Justice Decision that banned discrimination based on gender in insurance pricing is clearly visible in the data: starting from January 2013 the MW for male annuitants worsened, while for female annuitants it improved. This had to be expected given that male and female annuitants have different life expectancies but all the other factors in the calculations are not gender-specific. For male annuitants with small pots the MW is lower than it was in the past, but for female annuitants the picture is reversed.

Table 7 shows the average MW of our baseline profile. Results show that in the period after the European Court of Justice (ECJ) decision the average MW for male annuitants decreased from 94% to 91.4% and MW for female annuitants increased from 91.9% to 95.7%. Overall, the average in the post-ECJ period is 93.6% compared to 92.9% in the pre-ECJ period. However, other factors contemporaneous to the ECJ decision may have an impact on the MW of annuities. For example, the Retail Distribution Review changed the way advisers charge for advice and may have had positive impact on MW. In addition to that, the increased take-up of enhanced annuities (32% in 2012 compared to 13% in 2008²⁷) may have an impact as well on the level of MW of annuities. Table 8 shows the average MW before and after the ECJ decision for a £10,000 pot.

Table 7: Average MW before and after ECJ decision for a level, no guarantee annuity (65yo, average quote, £50k pot)

Gender	Average relevant period (Jan 2006 – June 2014)	Average pre-ECJ decision (Jan 2006 – Dec 2012)	Average post-ECJ decision (Jan 2013 – June 2014)
Male	93.6%	94.0%	91.4%
Female	92.5%	91.9%	95.7%
Average male-female	93.0%	92.9%	93.6%

²⁷ Data from ABI website: www.abi.org.uk/

Table 8: Average MW before and after ECJ decision for a level, no guarantee annuity (65yo, average quote, £10k pot)

Gender	Average relevant period (Jan 2006 – June 2014)	Average pre-ECJ decision (Jan 2006 – Dec 2012)	Average post-ECJ decision (Jan 2013 – June 2014)
Male	86.7%	87.7%	82.3%
Female	86.9%	86.7%	87.4%
Average male-female	86.8%	87.2%	84.8%

4.1.1 Impact of interest rates and mortality improvement on annuity payments

As described above, annuity payments (and therefore MW) depend heavily on two factors: interest rates and mortality assumptions.

Annuity rates have fallen substantially in recent years. Consequently, consumers and other stakeholders have the perception that annuities are poor value products. However, interest rates are currently very low and life expectancy has increased, and these have both pushed annuity rates down. To illustrate the relevance of these two key factors, we analyse separately the impact of interest rates and mortality assumptions on an annuity available in the Open Market in June 2014 for our baseline profile.

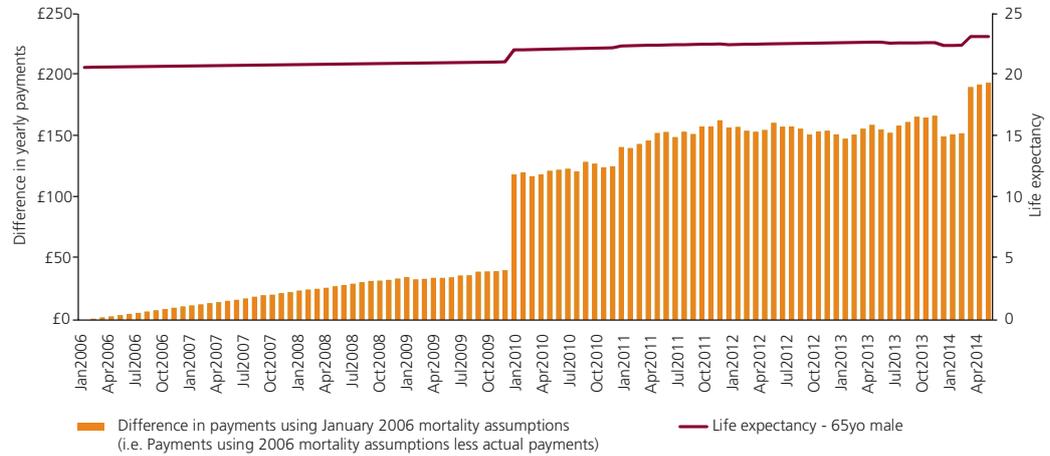
We calculate:

- the annuity rates would firms offer in June 2014 if life expectancy was at levels of 2006, keeping MW and interest rates at levels of June 2014 and
- the annuity rates would firms offer in June 2014 if interest rates were as they were in 2006, keeping MW and life expectancy at levels of June 2014²⁸

First, all else equal, if life expectancy in June 2014 was equal to life expectancy in January 2006, a provider would offer around 7% more income per year (£3,072 compared to £2,879 p.a.). As annuitants are expected to live longer than in 2006, annuity providers have compensated for having to pay income for longer by reducing the income offered to new annuitants. From a consumer point of view, annuitants receive less money per year but they are expected to live longer. Figure 6 shows the yearly impact in monetary terms of the change of mortality assumptions for an annuity on sale at any point in time between 2006 and 2014 (the last column of the chart refers to June 2014). The red line shows how the life expectancy of our baseline profile increased over the relevant period, according to our model.

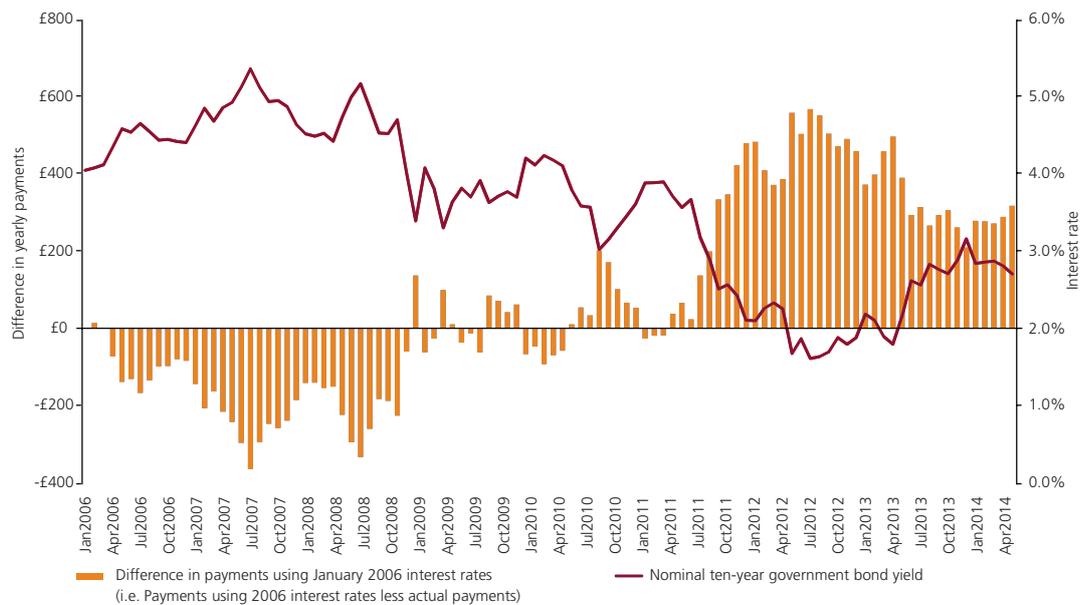
²⁸ See Annex C for a technical explanation.

Figure 6: Monetary impact of changes in mortality assumptions, keeping MW and interest rates constant.



Second, we investigate the impact of interest rates. All else equal, if interest rates in June 2014 were equal to interest rates in January 2006, a provider would offer around 11% more income per year (£3,196 compared to £2,879 p.a.). This means that recent low interest rates have significantly impacted on annuity rates and more so than the impact of improved longevity. This contributes to the perception that annuities are poor value for money. Figure 7 shows the yearly impact in monetary terms of the change of interest rates for an annuity on sale at any point in time between 2006 and 2014 (the last column of the chart refers to June 2014). The red line shows the yields of a 10-year government bond.

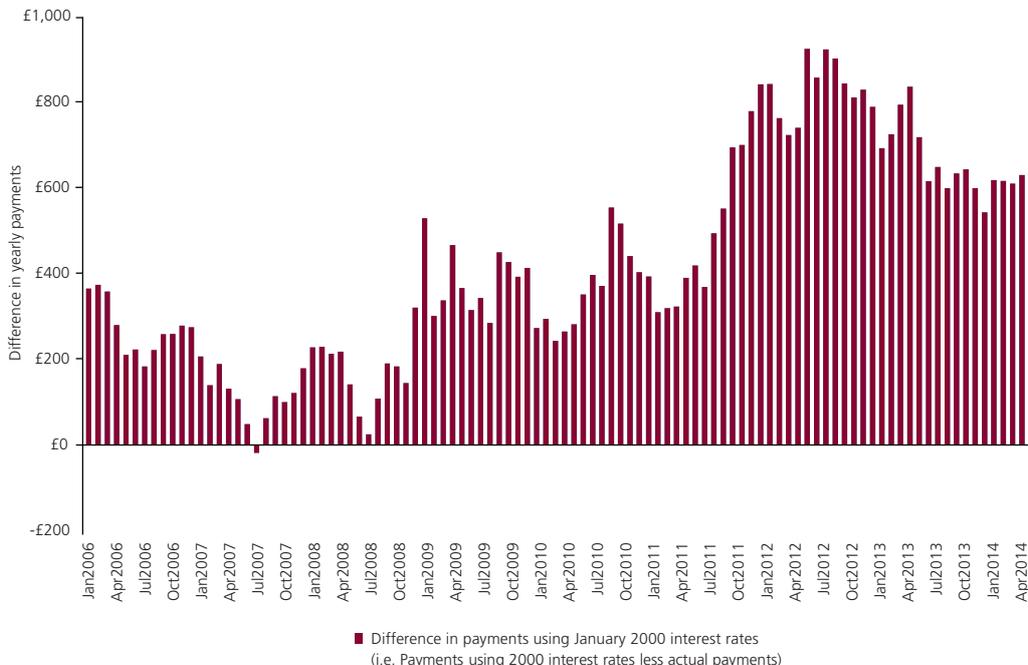
Figure 7: Monetary impact of changes in interest rate, keeping MW and mortality assumptions constant.



The comparison stands out even more if we take as reference point the interest rates in January 2000, when interest rates were higher than in 2006. Figure 8 shows that keeping MW and mortality assumption of June 2014, if interest rate were at the level of January 2000, a retiree

who buys an annuity in June 2014 would obtain around £660 more per year with a £50,000 pension pot.

Figure 8: Monetary impact using January 2000 interest rates.

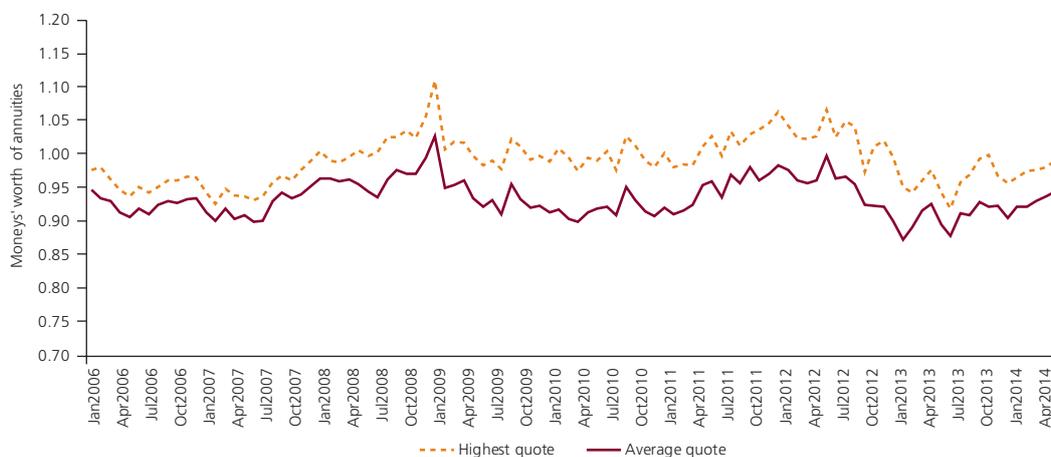


4.2 The importance of shopping around

The importance of shopping around is clear from inspecting the graphs (see Figure 9 below). Although all the quotes we have are based on the open market, for all the contracts we examined getting the best quote available significantly improves the MW. The average MW, over the period Jan 2006 to June 2014, is 94% using our baseline profile but increases to 99% if we use the best quote available in the market at each point in time. All else equal, retirees could get on average £189²⁹ more every year by shopping around (which represents 5.9% more income than the average quote). For a 65-year-old male annuitant with a £10,000 pot the additional income obtained by taking the best quote, rather than an average quote, is approximately £31 per year (which represents 5.1% more income than the average quote).

²⁹ Over the period January 2006 to June 2014.

Figure 9: MW of annuities: average versus best quote in the market (baseline profile)



Combining the information on the MW of annuities bought with larger pots and the difference in MW that can be obtained by getting the best quote, it is clear that for annuitants, with larger pots, that do shop around, annuities can represent extremely good value.

More on shopping around: internal and OMO annuities quotes

As explained above, the quotes collected by Moneyfacts are those offered in the open market and represent what an annuitant could obtain by exercising the OMO. For the Thematic Review we published in 2014 we asked a number of providers for the quotes available for their own customers (i.e. those not exercising the OMO). We have different profiles for two dates in May and July 2013. A summary of the average quotes is reported in Table 9.

We calculate the difference between the MW of annuities bought from the incumbent providers and the MW of annuities bought in the open market.

Table 9: Average internal quotes for selected profiles

Gender	Age	Pot	Quote	
			May 2013	July 2013
Male	59	£7,498	£301.74	£316.03
		£23,745	£968.99	£1,012.46
		£68,403	£2,843.47	£2,970.08
Male	66	£7,498	£361.78	£377.07
		£23,745	£1,152.53	£1,199.50
		£68,403	£3,369.77	£3,506.93

The profiles used in the Thematic Review do not exactly match the profiles used by Moneyfacts (they differ with respect to pot size, age and firms sampled), but it is still useful to compare the MW for the appropriate months, keeping in mind the differences in the profiles (see the Thematic Review for more information on the sample³⁰).

30 The Thematic Review: www.fca.org.uk/news/tr14-02-thematic-review-of-annuities.

Table 10 suggests that the MW of the annuities available in the open market is higher than the MW of the annuities available to internal customers, especially for annuitants with larger pots.³¹ For example, a 60-year-old male annuitant with a pot of £50,000 obtains a better deal by shopping around in the open market compared to a 59-year-old annuitant who buys an annuity from his existing provider with a £68,403 pot (MW of 92% and 83% respectively). Note that since MW generally increases with the pot size, and the pot size used in the Thematic Review is higher than the one used in the Moneyfacts quotes, the difference between the MW of open market annuities and internal annuities is material.

Table 10: Average OMO vs. internal MW of annuities for selected profiles

OMO/Internal	Age	Pot	MW	
			May 2013	July 2013
OMO quotes (Moneyfacts)	60	£10,000	83%	78%
	60	£50,000	92%	86%
Internal quotes (Thematic review)	59	£7,498	77%	76%
	59	£23,745	81%	79%
	59	£68,403	83%	80%
OMO quotes (Moneyfacts)	65	£10,000	84%	80%
	65	£50,000	93%	88%
Internal quotes (Thematic review)	66	£7,498	79%	77%
	66	£23,745	82%	80%
	66	£68,403	83%	81%

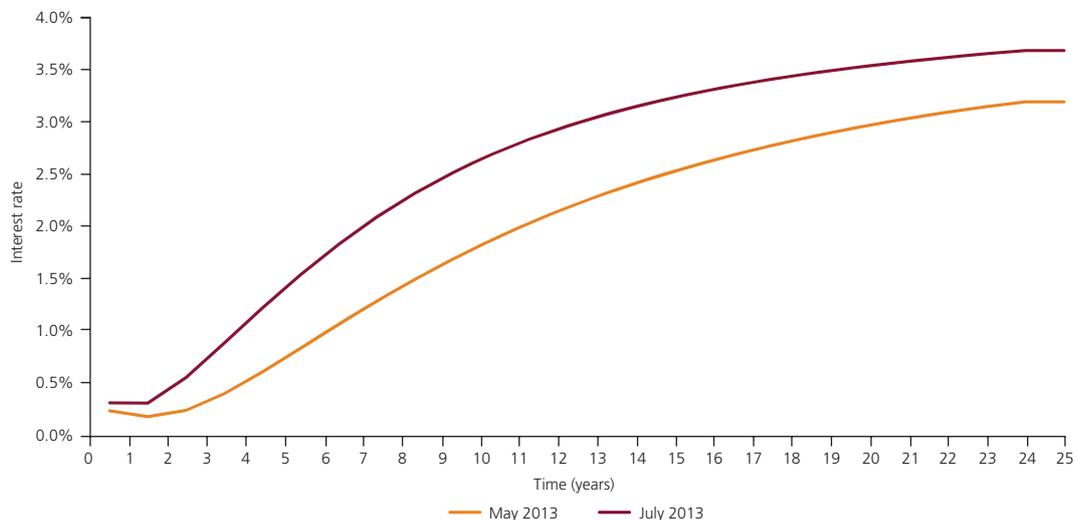
This confirms the findings of the Thematic Review of annuities published in February 2014, which highlighted the importance of shopping around and found that customers who purchase a standard annuity from their existing pension provider could increase their income by purchasing an annuity on the open market.

Table 10 shows that MW of OMO annuities decreased considerably between May and July 2013. To understand the reasons of this change we have to look at the yield curve in those two months. Figure 10 shows that interest rates went up significantly between May and July 2013.³²

³¹ We used 'lives' mortality assumptions for the smallest pot (£7,498) and 'amounts' mortality assumptions for the other two pot sizes.

³² In May 2013 the Bank of England released its inflation report and the Governor, in his opening remarks, stated that 'growth is likely to strengthen over the course of the year': www.bankofengland.co.uk/publications/Pages/inflationreport/2013/r1302.aspx.

Figure 10: Yield spot curve in May 2013 and July 2013



Other things equal, an increase in the interest rate has a negative impact on MW. Obviously firms will adjust their annuity quotes; however, this may take some time. If we observe the trend in MW in mid-2013, we observe that MW reaches a minimum in July 2013 to return in the following months to the levels reached in May. Table 11 illustrates the described trend.

Table 11: Average MW between May 2013 and October 2013

Gender	Age	Pot	2013 MW					
			May	June	July	August	September	October
Male	60	£10,000	83%	79%	78%	80%	80%	82%
	60	£50,000	92%	88%	86%	90%	90%	92%
	65	£10,000	84%	81%	80%	82%	81%	83%
	65	£50,000	93%	90%	88%	91%	91%	93%

The internal quotes obtained for the Thematic Review were requested on specific dates which are different from the reference dates used by Moneyfacts. Firms may have already adjusted their internal quotes for the change in the interest rate and this may explain why internal MW varies less than OMO MW.

4.3 Annuities with a guaranteed period

We compared the MW of annuities with and without a guaranteed period. Our analysis suggests that for young annuitants the MW of annuities with a guarantee is very similar to the MW of annuities without one. Young annuitants are very likely to outlive the guarantee period (96% of 55-year-old annuitants will be alive after 10 years³³) and therefore annuity providers adjust only slightly their quotes (a non-guaranteed annuity pays £2,594 per year to a 55-year-old male annuitant compared to a 10 year guarantee that pays £2,577³⁴). See Figure 11 for the trend of guarantee annuities versus non-guarantee annuities over the relevant period.

³³ This is the probability that a male annuitant (with £50k pot) who is 55 in January 2006 survives at least 10 years.

³⁴ Average calculated over the relevant period.

Figure 11: MW of annuities with a guarantee for younger annuitants (55yo, male, £50,000 pot)



As annuitants get older, the guarantee period plays an important role and providers materially adjust the quotes, but at the same time the likelihood of not surviving until the end of the guarantee period increases so retirees may find such guarantees more attractive. For example, a 75-year-old annuitant who buys a non-guaranteed annuity receives £4,353 per year compared to £4,011 if he buys a guaranteed annuity. In terms of MW we observe that guaranteed annuities give better returns than non-guaranteed annuities for a 75-year-old annuitant. In particular, on average over the relevant period the MW of a 10-year guaranteed annuity is 93% compared to 92% for a 5-year guarantee and 91% for a non-guaranteed annuity. The relative order holds across different profiles. See Figure 12 for the trend over the relevant period. The pattern is consistent for smaller pots and for female annuitants.

A number of previous studies calculated the MW of guaranteed annuities in the UK. Finkelstein and Poterba find that MW increases with the length of the guarantee period and they argue that this is consistent with shorter-lived retirees having private information about their mortality and buying guaranteed annuities (Finkelstein & Poterba, 2002). A possible reason why guarantees for older annuitants appear to offer better value is that annuitants who buy annuities with a guarantee have shorter than average life expectancy and providers adjust for that.

Cannon and Tonks find as well that guaranteed annuities have higher MW than annuities without a guarantee period (Cannon & Tonks, 2013). They argue that guaranteed annuities are by their nature less risky for the providers compared to level annuities and therefore the MW is relatively higher. Guaranteed annuities are less risky because the guarantee converts a standard annuity into a combination of a risk-less bond for the guaranteed period and a deferred annuity. During the period of the guarantee all payments are certain rather than dependent on annuitants' mortality. This reduces the risk for the first years of the contract. Further, as annuity payments after the guaranteed period are lower the impact of annuitant living an extra year is smaller than compared to a level annuity.

Figure 12: MW of annuities with a guarantee for older annuitants (75yo, male, £50,000 pot)

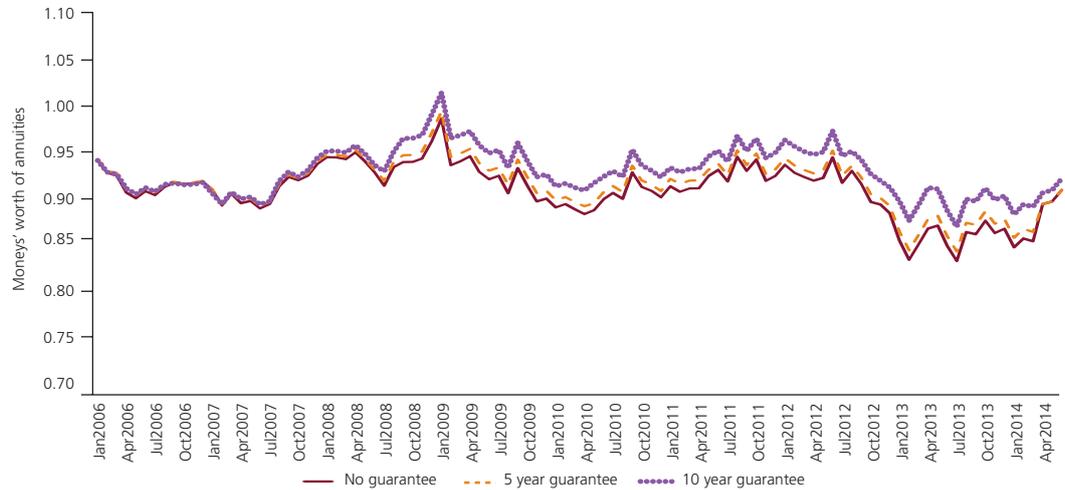
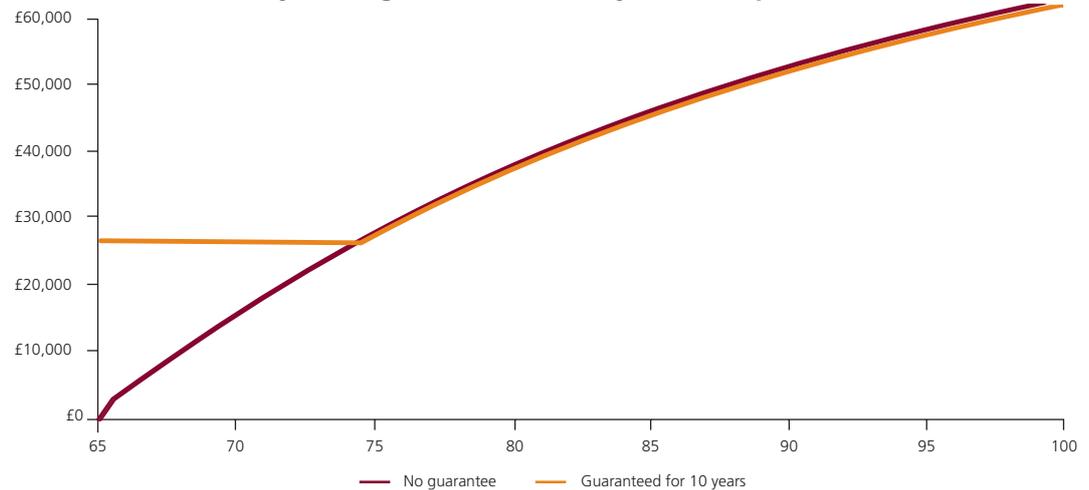


Figure 13 below shows the age at which an annuitant receives a certain amount of money back for a 65-year-old annuitant and compares a guaranteed annuity with an annuity without guarantee. This shows that an annuity with guarantee may be appealing for a consumer who is concerned not to 'lose' the pension pot in the (unlikely) case of dying early. Given that a 65 year old has a low probability of dying before turning 75, the difference in the payment is consequently small.

Figure 13: Amount of money a 65-year-old male annuitant receives at any given age for a standard annuity and a guaranteed annuity (£50,000 pot)



4.4 Escalating annuities

Interestingly, escalating annuities have a considerably lower MW than level ones.³⁵ For our baseline profile, annuities that escalate at 5% a year have an MW of 89% while RPI-linked annuities have an MW of 83% (compared to 94% for a level annuity). When it comes to inflation-linked annuities, it is clear that difficulties in forecasting future inflation, the risk that

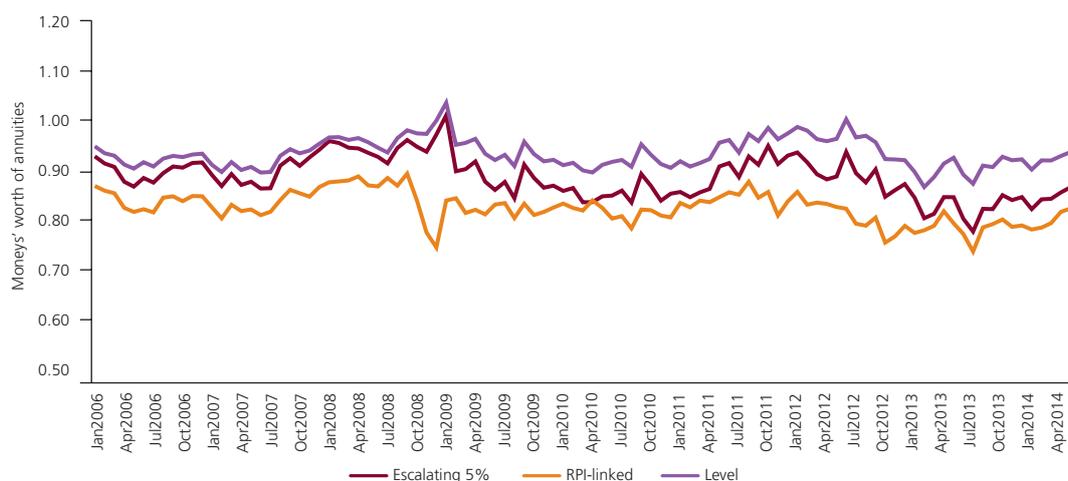
³⁵ To calculate the MW of RPI-linked annuities we have discounted future payments using a real yield curve. See Annex A for a mathematical expression of the MW of an escalating annuity.

inflation may overshoot forecasts, the possibility of adverse selection (i.e. longer lived retirees purchase escalating annuities) and the difficult task of matching inflation-linked liabilities with assets offering fixed real yields could be potential explanations for lower levels of MW. These results hold across different profiles of annuitants.

Two papers (Finkelstein & Poterba, 2002) (Cannon & Tonks, 2013) find very similar outcomes. Cannon and Tonks suggest that these results could also be due to 'cohort mortality risk' i.e. the fact that higher than expected longevity has a greater financial impact on an escalating annuity than on a level annuity (as surviving for an additional time period will result in a larger payment being made to the annuitant under an escalating annuity), and therefore insurers may need to hold higher levels of capital against their longevity risk.

The low MW of escalating annuities may explain, at least in part, the reluctance of retirees to buy them: annuity providers are retaining a larger share of the premiums they receive and retirees may be willing to bear the inflation risk themselves rather than paying the price of having a substantially reduced starting income.

Figure 14: MW of level and escalating annuities for male 65yo annuitants with £50,000 pot



4.5 MW of annuities for different age profiles

We calculated the MW of annuities for six different age profiles (50yo, 55yo, 60yo, 65yo, 70yo and 75yo) for different products. Over the relevant period, we do not find an age profile that consistently obtains better MW across all products and individual profiles. Finkelstein and Poterba find that MW declines with age and they argue that this is consistent with the private information about mortality risk as annuitants get older (Finkelstein & Poterba, 2002). However, Cannon and Tonks find that this pattern reversed over the period between 2001 and 2004 (Cannon & Tonks, 2013).

Therefore, solely based on the MW, there does not seem to be an optimal age at which to annuitise. However other considerations will be important in this respect: the mortality premium available for older annuitants, the lack of time to recover any losses that may be incurred by remaining invested and general attitudes to risk may well result in an 'optimal' age at which to annuitise.

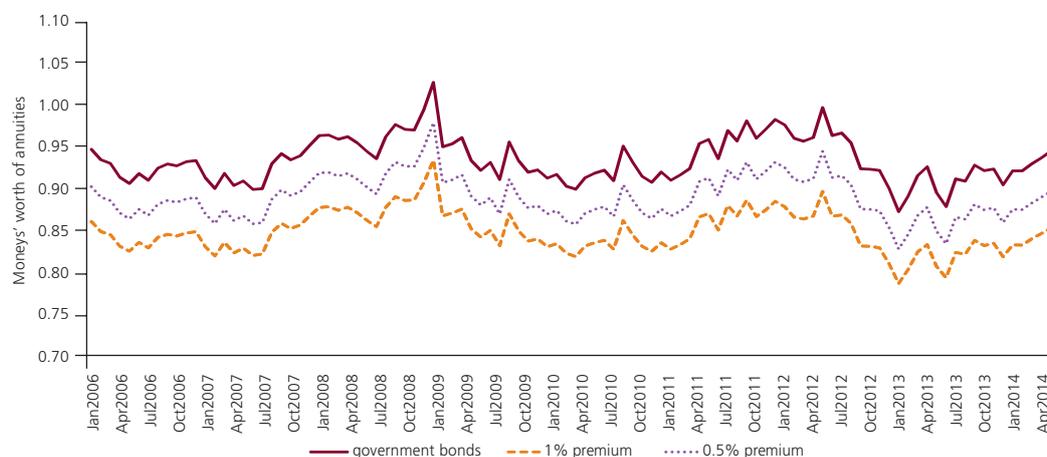
4.6 Sensitivity analysis

To test the robustness of the results discussed above we have tested whether they are particularly sensitive to the underlying assumptions. We have therefore calculated the MW of annuities changing the underlying mortality projections and the rates used to discount future payoffs.

4.6.1 Sensitivity to the discount rates

We calculated the MW of annuities using different interest rates to discount future payoffs. It may be appropriate to discount future annuity payments using a risk-free rate plus a risk premium to assess whether markets have been operating close to a competitive level or whether we could infer that competition was not properly working.

Figure 15: The MW of annuities with different discount rates (65yo male with a £50,000 pot)



The MW of annuities declines by four percentage points if future payments are discounted allowing for a 50 basis points risk premium and by nine percentage points if the risk premium is assumed to be 100 basis points. Other academic studies use similar risk premia (Cannon & Tonks, Money's Worth of pension annuities, 2009). In Section 3.2.2 we explained why we consider that the risk-free rate is the most appropriate rate to discount future payments from the consumer point of view. However, the use of the risk-free rate is likely to overestimate the MW of annuities. Indeed, firms that are competitive in the open market are very likely to invest in riskier assets such as investment grade corporate bonds to back their annuities and are therefore very likely to earn a non-zero liquidity premium.

4.6.2 Sensitivity to the mortality assumptions

As explained in the previous sections, mortality assumptions are a very complex issue and every annuity provider uses its own mortality assumptions. They are constantly debated in the actuarial and academic community and play a crucial role in the pricing strategy of annuity providers. As such it makes sense to check the robustness of our conclusions for changes to these assumptions.

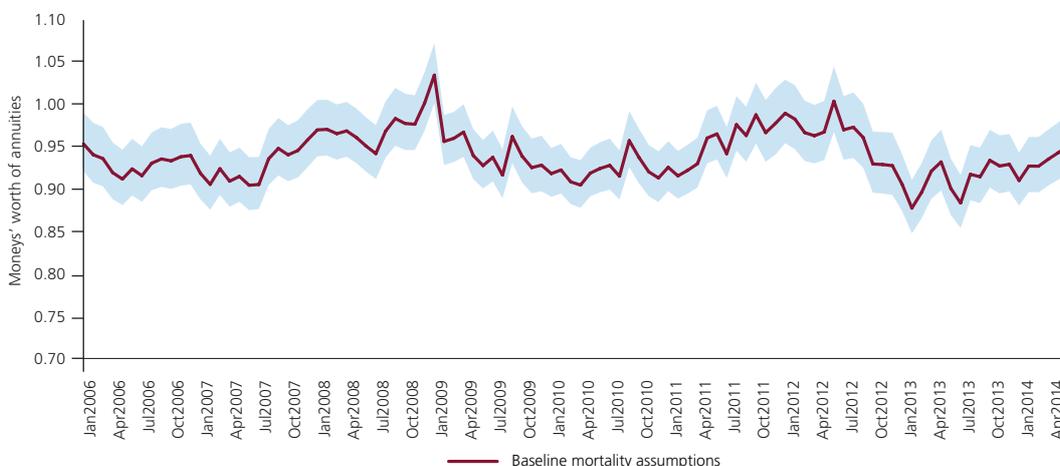
Our model allows us to make a number of sensitivity checks. First firms may apply different multipliers to the base mortality tables. Insurers may learn about specific characteristics of their own portfolio and may adjust the base mortality table using appropriate multipliers. Secondly, during the analysed period it was common industry practice to use the CMI's Medium Cohort projection to adjust the base mortality tables. The Short and Long Cohort projections were occasionally used, but these were generally regarded as underestimating or overestimating the

extent of the cohort effect respectively. Thirdly, in order to ensure that allowance for future mortality improvements was not understated, firms usually applied an ‘underpin’³⁶ to the projection, which reflected the firm’s own view of future mortality improvements.

Since we adopted the assumptions that were commonly used by firms at the time it may be arbitrary to pick a limited number of assumptions to analyse (note as well that every assumption applies to a limited sub-period within the relevant period or to a limited number of profiles). We have therefore recalculated the MW of annuities applying mortality projections that are 1% better or worse across the board. In the past insurers have tended to underestimate overall mortality improvements but there is no guarantee that this will be true in the future.

The red line in Figure 16 shows the MW of our baseline profiles and the shaded area represents how MW varies if the assumptions about mortality improvements are varied by between -1% and +1%. As explained above, to take into account changes in the mortality of the population, improvements are applied to adjust the base mortality tables. We performed a sensitivity analysis on such improvements and calculated how the MW changes if mortality improvements are 1% p.a. higher or lower. On the one hand, if we increase the improvement assumption by 1% p.a. (i.e. if expected mortality improvements are 3% p.a., then we assume improvements are 4% p.a.), annuitants live longer and receive regular payments for a longer period. This increases the MW of our baseline profile from 94% to 97%. Symmetrically, if we lower the improvement assumption by 1% p.a., the MW falls from 94% to 91%.

Figure 16: The MW of annuities with different mortality assumptions



36 It is common practice in the industry to adjust longevity improvements using ‘underpins’ in order to ensure that improvements never fall below 1% p.a. (0.75% p.a. for females). This is used to price prudently against the risk that annuitants live too long.

5. Summary of findings on Money's Worth of annuities

The analysis described above supports a number of conclusions with respect to the value that annuities have provided in recent years in the UK.

First, the MW of annuities is not significantly worse today than it was in 2006. However, by considering our results together with those of other studies, there seems to have been a reduction in the MW of annuities in the years 2000 to 2006 (see Section 3.1 for a review of the previous assessments of the MW of annuities in the UK). We cannot be sure what the likely reasons underpinning this decline are. One reason could be that annuity providers had wrongly estimated future mortality rates in the past.

Second, the MW of annuities bought with smaller pension pots is, on average, lower. This may well reflect the higher incidence of administrative costs, but it clearly implies that annuitants that have not saved a significant amount at retirement may well find alternative products, or even taking all their money as cash, relatively more attractive. This confirms the position the FCA took in the Thematic Review which showed that choices for people with smaller pots were limited.

Third, shopping around can considerably increase the value of an annuity contract. The average MW of the internal quotes we obtained for the 2013 Thematic Review was up to nine percentage points lower than the average MW of quotes available on the open market at the same time. Even by considering only quotes available on the open market the MW can be considerably increased by picking the best rather than the median average quote.

Fourth, the market for inflation-protected annuities offers worse value than the market for standard ones. We acknowledge that product providers are taking on additional risk for these products, but, given the importance of maintaining purchasing power over time, especially in the future landscape where more complex products are likely to emerge, this is somewhat concerning.

It is difficult to ascertain what caused these trends but the introduction of the RDR and the ECJ decision to ban gender discrimination in insurance took place at roughly the same time. These two events, as well as the increase in the share of enhanced annuities being bought are all likely to be contributing factors.³⁷ Before January 2013 annuity rates were likely to incorporate commission paid to financial advisers. Following the retail distribution review (RDR) this is no longer the case for those people who buy an annuity using an advised service. Therefore we should have expected the MW of annuities to improve following the removal of commission. Overall it does not look like this happened.

³⁷ Annuitants buying enhanced products have lower life expectancies, which we cannot take into account in our analysis for lack of data. As such the MW of standard annuities would appear to be worse than it is if many people buy enhanced products.

This could suggest that there was no pass-through of the RDR benefits. However the implementation of RDR and the ECJ decision were contemporaneous to other changes in the market. First, recent years have seen an increasing take-up of enhanced annuities. This may have led to an increase of the life expectancy of retirees buying a standard annuity, which would in turn reduce the annuity rates of standard annuities. Second, uncertainty on the implementation of Solvency II may have increased risk in the annuity markets and therefore pushed rates down. These two effects could have counterbalanced the removal of commission from annuity rates. Finally, there has been growth in the number of non-advised sales where commission is still used.

Overall we can conclude that annuities represent good value for money especially for retirees with larger pension pots and for those retirees who shop around for the best available quotes in the market.

6. The Value for Money of alternative retirement strategies

In the previous sections we have confined our analysis to annuities, as they have historically been the product that the overwhelming majority of retirees bought. We have also established that, from an economic perspective, annuities seem to offer 'reasonable' value for money, depending on the how large is the liquidity premium insurers are able to earn (see section 4.6.1).

In the future landscape, however, retirees will have a greater range of options and increased flexibility. In the remainder of this paper we therefore analyse some of these options in more depth to assess the circumstances in which it is likely that retirees would benefit from different products or product characteristics.

This is not an easy task as we do not yet know what products will be developed and, in contrast with annuities, we do not have a long history of the pricing or other characteristics of these products on which we can rely. We therefore compare the potential outcomes of buying an annuity with the outcomes that can be achieved by using the pot's money in other ways. We compare the following strategies:

- buy an annuity
- **self-annuitise** (take the same income as the average annuity quote for a level annuity)
- amortise to 85 year old (take the a constant nominal income each year until 85 years old at which point funds are exhausted, hereafter '**amortise to 85**')
- amortise to 100 year old (take a constant nominal income each year until 100 years old at which point funds are exhausted, hereafter '**amortise to 100**')
- consume each year a fraction of the retirement pot depending on life expectancy at that time (i.e. consume 1/20th of the pot if you expect to live 20 years, hereafter '**1/LE**'³⁸)

These strategies simulate decisions that retirees could make with their pots as an alternative to taking an annuity and, as such, can be seen as a particular drawdown path that could be followed by retirees. The amortisation strategies are arguably more naïve than 1/LE, which takes into account new information (i.e. survival) when it becomes available. The above strategies, apart from annuitisation, avoid the 'risk' that if a retiree dies young then their pension pot is lost but this is at the cost of exhausting the pension pot if the retiree survives for a sufficiently long time.

³⁸ Under a drawdown strategy, if the retiree has a life expectancy of 20 years then they will draw 1/20th of their pension pot as their annual income. The following year they will do the same based on their new remaining life expectancy. If their life expectancy was 19.5 years then they will draw 1/19.5th of their pension pot as income in the following year.

As part of this work we did look at two products that give retirees short-term income with different levels of mortality risk transfer. One product, using the MW approach we used in the first section of this report, provided good value to consumers. The other appeared less good but both had similar MW values in the range we found for annuities. Of course, these products do not take on the long-term longevity risk that annuities do and therefore we might expect a higher MW.

Our aim in this section of the paper is to assess the market from a forward-looking perspective. As such we do not report any time series results but we give a snapshot of what is likely to happen on the basis of past information available at June 2014 and discuss which factors are likely to be more important for different types of retirees.³⁹

For the main part of our analysis, we have based our assessment on the assumption that retirees would invest their monies in riskless bonds. This is because this assumption allows us to concentrate on issues other than investment risk and it facilitates the comparison with an instrument like the annuity that in its standard form does not have any investment risk. However, we acknowledge that retirees may wish to buy products that give them exposure to riskier assets and a potentially higher return. We therefore also investigate the impact of investing in equities.

The strategies mentioned above are reasonable and are likely to simulate paths that retirees may well choose but are not based on actual products that exist in the market. There is a wide academic literature that considers the optimal decumulation strategy (Blake, Cairns, & Dowd, 2003) (Dushi & Webb, 2004) (Milevsky & V.R.Young, 2007). For example, Dushi and Webb investigate optimal strategies where consumers can annuitise any proportion of their wealth at any time. The strategies here are simpler than presented in these papers, but we believe they represent strategies that may be chosen by consumers in the future landscape and therefore are a good representation of the possible risks that consumers face.

6.1 Data used in the value for money analysis

For consistency whenever possible we use here exactly the same data we used when assessing the MW of annuities. The only addition we made is to estimate returns that can be obtained by getting some exposure to risk given that many retirees who decide to buy drawdown products (or products with similar characteristics) are likely to want a degree of exposure to risky assets.

We also briefly describe our assumptions around mortality, how they differ from those used when discussing annuities and why.

We are well aware that it is impossible to establish a single, universal metric on the basis of which different strategies and products can be compared. Retirees may have different preferences with respect to risk and different needs and circumstances. However, by analysing a number of different outcomes associated with these strategies and products, we can shed some light on which factors retirees should take into account in the future landscape – as well as areas where conduct risk may materialise in the coming years.

³⁹ Our consumer research showed that consumers exhibit strong present bias and underestimate longevity risk, and that the framing of information can have a significant impact on consumer choice. In this section, we assess the risks consumers face from making poor decisions, which may be affected by these consumer behaviours.

6.2 Methodology

The choices that retirees will face in the future market landscape will be complex given that new products will be available and the fact that many aspects should be taken into account when picking a retirement strategy. In this section of the paper we assess the potential incomes and probability that consumers exhaust their pension pot, as well as the potential for retirees to provide bequests.

We therefore compare the different strategies from a number of different perspectives to assess whether some strategies are unequivocally better than others or, more likely, what trade-offs retirees face when picking strategies.

We compare the products and strategies on the basis of the:

- amount of yearly income they can provide in retirement and the likelihood of exhausting the pension pot in old age
- net present value of each strategy at any given point in time and the likelihood of recovering the purchase price
- the likelihood of receiving different amounts of money over the life of the product

We also analyse the effects of investment risk and fees (which may include for example investment management fees and administration costs) on the potential consumption paths of retirees. The Summary of key findings sets out a summary of the findings from this analysis.

6.2.1 Yearly income

The amount of income that retirees can get by adopting any of the above strategies is clearly of paramount importance to assess their value for money. Using annuity rates from June 2014, the interest rate available on riskless bonds at the same time (and then the likely returns obtained by investing in equity) and the life expectancy we estimated, we calculate what income could be achieved with any of the strategies.

We also take into account the fact that by picking a strategy, rather than buying an annuity, retirees run the risk of exhausting their pot in old age and having no income in the last years of their lives. The calculations here focus on the income people receive during their retirement rather than any bequests they make if they die before they have exhausted their assets. We do, however, assess the level of bequests when investing in riskless assets.

6.2.2 Net present value and the likelihood of recovering the purchase price

The net present value of the other strategies is, by construction, equal to the purchase price. Retirees cannot lose any money if they invest in riskless bonds and if they die they can leave the remainder to their heirs. However, we examine the two components of the present value – namely income payments and potential bequests – for the different strategies to assess how much retirees need to trade-off between these two aspects. We do not consider the impact of Inheritance Tax when we analyse the bequests under the different strategies.

6.2.3 Likelihood of receiving other amounts

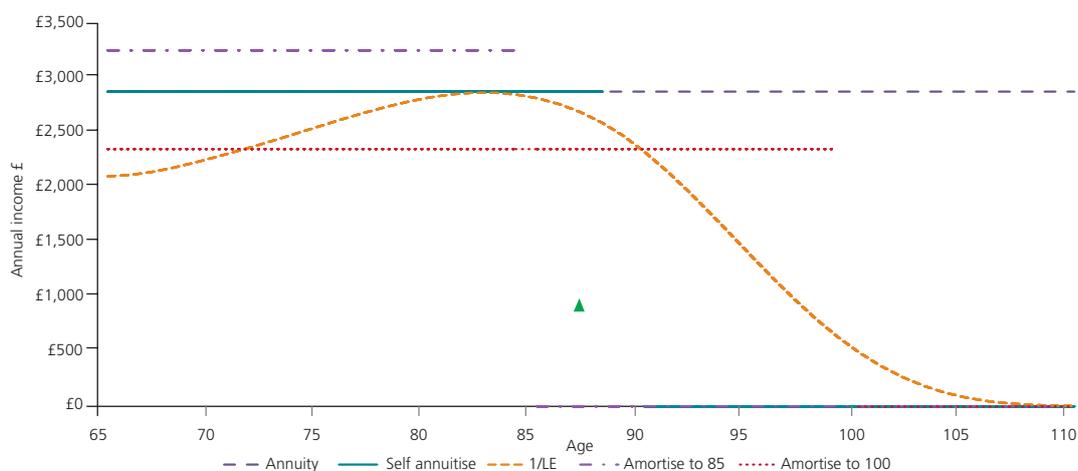
As an addition to the analysis described in the previous paragraph we assess the likelihood of receiving any other amount in future payments (excluding bequests for non-annuity strategies).

6.3 Results under the risk-free scenario

6.3.1 Yearly income

To assess the yearly income that can be achieved by adopting any of the strategies we present two graphs (based on June 2014), one for our 'baseline' profile and one for the same profile but for a 75 year old. This is illustrated in Figure 17 and Figure 18.

Figure 17: Income profile of alternative strategies for a 65-year-old male with a retirement fund of £50,000 retiring in June 2014*



* the green triangle marks the point where the retiree has less in the pot than the annuity income under the self-annuitise strategy.

Figure 17 shows the income profile for a 65-year-old man with a £50,000 pot. Unsurprisingly, given that the money runs out after 20 years, the highest income available is provided by the 'amortise to 85' strategy. In this case, a 65 year old would be able to consume £3,256 per year (£651 per year from a £10,000 pot). The second highest income is provided by the annuity (and the self-annuitise strategy) at £2,879 per year (£536 from a £10,000 pot). The 1/LE strategy produces significantly lower incomes initially (£2,105) but this rises to almost an equivalent income to an annuity when the retiree is around 83 years old (income drawn reaches £2,869). At other points in time the income received is significantly lower than an annuity.

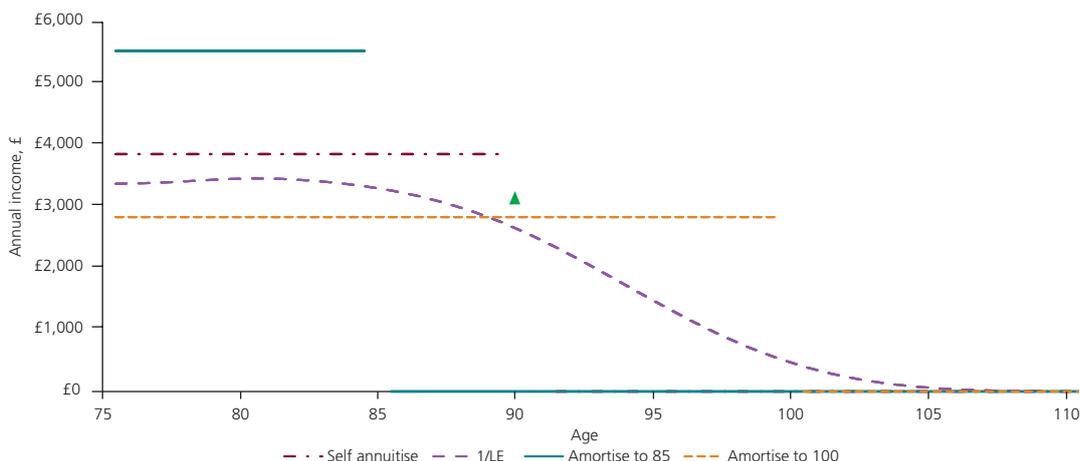
The 'amortise to 100' strategy produces a significantly lower income of £2,352 per year (£471 from a £10,000 pot). The picture is similar for female retirees except that as females have a different mortality profile, the 1/LE strategy will provide lower incomes at the beginning as life expectancy will be higher and therefore the annuitant will consume a slightly smaller part of their retirement pot. Female retirees will consumer slightly more under this strategy than under the annuity at around 84 years of age. This is reflected in Table 12 below.

Although the precise numbers change over time because of changes in annuity rates, interest rates and mortality projections, the overall message does not: the ranking of the different strategies is remarkably stable. The only difference is which strategy produces the lowest initial income between the 'amortise to 100' and the 1/LE one.

It may not be surprising that annuities provide higher income than drawdown strategies, as there is a trade-off between two components of annuity products: risk sharing and the cost of providing annuities. The fact that annuitants benefit from a cross-subsidy from those annuitants that have already died suggests that, all other things being equal, annuity income should be higher than for alternative strategies for retirees who are still alive. In contrast, the cost of

providing an annuity will make alternative strategies look better in comparison to the annuity. This analysis implies that the mortality premium outweighs the costs of providing the annuity.

Figure 18: Income profile of alternative strategies for a 75-year-old male with a retirement fund of £50,000 retiring in June 2014*



* the green triangle marks the point where the retiree has less in the pot than the annuity income under the self-annuitise strategy.

For a 75 year old the rankings do not change but there are two features that emerge. First, the difference in income that can be achieved using the ‘amortise to 85’ strategy increases substantially (as the pot is exhausted in just 10 years). Second, the incomes that can be drawn down using the remaining strategies are significantly below the income that can be obtained with an annuity.

Table 12: Income under the different strategies

	Strategy	65 year old		75 year old	
		Male	Female	Male	Female
Initial income (£ per year)	Annuity	2,879	2,879	3,849	3,849
	Self-annuitise	2,879	2,879	3,849	3,849
	1/LE	2,105	1,973	3,369	3,080
	Amortise to 85	3,256	3,256	5,523	5,523
	Amortise to 100	2,353	2,353	2,828	2,828
Income at age 85 (£ per year)	Annuity	2,879	2,879	3,849	3,849
	Self-annuitise	2,879	2,879	3,849	3,849
	1/LE	2,818	2,887	3,259	3,212
	Amortise to 85	0	0	0	0
	Amortise to 100	2,353	2,353	2,828	2,828
Income at age 100 (£ per year)	Annuity	2,879	2,879	3,849	3,849
	Self-annuitise	0	0	0	0
	1/LE	492	670	403	594
	Amortise to 85	0	0	0	0
	Amortise to 100	0	0	0	0

Table 12 conveys similar information on the profile of income at different stages of retirement. Table 13 includes an assessment (on the basis of relevant discount rates and mortality projections) of the probability of exhausting the pension pot if using each of the different strategies as well as the age at which the money runs out.

It is clear that amortising to 85, even if it allows for a larger income to be consumed in the initial years would result in a very large percentage (from 65% to 76% depending on age and sex) of retirees with no income for their later years.

The 'amortise to 100' strategy not only would not allow retirees to consume as much as they could if they adopted any other strategy but would still leave approximately one in ten who will turn 100 without any income.

Adopting a self-annuitisation strategy would result in outcomes that are in between the two amortisation strategies. Retirees would be able to consume as much as they would with an annuity, but between 46% (for a 75-year-old man) and 58% (for a 65-year-old woman) of them would turn 90 and have no money left for the last years of their life.

The 1/LE strategy seems attractive given that the probability of exhausting the pension pot is negligible. However the flexibility that it allows comes at the cost of consuming less than would be possible with an annuity. When people turn 94 they would only be able to consume less than 50% of what would be available with an annuity and, when they turn 100, they could only consume between 15% and 21% of what they could had they bought an annuity.

Table 13: The probability of exhausting the pension pot when using the different strategies

	Strategy	65 year old		75 year old	
		Male	Female	Male	Female
Probability of exhausting the pension pot (%)	Annuity	0%	0%	0%	0%
	Self-annuitise	49.9%	57.6%	46.0%	54.4%
	1/LE*	~0%	~0%	~0%	~0%
	Amortise to 85	65.9%	72.1%	70.7%	76.5%
	Amortise to 100	9.1%	12.3%	7.3%	10.5%
Age at which pots runs out of money (years)	Annuity	∞	∞	∞	∞
	Self-annuitise	90	90	91	91
	1/LE*	>110	>110	>110	>110
	Amortise to 85	85	85	85	85
	Amortise to 100	100	100	100	100

* The probability of exhausting the pension pot is essentially zero but the income available in the last few years is negligible.

To put these results in context, it is worth bearing in mind the life expectancy of retirees. Table 14 shows the life expectancy of consumers for the scenarios we present in the analysis of alternative strategies. On average, retirees will live to around 90 years of age. This explains, for example, why the amortise to 85 strategy would not be a good idea for consumers without other sources of income for the years following their 85th birthday.

Table 14: The life expectancy of retirees with £50k pension pots in June 2014

Age		Male	Female
65	Remaining years	23.8	25.4
	Life expectancy	88.8	90.4
75	Remaining years	14.9	16.3
	Life expectancy	89.9	91.3

Finally, we compare the drawdown strategies to an internal annuity bought from the existing provider using the data we requested for the Thematic Review. Figure 19 replicates the analysis described in Figure 17 above and in addition it shows the income generated by an internal annuity.⁴⁰ As showed in Section 4.2, the MW of internal annuities is on average lower than annuities bought on the Open Market, and the income generated by an internal annuity is also lower (around £2,500 p.a. compared to £2,897 p.a.).

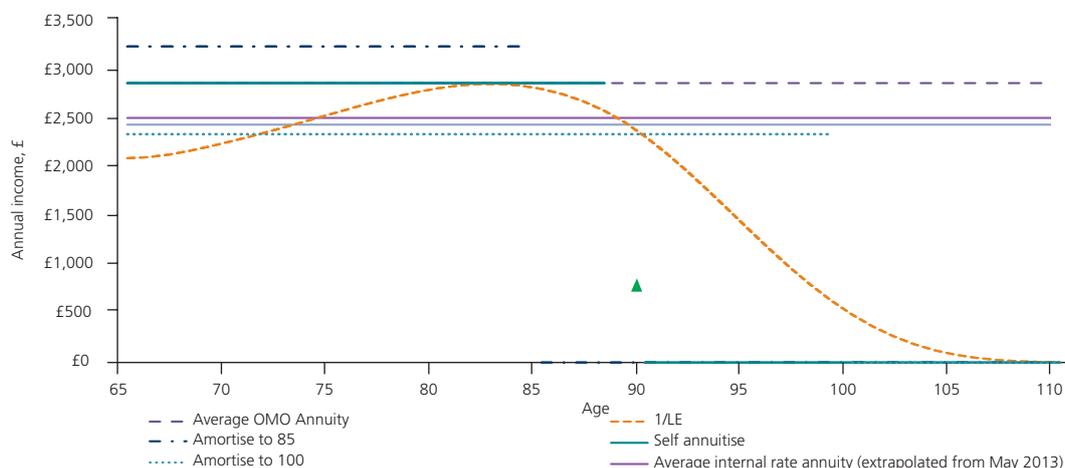
It therefore not surprising that an internal annuity bought at 65 looks worse than an external annuity when we compare it to other drawdown strategies. Figure 19 shows that while an external annuity gives a higher income than the drawdown strategies at any period in time (except from the 'amortise to 85' strategy), an internal annuity gives lower income than the 1/LE strategy for approximately 13 years (from 75 to 88). Moreover an internal annuity is only slightly better than the 'amortise to 100' strategy (which gives approx £2,350 p.a.), while an external annuity is considerably better than the 'amortise to 100' strategy.

This reinforces the findings of the Thematic Review on the importance of shopping around and the use of the Open Market. On the one hand, if an annuitant opts for the Open Market he will buy an annuity that gives reasonably good value compared to other drawdown strategies, and protects himself from exhausting the pension pot. On the other hand, an annuitant who does not exercise the Open Market Option, will buy on average a poor value annuity, despite protecting him from the risk of exhausting the pension pot.

In the rest of the paper we always use our 'baseline' OMO quote as the comparator.

⁴⁰ To calculate the income obtained from an internal annuity, we used the data we requested for the Thematic Review on annuities. We calculated the MW of an internal annuity for the two points in time when we had internal quote data. We then interpolated the MW on an annuity purchased with £50,000 by a 65-year-old man from the quotes we had for internal annuities (see Table 9) to obtain a figure comparable to an annuity bought in the Open Market. We then calculated what income would generate an annuity with the same MW if the annuity was sold in June 2014.

Figure 19: Income profile of alternative strategies for a 65-year-old male with a retirement fund of £50,000 retiring in June 2014 – using the MW of internal annuity from the Thematic Review



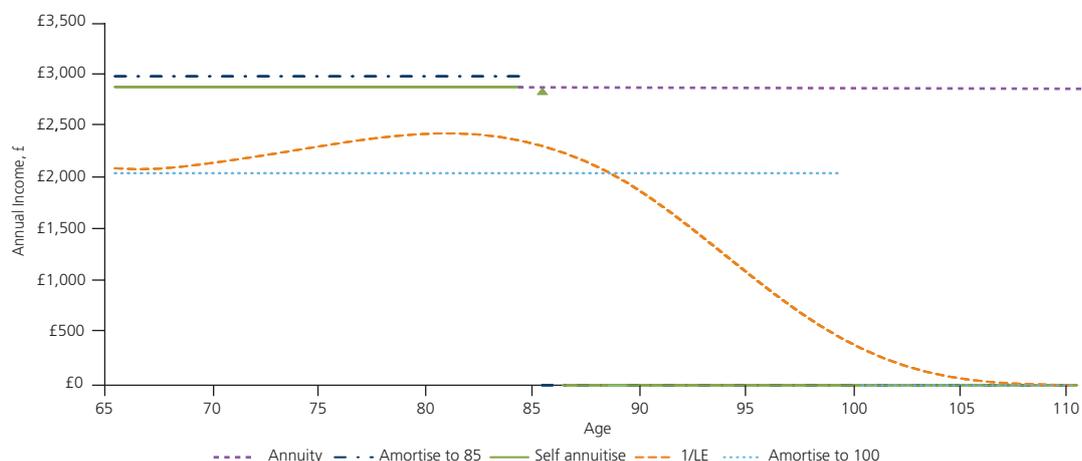
6.3.2 The role of investment charges

The previous comparison of annuity income with alternative strategies fails to take into account the fact that annuities are net of all investment costs, whereas the other strategies are gross of these transaction costs. For these strategies the transaction costs are going to be relatively small but definitely not negligible. For instance, in footnote 20 we described the costs that would be incurred by buying UK gilts. These fees could be higher if retirees buy mutual funds and other transaction costs (e.g. wrapper fees or transaction costs) may well be present.

A reasonable assumption would be that other strategies are charged fees that total 1% per annum on the remaining assets in the pension pot. This seems a conservative assumption given the fees we observe for drawdown products, which include annual management fees for the fund manager and platform fees. In many instances they may be closer to 3%; we also investigate the impact of fees at this level. This is to illustrate the impact charges could have on the income available. Fees could be higher or lower for a variety of reasons.

Figure 20 shows the impact of these illustrative 1% fees on the income streams available for the non-annuity products. It shows that the self-annuitise strategy means the retiree runs out of money earlier, by the time they are 86. The ‘amortise to 85’ strategy gives £103 more than the annuity rather than £377 more. The equivalent figures for a 75-year-old annuitant are that with the self-annuitise strategy the retiree runs out of money at 90, rather than 91, and retirees using the ‘amortise to 85’ strategy will provide £1,418 more than an annuity, compared to £1,673 without charges. Where fees are 3%, the annuity provides the highest income, with the amortise to 85 strategy providing around £400 less income per year, and the retiree exhausting the pension pot in their early 80s using the self-annuitise strategy. Fees can therefore reduce substantially the amounts that can be consumed using non-annuitisation strategies.

Figure 20: Income profile of strategies with fees at 1% – 65-year-old male with a retirement fund of £50,000 retiring in June 2014



6.3.3 Net present value and likelihood of recovering the purchase price

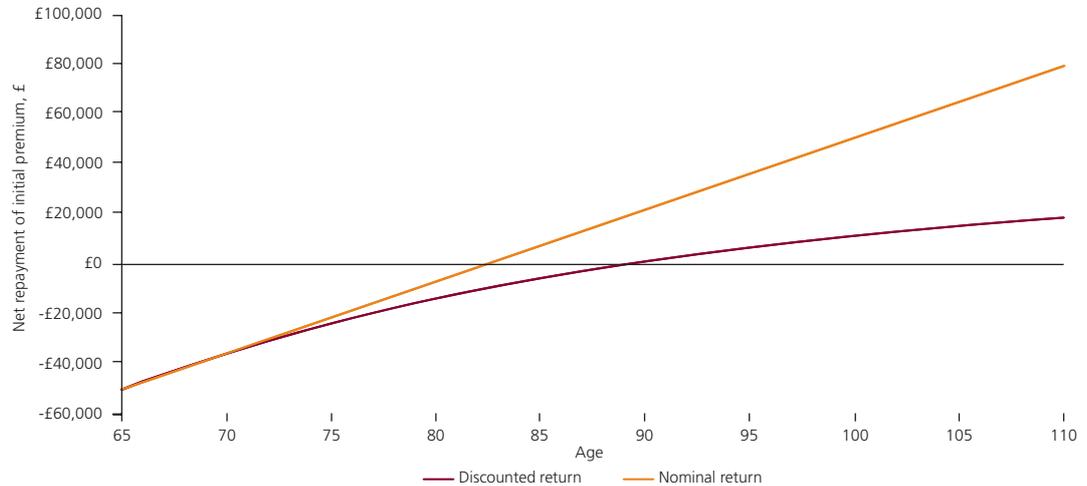
The preceding analysis showed the income profile of different strategies for providing an income stream in retirement from a pension pot. However, it misses out some of the important considerations of retirees when choosing a strategy. A common complaint about annuities is that retirees need to live for a long time (which it is perceived as being an unlikely outcome) before they get ‘their money back’.⁴¹

Retirees can think about this question in two ways. A simple approach would be to think about nominal amounts and count how many years a retiree has to live before he or she recovers the premium spent to buy an annuity. Another approach would be to consider the question in net present value terms i.e. discounting the future cash flows at the appropriate rate.

We start with discussing annuities, given that they are the only strategy where money can be ‘lost’ (in case of death as no additional payments would be made). We present the results of both approaches in Figure 21 for the baseline profile and in Figure 22 for the same profile but with a £10,000 pot.

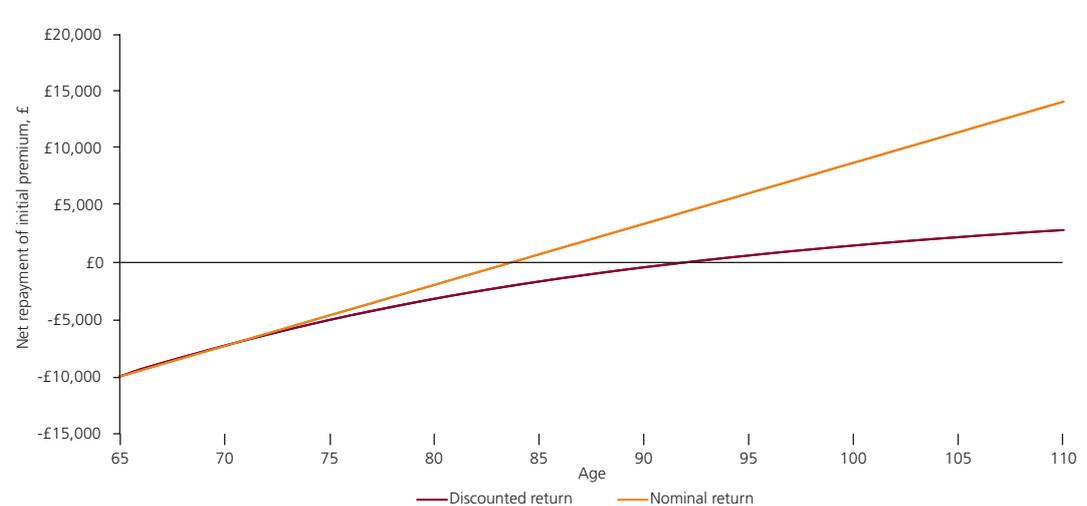
⁴¹ Ignition house, in research for the FCA, found that consumers significantly underestimate their life expectancy (see Exploring Consumer Behaviour in the At Retirement Landscape – Qualitative Consumer Research).

Figure 21: Breakeven age at which premium is returned to retirees – £50k level annuity



In nominal terms an annuitant with a £50k pot will receive their money back after around 17 years, i.e. at around 82 years old. Under the approach where cash flows are discounted then retirees will only get their money back when they are 89. The likelihood of this happening is 76% (81% for females) and 50% (57% for females) respectively.

Figure 22: Breakeven age at which premium is returned to retirees – £10k level annuity

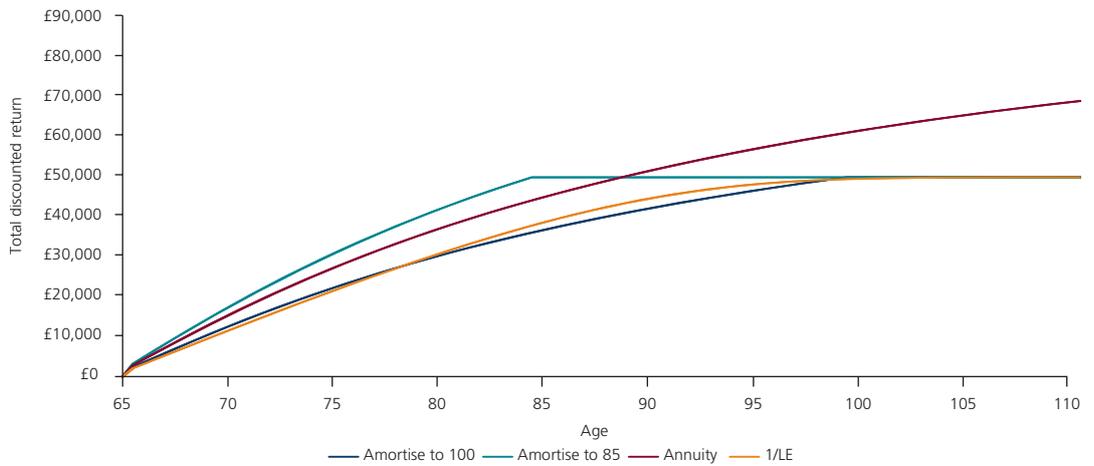


This picture is worse for smaller annuity pots, where the income available is proportionally lower and therefore annuitants get their money back later. At 83 retirees get their money back in nominal terms and at 92 in NPV terms. The likelihood of this happening is 68% and 34% for male annuitants respectively (76% for female and 41% for female annuitants respectively).

For older annuitants, the number of years required to recover the money is smaller but so is the likelihood of reaching that age. For a 75 year old with a £50,000 pot, 12 years will be required to recover their money in nominal terms and 15 years to recover it in NPV terms. The likelihood of this happening is 61% and 46% for male annuitants respectively (68% and 54% for female annuitants respectively). The corresponding numbers for a £10,000 pot are 13 years and 17 years and the corresponding likelihoods 53% and 33% for male annuitants (61% (and 41% for

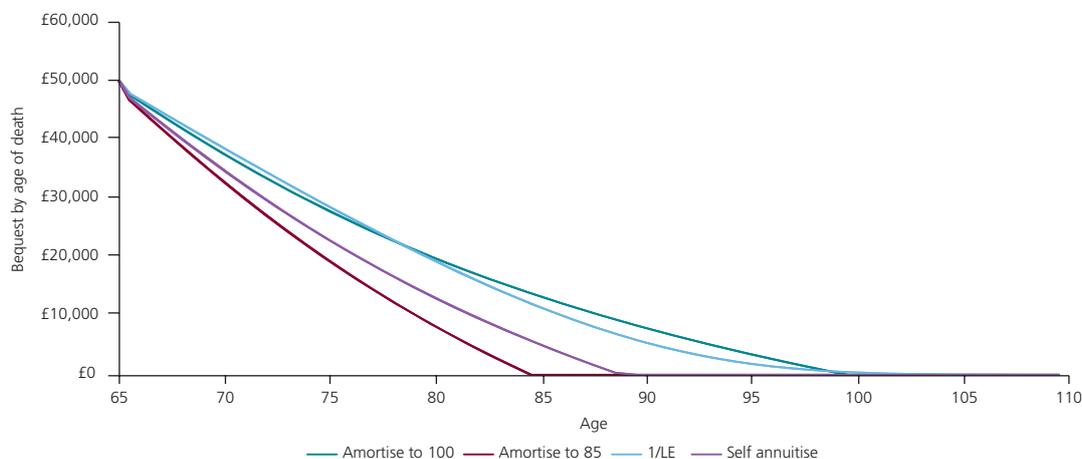
female annuitants). Given that, for the time being, we are assuming that retirees would invest in riskless bonds, for strategies other than annuities there is clearly no risk of losing capital due to lower-than-expected returns: any amount that remains if a retiree dies can be passed on to heirs. Despite this, it is informative to show how the two components (payments and remainder value) make up the full value of the strategy. Figure 23 and Figure 24 therefore report respectively the total discounted value of the payments received using the various strategies and the amount of potential bequest that can be left in case of death at any age.

Figure 23: Total discounted value of payments from the different strategies*



* the self-annuitise is not shown separately: it has the same profile as the annuity profile except it is truncated at £50,000 (i.e. the retiree cannot receive back more than £50,000).

Two things are worth noticing, the first is that the annuity strategy is the only one where the potential value exceeds the initial amount given as the insurance element of the contract enables people to receive more than they put in when they purchased the product. Second, the amount that can be left as a bequest declines pretty quickly for all the other strategies: by the time people turn 78 the remaining value of the pot is less than 50% of the original amount in all cases and less than a third by the time they turn 83.

Figure 24: The decreasing potential bequest in case of death, by age

6.3.4 Likelihood of receiving other amounts

Here we generalise the result presented in the previous sub-section by considering the likelihood of receiving back from the chosen strategy different amounts.⁴² We focus our attention on the NPV calculations rather than the nominal ones as this is the rational comparison to make. As usual we use our baseline profile and the same profile for a £10,000 pot.

Rather than presenting the results depending on the age of the person retired we present the probability of receiving any given amount. This complements the information above on the income that can be achieved at any given point in time following any of the strategies.

Given that it pays considerably more in the initial years after retirement, the 'amortise to 85' strategy guarantees that more than 80% of the people using it would receive payments in excess of £40,000. The 'amortise to 100' and 1/LE strategies would result in 50% and 60% receiving at least this amount. The annuity is somewhere in between: 65% of the people would receive at least £40,000.

For pots of £10,000 the results are similar: 65% of people would receive at least £8,000 back. No changes would apply to the two amortising strategies (as life expectancy is not taken into account) while the 1/LE performs slightly better in this instance.

The better performance of annuities bought with large pots is even clearer if we focus on the share of people who will receive more than the original amount: this percentage is 36% for £10,000 pots and 52% for £50,000 pots.

⁴² The graphs exclude bequests for non-annuity strategies. If they were to include bequests then there would be a straight line at the level of the premium: whatever is not paid out in income can be recovered as a bequest.

Figure 25: The probability distribution of cumulative discounted return for different retirement strategies – 65-year-old male with a retirement fund of £50,000 retiring in June 2014 (no fees)



6.4 Results under the scenario with investment risk

In the analysis conducted so far we have assumed that retirees who do not buy an annuity would invest their money in riskless bonds and earn the risk-free rate. We think this assumption has merit given that the main purpose of a pension is to provide an income and not to increase wealth, and that retirees may well not be willing to bear a substantial amount of risk. However, it is also clear that at least some retirees, perhaps higher net worth individuals who have other income streams, may be comfortable with higher levels of investment risk. Furthermore, one of the main advantages of retaining control over one's pot is the ability to select an investment strategy and it therefore makes sense to analyse what the likely effects of taking up investment risk would be.

It is likely, however, that retirees would incur costs in implementing an investment strategy. Asset management charges, dealing costs, advice costs (for those retirees that will use an adviser) and the cost of the wrapper or the platforms will be relevant here. While these costs can be avoided altogether if retirees buy an annuity (and can be considerably reduced if they are content with earning the risk-free rate) they will form part of a strategy that involves investment risk.

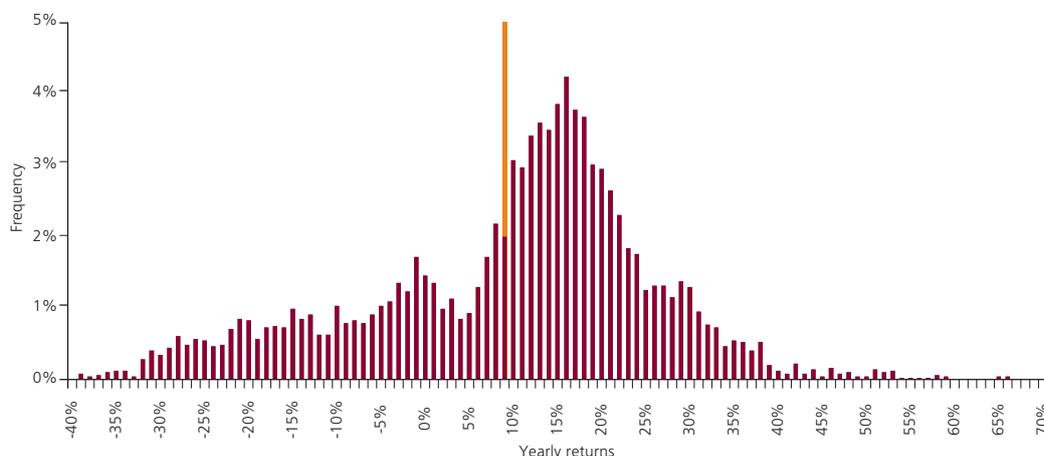
We present results where overall costs applied to non-annuity strategies are 1% and 3% of the remaining pot each year (a low cost and a high cost scenario), as well as a baseline where no additional costs are levied.

The introduction of investment risk, however, also makes it more difficult for us to include the amortisation strategies: given that the returns are uncertain retirees would have to constantly re-assess their spending. We therefore focus on the self-annuitisation and 1/LE strategies. All the results below are generated using 10,000 simulations of the long-term performance of the FTSE 100 Total Return Index, as described in the next section.

6.4.1 Risk premium

When discussing strategies that allow retirees to take some investment risk we need a baseline for assessing this risk. We rely on the FTSE 100 total return index, as it includes income from dividends as well as the value of the underlying shares.

Figure 26: Distribution and mean of yearly returns for the FTSE 100 total return index (July 1994 – July 2014)



Note: the vertical orange line denotes the mean return.

We use the 20-year period from July 1994 to July 2014 to analyse these returns. Any choice of period is somewhat arbitrary, but our view is that 20 years is a sufficiently long period to cover the economic cycle. Using the entire period for which the index is available (from 1984) would make investing in equities slightly less risky in terms of volatility but average returns would be lower. The frequency of annual returns of the FTSE 100 total return index is reported in Figure 26 together with the mean return.

We calculated annual returns for each day of the 20 years of FTSE total return data. We then used these data to create 10,000 scenarios for the possible future returns from investing in this index. We randomly chose one of the potential FTSE returns for each year of each scenario. For example, in year 10 of scenario 5 we randomly draw a yearly return from the distribution of yearly FTSE returns. We then drew again from the distribution for the next year and so on. By doing so, retirees experience variability in their yearly returns under each scenario, as happens in reality. By doing this for every year of every scenario we modelled various drawdown strategies, taking in to account the riskiness of investing in equities. This gave us with a distribution of the potential outcomes from investing in equities to provide a retirement income.

We chose this length of time as it covers a significant period of recent history that contains several periods of increasing and falling markets. This will provide a reasonable representation of the future risks retirees face. We could have used a longer time period for these returns, but using data from longer ago may not better describe the risks consumers face. We note that over different periods of time the equity risk premium has fluctuated over time (Dimson, Marsh, & Staunton, 2003).

We acknowledge that this is a simple approach to assessing alternative strategies with investment risk. Our analysis does not account for either persistence in returns or reversions to the mean of investment returns. For example, one paper (Campbell & Schiller, 2001) found that there is some persistence in stock returns. Alternatively, (Balvers, Wu, & Gilliland, 2000) find mean reversion in stock market returns. Even if either of these is present in the equity returns presented we do not believe their effects are large enough to materially affect the outcomes consumers face by using equity to provide an income in their retirement. We also note that extreme events with low probability – so called ‘black swans’ – have the potential to significantly affect investor outcomes but are perceived extremely unlikely looking at past data.

Further, the returns provided at the beginning of the period were in a period of high inflation in comparison to the present time. Yields on equities may have been higher for the early part of period of our data than could be expected in the future. Consequently, it is possible that our analysis overstates the incomes that can be expected from investing in equities. If so, the risks of investing in equities to provide a retirement income are greater and the potential upside is smaller than presented in the following analysis.

First we present the case in which a retiree chooses a self-annuitisation strategy. We discuss the distribution of the remaining pot sizes and the probability of exhausting the pension pot at different ages. We combine this information with different levels of fees that retirees may have to pay. There is no need to discuss annual consumption in this case: retirees have access to the same amounts that would be available if they were annuitising. That is, under the strategy of self annuitising, consumers take exactly the same income as that obtained from purchasing a standard, level annuity.

Second we discuss the consumption paths that can result if the retiree adopts the 1/LE strategy. Clearly these paths depend on how well their funds are performing as well on their remaining life expectancy. In this case too we combine the information obtained by adopting this strategy with different levels of fees.

6.4.2 Self-annuitisation strategy

It is clear that the self-annuitisation strategy has the potential to increase the wealth of retirees but embeds a significant element of risk. In the absence of fees there is approximately a 65% chance of the pot being larger than £50k after 20 years but there is a one in ten chance that retirees will exhaust their pension pot by age 85. On average, consumers' pot size increases substantially, but mainly because those investing at opportune times experience significant growth in their pots and these outcomes dominate the figures.

Table 15: Probability of preserving capital at £50k and of exhausting the pension pot at 85

		Probability of pot being larger than £50k at 85	Exhaust the pension pot by 85
65 years old	0% fees	65.0%	10.1%
	1% fees	54.3%	14.4%
	3% fees	32.6%	27.1%
75 years old	0% fees	47.0%	2.9%
	1% fees	39.1%	3.9%
	3% fees	23.4%	7.7%

Including fees in the calculations clearly reduces the expected returns that retirees can enjoy. If fees total 1% of the pot size then the probability of pots being larger than £50k in 20 years is 54%. 14% of the time retirees will exhaust their pension pot by age 85 and 24% of the time retirees will have exhausted their pot even before they would have if they had invested in risk-free bonds. Higher levels of fees would make achieving good returns more difficult: in the somewhat extreme, but still plausible, scenario of fees of 3% per year in over 50% of the time people exhaust their pension pot by age 95.

For those adopting this strategy at 75 years old, 2.9% of the time retirees will exhaust their pension pot by the time they turn 85. With fees at 3% a year, under the median scenario retirees will have exhausted their pot by age 93 and 70% of the time retirees exhaust their pot by age 100.

To convey similar information in a slightly different way, Figure 27 and Figure 28 report the probability of exhausting the pension pot at different ages for different levels of fees. The potential for growing one’s pot is clearly present but there is a significant risk of exhausting the pension pot nonetheless.

Figure 27: The probability of exhausting the pension pot for a 65-year-old retiree using the self-annuitise strategy investing in equities – for different levels of fees

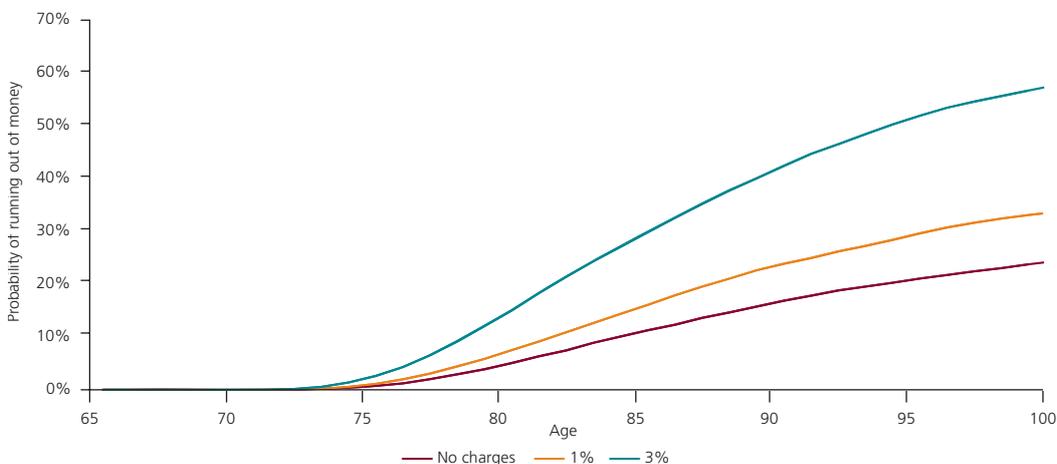
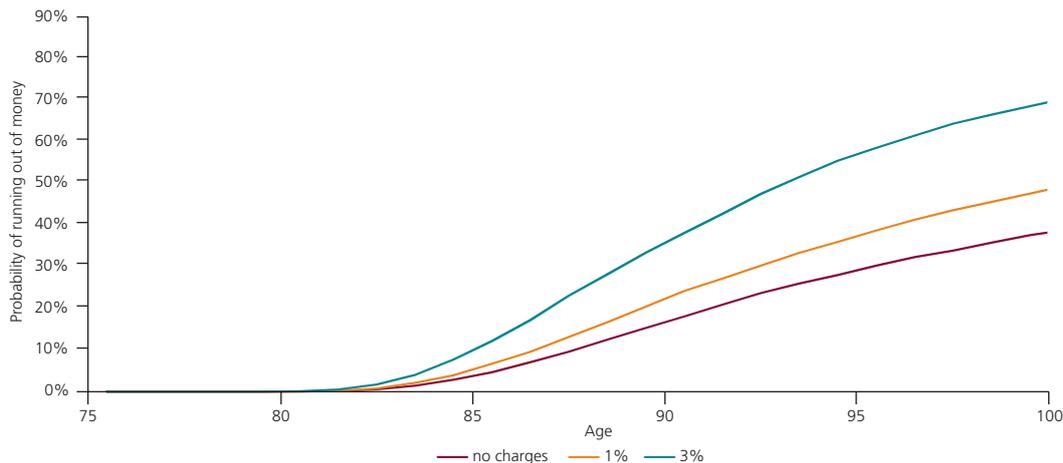


Figure 28: The probability of exhausting the pension pot for a 75-year-old retiree using the self-annuitise strategy investing in equities – for different levels of fees



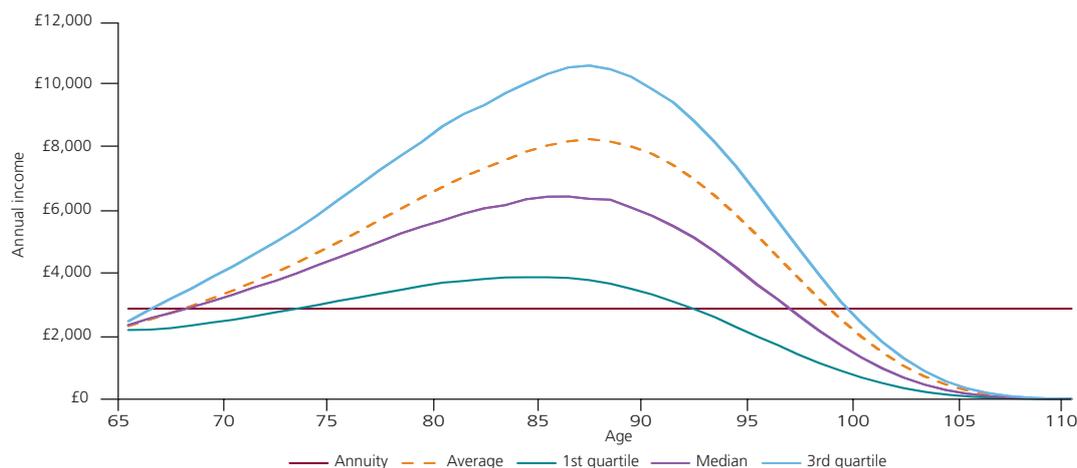
6.4.3 1/LE strategy

In all the cases discussed above retirees consume the same amount they would consume had they bought an annuity. In the 1/LE case, consumption patterns depend on both investment performance and life expectancy. We are mainly interested in two things, the size of the potential gains from a consumption perspective and the likelihood of such gains materialising.

The results of our simulations are reported in Figure 29. If fees are as high as 3% a year, then 14% of retirees do not consume more than the annuity. The consumption difference in the later years is even more startling: 74% of the time consumers will consume less than the annuity sometime between 70 and 85, and 22% of the time retirees will consume less than half of the annuity income between 85 and 90.

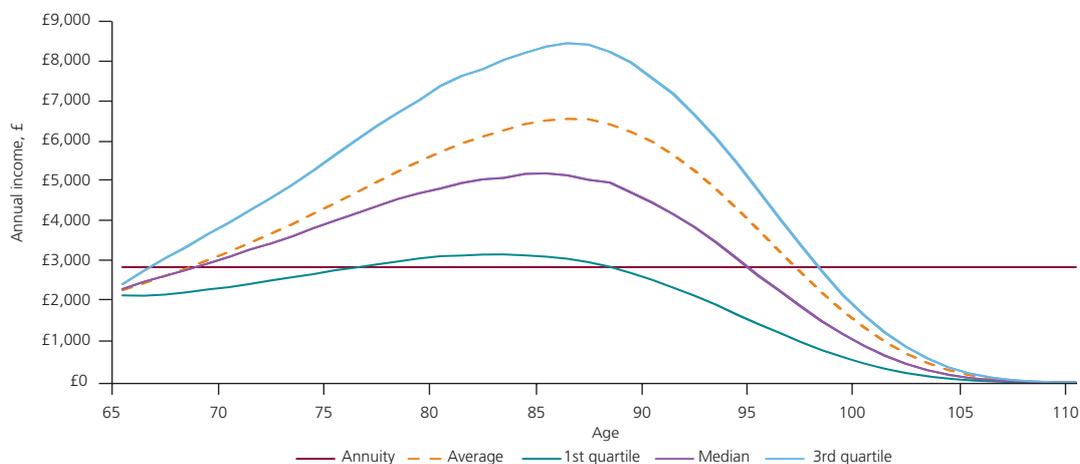
By looking at Figure 31 it is clear that this strategy could yield substantial consumption gains for retirees. On average, retirees get to consume more than an annuity each year if they invest in equities (on average their income is £4,258 compared to £2,879 in year 10) but there is considerable volatility in both the changes in consumers' yearly income and in their average income over time. Only 50% of the time do retirees get to consume more than the annuity every year between the ages of 70 and 85 even though the median yearly income is significantly above the annuity income. 30% of the time they will not consume as much as the annuity in any of the first five years. A significant minority can enjoy very large consumption in their later years. However, 3% of the time people never consume more than with an annuity at any point of their retirement due to poor investment returns.

Figure 29: Distribution of income using a 1/LE strategy with no fees



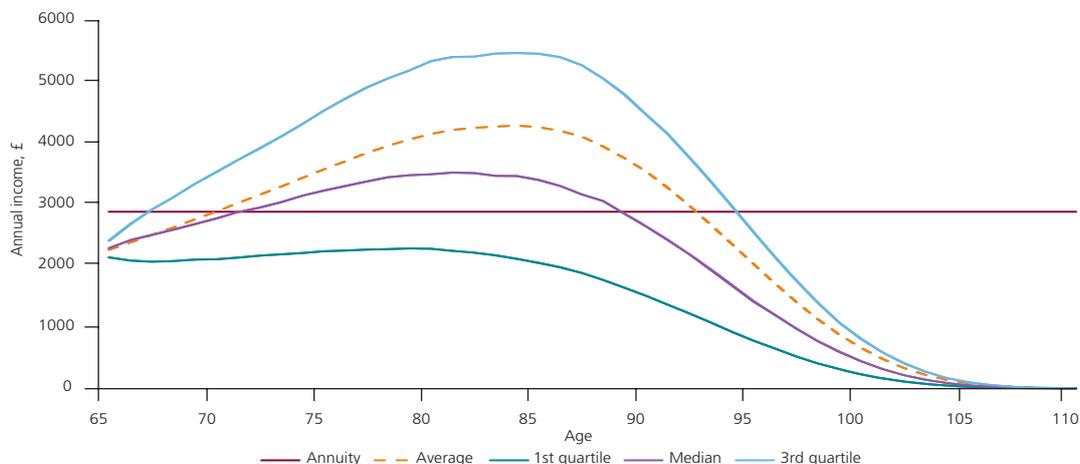
The picture is worse once fees are taken into account. Even with overall fees at 1% a year, 5% of the time retirees will consume less for all years than with an annuity, and in only 42% of scenarios will retirees consume more than the annuity every year between 70 and 85 and 9% of the time consumers will consume less than half the annuity income at some point between 85 and 90.

Figure 30: Distribution of income using a 1/LE strategy and fees at 1%



If fees are as high as 3% a year then 14% of retirees never get to consume more than the annuity. The consumption difference in the later years is even more startling: 74% of the time consumers will consume less than the annuity sometime between 70 and 85, and 22% of the time retirees will consume less than half of the annuity income between 85 and 90.

Figure 31: Distribution of income using a 1/LE strategy and fees at 3%



The strategy is similar if adopted by a 75 year old. 3% of retirees never earn more than the annuity and 30% of consumers will not have income greater than the annuity in the first five years and it is very unlikely consumers will consume as much in every one of the first five years. With fees of 1% (3%), 5% (10%) of retirees never have the same income as could be obtained through an annuity.

Table 16 shows the cumulated consumption at different ages for an individual who buys an annuity compared to the consumption of an individual who adopt the 1/LE strategy with fees of 1%. Under 41% of scenarios, individual who bought an annuity at 65 and who reached age 75 will have consumed nominally more than retirees who adopted the 1/LE strategy. This falls to 24% for the first 20 years but to some extent this flatters the 1/LE strategy as annuity payments are front-loaded for annuities compared to the 1/LE strategy for 65-year-olds and does not account for the volatility in income that consumers face using the 1/LE strategy. For

retirees starting the strategy later (i.e. at 75), the probability of consuming more than the annuity after 10 years is 72% but after this there is an increasing chance of consuming less.

Overall, therefore, alternative strategies become riskier at older ages and it may well make sense to annuitise once the mortality premium embedded in annuities kicks in.

Table 16: Distribution of nominal cumulated income by different ages for different strategies for a male 65yo annuitant with a £50k pot with fees at 1% (average quote of June 2014)

Age	Profile strategy	Percentile	Cumulated income
75	Annuity	–	£28,788
	1 over LE	1st quartile	£24,812
		median	£30,847
		3rd quartile	£37,737
85	Annuity	–	£57,577
	1 over LE	1st quartile	£58,277
		median	£79,249
		3rd quartile	£107,313
95	Annuity	–	£86,365
	1 over LE	1st quartile	£87,877
		median	£126,114
		3rd quartile	£180,728

7. Conclusions

We have calculated the MW for a number of different annuity contracts, ages and time periods. For our baseline profile approximately 94% of the premiums gathered by insurance firms are handed back to retirees throughout the period (after adjusting for the time value of money). This amount, or MW, is reasonably stable between 2006 and 2014. Moreover, our calculations show that smaller pots return a lower MW of annuities. This suggests that annuities represent good value for money as consumers get the vast majority of their premium returned to them in income. This is wholly different from the perception consumers have of annuities. This perception may have arisen from the reduction in annuity rates that have occurred in the recent past which can be attributed to falls in interest rates and increases in mortality. Consumers who switch from annuities to alternative strategies face these very same factors when choosing alternative ways of drawing a retirement income.

We also observed that while annuities bought in the Open Market provide reasonably good value for money, annuities bought internally from the pension accumulation providers give a lower MW. This reinforces the findings of the Thematic Review on annuities on the importance of shopping around and the use of the Open Market.

By comparing the different strategies in terms of the annual income they can give to retirees it is clear that it is difficult to match the income that a level annuity would provide. The only strategy that, without exposing the retiree to investment risk, beats a level annuity in terms of yearly income is the 'amortise to 85' strategy. But if retirees were to adopt this strategy then between 65% and 78% of them (depending on gender and age of annuitisation) would turn 85 and have no money left.⁴³

Some retirees may find the option to withdraw a yearly income equivalent to the annuity attractive, given that it avoids a potential capital loss if the retiree dies soon after retiring. However, such a strategy would still be quite risky: between 30% and 37% of retirees would exhaust their pot and be left with no income. Overall, therefore, retirees who prefer to retain flexibility on how and when they spend their money might have to pay a substantial price either in terms of reduced spending power or in terms of risk of having no money left for the last few years of their lives.

The lack of attractiveness associated with buying an annuity, however, is that retirees may perceive that it will take a long time to recover the purchase price. A 65 year old would require 17 years – and a 75 year old 12 years – to recover the nominal amount (and quite a bit longer if the calculation is made in net present value terms). The length of time it takes to recover the money, the fact that people tend to care more about the present than about the future and the tendency to underestimate life expectancy might all contribute to the lack of attractiveness of annuities.

⁴³ According to the longevity models used in this study, almost one out of two annuitants (with £50k pot) aged 65 in June 2014 will survive to 90.

If retirees can either afford to bear investment risk (e.g. because they have substantial additional wealth in addition to their pension pot), or are comfortable with doing so (e.g. because they are risk loving) then strategies other than annuitising become considerably more attractive. By investing in risky assets, a majority of retirees may be able to enjoy higher consumption in a number of years and keep the option of buying an annuity open. And a significant minority will consume considerably more than with an annuity. However a significant minority would still exhaust their pot early in their retirement.

Being able to invest cheaply would also help retirees obtain higher consumption. Withdrawals of approximately 5% a year from the fund coupled with high fees make achieving high returns more difficult. Even if retirees pay no investment fees almost a quarter of them will exhaust their pension pot by age 100 if they withdraw the same amount as an annuity and approximately 10% of them will never consume as much as with an annuity if they adopt the 1/LE strategy. But the potential upside is substantial and some retirees may well be prepared to take that risk. If fees are 3% a year, a high amount but by no means an impossible option,⁴⁴ the situation worsens considerably.

The size of the pot a retiree has will be a major factor in the choice of an appropriate retirement strategy. Smaller retirement pots provide poorer value annuities but retirees with these small pots are likely to be less able to cope with the risks that alternative strategies create. For instance they would not be in a position to draw on other sources of income if they suffer a negative investment shock early in their retirement. Furthermore, the fixed costs of running alternative strategies (e.g. advice) are likely to affect investment performance for these small pots much more heavily and therefore these alternative strategies may be less suitable for those with smaller pots. Overall therefore it is retirees that have limited other wealth that could be more vulnerable in the future landscape.

All the above analysis is based on the implicit assumption that the MW of annuities does not deteriorate significantly as, if that were to be the case, alternative strategies will become clearly more attractive to retirees. The analysis presented in the first part of this paper showed that no decline could be seen in the last eight years. However, if annuity sales shrink significantly it might become more difficult for insurance companies to pool risk efficiently and selection effects may increase, resulting in lower annuity rates further exacerbating the issue.

⁴⁴ An adviser charge of 0.5% a year, a fund management charge of between 0.75% and 1% a year and a wrapper charge of 0.4% a year would result in annual expenses in the region of 1.65% to 1.9% a year. More expensive funds or other costs such as transaction-specific fees or annual wrapper fees may well result in overall costs of 3% a year.

Annex A

Glossary

Money's Worth of annuities (MW) is a measure to assess the value of a pension annuity. It is the present value of the expected future payments divided by the premium paid initially. It is based on three things:

1. the annuity rate, which is the payment divided by the premium
2. the probability of being alive (and therefore of receiving the payment) in any given period in the future
3. the interest rates to calculate the discount factors to calculate the present value

In mathematical terms, MW can be expressed as follows:

$$\text{Money's Worth}_{\text{level}} = A_t \sum_{i=1}^T \frac{\pi_{t,t+i}}{(1 + R_{t,i}^{\text{Nom}})^i}$$

Where t is the time of purchase, A_t is the annuity rate at time t , $\pi_{t,t+i}$ is the probability that a retiree will live i more periods and $R_{t,i}^{\text{Nom}}$ is the nominal discount rate applying between time t and $t + i$.

The MW of an RPI-linked escalating annuity is:

$$\text{Money's Worth}_{\text{RPI-linked}} = A_t \sum_{i=1}^T \frac{\pi_{t,t+i}}{(1 + R_{t,i}^{\text{Real}})^i}$$

Where t is the time of purchase, A_t is the annuity rate at time t , $\pi_{t,t+i}$ is the probability that a retiree will live i more periods and $R_{t,i}^{\text{Real}}$ is the real discount rate applying between time t and $t + i$.

The MW of a 5% escalating annuity is:

$$\text{Money's Worth}_{\text{5\% escalating}} = A_t \sum_{i=1}^T 1.05^{i-1} \frac{\pi_{t,t+i}}{(1 + R_{t,i}^{\text{Real}})^i}$$

Where t is the time of purchase, A_t is the annuity rate at time t , $\pi_{t,t+i}$ is the probability that a retiree will live i more periods and $R_{t,i}^{\text{Real}}$ is the real discount rate applying between time t and $t + i$.

The MW of a guaranteed annuity can be expressed as follows:

$$\text{Money's Worth}_{\text{guaranteed}} = A_t \left(\sum_{i=1}^G \frac{1}{(1 + R_{t,i}^{\text{Nom}})^i} + \sum_{i=G+1}^T \frac{\pi_{t,t+i}}{(1 + R_{t,i}^{\text{Nom}})^i} \right)$$

Where t is the time of purchase, A_t is the annuity rate at time t , $\pi_{t,t+i}$ is the probability that a retiree will live i more periods, $R_{t,i}^{\text{Nom}}$ is the nominal discount rate applying between time t and $t + i$ and G represent the guaranteed period (e.g. 5 years or 10 years) during which the probability to receive the payment is equal to 1.

Standard annuity. Commonly offered to a healthy person (as opposed to an enhanced annuity which is usually offered to a retiree with health problems).

Enhanced annuity. Commonly offered to retirees with health problems.

Level annuity. Pays the same amount of money for all the life of the annuitant.

Escalating annuity. Pays an increasing amount of money and it can either be linked to the RPI index or increase at a pre-agreed rate (e.g. 5% per annum).

Guaranteed annuity. Guarantees the payments for a pre-agreed number of years (usually five or ten years). In case the annuitant dies before the guaranteed period, the payments go the annuitant's estate.

Single life annuity. An annuity sold to an individual person and the payments stop when the annuitant decease (as opposed to joint annuities, which are linked to the life a couple).

Joint life annuity. Makes payments until the demise of both partners (payments may reduce after the death of one of the partners).

Investment linked annuity. Linked to the performance of the stock market. The income of the retiree could go down as well as up. These can either be unit-linked to a particular portfolio of funds, or with-profits i.e. relating to the particular scheme in which the funds are invested.

OMO annuities. These are annuities bought using the Open Market Option,

Internal annuities. Bought from the pension accumulation services provider.

CMI Base mortality table. For base mortality rates, it is typical to use a standard mortality table, which is then adjusted for any additional information available about the expected mortality rates of the individuals in question.

Short, Medium and Long Cohort projection. Revised projections used to adjust the base mortality table for the expected longevity improvement.

Annex B

More on longevity assumptions

Table 17 and Table 18 summarise the longevity assumptions used in this study.

Table 17: Base mortality tables

Pot size	Gender	Base mortality rates
£10,000	Males	100% PCML00
	Females	100% PCFL00
£50,000	Males	100% PCMA00
	Females	100% PCFA00

Table 18: Mortality improvements and underpin used

Purchase date	Gender	Improvement basis	Underpin/long-term rate
On or prior to 31 December 2009	Males	100% of Medium Cohort	1% (underpin)
	Females	75% of Medium Cohort	0.75% (underpin)
1 January 2010 to 31 December 2010	Males	CMI 2009 (males)	1.5% (long-term rate)
	Females	CMI 2009 (females)	1.25% (long-term rate)
1 January 2011 to 31 December 2011	Males	CMI 2010 (males)	1.5% (long-term rate)
	Females	CMI 2010 (females)	1.25% (long-term rate)
1 January 2012 to 30 June 2013	Males	CMI 2011 (males)	1.5% (long-term rate)
	Females	CMI 2011 (females)	1.25% (long-term rate)
1 July 2013 to 31 December 2013	Males	CMI 2012 (males)	1.5% (long-term rate)
	Females	CMI 2012 (females)	1.25% (long-term rate)
From 1 January 2014	Males	CMI 2013 (males)	1.5% (long-term rate)
	Females	CMI 2013 (females)	1.25% (long-term rate)

Figure 32 shows the life expectancy for an annuitant at different ages. For example, the life expectancy of a female annuitant ages 55 increased from 32 years in January 2006 to almost 35 in June 2014. Another example is the life expectancy of a male annuitant aged 85 that increased from 7 years in 2006 to 8 years in June 2014.

Figure 32: Different like expectancy for an annuitant with £50,000 pot at different ages.

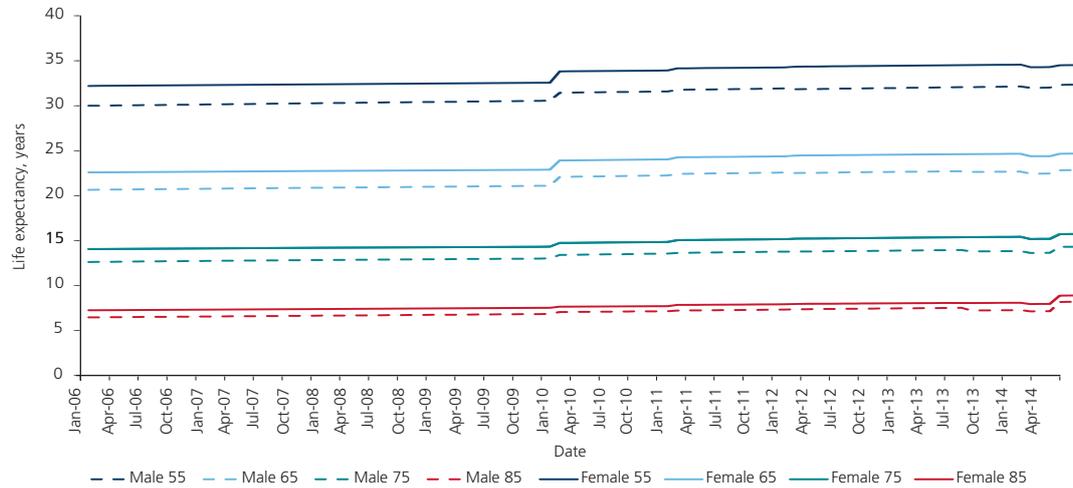
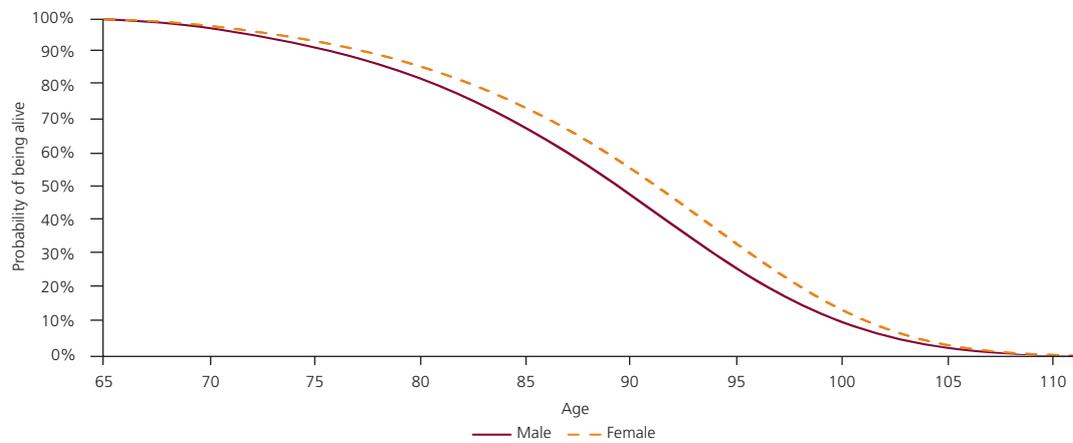


Figure 33 shows the probability of being alive for a 65-year-old annuitant at different ages.

Figure 33: Probability of being alive for a 65-year-old annuitant, with a £50,000 pot



Annex C

Impact of interest rates and mortality assumptions on Money's Worth

In Section 4.1.1 we estimate the impact of the variation of interest rates and longevity assumptions on annuity payments. Here we show the mathematical expressions used to calculate such impact. As explain earlier, we are interested in calculating the yearly payment that an annuitant would receive if he buys an annuity in June 2014 assuming that mortality assumptions are the same as January 2006 and keeping MW constant. In other words, we want to calculate A_t^* such that:

$$A_t^* \sum_{i=1}^T \frac{\pi_{Jan\ 2006, Jan\ 2006+i}}{(1 + R_{t,i}^{Nom})^i} = A_t \sum_{i=1}^T \frac{\pi_{t,t+i}}{(1 + R_{t,i}^{Nom})^i} \overbrace{\hspace{10em}}^{MW_t^{Actual}}$$

After a simple manipulation we can write A_t^* as follows:

$$A_t^* = \frac{A_t \sum_{i=1}^T \frac{\pi_{t,t+i}}{(1 + R_{t,i}^{Nom})^i}}{\sum_{i=1}^T \frac{\pi_{Jan\ 2006, Jan\ 2006+i}}{(1 + R_{t,i}^{Nom})^i}}$$

When $t = June\ 2014$, A_t^* represents that payment that a retiree would obtain purchasing an annuity in June 2014 if mortality assumptions were the same of January 2006, keeping MW constant.

Similarly, we can calculate the payment in June 2014 using the interest rates of January 2006. In other words, we want to calculate A_t^* such that:

$$A_t^* \sum_{i=1}^T \frac{\pi_{t,t+i}}{1 + R_{Jan\ 2006,i}^{Nom}} = A_t \sum_{i=1}^T \frac{\pi_{t,t+i}}{1 + R_{t,i}^{Nom}} \overbrace{\hspace{10em}}^{MW_t^{Actual}}$$

After a simple manipulation we can write A_t^* as follows:

$$A_t^* = \frac{A_t \sum_{i=1}^T \frac{\pi_{t,t+i}}{(1 + R_{t,i}^{Nom})^i}}{\sum_{i=1}^T \frac{\pi_{t,t+i}}{(1 + R_{Jan\ 2006,i}^{Nom})^i}}$$

When $t = June\ 2014$, A_t^* represents that payment that a retiree would obtain purchasing an annuity in June 2014 if interest rates were the same of January 2006, keeping MW constant.

Annex D

Alternative ways to consider Money's Worth

As explained above, the MW of an annuity is the expected present value of the annuity payments divided by the actual price paid. It is a measure of how much a retiree on average will receive back of their pension pot, adjusted for the time value of money. Alternative ways of assessing MW are:

- i) to consider how large the reduction in yield compared to an alternative investment option is
- and ii) to calculate the payment that would correspond to an MW of 100%

7.1.1 Reduction in yield

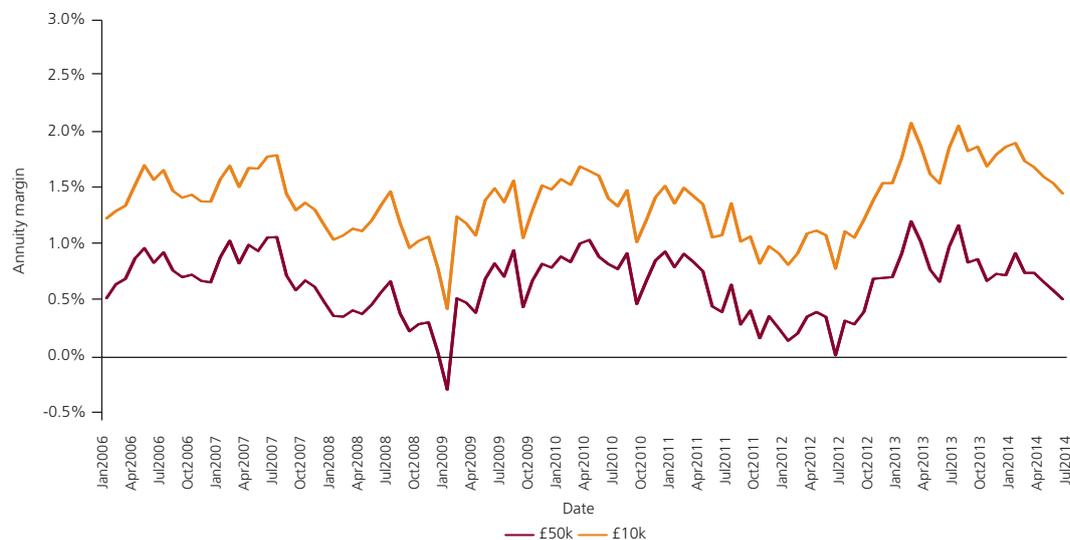
To calculate the reduction in yield we adjust the formula for MW with the single rate m so that the MW is equal to 1 and solve for the value of m .

$$\text{Money's Worth} = A_t \cdot \sum_{i=1}^T \frac{\pi_{t,t+1}}{(1+R-m)^i} = 1.$$

Clearly an annuity provides insurance against the possibility of outliving one's assets and we should expect a cost of this insurance compared to alternatives.

Figure 34 shows the level of m for £10,000 and £50,000 pots. As would be expected, given that smaller pots have lower MW, those with smaller pots need a much lower discount rate (or higher level of m) than larger pots to provide an MW of one. Over the period, on average, annuitants with a small £10k pension pot are receiving 1.4% a year less than would be expected given the rates available on government securities. In contrast, those with large £50k pension pots are only losing, on average, 0.7% per year.

Figure 34: Annuity margins from January 2006 to June 2014.



This reduction in yield can be viewed as analogous to an implicit Annual Management Charge in fund management. This is because in each year, for all future income payments (or remaining investment), the annuity provider is taking this percentage from these assets.

This cost also covers any anti-selection effects (i.e. retirees who consider themselves healthy are disproportionately likely to purchase an annuity) or longevity risks (everybody lives longer than expected) the life insurer must bear, as well as the administration costs of putting the annuity in place and running it over the life of the annuitant.

This analysis assumes that annuity providers invest solely in government securities. However annuity providers are usually able to earn an illiquidity premium over and above the risk-free rate. This has the effect of increasing the cost to retirees of investing in annuities given that the underlying assets would yield higher returns. However, there is risk associated with this approach which is not borne by an annuitant.

In a paper published in 2000, Murthi, Orszag and Orszag⁴⁵ (Murthi, Orszag, & Orszag, 2000) obtain reductions in yields for the UK in the year 2000 for a similar profile to ours. These are smaller than the ones we find for the 2006-2014 period. Although their results are based on a single date (in April 2000) this could be considered as evidence that annuities are worse value for money than they were in 2000. This result is confirmed by the report by Cannon and Tonks (Cannon & Tonks, 2013) which highlighted a reduction in the MW from the year 2000 to 2006.

From an investment perspective our estimate of the reduction in yield (RIY) can be compared to annual management charges in fund management. The comparison here seems to be quite favourable for annuities bought with larger pots where the RIY is 0.65% a year but less so for annuities bought with £10,000 pots. However, we should bear in mind that the annuity rates are inclusive of all the costs associated with buying the product (with the possible exception of advice), including the cost of the longevity protection, while transaction costs may well be payable if retirees decide to manage their own funds, an approach that generally comes with no longevity protection.

7.1.2 Reduction in yearly payments

Similarly, we can calculate the yearly payments that an annuitant would obtain if the annuity available was actuarially fair. To calculate the difference between the actual quote and the quote of an actuarially fair annuity we modify the expression of the MW in the following way:

$$\text{Money's Worth} = (A_t + p_t) \cdot \sum_{i=1}^T \frac{\pi_{t,t+i}}{(1+R)^i} = 1,$$

where p is the reduction in yearly payments compared to an annuity with MW equal to 1. For our baseline profile the monetary difference between the actual annuity quote and the actuarially fair annuity is £217 per year on average. This represents 7% of the actual payment. The reduction in payments is around 7-8% for all age profile and genders with a pot of £50,000. The reduction increases to 15-16% for annuitants with a pot of £10,000 (across all age and gender profiles). This suggests again that the larger the pension pot, the better value an annuity is. Table 19 shows the average reduction in yearly payments for different profiles.⁴⁶

⁴⁵ See www.oecd.org/dataoecd/30/61/2402277.pdf.

⁴⁶ The figures refer to a level annuity without guarantee.

Table 19: Average yearly payment reduction

Gender	Age	Pot	Average yearly payment reduction	% of actual payment
Male	65	£10,000	£93.05	15%
	70	£10,000	£115.59	16%
	65	£50,000	£217.09	7%
	70	£50,000	£292.64	8%
Female	65	£10,000	£87.52	15%
	70	£10,000	£107.01	16%
	65	£50,000	£245.94	8%
	70	£50,000	£322.74	8%

Annex E

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Appendix:

Mortality assumptions for value for money calculations

This appendix was written, and the associated mortality assumptions used in the report were developed, by professional actuaries supporting the authors of this report.

Disclaimer

In order to comprehend this report fully, any user should be advised by an actuary with a substantial level of expertise in areas relevant to this analysis to appreciate the significance of the analysis and the impact of the analysis on the mortality assumptions presented. This report must be read in its entirety together with the Appendices to be understood and must remain together with the Appendices at all times.

There is considerable variability surrounding future changes in longevity, and the influences on future experience are numerous and complex. This gives rise to significant uncertainty in the underlying parameters used in the analysis presented in this report. Moreover, the analysis of past experience may also be subject to uncertainty caused by insufficient data, data errors, heterogeneity in the data and random variability. This variability and uncertainty can lead to significant differences between the actual mortality rates of a specific group of individuals and the mortality assumptions given in this report.

The mortality assumptions and methodologies presented in this report do not constitute an exclusive set of reasonable methodologies and assumptions. The use of alternative methodologies, projection models, assumptions and analyses could yield results materially different from those presented.

The assumptions presented in this report are based on an actuarial analysis that uses historical mortality data and industry benchmarking. We are not experts in the fields of epidemiology or medical advances, for example, and have not sought to take account of expert knowledge from these fields in projecting future longevity trends.

It is also noted that while life expectancies are provided for some sample ages and used in the illustrative analysis presented, they are based on assumptions that have been derived from expected patterns of mortality of large groups of similar individuals. No one knows exactly when any one individual will die, nor is a life expectancy intended to suggest the time until death of an individual will be close to his or her life expectancy. For a variety of reasons (such as improvements in medical technology, unanticipated general mortality improvement, mis-estimation of the life expectancy or randomness associated with an individual's lifespan), any one individual might live much longer than his or her estimated or assumed life expectancy. With small groups or subsets of insured lives, and particularly with a single insured, the actual time until death may be significantly different from the life expectancy or that predicted by any particular mortality table.

Introduction

The purpose of this report is to summarise the proposed mortality assumptions to be applied in the Money's Worth and Value for Money framework for annuities and other retirement products.

The output from this exercise will be a set of assumed mortality rates for each of the following categories of individual:

- 1.** Those buying level annuities with no guarantee period
- 2.** Those buying level annuities with a guarantee period
- 3.** Those buying increasing annuities (fixed or inflation-linked increases) with no guarantee period
- 4.** Those buying increasing annuities with a guarantee period

In addition, the analysis will split according to pot size, with differing assumptions in respect of a £10,000 pot size and in respect of a £50,000 pot size.

Executive Summary

Mortality assumptions can be broken down into:

1. **Base mortality rates**, i.e. the mortality rates that are assumed to apply at the date in question; and
2. **Rates of mortality improvement**, i.e. the assumed changes in mortality rates in future years as a result of improvements in medicine, lifestyles and other factors.

Choice of base mortality rates

For base mortality rates, it is typical practice in the insurance industry to assume mortality rates are in line with those taken from a standard mortality table, which is then adjusted for any additional information available about the expected mortality rates of the individuals in question.

When considering which standard table should be chosen, the following questions need initially to be answered:

1. Should the table reflect UK population mortality rates or some subset of the UK population, for example UK defined contribution ('DC') pensioners?
2. If the latter, precisely which category of pensioner should be chosen?
3. Should a lives-based or an amounts-based table be used?

The Continuous Mortality Investigation ('CMI'), on behalf of the UK Institute and Faculty of Actuaries, produces mortality tables that are derived from mortality data specifically relating to pensioners and annuitants whose benefits are provided by insurance companies. Therefore, in response to the first question above, it is thought that these tables would be more appropriate than a UK population mortality table, which would include the mortality rates of individuals who have no pension provision or defined benefit pension provision, and therefore might represent a different profile of affluence and, as a result, a different average mortality rate.

In response to the second question above, it was deemed that the 'Life office pensioner' category should be chosen from the range of CMI pensioner mortality tables. This is the largest category and represents DC pensioners whose occupational pension schemes and resulting retirement income are administered by life insurers. This was considered to be the most appropriate fit to the individuals that the FCA is concerned with.

On the lives vs. amounts question: Lives-based mortality tables are derived from a mortality study which gives equal weight in assessing mortality rates to each death and exposure year underpinning the mortality study, whereas amounts-based mortality tables give greater weight to the deaths and exposures of those individuals with larger pension amounts.

It is common practice for UK insurers to use amounts-based tables for pricing and reserving. The rationale for this is that the mortality experience of individuals with large pension amounts affect annuity providers financially more than those with small pension amounts, and therefore an amounts-based table is potentially better at reflecting the financial impact of longevity on annuity providers whose annuitants have a wide range of pension amounts.

A consequence of this is that the mortality rates in an amounts-based table will better reflect the life expectancies of individuals with larger-than-average pension pots.

Therefore, in response to the third question above, and given the distribution of pension pot sizes in the UK, it was considered that an individual with a £10,000 pension pot (i.e. a relatively small pot) would be better represented by a lives-based table, whereas an individual with a £50,000 pension pot (i.e. a relatively large pot) would be better represented by an amounts-based table.

Therefore it is proposed to use mortality rates from the CMI's lives-based PCML00 (males) and PCFL00 (females) tables for those with a pension pot of £10,000, and mortality rates from the CMI's amounts-based PCMA00 (males) and PCFA00 (females) tables for those with a pension pot of £50,000.

It is necessary to decide whether to adjust these tables to reflect any additional information available about the individuals.

In this case, the only information assumed to be available at the time of purchase is the fact that the individual has a DC pension pot, and that they are purchasing a particular form of annuity using a £10,000 or £50,000 pension pot.

When it comes to mortality modelling, it is not thought to be standard practice amongst insurers to differentiate (in terms of expected mortality rates) between those individuals who choose increasing annuities over level annuities, or individuals who opt or do not opt for a guarantee period. In addition, no public data is currently available in respect of historical differences in mortality rates between individuals choosing different annuity structures and it would therefore be speculative to adjust mortality rates on the basis of the specific product bought by annuitants.

Therefore it is proposed to use the same base mortality rates for individuals purchasing level and increasing annuities, with or without a guarantee period.

In summary, the proposed base mortality assumptions are given in the table below. All base mortality assumptions are assumed to apply at 30 June 2000.

Pot size	Gender	Base mortality rates
£10,000	Males	100% PCML00
	Females	100% PCFL00
£50,000	Males	100% PCMA00
	Females	100% PCFA00

Choice of mortality improvement assumptions

It is standard practice for mortality improvement assumptions to be calibrated in part by reference to historical improvements in UK population mortality rates. This is because the dataset available on historical mortality improvements amongst the DC pensioner population is not large enough to draw meaningful conclusions on historical trends and their propensity to continue.

The mortality improvement assumption adopted for the FCA's Money's Worth and Value for Money framework depends on the purchase date of the annuity. This is because the FCA's work is intended to reflect mortality assumptions **that would have been applied at the time of purchase**. Standard practice amongst practitioners has evolved since 2006 (the year from which the FCA's study begins), and a number of new sets of mortality improvement projections have been published by the CMI in that time. Therefore, the table of mortality improvements that would have been used to price an annuity in 2006 is different from that used during 2013.

For purchases prior to 2010, it is proposed that, for males, mortality improvement assumptions are in line with the CMI's Medium Cohort projection, which was common practice amongst practitioners at that time. For females, mortality improvements are assumed to be in line with 75% of the Medium Cohort table. This is because females have historically exhibited lower rates of mortality improvement than males, and using 75% of the Medium Cohort table was common industry practice to reflect this.

An 'underpin' of 1% for males and 0.75% for females is proposed. This underpin ensures that improvements never fall below 1% p.a. (0.75% p.a. for females), and is broadly in line with observed market practice at the time.

For purchases in 2010 and beyond, it is proposed that mortality improvements are taken from an appropriate⁴⁷ iteration of the CMI's mortality projections model. This is a model that projects future rates of mortality improvement by blending a statistical projection of historical UK population improvements into a long-term rate of improvement that is specified by the user. An analysis of UK insurers' reserving assumptions since 2010 indicates that a long-term rate of improvement of 1.5% p.a. for males and 1.25% p.a. of females would be within the range of observed market practice for best estimate assumptions (i.e. after allowance for the fact that reserving assumptions are required to be prudent measures of expected future experience).

It is therefore proposed that the following set of improvement assumptions (dependent on purchase date) is used:

Purchase date	Gender	Improvement basis	Underpin/long-term rate
On or prior to 31 December 2009	Males	100% of Medium Cohort	1% (underpin)
	Females	75% of Medium Cohort	0.75% (underpin)
1 January 2010 to 31 December 2010	Males	CMI 2009 (males)	1.5% (long-term rate)
	Females	CMI 2009 (females)	1.25% (long-term rate)
1 January 2011 to 31 December 2011	Males	CMI 2010 (males)	1.5% (long-term rate)
	Females	CMI 2010 (females)	1.25% (long-term rate)
1 January 2012 to 30 June 2013	Males	CMI 2011 (males)	1.5% (long-term rate)
	Females	CMI 2011 (females)	1.25% (long-term rate)
1 July 2013 to 31 December 2013	Males	CMI 2012 (males)	1.5% (long-term rate)
	Females	CMI 2012 (females)	1.25% (long-term rate)
From 1 January 2014	Males	CMI 2013 (males)	1.5% (long-term rate)
	Females	CMI 2013 (females)	1.25% (long-term rate)

As the standard CMI base mortality tables are based on historical mortality rates between 1999 and 2002 (i.e. centred on mid-2000), it is proposed that mortality improvements are assumed to apply to the base mortality rates from mid-2000 onwards. In other words, the base mortality rates are assumed to apply in mid-2000.

⁴⁷ The iteration of the CMI model chosen is based on an estimate of the approximate period when UK market practice shifted from the use of one iteration to the next.

An overview of mortality rates

A mortality rate for an individual aged precisely x is defined to be the probability that the individual will die by the time they reach age $x + 1$. This probability is typically denoted by the symbol q_x .

However, practitioners recognise that the mortality rate for an individual aged x is likely to depend on a number of other factors in addition to the individual's age. For example:

1. The gender of the individual
2. The calendar year to which the mortality rate relates (as mortality rates are expected to exhibit a decreasing trend over time as a result of improvements in medicine, lifestyles etc.)
3. The individual's affluence, occupation and / or socioeconomic status
4. The individual's state of health
5. The individual's lifestyle
6. Any other information available about the individual

In order to address the factors listed above, a mortality rate applying to an individual of a given gender aged x in year t is typically expressed as:

$$q_{x,t} = M\tilde{q}_x \prod_{s=b+1}^t (1 - r_{x,s})$$

where:

\tilde{q}_x is the age and gender-specific mortality rate from a mortality table.

M is a multiplier that is designed to reflect available information about the individual and any information on observed mortality rates of similar individuals. This is typically derived by insurers based on the mortality experience of their own portfolios. It is typically a constant, but can vary by age.

$r_{x,s}$ is the annual rate at which the mortality rate for a life aged x is assumed to improve (i.e. decrease) between years $s - 1$ and s .

b is the year in which the mortality rate $M\tilde{q}_x$ is assumed to apply (it is assumed that $t \geq b + 1$).

In other words, mortality rates can be expressed as the product of:

1. A 'base mortality rate' (i.e. $M\tilde{q}_x$); and
2. A mortality improvement factor (i.e. $\prod_{s=b+1}^t (1 - r_{x,s})$)

The base mortality rate is that assumed to apply to the individual at time b , i.e. before any allowance for mortality improvements has been made.

The date at which the base mortality rate is assumed to apply depends on the specific mortality table being used and how the multiplier M has been derived.

It is important when specifying mortality assumptions that the following items are specified:

1. The mortality table being used;
2. The value of M ;
3. The table of mortality improvements to be applied; and
4. The value of b , i.e. the year in which the base mortality rates are assumed to apply, and the year in which mortality improvements are assumed to begin

Choice of base mortality table

For the purposes of the mortality rates applying to individuals reaching retirement, there are two broad choices when it comes to the mortality table to choose:

1. A mortality table issued by the CMI, which is a subsidiary of the Institute and Faculty of Actuaries; or
2. A mortality table produced by the Office for National Statistics ('ONS').

The CMI produces graduated mortality tables that are based on the mortality experience of subsets of the UK population that are of particular interest to actuaries, including pensioners and annuitants.

The ONS produces mortality tables that are based on the mortality experience of the UK population as a whole (or the populations of the UK's constituent countries).

The table below gives a list of the most recent relevant mortality tables produced by the CMI and the ONS, with a description of the underlying dataset and estimated period life expectancies⁴⁸ implied by each table at ages 60, 65 and 70. All of the CMI tables are based on data between 1999 and 2002 (with a midpoint of 30 June 2000). The ONS population tables are based on data between 2010 and 2012.

⁴⁸ This is the life expectancy implied by the mortality table for an individual of that age **assuming no allowance for mortality improvements**. This is useful as a comparison of base mortality tables, but is likely to understate the 'true' life expectancy that would result if allowance was made for mortality improvements.

Table	Issued by	Description	Sex	Lives / Amounts ⁴⁸	Period life expectancy at age 60 (years)	Period life expectancy at age 65 (years)	Period life expectancy at age 70 (years)
IML00	CMI	Immediate annuitants	Males	Lives	23.1	18.9	14.9
IFL00	CMI	Immediate annuitants	Females	Lives	26.5	21.9	17.5
PNML00	CMI	Life office pensioners, normal retirements	Males	Lives	21.6	17.4	13.7
PNFLO0	CMI	Life office pensioners, normal retirements	Females	Lives	24.7	20.3	16.1
PNMA00	CMI	Life office pensioners, normal retirements	Males	Amounts	22.8	18.5	14.6
PNFA00	CMI	Life office pensioners, normal retirements	Females	Amounts	25.5	21.0	16.8
PEML00	CMI	Life office pensioners, early retirements	Males	Lives	20.6	16.6	12.9
PEFLO0	CMI	Life office pensioners, early retirements	Females	Lives	23.7	19.4	15.4
PEMA00	CMI	Life office pensioners, early retirements	Males	Amounts	22.2	18.1	14.3
PEFA00	CMI	Life office pensioners, early retirements	Females	Amounts	24.4	20.0	16.0
PCML00	CMI	Life office pensioners, combined	Males	Lives	21.2	17.2	13.5
PCFLO0	CMI	Life office pensioners, combined	Females	Lives	24.4	20.1	16.0
PCMA00	CMI	Life office pensioners, combined	Males	Amounts	22.5	18.4	14.5
PCFA00	CMI	Life office pensioners, combined	Females	Amounts	25.3	20.9	16.7
RMV00	CMI	Retirement annuitants, vested	Males	Lives	22.1	18.2	14.4
RFV00	CMI	Retirement annuitants, vested	Females	Lives	26.4	22.0	17.7
PPMV00	CMI	Personal pensioners, vested	Males	Lives	23.8	19.9	16.1
PPFV00	CMI	Personal pensioners, vested	Females	Lives	27.3	22.9	18.6
NLTUK1012 (M)	ONS	UK population	Males	Lives	22.2	18.2	14.4
NLTUK1012 (F)	ONS	UK population	Females	Lives	25.0	20.7	16.7

⁴⁹ The distinction between tables based on 'lives' and those based on 'amounts' is that tables based on amounts reflect mortality rates for the group of lives in question that are weighted by pension amount. Therefore, amounts-based tables put more weight on the mortality rates of individuals with larger pension amounts, as these are the individuals whose mortality rates will have the largest financial impact on the pension/annuity provider. In general, amounts-based tables result in higher life expectancies than lives-based tables, as more weight is given to those individuals with larger pension amounts who generally live longer than the average person.

A brief description of some of the CMI's categories above is given in the following table:

Category	Description
Immediate annuitants	Individuals holding (non-pension) purchased life annuities ('PLAs'). These are lifetime annuities purchased out of non-pension resources and are subject to different tax treatment from pension annuities
Life office pensioners	Pensioners insured under life office pension schemes, for example DC pensioners whose pensions are administered by life insurers. Mortality tables are available for those taking early retirement and normal retirement, and there is a combined table of normal and early retirements
Retirement annuitants	Individuals holding retirement annuities, as defined by Section 620 of the Income and Corporation Taxes Act 1988 ('ICTA 1988'). These contracts were effectively superseded by personal pensions in 1988.
Personal pensioners	Individuals holding personal pension policies, as defined by Chapter IV of Part XIV of ICTA 1988.

It should be noted that the CMI also publishes mortality rates in respect of UK self-administered pension schemes ('SAPS'). The most recent of these are the 'S2' series. However, the SAPS tables reflect the mortality rates of individuals with defined benefit pension provision, rather than individuals who annuitise with life insurers. Therefore no further consideration is given in this report to the use of the SAPS tables for the FCA's work.

There are four questions that need to be answered in order to decide which mortality table is most suitable as a starting point for each category of individual:

1. Is a population-based table the most appropriate choice, or should CMI tables reflecting the mortality experience of an appropriate class of annuitant/pensioner be used?
2. If CMI tables are used, which category best represents the individual? (e.g. life office pensioners, immediate annuitants etc.)
3. If CMI life office pensioner tables are used, should a lives-based or an amounts-based table be used?
4. If CMI life office pensioner tables are used, should the 'normal retirements' table or the 'combined' table be used?

CMI vs. ONS

The purpose of the Money's Worth framework is to assess the following two things:

1. Historical Money's Worth achieved by individuals who have bought an annuity since 2006; and
2. The relative attractiveness of options available to an individual who is reaching retirement now and who has access to some degree of pension savings in a DC pension scheme or schemes.

Both of these categories lend themselves to the use of a CMI table as they both reflect a subset of lives that is potentially distinct from the general population.

It is therefore proposed that the most appropriate CMI mortality table is chosen for each category of lives as a starting point. The CMI tables have the added advantage that they extend to age 120, whereas the ONS tables do not give mortality rates above age 100.

CMI category

The table below shows the proposed CMI table category to be applied to each category of individuals under consideration.

Category of individual	Proposed CMI table category ('compulsory' purchases)
Those buying level annuities with no guarantee period	Life office pensioners
Those buying level annuities with a guarantee period	Life office pensioners
Those buying increasing annuities (fixed or inflation-linked increases) with no guarantee period	Life office pensioners
Those buying increasing annuities with a guarantee period	Life office pensioners

As is common practice in respect of pricing and reserving amongst UK life insurers writing annuity business, it is proposed that the life office pensioner category be used for all historical annuity purchases. This category makes up the majority of annuity purchases in the UK and reflects an environment of compulsion or effective compulsion for annuity purchases.

It is proposed that the life office pensioner category (i.e. option 2 above) is chosen. This has been chosen for the following reasons:

1. Individuals who purchased PLAs are likely to be distinct in socioeconomic status and affluence from individuals who buy pension annuities under the new regime. Holders of PLAs are individuals with a material level of non-pension savings available which allowed them to purchase the PLA, whereas future purchasers of pension annuities may not have significant financial resources outside of their relatively modest DC pension funds. Therefore it is considered that life office pensioner tables provide a better starting point for the mortality rates of future purchasers of pension annuities.
2. The dataset on which the immediate annuitant tables are based is significantly smaller than the life office pensioners dataset, and therefore greater confidence can be placed in the accuracy of the life office pensioner tables.

Lives vs. amounts

The life office pensioner tables are split into tables that are 'lives-based' and 'amounts-based'. Lives-based mortality tables are derived from a mortality study which gives equal weight in assessing mortality rates to each death and exposure year underpinning the mortality study. Amounts-based tables weight the mortality experience by the pension amount of the individual, and therefore the mortality rates of those individuals with large pension amounts contribute proportionally more to the overall mortality rates than those individuals with smaller pension amounts. Amounts-based tables tend to result in higher life expectancies as the affluent, long-lived lives with larger pension amounts contribute proportionally more to the mortality rates.

A consequence of this is that the mortality rates in an amounts-based table will better reflect the life expectancies of individuals with larger-than-average pension pots.

Annuity providers are most concerned by the financial impact of longevity rather than the demographic impact (as measured by the number of deaths). Annuity providers therefore

typically base their pricing and reserving assumptions on amounts-based tables as these tables best reflect the financial effect of longevity on them.

For the Money's Worth framework, two hypothetical individuals with pension pots of £10,000 and £50,000 are being considered.

The average pension amount of the data underlying the life office pensioner combined tables was around £1,400 p.a. At the time of the study (1999-2002), annuity rates were around 8.5%, and had been higher than this during the previous two decades. A pension amount of £1,400 p.a. therefore probably corresponded to a pot size in the range £10,000 to £15,000.

It is therefore considered reasonable that the data underlying the life office pensioner tables is broadly reflective of the mortality rates that apply to a pot size of £10,000.

Therefore, it is proposed that a lives-based (i.e. unweighted) table be used for pot sizes of £10,000.

Pot sizes of £50,000 are well above the average pot size, and it is therefore considered that a table that gives greater weight to the mortality experience of higher pension amounts would be a better fit for a £50,000 pot size.

It is therefore proposed to use an amounts-based table for pot sizes of £50,000.

This approach effectively means that lower life expectancies will be assigned to individuals with £10,000 pots than £50,000 pots, reflecting the known link between affluence and life expectancy.

'Normal' vs. 'combined'

The life office pensioner tables are split into 'normal retirements', 'early retirements' and 'combined'.

The Money's Worth framework is considering individuals who could have purchased annuities as a result of both normal and early retirements, and therefore it makes sense to use the 'combined' tables for this work. In practice, the two tables give relatively similar life expectancies, particularly at age 65 and beyond.

Overall choice of base mortality table

For compulsory (or effectively compulsory) annuity purchases, it is proposed that the base mortality table to be used for all purposes should be the life office pensioners combined tables. For pot sizes of £10,000 the lives-based tables (PCML00 for males and PCFL00 for females) are proposed, and for pot sizes of £50,000 the amounts-based tables (PCMA00 for males and PCFA00 for females) are proposed.

Choice of base table multiplier and year of application

This section deals with the choice of b and M , i.e. the year the base mortality rates are assumed to apply and the multiplier that is assumed to apply to the base mortality table to reflect known differences between the individuals in question and the individuals making up the dataset underlying the choice of standard table.

These two parameters are linked, as the choice of multiplier will often reflect mortality experience for an insurer's portfolio during a particular period, and therefore improvements will often be applied from the centre of the period in question.

For example, if an insurer were to analyse its annuitant mortality experience between 2010 and 2013, it might discover that, in aggregate, the number of deaths was 90% of what might be expected from the mortality rates in the standard table. This might lead the insurer to set the best estimate base mortality rates for its annuitants to be 90% of the rates from its standard table, and apply mortality improvements from the centre (adjusted for data volumes) of its experience study period, i.e. from the end of 2011.

However, multipliers used by insurers are specific to their own portfolios and to their choice of standard table. Differences between insurers' portfolios and the standard table can arise due to a number of reasons, for example:

1. The insurer's experience is based on a different time period from that underlying the standard table
2. The insurer's portfolio has different characteristics from that underlying the standard table, for example differences in:
 - a. Affluence
 - b. Socioeconomic group
 - c. Pension amount
 - d. Age
 - e. Sales channel

The insurer's dataset may not be large enough to provide fully credible results and therefore there may be random fluctuations or biases that give rise to differences. In this case, the insurer will have to decide how much reliance it can place on its own dataset.

It is not considered desirable from the FCA's perspective to use mortality assumptions that are specific to individual firms, and therefore it would be spurious to use the (relatively limited) public information on base mortality multipliers used by insurers in order to derive (for an 'average' individual) a multiplier that is different from 100%.

It is therefore proposed that, for maximum objectivity, 100% of the standard mortality table is assumed to apply to individuals who have purchased annuities under a regime of compulsion, i.e. $M = 100\%$.

The life office pensioner tables are based on mortality experience between 1999 and 2002. The spread of mortality data within the 1999-2002 quadrennium upon which the '00' tables are based means that it is common practice to assume that mortality improvements apply from 30 June 2000, i.e. $b = 30 \text{ June } 2000$.

There is an outstanding question of whether mortality rates should be assumed to differ depending on whether an individual purchases a level or increasing annuity, or depending on whether a guarantee period is chosen.

An argument can be made that individuals who purchase increasing annuities might be expected to have higher life expectancies, all else being equal, than those who buy level annuities. Similarly it might be expected that those who choose annuities with a guarantee period (during which payments are made even if the individual dies) would have a lower life expectancy than those who opt for an annuity with no guarantee period. There also seem to be some evidence in academic papers for this.

However, there are potential reasons other than differing health why individuals may choose to purchase different annuity structures. Such choices also depend on things such as:

1. The individual's attitude to risk;
2. The individual's perception of the relative value offered by the insurer in its pricing of the different structuring options;
3. The individual's other available financial resources; and
4. Any life insurance policies the individual has that would negate any need for a guarantee period.

In addition, there have been no public studies carried out to assess differences in mortality rates between level and increasing annuities and annuities with or without guarantee periods. As a result, UK annuity providers are not thought typically to differentiate between individuals along these lines when setting mortality assumptions.

It is therefore not proposed to differentiate between individuals based on level versus increasing payments and between those who opt for and against a guarantee period. Any adjustment made for these purposes would therefore be speculative and subject to wide error margins.

Therefore, for all annuitants who purchased annuities under the compulsory regime, it is proposed to adopt base mortality rates equal to 100% of the PCML00/PCFL00 tables, with mortality improvements applying from 30 June 2000.

Choice of mortality improvements basis

In order to measure historical rates of mortality improvement in a population with any reliability, a very large population with a long history of mortality data is required.

The dataset of life office pensioners is too small and has too short a history to draw meaningful conclusions around trends in historical mortality improvements amongst that subset of the population.

Common industry practice therefore treats improvements in UK population mortality rates as a proxy for historical improvements in the mortality rates of the group of lives that is of interest.

The choice of improvements basis is complicated by the fact that the Money's Worth framework is looking at historical annuity purchases since 2006. Industry practice in respect of mortality improvement assumptions has changed a number of times since 2006, and the FCA's aim is to assess the Money's Worth based on mortality assumptions **that would have been applied at the time of purchase**. Therefore the approach adopted for a given individual will depend on the purchase date of the annuity.

The following sub-sections outline the proposed approach for a number of potential purchase dates.

7.1.3 Purchases prior to 2010

For purchase dates on or before 31 December 2009, it is proposed that mortality improvements are projected using one of the CMI's interim cohort projections, as was industry practice at that time.

These projections arose following the production of a set of mortality improvements ('the 92 series') based on historical UK improvements between 1975 and 1994.

However, it was realised that the 92 series improvements understated actual improvements that were observed to be occurring for certain 'cohorts' of individuals, i.e. individuals born in certain years. The 92 series projection was therefore adjusted to allow for the expected development of this cohort effect, resulting in three revised projections, known as the Short Cohort, the Medium Cohort and the Long Cohort, collectively known as the interim cohort projections.

In the Short Cohort projection, the cohort effect was assumed to continue until 2010. This was extended to 2020 for the Medium Cohort projection and to 2040 for the Long Cohort projection.

The interim cohort projections were intended to be used as a short term measure until a more satisfactory methodology could be developed, and until 2010, it was relatively common market practice amongst annuity writers to use one of the interim cohort projections as a best estimate of future rates of mortality improvement.

In order to ensure that allowance for future mortality improvements was not understated, an 'underpin' was typically applied to the projection. The effect of this underpin was to ensure that assumed mortality improvements never fell below a particular level. For example, an underpin of 1% would result in mortality improvements for a given year and age equal to the higher of the rate of improvement from the relevant cohort projection and 1%.

An analysis of insurers' approaches to mortality improvements for reserving purposes at the 2008 and 2009 year-ends has revealed that a relatively typical assumption in respect of mortality improvements would have been to use the Medium Cohort projection with an underpin of 2% for males, and 75% of the Medium Cohort assumptions with an underpin of 1.5% for females.

Females have historically exhibited lower mortality improvements and therefore it is common to assume lower mortality improvements for females.

However, reserving assumptions are required to be prudent estimates of future experience, and therefore it is likely that the underpins described above contained a margin over and above the best estimate of future experience.

Experience of margins for prudence applied by insurers indicates that a best estimate assumption might comprise an underpin of around 1% for males and 0.75% for females.

The Medium Cohort projection was the most commonly used projection amongst insurers. The Short Cohort projection was occasionally used, but was generally regarded as underestimating the extent of the cohort effect. The Long Cohort was used by some for reserving assumptions, as this was thought to be a prudent estimate of the impact of the cohort effect.

It is therefore proposed that, for purchases made on or before 31 December 2009, the mortality improvement assumption should be:

- 1. Males: 100% of Medium Cohort improvements with a 1% underpin**
- 2. Females: 75% of Medium Cohort improvements with a 0.75% underpin**

Purchases during 2010

During 2009, the CMI released the first version of its mortality projections model ('CMI 2009'). This model contains gender-specific historical UK population mortality improvements up to 2006, and from that point onwards projects mortality improvements as a blend of the following two elements:

- 1.** A P-spline projection⁵⁰ fitted to historical UK population mortality improvements; and
- 2.** A long-term rate of mortality improvement that is a user input.

In the resulting projection, short term future improvements are assumed to be driven primarily by the first item above, whereas in the long term, the long-term rate is assumed to dominate. This is predicated on the assumption that historical population improvements are considered to be a reasonable guide to future improvements in the short-to-medium-term, but in the medium-to-long-term, improvements could take on a different shape that depends on the (as yet unknown) future drivers of those improvements.

Each year since 2009, the CMI has released an updated parameterisation of the CMI Model, which reflects an extra year of historical mortality data for the UK population.

It is proposed that purchases between 1 January 2010 and 31 December 2010 are assessed using the CMI 2009 model. This allows for the fact that, although the CMI 2009 model was released in mid-2009, it will have taken a number of months for insurers to assess the impact of the new model on their pricing and reserving, and therefore it is unlikely to have been commonly used much before the start of 2010.

An analysis of insurers' approaches to reserving approaches at the end of 2010 was carried out, and an adjustment was made to reflect the fact that reserving assumptions will contain an implicit margin for prudence. This resulted in a proposed best estimate (i.e. non-prudent) long-term rate of improvements of 1.5% p.a. for males and 1.25% p.a. for females.

It should be noted that the CMI model assumes a lower long-term rate for those at the oldest ages, as mortality improvements at the older ages have historically been lower than at younger ages.

Therefore it is proposed that, for purchases made during 2010, mortality improvements are generated using the standard (i.e. core) parameterisation of CMI 2009 with a long-term rate of 1.5% p.a. for males and 1.25% p.a. for females.

Purchases since 2011

No discernible trend has been observed in the long-term rates assumed by insurers for reserving purposes since the release of CMI 2009, and therefore it is assumed that a long-term rate of 1.5% p.a. for males and 1.25% p.a. for females applies to all iterations of the CMI model.

⁵⁰ This is a technique whereby a smooth mathematical function is fitted to historical data. The mathematical function is piecewise-defined by polynomial functions, and a 'penalty function' is included which aims to impose smoothness and avoid overfitting.

Insurers have tended to adopt new versions of CMI models within a few months of their release.

Therefore, the timings of the releases of the 2010, 2011, 2012 and 2013 iterations of the CMI model leads to a proposal that the following assumptions should be made in respect of mortality improvements:

Purchase date	Gender	Model	Underpin/long-term rate
On or prior to 31 December 2009	Males	100% of Medium Cohort	1% (underpin)
	Females	75% of Medium Cohort	0.75% (underpin)
1 January 2010 to 31 December 2010	Males	CMI 2009 (males)	1.5% (long-term rate)
	Females	CMI 2009 (females)	1.25% (long-term rate)
1 January 2011 to 31 December 2011	Males	CMI 2010 (males)	1.5% (long-term rate)
	Females	CMI 2010 (females)	1.25% (long-term rate)
1 January 2012 to 30 June 2013	Males	CMI 2011 (males)	1.5% (long-term rate)
	Females	CMI 2011 (females)	1.25% (long-term rate)
1 July 2013 to 31 December 2013	Males	CMI 2012 (males)	1.5% (long-term rate)
	Females	CMI 2012 (females)	1.25% (long-term rate)
From 1 January 2014	Males	CMI 2013 (males)	1.5% (long-term rate)
	Females	CMI 2013 (females)	1.25% (long-term rate)

The dates chosen for changes in the mortality assumption are chosen in order to be broadly consistent with observed industry practice during the periods in question. However, they are necessarily approximate and clearly will not reflect with precision the practices adopted by individual insurers.

It should be noted that the use of the mortality improvement assumptions listed above leads to a discontinuity in implied life expectancies when the Medium Cohort model is assumed to be replaced by the CMI 2009 model. It is felt that this is a reasonably realistic approximation to what happened in the industry in 2009/2010, as there was a feeling by that point that actual mortality improvements were exceeding those in the Medium Cohort table, and therefore the introduction of the CMI model resulted in many firms strengthening their assumptions. However, users should be aware of the existence of this discontinuity.

Annual vs. monthly mortality rates

For some applications of mortality modelling, for example some forms of cash flow modelling, mortality rates are converted into monthly rates. Practice varies in the precise method of converting mortality rates, but a common approach is to assume that:

$$q_{x,y}^{(m)} = 1 - \left(1 - q_{x,y}\right)^{\frac{1}{12}}$$

where $q_{x,y}^{(m)}$ is the monthly mortality rate applying for a life aged x last birthday in year y .

Using a monthly conversion formula of this form means that the overall probability of death between ages x and $x + 1$ is the same as under the annual approach.

Using this approach to monthly conversion, life expectancies on a monthly basis are very close to the annual approximation described above. For example, for a 60-year-old male, the period life expectancy using PCML00 is 21.861 on an annual basis, and 21.852 on a monthly basis, i.e. a 0.04% difference.

In order to model annual cash flows for an annuity payable monthly, it is proposed to assume that, on average, individuals who die during a given year do so halfway between integer ages. For example, if there is an annuity of £100 p.a., and the expected mortality rate of an individual in the first year of the annuity is 1%, the first year's expected cash flows will be £99.50 (i.e. £100 x (1 - 0.01/2)). This reflects the assumption that all deaths occur halfway through the year, and therefore the first 6 monthly payments will be made to all individuals, including those who die during the year.

Given the insignificant nature of the difference between monthly and annual life expectancies, it is proposed that annual mortality rates be used for the FCA's Money's Worth and Value for Money frameworks. For annuities payable monthly, the annual mortality rates will be used on the assumption that deaths occur halfway between integer ages.

Calculating life expectancies from mortality rates

Suppose that, for a given individual aged x in year y , a mortality table has been derived for that individual.

In other words, for each $t \geq 0$, we have a value of $q_{x+t,y+t}$, which is the mortality rate assumed to apply to that individual in year $y + t$ (when the individual will be aged $x + t$). This mortality rate will include an allowance for mortality improvements between year y and year $y + t$.

For a given value of t , the survival probability $p_{x,t}^{(y)}$ is defined to be the probability that the individual aged x in year y survives to age $x + t$. That is:

$$p_{x,t}^{(y)} = \prod_{s=0}^{t-1} (1 - q_{x+s,y+s})$$

If $\bar{T}_{x,y}$ is defined to be the (continuous) random variable representing the (unknown) future lifespan of the individual aged x in year y , then the life expectancy is defined as $\bar{e}_{x,y} = E(\bar{T}_{x,y})$, i.e. the expected value of $\bar{T}_{x,y}$.

However, it is computationally difficult to calculate the expected value of $\bar{T}_{x,y}$, and therefore we define:

$$T_{x,y} = [\bar{T}_{x,y}]$$

i.e. $T_{x,y}$ is the integer part of $\bar{T}_{x,y}$.

$T_{x,y}$ is known as the 'curtate future lifespan' of the individual, and is a discrete random variable that takes integer values. If, for example, the individual in question survives until age $x + 22.7$, then the observed value of $T_{x,y}$ is 22.

The expected value of $T_{x,y}$ is known as the curtate life expectancy and can be derived as:

$$e_{x,y} = E(T_{x,y}) = \sum_{t=1}^{\infty} p_{x,t}^{(y)}$$

In practice, longevity practitioners assume that there is an age w at which every individual is assumed to have a mortality rate of 1, i.e. they are certain to die within the next year. It is standard practice to assume that $w = 120$. In this case:

$$e_{x,y} = E(T_{x,y}) = \sum_{t=1}^{120} p_{x,t}^{(y)}$$

The total life expectancy of the individual can then be estimated as:

$$\bar{e}_{x,y} \approx e_{x,y} + 0.5$$

This approximation is a common one which assumes that, on average, individuals who die in a given year will die halfway through the year.