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Pension pots and how to survive them

Les Mayhew, David Smith & Douglas Wright.

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The Pensions Institute
Cass Business School
City University London
106 Bunhill Row
London EC1Y 8TZ
UNITED KINGDOM

http://www.pensions-institute.org/

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Les Mayhew
David Smith
Douglas Wright

Cass Business School,
Faculty of Actuarial Science and
Insurance, City University London

lesmayhew@googlemail.com

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Cass Business School
CITY UNIVERSITY LONDON
EST 1894

The International Longevity Centre – UK (ILC-UK) is a futures organisation focussed on some of the biggest challenges facing Government and society in the context of demographic change.

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ILC–UK
11 Tufton Street
London
SW1P 3QB

Tel: +44 (0) 20 7340 0440
www.ilcuk.org.uk

Foreword

The International Longevity Centre - UK (ILC-UK) sees annuities as an important part of the product offer to help people manage their pension pots over their lifetime. We have published widely on the case for annuities including a think-piece which explored the case for purchased life annuities.

We know from our previous research that the vast majority of retirees want a guaranteed income from their pension savings. Annuities guarantee an income.

But it is clear that since the end of compulsory annuitisation, these products are falling out of favour.

Earlier this year we launched a new Centre for Later Life Funding, a Centre which will seek to influence how policy and practice can respond to the changing retirement income landscape.

As part of the work of this Centre, we see this piece of work by Les Mayhew and colleagues at Cass as an important contribution to the debate on how individuals can maximise their retirement income.

The paper highlights the need for people to take advice, with the authors pointing out that “the decision on what to do with a pension pot was already complex but now has become even more so.” ILC-UK continue to believe that there is a significant advice gap. If people are to make the best decision about how to maximise their retirement income, we have to find new ways of expanding the advice market. Policymakers must look to find ways to ensure we open up advice to many more people.

The report also highlights the fact that too many pension pots are far too small. With auto-enrolment seemingly successful in bringing more people into saving, the next and arguably much more difficult challenge, is how to get them to save adequately.

Baroness Sally Greengross
Chief Executive, International Longevity Centre - UK

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Executive summary

In 2014, the UK Government announced radical proposals which allow people to withdraw money from their pension pot from age 55, subject to their marginal rate of income tax in that year. The main effect of this change is to remove the obligation to annuitise at any future age and hence puts more onus on individuals to ensure they manage their resources appropriately and plan ahead.

This paper is concerned with how individuals can best use their pension pots to align them with their own personal financial objectives and longevity risks. It finds that, for most people, annuitising at retirement is *not* the best option and that income draw-down is preferable, especially where there is a bequest motive and/or the individual has other valuable assets such as property.

There are several reasons for this. People are living longer and annuity rates are at a historic low and are expected to remain so. In addition, the legally required introduction of uni-sex pricing has reduced their attractiveness to men, whilst protecting annuity income against future inflation is expensive. Most importantly, if you die young the annuity dies with you.

ONS data show that the median size of fund is very small (circa £20k). For those in this situation it annuitising could affect welfare benefit entitlement, by incurring a higher marginal tax rate as benefits are withdrawn. In these cases, it may be better to spend the fund, pay off debts, or gift the money. As for drawdown, so long as funds are invested sensibly, there is only a small chance that the funds will run out before you die.

Using drawdown allows the flexibility to meet other personal objectives in life such as bequesting and finding the money for unexpected emergencies. The increase in income insecurity is less risky if one has other sources of secure income such as a state or occupational pension or you are a homeowner and can therefore release equity or sell up and downsize if the need arises.

The possibility of having to pay for long-term care in later life is an important unfunded risk. However, because of their small value a typical annuity will only make a modest contribution to care home fees. Even if all retirement income is pooled long term care is hard to budget for, and so homeowners may need to release equity to pay for care whilst others will continue fall back on to the state for financial support.

Annuities are more attractive at older ages as a guard against longevity risk, especially if there is no bequest motive, or if a person lives alone (e.g. following the death of a partner), or does not own his/her own home. They give better value due to the phenomenon of ‘mortality credit’ and generally provide a better return than other investments. For those in poor health and in their early years of retirement, an impaired annuity could also be good value

The decision on what to do with a pension pot was already fairly complex but now has become even more so. The options described in this paper are sensible and can be low risk if simple rules are followed. People’s circumstances including tax liabilities vary and can change over time and so tax and inheritance planning will assume greater importance in the absence of annuitisation.

Finally, annuitising is an irrevocable step and so before making a decision people should first undertake a financial ‘health check’ if they are unsure what to do; and if they do go for the drawdown option, to seek regular financial advice during their retirement if their circumstances or financial objectives change.

Pension pots and how to survive them

1. Introduction

Historically, a majority of people in the UK (around 75%) with a defined contribution pension plan bought an annuity at retirement with their pension pot.[1] The main advantage of an annuity is that it provides a guaranteed income, in either nominal or real terms, for life; hence the individual no longer bears any investment or longevity risk.

In 2014, the Government announced radical proposals which now allow people to withdraw money from their pension pot from age 55 (rising to 57 in 2028), 'how they want, subject to their marginal rate of income tax in that year' (see HM Treasury, 'Freedom and choice in pensions'[2]).

By removing the obligation to annuitise their funds at retirement or any future age, there is now more onus on the individual to make sure they have sufficient resources to last for their retirement and, if they choose to spend their money otherwise, to ensure they are aware of the possible consequences.

It is widely accepted that these and other changes, including tax adjustments, will have an enormous impact on the pensions industry as a whole and also wider ramifications in terms of tax and estate planning (PWC, 2015). The full effects will take time to mature, but companies providing wealth management services will clearly be one of the main beneficiaries.

Opening up such choices to people can be risky unless they are adept in financial planning. The evidence is that whilst some are, most are not (Money Advice Service, 2013) and having a financial health check before committing to an annuity will become more important.

As has been widely noted, managing the transition into retirement can be complex (Pensions Policy Institute, 2014). Pensionwise is a free and impartial government service about your defined contribution pension options which provides users with helpful information and so fills some of the information gap (www.pensionwise.gov.uk/).

Our aim is to go beyond what is on this website as follows: a) to personalise what to do with pension pots; b) be able to assess the value of annuitising versus the alternatives; and c) look at other sources of retirement income if the pot runs out.

For an individual, there will be three key things for them to consider when deciding on a strategy to manage their pension pots:

1. The risk of living longer than expected and running out of cash, and hence whether to manage this risk by buying an annuity at some point during retirement
2. Any gift or bequest motive or plans for a major purchase that may affect the rate of drawdown or investment strategy

[1] Pensions: income drawdown: Standard Note: SN 712, House of Commons Library

[2] HM Treasury (2014) Budget 2014: Policy Costings
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/295067/PU1638_policy_costings_bud_2014_with_correction_slip.pdf

3. The volatility of investment returns in the absence of annuitisation including potential tax liabilities.

How individuals will act as a result of this new freedom is, at the moment, largely guesswork. The Treasury, for example, estimates that around 30% of people who have assets in defined contribution schemes will decide to drawdown their pension at a faster rate than via an annuity (HM Treasury 2014, see footnote 1 above).

The industry view, and also our own, is that the flight from annuities will be larger than this as many embrace the new freedoms. Actual behaviour will depend on a range of factors including the size of pension pot and the availability of other retirement income, but also other financial assets such as housing wealth.

One consideration will be any reduction in entitlement to state means tested benefits, especially for those with small pension pots (the median pension pot size is less than £20k currently) and only the state pension for income. Spending the pot may be the better option; if so advice should be sought first on which benefits may be affected before taking action (e.g. help with paying local Council Tax).

An indication that this may be a key government concern is that it has just announced an option to increase the state pension by up to £25 a week on payment of a lump sum estimated to be about £22,250. On the open market we estimate that this would buy a fully indexed annuity only worth initially about £18.60 a week and so this is a clear inducement to try and head off this behaviour as well as meeting other goals.

The state pension is also transitioning into a higher flat rate pension from 2016 and because its value is guaranteed and underwritten by the state it can be relied upon in hard times. Together these considerations can tip the risk profile away from annuities in favour of drawdown at the margins but the arguments are finely balanced and depend, as we shall argue, on wider personal circumstances.

Although the issues are potentially complex, opportunities for retirees are enormous, but the risks are different (Brancati and Franklin, 2014). The previously automatic requirement to annuitise is replaced by other concerns such as longevity risk, inflation and investment returns. Many will find this challenging and so we believe people should seek a financial 'heath check' before deciding on what to do with their pot (DEMOS, 2014; Pension Policy Institute, 2014).

Our paper seeks to inform such decisions by linking options to individuals based on their health, other sources of wealth (especially property) and any bequest motive (which can include a cohabiting partner as well as friends and relatives). In doing so, we focus on using a person's pension pot to maximise their lifetime income whilst balancing risk.

Although a pension pot can be accessed from age 55, our basic starting point is a person aged 65 in order to align our analysis with the approximate commencement of the state pension.[3] We consider a person with accumulated pension pots worth £100k. This individual is used for illustrative purposes only but is fairly typical of many retirees today.[4]

[3] State pension age for men and women is changing and being harmonised so 65 is used here as a guide.

[4] Pension pot sizes vary widely. For persons age 55 + and earning between £35k and £50k a year, the average value of pension pots is above £35k but the median value is much lower at less than £20k. Source ONS 2010/12 and ABI.

The logic of our analysis suggests that people will start viewing their pension pot, home and other assets collectively as their source of retirement funds. However, we do not discuss the significant risk of incurring costly long-term care in later life as most people's pension income or their size of pension pot would not be able to cover this. This requires separate analysis and is only touched on briefly.

The paper is set out as follows:

- In Section 2, we review what the effects of the new flexibilities are likely to be on the decision to buy an annuity by aligning their decision to their retirement strategies.
- In Section 3, we deal with two types of longevity risk, which we call the selection effect and longevity drift, and the difference that these will make to future financial planning
- In Section 4, we provide worked examples of different draw-down strategies and address the question whether the risk that a retiree will run out of money can be avoided without buying an annuity?[5]
- In Section 5, we consider the timing and bequeathing of wealth.
- In Section 6, we consider the integration of housing wealth into retirement planning and ask the question 'what if the pot does run dry?'

Our general conclusions are then set out in Section 7.

2. Pension options

2.1. Risks applying

With the exception of annuities, in which one is locked in until death, it is possible to switch strategies over time (although the government is also looking at ways for individuals to cash-in their existing annuities).

An important consideration is the 25% tax-free part of the pension pot. Under previous regulations, people were expected to take this amount in full at retirement. In this sense, the options of how a pension fund would be drawn down were entirely pre-determined, but now all that is changing.

Nevertheless, we expect this behaviour to continue in most cases, as many people will have based their retirement plans on accessing the whole pot on retirement, notwithstanding the possible tax implications. Some however will leave the untaxed component untouched to generate a greater tax-efficient investment return.

Table 1 sets out the main options available to people. These are not designed to be mutually exclusive since a typical individual may split their pension pot in more than one way by adopting a hybrid strategy e.g. annuitising some of the pot and spending the rest flexibly or delaying annuitising until a later age.

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[5] An obvious advantage of this is that when you die, a carefully calibrated flexible draw-down strategy will always have some money left over, whereas an annuity dies with you.

The basic options are to: (A) Withdraw all of the pot at the outset; (B) Draw down money each year until it is exhausted; and (C) Annuitise. Each has various pros and cons as listed in Table 1.

Option	Instant and flexible access to whole pot	Avoid higher rate tax implications	Gift or bequest opportunity	No danger of money running low	Avoid IHT implications (2)(3)
(A) Withdraw all	✓	✗	✓	✗	✗
(B) Drawdown	✓	✓	✓	✗	✓
(C) Annuitise	✗	✓	✗	✓	✓

Table 1: Risks applying to how a pension is taken according to the three main options

Note: 1. Ticks indicate generally 'applies'. Note2. IHT (Inheritance Tax). Note 3: e.g. if a person with a large pot withdraws all of it but dies before spending it

No single option provides any income guarantees except for (C), annuitisation i.e. the status quo. This has the sole but important advantage that income never runs out, though if it is a flat rate annuity then inflation can severely erode the value of the income over time. But on other criteria, such as the ability to bequeath, meet financial emergencies or switch investments, the inflexibility of annuities means these opportunities are currently closed off for good.

2.2. Individual considerations

Notwithstanding the technical and financial risks above, we consider three main reasons for choosing one strategy over another. These can be summarised under three headings:

- Health – poor health may lead to an individual drawing down their pot quicker than a healthy person or buying an impaired annuity.
- Home ownership – if individuals own their home outright, then this can be considered as an asset that can be turned into cash or an annuity if their pot is exhausted. In contrast, non-home owners still have to pay their rent.
- Bequest motive – whether a person wishes to either gift money when they first access their pension pot or to have some money to bequeath on death to a surviving partner, relative, friend or organisation.

In practice, most people will face changes in these circumstances over the course of their retirement. Therefore, the best strategy may vary over time (assuming they have kept some flexibility).

Here are some examples:

- Poor health affects longevity and therefore the value for money of an annuity. A health change during retirement may qualify a person for an impaired annuity with enhanced rates, which can give the impression of giving better value for money.

- For homeowners, downsizing can be a source of additional funds as long as there is no significant debt. However, if the individual's health or mobility has deteriorated, equity release may be a more practical option.
- Transferring the tax free part of the pot immediately to children who stand to benefit more than if the money was instead bequeathed on death (e.g. as a deposit on a house). As long as the retiree lives for seven years after making a gift, there will be no inheritance tax to pay.

2.3. Options matrix

Investing pension pots is not without risk and so there is a danger that income may run out or become insufficient. Different financial strategies come with different levels of risk depending on personal circumstances and choosing the correct level of risk based on fund size, other assets such as the home and bequest motives becomes paramount.

This idea can be expressed in a simple table matching financial strategies to personal objectives. Table 2 is an example of this. It has eight rows, one for each combination of the three factors applying, as denoted by 'Y'. The last three columns indicate which financial strategy is best suited and where hard choices may be needed. In some cases more than one strategy applies.

Person type	In poor health	Home owner	Bequest motive	Option (A)	Option (B)	Option (C)
1						✓
2	Y				✓	✓
3		Y			✓	
4			Y	✓		✓
5	Y	Y			✓	
6	Y		Y	✓		✓
7		Y	Y	✓	✓	
8	Y	Y	Y	✓	✓	

Table 2: Each row represents a different combination of considerations: Ticks are shown against the most likely financial options applying to each person type identified by their situation

Key to table: (A) Withdraw all or part of pot; (B) Drawdown; (C) Annuitise

The decision logic in each case can be summarised one row at a time showing the impact of different personal circumstances and financial objectives. Consider each of the following stylised examples in row order.

1. Person type one is in good health, and hence longevity is a risk. As a non-home owner, they have nothing to fall back on and must pay rent to keep a roof over their head. With no bequest motive, their best strategy is to annuitise (unless they have a very large pot that is unlikely ever to be exhausted).

2. Type two is similar to type one, but is in poor health. Thus, the longevity risk is reduced, but buying an annuity is likely to be poor value for money (unless they buy an impaired annuity which pays out significantly more each year). However, if this is not available to them, then drawdown is likely to be a better option.
3. Type three is also similar to type one, but is a home owner. If they have an outstanding mortgage, they could use some of their pot to pay this off. With a mortgage-free home, drawdown is likely to be a better option, since they can always release equity from their home later.
4. Type four has a bequest motive, but is otherwise like type one. They can withdraw money early on to help their children financially (such as getting them onto the housing ladder). They could also purchase a joint annuity with their partner so that both their income needs are met even after one dies.
5. Type five is similar to type two, but with the major difference that they own their home. This will allow them to take more financial risk, especially as they do not have any bequest motive. They may be able to secure an impaired annuity at a higher rate, but they are probably better off using a combination of income drawdown and equity release.
6. Type six is in an awkward position as they want to leave money behind, but they are in poor health and do not own their own home. The main danger is using up all of their assets before they die with nothing to pass on. In principle they could gift money before death, but they may leave themselves short of cash unless they buy an impaired annuity.
7. Type seven has access to housing equity and so may choose to gift money early on knowing they have the option of equity release later. They may use income drawdown in order to maximise the investment return on their pension pot.
8. In the case of type eight, the availability of impaired annuities will impact the decision of whether to annuitise or not. With the home providing financial security and also a source of funds to bequeath, this person may choose income drawdown based on their shorter life expectancy.

As already noted, there is usually more than one option for each person type. In practice, we believe that many will pursue a hybrid approach and so hedge their options. This is likely to require regular financial advice to ensure correct choices are made, but from this analysis it seems certain that the traditional annuity market will decline.

2.4. Other factors affecting option selection

The above considerations are not the end of the story as there are many other behaviour altering factors to consider (e.g. continuing to work whilst drawing a pension).

For example:

- A person with income from a defined benefit pension scheme would see this as their guaranteed pension income and may therefore take more investment risks with their defined contribution pension pot.

- Those with very large pension pots have the most flexibility. Their strategy is more likely to involve choosing the most tax effective options including the timing of withdrawals across tax years.
- For a person working beyond normal pension age, it is likely they will opt for flexible income drawdown because by deferring taking their pension, they can continue to benefit from the tax advantages of saving within a pension fund.
- In couple households in which income is pooled, it is more cost effective to use the fund that attracts least tax, to take advantage of tax free investments or to delay taking a pension.

Of all the future financial contingencies, paying for long-term care is the most important and the least predictable. The public system for funding social care in the UK is among the least generous in developed countries and is heavily means tested (Karlsson et al, 2007). For most people, its cost would overwhelm the average pension pot and no amount of pot management would solve the problem (Mayhew et al, 2010).

Innovative ideas are needed to deal with funding long-term care but to date both the private sector and government have achieved very little in terms of incentivising people to save or by providing affordable financial solutions, although there have been some practical suggestions (e.g. Mayhew and Smith, 2013).

The present position is that most people with property should not count on any state financial support and so may need to release some or all of the equity to pay for it (Mayhew and O'Leary, 2014; Just Retirement, 2012). The value can be used to pay for institutional care or provide additional income to pay for care provided in the home. The practical details are explored more fully in Mayhew and Smith, 2014c.

Any strategy for managing a pension pot is predicated in some way on life expectancy. If we knew our date of death, personal finances could be planned much more precisely and there would be no need for an annuity or indeed a life insurance market. In reality predicting life expectancy is a tough challenge with both genetic and lifestyle factors to consider (Karlsson et al, 2009). The next section puts a scale on those risks.

3. Life expectancy

3.1. Selection effects and longevity drift

Life expectancy has been increasing rapidly in recent decades and is projected to continue and so pension pots must stretch further. Such increases are hugely significant for pension planning and will inform not only annuity rates but also how much to draw down and when to annuitise. It is impossible to predict accurately one's exact age of death but as far as longevity risk is concerned, there are principally two issues to consider: (a) selection effects and (b) longevity drift.

(a) Selection effects

In England and Wales, future life expectancy at age 65 using current mortality rates is 19.1 years for a man and 21.6 years for a woman. Hence, at age 65, a man can expect to die at age 84.1 and a woman at age 86.6 (see tables at Annex A).

However, the same life table records that an 80-year-old man currently has a life expectancy of 8.8 years, and so can expect to die at age 88.8 (i.e. more than four years later than when he had expected to die at age 65). Similarly, for a woman currently aged 80, the expected age at death increases from 86.6 to 90.2.

We refer to this change in expectation as the 'selection effect'. It happens because the expected age at death of a population at age 65 includes those who will die before age 80, so the life expectancy of an 80-year-old will by definition exclude those dying between 65 and 80. The expected age at death at age 80 is hence greater than it was at age 65, and this process continues at every age.

Consider, for example, a man turning 65 today with a current life expectancy of 19.1 years. From above, if this person survives to age 80, his future life expectancy (based on current mortality tables) is 8.8 years. As a result of the selection effect, his expected age at death is now nearly five years older than it was at age 65 (i.e. $(80+8.8)-(65+19.1)=4.7$ years).

(b) Longevity drift

Besides selection, life expectancy is also affected by 'longevity drift'. This is caused by the general improvement in mortality rates and is the dividend from healthier life styles and better health care over many decades.

It works as follows. If a person aged 65 today survives to age 66 their mortality risk will be lower than that for a current 66 year old. If they survive another year their risk is again reduced relative to previous mortality rates for 67 year olds and this process continues as people age.

By definition longevity drift only reveals itself over time – metaphorically speaking, the life expectancy goal posts keep shifting. The Office for National Statistics (ONS) publishes life tables for future years which include future predicted mortality improvements from which we can deduce its future effects. Using these life tables we find that a 65 year-old for example has a life expectancy of 21.9 years rather than 19.1 years due to drift.

The combination of longevity drift and selection is highly significant from a pension standpoint. To give an example, consider a man who will be aged 80 in fifteen years hence. He has a projected life expectancy of 11.4 years (rather than 8.8 years for a man reaching age 80 today).

So, if a man aged 65 today survives to age 80, his expected age at death will then be 91.4, 7.3 years older than it was at age 65 i.e. $(80+11.4)-(65+19.1)=7.3$ years. Of the extra 7.3 years, 2.6 years are due to longevity drift (7.3 – 4.7 = 2.6). That is to say he gains 4.7 years from selection and 2.6 years from drift relative to what he had expected at age 65.

These examples are for men but women's circumstances require different consideration for the simple reason that women often have lower pension savings but also greater longevity. However as far as annuities are concerned it is men that are disadvantaged since the introduction of unisex pricing of annuities from December 2012. Financially, this benefits women because they live longer (although men have been catching up – see Mayhew and Smith, 2014b).[6]

[6] For a female, the corresponding selection effect numbers are $(80+10.2)-(65+21.6)=3.6$ years and the corresponding total (i.e. selection and drift) numbers are $(80+12.7)-(65+21.6)=6.1$ years

4. Annuities versus income drawdown

4.1. What is an annuity?

For definitional clarity, an annuity is a sum of money, either fixed or increasing, that is paid regularly to the policyholder, typically for the rest of their life. They are usually purchased at the time of retirement using the accumulated funds in a pension pot and, in our case, are represented by option C in Table 1. What are annuities for and how do they compare with draw down?

The important point about annuities is that they provide income security until death. If a person lives to an old age, the annuitant benefits; whereas if they die earlier than expected, the insurer benefits. Thus, the person is effectively insuring themselves against running out of money due to living longer than expected and, in addition, protecting themselves against poor investment returns.

For illustration, we use a standard single-life annuity where the annual payments increase in line with price inflation (option C) as the benchmark with which to compare two other options in Table 1: (A) withdrawal of the pot or (B) income drawdown. Note that option A is a variant of option B in which the whole pot is taken in one go.

As noted above, gender is no longer a relevant consideration when pricing annuities. To create a unisex annuity rate on retirement, we will assume that our population at age 65 is made up of equal numbers of males and females and hence use mortality rates that reflect the entire population regardless of gender.

Mathematically speaking, assuming a long-term risk-free (real) interest rate of 0% per annum[7], an indexed linked annuity initially paying one pound per annum for a person of exact age 65, denoted by $\bar{a}_{65}$, is given by the discounted value of the expected future annuity payments such that:

$$\bar{a}_{65} = \int_{t=0}^{\infty} v_{0\%}^{t} \times {}_{t}p_{65}\, dt = \int_{t=0}^{\infty} {}_{t}p_{65}\, dt \approx \left(\sum_{t=1}^{\infty} {}_{t}p_{65} \right) + \frac{1}{2} = \dot{e}_{65} = 23.1010$$

where ${}_{t}p_{65}$ is the probability that a life of age 65 will survive to age $(65+t)$, based on the unisex mortality table described above (and allowing for longevity drift).

Note that, because we have used a real rate of interest of 0% per annum, the price of the annuity at age 65 (or, indeed, any age), $\bar{a}_{65}$ is equal to the future life expectancy at that age, $\dot{e}_{65}$.

Further, because the mortality table used is unisex, the future life expectancy at age 65 is, approximately, an average of the male life expectancy at age 65 of 21.9 years and the female life expectancy at age 65 of 24.3 years, after taking longevity drift into account.

Hence, with a pension pot of £100,000 on retirement at age 65, an annual inflation proofed annuity is worth:

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[7] In practice, insurance companies may use a slightly higher interest rate when pricing annuities (which, in itself, would lead to a slightly higher level of annual annuity income). However, this will be offset by additional loadings in the annuity price for expenses, profit and the longevity risk transferred to the company. Thus, an assumed (real) interest rate of 0% per annum seems appropriate here.

$$\frac{100,000}{23.1010} = £4,328.82$$ [8]

As with all standard annuities there is no residual wealth to bequeath on death. We therefore use this figure as our benchmark to compare options B and C in Table 1 for different drawdown strategies.

4.2. Income Drawdown - Option B

Rather than buying an annuity (which transfers both the investment risk and the longevity risk to the insurance company), a person can opt for income drawdown where the pension pot is invested in assets whose value can rise or fall over time and from which the individual draws an income each year.

As a general rule, when pursuing a diversified investment strategy, the lower the expected investment returns, the more certain are the returns. For the investor, pursuing a higher risk strategy should give them a higher expected return which means that their pension pot will last longer.

However, the volatile returns mean that, if there are some years of poor investment returns, the pension pot may actually run out far quicker than if a low risk strategy had been chosen. We represent the range of investment returns that could be achieved by the investor using 5,000 computer simulations that allow for the ups and downs in annual investment returns.[9]

For illustrative purposes we assume an expected investment return of 3% per annum (in real terms i.e. in excess of price inflation) with a standard deviation of 6% per annum. This can be thought of as being consistent with a moderate risk investment strategy focused on government bonds and blue-chip equities.[10] There are two cases to consider: fixed income drawdown and flexible drawdown.

Case 1 – Fixed Income Drawdown

When we refer to fixed income drawdown the value is fixed in real terms i.e. the amount each year will increase by inflation just as our annuity does but the results are shown as fixed real amounts. Firstly, let us consider the situation where a person draws down an income equal to the amount that would have been received had s/he purchased a unisex annuity (i.e. £4,328.82 p.a from above).

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[8] Note that, under the new gender equality regulations, this same amount must be offered to both males and females. Prior to 21 December 2012, males could be offered a higher annuity (of $\frac{100,000}{21.8955} = £4,567.15$) reflecting their lower future life expectancy, whereas females would be offered a lower annuity (of $\frac{100,000}{24.2516} = £4,123.44$) reflected their higher future life expectancy.

[9] This is done using a series of independent and identically distributed log-normal random variables, as is standard practice for this type of calculation

[10] Individuals with different risk appetites could choose either a lower risk (and lower expected return) or a higher risk (and higher expected return) strategy. However, we do not explore the effect of this further here.

The main advantage of this strategy (over purchasing an annuity) is that, on death, any residual wealth can be bequeathed. In addition, the individual stands to benefit from possible higher investment returns; but he or she also stands to lose out if investment returns are less than expected, in which case a more flexible approach is preferable. We return to this in Case 2.

Figure 1 shows the median residual wealth at each future age assuming a level annual drawdown of £4,328.82 and a starting pot of £100k. At each age the residual pot is adjusted to allow for the net impact of withdrawals and investment returns. The dotted curves either side of the median line represent the risk margins involved by showing the 25th and 75th percentiles for the fund value at each age i.e. the range of fund values within which half of all possible outcomes will arise.

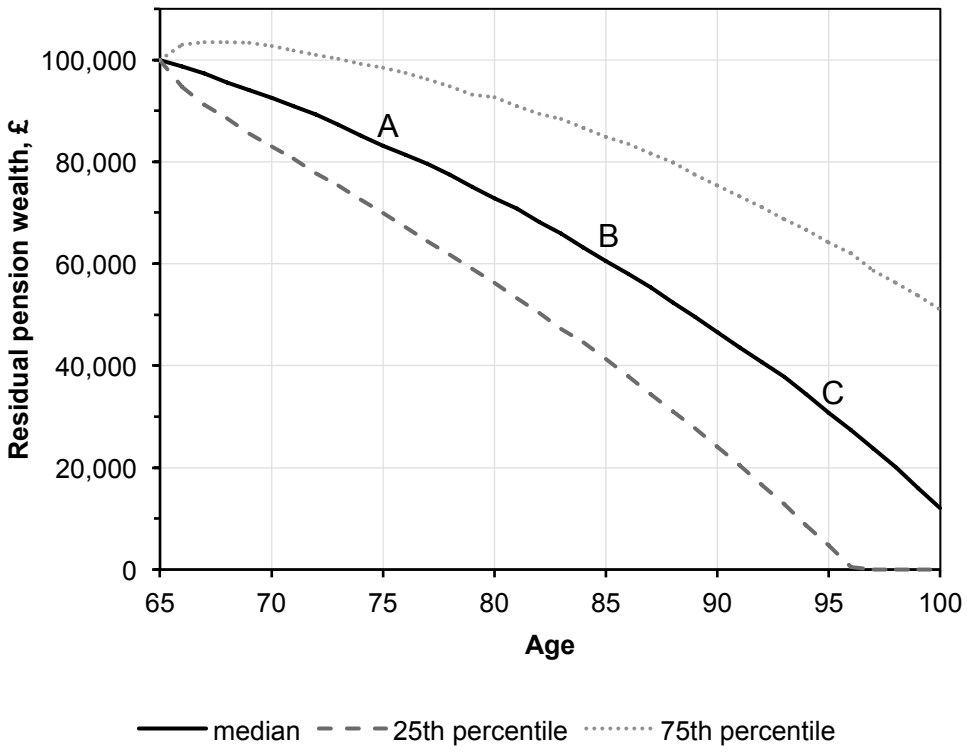

Figure 1: Median residual pension wealth based on fixed income drawdown equivalent to amount that can be obtained on annuity purchase

We can see that, under the fixed drawdown approach, the median residual wealth at age 100 is approximately £12,000, although there is a probability of 25% that the fund will be completely exhausted by age 95. We also overlay on the chart for comparison what the value of annuity would be if the residual pot were to be used to buy an annuity at three later ages instead of at age 65.

At age 75 (point A), the median value of the pot would be worth £83,139.30 which would buy an annuity worth £5,370.76 p.a.; by age 85 (B) it will be worth £60,557.47 and buy an annuity worth £6,728.61 p.a.; by age 95 (C) it will be worth £30,738.29 and buy an annuity worth £8,110.37. The key point is that deferring taking an annuity until a later age can be financially advantageous.

If you do not annuitise, how material is the actual risk of pot exhaustion? It depends on the likelihood of someone reaching age 95, which depends in turn on a number of factors (most notably gender and health). Table 3 summarises the probability of an individual retiring at age 65 in 2015 surviving to given future ages, based on the ONS life table in Annex A, and gives an alternative picture of risks faced by individuals.

Whilst the probability of exhausting the fund by age 95 is the same regardless of gender (as the amount drawn down each year is not gender-dependent), Table 3 shows that the probability of surviving to this age is significantly higher for women (33.6% compared with 24.2% for men). This finding is reinforced in Figure 2 which shows the probability of the fund being exhausted at each future age.

The strong implication from our analysis is that, unless a person expects to live considerably longer than age 85 (and, arguably, even age 90 or 95), it is difficult to see any real advantage in purchasing an annuity on retirement especially if you have a bequest motive.

Age x	Probability of surviving from age 65 to age x, ${}_{x-65}p_{65}$			
	male (with drift)	male (without drift)	female (with drift)	female (without drift)
75	0.85876	0.83089	0.90156	0.88437
80	0.74842	0.68609	0.81847	0.77596
85	0.60186	0.49275	0.69738	0.60972
90	0.42281	0.27038	0.53169	0.38566
95	0.24165	0.09741	0.33624	0.16797
100	0.10149	0.01887	0.16161	0.04156

Table 3: Probability of survival to given future ages for a life of age 65 retiring in 2015 (based on ONS life tables)

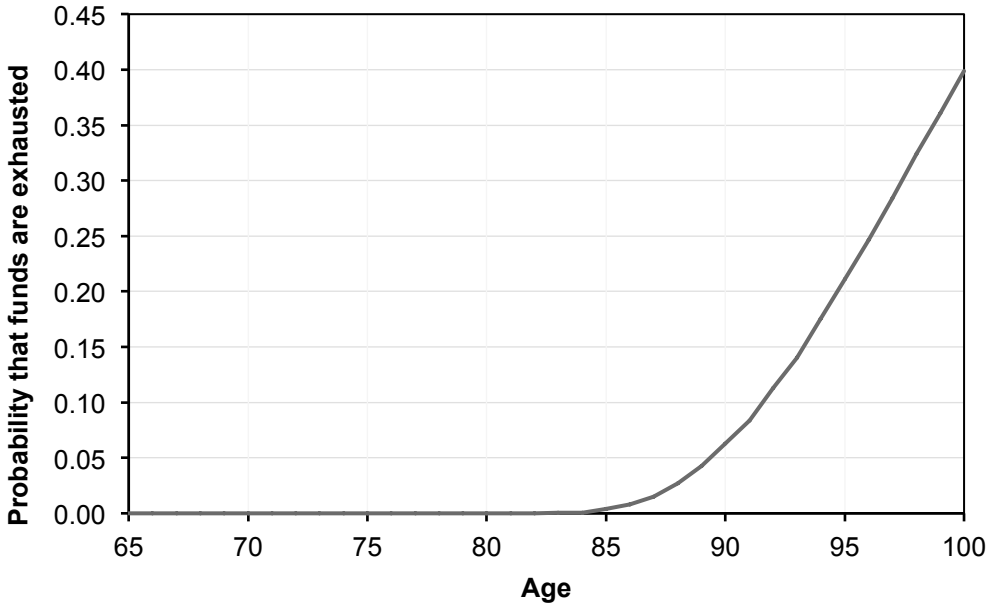

Figure 2: Probability that fund is exhausted at each future age based on a level annual drawdown of £4,328.82 and a starting pot of £100k (with longevity drift included)

In short, the probability of exhausting the funds before death is relatively small (about 7% at age 90, an age to which, from Table 3, only 42% of men can expect to survive). This means that if a person dies earlier than expected, the residual wealth can be bequeathed to others rather than benefiting the insurance company, as would be the case if an annuity had been purchased.

For a woman the probability of surviving to any given age is higher than for a man and so they are taking more risk. In practice, a man or woman may choose to draw down funds for a number of years after retirement and purchase an annuity later as personal circumstances change. For

example, if their health deteriorates then they may be offered an impaired annuity at much more favourable rates (which may make an annuity more attractive).

It is also possible that the original aim of bequeathing money is superseded due to:

- The death of a spouse or children becoming financially independent
- Interest rates increasing making annuities better value, or
- Changes in legislation that allow companies to offer better annuity rates at some future date.

Rather than drawing down money at the same level as the income provided by purchasing an annuity, individuals are now free to draw down money as they wish and so it is also important to consider more aggressive drawdown strategies.

It is thus helpful to consider how different annual amounts affect the risk that the fund becomes exhausted by a given age. For simplicity, let us assume that that the level of income drawdown remains unchanged throughout retirement in real terms. Figure 3 shows the impact on income by the age of different fixed drawdown strategies based on higher amounts of annual withdrawals.

As expected, choosing a higher level of annual income is likely to lead to the fund being exhausted earlier. To put this in context, we saw that the probability of a man retiring at age 65 in 2015 surviving to age 95 is 24.2% and 33.6% for a woman. Based on an annual drawdown of £7,000, the median age at which the fund is exhausted falls to 83; the probability of a man surviving to age 83 in this case is now higher at 66.5% (and 75.1% for a woman).

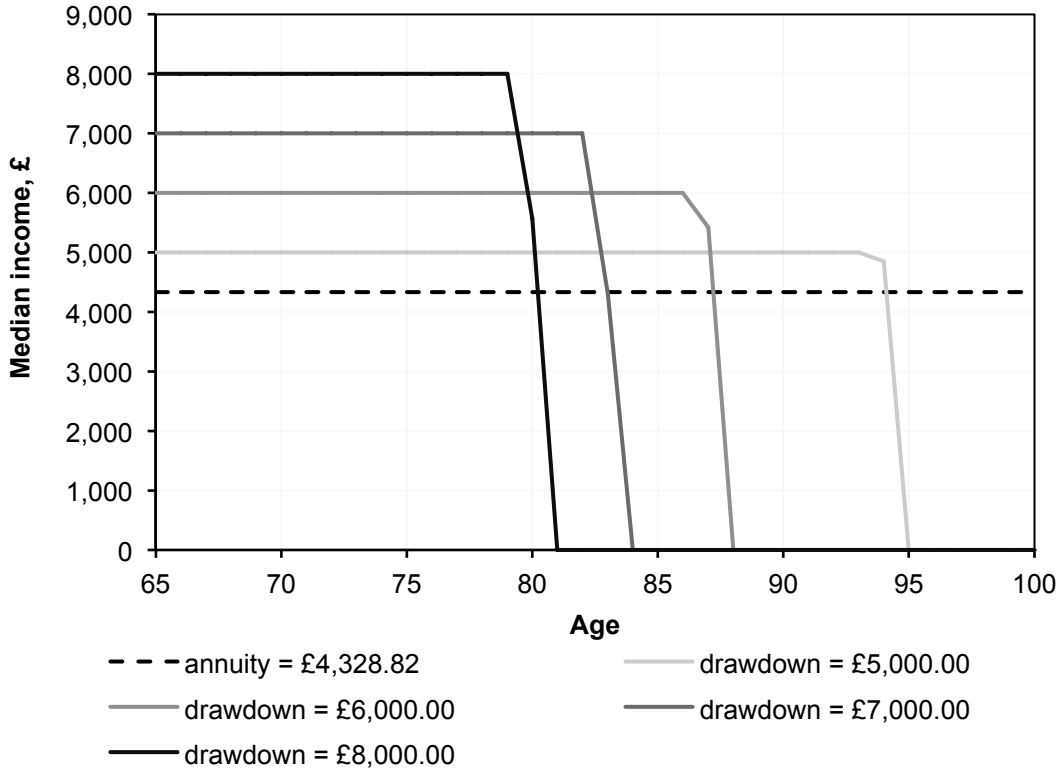

Figure 3: Fixed (in real terms) income drawdown compared with an annuity

Hence, the main problem with this more aggressive option is that the individual faces an income 'cliff edge' (i.e. the fund is exhausted prior to death). However, as these examples show, the probability of this happening can be quite low as long as drawdown is done in moderation.

A person also faces potential tax liabilities if too much is withdrawn. The first 25% of any pension pot is tax free with remaining amounts taxed at the individual's marginal rate (typically 20% for standard rate tax payers above the personal allowance). Care is needed not to stray into a higher income tax bracket if it can be avoided once income from all sources is combined.

What if the pot is exhausted? We are fortunate that the welfare system in the UK has a built in safety net. In the future it will include a more generous flat rate pension from 2016 and continued eligibility for benefits such as reduced payment of Council Tax or Attendance Allowance, although the qualifying age for the state pensions is being increased in stages.

Typically the value of these benefits is far in excess of the value of an annuity based on the average pension pot at normal state retirement age. For a means tested benefit, such as help with Council Tax, the amount of received may be offset by the value of the annuity.[11] By how much depends on other circumstances such as whether a person lives alone but clearly it is another factor in deciding whether or not to annuitise.

Case 2 – Flexible income drawdown

High risk investment strategies coupled with a high fixed annual drawdown run the danger of what is termed by some analysts as 'pound cost ravaging'.[12] It describes the so-called 'ravaging' effect that regular, fixed withdrawals can have if they are made after markets have fallen. Such withdrawals exacerbate the drop in share values by crystallising the losses. They therefore make future recovery more difficult.

Rather than fixed drawdown, individuals may prefer to flex income levels according to the size of pot remaining or their income needs as well as adopting a more moderate investment strategy. For example, one could elect to draw down a fixed percentage of the remaining pot each year by calibrating that percentage so as to achieve one's own personal financial goal, such as not dying penniless.

The specific issue to be guarded against here is to not run out of money too soon which is dependent on longevity risk as well as investment returns. One way to manage longevity risk is to draw down an income each year that is dependent on future life expectancy. We call this the flexible income drawdown strategy as the following example shows.

We saw earlier that the future life expectancy of a male on retirement at age 65 in 2015 is 21.8955 years (see Annex A). Thus, based on an initial pension pot of £100,000, the individual can draw down an annual income of:

[11] This will only occur if a household's combined income from all sources falls below a qualifying level for Council Tax support. Those standing to lose out will live alone and not have any other sources of income such as an occupational pension.

[12] See: http://www.telegraph.co.uk/finance/personalfinance/investing/11210093/Invest-100000-in-shares-and-take-an-annual-income.-How-long-till-youre-bust.html. This may be contrasted with the more familiar term of pound cost averaging which describes the process of regularly investing the same amount, usually on a monthly basis, to smooth out the impact of the highs and lows of the price of any chosen investment.

$$\frac{100,000}{21.8955} = £4,567.15$$ [13]

For simplicity, suppose now that the actual investment return achieved during the year of age 65 to 66 is exactly in line with expectations, the remaining fund (in real terms) at age 66 will be:

$$£100,000 \times 1.03 - £4,567.15 = £98,432.85$$

Then, based on the future life expectancy at age 66 of 21.1247 years, the individual will now be able to draw down an annual income in the coming year of:

$$\frac{98,432.85}{21.1247} = £4,659.61$$ [14]

If continued each year, this process will ensure that the fund will never be exhausted (as the amount drawdown at each future age is a specified proportion of the fund currently remaining). Note, however, at very old ages, the fund remaining and hence the income produced from it, can still end up being very small.

Figure 4 shows how this works in practice. It indicates the median annual income achieved for both a man and a woman withdrawing amounts each year based on their (gender-specific) life expectancy at each age up to age 100. It shows that the male pensioner will receive more income than an annuity worth £4,382.28 p.a. at least initially because they are using the appropriate mortality rates for their gender.

We see that the level of income then increases on average due to the superior expected investment returns achieved compared a funds used to support annuities. We find that the median income in real terms reaches nearly £5,500 at age 78 and continues to be higher than the income from the annuity up to age 89. This is seen by comparing the solid line with the straight hatched annuity line.

The outer dotted lines provide an indication of how much variation is possible in income level over time (as a result of uncertain investment performance).[15] The main point here is that in some cases the investor would make large gains (resulting in significantly increased income); but even if there were losses, these would often be manageable as long as the individual took avoiding action such as reducing the income drawn down.

[13] For a woman retiring at age 65 in 2015, the corresponding amount that should be drawn down in the first year of retirement is $\frac{100,000}{24.2516} = £4,123.44$. Note that these amounts are equal to the annual annuity income that would have been calculated prior to 21 December 2012.

[14] In general, if the remaining fund held at age x is F_x, then the annual amount of income drawn down is equal to $\frac{F_x}{\dot{e}_x}$ (where $\dot{e}_x$ is the future life expectancy at exact age x).

[15] Based on the inter-quartile range of simulated outcomes

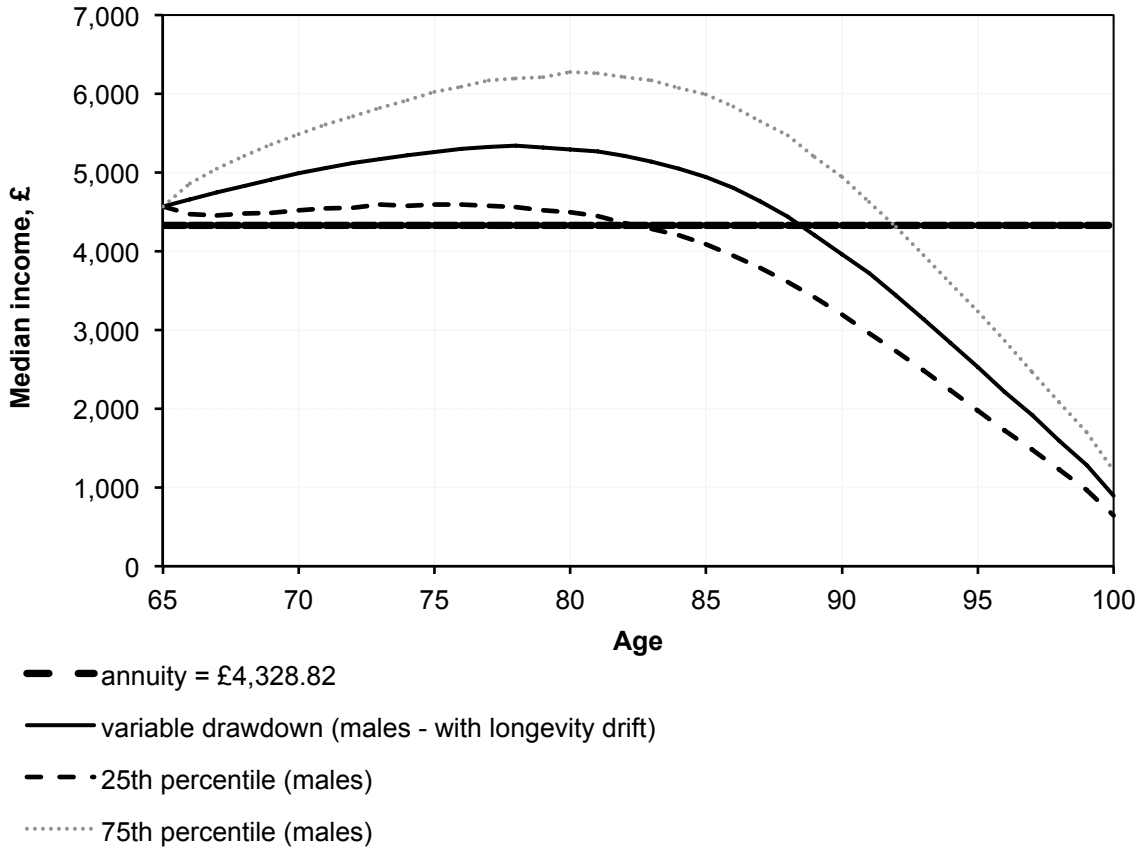

Figure 4: Flexible income drawdown (for a male with longevity drift)

Whether the decline in income is manageable or not depends on age at death and income needs in old age. As previously noted, the ONS 2015 male life table shows that the probability of surviving to age 95, by which time expected income would drop to around £2,500, is 24.2% (with longevity drift). In other words, the chances of living beyond this age are small, but not negligible.

For a woman, the initial income is lower than that from purchasing an annuity. However, by deferring income and benefiting from investment returns, income should rise quickly to a high of approximately £5,200 per annum at age 82, before gradually declining as for a man. In other words, increased life expectancy for women results in lower income initially and more later (when women are more likely to still be alive).

5. Bequeathing wealth

5.1. Rate of pot depletion

For people purchasing an annuity, bequeathable wealth is zero but people using drawdown it provides further options. Under option B, Table 1, residual wealth depends on the amounts withdrawn annually, the investment returns achieved and the age of death. How much to bequeath and at what age is a therefore key consideration for many and a reason for not buying and annuity.

Figure 5 shows the median residual wealth at each future age for different fixed (in real terms) annual income levels. This includes comparison with purchasing an annuity and also the flexible drawdown based on both male and female life expectancy. In the latter cases, it can be seen that the residual wealth is never entirely exhausted (though it may become negligible at the highest ages).

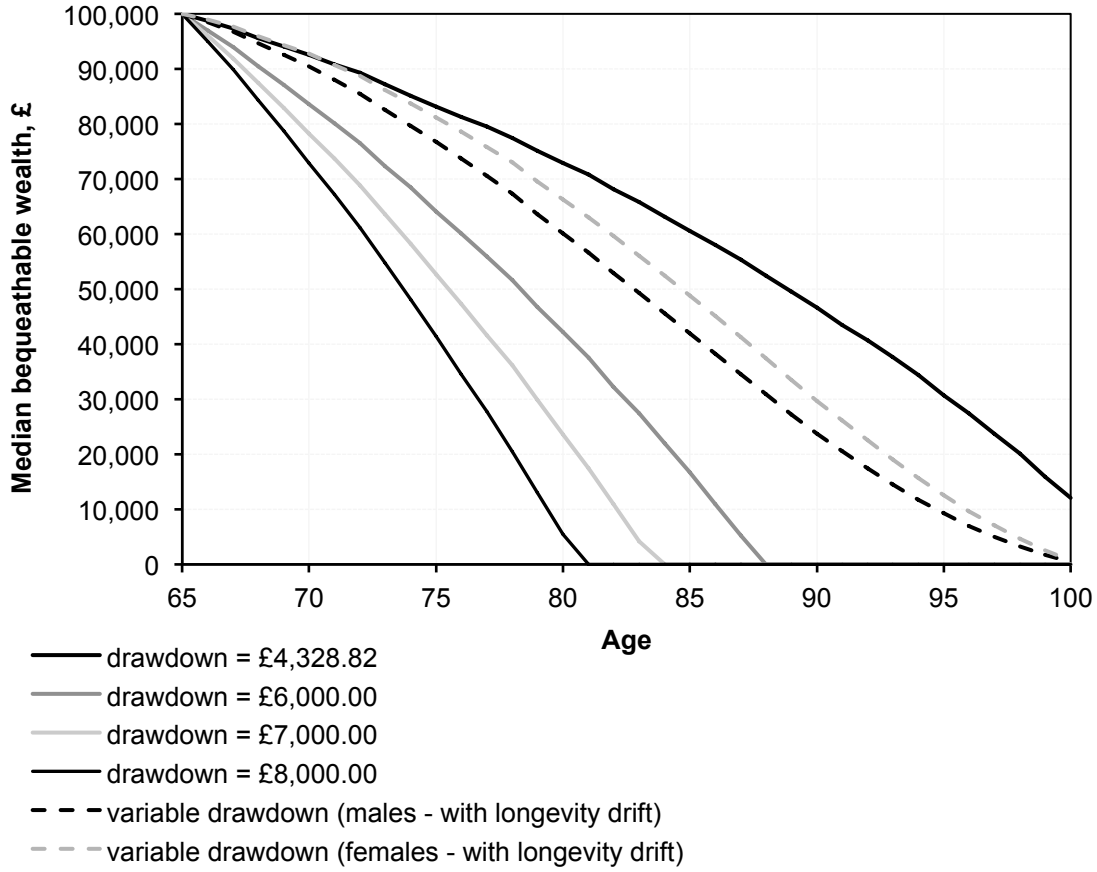

Figure 5: Median bequeathable wealth each future age for an individual retiring at age 65 in 2015 with an initial pension pot of £100,000

As would be expected, the pot is depleted more quickly for higher levels of drawdown. For the case where drawn down equates to an annuity, the amount of wealth remaining at age 95 would be around £30,000 or 30% of the original pot. Using flexible drawdown it would be around £10,000 at the same age.

Figure 6 shows a plot of annual income in retirement against age in which the curves shown connect combinations of age and income with the same probability of exhausting the fund. Three curves are shown with a probability of exhausting the fund of 10% (consistent with a risk-averse individual), of 25% (consistent with a medium-risk individual) and of 50% (consistent with a higher-risk individual).

For example, if we look over a future time horizon of 21.9 years (i.e. the future life expectancy of a man retiring at age 65 in 2015, allowing for longevity drift), a risk-averse individual who wants only a 10% chance of the fund being exhausted by this stage can draw down an annual income of around £5,000 (as denoted by P on Figure 6).

By contrast, a man with low risk aversion (i.e. who is prepared to accept a 50% chance of the fund being exhausted over the same period) can draw down an annual income of over £6,200 (as denoted by R).[16]

[16] For a woman retiring at age 65 in 2015, future life expectancy is 24.3 years (allowing for longevity drift). A risk-averse female (i.e. one who accepts a 10% chance of the fund being exhausted by the end of this period) can draw down an annual income of around £4,700, whereas a more risk-seeking female (i.e. one who accepts a 50% of the fund being exhausted at the end of this period) can draw down £5,700.

We can use Figure 6 to explore the effect of ignoring longevity drift on retirement. If the future life expectancy of a man retiring at age 65 in 2015 is 19.1 years, a medium-risk individual who accepts a 25% chance of the fund being exhausted before death would (mistakenly) draw down an annual income of around £6,200 (as denoted by Q). If longevity drift is taken into account, this risk increases to 50% due to his (higher) expected future lifetime (from R above).

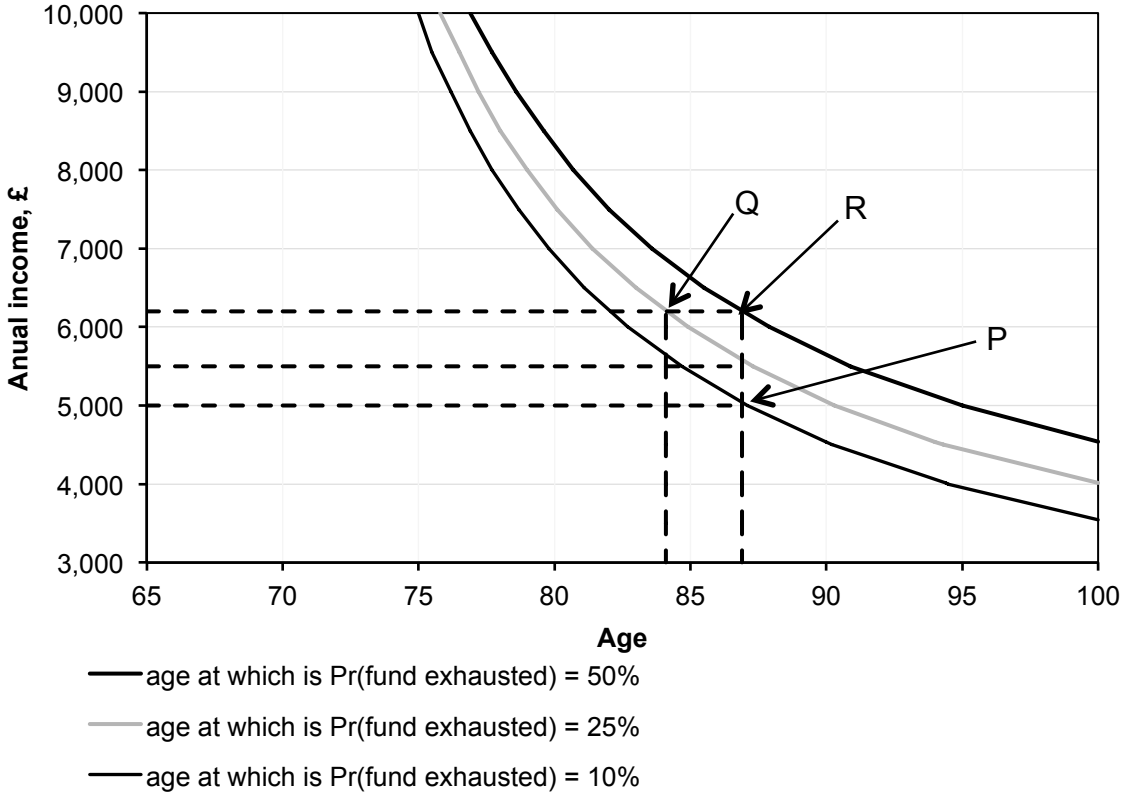

Figure 6: Probability curves for income against age at which an initial fund of £100,000 at age 60 is exhausted

5.2. Gifts versus bequests

Rather than waiting until death to bequeath any residual pension wealth, some individuals may prefer to transfer part of their accumulated pension pot immediately on retirement (possibly for use by their children as a deposit on a house, to help elderly parents pay for their care or to pay off a mortgage).

Such transfers may be subject to a higher rate of tax at the point of drawdown depending on whether they exceed the 25% tax free limit or not. In most cases, a person would normally decide on the desired level of income in retirement and the risk involved, before deciding the amount to gift/spend and also any tax implications.

In Figure 7, we consider the level of fund required in retirement at age 65 to support different levels of income. The risk of exhausting the fund is measured by the median age at which this occurs. Contours show three different sizes of fund: £80,000, £100,000 and £120,000. A reasonable aim

would be to align the median age of exhausting the fund with expected age at death (i.e. 86.9 years for males). What are his options?

A man requiring an annual income of £4,930 would need a pension pot at age 65 of £80,000 (point A). If his pot was £120,000 instead, he could potentially gift £40,000 and still achieve his required income goals. However, a man who requires an income of £7,500 would need a pension pot at age 65 of £120,000 and so would not have the same flexibility.

Note that it is possible to reconcile Figure 7 with Figure 6. Based on a median pot exhaustion age of 86.9, a pension pot of £100,000 at age 65 will be required to support an annual income of just under £6,200. This is consistent with the result given in Figure 6 where, with this level of annual income, the probability of exhausting the fund by age 80 is 50%.

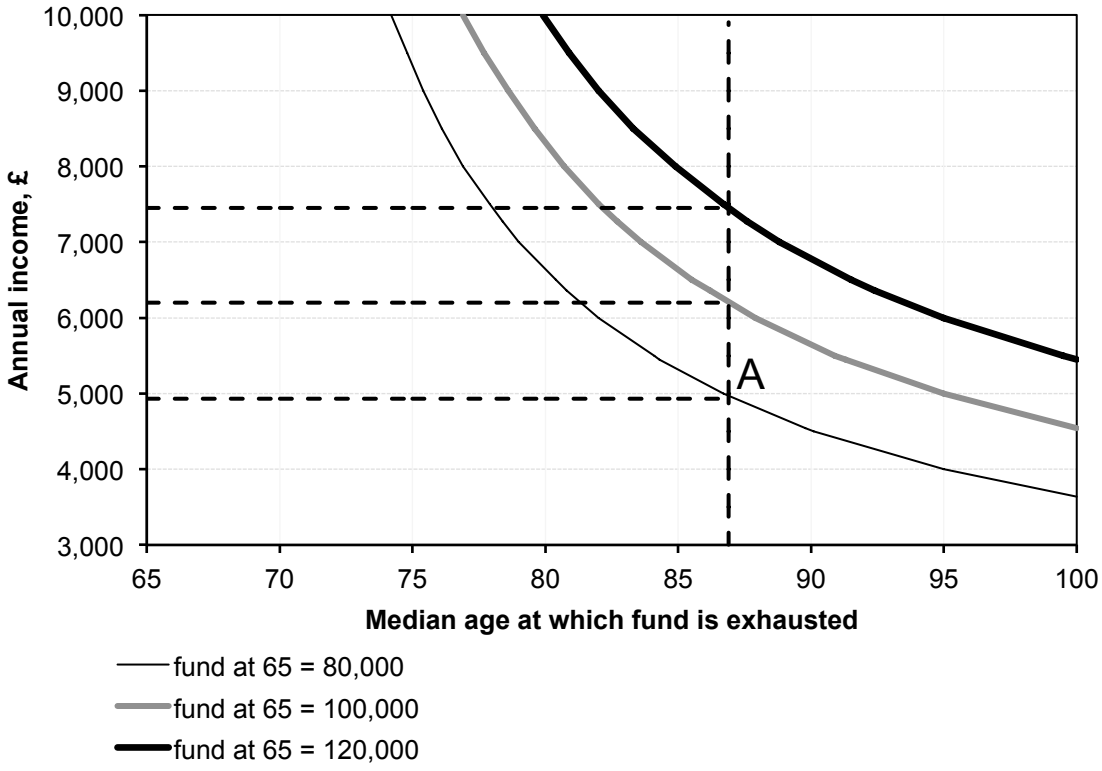

Figure 7: Curves for income against versus age at which fund is exhausted for pot sizes ranging from £80,000 to £160,000

6. Incorporating housing wealth into retirement planning

Under income drawdown, we saw that the possibility of the pot running dry or falling to very low levels is very small if it is planned carefully, although whether it matters or not depends on other income at a person's disposal. This could include a separate occupational pension, entitlement to a state pension, age related means and non-means tested benefits and various benefits in kind.

It is also theoretically possible to put one's personal finances on a 'glide path' so that income matches future needs, which are often less at say age 80 that they were at retirement. Clearly, this would require an article of faith in the Government to maintain a safety net if things went wrong e.g. if certain benefits were to be withdrawn such as heating allowances and free television licenses.

Home owners have the additional advantage of being able to generate replacement income by downsizing with the presumption that trading down will provide a surplus which can be invested, although stamp duty, legal fees and moving costs may be significant and could cancel out any profit depending on the gap between the sale and purchase price.

Equity in the home can also be ceded to a financial provider in exchange for a lump sum, a regular payment or an annuity with the debt being repaid on death or sale of the property. A problem is that equity release is often seen as expensive due to a combination of the uncertainties about future interest rates and increases in longevity, i.e. a lot of equity has to be given up for a relatively small income.

However, at older ages the risks of uncertainties both in future interest rates and increased life expectancy are much reduced and so the annuity purchased by releasing equity or the money borrowed is significantly cheaper. How much is repaid depends on the terms of the agreement including borrowing rates and assumed future changes in house price inflation. Mayhew and Smith, 2014 describes how this would operate in practice in another ILC publication.[17]

It is important to note that couple households are more financially resilient since two people can live more cheaply (per person) and, in many cases, one is able to look after the care needs of the other. However, all this can change when one of the couple dies and this can act as an important trigger for releasing equity. Unlike a pension pot, the value of a home is effectively set aside until needed. The money can be used to provide additional income or pay for care.

7. Concluding reflections

UK pensions rules changed dramatically on April 1st 2015. The effect has been to provide individuals with far more flexibility in how to spend their retirement savings. The new rules do not apply to the diminishing number of people with defined benefit occupational pensions, but only to those with defined contribution or personal pensions.

Traditional annuities have developed a somewhat tarnished reputation in recent years. This is mainly due to people perceiving them as poor value and inflexible. However, part of the reason for this is that they under estimate how long they are going to live and the high cost of inflation-proofing i.e. they downplay the value of the income guarantee provided by annuities.

Regulation also plays a major part in making annuities unattractive by forcing companies to invest in low yielding government bonds which increases the prices charged to policyholders. This has also limited the flexibility that can be designed into annuities whilst the guarantee of income for life meaning that companies must make prudent assumptions on increases in longevity. The introduction of unisex pricing from 2013 has arguably only exacerbated the problem.

In the paper situations were described for which an annuity usually provides poor value. This occurred most commonly when a person owned their own home or had other assets to fall back on. This arose for three reasons:

[17] The UK Equity Bank: Towards Income Security in Old Age. ILC-UK. http://www.ilcuk.org.uk/index.php/publications/publication_details/the_uk_equity_bank_towards_income_security_in_old_age

(a) Expected returns from the fund using income drawdown should be higher than the returns expected from a fund supporting annuities.

(b) For males, annuity rates are calculated using mortality rates that are too low due to gender equalisation regulations.

(c) If the individual dies then an annuity dies with them while if they use drawdown the residual pot can be bequeathed. This is particularly beneficial for those who die early.

However, it is not all gloom. At older ages, say over 80, the purchase of an annuity can be reconsidered as it may provide better value for money. The reasons are:

(a) Annuity funds are pooled so that if a member of the pool dies, the funds held are (effectively) distributed amongst the survivors (as it is no longer required to pay benefits to the deceased). This so-called 'mortality credit' boosts the investment return achieved each year by those surviving and is generally greater than could be earned by investing the funds independently.[18]

(b) The expected remaining lifetimes of males and females in their mid-80s is similar so that unisex pricing makes little difference to the income a person will get.

(c) The bequest motive will tend to lessen in importance as dependents become independents and the need for income security rises in importance.

It is also technically possible to make annuities attractive again if certain regulations were relaxed, including a loosening of requirements on investment strategies. New types of products could emerge, if they allowed for example purchasers to decide on income patterns that aligned with their future income needs or even stopped at a given age. Different with-profits annuities could be developed with a guaranteed minimum income with the rest based on stock market performance and so on.

Another often discussed option is disability linked annuities which provide an uplift in income on a person becoming disabled or severely disabled. Unless it was a very large uplift such products would only partially meet any care costs unless the pension pot was large at the outset and the uplift correspondingly high. The key point is that the income is secure and could also meet increased needs in later life until death.

However, other conclusions flow from our analysis that point strongly away from annuitisation and towards the flexibility of drawdown. Unsurprisingly, many of them are conditional upon a person's personal circumstances and retirement aims, of which income security in retirement is just one. Other considerations include a person's state of health, living with or making financial provision for a partner, gifting or making bequests and so on.

In particular, we have argued that there are other ways to build security which does not necessarily involve the purchase of an annuity at the outset (or, indeed, at any time in life). In many cases, we saw that income drawdown makes more financial sense and provides much greater flexibility if circumstances change as long as simple rules are followed – i.e. the cliff edge that comes with aggressive drawdown is avoided.

We saw for example that the risks of drawdown are mainly 'tail end' (i.e. towards the end of life), such as living longer than you had expected when making a retirement plan. We argued that the

[18] This idea is discussed further by, amongst others, Blake, Wright and Zhang (2014).

downside of longevity risk could be mitigated using flexible rather than fixed income drawdown and by reducing investment risk. One of the options suggested is to purchase an annuity at say age 80 using the reminder of the pot but the same effect could be accomplished by releasing equity from the home - two options which should first be compared on a like for like basis.

Hitherto, equity release as opposed to a standard annuity was often seen as expensive at early ages due to the combination of interest rate and longevity risks such that a lot of equity in the house has to be given up for a relatively small income or lump sum.[19] However, from age 75 and older an annuity purchased on this basis is better value so that more income can be gained from giving up a similar amount of equity and there may also be tax as well as bequest advantages (Mayhew and Smith, 2014c).

The value in the home in these cases acts as a financial back-stop in the event of pension pot being depleted too soon, income loss on the death of partner, or care costs becoming unaffordable. With care costs in nursing or residential care running at around £1000 a week, this is beyond the reach of most retirees and so a person's home becomes the principal asset of choice in these cases (although domiciliary care is cheaper, provided it is not needed on a 24 hour basis).

Unfortunately, the Government has not promoted any tax and benefit friendly ways of saving for long term care or in promoting new product ideas (which are now starting to come forward: see Mayhew et al, 2010). Insuring against this risk and therefore protecting your home is not cheap (and premiums increase with a person's age).This means that if purchased it would cut significantly into retirement income and living standards by reducing consumption.

One option is to use equity in the home to pay for long term care insurance, the premium for which is repayable after death, so the home itself becomes the main financial asset of choice in these circumstances. The key advantage of this approach is that it would avoid having to pay expensive premiums whilst alive, but also allow an individual to remain in their own home until death.

It follows that dividing the equity in a home between meeting income and long term care needs is likely to become more popular with the new pension freedoms (Mayhew and O'Leary, 2014d). It can also be noted in passing that leaving a large legacy in the form of a valuable home might attract a large inheritance tax bill. The logic is that personal wealth could be more productively used by spreading its ownership, or by downsizing and releasing surplus funds that can be gifted at an earlier age.

It goes without saying that all of the above require careful planning an advice, but the greater flexibility that is the result of the pension changes from April 1st 2015 makes these options more feasible and practical. The key point is not to rush into buying an annuity before reviewing the options and income requirements in later life. Before deciding whether to by an annuity each person should therefore consider undergoing a financial health check; and if they do go for the drawdown option then they should seek regular financial advice.

[19] Equity Release Council, 'What is equity release?' www.equityreleasecouncil.com/what-is-equity-release/ (accessed 12 Feb 2014).

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ANNEX A: Life expectancy with and without longevity drift from age 65

age, x	$\dot{e}_x$ (male, with drift)	$\dot{e}_x$ (male, no drift)	$\dot{e}_x$ (female, with drift)	$\dot{e}_x$ (female, no drift)
65	21.90	19.13	24.25	21.61
66	21.12	18.35	23.42	20.77
67	20.36	17.57	22.60	19.94
68	19.61	16.81	21.78	19.12
69	18.86	16.06	20.97	18.31
70	18.12	15.32	20.17	17.51
71	17.40	14.60	19.38	16.72
72	16.68	13.89	18.59	15.94
73	15.97	13.20	17.82	15.18
74	15.28	12.53	17.05	14.42
75	14.59	11.87	16.29	13.69
76	13.92	11.23	15.54	12.96
77	13.26	10.60	14.81	12.25
78	12.61	9.99	14.08	11.56
79	11.98	9.40	13.37	10.88
80	11.36	8.82	12.68	10.22
81	10.75	8.26	11.99	9.59
82	10.16	7.73	11.33	8.97
83	9.59	7.21	10.68	8.39
84	9.03	6.72	10.04	7.82
85	8.49	6.26	9.42	7.29
86	7.96	5.83	8.81	6.78
87	7.45	5.42	8.23	6.30
88	6.96	5.04	7.65	5.85
89	6.47	4.69	7.09	5.42
90	6.00	4.36	6.54	5.03
91	5.55	4.05	6.01	4.66
92	5.12	3.77	5.50	4.31
93	4.71	3.51	5.01	3.99
94	4.32	3.26	4.54	3.70
95	3.96	3.03	4.10	3.43
96	3.63	2.81	3.72	3.19
97	3.31	2.61	3.38	2.96
98	3.00	2.42	3.09	2.75
99	2.72	2.24	2.81	2.55
100	2.47	2.08	2.56	2.36

ILC–UK
11 Tufton Street
London
SW1P 3QB
Tel : +44 (0) 20 7340 0440

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