

ELSA Pension Wealth Derived Variables (Waves 2 to 5): Methodology

Rowena Crawford*

Institute for Fiscal Studies

Version 1 – November 2012

1. Introduction

This document describes in detail the methodology used to calculate derived state and private pension wealth for individuals in waves 2 to 5 of the English Longitudinal Study of Ageing (ELSA).¹ The derived pension wealth variables are available in datasets called *Wave_X_Pension_Wealth*, where X refers to the wave of data (i.e. 2 to 5). A companion document *Pension Wealth Derived Variables: User Guide* gives a brief introduction to the available derived variables.

Pension wealth estimates are available at the individual level, and are included for all individuals in ELSA. State pension wealth is calculated at the individual level. Private pension wealth is primarily calculated at the pension level for all individually reported private pensions. The methodology used differs according to the type of pension in question; broadly whether it is a current or retained pension or a pension in receipt, and whether it is a defined contribution (DC) or defined benefit (DB) pension.² Private pension wealth is then aggregated into broad categories of private pension holdings at the individual level.

The pension wealth derived variables give the discounted present value of the stream of income that an individual will receive from their pensions between starting to draw these pensions and death. For individuals aged under the state pension age (SPA) this is calculated under two alternative assumptions: first, that individuals leave work and cease accruing any

* Funding for this work was gratefully received from the Economics and Social Research Council (grant numbers: RES-000-22-4323 and RES-544-28-0001). The author would like to thank Carl Emmerson, Cormac O'Dea and Gemma Tetlow for helpful comments.

¹ Similar aggregate derived pension wealth variables are available for ELSA wave 1. The methodology used for the wave 1 calculations is described in detail in Banks, Emmerson and Tetlow (2005) and is broadly comparable to that use for the waves 2 to 5 calculations (described here).

² Defined contribution pensions are those where contributions are paid into a fund, which is invested and then used to purchase an annuity at retirement. The pension income received will depend on the contributions made, the investment return earned and the annuity rate available when the fund is annuitised. Defined benefit pensions are ones where the pension received depends on some function of salary and years of tenure in the scheme.

further rights to their pensions in the year they are interviewed. Second, that individuals continue to work and accrue pension rights until they reach the SPA. Derived pension wealth under both these assumptions is made available in the datasets.

The aim of this document is to describe in detail the derivation of pension wealth for ELSA waves 2 to 5. Throughout, 20XX refers to the first year of the ELSA survey period, so for wave 2 20XX refers to 2004, for wave 3 20XX refers to 2006, for wave 4 20XX refers to 2008 and for wave 5 20XX refers to 2010. The derivation methodology is intended to be identical across the different waves, but that is unfortunately not possible in all cases. Any major differences between the methods used across waves, for example due to changes in the rules for calculating state pension entitlement, are described. However, there may be some small differences in the imputation methods used, for example because the characteristics of individuals for whom data need to be imputed differ, which are not described here for brevity.

The rest of this document proceeds as follows: Section 2 describes the general method used to calculate pension wealth given pension income, the imputation procedure employed when there is missing data and the main assumptions that are pertinent to the calculation of pension income and wealth. Section 3 describes the methodology used to calculate state pension income, while Section 4 describes the methodology used to calculate private pension income.

Readers are assumed to have a working knowledge of the UK pensions system, both state and private. For more information on the UK pensions system please refer to, for example, Bozio, Crawford and Tetlow (2010), Budd and Campbell (1998), Emmerson and Johnson (2001) or Clark and Emmerson (2003).

2. Summary of general methodology and main assumptions

2.1. Calculating pension wealth

The pension wealth derived variables give the discounted present value of the stream of income that an individual will receive from their pensions between starting to draw these pensions and death. Broadly speaking this is calculated at the pension level according to the generic equation:

$$Wealth = \sum_{s=r}^{r+LE} \left(\frac{1}{1+\delta} \right)^s (1+i)^{s-r} P$$

Where P is annual pension income in year the individual starts to draw the pension (r), i is the real indexation of pension income in retirement, δ is the real discount rate and the year of death ($r + LE$) is the date the individual starts to draw the pension plus life expectancy at that age.

In the case of some pensions, an individual's spouse may be entitled to survivor benefits if they outlive their spouse. We include this as wealth of the original individual, and add the

present discounted value of the stream of pension income received by the spouse to the net present value of the stream of pension income received by the individual:

$$Wealth = \sum_{s=r}^{r+LE} \left(\frac{1}{1+\delta} \right)^s (1+i)^{s-r} P + I \left(\sum_{s=r+LE}^{r+LE^P} \left(\frac{1}{1+\delta} \right)^s (1+i)^{s-r} \alpha P \right)$$

Here I is an indicator of having a surviving spouse, α is the proportion of the pension income that the spouse would inherit, and LE^P is the life expectancy of the spouse in the year the individual starts to draw the pension.

For all pensions, an annual real discount rate (δ) of 2.5% is assumed. As a result of this discounting, the present value of a given stream of pension income P to, say, a 64 year old man is higher than the value of the same flow of income to a 50 year old man since the stream of income for the latter is discounted over 14 more years.

Throughout the calculations we assume that everyone dies at his life expectancy. The life expectancies used are sex-, age- and smoker-specific cohort based life expectancies in 20XX from the Government Actuary Department based on 20XX population projections.³ We assume that these life expectancies do not change over time.

The main complexity in the pension wealth calculations is the estimation of pension income in retirement (P), which will be discussed in Section 3 for state pensions and Section 4 for private pensions. Of the other parameters, the date the individual starts to draw their pension (r), the indexation of pension income in retirement (i), the proportion of the pension that would be inherited by a surviving spouse (α) also differ according to the pension in question.

Pension wealth for individuals aged under the SPA is calculated under two alternative scenarios: first, that individuals cease work immediately in 20XX, and accrue no further rights to their pensions. Second, that individuals work each year between 20XX and the SPA (even if they are not currently employed in 20XX) and accrue additional pension wealth in that period. These alternative assumptions potentially result in a different estimate for pension income (P), and may invoke a different assumption about when the individual starts to draw their pension (r). Pension wealth for individuals aged over the SPA is calculated assuming that they start to draw any remaining pension entitlement which they are not currently receiving in 20XX.

³ The exception to this is when calculating the present discounted value of pension income from current (or 'now retained') DC pensions. In this case sex-, age- and smoker-specific cohort based life expectancies in 2005 (based on 2004 population projections) are used, in order to be consistent with the 2005 annuity rates used. This is discussed in more detail in section 4.1.1.

2.2. Imputation procedures

Wherever possible the data required to calculate pension income and pension wealth are taken from the responses of ELSA individuals themselves. However this is not always available, either because the ELSA questionnaire does not attempt to elicit the required data, or because the particular individual in question did not know, or refused to give, an answer to the relevant question. In the former case, assumptions are made about the required data – the main assumptions are discussed in section 2.3, and assumptions pertaining to particular types of pensions are described in the relevant parts of section 3 and section 4. In the latter case, the response for the individual for whom the data is missing is generally imputed from the responses of other individuals.

The imputation procedure used is known as a conditional hotdeck. This works by randomly selecting someone else with matching characteristics, and assuming that the person with missing information should have responded the same as this matched person. The characteristics matched upon are specific to the variable which is being imputed, and are chosen because they are believed to be correlated in some way with the missing variable. In ELSA, individuals who do not know or refuse to answer financial questions (such as earnings, or DC fund value) are subsequently asked a series of questions known as ‘unfolding brackets’ that attempt to elicit the range in which the answer lies. When imputing a missing variable for which the range in which the answer lies is known, the hotdeck selects an individual with matching characteristics whose answer also lies in the same range.

The advantage of using a hotdeck procedure rather than say, using the median response of all those in the sample with matching characteristics, is that it maintains the variance properties of the original sample. The variables for which missing data is imputed, and the characteristics matched upon, are mentioned in the relevant parts of sections 3 and 4.

2.3. Main assumptions for calculation of pension income

The calculation of pension income requires us to make various assumptions about both past and future behaviour. Table 1 gives a summary of the key assumptions we have made, which are relevant for the calculation of income from a number of different types of pension.

Table 1: Summary of main assumptions for calculating pension income

	Assumption	Relevant for:
Future annual inflation	2.5%	All
Past employment	In full-time employment between leaving education and date left last job (also assume that those currently self-employed have always been self-employed)	BSP, Additional pension
Contracting out	Assume contracted-in in all years in current scheme unless know they are contracted out. Assume contracted out in all years when	Additional pension

	in a past pension. Assume contracted out in all past years if currently receiving pension income.	
Annuity rates	Second best age-, sex- and smoker- specific single life level annuity rates quoted by Financial Services Authority in January 2005*	Current DC pensions, retained (previously current) DC pensions
Future real return on assets	2.5%	Current DC pensions, retained (previously current) DC pensions
Real return to pension funds pre-20XX	Assume median economy-wide pension total fund return	Retained DC pensions
Future DC contributions	Constant fraction of earnings if reported as a fraction of earnings; constant nominal amount if reported as an amount	Current DC pensions

* 2005 annuity rates are used for deriving pension wealth in all waves of ELSA to avoid inducing large fluctuations in pension wealth figures across different waves resulting from the temporary disruption to annuity markets in subsequent years caused by the financial crisis and the Bank of England's policy of quantitative easing. To ensure consistency with these annuity rates, the life expectancies used to calculate the value of annuitized DC wealth are therefore also fixed at 2005 levels.

2.3.1. Estimating earnings histories

To calculate state pension entitlements and pension income from retained private pensions it is necessary to know an individual's past earnings history. This information is not available in the core ELSA data. Instead earnings histories for each ELSA respondent are simulated by matching ELSA respondents to earnings profiles from cross-section data, employing a method similar to that used by Blundell, Meghir and Smith (2002).

These earnings histories are based on current earnings so, as some ELSA respondents either did not know their exact earnings or else were not in employment when they responded to the ELSA survey, we begin by simulating earnings in 20XX. In the case of those who did not know their earnings, this was imputed using a hotdeck conditional on age, sex, marital status and earnings in the range indicated).⁴ For those who were out of work in 20XX, we used a quantile (median) regression across individuals (aged below the SPA) in employment in 20XX of log earnings on age, age squared and education level for men and women separately.⁵

⁴ In the case of self-employed people, whose earnings were imputed from amongst other self-employed people only, the hotdeck was conditional only on education and the band within which their earnings lay.

⁵ This method was also used to impute earnings for those self-employed people who reported making a loss or earning zero profit in 20XX.

This was then used to predict earnings for all those who still had missing earnings (including those aged over the SPA).

The earnings profile is based on data from consecutive waves of cross-sections from the Family Expenditure Survey (FES) from 1978 to 20XX. A quantile regression of log earnings is performed to find median gross earnings for a specific group (based on year of birth, sex and education level) in all years between 1978 and 20XX. The year of birth is grouped into three-year cohorts and three education groups are used (those who left full-time education at or before the compulsory school leaving age, those who left full-time education between the CSL and 18 and those who continued in full-time education past 18 years old). Interactions were allowed between education and sex and between education and cohort. However, interaction terms between sex and cohort and between all three variables together were not included.

The effect of imposing these limitations on the relationship between earnings, sex, education and cohort is as follows. First, the interaction term between education and sex allows for the effect on earnings of having a higher level of education to be different for men and women who were born in the same year. Second, the interaction term between education and cohort allows for the effect of a higher level of education on earnings to differ for people born in different years. Third, the omission of the interaction term between sex and cohort means that the effect on earnings of being female relative to being male cannot differ for people born in different years but with the same level of education.

Finally, median earnings were calculated across three consecutive years of data. For example, median group earnings for 2000 were found by taking the median earnings for people in that group in 1999, 2000 and 2001 (where the earnings in 1999 and 2001 are inflated and deflated, respectively, using average earnings growth).

One final adjustment is made to the earnings profile. Those who are still in employment after the state pension age are unlikely to be representative of the rest of their cohort. Therefore, median earnings for those groups over the SPA in any year are replaced with their real median group earnings in the year before the SPA (assuming 2.5% inflation).

To get an earnings profile for each ELSA respondent, we use the earnings information available in ELSA to calculate the ratio of actual earnings to group median earnings (from the FES) in 20XX. We then assume that this individual effect is the same in every year from 1978 to 20XX as it was in 20XX. The underlying assumption here is that any shocks affect individuals in the same group in the same way and so the ordering of individuals in each group does not change over time. So, for example, an individual who earns 20% more than their group median in 20XX is assumed to always earn 20% more than their group median.

To estimate earnings prior to 1978 (not needed for state pension entitlements, but potentially needed for calculating retained private pension income): for years between 1963 and 1977 we take estimated earnings in 1978 and assume that the individual experienced average economy wide earnings growth during this period; for years prior to 1963 we take estimated earnings in 1963 and assume individuals experienced 2% real earnings growth per year prior to that.

To get earnings in years after 20XX, we assume no real earnings growth in future years for individuals aged 55 and over, and 2.5% real earnings growth in future years for individuals aged under 55.⁶

Table 2 summaries the main assumptions used to estimate the past and future earnings of ELSA respondents.

Table 2: Summary of assumptions for estimating earnings histories

	Assumption	Relevant for:
Earnings history 1978-20XX	Assumed to stay at the same multiple of group median earnings, calculated from Family Expenditure Survey data	Additional pension, retained pensions
Earnings growth 1962-1978	National average real earnings growth	Additional pension, retained pensions
Annual earnings growth pre-1962	2% real earnings growth	Additional pension, retained pensions
Future earnings growth	No real earnings growth if aged 55 or over, 2.5% real earnings growth if aged under 55	Additional pension, current pensions

3. Estimating state pension income

There are two main types of state pension provision in the UK. The first is the Basic State Pension (BSP), the second is the additional state pension (either the State Earnings Related Pension Scheme, SERPS, or the State Second Pension, S2P). Entitlement to the state pension is broadly based on individuals' National Insurance contribution (NICs) histories, which in turn depend on an individual's earnings and employment history. Since NICs histories are not directly available in the ELSA data, certain assumptions have to be made when calculating both BSP and additional pension entitlements. These are described in sections 3.1 and 3.2 respectively.

The UK state pension system underwent significant reform as a result of the Pensions Act 2007 (PA07), which affected individuals retiring from April 2010. The derived state pension wealth variables are calculated for each wave under the state pension system that was legislated for at the time of interview: wave 2 and wave 3 are therefore calculated according to the rules of the 'pre Pensions Act 2007' system, while wave 4 and wave 5 state pension wealth are calculated under the rules of the 'post Pensions Act 2007' system.

It should be noted that for individuals who are already aged over the SPA, an alternative estimate of their total state pension wealth could be found using the income they actually

⁶ Banks, Emmerson and Tetlow (2007) considered ELSA panel data and concluded that average real earnings growth of 2.5% for 50-54 year olds and 0% for those aged 54 and over was appropriate.

receive from state pensions, as reported in the Income and Assets module of ELSA, rather than the estimated state pension wealth figures described here. This will not, of course, be the case for individuals who have deferred their state pensions (i.e. people over the SPA who do not currently receive any state pension income but who will in future receive higher state pension income as a result).

3.1. Basic state pension income

To calculate entitlement to BSP for those who are currently in paid work, we assume that they have been in paid work, earning above the Lower Earnings Limit (LEL) since they left fulltime education. Anyone who said they left fulltime education after their nineteenth birthday is assumed to have left education at age 21. For those who were not in paid work when interviewed we assume that they were in paid work (earning above the LEL) for all years between leaving education and finishing their last job. For individuals who did not report when they were last in paid work, this was imputed conditional on sex and marital status⁷, education and five-year age cohorts.

Additionally, all individuals are credited with accrual when they were aged 16, 17 or 18 and had not left fulltime employment by that point. This estimate of the number of 'qualifying years' (the number of years in employment plus early years credits) was then divided by the 'requisite number' of years to give the fraction of BSP to which an individual is entitled.⁸ Individuals with a fraction of 1 or more are entitled to the full BSP. Prior to PA07 (i.e. in waves 2 and 3), any individuals with a fraction below 0.25 are not entitled to any part of the BSP.

Prior to 1978, married women could opt to pay reduced rate NI contributions in exchange for not accruing their own entitlement to the BSP. We know which women in the ELSA sample report having at some time chosen to do this. For these women, we assume they chose to pay reduced rate NI in all years when they were in employment. Therefore, these women are assumed to accrue no entitlement to the BSP.

Individuals who received child benefit for children aged under 16 but who were not earning above the LEL in any year were eligible for Home Responsibilities Protection (HRP). Prior to PA07 this essentially reduces the 'requisite number' of years of NI contributions used when calculating the proportion of BSP to which the individual is entitled. Since PA07, years of HRP have instead counted as 'qualifying years'. Therefore, if a woman in the ELSA data is assumed to be out of work in any year when one of her children was aged less than 16 years, we credit her with HRP. HRP, however, cannot be used to reduce the 'requisite number' of

⁷ The sample was split into three gender and marital groups: men, single women and married women.

⁸ Prior to PA07 the 'requisite number' of years of NI contributions – the number of years required for full entitlement to the BSP – depended on the length of 'working life' – the number of years between an individual reaching 16 and reaching the SPA. See Bozio et al (2010) for more details. As a result of PA07, for individuals reaching SPA from 2010 onwards the 'requisite number' of years is 30.

years below 20 years (pre PA07), or be used to credit more than 22 ‘qualifying years’ (post PA07).

Married women (and men married to women born after 5 April 1950) are entitled to receive BSP income equal to 60% of their partner’s entitlement if they do not (in their own right) qualify for this level of BSP income (this is known as a Category B pension). Therefore, married individuals in the sample, who qualify for less than 60% of their partner’s BSP entitlement, are given BSP income equal to this level (instead of what they would receive in their own right) for all years when both partners are above the SPA. Finally, when one spouse dies, the surviving spouse inherits the deceased spouse’s BSP entitlement (in place of his own) if his spouse’s entitlement exceeded his own.

The category B pension received and the spouse’s entitlement that is inherited (where relevant) do, of course, depend on when the individual’s spouse retires. Therefore, throughout these calculations we assume that the spouse retires in the same year as the individual is assumed to retire. The exception to this is when we calculate figures for retirement at the SPA. In this case, we assume that the individual’s spouse also retires at their SPA, which will probably be in a different year. The reason for this is that it may be interesting to examine family pension wealth if both partners work until the SPA. In this case we would want to add together the pension wealth (assuming retirement at the SPA) of both partners. In order to do this consistently, the calculation of pension wealth must assume his spouse retires at the SPA as well.

It is assumed that all individuals start to draw their BSP when they reach the SPA since this is the earliest an income from the UK state pension system can be received. We assume that the value of the BSP rises in line with inflation (2.5%) in all future years for waves 2 and 3. Post PA07 (i.e. in waves 4 and 5) we assume that the value of the BSP rises in line with real earnings growth from 2012. Pension income from the BSP is increased by £0.25 per week for individuals aged over 80.⁹

3.2. Additional pension income

An individual’s entitlement to the additional pension depends on his employment and earnings history. Though the exact calculation of the additional pension entitlement has changed several times, essentially entitlement accrues in proportion to earnings between a lower earnings limit and an upper earnings limit in all years of a person’s working life since 1978.

Using individuals’ simulated earnings histories (described in section 2.3.1) it is possible to calculate SERPS and S2P accrual from 1978 to 20XX, and simulate SERPS accrual in the future. The rules for SERPS accrual changed twice between its introduction in 1978 and its

⁹ Individuals aged over 80 may be entitled to Category D pension if they are not eligible for a Category A or Category B pension, or if their entitlement is less than the Category D rate (see Bozio et al (2010) for more details). These Category D pensions are not included in the state pension wealth calculations.

replacement by S2P in 2002, while the rules for S2P have also been changed since its introduction (in the Pensions Act 2007). There are therefore five different systems under which individuals accrue additional state pension entitlement. How these systems apply to particular individuals depends on when they reach the SPA. For a detailed description of the various SERPS and S2P systems see Bozio, Crawford and Tetlow (2010).

Under all systems, only earnings below the 'Upper Earnings Limit' in that year are eligible to accrue entitlement. Individuals do not accrue any entitlement to the additional pension if they are self employed. Individuals who are observed as self employed in the ELSA data are assumed to have always been self employed and therefore have no additional state pension entitlement. Women who have ever paid the reduced rate of national insurance (discussed above) are also assumed to have no additional state pension entitlement.

Finally, individuals who are contracted out at any point do not accrue any entitlement in those years in which they are contracted out. Anyone who had a private pension in years between 1978 and 1988 is assumed to be contracted-out in these years. During these years, the majority of employer provided DB schemes were contracted out – the condition being that they had to provide benefits at least as generous as those provided by SERPS. These were by far the majority of private pensions at the time. This is because prior to 1988 the only forms of private pension available were employer DB schemes, S226 schemes for the self-employed (who do not accrue SERPS/S2P entitlement) and retirement annuity plans.

In 20XX, if a person had a DB pension, we assume they are contracted out. If a person had a DC pension and says they are contracted out, we assume they are contracted out. Otherwise we assume they are contracted-in in 20XX. For years between 1989 and 20XX, if the individual was in the same pension scheme as he is a member of in 20XX, we assume his contracting out status is the same. For any years between 1989 and 20XX when he was not in his current scheme, we know whether or not he was in any other private pension scheme for any of these years. If he was, we assume he was contracted out in those years. If an individual is in receipt of a private pension in 20XX we assume he was contracted out in all past years. For all years after 20XX, an individual's contracted-out status is the same as it was in 20XX, unless he is over the SPA in which case he ceases to accrue SERPS or receive a contracting-out rebate, since anyone aged over the SPA no longer pays employee NI contributions.

Once we had the employment and earnings history and the contracting-out status in each year for each individual, using the rules of the schemes, an estimate was made of the income that would be received from the second tier state pension in all years from the SPA to death. In addition, recipients' spouses are also entitled to survivor benefits from SERPS/S2P if they outlive their spouse. The surviving spouse inherits between 100% and 50% of the SERPS/S2P income – the percentage inherited depends on the date of birth of the deceased spouse.

4. Estimating private pension income

The method used to estimate private pension income depends on the type of pension, of which there are 7 broadly defined categories:

- Current DC pensions
- Current DB pensions
- Retained DC pensions (that were current in a previous wave)
- Retained DB pensions (that were current in a previous wave)
- Retained pensions (that were never observed as a current pension)
- Pensions that are already in receipt
- Widow/divorcee pensions

Some private pensions are integrated with the state pension system. In other words, benefits from the private pension are reduced once the individual begins drawing their state pension, by some amount up to the level of state pension received. A question about whether or not an individual's pension scheme was integrated was piloted in ELSA. However, virtually no respondents knew the answer to this question and so it was dropped from the final survey. As a result we do not know whether private pensions are integrated or not. Therefore, we assume throughout that no schemes are integrated. This will have the effect of over-estimating total pension income and wealth for individuals with integrated private schemes.

4.1. Current pensions

4.1.1. Current DC pensions

For all DC schemes ELSA respondents are asked to give the current value of their fund. This measure includes wealth from personal pensions, stakeholder pensions, S226 plans and additional voluntary contributions (AVCs) and freestanding additional voluntary contributions (FSAVCs) to DB schemes. If the individual does not know any element of his fund, he is asked to give a range in which it lies from various upper and lower bound options. If the individual does not know the fund value precisely, we hotdeck a value (conditional on the quartile of current earnings multiplied by pension tenure and whether or not the pension was an employer pension) from within the range the individual indicated.¹⁰ A variable is included in the data to indicate whether any element of the fund value was imputed.

The income from a DC pension fund depends on annuity rates at the time the individual annuitises their fund. Individuals can choose to purchase an annuity that is indexed to prices or one that is fixed in nominal terms. We use annuity rates that assume the latter option is chosen, as this is in practice what is most commonly bought. The annuity rate they receive

¹⁰ For those with zero earnings we hotdeck a value conditional on education, tenure and pension type from within the range indicated.

was the second best age, gender and smoker specific single life annuity rate¹¹ quoted by the Financial Services Authority (FSA) in January 2005 assuming a £100,000 fund.¹² 2005 annuity rates are used for deriving pension wealth in all waves of ELSA to avoid inducing large fluctuations in pension wealth figures across different waves resulting from the temporary disruption to annuity markets in subsequent years caused by the financial crisis and the Bank of England's policy of quantitative easing. To ensure consistency with these annuity rates, the life expectancies used to calculate the value of annuitized DC wealth are therefore also fixed at 2005 levels.

Individuals can annuitise their DC fund at any age between the 'minimum pension age' and 74. Prior to the implementation of the Finance Act 2004 (applicable to individuals responding in wave 2), the minimum pension age was 50. As a result of the Finance Act 2004, from April 2010 the minimum pension age was increased to 55.

Under the 'retire now' scenario we assume that individuals annuitise their fund immediately if they are aged over the minimum pension age, and at the minimum pension age if they are not (with their fund accruing interest at a real 2.5% a year between 20XX and when they reach the minimum pension age).

Under the 'retire at SPA' scenario, individuals are assumed to annuitise their fund at the SPA (or in 20XX if they are already aged over the SPA), using the same annuity rates that were used for 20XX. In other words, we assume that annuity rates remain constant over time. This is in line with our assumption that life expectancies do not increase over time either. In reality, longevity is increasing so younger individuals will have a longer life expectancy when they reach, for example, the SPA than individuals currently at the SPA do. Therefore, in the future, we would expect annuity rates to fall since the income will be received over a longer period. However, since we assume constant life expectancies, it is consistent also to assume constant annuity rates (or at least not to incorporate any fall in annuity rates that is occurring due to rising longevity).

In order to calculate an individual's DC pension fund if they continue to work until the SPA, we need to know not only at what rate the current fund will appreciate (assumed to be 2.5% real), but also how much the individual will contribute to the fund in future years if he continues working. From ELSA we know the value of contributions currently being made. For individuals who report these contributions as a £ amount, we assume that in future years they contribute the same (nominal) £ amount. For individuals who report their contributions as a percentage of salary, we assume that in future years they contribute the same fraction

¹¹ The part of the DC fund that comes from contracted out rebates will, in fact, have to be annuitised at a non-gender specific, joint-life annuity rate. However, since we do not know how much of the fund comes from contracted out rebates, we cannot annuitise this part at a different rate.

¹² www.fsa.gov.uk/tables

of salary.¹³ Individuals who do not report either the employee or employer contribution (or both) have this imputed, conditional on sex, age and whether the pension is an employer pension. An indicator variable is included in the data showing if any element of personal or employer contributions was unknown and therefore imputed. We assume that individuals with DB schemes make no AVCs or FSAVCs in future.

4.1.2. Current DB pensions

The value of a defined benefit scheme depends on how income from the scheme is calculated. In general, this is done by multiplying the number of years in the scheme by an accrual rate and a measure of final salary.¹⁴ These elements determine the income from the scheme in the first year of receipt. After this the actual income depends on the indexing rules of the scheme. Most schemes are indexed to inflation but some are indexed above inflation. The final element in determining the value of the pension is the one-off lump sum that is sometimes received when the pension is received.

We treat as defined benefit schemes any cases where the individual knows their employer scheme is DB and also any cases where the individual knows they have an employer scheme but does not know whether it is DB or DC.

In order to calculate the value of the pension if the individual stops working and starts drawing the pension in 20XX there are 5 steps. First the number of years the individual has been in the scheme is known from responses in ELSA. For those individuals who did not know their pension tenure, we assume that they have been in the scheme since they started their present job. Where individuals did not report both their pension tenure and their job tenure, pension tenure is imputed conditional on sex and education.

Second, the final salary used is gross earnings from the main job in 20XX. This measure of earnings is imputed for those for whom it is missing, as described in section 2.3.1. Final salary for calculating pension entitlement has been subject to a cap since 1989.¹⁵ Therefore,

¹³ Banks, Emmerson and Tetlow (2007) provide evidence that such assumptions would have been appropriate between 2002–03 and 2004–05.

¹⁴ Part time workers accrue pension entitlement each year equivalent to the fraction of full time hours that they work. This fraction of a year's accrual is then multiplied by their fulltime-equivalised salary. For individuals who have always been part time workers, an equivalent calculation will be to assume they have accrued a full year for each year of part time employment but multiply the number of years by their annual part time salary, which is what we do. However, this method of calculating pension entitlement will over estimate pension income for individuals who used to work part time but now work fulltime, whilst it will underestimate pension income for individuals who used to work fulltime but have moved into part time employment.

¹⁵ The limits set by the Earnings Cap were replaced from April 2006 by the lifetime allowance and annual allowance limits. However, many DB schemes continue to use the 'notional' earnings cap to restrict pension benefits.

final salary is set to this cap if it exceeds this level and the individual joined the pension scheme after 1988.¹⁶ For individuals aged under the minimum retirement age in 20XX, final salary is uprated in line with inflation until the year the individual reaches the minimum pension age.

Third, the fraction of final salary accrued for each year the individual is in the scheme was taken from responses in ELSA. The most common accrual fraction was 1/80th, followed by 1/60th. For those respondents who did not know what fraction they accrued we imputed the fraction conditional on sex, education, and whether their scheme was broadly a public or a private DB scheme. Once we knew the accrual fraction and how long the individual had been in the scheme, one final adjustment had to be made. Pension rules limit pension income to two-thirds of final pensionable salary. Therefore, if the number of years in the scheme multiplied by the accrual fraction exceeded two-thirds, it was reduced to two-thirds.

Fourth, ELSA respondents are asked whether their pension income would be indexed above inflation. For those individuals who knew that it would not, and those individuals who did not know, we index their pension income (once they start drawing it) to inflation of 2.5%. For those who thought that their pension income would be indexed above inflation, we assume it is indexed to average earnings growth (4.5%).

Finally, respondents are asked what lump sum they expect to receive from their DB scheme when they retire. We assume that an individual expects to retire at the normal retirement age (NRA)¹⁷ for his scheme and then find the expected lump sum as a fraction of pension income in the first year of receipt (assuming that he continues to work until the NRA with no real earnings growth). We then calculate the lump sum that he will receive if he retires this year as this fraction times the pension income he receives this year. For respondents who did not know their lump sum precisely we hotdeck a value (conditional on whether the pension scheme was public or private and the accrual fraction¹⁸) from within the range the individual indicated.

Variables are included in the data set to indicate whether any information about the DB scheme was imputed for each individual. One variable shows whether or not the individual was missing any major information required for computing DB entitlement (accrual fraction or pension tenure), and a second variable shows whether or not any secondary required information is imputed (lump sum, normal retirement age or indexation rules).

Under the 'retire now' scenario individuals are assumed to start drawing their pension in 20XX if they are aged over the minimum pension age, or at the minimum pension age if they are not. Pension income in the first year of receipt is final salary multiplied by the number of

¹⁶ When the individual joined the scheme is estimated using their current pension tenure.

¹⁷ If the normal retirement age is not known, this is hotdecked, conditional on sector of employment and the reported accrual fraction.

¹⁸ Two categories of accrual fraction were used – 1/60th or greater and less than 1/60th.

years in the pension scheme and the accrual fraction. However if an individual retires before the NRA, an actuarial reduction is usually applied to the income. The most common reduction is 4% for each year before the NRA that an individual retires.¹⁹ Therefore, this reduction is applied to the pension income that an individual is entitled to if he retires before the NRA. In addition we assume that the recipient's spouse inherits 50% of the income after the recipient dies.

Under the 'retire at SPA' scenario, the final salary of the individual at SPA (described in Section 2.3.1), combined with accordingly increased pension tenure and the same accrual fraction, gives the pension income. Again, final salary is capped at the earnings cap (which is assumed to increase in line with the retail price index in future years²⁰) and total accrual is capped at the lower of two-thirds of final salary or 40 years in the scheme. We continue to assume the spouse inherits 50% of the entitlement. The lump sum is assumed to be the same fraction of the first year's pension income as it was for retirement 'now'.

It should be noted that in the case of current DB pensions, retirement at the SPA is not necessarily wealth maximising for individuals. Once individuals have passed the NRA for their scheme, it may be beneficial for them to start claiming their pension, rather than contributing for longer and accruing additional entitlement. This is particularly likely to be the case for individuals who have reached the accrual cap or who are experiencing no earnings growth.

4.2. Retained pensions

We have information on a number of previous pensions to which a respondent no longer contributes but from which he is yet to receive an income. The individual could either have transferred the rights from this scheme into another scheme or received a lump sum payout or retained the rights in the original scheme. In the case of the first two, this wealth will be picked up elsewhere, as current pension wealth or other financial wealth, respectively. In the third case, we need to value the pension rights retained.

The value of retained pension rights is calculated differently depending on whether a pension had always been a past pension since the respondent first answered the ELSA survey or whether the pension had been a current pension that the respondent described in a previous ELSA wave (since much more information is available for the latter).

4.2.1. Retained DB and DC pensions (that were current in a previous wave)

The method for calculating income from past pensions that a respondent is not yet in receipt of, but which were current pensions reported in a previous wave, is similar to calculating income from current pensions since the information available about the pension is similar. The respondent is assumed to have 'left' their pension scheme (i.e. when it changed from being a current pension to a retained pension) either when they left their last job or when

¹⁹ Government Actuary's Department (2003), p32

²⁰ Indexing to prices has been normal practice since the earnings cap was introduced.

they started their current job (if this date fell between the current wave interview date and the date of interview when the pension was last reported to be current), or half way between the two relevant interview dates. The final tenure in the scheme is therefore taken to be the tenure reported when the scheme was last current, plus the years between that interview date and the date the respondent is assumed to have left the scheme.

For DB pensions, tenure and salary progression cease when the individual is assumed to leave their pension scheme. For DC pensions, the fund value is up-rated to 20XX using average pension fund growth and contributions cease when the individual is assumed to leave their pension scheme. The value of DC and DB pension income is then calculated using the methodology in Section 4.1 and 4.2 (respectively).

Since individuals with retained pensions are not yet receiving the pension income, though in theory most could, we assume that they choose not to draw their pension until the SPA for DC pensions, and the NRA for DB pensions. This assumption is maintained in both the 'retire now' and 'retire at SPA' scenarios. The future income from retained pensions is also not affected by retiring later since the individual will not still be making any additional contributions and the final salary of interest, the years of tenure and the accrual fraction are all obviously the same.

4.2.2. Retained DB and DC pensions (that have never been observed as current pensions)

For retained pensions that have not been observed as a current pension in a previous ELSA wave, a greater number of assumptions have to be made since the ELSA survey asks less detailed questions about these pensions than it does about current pensions. Respondents are asked what income they expect to receive from these past schemes when they retire. However, we did not want to use personal expectations when calculating pension wealth.

To calculate pension income we need to know how long the individual was in the scheme and the year he left the scheme. Individuals are asked to give the date they joined the scheme and the date they left the scheme. However some people did not know one or both of these pieces of information. For these individuals, tenure was imputed from the other individuals who did report both a start and end date, conditional on sex and education. For those missing only a start or end date, this is calculated using the imputed tenure and the reported end or start date. For those missing both the start and end date, the end date is assumed to be the year the individual's last job ended or the year their current job started, and the start date is then computed using the imputed tenure.

For wave 3 onwards, individuals are asked whether their retained pensions were DB or DC schemes. If individuals did not respond but report that their pension was an employer pension, then it is assumed to be a DB scheme. In wave 2, retained pensions are assumed to be DB schemes if they were started before 1989, or if they were started after 1989 but were an employer pension scheme. For DC schemes, we assume that sufficient contributions were made to produce a fund that, if annuitised at the SPA, would produce an income equal to that of a DB scheme that had been contributed to over the same period. Pension income

for all retained pensions (that have never been observed as current pensions) is therefore calculated in a way analogous to a DB scheme.

We calculate pension income using the number of years in the scheme, final salary and an accrual fraction. In other words, we take the salary in the year the individual left the scheme, up rate this in line with inflation to the year he reaches the SPA²¹ and then multiply this figure by pension tenure and some accrual fraction to find pension income. Since the respondent is not already receiving the pension, though in theory he could, we assume that he chooses not to draw the pension until the SPA. (We do not know the NRA of retained DB schemes that have not been a current pension in a previous wave of ELSA.)

An individual's salary in the year they left the scheme is calculated as described in section 2.3.1. Schemes that started after 1988 have a cap on pensionable earnings for the purposes of calculating entitlement. Therefore, for any past scheme commencing after 1988, we apply this earnings cap to final salary in the year the individual left the scheme.²² The final salary is then inflated using the retail price index to find the nominal value in the year the individual reaches the SPA (i.e. the year he starts receiving his pension from this scheme).²³

The accrual fraction is assumed to be 1/60th, and we assume that no lump sum is received. These three elements give us pension income from the scheme if the individual starts drawing it at the SPA. This pension income is then indexed to inflation (2.5%) for all future years.

4.3. Pensions already in receipt

Income from past private pensions that are in payment is reported in ELSA. In addition, respondents who have been divorced or widowed are asked if they are receiving a pension from a former spouse. The only difficulty in finding gross income from past schemes in 20XX was that respondents in ELSA could give the level of income either before or after tax. For those who gave the value before tax, we obviously knew gross income. However, for those that gave the income net of tax, we would need to know the value of all other sources of income in order to find their marginal tax rate. Since this is fairly complicated, we assume that everyone pays basic rate tax on this pension income and use this assumption to calculate gross pension income from the net value reported. For people who did not know

²¹ The Social Security Act 1985 introduced revaluation of preserved benefits for leavers from January 1986 in line with the lower of retail prices or 5%. Therefore, we do not revalue the final salary for individuals who left their scheme before 1986, but we do revalue final salary for all individuals leaving schemes in 1986 or later.

²² Schemes that began in 1987 or 1988 were also subject to final salary caps (which were higher than the caps that applied from 1989 onwards) but we have not included these.

²³ Pension schemes are not required to uprate pension entitlements for members who left prior to 1986. So we do not uprate these entitlements. From 1986 onwards, uprating became mandatory.

or refused to say whether the value was before or after tax we assumed that the value was net of tax.

Where respondents were not sure of their income for any of these schemes they were asked to give a range in which the true value lay. For these people, a hotdeck (conditional on age and sex) was used to impute a total current income from pensions in receipt, from between the lower and upper bounds of their total current pension income.

The resulting variable for total current pension income in receipt (which is measured at the individual level, rather than the pension level) is the same as that available in the *Wave_X_Financial_Derived_Variables* datasets. An imputation flag is provided in the pension wealth dataset to indicate whether the total current income from pensions in receipt was imputed.

Individuals are asked whether each pension in receipt is adjusted to take account of inflation. For those who reported that it was, or who did not know, we assume that in future years' pension income increases in line with inflation at 2.5%. For those who reported it was not we assume that their pension income remains constant in nominal terms. For individuals with more than one pension currently in receipt, whose pensions are indexed differently, we assume that total current pension income is indexed according to the indexation of the pension that provides the highest current income.

4.4. Widow/divorcee pensions

The final category of pensions is widow/divorcee pensions that are not currently in payment but from which the individual expects to receive income from in the future. Each respondent who has been divorced or widowed is asked about the income they expect to receive from such schemes. Whilst in all other aspects of our calculation of pension wealth we have avoided using individual's expectations of their future pension income, we could not avoid using them here because the value of the pension fund depends on the characteristics of a former partner, whom we know nothing about from the ELSA data.

Individuals can give the expected value of the pension either as a total amount or as an annual income. If the respondent is not exactly sure how much they will receive, they are asked to give boundaries within which the figure for annual income is likely to lie. For these people we hotdeck (unconditionally²⁴) the value for annual pension income, from within the range they indicated.

We assume that individuals start to draw an income from these pensions at the SPA. Furthermore, we assume that individuals expect to do this and so the figure they give for expected future income from the pension takes into account any accrual between 20XX and when they reach the SPA.

²⁴ This is an unconditional hotdeck because the value of the pension depends on the characteristics of a former spouse rather than on the characteristics of the individual in the ELSA sample.

References

- Banks, J., Emmerson, C. and Tetlow, G. (2005), 'Estimating pension wealth of ELSA respondents', Institute for Fiscal Studies Working Paper WP05/09, <http://www.ifs.org.uk/wps/wp0509.pdf>
- Banks, J., Emmerson, C. and Tetlow, G. (2007), 'Better prepared for retirement? Using panel data to improve wealth estimates of ELSA respondents', Institute for Fiscal Studies Working Paper WP12/07, <http://www.ifs.org.uk/wps/wp1207.pdf>
- Bozio, A., Crawford, R. and Tetlow, G. (2010), 'The history of state pensions in the UK: 1948 to 2010', Institute for Fiscal Studies Briefing Note BN105, <http://www.ifs.org.uk/bns/bn105.pdf>
- Budd, A. and Campbell, N. (1998), 'The roles of the Public and Private Sectors in the UK Pension System', in Feldstein, M. (ed), *Privatizing Social Security*, National Bureau of Economic Research, Chicago: Chicago University Press.
- Clark, T. and Emmerson, C. (2003), 'Privatising provision and attacking poverty? The direction of UK pension policy under new Labour', *Journal of Pension Economics and Finance*, Vol. 2, No. 1, pp. 67–89 March 2003
- Emmerson, C. and Johnson, P. (2001) 'Pension provision in the United Kingdom', in Disney, R. and Johnson, P. (2001) (eds.) *Pension systems and retirement incomes across OECD countries*, Aldershot: Edward Elgar
- Government Actuary's Department (2003), 'Occupational Pension Schemes 2000: Eleventh Survey by the Government Actuary, London: The Stationary Office