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AN EXAMINATION OF THE EFFECT OF WEALTH AND EARNED INCOME ON THE DECISION TO RETIRE IN THE UK

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ABSTRACT: This paper investigates the impact of financial wealth and earned income on the retirement decision using data from the English Longitudinal Survey of Ageing. The estimation results from a random effect dynamic probit model show that housing wealth has virtually no impact on the decision to retire, while financial wealth encourages it and earned income discourages it. The retirement decision is also found to be state dependent, and this persistence is stronger for those retirees with lower housing wealth and lower financial wealth.

JEL codes: J14 J26
Keywords: Retirement decision, Retirement dynamics, Dynamic panel estimation, Income and wealth

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Introduction

For a long time the conventional view of retirement from paid employment was that of a situation that arose once a certain age was reached, the statutory retirement age, whereby all paid employment activity ceased. Often, upon retirement the worker would start receiving a pension which, alongside with any accumulated savings and wealth, would sustain them for the rest of their natural life. The shift from work to retirement was abrupt and mostly irreversible. This rather simple picture of the financial arrangements surrounding retirement is rapidly becoming less and less relevant, being replaced by a much more complex and flexible regime (Houseman, 2001). The increased complexity in retirement arrangements has been happening for several reasons. First, we live much longer, second, the jobs that we do today are not as dependent on high levels of physical fitness as they used to be, and third, we spend a higher proportion of our lives in retirement than we used to only few decades back. As a result, conventional retirement pathways are rapidly giving way to new ways of arranging the employment and pension arrangements of the (typically post-65) later years of our lives.

Taking increased longevity first, comparing today with the time when retirement was first introduced in the start of the 20th century, we note that the statutory retirement age was not far off the expected age of the retiring workers, so that the need for a substantial pension fund was not as prominent as it is today. Today, the expected remaining life years for a 65 year old male entering retirement, is anything between 15 and 25 years, with little or no paid employment income and unabated consumption. In part, the increased longevity was not fully anticipated by the institutional arrangements in place, with consequences regarding the capacity of national pensions to fund adequately those in retirement (Heijdra and Romp, 2009) and with some hard years of transition lying ahead for many western economies.

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Increased longevity has been accompanied by medical (preventive and/or curative) improvements in the way several long-term conditions can be handled using less invasive and less work-limiting interventions

Second, on top of living longer and ageing in better health, the demands that are put on us by the jobs that we are asked to perform as we age, are in many instances, physically far less strenuous than they used to be. For example, the proportion of heavy manufacturing jobs which used to inflict unhealthy and dangerous working conditions has decreased, and the proportion of physically less taxing service jobs has increased. Further, new health and safety regulations have improved the physical demands put on us by work.

Finally, on top of ageing in better health and living longer, we are now also living relatively more expensively during the healthy years of our retirement, and considerably more expensively during the last few years of our lives, where health expenditure can be very high, and often also very effective at keeping us alive (and spending) for longer.

It is no surprise that faced with such big changes, the majority of western economies has been re-examining and re-designing many of the pertinent retirement rules. It is also no surprise that an increasing number of retirees are facing their retirement as a flexible employment state whereby the transition into retirement is not an irreversible decision any more (Kantarci and van Soest, 2008).

To understand the present international picture, we must note that different economies started from different positions (Henkens and van Dalen, 2003; Dorn and Sousa-Poza, 2010). The leading labour market in respect of pre-existing flexibility has been the US, where, for example, as high as 11.3% of all transitions into retirement in the year 1992 for people aged 51 to 63 were reversed by 1994, just 2 years after they were made (Bender et al.2011). The UK labour market which is the focus of this paper has been far less flexible regarding the

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retirement age, but is already moving towards more flexible retirement arrangements (Meadows, 2003; Bank and Smith, 2006). Notwithstanding the economic and institutional differences across countries, the general trend in the start of the 21st Century has been one of longer working lives. This change is being manifested in two ways. First, people who work postpone their transition into retirement (Galasso, 2008; Hanel, 2010). Second, people who have retired reverse their decision and come back to full time paid employment (Maestas, 2004).

This paper uses English panel data to examine the factors that influence the timing of entry into retirement as well as the factors that influence the decision to return to work after a retirement spell. There are some key factors that determine whether an individual will retire earlier or later than their peers and whether they are more or less likely to remain retired once they have made the transition into retirement, and the paper focusses on two such factors: wealth and earned income. We would expect that higher income would delay initial retirement, while high paid employment opportunities may make the exit from retirement more likely. This would be a form of substitution effect. We would also expect that higher wealth would speed retirement up, which would be a form of income effect. We make the distinction between the effect of housing wealth and other financial wealth, taking into account the lower liquidity of housing wealth.

The focus of this paper is to estimate how the propensity to retire and the propensity to remain retired may depend on earned income and wealth. The next Section describes the data we use. Section 3 describes the econometric methodology we use in order to estimate the propensity to retire and to remain retired. Section 4 presents the estimations results and discusses their interpretation and implications. Section 5 concludes.

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DATA

We use the data from the English Longitudinal Survey of Ageing (ELSA) for this analysis. The ELSA has surveyed people aged fifty and over and their younger partners living in England for every two years. The sample was drawn from the existing respondents to the Health Survey of England (HSE) in 1998, 1999 or 2001. The data has rich information on demographics, financial circumstances and health status. An initial wave from the HSE (named ELSA wave 0) and ELSA wave one to wave four are currently available, and we use the information from these five waves for this analysis. An important point to notice is that refreshing samples were added in wave 3 and wave 4 to ensure sample representativeness.†

Table 1: Transitions between self-reported retirement statuses by wave

		Retirement Status at *t*					
		Cases			Percentages		
		Not Retired	Retired	Total	Not Retired	Retired	Total
Wave	Status at *t*-1						
	Not Retired	3923	1219	5142	76.29	23.71	100.00
t=1	Retired	357	2614	2971	12.02	87.98	100.00
	Total	4280	3833	8113	52.75	47.25	100.00
	Not Retired	3438	804	4242	81.05	18.95	100.00
t=2	Retired	396	2371	2767	14.31	85.69	100.00
	Total	3834	3175	7009	54.70	45.30	100.00
	Not Retired	2816	726	3542	79.50	20.50	100.00
t=3	Retired	248	2182	2430	10.21	89.79	100.00
	Total	3064	2908	5972	51.31	48.69	100.00
	Not Retired	3119	734	3853	80.95	19.05	100.00
t=4	Retired	212	2128	2340	9.06	90.94	100.00
	Total	3331	2862	6193	53.79	46.21	100.00

Note: Ages are restricted to be between 50 and 75 years.

The analysis focusses on people aged between 50 and 75, dropping economically inactive individuals. Following Bender et al. (2011) we use self-reported retirement to define retired individuals. Table 1 presents the transitions between into and out of self-reported retirement by wave, and provides a preliminary view of the persistence and dynamics in retirement decisions. For example, among the retirees surveyed in wave 0, about 88 percent remained retired in wave 1, and 12 percent returned to work. Among the non-retirees in wave 0, about

† See Marmot et al. (2003) for more details about the ELSA survey.

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76 percent were still employed in wave 1, and about 24 percent had moved into retirement. Similar patterns are observed in subsequent waves, and these patterns influence our choice of econometric modelling, as they indicate the potential presence of state persistence in retirement decisions, with the majority of the sample not changing their retirement status over time, but also with a sizeable minority doing the opposite.

Table 2 displays the summary statistics for selected variables for waves 0 to 4. In addition to the basic demographic variables (age, gender, university education, marital status), we also have a dummy variable showing whether the individual has a work-limiting health problem or not. The data also provides information on whether the individual has private health insurance, which can be expected to influence retirement decisions.

Table 2: Means and standard deviations of variables

Variable	Wave 0	Wave 1	Wave 2	Wave 3	Wave 4
Retired at t	0.492	0.505	0.530	0.467	0.498
	(0.500)	(0.500)	(0.499)	(0.499)	(0.500)
Age 50 to 61	0.503	0.504	0.473	0.528	0.476
	(0. 500)	(0.500)	(0.499)	(0.499)	(0.499)
Age 62 to 64	0.106	0.104	0.112	0.111	0.134
	(0.308)	(0.305)	(0.315)	(0.314)	(0.340)
Age 65 plus	0.391	0.392	0.416	0.361	0.390
	(0.488)	(0.488)	(0.493)	(0.480)	(0.488)
Female	0.498	0.495	0.506	0.502	0.523
	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)
University degree	0.227	0.267	0.290	0.308	0.319
	(0.419)	(0.442)	(0.454)	(0.462)	(0.466)
Single, never marred	0.057	0.057	0.054	0.059	0.061
	(0.232)	(0.232)	(0.226)	(0.235)	(0.239)
Married or have a partner	0.721	0.717	0.714	0.721	0.723
	(0.448)	(0.451)	(0.452)	(0.449)	(0.448)
Legally separated, divorced	0.221	0.226	0.232	0.221	0.216
or widowed	(0.415)	(0.418)	(0.422)	(0.415)	(0.412)
Health (work limiting)	0.301	0.268	0.240	0.220	0.221
	(0.459)	(0.443)	(0.427)	(0.414)	(0.415)
Having private health	-	0.173	0.176	0.184	0.173
insurance		(0.378)	(0.381)	(0.387)	(0.379)
N	11423	7709	5987	6252	7555

Note: Data from ELSA wave 0 to wave 4. Total sample size is 38,926. Private health insurance information is not available in wave 0.

As already mentioned, we use the following economic variables for estimation: household income per head, net housing wealth and net financial wealth on retirement. These variables are introduced in the form of three sets of dummy variables, one for each of the second, third

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and fourth quartiles of the original wealth and income level. This information is available for all four waves. Detailed definitions for all variables used in this paper are presented in the Appendix.

Empirical methodology

The paper uses the panel nature of the ELSA data for the estimation. The latent equation for the Random Effects Dynamic (RED) probit model is specified as follows

$$RET_{it}^{*} = X_{it}^{'}\beta + \gamma RET_{it-1} + \varepsilon_i + u_{it} \qquad (1)$$

where RET_{it}^{*} is the latent retirement decision dependent variable for $i=1,\dots, N$, individuals observed over $t=1,\dots, T$ periods, RET_{it} is the reported retirement indicator variable which takes the value 1 for those who report themselves to be retired and 0 for those who report themselves to be in employment at t, X_{it} contains all observed explanatory variables for person i at time t, and ε_i and u_{it} are components of the error term with u_{it} assumed to be *iid*.

The observed retirement outcome RET_{it} is defined as:

$$RET_{it} = 1 \quad \text{if } RET_{it}^{*} >= 0 \qquad (2)$$

$$RET_{it} = 0 \quad \text{if } RET_{it}^{*} < 0$$

To estimate the dynamic random effects probit model, two subtle but nonetheless serious estimation problems would arise if Equation 1 were to be estimated using a standard Random Effects (RE) framework.

The first problem would result from the often criticised as unrealistic assumption of zero correlation between the error terms and the covariates in the RE model. This can be resolved

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using the method proposed by Mundlak (1978). This is done by assuming that the relationship between X_{it} and ε_i can be written as $\varepsilon_i = \overline{X}_i^{'}\varepsilon + v_i$, where $v_i \sim iid$ follows the normal distribution and is independent of X_{it} and u_{it} for all i and t. In practice the Mundlak method can be implemented by including in the right-hand side of Equation 1 the individual (over time) means for each of the time-varying explanatory variables, often called the Mundlak corrections.

The second problem arises from the possibility that the lagged dependent variable in the right-hand side of Equation 1 may be correlated with the error terms. To the degree that the individual specific error term ε_i may be time-invariant, it is possible that even after we have corrected for the possible correlation of the individual specific error term with observed contemporaneous factors (the X_{it}), ε_i may still be a source of bias by being correlated with the lagged dependent variable. It can be shown that assuming that RET_{it-1} and ε_i are uncorrelated amounts to assuming that the first observation of RET_{it-1} is uncorrelated with the individual-specific error term ε_i. This assumption is difficult to justify on empirical or theoretical grounds. The problem was first examined in detail in the econometrics literature by Heckman (1981a and 1981b), and it has been named the problem of initial conditions. Ignoring initial conditions that are correlated with the individual-specific error term ε_i results in overestimating state dependence, which would manifest itself through an overstated coefficient of RET_{it-1} in Equation 2.

Heckman (1981a and 1981b) proposed that initial conditions be modelled by using the values of the first wave of a panel dataset to approximate the true values of the initial conditions. Supposing we have a vector of exogenous instruments z_{i1}, which includes x_{i1}, and assuming that u_{i1} satisfies the same distributional assumptions as u_{it} for t>1, a linearized reduced form

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approximation of the latent variable in the initial period equation can be specified as $RET_{i1}^{*} = z_{i1}^{'}\delta + \theta\varepsilon_i + u_{i1}$. Exclusion instruments are used to identify the initial conditions. Assuming that u_{it} and ε_i follow a normal distribution, the coefficient estimates could be consistently obtained by maximizing the joint probability of the observed binary outcomes (i.e. the first/initial period and all subsequent periods) using maximum likelihood estimation.

Alternative estimators to the one developed by Heckman have been proposed by Orme (2001) and Wooldridge (2005). This paper follows the method of Wooldridge (2005) and combines it with the Mundlak (1978) method to estimate the following equation[‡]

$$RET_{it} = X_{it}^{'}\beta + \delta RET_{i1} + \gamma RET_{it-1} + \overline{X}_{i}^{'}\alpha + \varepsilon_i + u_{it} \qquad (3)$$

We estimate Equation 3, with a one-period lag of the dependent variable. The lagged dependent variable estimates retirement state persistence (for those who chose to retire). In addition to the standard demographic characteristics in the *X* vectors, we include the two financial wealth variables and the paid employment per person household income variable. The two wealth variables will reflect jointly the income effect of wealth on retirement decisions. That is, their estimates will reveal if retirement is treated as a positively valued leisure good, in which case we would expect that the richer people will be able to "buy" more of it, thus increasing their retirement probability. The expected estimated sign for the wealth variables will therefore be positive.

There is one main difference between the two wealth variables, which, we note, may be age-related. Housing wealth will typically be far less liquid that financial assets wealth. This

[‡] Arulampalam and Stewart (2009) compare several convenient shortcuts for implementing the Heckman method using the Orme and the Wooldridge estimators alongside the original two-equation estimator proposed by Heckman. They conclude that "it is advantageous to allow for correlated random effects using the approach of Mundlak (1978), but once this is done, the three estimators provide similar results" (p.13). In this draft we assume the Wooldridge estimator for mere computational speed and convenience, with the implementation of the full two-stage Heckman method planned as the next estimation step.

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would imply that the level of housing wealth may not be as influential on short-run changes of the retirement status, at least not among those who have repaid their mortgage in full. By contrast, wealth represented by other financial assets will be more liquid in the short-run and can be expected to have a stronger and more immediate influence on retirement plans.

The income in paid employment variable will represent the substitution effect on retirement decisions. Someone with a higher income will have a lower propensity to retire as buying more leisure will cost them more than it would cost someone with a lower income. The expected estimated sign for the income variable will therefore be negative.

The next step is to estimate Equation 4 which interacts the lagged dependent variable with the wealth and income variables, represented by *W*.

$$RET_{it} = X_{it}^{'}\beta + \delta RET_{i1} + \gamma RET_{it-1} + \overline{X}_{i}^{'}\alpha + W_{it}^{'}RET_{it-1}\delta + \varepsilon_{i} + u_{it} \qquad (4)$$

Equation 4 examines if the effect of state persistence is carried through to the income and substitution of leisure effects. There are no clear theoretical priors as to the direction of the estimated interaction effects.

Estimation Results

Estimation results are presented in Table 3. We show two sets of results, the first set is derived using Equation 3 and focuses on the estimation of the income and substitution effects using the wealth and income variables respectively. The second set of results is derived using Equation 4 and includes interaction terms between financial and income variables and the lagged retirement variable and focusses on the examination of the possible joint effect of retirement state-persistence and the three economic variables.

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Table 3: Dynamic RE Probit Estimations using Wooldridge's Method

	Model 1		Model 2	
	Coefficient	Z value	Coefficient	Z value
Main effects				
Retired at t-1	1.171	21.08	1.487	11.13
Initial Condition	2.359	21.40	1.263	18.59
Age 62 to 64	0.634	9.55	0.857	13.47
Age above 64	1.855	17.96	2.215	22.35
Female	0.501	9.71	0.447	11.43
University degree	0.155	2.71	0.031	0.71
Married or have a partner	-0.687	-1.74	-0.605	-1.64
Legally separated, divorced, widowed	-0.289	-0.74	-0.209	-0.57
Health (work limiting)	0.242	3.67	0.240	3.88
Private health insurance	-0.295	-3.19	-0.325	-3.64
Housing wealth				
Net housing wealth 25 to 50%	0.033	0.35	0.076	0.81
Net housing wealth 50 to 75%	-0.165	-1.58	-0.155	-1.48
Net housing wealth 75 to 100%	-0.176	-1.44	-0.142	-1.17
Financial wealth				
Net financial wealth 25 to 50%	0.189	2.22	0.308	3.66
Net financial wealth 50 to 75%	0.389	4.11	0.475	5.07
Net financial wealth 75 to 100%	0.642	6.17	0.701	6.80
Household income per head				
Household income ph 25 to 50%	-0.359	-5.32	-0.157	-2.26
Household income ph 50 to 75%	-0.851	-11.57	-0.678	-9.09
Household income ph 75 to 100%	-1.468	-17.17	-1.314	-15.13
Interactions with Retired at t-1				
Housing wealth				
Net housing wealth 25 to 50%	-	-	-0.277	-1.76
Net housing wealth 50 to 75%	-	-	-0.399	-2.51
Net housing wealth 75 to 100%	-	-	-0.451	-2.78
Financial wealth				
Net financial wealth 25 to 50%	-	-	-0.743	-4.72
Net financial wealth 50 to 75%	-	-	-0.577	-3.55
Net financial wealth 75 to 100%	-	-	-0.516	-2.95
Household income per head				
Household income ph 25 to 50%	-	-	-0.653	-4.23
Household income ph 50 to 75%	-	-	-0.603	-3.82
Household income ph 75 to 100%	-	-	-0.522	-3.13
Mundlak Corrections				
Age 62 to 64	1.761	11.01	0.226	1.80
Age above 64	0.473	3.96	-1.187	-10.45
Female	-	-	-	-
University degree	-	-	-	-
Married or have a partner	0.554	1.35	0.630	1.66
Legally separated, divorced, widowed	0.216	0.53	0.170	0.45

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Health (work limiting)	0.765	7.28	0.561	6.50
Private health insurance	0.151	1.28	0.237	2.27
Housing wealth				
Net housing wealth 25 to 50%	0.050	0.39	-0.324	-2.68
Net housing wealth 50 to 75%	0.189	1.39	-0.035	-0.27
Net housing wealth 75 to 100%	0.297	1.94	0.037	0.26
Financial wealth				
Net financial wealth 25 to 50%	0.097	0.77	-0.476	-4.17
Net financial wealth 50 to 75%	0.123	0.93	-0.529	-4.34
Net financial wealth 75 to 100%	0.652	4.48	-0.414	-3.10
Household income per head				
Household income ph 25 to 50%	-0.163	-1.35	-0.359	-3.32
Household income ph 50 to 75%	-0.261	-2.19	-0.247	-2.29
Household income ph 75 to 100%	-0.032	-0.25	0.302	2.65
Interactions with Retired at t-1				
Housing wealth				
Net housing wealth 25 to 50%	-	-	1.471	6.27
Net housing wealth 50 to 75%	-	-	1.203	5.01
Net housing wealth 75 to 100%	-	-	1.102	4.33
Financial wealth				
Net financial wealth 25 to 50%	-	-	1.937	8.35
Net financial wealth 50 to 75%	-	-	2.017	8.22
Net financial wealth 75 to 100%	-	-	2.238	8.05
Household income per head				
Household income ph 25 to 50%	-	-	1.544	7.03
Household income ph 50 to 75%	-	-	1.250	5.46
Household income ph 75 to 100%	-	-	0.710	2.74
Constant	-2.057	-14.53	-1.431	-13.98
Sample size (persons)	21890(8609)		21890(8609)	
Log likelihood	-5169.91		-4352.18	

Notes: Reference groups are: aged below 61, male, without college education, single and never married, without work limiting health problem, without private health insurance, net housing wealth 0-25%, net financial wealth 0-25% and household income per head 0-25%.

Table 3 suggests that retirement is a self-persistent state, that is, having been retired for the last year increases in itself, the probability of being retired in the next year, It is worth noting that, *a priori*, past retirement can make future retirement more likely (someone gets used to being retired or their human capital deteriorates), but it can also make future retirement less likely (someone may realize that they do not like retirement, or that their pension plans were unrealistic and they need to build some more pension, or that the recession is over and their

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earning potential has increased). The estimated coefficient is compatible with this diversity as it is an average estimate and it simply suggests that *on average* past retirement makes future retirement more likely, and that this average effect may contain people with very different individual responses to incentives.

The precise estimate of the initial condition indicates that the initial conditions instruments are statistically significant. Unsurprisingly the probability of retirement increases with age (reference category is age 50 to 61). Women are more likely to retire. University education increases the probability of retirement, but as we see the effect disappears after the inclusion of the interaction terms between state-persistence and wealth and income, presumably because these interactions are very different by job type and education level. Married and partnered people are less likely to retire, but the statistical significance of the estimate is only marginally significant. Having a work limiting long term health condition increases the retirement probability while those with a private insurance are less likely to retire. It is interesting to note that, with the exception of the higher education variable (for which there is a clear and intuitive explanation) all other variables have very similar coefficients, in both models with and without the interaction terms.

Income and substitution effects of wealth and earned income on retirement

We now turn to the coefficients of the wealth and income variables. Note that they come in two sets. The first set is marked as “Main effects” and estimate the “within” effect (i.e. how much will the experience of an increase in earned income produce a reduction in the probability of retirement) and the second set is marked as the “Mundlak corrections” and estimate the “between” effect (i.e. how much being a high income earner in general, may influence the probability of retirement). We begin with the main effects and then bring in the Mundlak corrections.

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Housing wealth does not appear to have a significant main effect on retirement probabilities. This result applies to both estimations of Equations 3 and 4 indicating that the inclusion of the interaction terms in Equation 4 does not affect the housing wealth main effects. We could attribute this result to several explanations including the fact that housing is not a liquid asset and cannot be easily divided into smaller parts that could be gradually sold off. It could also be that housing wealth may be saved at the start of retirement in order for it to be used at a later age, and at a later stage of (deeper) retirement when the independent use of a house may not be as feasible and attractive as before. Although this paper has little direct evidence on what happens in later retirement years, our present results suggest clearly that changes in housing wealth are not used in any significant way regarding early retirement decisions.

The main effect financial wealth shows a clear *income effect* regarding retirement. Again we see this result applies to both estimations of Equations 3 and 4 indicating that the inclusion of the interaction terms in Equation 4 does not affect the financial wealth main effects. Results suggest that people with more wealth have more money to buy what they like and they also buy more leisure through retirement. The main effect is gradual and appears to become stronger and more precisely estimated as the level of wealth increases. Given that the variable is defined as a set of three quartile dummies with the lowest quartile as the reference category, this is a highly intuitive result, which also appears in both Equations 3 and 4.

The Mundlak correction of housing wealth suggests that those who belong to the highest housing wealth quartile may be more likely to be retired. This may well be the result of being overall very wealthy, a suggestion which is supported by the Mundlak correction of the financial wealth variable, which is also only significant for the highest wealth quartile. However it is noteworthy that the coefficients of the Mundlak effects change drastically when

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we introduce the interaction term between retirement state persistence and housing wealth using Equation 4.

The main effects of earned household income per head estimated using both Equations 3 and 4 suggest that increased income can be the cause of lower retirement rates. The *a priori* effect of increases in earned income could be expected to reflect a conventional *substitution effect*, whereby a pay rise increases the opportunity cost of leisure, and less leisure is consumed. The Mundlak correction of earned income does not appear to contain any interesting information, presumably because the long term effect of high income will have been translated into either housing, or financial wealth.

In conclusion, the results from both Equations 3 and 4 suggest a statistically significant income effect mainly driven by financial wealth and a statistically significant substitution effect driven by earned household income.

How self-persistent is retirement?

One of the main shortcomings of the ELSA data is that it only provides us with 4 waves of data (plus the initial wave from the EHS). The limited number of observations per person makes the estimation of dynamics harder to develop. Notwithstanding this data limitation, the estimates of the lagged retirement variable are very precisely estimated in both Equations 3 and 4, a result that encourages the further investigation of the possible interactions between the lagged dependent variable (which estimates the state-persistence of retirement) and the core economic drivers of retirement (which estimate the income and substitution effects through the wealth and earned income variables). The intuition underlying the estimation of the interaction term between lagged retirement and the economic variables runs as follows.

Having estimated separately the income and substitution effects and the state persistence of retirement, we begin by asking if persistence for people with higher income or wealth will

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differ from the persistence of people with lower income or wealth. For those who have retired, this question is equivalent to asking if earned income or wealth may influence their decision to remain retired or not. Estimates of the interaction variables in Equation 4 are all statistically significant. They suggest that retirees in the lowest housing and financial wealth quartiles will exhibit stronger retirement persistence than their higher wealth counterparts. In the case of household income, the interaction term with retirement persistence takes a specific interpretation for those who are already retired, in that it measures the effect of another member of the household getting a higher wage (which according to the main effect of the earned income variable will reduce their propensity to retire) on their decision to remain retired. The estimated negative coefficient suggests that such earned income increases will make the return to employment less likely, i.e. reinforce their retirement persistence.

Conclusion

This paper estimated the propensity to retire and the persistence of remaining retired in the UK using the ELSA data set. The main objective of the paper was to estimate the income and substitution effects on retirement decisions of housing and financial wealth, and of earned income, respectively. Estimation results reveal income and substitution effects that accord with economic theory. In particular, we find that housing wealth does not have a noticeable effect on the decision to retire, financial wealth encourages it and earned income discourages it. Estimation results also suggest that retirement exhibits state persistence, that is, being retired at any point in time will in itself increase the probability to remain retired. Although the main limitation of the ELSA data set is the lack of a long observation period, persistence is estimated very precisely. The potential interaction between state persistence and wealth and income is estimated. Results suggest that the retirement of the lower wealth retirees

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shows more state persistence, as does that of retirees in the lowest earned income quartile households.

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Appendix

Definition of Variables

Retired(t): (Dependent variable) Self-reported dummy variable: takes the value 1 if an individual is retired, zero otherwise.

Retired(t-1): (Independent variables) Self-reported dummy variable: takes the value 1 if an individual is retired, zero otherwise.

Age:

Age 50 to 62 (reference category): Dummy variable, takes the value 1 if an individual is aged between 50 and 61, zero otherwise.

Age 62 to 64: Dummy variable, takes the value 1 if an individual is aged between 62 and 64, zero otherwise.

Age 65 plus: Dummy variable, takes the value 1 if an individual is aged between 65 and 75, zero otherwise.

Female: Dummy variable, takes the value 1 if an individual is female, zero otherwise.

University degree: Dummy variable, takes the value 1 if an individual has a university degree, zero otherwise.

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Marital status:

<u>*Single, never marred (reference category):*</u> Dummy variable, takes the value 1 if an individual is single and never married, zero otherwise.

<u>*married or have a partner:*</u> Dummy variable, takes the value 1 if an individual has a spouse or partner, zero otherwise.

<u>*legally separated, divorced, widowed:*</u> Dummy variable, takes the value 1 if an individual is legally separated, divorced or widowed, zero otherwise.

<u>**Health problem (work limiting):**</u> Dummy variable, takes the value 1 if an individual has a work- limited health problem, zero otherwise.

<u>**Private health insurance:**</u> Dummy variable, takes the value 1 if an individual has private health insurance in England, zero otherwise.

Net housing wealth:

<u>*Net housing wealth 0 to 25% (reference category):*</u> Dummy variable, takes the value 1 if an individual's net housing wealth is in bottom 25% quartile of the sample, zero otherwise.

<u>*Net housing wealth 25 to 50%:*</u> Dummy variable, takes the value 1 if an individual's net housing wealth is in the 25 to 50% quartile of the sample, zero otherwise.

<u>*Net housing wealth 50 to 75%:*</u> Dummy variable, takes the value 1 if an individual's net housing wealth is in the 50 to 75% quartile of the sample, zero otherwise.

<u>*Net housing wealth 75 to 100%:*</u> Dummy variable, takes the value 1 if an individual's net housing wealth is in the 75 to 100% quartile of the sample, zero otherwise.

Net financial wealth:

<u>*Net financial wealth 0 to 25% (reference category):*</u> Dummy variable, takes the value 1 if an individual's net financial wealth is in bottom 25% quartile of the sample, zero otherwise.

<u>*Net financial wealth 25 to 50%:*</u> Dummy variable, takes the value 1 if an individual's net financial wealth is in the 25 to 50% quartile of the sample, zero otherwise.

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Net housing wealth 50 to 75%: Dummy variable, takes the value 1 if an individual's net financial wealth is in the 50 to 75% quartile of the sample, zero otherwise.

Net housing wealth 75 to 100%: Dummy variable, takes the value 1 if an individual's net financial wealth is in the 75 to 100% quartile of the sample, zero otherwise.

Household income per head:

Household income per head 0 to 25% (reference category): Dummy variable, takes the value 1 if an individual's household income per head is in bottom 25% quartile of the sample, zero otherwise.

Household income per head 25 to 50%: Dummy variable, takes the value 1 if an individual's household income per head in the previous year is in the 25 to 50% quartile of the sample, zero otherwise.

Household income per head 50 to 75%: Dummy variable, takes the value 1 if an individual's household income per head in the previous year is in the 50 to 75% quartile of the sample, zero otherwise.

Household income per head 75 to 100%: Dummy variable, takes the value 1 if an individual's household income per head in the previous year is in the 75 to 100% quartile of the sample, zero otherwise.

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