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Booms, busts and retirement timing

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Cyclical fluctuations - which affect both asset and labour markets - can have an ambiguous effect on retirement. We explore this empirically using data from the British Household Panel Survey, exploiting small area geographic identifiers to match local house prices, earnings and unemployment to respondents. We match stock prices via the date of interview. Our results show little evidence of any positive wealth effects despite large spatial and temporal variations in asset prices over the period analysed. We find more response to local labour market conditions - increases in unemployment are associated with earlier retirement while increases in wages delay retirement.

Key words: Retirement, Wealth, Unemployment

JEL classification: J26, D12

INTRODUCTION

A number of studies have examined how personal characteristics and individual pension incentives affect retirement decisions in the UK (see Meghir and Whitehouse, 1997; Blundell and Johnson, 1998) but there has been less focus on the effect of wider economic conditions. This is the subject of this paper. Specifically, we examine how the timing of retirement may be affected by the economic cycle, via changes in local labour market conditions and fluctuations in asset prices.

In considering the joint influence of labour markets and asset markets on retirement, it is unclear a priori how the timing of retirement will be affected by economic booms and busts (Coile and Levine, 2011). Increased demand for labour during a boom - captured by cyclical changes in both unemployment rates and rates of earning growth - may lead to later retirement. But rising asset prices, which are often correlated with increased labour demand at a national level, might tend to work in the opposite direction, inducing earlier retirement through a wealth effect. The evidence to date, mainly from the US, suggests an effect of local labour market conditions but has found little support for strong wealth effects.

We provide new evidence using the British Household Panel Survey (BHPS). This is an annual survey that contains detailed information on individual and household characteristics, including housing tenure and pension status. We make several contributions to the existing literature. First, we are the first UK study to look at retirement and cyclical fluctuations. As we show below, the UK makes a particularly good setting to study the effect of house price shocks on retirement because of the magnitude of price volatility over the period, which was large (greater than that in the US) and arguably largely unexpected. Second, we are able to exploit small geographic identifiers to match local house prices, earnings and unemployment to respondents. This allows us to model the impact of local economic conditions on retirement timing more precisely. We also use the availability of interview dates to model within-year variation in stock price fluctuations. Third, we explore potential heterogeneity in the effect of the business cycle on retirement. We allow the effect of labour market conditions and asset prices to vary according to worker skill level and to their pension provisions, since retirement incentives created by changes in economic activity are likely to differ across these dimensions.

We expect low-skilled workers who are less mobile to be more affected by local economic conditions than high-skilled workers, who may consider conditions in a more national market, while we expect those with defined benefit (DB) pension arrangements, whereby pension wealth is more often linked to final salary, to be more sensitive to earnings growth.

To preview our results, our results provide further evidence that the effect of labour market conditions dominates wealth effects. We find some evidence that low-skilled workers are more sensitive to local labour markets while workers with DB pension arrangements are more responsive to changes in earnings. In line with earlier US studies we find no positive effect of rising house and stock market prices on retirement - this is in spite of UK house prices on average more than doubling in real terms during the period we look at. We find some evidence that that rising stock prices may actually work to delay retirement among holders of defined contribution (DC) pension plans.

The remainder of the paper is structured as follows. The next section describes how economic conditions may impact on retirement and discusses the literature to date. Section II. presents our empirical strategy while Section III. discusses the data. Our main results are in Section IV., while further sensitivity analysis is presented in Section V.. Finally, Section VI. concludes.

I. ECONOMIC CONDITIONS AND RETIREMENT

Labour market conditions

The standard model of retirement suggests that workers compare the expected value of retiring today with the expected value of retiring at some date in the future. Workers then choose whether to continue to work on the basis of a comparison of these valuations. In such a framework, an increase in wage rates is likely, on the margin, to increase the value of remaining in work - both directly and, for those in employer-provided defined benefit (DB) pension plans, indirectly by an accrual effect on prospective pension rights.

The limited existing research on the effect of exogenous wage changes on retirement has computed shocks to life-cycle earnings profiles for various occupations and cohorts (see Meghir and Whitehouse, 1997; Haardt, 2007) and interpreted these as individual-specific productivity changes over time. Our inference here is that observed local earnings shocks arise as a consequence of economic cycles that may in part be driven by fluctuations in the demand for labour; hence economic booms raise the demand for labour and exert upward pressure on wages, with the reverse in economic busts. Even though shocks to labour demand may not imply permanent changes to wages, economic cycles exhibit sufficient persistence as to induce older workers with shorter remaining working lives to respond to these changes. Moreover, since different occupations are responsive to economic conditions at different levels of spatial disaggregation (with, broadly speaking, more skilled workers searching labour markets at higher levels of spatial aggregation), local shocks to labour demand have differential impacts on different group of workers.

While the retirement decision is formulated as the outcome of an optimisation process in which individuals have the option of continued employment until the optimal retirement age is reached, in practice, the availability of jobs may place constraints on reaching the optimal retirement age. In the UK, Meghir and Whitehouse (1997) show that the national unemployment rate, which is assumed to proxy the job arrival rate, is linked to exit and entry rates from employment among older workers. One reason for focusing on local rather than aggregate fluctuations in unemployment is that the latter masks large variations in local labour demand. However, it is also likely that the effect of local labour markets on retirement timing hinges on the extent to which workers can move - either occupation or locality - in search of work. A priori, we might expect local changes in unemployment to have a greater effect on the job opportunities of low-skilled workers who are typically less mobile. Institutional arrangements in the UK may also favour earlier retirement among low-skilled workers since means-tested benefits are available from the age of 60 without any requirement to seek work for individuals without private pension arrangements. Moreover, disability benefits may provide an alternative route to early retirement. Benítez-Silva *et al.* (2010) show that disability benefit claims vary inversely over the business cycle and that this pattern is particularly strong in the UK.

Most of the evidence linking local unemployment to retirement is based on US data. Coile and Levine (2006, 2007) provide evidence that a 1 percentage point increase in state-level unemployment raises the average probability of retirement by 0.18 percentage points, with this effect disproportionately concentrated among low-skilled workers. Similarly, Goda *et al.* (2011)

find that county level unemployment rates affect expectations of retiring by 62 (but not by 65). However, they do not find any evidence of differential effects of local labour markets across workers with different skill levels. For the UK, Haardt (2007) finds weak evidence that regional unemployment rates matter to retirement decisions.

Asset prices

A number of US studies have examined the effect of fluctuations in stock market prices over the economic cycle on retirement decisions. Increases in financial asset prices in economic upturns are assumed to induce people to retire earlier (whether the assets are held directly or indirectly as part of a defined contribution (DC) pension scheme) through a wealth effect. Sevak (2002); Coronado and Perozek (2003); Kezdi and Sevak (2004); Coile and Levine (2006); Hurd *et al.* (2009); Coile and Levine (2011) look at the effect of the boom in asset prices from the mid-1990s onwards but find weak or no significant results.[1] In contrast, Goda *et al.* (2011) find evidence that the recent stock market decline is associated with an increase in the *expectation* of working beyond aged 62 in the 2008 wave of the Health and Retirement Survey. Moreover, this effect is particularly strong for older workers, who are likely to reach what might have been their planned retirement age before the market recovers. However they do not test whether this effect differs between asset owners and non-owners, and in any event Goda *et al.* (2012) find no relationship between stock market performance and retirement expectations over a longer time horizon once they control for other variables.

Two explanations are put forward in the literature to account for why large changes in stock market prices deliver small wealth effects in practice. The first is that the majority of individuals hold only small amounts of wealth in equities and consequently are generally unaffected by, what is for most, small changes in wealth. About 10% of total wealth held by English households is exposed to stock market fluctuations, and is divided roughly equally between direct and indirect investments (Banks *et al.*, 2012). The second is that the elasticity of retirement to changes in wealth is small. There may be a third possible explanation. Expectations of future stock market performance may be shaped by recent stock market activity (Hurd *et al.*, 2011; Hurd and Rohwedder, 2012). Workers may delay retirement when asset prices are higher if they believe that such prices predict higher future returns to stockholding which would be foregone by annuitising now. This might be where stockholders believe that higher prices reflect an upward shift in 'fundamentals' (such as company profitability and future dividend streams). However higher stock prices now may reflect other factors such as changes in discount rates (Goda *et al.*, 2012) or, if unrelated to 'fundamentals' may actually presage lower stock market growth in the future (Campbell, 1991). Consequently, the implications of higher stock prices now for the future path of stock prices are unknown a priori.

Given the high level of home ownership in Britain, fluctuations in house prices may have a greater impact on wealth holdings than changes in stock market values, especially among households with limited holdings of assets in private pensions.[2] Previous empirical studies on the effect of house prices, however, find little evidence of wealth effects. Farnham and Sevak (2007) for the United States find evidence of a housing wealth effect on matched individual-Metropolitan Area house price data but the impact is highly sensitive to the inclusion or otherwise of state-level fixed effects. On the other hand, Coile and Levine (2011) and Goda *et al.* (2011) fail to find any effect of house prices on retirement intentions or outcomes. The UK provides a good case study for analysing the effect of house prices on retirement because of the magnitude of variation in house prices over the period compared to the US (see Disney and Gathergood, 2011), and the greater role of housing wealth in UK portfolios.

II. EMPIRICAL STRATEGY

In this analysis, as in Coile and Levine (2011), we employ discrete-time duration methods to model the time elapsed from age 50 until complete withdrawal from the labour force, which given a one-to-one correspondence between years and age is equivalent to modelling the age at which people retire after 50. We sample people aged 50 or older, who are in the labour force, and are observed at any time point between 1991-2008 for our analysis.[3] In effect, we have a stock sample of people aged 50, with people aged 51+ comprising a group of delayed entrants, who are first observed after they become at risk of retirement. By definition, delayed entrants have longer duration times because anyone retiring before reaching these older ages would not appear in our sample. Thus it is necessary to condition the likelihood contribution of delayed entrants on the probability of still being active in the labour force at older ages, which is handled in a straightforward manner in discrete-time duration methods (see Jenkins, 1995). We adopt a proportional odds hazard specification, which lends itself to estimation as a logit model after some data re-structuring.[4] Consequently, the hazard is specified as:

$$(1) \qquad \theta_{\mathrm{ik}} = \frac{1}{1+\exp(-\mathrm{x}'_{\mathrm{ikjt}}\beta)}$$

where

$$\begin{aligned} \mathrm{x}'_{\mathrm{ikjt}}\beta =& \beta_1\%\Delta\mathrm{earnings}_{\mathrm{jt}} + \beta_2\%\Delta\mathrm{unemployment}_{\mathrm{jt}} + \beta_3\%\Delta\mathrm{HP}_{\mathrm{jt}} + \beta_4\%\Delta\mathrm{HP}_{\mathrm{jt}} * \mathrm{homeowner}_{\mathrm{ikjt}} \\ &+\beta_5\%\Delta\mathrm{FTSE}_{\mathrm{t}} + \beta_6\%\Delta\mathrm{FTSE}_{\mathrm{t}} * \mathrm{investor}_{\mathrm{ikjt}} + \mathrm{z}'_{\mathrm{ikjt}}\gamma + \pi_{\mathrm{j}} + \delta_{\mathrm{t}} \end{aligned}$$

This specification of the hazard θ_{ik} implies that the probability of individual i retiring at age k (conditional on person i still being at risk of retirement) depends on a set of personal characteristics at that age, and on economic forces that evolve over time (indexed by t) and vary across localities (indexed by j). The specification also allows for locality (postcode area) fixed effects π_{j} and time fixed effects δt.

Economic theory suggests that fluctuations in asset prices, unemployment and earnings may influence retirement timing. In practice, however, it is not clear whether levels or changes in these variables are most relevant to the retirement decision. There is no consensus in the empirical literature to date as to how to measure economic conditions. For example, Coile and Levine (2011) consider changes in asset prices and levels of unemployment whereas Goda *et al.* (2011) consider both levels and changes in stock prices alongside levels of house prices and unemployment rates. In this analysis, we consider whether changes in the economic environment over the past year can explain whether a person retires over that period. This allows an easy comparison of asset prices versus unemployment and earnings.[5] Hence we include the annual percent change in the FTSE and its interaction with investor status, and the annual percent change in local house prices and its interaction with homeowner status. There should be no effect of stock prices or house prices on those who do not own these assets but that does not preclude the possibility that asset price fluctuations proxy for general economic expectations. We expect a positive sign on the interaction term if greater stock market or housing wealth is used to fund earlier retirement. However, as outlined above, higher stock prices may delay retirement if they reflect perceived changes in fundamentals such as company profitability. A potential concern is that asset ownership is endogenous to asset price fluctuations. For example, Hurd and Rohwedder (2012) find that increased expectations of stock market gains have a modest but positive influence on stock purchases, with weaker effects observed for those with indirect compared to direct stock holdings. As a robustness check, we also use education levels as an alternative proxy of investor status.

To capture local labour market conditions we include annual percent changes in unemployment and earnings. Higher unemployment may lead to earlier retirement if a lack of job opportunities prevents people from continued employment while increased potential earnings may encourage people to defer retirement, particularly where pension schemes are linked to earnings.[6]

Finally, z is a vector of control variables likely to influence the retirement decision. This includes demographic variables such as gender, race, marital status, the number of self-reported health problems, dummies for the number of adults living in the household and if any children live in the household, dummies to indicate the highest level of education achievement (i.e. weak or non-existent O-levels/GSCE's, A-levels or good O-levels/GSCE's, and degree or similar higher qualification as the base category) and whether a person returned to education in later life to obtain these qualifications. It also includes a set of financial variables such as housing tenure, investor status, whether the individual has a private pension with their employer (typically, in this period, a DB plan) or has purchased a personal pension plan (a DC pension). We allow for differential patterns of retirement across employees in the public and private sector, and the self-employed by including relevant employment dummies. Moreover, as we sample people aged 50+ at any point in time, we account for any systematic differences in careers that begin at different times by including the year in which a person left full-time education. To model the baseline hazard we include a full set of (gender-specific) age dummies. Standard errors are clustered by postcode area/year.[7]

Coefficients obtained from a proportional odds hazard model represent the change in the log-odds of event occurrence (retirement) associated with a unit change in a regressor. We prefer, however, to calculate the change in the hazard itself, thus providing an assessment of the change in the (conditional) probability of retirement. For the non-interacted terms such as education and unemployment rates we calculate (using earnings to illustrate):

$$(2) \qquad \mathrm{ME} = \mathrm{n}^{-1}\mathrm{a}_{\mathrm{i}}^{-1}\sum_{\mathrm{i}=1}^{\mathrm{n}}\sum_{\mathrm{k}=\mathrm{a}_{\mathrm{min}}}^{\mathrm{a}_{\mathrm{i}}} \beta_1[\theta_{\mathrm{ik}}][1-\theta_{\mathrm{ik}}]$$

For the interacted terms, such as house prices and stock prices, the marginal effect varies across different groups i.e. homeowners versus non-homeowners or stock holders versus non-stock holders. We therefore present marginal effects for each of these groups. For example, we calculate the sample average marginal effect of house prices on homeowners as follows:

$$(3) \qquad ME = n^{-1}a_i^{-1}\sum_{i=1}^{n}\sum_{k=a_{min}}^{a_i} (\beta_3+\beta_4)[\theta_{ik(HO=1)}][1-\theta_{ik(HO=1)}]$$

where HO=1 indicates that all individuals in the sample are assigned home ownership status. Similarly, the sample average marginal effect of house prices on non-homeowners is:

$$(4) \qquad ME = n^{-1}a_i^{-1}\sum_{i=1}^{n}\sum_{k=a_{min}}^{a_i} \beta_3[\theta_{ik(HO=0)}][1-\theta_{ik(HO=0)}]$$

where HO=0 indicates all individuals are treated as non-homeowners. The sample average of the individual-level difference between Equations 3 and 4 is the marginal effect of the interaction effect (Ai and Norton, 2003), which we present at the foot of each table. Similar calculations are made for the marginal effects of stock prices across stock holders and non-stockholders. All marginal effects and standard errors are obtained using the Stata command predictnl.

III. DATA

We use the British Household Panel Survey (BHPS) 1991-2008.[8] The BHPS is a nationally representative survey of more than 5,000 British households (approximately 10,000 adults) which collects data on household demographic and socio-economic circumstances as well as regular financial information. We sample all individuals aged 50-69 who report that they are in the labour force (i.e. employed, self-employed or reportedly seeking work). We define retirement as a permanent exit from the labour force (i.e. any move into retirement, family care or long-term sickness without reversing this state). Over the period studied there was relatively little churn (i.e. people moving in and out of retirement) and using alternative definitions, such as the first time people move into retirement, yields similar results. As people are sampled from age 50, transitions into retirement occur from age 51 and from 1992 onwards.

[Figure 1 here]

Figure 1, pooling the BHPS across all years, shows that the retirement hazard varies by age with clear spikes at the ages at which men and women are first entitled to receive a state pension (65 and 60 respectively). Of course the hazard will also vary over time in line with the changes in economic circumstances described in this paper.

[Table 1 here]

Since 1992 the BHPS asks respondents whether they have made any contributions to a personal pension in the previous year and, if the response is positive, in which year membership of the scheme began. In 1995, 2000 and 2005, further information is asked of respondents concerning the nature of their financial asset holdings, including stock ownership. Because this information is asked intermittently, we use an imputation method to assign those particular financial assets to respondents in other years (full details are available in Appendix B). We define an investor as anyone with a personal pension or stocks. The BHPS collects housing tenure status at the household level so we restrict the analysis to people listed as the main occupiers.[9]

While the BHPS collects self-reported house values from homeowners, this may contain various biases as a measure of underlying house price gains (for example, investment in home improvement is not separately measured in the BHPS). As a proxy for changes in local house prices we use restricted-access postcode area identifiers in the BHPS to match annual changes in local (postcode area) house prices, and also earnings and unemployment rates to respondents. There are 124 postcode areas in the UK and 97 are present among our BHPS sample. This is a much finer level of disaggregation of 'local' variables than in much of the previous UK and US literature, which tends to disaggregate only to the regional (or occasionally, county level). To construct average local house prices we utilise The Halifax house price data provided by HBOS, while gender specific average full-time gross weekly earnings and unemployment rates are taken from the New Earnings Survey/Annual Survey of Hours and Earnings (ASHE) and Nomis (the register of official labour market statistics) respectively. Details of how these variables are constructed are also described in Appendix B. All these variables are simple averages and are have not been adjusted for the composition of sales (in the case of house prices) or for the composition of firms (in the case of earnings). In principle, there may be additional noise in these measures, since the change in house prices may simply reflect a change in the ratio of low to high value properties sold while any observed change in earnings will reflect both productivity shocks in a given industry, and the entry and exit of firms operating in different industries.

The FTSE All Share price index is taken from Thompson Reuters Datastream and is available on a daily basis Monday-Friday. We construct annual changes in the index on each day, and match these to respondents in the BHPS by interview date.[10] Interview dates are essentially random in the BHPS among older individuals who are active in the labour market, although there is some evidence that people interviewed in the first week of the survey period report fewer health problems. Summary statistics are presented in Table 1.

The measure of unemployment is taken from administrative data based on the claimant count. The official measure of unemployment based on economic inactivity and work-seeking behaviour is derived from the Labour Force Survey (LFS) and is available for UK regions from 1992. The former differs from the latter insofar as it excludes those unemployed that are not receiving benefits. Inspection of claimant count and LFS national unemployment series suggests these series diverged somewhat after 1995 with the tightening of benefit eligibility rules, and that the LFS series is consistently above the claimant count series. Using data from 1992 onwards would exclude a period in which very large changes in unemployment occurred. When we compare changes in local unemployment with the official regional series across the period both measures are available, we find a very close correspondence between the 5% and 50% percentiles but our measure produces smaller changes across the 75% to 99% percentiles. However, the largest changes in LFS regional unemployment is 45% compared to 93% in our data, which corresponds to a doubling in unemployment in one location from a very low value in 2000. We argue that the finer level of geographic variation in claimant count data outweighs the disparities in the trends over time.

Table 1 gives an indication of the magnitude of percentage changes in the key labour market and asset price variables over the period as a whole. A strength of our approach is that we are able to use measures of house prices and labour market conditions at a local level. This is important since economic expansions and contractions do not occur uniformly throughout the UK. This is evident from Figures 2-4, which document recent changes in earnings, unemployment and house prices across selected postcode areas (i.e. cities or clusters of towns) in four UK regions. There are differences across regions as would be expected; there are also variations within the regions. For example, increases in earnings in Bristol generally outpaced elsewhere in the South West during the economic upturn, as they also did in Nottingham in East Midlands. Moreover, house prices in some areas continued to rise substantially in 2004 (Darlington and Cleveland in the North East and Nottingham in East Midlands), even as the housing market slowed in neighbouring areas. Hence, local area data captures the finer detail in economic developments compared to regional or national data. These differential changes across cities would not be picked up using regional measures.

[Figure 2 here]

[Figure 3 here]

[Figure 4 here]

The correlation between asset markets and labour market conditions also weakens as the degree of spatial disaggregation increases, suggesting that an analysis of the retirement decision using local level data provides an opportunity to unpack the relative importance and effect of these various driving economic forces. This is shown in Table 2.[11] The correlation between changes in house prices and (male) earnings at the national level is 0.293 compared with 0.233 at the regional level and 0.201 at the local level. Similarly, the correlation between changes in house prices and (male) unemployment is -0.406 at both the national and regional level but is -0.367 at the local level.[12] The correlation between (male) unemployment rates and (male) earnings is dramatically lower at the local level compared with regional or national level data. This reflects a number of factors. Firstly, an increase in unemployment at the local level may reflect firm or plant closures, and these firms could pay higher or lower than the average local wage meaning that, at the local level, the effect on average wages from firm closures could go either way. However, we still observe a negative association between changes in unemployment and earnings. Secondly, our unemployment variable measures the unemployment of local residents whereas our earnings variable measures the wages paid by local firms, and there is a weaker correspondence between residents and the workforce at the local compared to regional or national level. Finally, our measure of earnings is based on county level data matched to the smaller geographies of postcode areas, and we would expect this process to weaken the correlation between measured earnings and unemployment at the local level.

[Table 2 here]

IV. ECONOMETRIC RESULTS

Column 1 of Table 3 reports marginal effects for the logit model according to Equations 2, 3 and 4 above. For brevity, only marginal effects for the key economic variables are reported. All marginal effects and standard errors have been multiplied by 100 to give the percentage point change in the retirement hazard.

[Table 3 here]

Our results indicate that high earnings growth during the boom years reduces the hazard of retirement, leading to delayed retirement. Specifically, a one percentage point increase in annual changes in earnings reduces the (conditional) probability of retirement by 0.16 percentage points. Such an increase comprises just under one third of a standard deviation, with the 10th to 90th percentile range of changes in earnings lying between -0.15 and 5.6 percent. In contrast, rising unemployment increases the conditional probability of retirement, leading to earlier retirement. A one percentage point increase in annual changes in unemployment increases the hazard by 0.06 percentage points. The range of unemployment outcomes is, however, much larger, with the 10th to 90th percentile falling between -15 to 8.5 percent. Repeating the analysis after standardising the labour market variables suggests that a one standard deviation increase in annual changes in earnings and unemployment rates has almost identical effects (in absolute terms) on the retirement decision. Our analysis therefore indicates that cyclical fluctuations in earnings are an important determinant of retirement behaviour that has thus far been overlooked.[13]

Turning to the impact of asset prices on retirement; we find no evidence that housing or stock market wealth influences retirement decisions given that changes in asset prices appear to have little effect on the retirement behaviour of asset holders, and if anything, larger effects of asset price movements are found among those without assets. The interaction effect, which is reported at the foot of the table, is thus negative but insignificant. Of course, as Table 2 indicates, house prices are correlated with unemployment rates and it may be that weak evidence of wealth effects reflects multicolinearity issues. However, we find little evidence of a housing wealth effect even when changes in house prices and its interaction with tenure status are included without the other economic variables in the empirical specification. Given the magnitude of the house prices changes over the period, this is a fairly strong test of the effect of housing wealth on retirement timing.

The incentive to retire following rising stock prices may differ across investors with direct equity holdings (i.e. shares) or indirect equity holdings (i.e. DC pension plans), which we investigate in Column 2 of Table 3. For example, if higher prices reflect an upward shift in 'fundamentals', the incentive to delay retirement may be stronger for owners of DC pension plans compared to owners of shares, owing to annuitisation rules and benefits linked to employment status (i.e. tax relief and employer contributions) affecting DC pension plans. In addition to potential differences across type of equity holding, differences may exist across type of pension holding more generally. For example, individuals with employer-provided pension plans (i.e. DB pensions) may be offered early retirement windows by their employers when stock prices are rising. We therefore re-estimate our model replacing the interaction term for investors in Equation 1 with two separate interaction terms defining shareholders and private pension holders, as well as including a third interaction term for employer pension holders.

Results presented in Column 2 show a positive albeit insignificant effect of changes in stock prices on the retirement decision of individuals with direct equity holdings, with personal or employer pensions, and even among individuals without any of these arrangement. However, there are suggestive differences in the effect of stock prices according to type of holdings, with a one percentage point increase in stock price changes leading to a 0.067-0.068 percentage point increase in the hazard for individuals with shares and DB pension plans, compared with a much smaller increase of 0.024 for those with DC pension plans. The effect of rising stock prices on those without any arrangements lies somewhere in between, increasing the hazard by 0.059 percentage points. Interestingly, the interaction term for stock prices and DC pension plans is negative and significant confirming the effect of stock prices differs across individuals with DC pension plans and individuals without any arrangements (even if there is no evidence that the overall effect of stock prices differs from zero in either group). In particular, the effect of rising stock prices on the conditional probability declines by -0.054 percentage points, relative to the baseline effect estimated for individuals without any arrangements, if the individual is a DC pension holder.

V. Sensitivity analysis

Retirement decisions by education level

In the following analysis we allow for heterogeneous effects of labour and asset market conditions on the retirement behaviour of individuals with high/low education. There are two reasons for this. Firstly, as discussed above, the degree to which national versus local labour market conditions affect retirement decisions will hinge on the extent to which workers can move, and we might expect workers with low skills - as proxied by low education - to be more constrained in their options. Certainly in our sample, we find that low-skilled workers (defined as having weak or non-existent GCSEs/O-levels as a highest qualification) live in an average of 1.03 postcode areas compared to 1.06 postcode areas for high-skilled workers, and this difference is statistically significant. We also find that high-skilled workers have a larger number of employers (1.56 compared to 1.55 for low-skilled workers) but this difference is not statistically significant. Given this, we might therefore expect low-skilled workers to exhibit a greater sensitivity to local labour market conditions. Secondly, analysis by education status provides a useful robustness check of the previous analysis. For example, education is more likely to be exogenous to fluctuations in stock prices and house prices than investor or home ownership status, and educated individuals are more likely to be asset owners, and have more valuable investments (Banks *et al.*, 2012). It is therefore of interest to verify that there is little evidence to support a wealth effect when using this alternative proxy of asset ownership. Results are reported in Table 4. Our results provide suggestive evidence that the retirement decisions of low-skilled workers are more sensitive to labour market conditions compared to high-skilled workers. For example, the marginal effect of changes in earnings and unemployment on the retirement hazard of low-skilled workers is larger than the corresponding effect for high-skilled workers, and this effect is statistically different from zero only for low-skilled workers. However, the difference in these marginal effects, reported at the foot of the table, is not statistically different from zero. These findings are broadly consistent with incentives contained in UK institutional arrangements, where means tested benefits are available from the age of 60 without any requirement to seek work. Moreover, we again find little evidence of a wealth effect. However, there is some evidence that low-skilled workers are more likely to retire earlier when facing rising house prices compared to high-skilled workers (see foot of table). Further investigation suggests that this effect is driven by low-skilled workers that do not own property, which is consistent with a degree of correlation between house prices and unemployment rates.

[Table 4 here]

In addition to allowing heterogeneous effects of local economic cycles by skill level, we also allow for the possibility of differential effects of cyclical fluctuations in earnings across members of employer-provided pension schemes and others. Over the period of observation, employer pension schemes are most likely to be final salary schemes and hence positive earnings shocks are likely to have implications for pension accrual - in addition to standard substitution effects - among this group. Results are presented in Column 2 of Table 4. A one percentage point increase in annual changes in earnings reduces the conditional probability of retirement among those with employer pensions by -0.238, which is much larger than the estimated effect presented in Table 3. It is also much larger than the estimated effect among the group without an employer pension, which is not statistically different from zero. However, we cannot reject the hypothesis that the marginal effect of changes in earnings on retirement are equal across holders of employer pension and others. Nevertheless, this evidence points towards the possibility that holders of DB pension schemes are responding to differential incentives produced by cyclical changes in earnings. The estimated effect of changes in unemployment is larger among non-holders of employer pensions, partly reflecting the fact that the majority these individuals are also low-skilled workers.

Other sensitivity tests

We carry out a number of sensitivity tests which we discuss here (results available upon request). Firstly, we consider whether our specification, which so far ignores the incentives faced by spouses during economic expansions and downturns, is sufficiently rich to capture the retirement behaviour of dual earner households. We approach this issue by allowing the effect of economic conditions on a spouse's retirement decision to influence one's own retirement decision (see Coile, 2004, for a fuller discussion and analyses).[14] We find little evidence that economic conditions faced by a spouse affect one's own retirement behaviour but we do find that people tend to retire later if their spouse is still economically active.

Secondly, we examine whether a lack of evidence supporting wealth effects can be explained by a failure to capture wealth shocks. However, we find little difference in our results when we replace changes in house prices and stock prices with a measure of asset price 'shocks' derived as residuals from an AR(1) process, similar to the approach adopted by Disney, Gathergood and Henley (2010) in their test of the life cycle model of saving. It also made no difference when we used changes in asset prices over a longer time frame (5 years) instead of annual changes. Finally, we also implemented a random effects logit estimator to take into account unobserved individual heterogeneity. Results confirm the effect of earnings but the unemployment effect is slightly reduced and estimated with less precision (estimated coefficient 0.0088 with standard error 0.00538) compared with an estimated coefficient of 0.01 and standard error 0.005 presented in column 1 of Table 3.

Finally, we compare our results using local-level data to results using regional-level data. Broadly speaking, the results are similar although the effect of changes in regional earnings on retirement is only significant at the 13 percent level, which comprises a large drop in precision, while conversely the effect of changes in regional unemployment is estimated with greater precision. We also repeat our analysis using the using the official LFS unemployment rate, which is available from 1992 at the level of British regions, to calculate changes in unemployment. We find no effect of changes in unemployment when using the official measure (the estimated coefficient is much smaller and not statistically different from zero), but we also find similar results when using our measure of unemployment over the same time period (see column 3), suggesting that much of the effect of changes in unemployment on retirement is driven by the sharp increases in unemployment observed in the early 1990's recession.

VI. CONCLUSION

This paper has examined the effect of changes in asset prices and labour market conditions on retirement timing in Great Britain over the period 1991-2008. We argued that changes in economic conditions would have competing effects on the timing of retirement: lower unemployment and higher earnings may prolong the working life whereas 'wealth effects' of asset price gains should have the reverse effect.

We find a large effect of unemployment and earnings on retirement decisions. People retire earlier when facing difficult labour market conditions, with some evidence that low-skilled workers are hardest hit. Consistent with the US findings, we find little support for wealth effects - with respect to housing or financial wealth - in the timing of retirement. Given the magnitude of the changes to house prices in the UK - and the importance of housing in older people's portfolios, this provides important new evidence that these wealth effects are not important.

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NOTES

1. Gustman and Steinmeier (2002) using a structural model, does however find larger effects of asset price changes on retirement.
2. Subject to the caveat that equity wealth is more liquid than housing wealth.
3. The choice to include all people aged 50 plus in our sample as opposed to people aged 50 in 1991 is deliberate since it both increases sample size and reduces the correlation between changes in economic circumstances and age that would arise were we to limit the sample to an ageing cohort.
4. For example, each individual duration is converted to a sequence of binary variables, which indicate whether an individual retires at that age or otherwise. With panel data very little manipulation is necessary. Since we do not observe all individuals in each year, the final sample uses only the continuous section of each individual's labour market history up until the point they retire or become right-censored. Essentially, this treats most individuals as delayed entrants.
5. A step-wise estimator that first separately includes levels, log levels and changes of each variable and then selects the term that leads to the largest reduction in the log-likelihood (and then repeats the process with the selected term and the levels, log levels and changes of remaining variables) indicates that unemployment levels and changes in earnings minimise the

log-likelihood. However, our results are invariant to using levels or changes in unemployment and for ease of comparison we stick with changes.

6. Age-specific unemployment rates and earnings growth might provide a better match to respondents but we rule this strategy out on grounds of potential endogeneity of age-adjusted rates of these variables in relation to retirement behaviour.
7. Owing to the equivalence of the discrete time hazard model and the independent Bernoulli trials model, it is not necessary to cluster the standard errors by individual in spite of analysing multiple observations on the same individual.
8. The BHPS became part of a newer and larger survey after this date and new data on BHPS respondents is only available for 2010 as part of an interim release. We therefore only consider the period 1991-2008. We also exclude booster samples added over the years (Northern Ireland and Scotland/Wales) as appropriate.
9. Just over 3% of people aged 50 and over are not the main occupier of the property they live in.
10. For respondents interviewed at the weekend, we match the annual change on the Friday preceding the weekend.
11. For consistency the same sources of data are used to calculate changes in economic conditions across national, regional and local level. Hence, we use claimant counts taken from Nomis to calculate changes in unemployment. We use house prices taken from The Halifax to calculate changes in house prices. These data are available for the older definition of British Region (Standard Statistical Region) and therefore all regional variables are measured across this geography. We use NES and ASHE data to calculate changes in earnings, however, ASHE earnings data is available only for a newer definition of British Regions (Government Office Region) and we match these data to the older definition of British Regions as best as we can.
12. This weaker correlation at the local level does not arise from using regional data between 2007 and 2008 to calculate the change in house price at the local level. We also find a weaker correlation between changes in house prices and unemployment at the local level when excluding 2008.
13. We find that changes in earnings rather than levels of earnings affect retirement behaviour.

14. This analysis requires that both household members complete the BHPS survey and is therefore based on a smaller sample.

Appendix A: Additional Table

[Table 5 here]

Appendix B: Online appendix

Identifying who is invested in the stock market

Firstly, whether the individual owns stocks in 1991 is imputed by matching information in 1995 to 1991, making some adjustments to account for the fact that stock ownership in 1991 was lower than in 1995 (Grout *et al.*, 2009) and because matching information from older selves to younger selves leads to stock ownership that is too high. For example, stock ownership was 20% in 1991 and because the BHPS is a random sample of households in that year, it is assumed that 20% of the BHPS sample own stocks. In 1995 just under 23% of the sample own stocks so assuming that the age distribution of stock ownership remains constant across these years (supporting this assumption the ratio of average stock holdings by age-groups 15-34, 35-49, 50-65, and 66+ between 1995 and 2000 ranges from 0.77 to 0.82) it is possible to calculate the proportion of people by age-group who would own stocks in 1991. For the age-group of interest, 50-69, the proportion that own stocks in 1995 is 0.34 and taking into account the lower stock ownership in 1991, it is calculated that 0.3 of this age-group would own stocks in 1991. Which respondents then 'lose' stocks is randomly determined. It is inevitable that some people will have owned stocks in 1991 but have sold them by 1995, which is not captured by this approach. Secondly, ownership information is filled in between the years 1991, 1995, 2000 and 2005. For example, if someone is observed to own stocks in both 1991 and 1995, 1995 and 2000, 2000 and 2005, it is assumed that they own stocks in the intervening years (and likewise in the case of no stocks). If someone is observed to switch stock ownership across any of these years, the year in which stocks are sold (bought) is randomly assigned, with switches distributed evenly across years. Stock ownership in 2005 is matched to 2006-2008. In spite of these efforts to match information on stocks to other years, in 16% of person-years of people aged 50-69 information on stocks is missing. For these cases, stock market exposure is determined entirely from information on private pensions. Where information on both stock ownership and private pensions is available, 28% of individuals observed not to own a private pension own stocks. 26% of individuals with missing stock market information do not own a private pension, suggesting that stock market exposure is underestimated for 7% of individuals.

House prices

House price data are based on mortgage transactions recorded by The Halifax (the UK's largest mortgage provider). These data have been provided by HBOS (now part of Lloyds TSB) and measure the average price of properties sold in just over 750 post towns on a yearly basis from 1988-2007. In addition, quarterly data on the average property sold in 32 London Boroughs begins in 1992. Post towns are collections of towns and villages that are grouped together to facilitate the delivery of mail to UK households. House price information is published only when 50 or more sales are made within a post town. Because some post towns are comparatively small, these data are incomplete. Therefore, the Royal Mail Post Town Gazetteer is used to match post towns to postcode areas - the next tier of the postal delivery system - and an average postcode area house price is constructed from (larger) post towns with continuous time series data. For postcode areas in central London, an average house price for 1991 is constructed using the average house price observed in 1992, adjusted by the growth rate of house prices in Greater London between 1991 and 1992. We use regional growth rates in house prices between 2007 and 2008 to impute local area growth rates between these years.

Figure 5 maps the postcode areas in Great Britain (excluding the Kirkwall postcode area in the North of Scotland) and shows the distribution of house prices in 2000 (deflated to 2000 prices) in these areas. Darker areas indicate higher house prices. House prices are highest in London at £139 000+, followed by the South East, and lowest in South Wales, some areas in the North of England and in Scotland, where house prices range between £46 000-63 000.

[Figure 5 here]

Unemployment rates

Male and female unemployment rates are calculated from claimant counts and working age population data available from Nomis. The claimant count records the number of people claiming Job Seekers Allowance and National Insurance credits at Job Centre Plus local offices and represents an unofficial measure of unemployment in postcode areas. Administrative data contains the entire population of claimants and is unaffected by sampling variability, which tends to plague the official measure of unemployment (based on the Labour Force Survey) at sub-regional geographies. While there is a great deal of overlap between unemployment measured via claimant counts and the Labour Force Survey (LFS), these estimates differ because some people do not claim benefits but are unemployed, for example, people whose partner is working may not be entitled to claim benefits. A comparison of UK employment rates and claimant counts overtime suggests a close correspondence between both series are reasonably similar for men until 1995 but diverge afterwards, which reflects the last major change in benefit entitlement rules. For women, both series essentially track each other over the entire period but estimates of unemployment rates based on claimant counts are consistently lower than LFS estimates, reflecting the fact that women may not be entitled to claim benefits if their partner is employed. Hence, postcode area unemployment rates based on claimant counts would consistently underestimate the true level. Mid-year population estimates are available at (a lower geography) Local Authority District (LAD) and the online tool GeoConvert is used to create postcode area level population information from LAD level data.

Earnings

Full-time (male/female) gross weekly pay by workplace are taken from The New Earnings Survey (NES) and the Annual Survey of Hours and Earnings (ASHE). The NES is based largely on a 1% sample of employees appearing in the pay-as-you-earn (PAYE) taxation system covering all types of employees in all types of businesses. In October 2004, the Annual Survey of Hours and Earnings (ASHE) replaced the New Earnings Survey (NES) although a back history of ASHE data from 1998 is available and is used in the present study. Both surveys report earnings at county level, which are matched to postcode areas to calculate the average of the county level earnings by postcode area. This process is complicated by changes to British counties from 1996 onwards, which increase the number of counties. In 1991 there are 96 counties (Greater London comprises 32 areas) but this number increases to more than 200 over time.

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TABLE 1
SUMMARY STATISTICS FOR BHPS VARIABLES

	mean	sd	min	max
retired	0.07	0.26	0	1
age	57	5	51	69
female	0.47	0.50	0	1
ethnic minority	0.03	0.16	0	1
lives with partner	0.84	0.37	0	1
widowed	0.04	0.19	0	1
divorced/separated	0.09	0.29	0	1
2 household adults	0.56	0.50	0	1
3+ household adults	0.32	0.47	0	1
children at home	0.09	0.29	0	1
no. of health problems	1.19	1.19	0	8
public sector employee	0.25	0.43	0	1
self-employed	0.16	0.37	0	1
weak or non-existent GCSEs/O-levels	0.34	0.47	0	1
A-levels or good O-levels/GCSEs	0.24	0.43	0	1
year left FT education	1960	7.53	1937	1981
returned to education	0.07	0.25	0	1
homeowner	0.86	0.35	0	1
investor	0.64	0.48	0	1
personal pension	0.49	0.50	0	1
employer pension	0.53	0.50	0	1
%Δ HP	4.95	10.03	-18.82	39.14
%Δ FTSE	2.51	15.49	-46.70	34.96
% Δ unemployment	-3.09	10.82	-41.54	93.13
% Δ earnings	1.88	2.95	-12.68	22.39
N	16520			

TABLE 2

RAW CORRELATIONS ACROSS ASSET AND LABOUR MARKET AT THE NATIONAL, REGIONAL AND LOCAL LEVEL

	%Δ HP	% Δ earnings	% Δ unemployment	%Δ FTSE
National level (1 geographical area)				
%Δ HP	1			
% Δ earnings	0.293	1		
% Δ unemployment	-0.406	-0.296	1	
%Δ FTSE	-0.0639	-0.121	-0.212	1
Regional level (11 geographical areas)				
%Δ HP	1			
% Δ earnings	0.233	1		
% Δ unemployment	-0.407	-0.275	1	
%Δ FTSE	-0.0579	-0.00143	-0.185	1
Local level (97 geographical areas)				
%Δ HP	1			
% Δ earnings	0.201	1		
% Δ unemployment	-0.367	-0.0650	1	
%Δ FTSE	-0.0581	-0.0244	-0.204	1

National level means variables are measured at the level of Great Britain. Regional level means variables are measured at the level of British regions. Local level means variables are measured at the level of postcode areas.

TABLE 3

MARGINAL EFFECTS FROM A PROPORTIONAL ODDS HAZARD MODEL OF RETIREMENT

	(1)	(2)
% Δ earnings	-0.162**	-0.160**
	(0.068)	(0.068)
% Δ unemployment	0.059*	0.061*
	(0.033)	(0.033)
%Δ HP (non-homeowners)	0.034	0.034
	(0.034)	(0.060)
%Δ HP (homeowners)	0.008	0.009
	(0.008)	(0.039)
%Δ FTSE (non-investors)	0.061	
	(0.061)	
%Δ FTSE (investors)	0.048	
	(0.048)	
%Δ FTSE (none)		0.059
		(0.055)
%Δ FTSE (stockholders)		0.068
		(0.061)
%Δ FTSE (private pension holders)		0.024
		(0.047)
%Δ FTSE (employer pension holders)		0.067
		(0.053)
Marginal effects on interactions:		
%Δ HP*homeowner	-0.025	-0.024
se	0.056	0.056
% Δ FTSE*investor	-0.013	
se	0.028	
% Δ FTSE*stocks		0.019
se		0.030
% Δ FTSE*personal pension		-0.054*
se		0.030
% Δ FTSE*employer pension		0.022
se		0.025
N	16520	16520
Log-likelihood	-3658	-3655

*p<0.1, **p<0.05, ***p<0.01. Standard errors clustered by area/time period. See Equation 1 and accompanying text for details of the hazard and control variables (estimated coefficients for Column 1 available in Table 5 in Appendix A). See Equations 2 and 3 for details of how marginal effects presented in this Table are calculated. Marginal effects of relevant interaction terms are presented in the footer of the Table and represent the sample average difference in Equations 2 and 3. Note marginal effects and associated standard errors are multiplied by 100.

TABLE 4

MARGINAL EFFECTS FROM A PROPORTIONAL ODDS HAZARD MODEL OF RETIREMENT

	(1)	(2)
% Δ earnings (high ed)	-0.131	
	(0.081)	
% Δ earnings (low ed)	-0.212*	
	(0.124)	
% Δ unemployment (high ed)	0.045	
	(0.037)	
% Δ unemployment (low ed)	0.077*	
	(0.043)	
%Δ HP (high ed)	-0.027	
	(0.039)	
%Δ HP (low ed)	0.070	
	(0.049)	
% Δ FTSE (high ed)	0.041	
	(0.046)	
% Δ FTSE (low ed)	0.082	
	(0.058)	
%Δ earnings (no employer pension)		-0.089
		(0.093)
%Δ earnings (employer pension)		-0.238**
		(0.099)
%Δ unemployment (no employer pension)		0.075*
		(0.039)
%Δ unemployment (employer pension)		0.048
		(0.038)
%Δ HP (no employer pension)		0.041
		(0.045)
%Δ HP (employer pension)		-0.015
		(0.040)
%Δ FTSE (no employer pension)		0.043
		(0.052)
%Δ FTSE (employer pension)		0.063
		(0.050)
Marginal effects on interactions:		
%Δ earnings*low	-0.081	
se	0.148	
%Δ unemployment*low	0.032	
se	0.041	
%Δ HP*low	0.097**	
se	0.045	
% Δ FTSE*low	0.041	
se	0.031	
%Δ earnings*employer pension		-0.149
se		0.134
%Δ unemployment*employer pension		-0.026
se		0.037
%Δ HP*employer pension		-0.056
se		0.041
% Δ FTSE*employer pension		0.020
se		0.026
N	16520	16520
Log-likelihood	-3660	-3661

See notes to Table 3.

TABLE 5

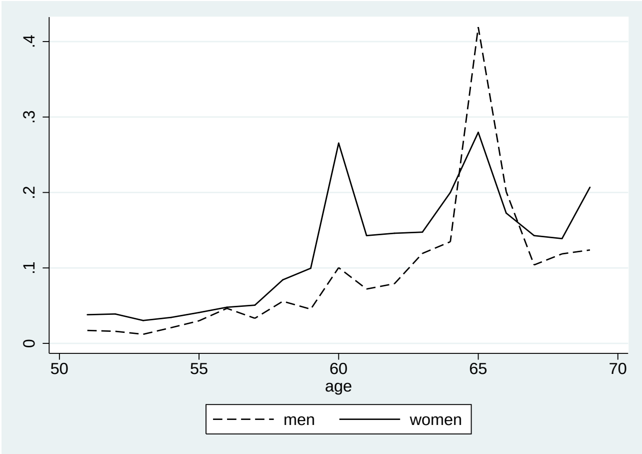
ESTIMATED COEFFICIENTS UNDERLYING RESULTS PRESENTED IN COLUMN 1 OF TABLE 3.

	(1)	
% Δ earnings	-0.027**	(0.011)
% Δ unemployment	0.010*	(0.005)
%Δ HP	0.005	(0.009)
%Δ HP*homeowner	-0.004	(0.009)
%Δ FTSE	0.011	(0.009)
%Δ FTSE*investor	-0.004	(0.004)
female	0.751**	(0.332)
ethnic minority	0.186	(0.221)
lives with partner	-0.065	(0.231)
widowed	-0.392*	(0.214)
divorced/separated	-0.515***	(0.187)
2 household adults	-0.507***	(0.195)
3+ household adults	-0.646***	(0.205)
children at home	-0.035	(0.169)
no. of health problems	0.200***	(0.025)
public sector employee	0.071	(0.093)
self-employed	-0.593***	(0.113)
A-levels or good O-levels/GCSEs	0.129	(0.100)
weak or non-existent GCSEs/O-levels	0.253**	(0.099)
year left FT education	-0.012	(0.019)
returned to education	-0.255*	(0.146)
homeowner	-0.059	(0.104)
investor	0.291***	(0.102)
personal pension	-0.460***	(0.096)
employer pension	-0.082	(0.072)
area dummies:	yes	
gender-specific age dummies:	yes	
year dummies:	yes	
N	16520	

*p<0.1, **p<0.05, ***p<0.01. Standard errors clustered by area/time period.

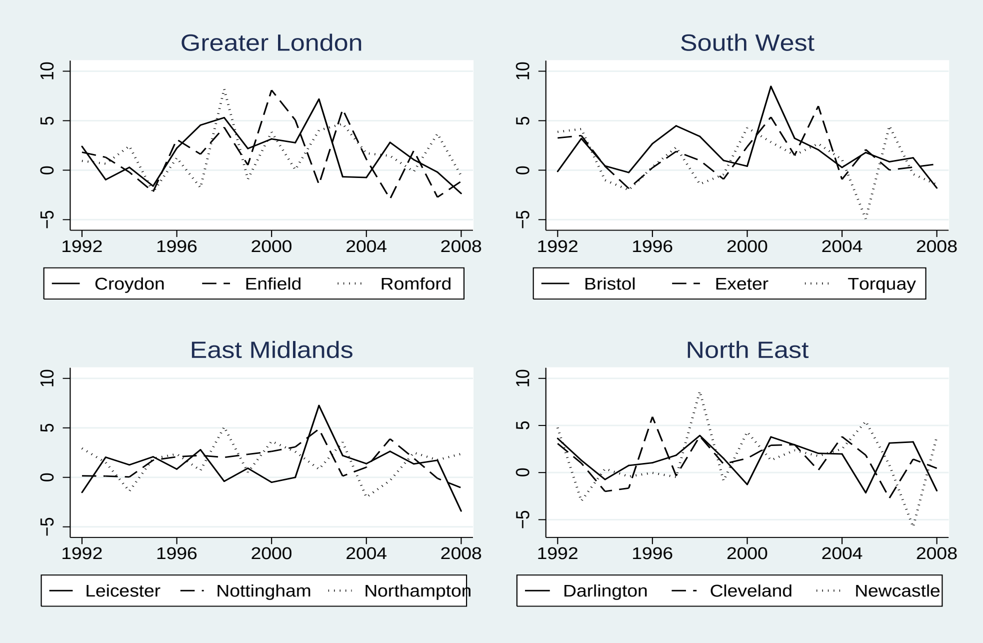
FIGURES

FIGURE 1
RETIREMENT HAZARD BY GENDER



Note: pooled BHPS sample 1991-2008

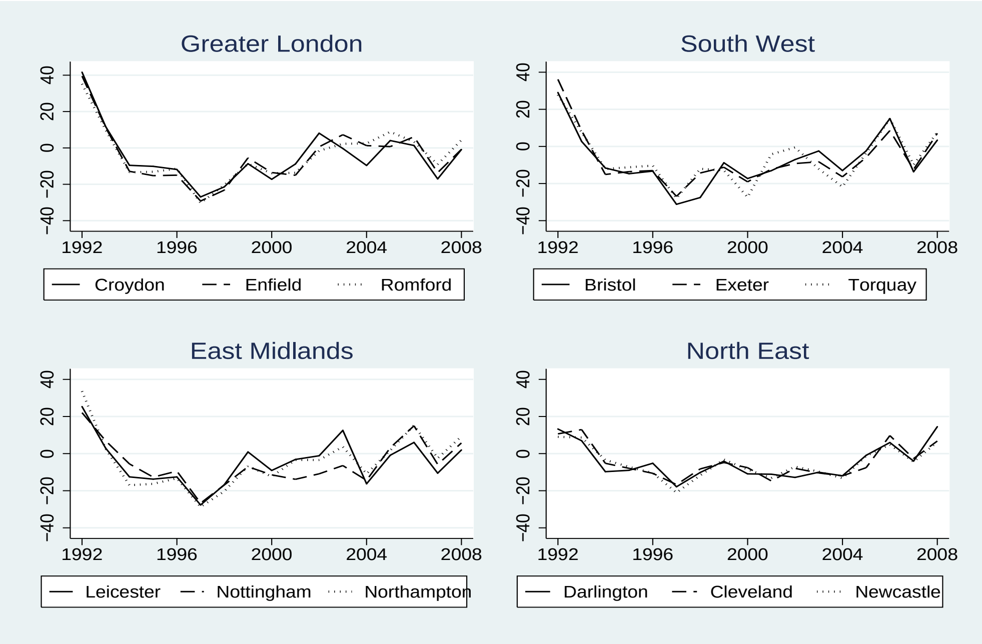
FIGURE 2
CHANGES IN MALE EARNINGS (%)



Changes in full time gross weekly male earnings across postcode areas in different regions. Postcode areas span cities or clusters of towns. Earnings data are taken from New Earnings Survey Journal, Annual Survey of Hours and Earnings. Details of data construction methods can be found in Appendix B.

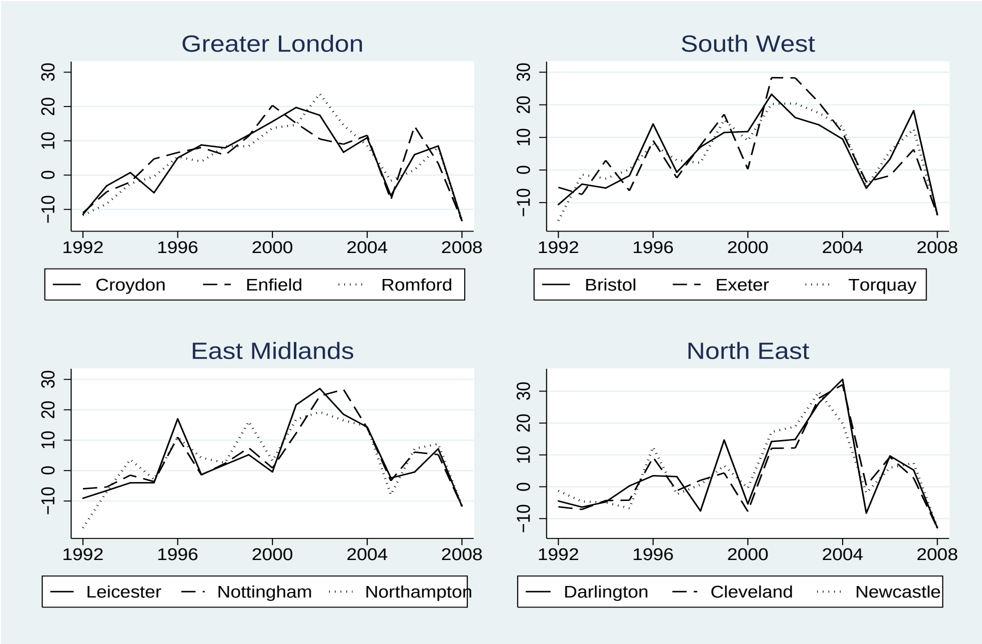
FIGURE 3

CHANGES IN MALE UNEMPLOYMENT (%)



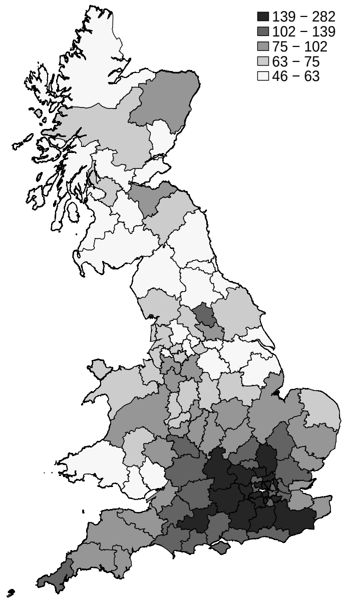
Changes in unemployment across postcode areas in different regions. Postcode areas span cities or clusters of towns. Unemployment data are taken from Nomis. Details of data construction methods can be found in Appendix B.

FIGURE 4
CHANGES IN HOUSE PRICES (%)



Changes in house prices across postcode areas located in different regions. Postcode areas span cities or clusters of towns. House price data are taken from The Halifax. Details of data construction methods can be found in Appendix B.

FIGURE 5
REAL POSTCODE AREA HOUSE PRICES IN 2000 (£1000'S)



Source: Halifax House Prices and own calculations.