WHEN COUPLES RETIRE: TIMING DECISIONS AND THE EFFECT OF SPOUSAL HEALTH

Submitted to the Central European University, Department of Economics

in partial fulfilment of the requirements for the degree of Master of Arts in Economics

by

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Budapest

2008

ABSTRACT

This paper utilises US longitudinal data from the Health and Retirement Study (HRS) to explore the retirement decisions taken within a couple and how these decisions interact with spousal health. The study begins with a review of the relevant literature, followed by data analysis and proceeds by developing two econometric models: a model of a spouse's retirement age and a model of the couple's retirement outcome. The paper finds that married individuals tend to adjust their labour force exit in order to bring it closer in time, thus lending support in favour of the joint retirement hypothesis. The analysis also indicates that the retirement synchronisation behaviour is more important for women than for men, both in terms of significance and in magnitude. Even though only 9% of the studied families retire together, the empirical results suggest that the retirement coordination behaviour accounts for nearly 20% of the observed joint retirements. Further, employing a self-rated health measure, the paper finds both men and women likely to remain employed longer in case they have a frail spouse with no access to health insurance, while spouse being in adverse health and having health insurance induces an earlier labour force exit only for men. On a couple level, the health cross-effect appears asymmetric: a husband experiencing health problems significantly lowers the probability that spouses will retire jointly; however, households do not respond to the female partner's ill-health.

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INTRODUCTION

The double challenge of an aging population on the one hand, and the need to insure the sustainability of the public pension and health insurance systems on the other, makes understanding an individual's retirement behaviour of considerable importance for the developed economies. Up until the late 1980s the vast majority of literature focused on studying the retirement behaviour of males, with very little or no attention paid to the retirement behaviour of couples. At the same time, however, the increasing labour force participation rate of females over the past decades, together with the fact that retirement-age individuals in couple households by far outnumber the single households, has given rise to a number of studies examining how couples coordinate their retirement decisions (see e.g. Hurd, 1990; Blau, 1998; Gustman and Steinmeier, 2000).

Understanding the retirement decisions of couples has important implications for families. Strong evidence of joint retirement might imply that older couples experience a substantial drop in family income at the time of retirement, especially in cases where one of the partners retires for health reasons. In contrast, evidence that one of the partners delays retirement as a response to a retirement of the spouse would make it possible for the couple to at least partially make up for the loss of household income. Hence, the issue may provide some insight for the well-being of elderly couples and has potentially important policy implications. To elaborate more on this, in the presence of strong joint retirement patterns any retirement policy that provides a member of a married or cohabiting couple with enough incentives to exit the labour force will, in addition, have an impact on the retirement decision of the other partner.

The primary research question addressed in this paper is: does the data provide any evidence that couples coordinate their retirement decisions? In contrast to the vast majority of the existing literature, the analysis here does not simply infer upon the existence of retirement synchronisation of married individuals, but also answers the question: if husbands and wives tend to synchronise their labour force exit, how much earlier/later do they tend to retire in order to bring their retirement dates closer to each other? In addition to this, the analysis is extended to evaluating the magnitude of the joint retirement behaviour and the importance of partners' retirement harmonization for the occurrence of joint retirements (the latter typically not addressed by previous research).

Among the various determinants of retirement, such as pension schemes and other economic variables, health related factors play a key role in explaining retirement. In this respect, the paper investigates a secondary research question: how do the retirement decisions of partners interact with spousal health? The questions of interest are examined using US longitudinal data from the first seven waves of the Health and Retirement Study (HRS) of the University of Michigan.

The key findings of this paper can be summarised as follows. The analysis provides support for the idea that married individuals tend to adjust their retirement decisions towards synchronisation; yet, the number of couples in the HRS who retire jointly is relatively low. The empirical results also indicate that the retirement coordination behaviour is more important for women than for men, both in terms of significance and in magnitude. The main contribution of the study is the finding that measuring the true impact of spousal health on the retirement decisions taken within a couple is achievable only when accounting for the interaction effects between one's health and health insurance status. In this way, the paper finds men with a frail spouse who has valid health insurance likely to retire earlier, while there is no similar effect for women. In contrast, both women and men are predicted to remain employed longer in case they have a spouse in adverse health with no access to health insurance. Finally, the spousal health cross-effect appears asymmetric on household level: a husband's ill-health is expected to lower the probability that the couple retires jointly, while the couple's retirement outcome is unaffected by the female partner's health.

The remainder of the paper is organised as follows. Chapter I discusses the motivation and theoretical framework behind the research questions addressed, and reviews the relevant empirical literature. Chapter II explains the data and variables employed in the study. This is followed by data analysis from the viewpoint of the joint retirement hypothesis. Chapter IV presents two econometric models: a model of the partners' individual retirement age and a model of joint retirement, both incorporating individual characteristics of the husbands and wives, as well as, spousal health cross-effects. Finally, Chapter V discusses the estimation results, followed by concluding remarks and a discussion of limitations.

CHAPTER I: LITERATURE REVIEW

Standard models of labour supply predict that a drop in family income will induce an individual to supply more labour in order to make up for the income loss and keep a certain level of consumption. Hence, employing a couple-approach, a decline in household income induced by spousal retirement might encourage the other partner to supply more labour in order to lessen the impact of income loss on the couple's consumption level. This direction of thought implies that in order to keep a certain income level (and hence, a certain level of consumption), couples tend to retire at different points of time. At the same time, however, there are several theoretical reasons why couples may tend to retire jointly. An extensively applied explanation in favour of joint retirement is complementarity of leisure – many authors hypothesise that older married individuals value leisure time more when sharing it with their partner (see e.g. Blau, 1998; Gustman and Steinmeier, 2000). Hence, when spouses retire, they often do so in order to spend leisure time together, coordinating the timing of their labour force exit. Secondly, there might be observable economic factors affecting both members of a couple, causing close retirement dates for the spouses (see e.g. Hurd, 1990). In addition to this, unobservable factors highly correlated between husbands and wives (the so called assortative matting) could lead to joint retirement (Becker, 1993). Finally, cross-effects, such as cross-earnings and cross-health effects could lead to a correlation between couples' retirement decisions (Coile, 2003).

Most of the empirical literature on the topic draws upon US data, although newly emerging European datasets have made analysis possible in several EU member-states. A wide range of American studies found evidence that couples tend to adjust their labour force exit based on the complementarity of leisure explanation. Early work in this field includes Bowen and Finegan (1969), who used data from the 1960 US Census, and reported that older married women tend to work less when their husbands are already retired. Later, Henretta and O'Rand. (1983) compared the joint retirement decisions to situations, where one of the spouses retires before the other, thus providing evidence in favour of a couple's labour force exit happening as close as possible in time.

One classic paper studying the retirement decisions of husbands and wives was produced by Hurd (1990), using data from the New Beneficiary Survey. Employing a structural approach and a Stone-Geary utility function, he observed that about 30% of the couples retire within a year of each other. Similar support in favour of the joint retirement hypothesis was found by Blau (1998), examining data from the 1970s of the Retirement History Survey. More recently, Gustman and Steinmeier (2000) have indicated some coincidence of retirement timing, even if the wife is much younger than the husband, and explained this finding by similar tastes for leisure in the couple. Using data from the HRS, Maestas (2001) developed a structural model for the determination of couples' retirement decisions and provided support that couples with greater complementarity of leisure tend to retire together.

There has not been much research on retirement behaviour of couples outside the US, although the topic has gained interest in the past few years. One of the first European studies that employed a couple-approach towards retirement was by Blau and Riphahn (1999), who investigated the labour supply behaviour of older married couples based on data from the German Socio-Economic Panel, and reported that the probability of one spouse to exit employment is larger if the other spouse is not employed. Jimenez-Martin et al (1999) used data from the European Community Household Panel (ECHP) and found that a working spouse is more likely to retire if his/her spouse has retired recently, the effect being stronger for females. In addition to this they provided evidence of assortative matting and complementarities of leisure. Banks and

Smith (2006) examined data from the British Household Panel Survey and reported that around 10% of women and men stop working at the same time as their partner, and other 10% retire a year after. Mark An et al (1999) provided support of strong complementarily of leisure for Danish husbands and wives, while cross-income effects were not found likely to induce spousal retirement.

One of the few researches of joint retirement in emerging economies, done by Queiroz (2006), found that couples in Brazil tend to synchronise retirement and that equalising male and female retirement ages would have a larger impact on male rather than female retirement. In addition to this, the study addressed the importance of financial cross-effects in a couple and provided evidence that wives are more responsive to husbands' incentives than vice-versa. This cross-effect is in contrast with the findings of Coile (2003), who studied US spousal retirement decisions as a function of the partners' own and cross-incentives, and reported that husbands respond to the financial incentives of their wives, but not the other way around.

All this research typically reported complementarity of leisure as the most important factor in explaining joint retirement, while correlation in spousal preferences and shared household income were found to be of secondary importance. However, for the most part these studies did not control for the health status of the partners, while at the same time theory predicts that the cross-health factors – cases where one of the spouses suffers from an illness or disability ─ has an important impact on the retirement decisions taken within a couple. In particular, if one of the partners retires for health reasons, the other partner may possibly retire or work fewer hours in order to devote time and personal care to the frail spouse, hence providing support for the joint retirement hypothesis. Coile (2003) analysed data from the HRS and suggested that the complementarity of leisure effect is stronger for men than for women (Coile, 2003 through

Querioz, 2006). Another alternative is that the healthy partner delays retirement in order to compensate for the loss of family income when his/her spouse retires for health reasons. This second effect is often referred to in the literature as the 'added worker effect' (see Gruber, 2000) and it works against the joint retirement hypothesis.

Empirical evidence for the cross-health effect on couples' retirement decisions is somewhat mixed: while several studies have found support for the added worker effect (see e.g. O'Rand et al, 1992), a number of other publications reported no significant link between spousal health and couples' retirement decisions. Using data from the HRS, Faverault and Johnson (2001) observed that both married women and men are more likely to retire in events when their spouse was not employed, as compared to cases when their spouse remained at work. At the same time, however, they reported a much smaller impact of spousal employment status when the spouse suffered from health problems. The results are, hence, in line with the joint retirement hypothesis of husbands and wives, except in the event of retirement induced by ill health.

In contrast, Coile (2004), using a wide range of health variables from the HRS, observed that spousal health shocks give rise to a significant added worker effects for husband's only, and no such effect on the female partner's retirement. The previously discussed analysis of Blau and Riphahn (1999) of West German data provided evidence that wives are less likely to exit the labour force in cases where their husband suffers from a chronic health condition; however, the same pattern does not hold for husbands. Among the results of Jimenez-Martin et al (1999) from an analysis of the ECHP, there is an important finding for asymmetric cross-effects of spousal health: while the health status of the husband plays a crucial role in explaining joint retirement, the health status of the wife has a much less stronger impact.

Overall, the literature suggests some evidence that couples prefer to retire jointly and, hence, adjust the timing of their labour force exit. However, in most countries only a small fraction of all couples retire together, while the majority of husbands and wives leave the labour force several years apart, typically the wives retiring first. Thus, although there is a consensus in the literature about the existence of coordination of the retirement decisions towards joint retirement, there is no clear evidence for the importance of this coordination; neither is there an indication for the magnitude of this coordination in terms of number of years by which husbands/wives adjust their retirement behavour. At the same time, relatively little or no attention has been paid to the question of how joint retirement varies with the circumstances surrounding the spousal labour force withdrawal: studies on the effect of spousal health on the retirement decisions taken in a couple provide quite an ambiguous picture of the importance of health-cross effects. The subsequent analysis in this paper shall attempt to shed light on these issues.

CHAPTER II: DATA AND VARIABLES

2A. Data

The analysis in this paper utilises the extended RAND version of the Health and Retirement Study[1] of the University of Michigan that includes Waves I-VII (1992-2004) of the original Health and Retirement Study. The HRS is a US nation-wide representative longitudinal survey containing household-level data on persons born between 1931 and 1941 (aged 51-61 in 1992). Following the individuals from the first wave in 1992, subsequent waves have been conducted every two years. In contrast to the original HRS, the RAND version has as a unit of observation individuals; each person living in a couple household is, consequently, observed twice: once as a respondent and once as a spouse.

Since the HRS contains data on elderly husbands and wives for a large sample over a relatively long period of time, it is particularly well suited for studying how spouses coordinate their retirement decisions. Moreover, an advantage of HRS is that in addition to the basic demographic variables, it provides detailed information relevant for the purposes of this paper, namely health, labour supply and retirement decisions. Another important strength of the dataset is the quality of health information collected: the respondents are asked a series of questions on their overall health status, health-related work limitations, as well as whether they experience certain medical problems. Finally, the HRS contains comprehensive information on variables that are considered important determinants of retirement, such as household wealth, job occupation and other economic characteristics.

The HRS surveyed 4,846 couples in 1992; however, the attention in this paper is restricted to individuals who live in couple households[2] in which both partners were employed at the baseline year of the survey. 2,140 couples satisfy this requirement and are considered for analysis.

2B. Variable definitions

Retirement

Any definition of retirement is complicated by the fact that two different aspects of the issue have to be taken in consideration: a state or condition of being withdrawn from active labour, and the act of withdrawing itself. The mainstream economic literature uses definitions of retirement based on three main elements: 1) a permanent withdrawal from the labour force or a drop in the hours of work supplied (see e.g. Coile, 2004); 2) receipt of a pension annuity, Social Security, or other type of retirement income (e.g. Hurd, 1990); and 3) the individual's subjective perception of oneself as being retired (Kapur and Rogowski, 2006).

However, each one of these definitions has potential drawbacks. A subjective retirement definition is questionable due to the fact that individuals might have different perceptions of what retirement is. On the other hand, studies using the labour force exit definition often define retirement simply as a labour force exit, without taking into consideration the fact that essentially retirement requires not only an exit from one labour force status but also an entry into a specific state, i.e. being retired. This is why some empirical works (e.g. Faverault and Johnson, 2001) fail to distinguish between persons who retire and persons who join the broad category of 'not in the labour force' (e.g. marginally attached). Finally, receipt of a pension income is even more problematic since drawing retirement benefits and the labour force exit often do not happen simultaneously: some individuals do receive a pension benefit but continue to work full-time, while at the same time others might have fully withdrawn from the labour force but do not draw a pension yet.

Taking the above into consideration, and aiming at fully benefiting from the data provided in the RAND HRS, this paper defines retired individuals as those who were employed at the baseline year of the HRS and entered into a state of being fully or partially retired in any subsequent wave of the survey.[3] In turn, the definition employed combines the retirement self-assessment and the labour supply elements; in particular, it considers as retired individuals who self-report themselves as retired and, at the same time, do not report full-time employment as their labour force status and are not looking for a full-time job.[4] This definition captures the idea of retirement as a 'state of mind' (i.e. one considers him/her self retired no matter that s/he might be supplying or willing to supply some part-time work) and, at the same time, reflects the notion of retirement as a transition from one state to another, i.e. a complete withdrawal from employment or withdrawal from active work (i.e. full-time employment) into retirement.

One last issue of concern is the joint retirement definition, which for the HRS is complicated by the fact that subsequent waves are conducted every two years. Several empirical studies using data from the HRS define a couple retiring jointly if both spouses retire at the time between two successive waves (see e.g. Kapur and Rogowski, 2006), in this way considerably over-counting the share of joint retirements. Having this in mind, this paper considers as joint retirements cases where both spouses not only transit from an employment into a retirement state at the time between two HRS waves, but in addition have the same retirement year (a variable derived in the RAND version for respondents who are completely or partially retired).[5] Thus, the joint retirement definition utilises a combination of retirement data from a previous and present wave, as well as a retirement self-report, employment status and a direct question response.

Health Measures

Another crucial variable in the study is the definition of one's health status, for the literature suggests that both own and spousal health might impact the retirement decision of a married individual. While the theoretical considerations why household health cross-effects possibly influence one's retirement have already been reviewed in the previous section, there are several reasons why one's own worsened health would, *ceteris paribus*, induce exit from active work: 1) it may increase the disutility of labour or decrease the return on labour; 2) it might make the individual eligible for disability benefits, thus providing a substitute for labour income; or 3) in cases where poor health is related to lower life expectancy, it increases the consumption available from the existing life-time wealth, in this way inducing earlier retirement (Deschryvere, 2005).

There is no consensus in the literature about the proper measurement of health. The key problem stems from the fact that the variety of health measures may be subject to reporting biases, and capture to a different extent the relationship between health and labour productivity. As already mentioned, the HRS contains a wide range of health variables, such as subjective overall self-report of health, as well as variables usually referred to in the literature as 'objective health measures' (see e.g. Deschryvere, 2005). The latter include indicators whether an individual experiences any limitations with activities of daily living (ADLs), certain diagnosed health conditions[6] or health shocks (changes over time).

A general problem with the use of self reported health status and number of functional limitations is that responses might not be independent of retirement outcome: individuals might attempt to rationalise their retirement decision by claiming ill health (the so-called 'justification hypothesis', see e.g. Bazzoli, 1985 and Bound, 1991). At the same time, Dwyer and Mitchell (1999) studied data from the HRS and reported that self-rated health measures are not endogenously determined with labour supply; in other words, they found no evidence in support for the justification hypothesis in the HRS sample. One other concern with the use of the self-reported health indicator is that it might be subject to measurement error since perception of adverse health might vary substantially among individuals. This concern remains even when employing reports of diagnosed health conditions: e.g. Baker et al, 2004 compared these indicators with data from respondents' medical files and revealed presence of considerable measurement error. In contrast, Dwyer and Mitchell, 1999 found little evidence of measurement error either in the objective or in the subjective indicators of poor health.

Adding up all these considerations, and the fact the key variable of interest in this paper is the effect of spousal and not of one's own health on one's retirement pattern, the analysis utilises as a measure of health the individuals' self-reported health perception. In particular, ill health is defined as the report of one's health as being 'fair' or 'poor' in contrast to 'good', 'very good' or 'excellent'. The major motivation behind the choice of this indicator is the unbalanced nature of the HRS and the fact the health self-report has, on average, a higher response rate compared to most of the other health variables. Moreover, use of health self-report makes differentiating between good and bad health straightforward. To elaborate more on this, employing objective health measures such as ADLs or diagnosed health conditions makes defining bad health rather subjective: it is hard to decide whether the presence of one such condition is enough to identify one as having poor health or incidence of several such conditions are needed (e.g. Coile, 2004 uses presence of one limitation of ADLs as a definition of ill health, while Faveraultt and Johnson, 2001 define bad health as presence of five functional limitations).

Other controls

In addition to the retirement and health indicators, the HRS provides a wide range of demographic variables, including age, gender, race and educational attainment. Age plays a key role in an individual's retirement decision; moreover, it is a fundamental characteristic that drives the retirement decisions taken within a couple. Education, in turn, is highly correlated with household wealth, as well as with the type of job occupation each one of the partners holds; what is more, it determines to a great extent the age when one enters the labour force. Further, the RAND version of the HRS contains a number of household wealth and income indicators (usually reported in nominal USD, and in cases where respondents were unable or unwilling to provide an exact amount, imputed).[7] Data on respondents' job characteristics is also present, including one's longest job occupation, which is expected to play a key role in his/her subsequent retirement pattern.

The HRS also provides information on other economic variables that are considered important determinants of one's retirement, such as participation in defined benefit or defined contribution schemes, individual retirement attitudes[8], as well as, respondents' subjective expectations for their spouse to retire at the same time.[9] However, these indicators suffer from a considerable drawback ─ very low response rate ─ which makes their usefulness rather questionable. Finally, the HRS dataset includes information on respondents' health insurance status, which is often reported as an important consideration both for own and spousal retirement, and ultimately, for the coordination of retirement decisions within a couple. Following the mainstream economic literature, this paper assumes that health insurance status is exogenously determined from retirement outcome (see e.g. Kapur and Rogowski, 2006).

CHAPTER III: DATA ANALYSIS

The HRS data analysis presented in this Chapter seeks to provide evidence in favour of the joint retirement hypothesis; in addition, the study is extended to examining the following research question: if married individuals synchronise their retirement decisions, how much earlier or later do they exit the labour force in order to bring their retirements closer in time? Finally, the last sub-section investigates the issue of the magnitude of joint retirements and retirement behaviour coordination, and how these interact with spousal health.

3A. Evidence for joint retirements

The thought experiment

Consider a thought experiment in which all working individuals can be observed in two alternative states: as living in a single household or as living in a couple household. At some given point of time t a random sample of employed individuals is drawn from the population (and let us assume for simplicity that these are all males) and is assigned a single household state, after which their labour force behaviour is studied until they exit into retirement. Suppose now this same random sample of working men can be observed back at time t in the other alternative state ─ as living in a couple household, and their subsequent retirement patterns are examined. A similar thought experiment could be performed for working females as well.

If such experiments were possible one could test whether living in a couple household affects the retirement behaviour of married individuals. Clearly, such experiments are unfeasible; however, what one could test in the light of the joint retirement hypothesis is the behaviour of men, respectively women, which are not identical, yet similar in all their characteristics, except household status. This direction of thought leads to the underlying hypothesis of the subsequent analysis: if the joint retirement hypothesis holds, i.e. if husbands and wives desire to retire at the same time, the retirement behaviour of married and single individuals who are otherwise similar in their characteristics would differ based on the fact that these living in couple households would adjust their retirement patterns in order to bring their retirement date as close as possible to that of their spouse.

In order to test this proposition, the paper looks at men and women in the HRS living in couple and in single households, and based on the comparison of their retirement behaviour makes inferences about the possible coordination of retirement for husbands and wives. For this purpose, retirement is described based on a simple data analysis, without taking into consideration any household cross-effects that could possibly influence couples' retirement decisions. As previously noted, the entire analysis is restricted to individuals who were employed at the baseline year of the HRS.

Males

The HRS contains 4,019 observations on men who were employed in 1992, of which 2,140 lived in dual-working households in 1992, and 477 were single.[10] As shown in Table 2 of the Appendix, both sub-samples have essentially the same characteristics; hence, in case of no spousal retirement coordination, the retirement behaviour of single and married men would not differ. If, on the other hand, the joint retirement hypothesis holds, the fact that married men in the HRS are, on average, older than their wives should shift the entire retirement probability distribution of married men to the right. For instance, a 62-year-old man in the HRS would have a wife who has not yet reached early retirement age[11]; therefore, he might delay his retirement in order to bring it nearer to the one of his spouse. In order to investigate the issue, the paper compares the retirement probabilities of men in single and in couple households for all retirement ages between 54 and 70.[12]

The upper panel of Figure 1 illustrates the retirement patterns of the two groups. Single men tend to have much higher retirement probabilities prior to reaching the early retirement age; once they turn 62, their retirement exhibits a clear peak, while after this age their retirement probability becomes substantially lower. As compared to single males, men living in couple households are much less likely to retire before turning 62 and much more likely to retire afterwards. Another point is that their retirement behaviour does not seem to have a clear peak at age 62: the retirement probabilities of married men are nearly equal at ages 62 and 63. Both groups seem to exhibit a minor secondary peak in their retirement probabilities at age 66.

Overall, Figure 1 makes it evident that married men tend to delay retirement as compared to single men: their retirement probability is to the right of the retirement probability of single men for all ages, except 60. At the same time, both groups are very similar in terms of their main characteristics, except for marital status. Hence, the observed difference in the actual retirement patterns of married and single males, taken together with the fact that married men are on average older than their wives, possibly implies that men living in couple households postpone their labour force exit in order to bring their retirement timing as close as possible with this of their wives.

Furthermore, the comparison between the retirement ages of males in single and in couple households leads to a question, typically not addressed by previous research: by how many years do married men tend to adjust their labour force exit, in order to bring it closer to this of their wives? An approximation of the retirement-age differential between married and single men in the HRS can be computed by smoothing the retirement probabilities, as shown on the lower panel of Figure 1. It seems from the smoothed graphs, then, that on average married men tend to delay retirement by about one year, as compared to single males; the retirement age differential being somewhat higher for ages after 66. In any case, retirement coordination seems to significantly magnify the timing of married males' labour force exit.

Females

The HRS studied 4,091 women, who were employed in the baseline year of the survey; 2,140 of them lived in dual-working families and other 1,032 were single.[13] However, the two sub-samples considerably differ in their means, possibly due to the fact that a large fraction of single females is composed of widowed women, who tend to be nearly 6 years older than women living in couple households. For this reason, the analysis is restricted to a comparison between married women and a sub-sample of 714 single women, which excludes widows.[14] This way, as shown in Table 2, the analysed sub-samples of single and married females include women with close characteristics. However, in contrast to males, the two groups have very dissimilar retirement preferences: a much larger fraction of single females report preferences to continue to work both after reaching age 62 and after age 65. Thus, based on the different retirement preferences of single and married women, even at this early stage of the analysis there is a clear indication that their retirement behaviour would differ.

The upper panel of Figure 2 illustrates the retirement patterns of single and married females by age. Interestingly, the retirement probability of single women reaches a peak at full retirement age, while the secondary peak is at early retirement age. In contrast, married women retire with highest probability when reaching early retirement age and the year after. For all ages before 63 women living in couple households retire with a substantially higher probability, as compared to single females, while the pattern is reversed after. Further, an approximation of the retirement-age differential between married and single women in the HRS is illustrated on the lower panel of Figure 2. The smoothed graphs show that married women tend to retire about two years earlier until age 63, while after this age they tend to retire just about a year sooner, as compared to single females.

Taken as a whole, Figure 2 clearly shows that married women tend to retire earlier, as compared to single females: their retirement probability is to the left of the retirement probability of single females for essentially all retirement ages. However, in the case of females in single and couple households it is hard to provide a precise rationalization for what determines their dissimilar retirement behaviour. One possible explanation is that the differences in single and married women's retirement patterns are determined solely by their dissimilar retirement preferences, as reported in Table 2, and not by the fact that married females adjust their labour force exit with their husbands. Alternatively, in the light of the joint retirement hypothesis, preferences of married women to retire earlier might simply reflect their desire to synchronise their labour force exit with that of their spouses, which further materialises in their actual retirement behavour.

The comparison is further complicated by the fact that, in contrast to married females, single women are major earners in their households; hence, they might delay retirement in order to keep a certain income level. Therefore, while the analysis does not provide clear-cut evidence for retirement synchronization behaviour in the case of married females, it definitely does not reject the joint retirement hypothesis: the data shows that for all ages prior to reaching early retirement age married females tend to retire about two years earlier than women in singe households, and about a year earlier after reaching 62. The observed retirement pattern, taken together with the fact that married females are on average younger than their partners, suggests that at least part of this behaviour might be accounted for by married women retiring earlier in order to bring their retirement timing closer to their husbands' retirement date.

3B. The importance of joint retirements and couples' retirement coordination

While the preceding data analysis provided support for the existence of synchronisation of the retirement decisions of husbands and wives, this sub-section aims to further investigate the couples' labour force exit. This is done by evaluating the magnitude of the joint retirements observed in the HRS and the importance of retirement behaviour harmonisation for the occurrence of joint retirements.

The magnitude of joint retirements

In order to assess the importance of joint retirements in the HRS, the retirement probabilities of husbands and wives can be decomposed by the change of the retirement status of their spouse. The decomposition is based on the fact that the retirement probability of a husband can be presented a sum of the probabilities of occurrence of the following mutually exclusive events: 1) the event that a husband retires and his wife retires, and 2) the event that a husband retires and his wife does not change her retirement status; or formally:

$$P(HR) = P(HR \cap WR) + P(HR \cap W\overline{R}),$$

where HR stands for the event that husband retires, WR stands for the event that wife retires and $W\overline{R}$ stands for the event that wife does not retire.[15]

Figure 3 illustrates the retirement decomposition of husbands' retirement probability by their wives' retirement status (both evaluated at the husband's age). Of all 2,140 men living in couple households and employed at the base year of the survey, 1,287 entered into retirement during the subsequent years of the HRS.[16] As the graph shows, the majority of husbands do not retire together with their wives: the probability that a husband retires and his wife does not change her retirement status accounts for about 20% of the observed husbands' retirements for ages below 65. The probability that a married man retires together with his wife reaches a peak at full retirement age, when just over 25% of all husbands who exit the labour force do so together with their wives. After age 65 the share of jointly retiring husbands decreases but remains somewhat higher than prior this age: 22% of all husbands who retire after full retirement age are likely to retire together with their partners. Overall, of all husbands in the studied sample who retired during the 14 years of the HRS, 183 retired simultaneously with their wives (comprising a share of 14% of all retiring married men).

Employing arguments analogous to the above allows for breaking down the wives' retirement probabilities according to their husbands' retirement status. Figure 4 presents a similar decomposition by illustrating the share of married females retiring jointly with their husbands or apart (all probabilities being evaluated at the wife's age). Of all 2,140 females living in dual-working households in 1992, 1,046 transited into retirement during the following 14 years. The wives' retirement patterns are somewhat similar to the ones observed in the case of husbands', with spouses retiring predominantly at different points of time. However, in contrast to married men, a larger fraction of females retire simultaneously with their husbands prior to reaching the early retirement age. The share of females who exit from labour together with their partner reaches a maximum at ages 56 and 60, when nearly a third of all females who retire, do so together with their partner. The fraction remains high up until reaching the early retirement age and the year after, with simultaneous retirements being observed for roughly 25% of all retiring wives. After age 63 less than a fifth of all married women who retire are likely to do so at the same time as their spouse. On average, of all women in couple households, who retired during the time of the survey, roughly 18% retired jointly with their partner; the share being slightly higher than that observed for men.

Significance of the spousal retirement behaviour coordination

While the analysis presented above comments on the joint retirements of husbands and wives in couples where at least one of the spouses retires, it is also useful to examine the share of joint retirements of all couples in the HRS. Of all 2,140 households in which both spouses were employed in the baseline year, 650 had two retiring partners during the years 1992-2004. The number of couples in which spouses retired together is 183, implying that of all dual-working couples at the baseline year of the HRS, nearly 9% retired jointly during the time of the survey. This seems to be a rather low fraction, which might give grounds for questioning the importance of couples' retirement decision coordination.

In order to further examine the issue, it is useful to compare the share of actually observed joint retirements to what this share would have been in the absence of retirement coordination. The analysis utilises the fact that in case of no synchronisation of retirement timing, the retirements of a husband and wife could be seen as two independent events; thus, the following equality should hold:

$$\text{P(Joint retirement)} = \text{P}(\text{HR} \cap \text{WR}) = \text{P(HR)}.\text{P(WR)}\,.$$

If, on the other hand, one is to account for the existence of retirement coordination between spouses, the two events are not independent and the observed probability of a joint retirement is described by the inverse of the Bayes' rule:

$$\text{P(Joint retirement)} = \text{P}(\text{HR} \cap \text{WR}) = \text{P}(\text{HR}|\text{WR}).\text{P}(\text{WR}) = \text{P}(\text{WR}|\text{HR}).\text{P}(\text{HR})\,.$$

Therefore, comparing the two probabilities — the joint retirement probability in case of no retirement synchronisation and the actually observed probability that a couple retires jointly — would shed light on the question of what fraction of all joint retirements is accounted for by the existence of spousal retirement behaviour coordination. This issue has largely been overlooked by the existing research on the topic and is considered the main contribution of this paper.

The two probabilities are illustrated in Figure 5 of the Appendix (both evaluated at the husband's age). As can be seen, in contrast to the case of no synchronisation of spousal retirement decisions, the probability that a couple retires jointly is substantially lower for all husband's retirement ages, except for age 70, when the two probabilities are equal. Moreover, for husbands younger than 58, roughly two thirds of all joint retirements are due to the presence of retirement behaviour coordination. After this age the difference between the two probabilities considerably drops, with spousal retirement behaviour harmonization typically accounting for about 30% of all joint retirements (the fraction accounted for by synchronisation reaching a peak of just above 43% at husband's age 60). This implies that in cases where the male partner exits the labour force earlier, the presence of retirement coordination behaviour is much more important for joint retirements to occur, while for husband's age after the early retirement age, even in the case of no retirement synchronisation, two thirds of all joint retirements would have happened anyway. Yet, the overall message from Figure 5 is that coordination of the retirement decisions taken within a couple accounts for a significant fraction of joint retirements: on average, 20% of all joint retirements would not have been observed in the absence of spousal retirement behaviour synchronisation.

To sum up, the data analysis suggests that married men tend to delay their labour force exit by about a year as compared to single males with similar characteristics. At the same time, married women tend to retire from one to two years earlier in contrast to single females. This, taken together with the fact that husbands in the HRS are, on average, 4 years older than their wives, provides support for the hypothesis that there is an adjustment of spousal retirement decisions towards synchronisation. Yet most husbands and wives seem to mainly retire at different points of time, with joint retirements being observed for only 9% of the studied couples. Nevertheless, spousal retirement patterns coordination accounts for an important part of the joint retirements: at least 20% of them would not have happened in the absence of synchronisation behaviour.

3C. The impact of spousal health

In order to test whether a spouse's retirement decision is driven by the health status of their partner, the paper compares the observed retirement probabilities of married individuals living in couples where the partner suffers from ill health with the retirement rates of husbands and wives, in couples where the partner is in good health. The key hypothesis of the subsequent analysis is that if one of these effects prevails over the other, the added worker effect would materialise in a shift of the retirement age distribution of the healthy partners to the right, while a desire to spend time together with the frail spouse or provide personal care would result in a leftward shift. Failure to observe a shift in the retirement probabilities of the two different groups might imply that married individuals retirement patterns are, indeed, independent on their partner's health, or that the two opposing effects offset each other, possibly driven by other individual or household-specific characteristics.

The upper panel of Figure 6 illustrates the comparison of the retirement probabilities of husbands living in households where the wife reports bad heath. Of all 14,980 couple-year observations during the 14 years of the HRS, 9,627 contain non-empty health-self reports for the female partner. In 8,300 of the cases the wife reported being in a bad or fair health, while for the remaining couple-year observations the female partner reported a good, very good or excellent health.

As can be seen in Figure 6, the two groups show no clear retirement patterns. For very early retirement age, husbands in couples where the wife reports ill health have a higher retirement incidence as compared to husbands with healthy partners, while the pattern reverses from age 57 on until reaching age 61. Married men with frail wives retire with a considerably higher probability when reaching the early retirement age and the year after, with their retirement pattern exhibiting essentially identical peaks of 0.29 both at age 62 and 63. At the same time, men living in households where the spouse is in good health retire with highest incidence rate a year after reaching early retirement age, when in 25% of all couple-year observations the male partner transits into retirement. The latter group of males is equally likely to retire aged 64, 65 or 66 with probability 0.21; in contrast, the retirement probability of males with wives in adverse health exhibits an evident peak of 0.24 at age 66. The retirement pattern of husband in couples where the wife is in good health seems to have a minor peak of 0.17 at age 68, dropping to 0.10 the years after. The lower panel of Figure 6 provides a comparison of the smoothed retirement probabilities of the two groups of married men. As expected, there is no observable left or rightward shift in their retirement patterns; the only noticeable difference is that men having frail spouses are slightly less likely to retire at ages 56 to 61 and at very late age.

Overall, it is hard to derive a conclusion based on the preceding investigation; however, the fact there is no major shift observed in the retirement probabilities of husbands whose wife suffers from an ill health, compared to husbands living in couples where the female partner enjoys good health, makes it is evident that none of the two opposing effects ─ the complementarity of leisure/personal care effect or the added worker effect ─ prevails over the entire range of husbands' retirement ages. On the contrary, it might appear logical to presume that for some retirement ages one of the effects prevails over the other, while the opposite is observed at other age intervals.

A similar analysis compares the retirement probabilities of females in households where the spouse reports bad health (parameterised as a poor or fair self-rated health), and in households where the husband is in good health. Of 14,980 couple-year observations of households where both partners were employed in wave I, 9,587 include non-empty observations for the male partners' health self-report. The majority of husbands rated themselves as being in poor or fair health, while for 1,628 couple-year observations the male partner reported a good health status.

As can be seen from the retirement probabilities illustrated on the upper panel of Figure 7, women falling in each of the two groups have nearly identical retirement patterns. This is especially pronounced for those between 59 and 67, when the retirement probabilities of married females seem to be independent on their husbands' health status. The two probabilities slightly diverge at early retirement age and the year after, when wives with partners in a bad health retire with probability 0.34 and 0.30 respectively, in comparison with 0.30 and 0.28 for married females with healthy husbands. Retirement probabilities of wives living in households where the male partner enjoys good health seem to differ from these of females whose husband suffers from ill health for ages after 67; however the latter are based on less than 50 couple-year observations. Same holds for retirement ages 54 and 55.

Examining the smoothed graphs, presented on the lower panel of Figure 7, reconfirms the similar retirement patterns of the two groups of married females: there are no shifts in the retirement incidence rates. The only observable difference appears to be that women with frail husbands tend to be somewhat less likely to retire at ages below 61 and at ages above 65, while the opposite holds for ages between early retirement age and age 64. This leads to the conclusion that there are no grounds to believe that the vast majority of married females would exit from the labour force in order to provide personal care in cases where their partner suffers form ill health; neither are there reasons to think married women in such couples would, on average, delay their retirement in order to insure a higher household income.

To sum up, neither the added worker effect, nor the complementarity of leisure and care giving effect prevails over the entire retirement age distribution of individuals with a spouse in poor health. What is more, the decision of a person with a frail partner to withdraw from work closely follows the retirement of those whose partner enjoys good health. This result raises an interesting question – why the retirement patterns of women and men in couple households remain largely unaffected by spousal health? One explanation could be that their retirement decisions are, indeed, independent of partner's health status. However, this would provide an oversimplified story since the resulting retirement patterns of married women and men with a spouse in adverse health might simply be due to the fact that each of the two effects ─ the complementarity of leisure and personal care effect and the added worker effect ─ impact different persons in different ways, which results in the effects offsetting each other at aggregate level. Verifying any of the two possibilities requires that the retirement decisions of the healthy partner are allowed to differ depending on his/her individual characteristics, other spousal cross effects, as well as, on household-level indicators. The next Chapter shall attempt to model this.

CHAPTER IV: EMPIRICAL MODELS

This Chapter examines the retirement decisions taken within a family by developing two econometric models: a model of the individual retirement age of husbands and wives and a model of couples' retirement. The main rationale behind the choice of estimating two separate models is to allow for studying the individual retirement decision of the male and female partners in turn, and ultimately, the retirement outcome observed at couple-level. Both models incorporate individual characteristics of husbands and wives, as well as spousal health cross-effects.

4A. A simple model of retirement age of husbands and wives

The key assumption of the analysis is that if partners coordinate their retirement timing, as shown in Chapter III, the main driver of this synchronisation would be the spousal age differential. To elaborate more on this, in view of retiring close in time, husbands and wives with age differential other than zero would need to adjust their labour force exit; the scale of this adjustment depending on the magnitude of the age gap between them. In addition to studying the impact of retirement coordination on each partner's individual retirement, the analysis shall attempt at shedding some light on the question whether, *ceteris paribus*, spousal health cross-effect alters in a significant way the other partner's choice of retirement age.

The paper assumes that the retirement age of a husband/wife, is determined by the following model[17]:

$$Retirement\ Age_{it} = \beta_0 + \beta_1 AgeDifferential_{it} + \beta_2 OwnHealth_{it} + \beta_3 SpousalHealth_{it} + \\ + \beta_4 X_{OWN\ it} + \beta_5 X_{SPOUSAL\ it} + \beta_6 X_{CPL\ it},$$

where i stands for husband, respectively wife, and t stands for time-period.

The attention is limited to individuals in dual-working households in the base year of the HRS, who transited into retirement during the subsequent years of the survey. In this way, the model of a husband's retirement age studies 1,287 men out of the 2,140 males in couples, where both partners were employed in wave I; likewise, the model of a wife's retirement age includes all 1,046 retiring females.

The key variable of interest in the model is the spousal age differential, measured as the gap between the husband's and wife's age. The impact of the age differential on a partner's retirement age is allowed to differ depending on whether the wife is older than the husband, whether the difference between the partners' age is relatively low (one to three years), and whether the age differential equals or exceeds the sample mean (four years or more). In addition to this, close attention is paid to the effect of spousal ill health (parameterised as 'fair' or 'poor' health versus 'good', 'very good' or 'excellent') on one's retirement age. As already stated in the variable description section, the major complication when employing self-reported measures of health stems from the fact that causality might possibly go in both directions: from one's own health self-report to retirement and the other way around, making inference problematic. However, there are no reasons to believe that one partner's health self-report would be in any way dependent of the other partner's retirement outcome. In other words, there are no reasons to expect that the impact of spousal health on a husband's or a wife's choice of retirement age will suffer from simultaneity bias.

Further, as suggested by notation, both models include a set of individual characteristics X_{OWN} of the husband/wife, among which race, educational attainment and longest job occupation; in addition, own health insurance status is taken into consideration. In turn, vector $X_{SPOUSAL}$ includes an indicator of spousal health insurance status and allows for the impact of spousal bad health on the other partner's retirement age to differ depending on whether the frail spouse has a valid health insurance or not. It is important to note here that neither spousal health, nor spousal health insurance status (and thus, their interaction) would be dependent of the other partner's retirement outcome, i.e. after the inclusion of a health and health insurance interaction term the estimated effect of spousal health will still be consistent. Couple-specific variables X_{CPL} are accounted for by the inclusion of a household wealth indicator. The model is specified with and without employing time-effects. Finally, the model is tested with and without the inclusion of own age in the X_{OWN} vector (parameterised as age dummies for ages between 54 and 62 years, 62 and 65 years and older than 65 in the husband's model; and ages between 54 and 63 years and above 63 for the wife's model; the omitted category is age below 54).[18]

4B. A model of joint retirement

In order to further examine the issue how the retirement outcome observed at a family level interacts with spousal ill-health, the paper estimates a binary response model of a couple's joint retirement. In particular, a couple's retirement outcome in each time-period is parameterised as a binary variable incorporating the following events: 1) couple retires jointly and 2) partners retire at different points of time. The response probability is assumed a standard normal cumulative distribution function (probit) of the following type:

$$P(\mathit{Joint\ Retirement})_{it} = \beta_0 + \beta_1 \mathit{Husband's\ health}_{it} + \beta_2 \mathit{Wife's\ health}_{it} + \\ + \beta_H X_{Hit} + \beta_W X_{Wit} + \beta_3 X_{CPLit},$$

where i stands for couple, and t stands for time-period.

The sample is restricted to dual-working households at the base year of the HRS, where at least one of the partners exited the labour force into retirement during the subsequent years. 1,505 couples satisfy this condition and are considered for analysis.

The key variables of interest in the model are the health statuses of the male and female partners, measured as poor or fair self-rated health. An important note should be made here: in contrast to the retirement age models where the justification hypothesis is not an issue, it might be a source of concern in the joint retirement model. For instance, if the justification hypothesis is correct, persons willing to retire early (say, prior to their spouse), might overstate their ill health condition in order to justify their labour force exit. In other words, their individual health self-report will be endogenous to the retirement outcome observed at couple level. As a consequence, the impact of a partner's adverse health on the probability that a couple retires jointly will suffer from a simultaneous bias. For this reason, the reliability of the estimation results in the couples' joint retirement model largely rests on the assumption that the justification hypothesis does not hold (as suggested by the research work of Dwyer and Mitchell, 1999).

In addition to the health variables of primary interest, a full set of the husband's demographic and economic indicators X_H, such as, race, educational outcome and longest job occupation, are controlled for. Further, individual characteristics of the female partner X_W are incorporated in the model, among which educational attainment and longest job occupation.[19] Individual health insurance status is expected to play a role in determining whether a couple with a spouse in adverse health, is more or less likely to retire jointly. In this respect, both X_H and X_W include an indicator showing if the male and female partners hold a valid health insurance. As mentioned already, both partners' health insurance statuses are assumed exogenous of their own and, ultimately, of the couple's retirement outcome. Finally, in order to test the hypothesis that families' retirement response to a spousal ill health differs from what the simple added worker effect and complementarity of leisure and personal care theory suggest, the model is expanded with the inclusion of interaction terms between the partners' health and health insurance status.

As already stated, the age gap between the male and female partner is likely to be an important predictor of joint retirements; for this reason, the vector of couple-specific indicators X_{CPL} includes the spousal age differential. The latter is parameterised as age dummies for wife older than the husband; age difference between the partners from one to three years, and differential of four years or more. In addition, an indicator of household wealth is integrated in the X_{CPL} vector. Analogously to the retirement age models, the joint retirement model specification is tested with the inclusion of the couple's mean age[20]. The model is specified with and without the inclusion of year indicators.

The estimation results of the empirical models described above are discussed in the next Chapter.

CHAPTER V: ESTIMATION RESULTS

5A. Retirement age model

The estimation results of the retirement age models for the male and female sub-samples are shown in Tables 3.1 and 3.2 in the Appendix. Both models are robust to employing time-dummies; this is why the paper shall focus on the specification with year-effects only. In order to assess the effect of the spousal age differential on each partner's retirement age the next section comments upon the results of the simplest model specification, reported in Column (2) of the two tables. For simplicity, the analysis assumes that in case of no spousal age differential, married males and females would have retired at the peak of their retirement probabilities, i.e. a year after reaching early retirment age.

The impact of the spousal age differential. Examples of retirement coordination

Let us first examine the least frequent case in the HRS ─ couples where the spousal age differential is negative, i.e. wife is older than her husband. The estimation results in Column (2) of Table 3.2 show that wives who are older than their partners tend to delay their labor force exit, as compared to married women with similar characteristics but the same age as their husband. In particular, the coefficient on the age differential in the female equation is positive 1.05, implying that wives in such couples retire on average a year later, compared to women who have no age differential with their partner, holding other factors fixed. At the same time, Column (2) of Table 3.1 reports that in such circumstances husbands tend to retire on average two years earlier compared to males in couple households, who are same age as their wife, *ceteris paribus*. One particular example of a joint retirement outcome in such households is the case where the wife is three years older than her spouse. In this case, the female partner would retire aged 64, a year later than a woman with similar characteristics who is the same age as her husband. At the same time, the husband would stop work two years before reaching 63, which would bring the two partners' retirement timing together. In contrast, in the absence of retirement coordination the spouses would have retired three years apart, the female partner exiting the labour force first.

Interestingly, Column (2) of Table 3.1 shows that in cases where the age differential between the male and female partner is between one and three years, the husband does not adjust his retirement timing: the coefficient on the age differential in the male equation is insignificant and essentially zero in magnitude. At the same time, however, Column (2) of Table 3.2 reports that wives in such couples retire, on average, a year and two months earlier, compared to the retirement age chosen by women with similar characteristics who are same age as their spouse. One such example is of a couple where the male partner is two years older than his wife, which is the case for 246 couples in the HRS. In such cases the husband has the same retirement pattern as a married men with close characteristics, who lives in a household with no spousal age differential. Hence, the male partner would retire at the peak of the male subsample retirement age ─ 63. At the time of her husband's retirement, the wife would be aged 61 and she would exit the labour force a year earlier, compared to the retirement age she would have chosen had she been same age as her husband, i.e. she would retire aged 62. This way the wife retires a year after her husband, compared to retiring two years apart had she not adjusted her labour force exit.

The most frequently observed case in the HRS is a household where the male partner is four or more years older than his wife. Nearly half of all couples studied in this paper have such an age differential. As the estimation results in Column (2) of Table 3.2 show, the female partners in such couples exit the labour force on average four years earlier, in contrast to females in couples where spouses are same age, *ceteris paribus*. Further, Column (2) of Table 3.1 reports that when the age differential is four years and above, husbands adjust their retirement pattern, as well. In particular, the coefficient on the age differential in the male equation is positive 0.94, implying that married men in such households tend to withdraw from active work about a year later, as compared to men who are the same age as their wives, holding other factors fixed. For instance, a husband who is five years older than his wife would retire roughly a year later, as compared to the retirement age he would have chosen in case of no age differential, i.e. he would retire aged 64. At the same time, the wife would retire four years prior to a woman with similar characteristics, who is the same age as her husband, i.e. she would leave the labour force at 59, same year when her partner reaches 64. In this way both spouses would retire jointly, compared to retiring five years apart had they not harmonised their labour force exit.

To sum up, the coefficients on the age differential in the male and female retirement age models are large in magnitude and highly statistically significant. There is one interesting exception though: the estimation results from the male subsample show that in couples where the husband is slightly older than his wife, he does not adjust his retirement pattern, while the female partner retires earlier. Taken as a whole, the findings of the preceding analysis are in line with the joint retirement hypothesis, suggesting that males and females in couple households alter their retirement decisions in order to bring their labour force exits closer in time.

The next section shall explore how the male and female partner's retirement decision interacts with spousal health depending on the complementarity of leisure and care-giving motives on the one hand, and the added worker effect, on the other.

The effect of spousal health

Males

Columns (1) and (2) of Table 3.1 report the results of the retirement age model estimated on the male subsample when not accounting for the possible interactions between a husband's own health and health insurance status on the one hand, and his wife's health and health insurance status on the other. As can be seen, the coefficient on wife's adverse health is negative 0.10 years and is insignificant at the conventional statistical levels. Thus, this model specification gives grounds to conclude that spousal ill health does not significantly magnify the husband's choice of retirement age.

In contrast, the model specification reported in Columns (3) and (4) of Table 3.1 allows for the impact of spousal health on a husband's retirement decision to differ, depending on whether or not his partner holds a valid health insurance. Similarly as before, the model is robust to inclusion of time dummies; this is why the paper shall only comment upon the results of the specification including controls for year-specific effects.

The coefficient on wife's self rated health reports the partial effect of a wife being in ill health on her husband's retirement age in case she has access to health insurance. The effect is significant at the conventional 5% level and implies that if the female partner holds a valid health insurance, her poor health would induce her husband to leave the labour force about a year earlier, compared to men in couple households, whose wife holds a valid health insurance and reports good health, *ceteris paribus.* This result is consistent with the complementarity of leisure and personal care hypothesis, suggesting that the healthy partner would retire earlier if his/her spouse experiences health problems.

Further, the partial effect of a wife's ill-health on her husband's retirement age in case she has no valid health insurance is obtained as the sum of the parameter estimates on wife's self-report of poor health and the interaction term between her health and health insurance status. As can be seen from Column (4) of Table 3.1 the magnitude of this effect is positive 0.40 and the coefficients are jointly significant at the 1% level. Thus, the estimation results imply that a husband whose wife experiences health problems and has no access to health insurance is likely to retire nearly five months later, as compared to a married man whose wife has no valid health insurance but is in good health, other factors being equal. This finding lends support for the added worker effect, predicting that the healthy partner would delay his/her retirement in response of a spousal adverse health, although the effect being relatively small in magnitude.

Females

The results of the corresponding retirement age model for the female subsample are presented in Table 3.2. The parameter estimates on husband's ill health for the model specification that does not account for the possible spousal health and health insurance status interactions, reported in Columns (1) and (2), are insignificant, small in magnitude and switching signs between the specifications with and without time effects. Therefore, the estimation results suggest no link between a wife's choice of retirement age and her partner's adverse health.

Columns (3) and (4) report the estimation results of the wife's retirement age model, when allowing for the impact of her partner's health to vary depending on his health insurance status. Overall, the coefficients on spousal health in the model estimated on the female sample are somewhat smaller in absolute terms and significance level than those estimated for men. The parameter estimate on spousal health reported in Column (4) is negative in sign, suggesting that having a husband in ill health induces the wife's earlier labour force exit in case he has access to health insurance. Surprisingly, though, the impact is small in magnitude (just above -0.34) and highly insignificant, implying that husband's adverse health plays no major role in his wife's choice of retirement age if he has valid health insurance.

In contrast, the sum of the coefficient on partner's health and the coefficient on the interaction term between spousal health and health insurance status shows an economically and statistically[21] significant effect of a husband's ill health on his wife's choice of retirement age in case he has no access to health insurance. In particular, the estimation results in Column (4) of Table 3.2 predict that, other factors being equal, the female partner would delay her retirement by roughly half a year, in case her husband experiences health problems and has no valid health insurance. This result is in line with the added worker effect hypothesis, suggesting that the healthy partner is more likely to remain employed if his/her spouse is in poor health, presumably in order to provide additional family income.

In the remaining columns of Tables 3.1 and 3.2 the impact of husband and wife's own health is allowed to differ depending on whether or not they have access to health insurance. The corresponding parameter estimates for the effect of spousal health reported in Columns (5) and (6) of the two tables tell a consistent story as the one described above, although the effect of a husband's ill health on his wife's retirement age being only marginally significant in case he holds a valid health insurance. Equally important, the retirement age models appear robust across all specifications, reported in Columns (1) to (6), and the parameter estimates on the spousal age differential remain stable.

Turning briefly to the other parameter estimates allows for commenting upon the effect of one's individual characteristics on his/her retirement age. Under the assumption that one's health and health insurance status are exogenous of one's retirement outcome, a husband's ill health would induce him to leave the labour force nearly a year and four months earlier in case he has access to health insurance, *ceteris paribus*; in contrast, he will not change his retirement age if he holds no valid health insurance. The results for the impact of a wife's adverse on her retirement outcome are virtually the same. In all model specifications access to health insurance facilitates retirement both for men and women and the effect is highly significant, regardless of their health status. Finally, although it is tempting to interpret the coefficient on household wealth as partial effect, it clearly suffers from simultaneity: while higher levels of household wealth may induce early retirement, low retirement age on its own impacts the income level a couple enjoys.

Finally, a source of concern regarding the performance of the retirement age models of husbands and wives is their sensitivity to the inclusion of a control for own age. As can be seen from Table 3.3 this causes most parameter estimates, among which these on spousal health, to generally drop in terms of significance and in magnitude. Moreover, the parameter estimate on spousal health in the male's retirement age model switches signs between the two specifications, implying the existence of an added worker effect, instead of complementarity of leisure and personal care effect, in case the female partner experiences health problems and holds a valid health insurance. This gives rise to a much larger and very significant added worker effect in case wife suffers from ill health and has no access to health insurance – the male partner is predicted to retire almost a year later, other factors being equal. In contrast, the parameter estimates on the husband's adverse health in the wife's retirement age model appear reasonably robust, although being somewhat smaller in magnitude. This specification problem is not uncommon in the retirement literature (see e.g. Gruber and Wise, 2004 through Querios, 2006). The main complication, as discussed by Gruber and Wise, stems from the fact that various characteristics influence one's retirement decision and some of those characteristics are used to construct other variables of interest. This is especially pronounced for variables such as one's age and wage, which are important determinants of all other characteristics driving one's retirement. Hence, the suggestion of Gruber and Wise is that a retirement model specified with age and/or wage might make it hard to separate the effect of other incentives on one's retirement outcome (Gruber and Wise, 2004 through Querios, 2006). This may at least partially explain why the retirement age models are not robust to the inclusion of own age. Yet, the identification remains a worrisome issue and shall be further investigated in the joint retirement model.

5B. Model of joint retirement

Table 4 of the Appendix shows the parameter estimates of the couple's retirement response model, reported together with the corresponding marginal effects. The model appears robust to the inclusion of year-effects; for simplicity the paper comments upon the specification with time dummies only. As in the model of a husband's and wife's individual retirement age, the joint retirement model is specified with and without accounting for the possible health and health insurance interactions. Where applicable the subsequent analysis discusses the results of the couple's retirement model in the light of the findings of the partner's individual retirement age models.

Columns (1) and (2) reports the estimation results of the simplest model specification when not allowing for the impact of a husband's and wife's health on the couple's retirement outcome to differ depending on whether or not they have access to health insurance. The coefficient on the husband's self reported health status is highly statistically significant and its marginal effect is negative 0.13, predicting that the male partner being in ill-health decreases the probability that the couple will retire together by 13 percentage points, *ceteris paribus*. At the same time, the parameter estimate on a wife's health status appears insignificant at the conventional levels and its partial effect is essentially zero in magnitude, suggesting that a wife being in poor health does not alter the retirement outcome observed at couple level. This asymmetry of the couple's retirement response to the male and female partner's adverse health appears somewhat puzzling. One likely explanation, suggested by the previous section, is that model specifications that do not account for the relationship between health and health insurance status fail to capture the true impact of health. The latter is tested by including health and health insurance interaction terms in the joint retirement model, the results of which are reported in Columns (3) and (4) of Table 4 (only the specification with time effects is discussed; the results with no year dummies are essentially the same).

The coefficient on husband's self-rated health in the latter specification measures the partial effect of a husband being in ill health on the family's retirement outcome in case he has access to health insurance. As can be seen from Column (4) a husband's poor health is predicted to have a negative impact on the probability that a couple retires jointly in case he has a valid health insurance, *ceteris paribus;* and the effect is significant at the conventional 5% level. To elaborate more on this, if the male partner experiences some health problems and has access to health insurance, his adverse health reduces the predicted probability that a couple retires jointly by approximately 14 percentage points, other factors being equal. The magnitude of this effect is very significant economically and is comparable with the impact of a negative age differential.

Moreover, the sign of the parameter estimate on the interaction term between a husband's health and health insurance status is negative meaning that in case the male partner is in bad health and has no valid health insurance his adverse health will additionally decrease the probability that the spouses will retire together. More precisely, the estimation results predict that couples, where the male partner experiences health problems while having no access to health insurance, are about 17 percentage points less likely to retire jointly, other factors being equal. It is hard to explain, though, the low magnitude and insignificance of the health and health insurance interaction, which appears to a certain extent contradictory to the empirical results of the retirement age models. In particular, the fact that husband experiencing health problems while having no access to health insurance induces the female partner to stay employed longer makes it reasonable to expect a significant health and health insurance interaction effect on a family level. This inconsistency between the results suggested by the partner's individual retirement age model and the model of couple's retirement might be due to the relatively low magnitude of the added worked effect; yet, it remains problematic to explain.

Further, the estimation results reported in Column (4) of Table 4 show that the parameter estimate on wife's ill-health is highly insignificant and its partial effect is zero in magnitude implying that the female partner's health has effectively no impact on the probability that the couple retires jointly in case she has access to health insurance. One possible reason for this might be found in the results of the retirement age models described in the previous section. In particular, the model of a wife's retirement age suggests that, in case the female partner holds a valid health insurance, her bad health induces her to retire more than a year earlier, *ceteris paribus*. However, the corresponding model of the male partner's retirement has shown that, in addition to impacting her own retirement decision, wife's health status will change the husband's retirement patterns by inducing him to exit the labour force about half a year earlier. Therefore, the observed insignificant household response to the female partner's adverse health in case she has access to health insurance, might possibly result from the fact that in such cases both partners will alter their retirement patterns in the same direction, i.e. they will retire earlier.

Finally, the estimations results of the model of couple's joint retirement imply that the retirement outcome observed on a couple level will remain largely unaffected by the female partner's health also in case she holds no health insurance. In particular, the parameter estimate on wife's adverse health and its interaction with her health insurance status are both individually and jointly insignificant, and the corresponding partial effect is close to zero in magnitude. Therefore, surprisingly, the joint retirement model specified with interactions between a wife's health and health insurance status and the model with no interaction effects tell a consistent story: the female partner's health indicators are irrelevant on a household level.

A brief look at the other parameter estimates shows that the couple's retirement model performs in line with the models of a husband's and a wife's individual retirement with respect to the effect of the spousal age differential. More precisely, compared to families where both partners are the same age, couples where the spousal age differential is other than zero are less likely to retire jointly. This effect is largest in terms of magnitude and significance level in households where wife is older than the husband, which reduces the probability that partners will retire together by nearly 15 percentage points; and smallest in couples where the husband is slightly older than his wife, which lowers the predicted probability of a joint retirement by 8 percentage points (the effect being only marginally significant in the model specification with health and health insurance interactions). Interestingly, lack of access to health insurance seems to negatively impact the probability that the spouses retire together only in the case of males, while there is no similar effect for women.

Lastly, a robustness check is illustrated in Columns (5) and (6) of Table 4 by the inclusion of a control for the couple's mean age. As can be seen, the parameter estimates of this model specification slightly differ in magnitude and significance from those reported in Columns (1) to (4) but the model seems reasonably robust. The point estimates on the spouses' self- reported health statuses and health and health insurance interactions have the expected signs both for the male and female partners, although the latter being statistically insignificant. In particular, the coefficient on husband's ill health, showing the impact of his adverse health on the couple's retirement outcome if he has a valid health insurance, is negative 0.28 with a marginal effect of 11 percentage points – slightly lower that the impact suggested by the model specifications that do not control for the mean age of the family. Similarly to the previous specifications husband experiencing health problems while having no access to health insurance is predicted to further reduce the probability that the partners retire together by roughly 3 percentage points, leading to an overall impact of just over 14 percentage points. As before the health and health insurance interaction terms seem to be insignificant at the conventional statistical levels.

To sum up, the findings for the effect of spousal health on the retirement decisions taken within a couple suggest that not accounting for the possible interactions between spousal health and health insurance status would lead to incorrectly concluding that the choice of retirement age of the other spouse remains unaffected by his/her partner's health. In contrast, allowing for the effect of spousal health to differ depending of the frail spouse's health insurance status, provides evidence that spousal adverse health significantly magnifies the retirement age of the healthy partner. On a couple level, husband being in adverse health is predicted to significantly lower the probability that spouses retire together. At the same time, in all model specifications the parameter estimate on a wife's health self-report is insignificant and close to zero in magnitude, suggesting that her health indicators are irrelevant at a household level. Both partners modifying their retirement decisions towards earlier retirement may account for this outcome if the female partner has valid health insurance; however, the insignificant couple's retirement response in case the female partner has no access to health insurance still remains a puzzle.

The observed differences between the suggestions of the partners' individual retirement models and the model of the couple's retirement outcome raise the question of what is the rationale behind. One evident cause would be that the exogeneity assumption of spousal health fails to hold in the joint retirement model, which leads to a biased estimation of the parameters of interest. Yet, another more sophisticated reasoning may provide a better description of the retirement decisions taken in couple households. To elaborate more on this, as already stated in the previous Chapter, both models of retirement age have as unit of observation individuals; hence, these models describe the choice of retirement timing of husbands and wives by modelling two individual decision-makers, when accounting for the spousal cross-effects and household indicators. In contrast, the couple's retirement model presents the retirement response of a household, i.e. it models the couple as a single decision-maker; again, when taking into consideration various characteristics of the partners and family-level indicators. Concluding on which of the two concepts is the correct one is far beyond the purposes of this paper; however, one message is clear: the retirement behaviour of partnered individuals needs to be to investigated in the context of all spousal interactions in contrast to studying it based on own characteristics only.

CONCLUSIONS AND CAVEATS

US panel data from the RAND version of the Health and Retirement Study has been utilised in this paper to explore the retirement decisions taken in a couple and how these decisions interact with spousal health. The analysis indicates that married individuals do adjust their labour force exit in order to bring it closer in time, thus providing evidence in favour of the joint retirement hypothesis. Even though the number of partners in the HRS who retire together is relative modest – about 10% – the spousal retirement coordination has been evaluated to account for an important part of the observed joint retirements. Further, the adjustment of the retirement timing has been found to substantially vary with the difference between partners' ages, which is broadly consistent with the results reported by Hurd (1990). In addition, this study has been able to assess the magnitude and significance of the retirement coordination separately for women and men, and has found it more important for females.

Moreover, consistent with the findings reported by Coile (2003) analysing data from the HRS, this paper lends support for the complementarity of leisure and care-giving effect for men whose wife is in ill health and has access to health insurance, while there is no similar effect for women. However, in contrast to Coile's results (2004), the analysis presented here has found both women and men likely to remain employed longer in case they have a frail spouse with no access to health insurance. The magnitude of this added worker effect has been assessed to be larger for females, yet relatively low ─ about six months. Further, in line with the suggestions of Jimenez-Martin et al (1999), the health cross-effect appears asymmetric on a couple level: while a husband experiencing health problems significantly lowers the probability that the partners will retire together, households do not seem to respond to a wife's adverse health.

The implications of these findings are twofold. First, in terms of methodology, the results strongly support the idea that spousal cross-effects in general, and spousal health in particular, play an important role in determining the retirement decisions taken within a family. This implies that – in line with the recent trends in the economic literature – the retirement behaviour of married individuals needs to be to investigated in a couple household context, in contrast to studying it on an individual basis only. Further, consistent with the work of Kapur and Rogowski (2006), the analysis presented here suggests that measuring the true impact of spousal health is feasible only when accounting for the interaction effects between one's health and health insurance status.

Secondly, the findings of this study have potential policy implications. More precisely, the fact that men and women in couple households tend to adjust their labour force exit, suggests that any legislative change that affects the retirement decision of a married individual, would have an additional impact on the other partner's retirement, and this is especially pronounced in case of females. Next, the existence of an added worker effect induced by a spousal adverse health, means that older couples are able to, at least partially, make up for the household income loss. At the same time, however, the relatively low magnitude of this effect, especially in case of males, cannot rule out the possibility that elderly families face a real drop in household income if one of the partners experiences health problems and has no health insurance. In this respect, one policy suggestion might be to make government and/or employer-provided retiree health insurance more affordable – converse to the recent trends in the US for a steady decline in retiree health benefits.

The results presented in this paper should be interpreted with care. One issues of concern is the suspected endogeneity of the self-rated health measure, which might have lead to questionable consistency of the estimated impact of one's health on his/her own retirement, as well as, on the retirement outcome observed on a couple level. Another notable limitation is restricting the sample to dual-working couples in the baseline year of the HRS. As can be seen from Table 5 in the Appendix, the sample selection might be problematic in case of females for nearly 20% of all women in the HRS were out of the labour force in 1992; failure to account for this might have resulted in a biased estimation of the parameters of interest. In addition, the existence of high attrition in the HRS sample might have further lead to biased results. However, correcting for attrition bias and sample selection in panel data models are challenging issues; this is the reason why this paper has made no attempt to address them. Lastly, the retirement age models' identification problem arising from the inclusion of own age needs further investigation. One would hope that extensions of this type of research would be able to account for these issues and find the extent of the true spousal retirement coordination and health-cross effect from the rich information available in the HRS.

APPENDIX

Table 1: Variable description

Original RAND HRS name	Variable	Description and Type
Identifiers		
SWhhidpn	Spouse identifier	Spousal household identification number in wave W Continuous
Demographic variables		
Hcpl	Couple household	Whether couple household Binary: 1 if married or partnered; 0 otherwise.
Rwmstat SWmstat	Marital status	Current marital status Categorical: 1=married; 2=married spouse absent; 3=partnered; 4=separated; 5=divorced; 6=separated/divorced; 7=widowed; 8=never married.
RWage Swage	Age	Age at the time of interview Continuous
RAgender SWgender	Gender	Categorical: 1=male; 2=female.
RAracem SWracem	Race	Categorical: 1=white; 2=black; 3=other.
RAedu SWedu	Education	Highest educational attainment Categorical: 1=left high school; 2=GED; 3=high school graduate; 4=some college; 5=college and above.

Note:
Variables refers to:
- HWvar - household, observed in wave W;
- RWvar – respondent, observed in wave W;
- SWvar – spouse, observed in wave W;
- RAvar, SAvar – time-invariant variable, observed in the baseline year only.

Original RAND HRS name	Variable	Description and Type
Health variables		
RWshlt SWshlt	Self report of health	'Would you say your health is: excellent, very good, good, fair or poor?', where: 1=excellent; 2=very good; 3=good; 4=fair; 5=poor.
RWwalksa, SWwalksa, RWwalk1a, SWwalk1a, RWwalkra, SWwalkra, RWsita, SWsita, RWchaira, SWchaira, RWclimsa, SWclimsa, RWclim1a, SWclim1a, RWstoopa, SWstoopa RWarmsa, SWarmsa, RWpusha, SWpusha, RWlifta, SWlifta, RWdimea, Swdimea	Functional impairments (Activities of Daily living)	Whether experiencing any difficulty performing the following activities of daily living (ADLs): walking one block, walking several blocks, walking across a room, sitting for about two hours, climbing one flight of stairs, climbing several flights of stairs, stooping, kneeling or crouching, reaching or extending arms above the shoulder level, pulling or pushing large objects, lifting or carrying more than 10 pounds and picking a dime from a table. Binary: 0=no difficulty; 1=some difficulty.
RWconde, SWconde	Doctor diagnosed health problems	Categorical Ever had been diagnosed with: 1=high blood pressure; 2=diabetes; 3=cancer; 4=lung disease; 5=heart disease; 6=stroke; 7=psychiatric problems; 8=arthritis.
RWconds, SWconds	Change in health conditions	Had any of the above conditions since last wave (sum of conditions since last wave)
Economic variables		
Hatotw	Household wealth	Total wealth of household Continuous
RWjlocc, Swjlocc	Longest job occupation	Categorical: 1=managerial specialty; 2=professional specialty operator/technical support; 3=sales; 4=clerical/administrative support; 5=service provision: household/cleaning/building services; 6=service: protection; 7=service: food preparation; 8=health services; 9=personal services;

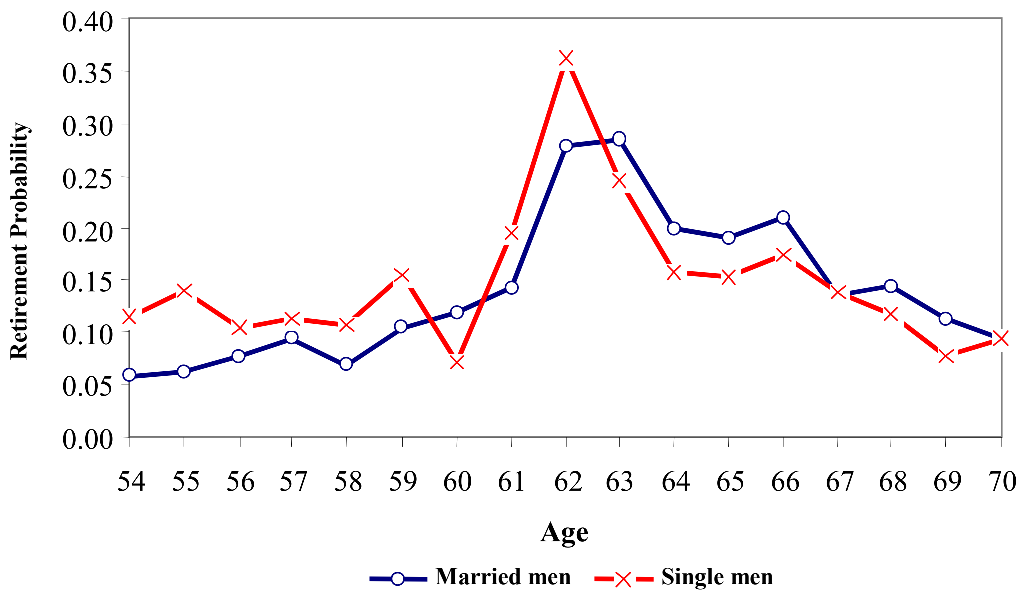
Original RAND HRS name	**Variable**	**Description and Type**
RWjlocc, Swjlocc	Longest job occupation (continued)	10=farming/forestry/fishing; 11=mechanics/repair; 12=construction; 13=precision production; 14=operators: machine; 15= operators: transport etc.; 16= operators: handlers etc.; 17=member of Armed Forces.
RWhigov, SWhigov	Health insurance	Covered by some type of health plan Categorical: 0=no; 1=yes.
RWptyp1 SWptyp1	Type of pension coverage	Categorical: 1=defined benefit; 2=defined contribution; 3=both.
RWsayret SWsayret	Retirement self-report	Whether one considers him/herself retired, partly retired or not retired at all Categorical: 0=not retired; 1=completely retired; 2=partly retired.
RWlbrf SWlbrf	Labour force status	Categorical: 1=employed full-time; 2=employed part-time; 3=unemployed; 4=fully retired; 5=partially retired; 6=disabled; 7=out of the labour force.
Rwretyr Swretyr	Retirement year	Year when retired Continuous
Retirement attitudes		
RAwork62 SAwork62 RAwork65 SAwork65	Self reported probability to work full time after ages 62 and 65	Categorical
Derived variables		
RemplW1, SemplW1	Employment status at the baseline year	Binary: 1=employed in wave I; 0= not employed in wave I.
Hjr	Couple retires jointly	Whether partners retire at the same year between two waves of the HRS Binary: 1=couple retires jointly; 0= partners retire in different points of time.
Hage	Couple's mean age	Simple average of the age of the partners

Table 2: Sample means for males and females in couple and single households

	Males		Females	
	in couple households	in single households	in couple households	in single households
Employed in 1992	1.00	1.00	1.00	1.00
Age in 1992	55.36	55.04	51.36	51.93
Race				
White	0.84	0.75	0.84	0.81
Non-white	0.16	0.25	0.16	0.19
Education				
Lower than high school	0.23	0.30	0.17	0.23
High school graduate	0.31	0.27	0.38	0.37
Some college education	0.21	0.21	0.26	0.17
College and above	0.25	0.22	0.19	0.23
Self reported health status				
Excellent	0.19	0.17	0.20	0.17
Very good	0.33	0.29	0.33	0.28
Good	0.32	0.31	0.29	0.32
Fair	0.13	0.16	0.15	0.18
Poor	0.03	0.07	0.03	0.05
Pension Coverage				
Defined Benefit	0.59	0.62	0.58	0.62
Defined Contribution	0.41	0.38	0.42	0.38
Retirement expectations				
Probability of working full time after age 62	0.54	0.54	0.39	0.58
Probability of working full time after age 65	0.31	0.33	0.20	0.34
Number of observations	2,140	477	2,140	714

Notes:
1. Samples are restricted, as follows:
   - Couple households: dual-working households in Wave I;
   - Single households: males and females in single households employed in Wave I; female sample excludes widowed.
2. Pension coverage and retirement expectations are based on less than a 50% response rate.

Figure 1
Panel 1: Retirement probabilities of married and single men by age



Panel 2: Polynomial smoothing

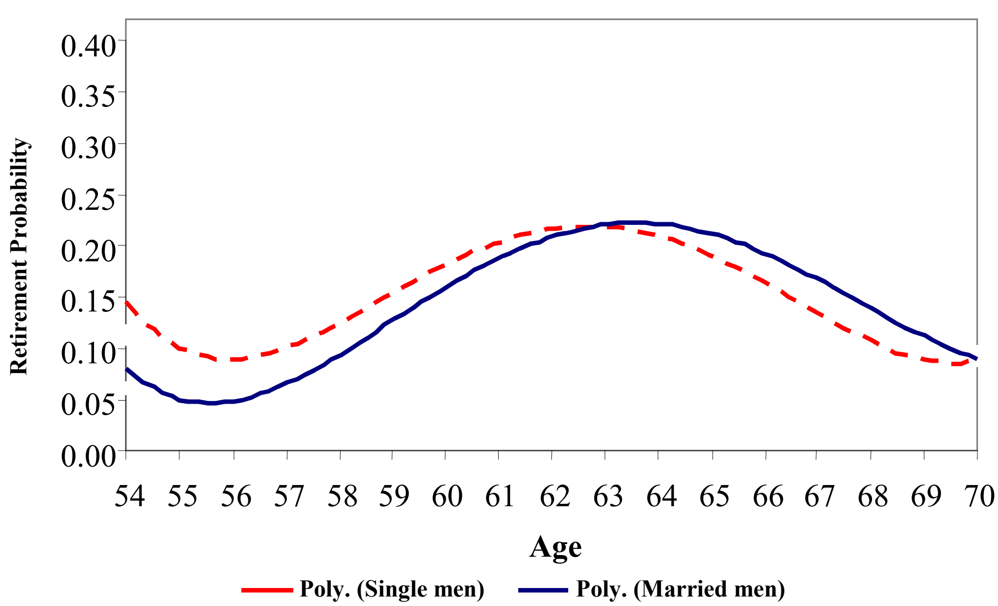
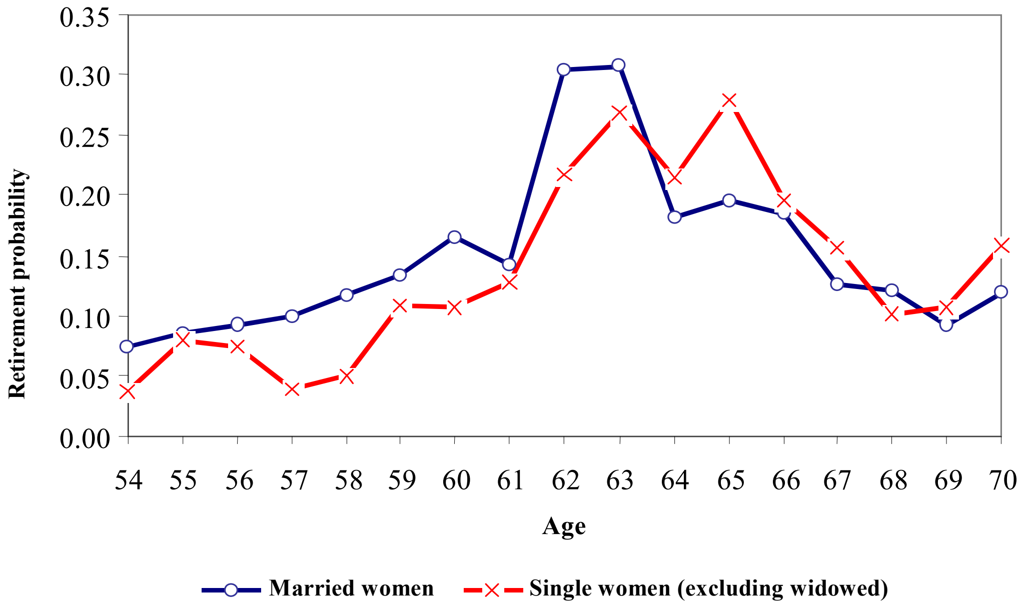


Figure 2
Panel 1: Retirement probabilities of married and single women by age



Panel 2: Polynomial smoothing

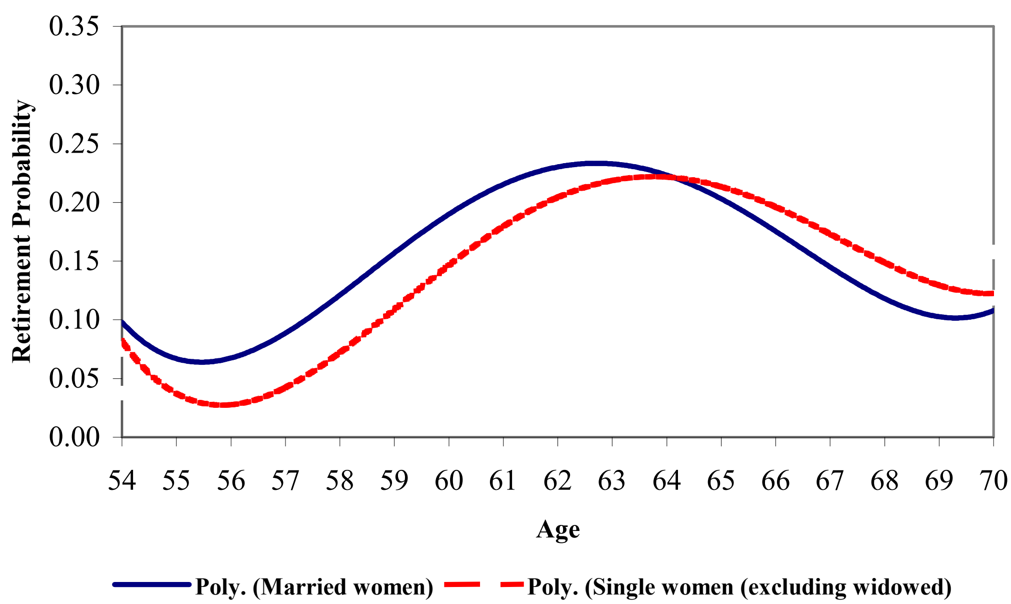
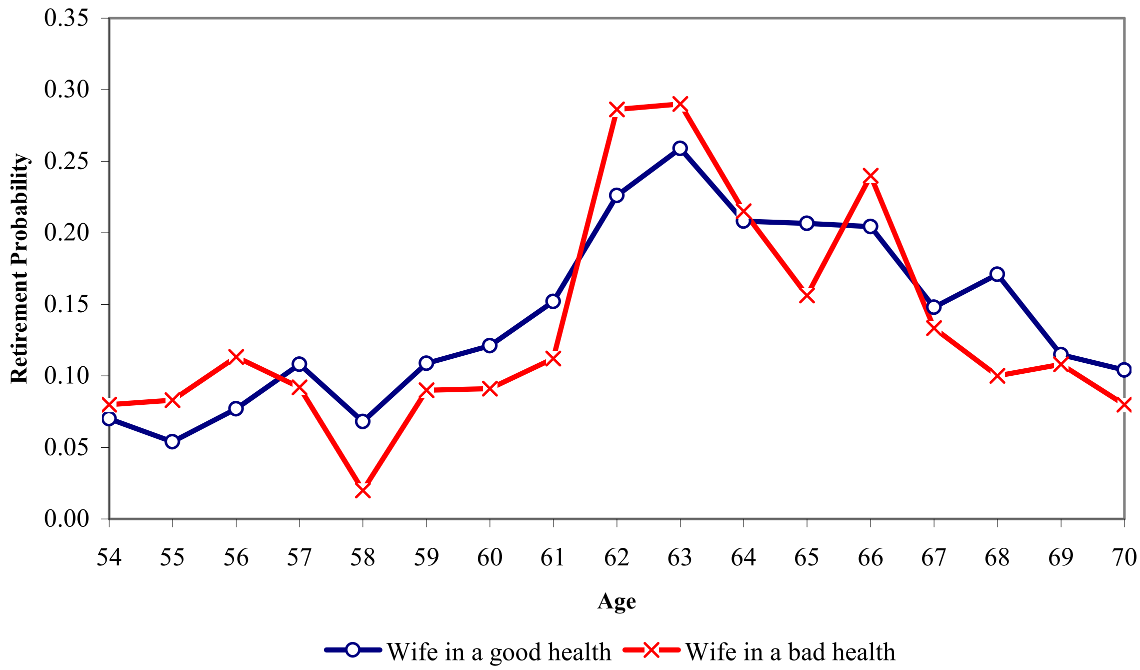


Figure 3: Husband's retirement probabilities by wife's retirement

Figure 4: Wife's retirement probabilities by husband's retirement

Figure 5: Actual vs. independent joint retirements

Figure 6:
Panel 1: Husband's retirement probabilities by wife's health status



Panel 2: Polynomial smoothing

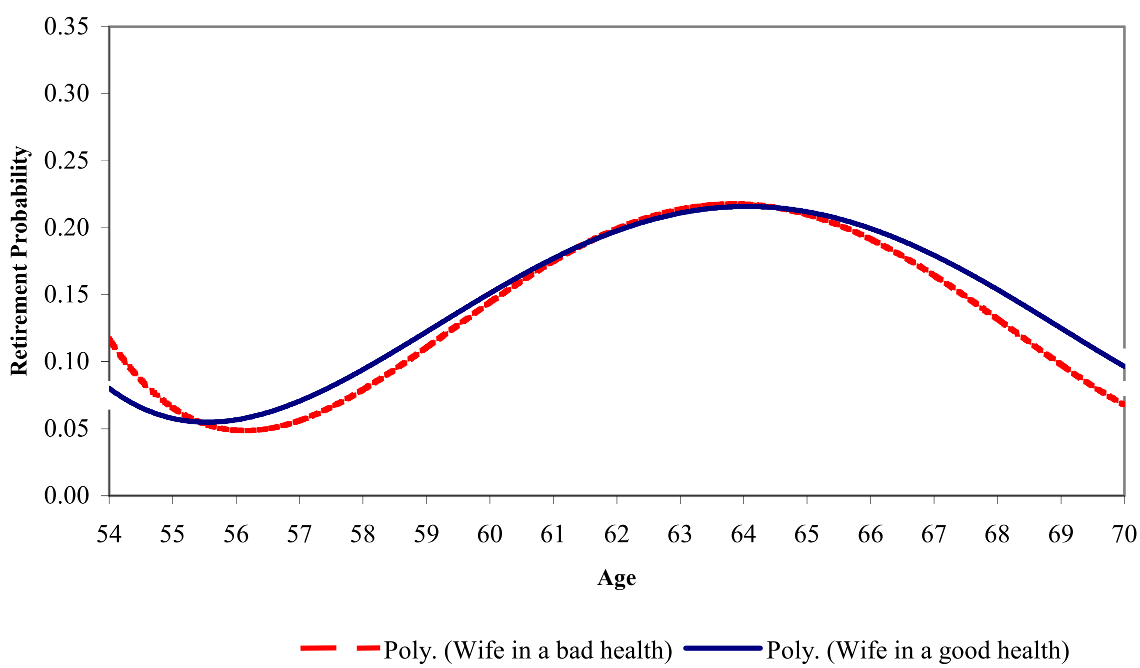
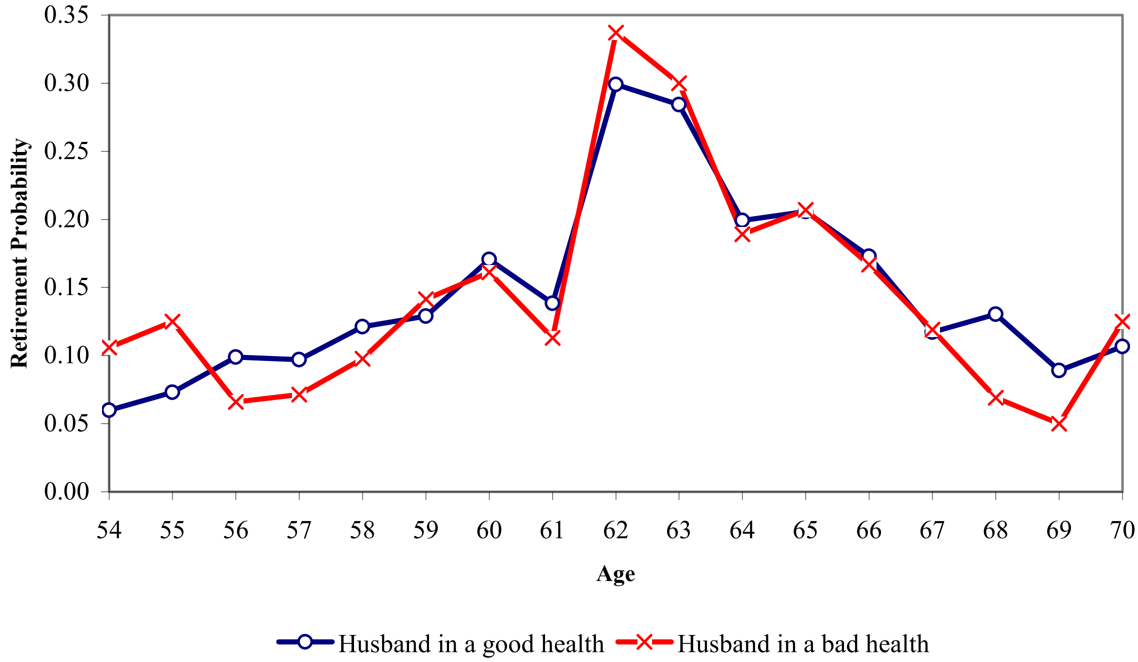


Figure 7:
Panel 1: Wife's retirement probabilities by husband's health status



Panel 2: Polynomial smoothing

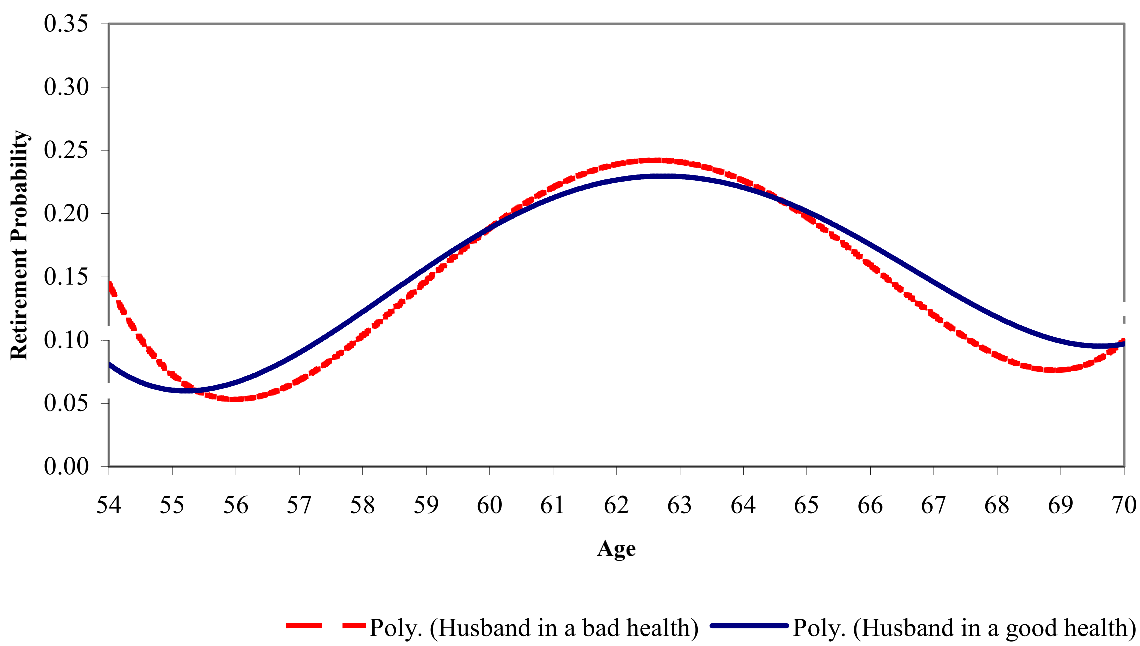


Table 3.1: Estimation results for the model of a husband's retirement age

	(1)	(2)	(3)	(4)	(5)	(6)
Spousal age differential (Reference: same age)						
Age differential<0	-2.1526*** (0.4414)	-2.1347*** (0.4364)	-2.1266*** (0.4333)	-2.1076*** (0.4288)	-2.1194*** (0.4290)	-2.1000*** (0.4235)
4>Age differential>0	0.0435 (0.3572)	0.0820 (0.3356)	0.0846 (0.0846)	0.1248 (0.3346)	0.0669 (0.3504)	0.1064 (0.3382)
Age differential≥4	0.9287*** (0.3224)	0.9429*** (0.3244)	0.9934*** (0.3008)	1.0094*** (0.3029)	0.9788*** (0.3069)	0.9941*** (0.3096)
Household wealth (in USD '0 000)	-1.7889 (1.2037)	-2.4774** (1.3456)	-1.6893 1.267024	-2.3932** (1.1429)	-1.7231 (1.2960)	-2.4379** (1.1650)
Respondent in bad health	-0.7993*** (0.1416)	-0.7990*** (0.1435)	-0.7675*** (0.1436)	-0.7665*** (0.1458)	-1.2819*** (0.2734)	-1.3139*** (0.2715)
Spouse in bad health	-0.0950 (0.2076)	-0.1062 (0.2111)	-1.0159** (0.4325)	-1.0443** (0.4273)	-0.8810** (0.3970)	-0.9004** (0.3908)
Respondent has no valid health insurance	-2.8933*** (0.3223)	-2.6676*** (0.25725)	-2.8592*** (0.3151)	-2.6320*** (0.2496)	-3.1174*** (0.3379)	-2.9042*** (0.2791)
Spouse has no valid health insurance	-1.5536*** (0.2717)	-1.3916*** (0.3638)	-1.8221** (0.2262)	-1.6643** (0.3195)	-1.7868*** (0.2286)	-1.6255*** (0.3241)
Respondent in bad health and has no valid health insurance					1.2927** (0.3264)	1.2997** (0.4416)
Spouse in bad health and has no valid health insurance			1.4222*** (0.3526)	1.4485*** (0.3346)	1.2831** (0.4508)	1.3762** (0.3102)
Time dummies	no	yes	no	yes	no	yes
Log likelihood	-9512.64	-9485.92	-9507.09	-9480.08	-9501.13	-9473.22
Number of observations	**N=1220**	**N=1220**	**N=1220**	**N=1220**	**N=1220**	**N=1220**

Notes:

1. Sample is restricted to males in dual-working households at the baseline year of the HRS, who retired in the subsequent years of the survey. Number of observations 1,287; regressions include fewer observations due to missing data.
2. Regressions control for own: race, educational outcome and longest job occupation.
3. White cross-section standard errors reported in parentheses.

*** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; * denotes statistical significance at the 10% level.

Table 3.2: Estimation results for the model of a wife's retirement age

	(1)	(2)	(3)	(4)	(5)	(6)
Spousal age differential (Reference: same age)						
Age differential<0	1.0834*** (0.2172)	1.0523*** (0.2039)	1.0874*** (0.2193)	1.0570*** (0.2066)	1.1022*** (0.2320)	1.0715*** (0.2192)
4>Age differential>0	-1.1735*** (0.2206)	-1.1979*** (0.2197)	-1.1816*** (0.2121)	-1.2060*** (0.2113)	-1.1549*** (0.2214)	-1.1794*** (0.2204)
Age differential≥4	-4.0278*** (0.3908)	-4.0748*** (0.3926)	-4.0259*** (0.3890)	-4.0725*** (0.3911)	-3.9905*** (0.3897)	-4.0372*** (0.3916)
Household wealth (in USD '0 000)	-2.8177*** (1.1316)	-2.9735*** (1.1421)	-2.8431 (1.1384)	-3.0028** (1.1481)	-2.8512** (1.1349)	-3.0132** (1.1456)
Respondent in bad health	-0.61360** (0.2560)	-0.5897** (0.2537)	-0.6025** (0.2505)	-0.5785** (0.2493)	-1.2909*** (0.3211)	-1.26103*** (0.3259)
Spouse in bad health	0.0109 (0.1536)	-0.0122 (0.1558)	-0.3048 (0.2320)	-0.3363 (0.2337)	-0.2301 (0.2163)	-0.2622 (0.2183)
Respondent has no valid health insurance	-2.0804*** (0.2876)	-1.9827*** (0.3177)	-2.0779*** (0.2867)	-1.9796*** (0.3174)	-2.3242*** (0.2541)	-2.2229*** (0.2908)
Spouse has no valid health insurance	-3.4216*** (0.34061)	-3.2961*** (0.3228)	-3.5680*** (0.3363)	-3.4459*** (0.3106)	-3.5137*** (0.3251)	-3.3914*** (0.3034)
Respondent in bad health and has no valid health insurance					1.2627** (0.4392)	1.2516** (0.4429)
Spouse in bad health and has no valid health insurance			0.9519** (0.4521)	0.9788** (0.4547)	0.8040* (0.4476)	0.8324* (0.4535)
Time dummies	no	yes	no	yes	no	yes
Log likelihood	-7444.661	-7438.83	-7442.88	-7436.95	-7439.38	-7433.49
Number of observations	**N=1018**	**N=1018**	**N=1018**	**N=1018**	**N=1018**	**N=1018**

Notes:
1. Sample is restricted to females in dual-working households at the baseline year of the HRS, who retired in the subsequent years of the survey. Number of observations 1,046; regressions include fewer observations due to missing data.
2. Regressions control for own: race, educational outcome and longest job occupation.
3. White cross-section standard errors reported in parentheses.

*** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; * denotes statistical significance at the 10% level.

Table 3.3: Estimation results for the retirement age models (own age controlled)

	Husband's retirement age				Wife's retirement age			
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Spousal age differential (Reference: same age)								
Age differential<0	-1.0068*** (0.3488)	-0.9854*** (0.3611)	-0.9982*** (0.3444)	-0.9777*** (0.3571)	0.6951*** (0.1639)	0.6976*** (0.1341)	0.7445*** (0.1905)	0.7620*** (0.1945)
4>Age differential>0	-0.0062 (0.2677)	-0.0108 (0.2710)	0.01049 (0.2623)	0.0058 (0.2652)	-0.3062*** (0.10760)	-0.3129** (0.1005)	-0.5217** (0.1346)	-0.4910** (0.1360)
Age differential≥4	0.3558 (0.3269)	0.3555 (0.3350)	0.3897 (0.3154)	0.3887 (0.3230)	-1.4735*** (0.1044)	-1.5012*** (0.1058)	-1.8596*** (0.1403)	-1.7793*** (0.1539)
Household wealth (in USD '0 000)	-2.3440 (1.3325)	-1.9960 (1.1223)	-2.3008* (1.3719)	-1.9664* (1.1663)	-3.7883*** (1.3116)	-3.7829*** (1.3002)	-4.1343*** (1.0637)	-3.9782*** (1.0801)
Respondent in bad health	-0.1172 (0.1079)	-0.1024 (0.1043)	0.1255 (0.2926)	0.1341 (0.2861)	-0.2247 (0.2660)	-0.2046 (0.2661)	-0.6052** (0.2946)	-0.6156** (0.2878)
Spouse in bad health	0.0408 (0.1958)	0.0332 (0.1904)	0.2924* (0.1533)	0.2742* (0.1547)	-0.0494 (0.2584)	-0.0483 (0.1284)	-0.1797 (0.1967)	-0.1621 (0.1998)
Respondent has no valid health insurance	0.5206*** (0.1433)	0.5215*** (0.1340)	0.8176** (0.3094)	0.8122*** (0.2929)	-0.4123*** (0.1056)	-0.5099*** (0.2168)	-0.0220 (0.2189)	-0.0877 (0.2137)
Spouse has no valid health insurance	-0.2554 (0.2614)	-0.3682 (0.2489)	0.2851 (0.3827)	0.1515 (0.4078)	-0.8482*** (0.0680)	-0.9475*** (0.0584)	-1.4560*** (0.0953)	-1.5475*** (0.0548)
Respondent in bad health and has no valid health insurance			0.3851 (0.3418)	0.3761 (0.3276)			0.6104** (0.2886)	0.5800** (0.2933)
Spouse in bad health and has no valid health insurance			0.6777*** (0.2522)	0.6494*** (0.2744)			0.5265* (0.3048)	0.5230* (0.3105)
Time dummies	no	yes	no	yes	no	yes	no	yes
Log likelihood	-9009.608	-8995.17	-9007.01	-8992.74	-7084.93	-7014.83	-7071.64	-7066.54
Number of observations	**N=1220**	**N=1220**	**N=1220**	**N=1220**	**N=1018**	**N=1018**	**N=1018**	**N=1018**

Notes:

1. Sample is restricted to females in dual-working households at the baseline year of the HRS, who retired in the subsequent years of the survey. Number of observations 1,046; regressions include fewer observations due to missing data.
2. Regressions control for own:
   - age (parameterised as age dummies, omitted category age below 54);
   - race, educational outcome and longest job occupation.
3. White cross-section standard errors reported in parentheses.

*** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; * denotes statistical significance at the 10% level.

Table 4: Estimation results for the model of a couple's joint retirement

	(1)	(2)	(3)	(4)	(5)	(6)
Spousal age differential (Reference: same age)						
Age differential<0	-0.3716*** (0.1241) [-0.1474***]	-0.3698*** (0.1246) [-0.1467***]	-0.3716*** (0.1242) [-0.1475***]	-0.3698*** (0.1247) [-0.1467***]	-0.3551*** (0.1241) [-0.1410***]	-0.3519*** (0.1244) [-0.1379***]
4>Age differential>0	-0.1964** (0.0992) [-0.0792**]	-0.1971** (0.0995) [-0.0782**]	-0.1949** (0.0992) [-0.0733**]	-0.1957* (0.0995) [-0.0761*]	-0.1855* (0.0991) [-0.0721*]	-0.1854* (0.0994) [0.0721*]
Age differential≥4	-0.2662*** (0.1001) [-0.1056]	-0.2604*** (0.1006) [-0.1033***]	-0.2641** (0.1000) [0.1049**]	-0.2585** (0.1006) [-0.1025**]	-0.2339** (0.1005) [-0.0910*]	-0.2229** (0.1011) [-0.0885*]
Household wealth (in USD '0 000)	-1.8041*** (0. 6163) [-0.7158***]	-1.6875*** (0.6022) [-0.6693***]	-1.7988*** (0.6165) [-0.7137***]	-1.6822*** (0.6025) [-0.6772***]	-1.8847*** (0.6278) [-0.7587***]	-1.8185*** (0.6189) [-0.7320]
Husband in bad health	-0.3154*** (0.0816) [-0.1251***]	-0.3169*** (0.0815) [-0.1257***]	-0.3600** (0.1419) [-0.1428**]	-0.3600** (0.1436) [-0.1428**]	-0.2777*** (0.1000) [-0.1102***]	-0.2775*** (0.0998) [-0.1101***]
Wife in bad health	-0.0696 (0.0844) [-0.0276]	-0.0723 (0.0844) [-0.0287]	-0.0459 (0.1062) [-0.0182]	-0.0501 (0.1063) [-0.0199]	-0.0952 (0.1363) [-0.0378]	-0.0927 (0.1363) [-0.0368]
Husband has no valid health insurance	-0.2166*** (0.0816) [-0.0859***]	-0.2447*** (0.0815) [-0.0971***]	-0.2749** (0.1631) [-0.1091**]	-0.3012** (0.0708) [-0.1195**]	-0.1269* (0.0776) [-0.0505*]	-0.1253* (0.0779) [-0.0500*]
Wife has no valid health insurance	-0.0104 (0.0692) [-0.0104]	-0.0301 (0.0844) [-0.0119]	0.0678 (0.1606) [0.0269]	-0.0226 (0.0748) [-0.0090]	0.0768 (0.1363) [0.0305]	0.0640 (0.0805) [0.0254]
Husband in bad health and has no valid health insurance			-0.0685 (0.1723) [-0.0272]	-0.0662 (0.1718) [-0.0262]	-0.0802 (0.1733) [-0.0318]	-0.0772 (0.1736) -0.0317]
Wife in bad health and has no valid health insurance			0.0682 (0.1712) [0.0271]	0.0627 (0.1713) [0.0249]	0.0453 (0.1716) [-0.0182]	0.0380 (0.1716) [-0.0153]
Time dummies	no	yes	no	yes	no	yes
Log likelihood	-1335.70	-1335.70	-1278.70	-1275.21	-1231.18	-1228.08
Percent correctly predicted (asymmetric cut-off)	Total: 61.34 Dep=0: 61.52 Dep=1: 59.70	Total: 62.05 Dep=0: 62.34 Dep=1: 59.45	Total: 61.92 Dep=0: 62.29 Dep=1: 58.25	Total: 63.02 Dep=0: 63.43 Dep=1: 59.00	Total: 63.55 Dep=0: 63.12 Dep=1: 57.68	Total: 63.61 Dep=0: 64.10 Dep=1: 59.99
Number of observations	**N=1338**	**N=1338**	**N=1338**	**N=1338**	**N=1338**	**N=1338**

Notes:

1. Sample is restricted to dual-working couples at the baseline year of the HRS, where at least one of the partners retired during the subsequent years of the survey. Number of observations 1,505; regressions include fewer observation due to missing data.
2. Regressions (1) to (4) control for:
   - husband's race, educational outcome and longest job occupation;
   - wife's educational outcome and longest job occupation.

Regressions (5) and (6) control for the above characteristics and couple's mean age.

3. Huber-White robust standard errors in parentheses.

*** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; * denotes statistical significance at the 10% level.

4. Marginal effects reported in quadratic parentheses (marginal effect for household wealth evaluated at the mean).

Table 5: Summary statistics for the full and restricted sample

	Males		Females	
	Full sample	Restricted sample	Full sample	Restricted sample
Labour force status				
Out of the labour force in 1992	0.01	0.00	0.19	0.00
Age in 1992	57.23	55.36	53.10	51.36
Race				
White	0.85	0.84	0.85	0.84
Non-white	0.15	0.16	0.15	0.16
Education				
Some high school	0.32	0.23	0.26	0.17
High school graduate	0.27	0.31	0.36	0.38
Some college	0.19	0.21	0.22	0.26
College and above	0.22	0.25	0.16	0.19
Health				
Self reported overall health status				
Excellent	0.15	0.19	0.16	0.20
Very good	0.28	0.33	0.31	0.33
Good	0.31	0.32	0.30	0.29
Fair	0.18	0.13	0.17	0.15
Poor	0.08	0.03	0.06	0.03
Number of observations	**4491**	**2140**	**4574**	**2140**

Note: The reported number of observations for the full male and female samples exclude observations for which all data is missing.

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ENDNOTES

[1] The RAND Version F, 2006 dataset is an extended version of the HRS, which contains cleaned and processed variables. This version is developed by the RAND Centre for the Study of Ageing (RAND HRS Data Documentation, Version F, 2006).

[2] The paper considers as individuals in couple households these, who live in a married or cohabiting couple, i.e. report either 'married' or 'partnered' as their marital status. For simplicity the paper regards all such individuals as 'husbands', respectively 'wives'. Since the underlying concept of the joint retirement hypothesis is that partners tend to retire jointly in order to spend more time together, individuals who are married but live separately, are not considered for analysis.

[3] While transitions from retirement into employment are interesting by themselves, this paper does not model the re-entry into the labour force after full or partial retirement; thus, the attention here is focused on the transition from active work into retirement. Transitions from retirement back into employment are observed for 1.17% of the males and 2.16% of the females in the studied sample.

[4] The RAND HRS provides extensive information on individuals' labour force status. In particular, it defines as full-time employed an individual working more than 35 hours a week, while an individual working part-time, who does not report oneself retired is considered part-time employed. If, on the other hand, the respondent is working part-time but self-reports him/herself retired, s/he is considered partially retired; individuals, who report themselves retired and do not work, are considered fully retired. Persons, who are not employed and are looking for a full-time job, are considered unemployed, even if they perceive themselves retired, while individuals, who are looking for part-time jobs but consider themselves retired, are defined as partially retired. In addition to this, the RAND HRS distinguishes between individuals, who are disabled or are 'not in the labour force' (RAND HRS Data Documentation, Version F, 2006). See also Table 1 of the Appendix: Variable description.

[5] The retirement year variable is derived in the RAND version for respondents who are completely or partially retired. The question about retirement year immediately follows the answer of considering oneself completely or partially retired; in addition, the RAND version examines several variables for the respondents' labour supply state. If in a subsequent wave the respondent is retired, the date of retirement is compared with the interview date. If the interview date is after the date of retirement, the retirement year variable, RWretyr, is set to the subsequent date. If retirement year is not available from these sources, and the respondent is in a retired employment status, then the retirement year given in combination with employment status is used.

[6] In addition to these indicators, the RAND HRS contains other health variables, such as, health instrument variables (e.g. body mass index, mother/father still alive, number of children, etc.), health care utilisation and medical

expenditure variables, as well as, subjective self-reports for the probability to live over 75 and 85. (RAND HRS Data Documentation, Version F, 2006).

[7] The net value of total wealth is computed as the sum of all wealth components, except the value of the individual retirement accounts and KEOGH plans, less all debt. Wealth and income imputations in the RAND data use an inverse hyperbolic sine transformation method, given by y=log$Y$+Y+1. For values of the outcome Y>>0, the transformation closely mimics the logarithmic transformation; however, for small amounts, on the order of between -$10 and +$10, the transformation differs from the logarithmic transformation. Imputations use a set of explanatory covariates, consistent across all waves.

[8] Self reported probabilities to work full time after ages 62 and 65.

[9] The variable reflects the respondents' answer to the question: 'Do you expect your spouse to retire at about the same time you do?'. The variable is omitted from the analysis due to the excessively low response rate.

[10] The rest are living in couple households, in which the wife was not employed in 1992.

[11] The Old Age Survivors Insurance, more popular as the Social Security system, has age 62 as the early retirement age and age 65 as full retirement age.

[12] Retirement is defined as described in Chapter II. Age 54 is chosen since the mainstream economic literature considers exits from the labour force as retirements only after this age; moreover, retirement probabilities below age of 54 are based on less than 50 observations. All probabilities are computed using the classic probability definition, i.e. the number of favourable outcomes divided by the number of all outcomes. The probabilities are conditional on a number of characteristics: gender, household status, own (and where applicable) spousal employment status in Wave I. (E.g. the retirement probability of a married man at age 54, living in a dual working household in 1992, is computed as the number of all married men aged 54, who lived in dual-working families in 1992 and retire at age 54, divided by the number of all married men in the HRS aged 54, who lived in dual-working families at the base year).

[13] The rest are living in couple households, in which the husband was not employed in 1992.

[14] In particular, the sub-sample of single females includes women, who are divorced, separated or never married. (RAND HRS Data Documentation, Version F, 2006).

[15] This can be seen by consecutively applying the total probability definition and the Bayes' rule:

$$\mathrm{P(HR) = P(HR|WR).P(WR) + P(HR|W\overline{R}).P(W\overline{R})} = \frac{\mathrm{P(HR \cap WR)}}{\mathrm{P(WR)}}\mathrm{P(WR)} + \frac{\mathrm{P(HR \cap W\overline{R})}}{\mathrm{P(W\overline{R})}}\mathrm{P(W\overline{R}) = P(HR \cap WR) + P(HR \cap W\overline{R})},$$

where WR and $\mathrm{W\overline{R}}$ are two mutually exclusive events.

[16] The number of observed transitions into retirement is relatively low, both for husbands and wives, due to the fact that there is severe attrition taking place; it should not be interpreted as implying that partners remain employed until the last wave of the HRS.

[17] The model draws upon the 'Simplified model of retirement age' constructed and estimated by Michael Hurd in ''The Joint Retirement Decision of Husbands and Wives' (1990). The model is modified, hence, the right-hand-side variables employed in the retirement age model in this paper differ from the oroginal ones employed by Hurd.

[18] Own age is not controlled in the model above.

[19] An indicator for wife's race is not included in the model since it is almost perfectly collinear with husband's race.

[20] Defined as the simple average of the husband's and wife's age.

[21] p-value of the Wald test 0.0374.