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SOCIAL SECURITY, PENSIONS AND RETIREMENT BEHAVIOUR WITHIN THE FAMILY

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SUMMARY

This paper estimates a structural model of family retirement using US data from the Health and Retirement Study (HRS). It provides further insight into household retirement decision making and the reasons for interdependence in the retirement decisions of each spouse. Improvements in HRS data and matched employer provided pension histories allow more precise identification of key parameters governing interdependent behaviour within the household.

In an earlier study we found that interdependence was due to preferences rather than coordination of retirement incentives in the budget, and in particular that it is not a correlation in preferences, but the appearance of the spouse's retirement status in the husband's and wife's utility function that is largely responsible for coordination of retirement between spouses. We now find that a measure of how much each spouse values being able to spend time in retirement with the other accounts for a good portion of that apparent interdependence. For the wife, the husband's retirement status influences her retirement decision only if she values spending time in retirement with her husband. For husbands, the effect of having the wife already retired on his retirement decision is roughly doubled if he enjoys spending time in retirement with his wife, but there is some effect even if he does not. This is consistent with our earlier findings that the husband is more influenced by having a retired spouse than the wife is. The increase in the extent of the dependence of the wife's labour supply on the husband's retirement from our past work probably is traceable to better measurement of the opportunity set facing the husband in HRS data.

Once estimated, we use the model to investigate the labour supply effects of alternative social security policies, examining the effect of dividing credit for earnings evenly between spouses, or of basing social security benefits on the amounts accumulated in private accounts. Both policies change the relative importance of spouse and survivor social security benefits within the household and both raise the relative reward to work later in the life cycle. The incentives created are modest, and retirement responds accordingly. Nevertheless, at some ages, such as 65, there may be as much as a 6% increase in the old age work force under privatized accounts. Copyright © 2004 John Wiley & Sons, Ltd.

1. INTRODUCTION

This paper estimates a structural model of family retirement using US data from the Health and Retirement Study (HRS). It provides further insight into household retirement decision making and the reasons for interdependence in the retirement decisions of each spouse. Improvements in HRS data and matched employer provided pension histories allow more precise identification of key parameters governing interdependent behaviour within the household. Once estimated, we use the

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model to investigate the labour supply effects of alternative social security policies, examining the effect of dividing credit for earnings evenly between spouses, or of basing social security benefits on the amounts accumulated in private accounts.

The next section describes the model of joint retirement we estimate. Section 3 discusses the data. Section 4 is a descriptive analysis to investigate just how common joint retirement is. Section 5 presents the estimates and discusses how the better pension data of the HRS has probably led to an increased estimate of the economic incentives on retirement. In Section 6, alternative potential explanations of joint retirement are explored in the context of the model. The effects of potential changes to social security are discussed in Section 7. Section 8 contains a brief conclusion.

2. OVERVIEW OF THE MODEL

We estimate a joint retirement model that mixes non-cooperation with some elements of cooperation, and selfish utility maximization with joint utility maximization.[1] The two spouses share household consumption. They do not consume goods according to own income. For each spouse, utility is a function of own leisure, the value of which may be in part determined by the spouse's retirement status, and household consumption. Although each spouse acts to maximize own utility, they may cooperate if doing so would increase both spouses' utility.

The utility functions for the two spouses are specified symmetrically. The subscript or superscript h signifies a variable that pertains to the husband; w signifies a variable pertaining to the wife.

For the husband we have:

$$U_h = \sum_{t=0}^{T} \left[\frac{1}{\alpha} C_t^{\alpha} + \exp^{(X_t^h \beta_h + \gamma_h L_t^w + \epsilon_h)} L_t^h \right]$$

For the wife, the utility function is:

$$U_w = \sum_{t=0}^{T} \left[\frac{1}{\alpha} C_t^{\alpha} + \exp^{(X_t^w \beta_w + \gamma_w L_t^h + \epsilon_w)} L_t^w \right]$$

C_t is family consumption, and L_t^h and L_t^w are the leisure of the husband and wife. L_t is a dichotomous variable taking on a value of 0 if the individual is working and 1 if retired at time t.[2] Each individual lives T years, and t is time since household formation. The terms $\exp^{(X_t^h \beta_h + \gamma_h L_t^w + \epsilon_h)}$ and $\exp^{(X_t^w \beta_w + \gamma_w L_t^h + \epsilon_w)}$ determine the relative values of retirement to the husband and wife. X_t is a vector of variables that includes a constant term, age, health and birth cohort. ϵ is an individual fixed effect, where higher values of ϵ indicate higher values of retirement to the individual. As age increases, so does the value of leisure. When the value of retirement outweighs the value of the wages from working, the individual retires.

Each spouse's utility may be linked to the other's through three possible channels. Most directly, consumption is family consumption, financed by a joint budget constraint which is described below. In addition, the spouse's utility appears in the exponential expression affecting the value of one's

[1] This model is developed in Gustman and Steinmeier (2000). A more complete description can be found there.

[2] Primarily to keep the model simple enough to estimate, part-time work is ignored and retirement is considered to be an absorbing state; once retired, one cannot return to work.

own leisure. In addition, the fixed effects in their respective utility functions may be correlated for husbands and wives. Lastly, we also include a direct measure of how each spouse values the opportunity to share leisure with the other.

Both the husband and wife maximize their respective utility functions subject to the constraint that lifetime family consumption cannot exceed family income:

$$\sum_{t=0}^{T} d^t C_t \leq Y = \sum_{t=0}^{T} d^t (1 - L_t^w) W_t^w + \sum_{t=0}^{T} d^t (1 - L_t^h) W_t^h$$

In this budget constraint, both consumption and wages are expressed in real terms, and d is the real interest rate. W_t^h and W_t^w are the husband's and wife's compensation amounts when employed. In addition to wages, compensation includes annual accruals to the present values of pensions and social security, due both to own and spouse and survivor benefits.

The sequence of decisions is straightforward. Because there is a common consumption parameter α, both spouses can agree on how to spend a given amount of lifetime family income. Each spouse then chooses own labour supply to maximize his or her own utility function. In choosing own labour supply, we assume that each spouse knows the leisure preferences of the other, and so bases their choice of own labour supply on the labour supply that the other spouse will choose as a result. With each spouse's labour supply entering the utility function of the other spouse, there is the possibility of two or more Nash equilibria. Should there be more than one Nash equilibrium, the one that is advantageous to both spouses will be chosen. When the spouses prefer different Nash equilibria, we assume that the spouse who retires first chooses the retirement date which is advantageous to that spouse, taking into account the retirement date that the second spouse will subsequently choose. There is no uncertainty in the model. Since both spouses know each others' preferences from the start, consumption and labour supply decisions are planned at the beginning of the life cycle with perfect foresight.

Details to the solution of the model are presented in our earlier paper. For family i, let $S_i(\alpha, \beta_h, \beta_w, \gamma_h, \gamma_w)$ be the set of values of $\in_h$ and $\in_w$ in the utility maximization problem which are consistent with retirement between the observed dates. If the retirement age for either spouse is not observed within the survey period (1992–2000), the set will not be bounded; this effectively is how the estimation procedure accommodates cases where a respondent has already retired before the survey starts or still has not retired when last observed.[3] Note that the boundaries of the set depend on the values of the utility function parameters. Further suppose that the values of $\in_h$ and $\in_w$ come from a bivariate normal distribution with density $f(\in_h, \in_w | \sigma_h^2, \sigma_w^2, \rho)$, where σ_h^2 and σ_w^2 are the variances of $\in_w$ and $\in_h$, and ρ is the correlation. Using this notation, the log-likelihood function is

$$\ln \mathcal{L} = \sum_{i=I}^{i=N} \ln \left[\int_{S_i(\alpha, \beta_h, \beta_w, \gamma_h, \gamma_w)} f(\in_h, \in_w | \sigma_h^2, \sigma_w^2, \rho) \, d\in_h \, d\in_w \right]$$

The integrals in the log-likelihood function are evaluated with a standard routine for cumulative joint probabilities of bivariate normal distributions. The likelihood function is maximized using a standard maximization routine, and standard errors for the estimates are calculated by the Berndt–Hall–Hall–Hausman method.

[3] In a similar fashion, if either spouse begins to collect social security disability insurance benefits, the observation is treated as right censored at the time the disability benefits begin. This effectively means that for such couples, the last survey used in determining S_i is the survey before the disability payments start.

3. THE DATA

Our central focus is on results using the HRS.[4] The HRS contains, for most respondents, social security earnings data, which greatly enhances the reliability of earnings figures, and pension descriptions collected from the employers, which provides the means to calculate retirement incentives much more accurately than would otherwise be the case. The model describes joint retirement and implicitly applies to couples in a long-term marriage where both spouses have a long-term commitment to the labour market, and the sample is chosen to conform to these criteria.

The sample is drawn from 4767 couples for whom both spouses completed HRS interviews in 1992. There are three main reasons why couples were dropped from the sample. About 30% (1424) had at least one partner who had changed spouses, either through divorce or widowhood, after age 35, and thus do not qualify as long-term marriages.[5] For these couples, a lifetime planning model that assumes continuous marriage is probably not appropriate. Secondly, about 39% of the couples (1876 observations) were dropped because although they were intact couples, one spouse was not a career worker.[6] For these workers, the whole concept of retirement is nebulous. Third, about 10% of couples (462) were dropped because although they were intact couples and career workers, the employer pension description is missing for the last full-time job.[7] These workers are likely to have strong retirement incentives that are not observed, since it is almost impossible to infer the incentives from the information reported by the respondents alone. Other sources of deletions amount to 290 observations.[8]

The decision to omit observations in the absence of the employer description of the pension is really a trade-off between selection bias due to missing data and bias due to imputations. In a non-linear model like ours, erroneous imputations can have fairly serious consequences. Suppose that the imputed pension plan contains a strong incentive to retire at age 60, the imputed normal retirement age. Suppose further that the actual normal retirement is 58, and that the respondent retires at that age. To the estimation programme, it will appear that the respondent has retired a couple of years before becoming eligible for a substantial increase in pension benefits, and it

[4] The HRS is funded primarily by the National Institute on Aging, with additional support from the Social Security Administration and others.

[5] If we were to include those who changed spouses after age 35, it would be necessary to determine how much wealth each spouse brought into the marriage, how they split obligations to children and other facts that are not available in the HRS data.

[6] We use fairly liberal criteria in defining who is a career worker. Career workers are those who have worked full-time (30 hours or more) more than 50% of the time between age 40 (or 1982, whichever came earlier) and the last year of observed full-time work, as determined by the jobs in the job history and the full-time work answers in wave 3. The last year of full-time work must be no earlier than age 50, or if the worker was not 50 in 1992, he or she must have been working full-time in 1992. This was cross-checked with the social security records if those were available; a worker would not be considered to be a career worker if he or she had zero social security earnings in more than 50% of the years in the above-mentioned interval, unless the individual indicated either government jobs or non-social security jobs. Also, an individual would always be considered to be a career worker if the social security earnings record indicated that he/she earned at least 60% of the real wages earned in the final full-time job for more than 50% of the years in the interval, even if the job history did not indicate enough years. This should catch instances of a series of short jobs which would be missed in the job history.

[7] About two-thirds of older workers have pensions, and the employer plan description is missing for about a third of them. This is little over a fifth, and assuming relatively little duplication of missing pensions within a family, around 40% of two-worker families would have at least one spouse with a missing pension.

[8] Two of these are minor yet not completely trivial. The first is where the number of full-time years is ambiguous because the social security record is missing and either the respondent was not interviewed at wave 3 or the wave 3 information about full-time years is missing (116 observations). The second is where the age in one survey was greater than or equal to the age reported in a subsequent survey (143 observations). This calls into question which age is correct and throws into doubt whether we have the correct age for the timing of retirement.

will infer that the individual is fairly unresponsive to economic incentives to retire. Since the responsiveness to economic incentives is a central issue in retirement research, and since the information about pensions from the respondent interviews is relatively poor, we decided to omit observations where the employer description of the pension is missing.[9]

We are going to compare the findings from the HRS with results from two studies that we undertook with data from the NLS Mature Women's Survey (NLS). The first, Gustman and Steinmeier (2000), uses data through the 1989 wave. The women in the NLS were born between 1923 and 1937 and thus were 52 to 66 years old in 1989. Pension characteristics used in that analysis were self-reported, since plan descriptions were not available at that time from the employers. We know from other work (e.g., Gustman and Steinmeier, 1989, 2004) that there are substantial errors in pension self-reports. Further, respondents can provide only a brief list of determinants of pension benefits. Without a detailed description of the pension from the firm, we had to apply population averages for some pension plan features.[10]

The sample selection criteria for the sample are much the same as for the HRS. Most of the omitted observations come either because the couple had changed spouses late in the working life or because one or the other spouse was not a career worker.[11] The main difference is that in the NLS sample, couples were not deleted because of the lack of employer descriptions of the pension. The final NLS sample contains about 564 couples out of the 2270 couples who were married at the beginning of the survey and participated in the survey through 1989.[12] The percentage retained in the NLS sample is about the same as for the HRS, except for the additional HRS deletions due to lack of employer descriptions of pensions.

Bridging the gap between our earlier study and the present one, we updated our earlier study.[13] The updated study uses the NLS data through 1992 and uses employer descriptions of pension plans when available. Unlike the HRS sample, we did not delete couples if the employer descriptions were missing, since the NLS managed to collect only about 20% of the plans for husbands. This brings up another important limitation of the NLS study, namely it is a study primarily of women. All of the information is collected from the wives, and the level of detail in the questionnaires is much greater for the work histories of the wives than it is for their husbands. Nor are there social security records available to provide an independent check of the work histories. All of this means

[9] The pension plan descriptions are missing disproportionately for employees in small firms, college grads, those with more than $100,000 in assets, long tenure workers, those in manufacturing and management, those earning more than $100,000 per year, those with defined contribution plans only, those with DB plans paying low benefits, and those with $25,000 to $100,000 in DC plans. Regressions are reported in Gustman and Steinmeier (2004).

[10] In that paper, the pension is assumed to be a simple DB plan, where the benefit is the product of a generosity coefficient times years of service times final salary. The generosity coefficient (the term in the benefit formula determining the replacement rate) is calculated from the respondent's report of expected pension benefits, or if expected pension benefits are not reported, a figure of 1.6% is used, which is the median for those plans for which we did have information. We assumed that all pensions reduce benefits from the age of normal retirement by 4.9% per year, a figure found in earlier work by Hatch *et al.* (1981).

[11] Career workers in the NLS refer to those with substantial full-time work experience (at least three consecutive surveys of work after age 40 and at least one-half of the surveys before the last survey with full-time work for women, or at least two-thirds of the surveys before the last survey with full-time work for men), and at least one survey of full-time work after age 50. Full-time work means at least 25 hours of work per week for women or at least 1250 hours per year for men, for whom usual weekly hours are not always available.

[12] Since the initial age of respondents was 30 to 44 in 1967, women who dropped out in the early years of the survey did so before reaching retirement age, and hence these women would not shed much light on a retirement analysis in any case.

[13] The later study was conducted for the US Department of Labor, Bureau of Labor Statistics (Gustman and Steinmeier, 1998). Results from this study have not been published elsewhere.

that there is an asymmetry between the information collected about the wives and the information about the husbands in the NLS.

4. DESCRIPTIVE ANALYSIS

Table I provides some idea as to the timing of retirement of husbands and wives within the HRS sample. By comparing the two parts of the table, we can determine the similarity between the sample used in the estimation, and the full sample including observations with missing data. Part A of the table is based on two-career couples in long-term marriages, while Part B excludes couples for whom we are missing information critical to calculating the budget constraint. It is the sample in Part B that is estimated and analysed later in the paper.

Among the 1467 couples in Part A who meet the definition of long-term couples with a lifetime commitment to the labour market, 514 wives and 476 husbands retired after the last wave of the survey. In addition, 235 wives and 284 husbands retired before the first wave of the survey. For the 435 couples within the box in Part A, both spouses retired between the first interview in 1992 and the last interview in 2000. Of those couples in the box, 205 couples, or 47%, are on the diagonal, which means that those couples retired within the same two-year period.

Though this provides strong evidence that there is a tendency for couples to retire at about the same time, the 47% figure overstates the percentage of couples in the entire sample who will retire

Table I. Retirement tabulations from the HRS by year

A. Including Observations With Missing Budget Constraint Data

	Retirement of Wife						
	Before 1992	1992–1994	1994–1996	1996–1998	1998–2000	After 2000	Sum of Husbands
Retirement of Husband							
Before 1992	107	43	37	25	27	45	284
1992–1994	26	59	15	19	15	29	163
1994–1996	24	21	46	21	21	40	173
1996–1998	22	17	27	53	24	36	179
1998–2000	26	8	17	25	47	69	192
After 2000	30	28	34	40	49	295	476
Sum of Wives	235	176	176	183	183	514	1467

B. Excluding Observations With Missing Budget Constraint Data

	Retirement of Wife						
	Before 1992	1992–1994	1994–1996	1996–1998	1998–2000	After 2000	Sum of Husbands
Retirement of Husband							
Before 1992	48	19	19	12	11	29	138
1992–1994	13	24	8	12	9	14	80
1994–1996	10	4	14	8	11	26	73
1996–1998	10	7	13	25	10	14	79
1998–2000	10	3	9	12	23	39	96
After 2000	12	16	18	24	23	156	249
Sum of Wives	103	73	81	93	87	278	715

together. The couples in the box include only those couples where both spouses elected to retire over the same eight-year period, and this sample thus necessarily includes a greater percentage of couples with joint retirement than will occur with the sample as a whole. As indicated in Section 2, the estimation procedure allows for retirement outside the survey years, so this censoring is not a problem for the estimates.

In Part B there are 715 couples. Thus approximately half of the couples in Part A are lost for not having economic information available. Approximately the same percentage of couples in this group retired within the 1992–2000 period as in Part A. These are the couples within the boxes in the table. Of those in the box in Part B, 45% were along the diagonal that indicates that they retired in the same two-year period. This is comparable to the 47% from Part A of the table. This evidence suggests the two samples, those with complete data and those with missing data, are similar.

5. ESTIMATES OF THE STRUCTURAL MODEL

Columns 1 and 2 of Table II report the maximum likelihood estimates for the parameters of the joint utility function and the associated standard errors using data from the HRS. Following the methodology reported above, the equations for the status of each spouse are jointly determined, allowing for the underlying interaction of the decisions of each spouse in a non-cooperative bargaining model. The estimation searches for the coefficients of each of the parameters appearing in the utility function(s) and the range of fixed effects that are most likely to be associated with the retirement outcomes observed for the couple, conditional on the constraints formed by the wage offer, social security and any pension. The dependent variables in the model are indicators for each spouse of the last observed age of full-time work and the first observed age of continuous retirement. These work/retirement observations correspond to the actual interview dates and are not imputed before, between or after the interview dates.

We estimate a parsimonious specification of the utility function, with only a few right-hand-side variables included in evaluating the utility for each spouse. First there is α, the exponent on the measure of joint consumption. The remaining measures affect the utility of retirement and are different for each of the spouses. For each spouse, the measure of age is continuous, so that no special effects are built into the outcomes through dummy age variables corresponding to spikes in the retirement hazard. Spouse's retirement status is a qualitative binary variable defined as whether the spouse is contemporaneously retired. This measure is interacted with a variable that indicates whether the respondent said that being with the other spouse was a 'very important' benefit of retirement. Health status is an indicator equal to one if the respondent has reported in two successive surveys that health status is fair or poor, or if self-reported health status is fair or poor at the last observed survey. An indicator of vintage (year of birth) is also included.

An important issue is whether the model captures the main features of the raw data as reported in Table I. To examine this, we create a table analogous to Table I by applying the estimates to the couples in the sample. Using the wages, pensions, social security and other characteristics of the couples in the sample, the estimated model is simulated to obtain the percentages of couples retiring at different dates. In Part B of Table I, for 27% of the couples both spouses actually retired between 1992 and 2000. The simulations imply a corresponding figure of 26%. In the same table, among the couples who retired between 1992 and 2000, that is, the couples inside the box in the table, 45% (86 of 192) actually retired within the same two-year period, with an implied

Table II. Parameter estimates for a structural model

	HRS		NLS			
	Coefficient	S/E	Self-reported pensions		Firm-reported pensions	
			Coefficient	S/E	Coefficient	S/E
Joint consumption exponent	−0.58**[a]	0.21	−1.53**	0.40	−1.21**	0.36
Husband's parameters						
Constant	−10.02**	0.85	−20.03**	1.28	−18.34**	1.32
Age[b]	0.45**	0.10	0.61**	0.15	0.68**	0.15
Wife's retirement	0.53*	0.27	0.58	0.52	1.19**	0.41
*Enjoy time with wife	0.34	0.27				
Health[c]	0.71*	0.32	2.05**	0.55	1.88**	0.50
Vintage[d]	0.09*	0.04	0.11*	0.05	0.12*	0.05
Std. dev. of fixed effects	2.69**	0.50	3.41**	0.71	3.51**	0.70
Wife's parameters						
Constant	−9.10**	0.55	−18.62**	0.70	−17.28**	1.04
Age[b]	0.42**	0.08	0.53**	0.10	0.73**	0.17
Husband's retirement	0.06	0.20	0.10	0.35	0.00	—[e]
*Enjoy time with husband	0.52*	0.24				
Health[c]	1.07**	0.33	0.98**	0.32	1.05*	0.41
Vintage[d]	0.12**	0.04	0.08*	0.04	0.11*	0.05
Std. dev. of fixed effects	2.36**	0.41	2.71**	0.47	3.56**	0.76
Correlation of fixed effects	0.19**	0.06	0.24**	0.06	0.09	0.06
Number of observations	715		564		449	
Log likelihood	−1772.39		−1394.47		−1545.24	

[a]** Indicates significance at the 1% level. * Indicates significance at the 5% level. In the estimates, an individual is retired if not working full-time and with no further observations of full-time work.
[b] Age is measured at the time of each survey. The actual age variable is the observed age minus 55. This is done to facilitate the maximization routine, and it has no implications for the estimates other than affecting the constant terms in the linear forms.
[c] Health equals one if in two consecutive surveys (or in the last observed survey) self-reported health is fair or poor.
[d] The vintage variable is the year of birth minus 1930 for the NLS, and the year of birth minus 1936 for the HRS.
[e] In the wife's retirement equation in column 5, the coefficient for the variable indicating the husband is retired is constrained to be zero.

confidence interval of ±7%. The model yields a corresponding figure of 39%, which though a bit lower still produces a very noticeable concentration of retirement along the diagonal where both spouses retire at about the same time.

The estimated coefficients are generally similar to those we found in our earlier study (Gustman and Steinmeier, 2000), which are reported in column 3 of Table II, with the associated standard errors in column 4. Column 5 reports the coefficients obtained extending the NLS data to 1992 and incorporating employer provided pension plan descriptions when available.[14] These earlier studies do not have a measure of whether the respondent enjoys time with the spouse, but dropping this variable in the HRS estimates has only a very minor effect on the other coefficients.

[14] Though generally similar in magnitude, the three sets of coefficients are statistically different. Using the HRS likelihood function, the NLS coefficients yield a likelihood ratio test statistic of 246.4 using the self-reported pensions and 102.5 using the firm-reported pensions. Both are substantially above 32.0, the 1% bound for the χ^2 with 16 degrees of freedom. The story is essentially the same if the spouse enjoyment variable is omitted from the HRS estimates.

The easiest way to interpret the findings is to begin with the coefficient on the age measure. This parameter indicates that the utility of retirement is increasing for the husband by about 57% per year with each year of age ($e^{45} - 1$), and by about 52% per year for the wife ($e^{42} - 1$). The coefficients on the age variable are lower in the HRS than in the NLS.[15] That suggests that economic incentives are likely to be more effective when they are evaluated using utility function parameters from the HRS. The smaller age coefficients in the HRS may reflect the more precise estimation of the pension incentives in the HRS, where pension plan descriptions were exactly matched, in contrast to reliance on crude pension formulas and self-reported plan descriptions in the NLS as in column 3, or a mix between imputed and matched plan descriptions, as in column 5.

For the husband, in the results using HRS data, having a retired wife is equivalent to the effect of being about a year older, or almost two years if the husband thinks that time spent with the wife is valuable. This compares to a value of about a year based on the NLS sample in column 3 using the respondent's descriptions of the pensions and about 1.8 years using the NLS sample with employer plan descriptions. For the wife, having a retired husband has almost no effect unless the wife values the husband's presence, in which case the effect is equivalent to a little over a year of age. In the NLS sample, using either respondent reported pensions or employer plan descriptions, there is almost no effect of having a retired husband on the wife's retirement preferences in the NLS sample. This finding, that in HRS data there is a stronger dependence of the wife's labour supply on the husband's retirement than in NLS data, is in part traceable to better measurement of the opportunity set facing the husband in HRS data. In the HRS, having a retired spouse continues to have a larger effect for men than for women, but the difference between husbands and wives is narrower than we found in our earlier work using NLS data.

In the HRS findings, for the husband the effect of ill health is equivalent to about an additional 1.5 years of age. This is considerably less than we found using the NLS self-reported data seen in columns 3 and 4, where poor health is equivalent to about three years of aging. For the wife, ill health has the same effect as about another 2.7 years of age, which is greater than the NLS results, where ill health is equivalent to about another 1.6 years of age.

Vintage is also significant, as is the standard deviation of the fixed effects. The former result suggests that those in widely different vintages will have considerable differences in taste. However, we should note that both the NLS and HRS are focused on a fairly narrow range of vintages, and extrapolating very far outside this range may be unsound. As for unobserved differences in retirement preferences (the fixed effects), it is clear from the magnitude of the standard deviation of these preferences that variations in taste create a considerable difference in retirement behaviour.

Lastly, the correlation of the fixed effect retirement preferences using the HRS data is almost identical to the value found in our earlier published data. This correlation is considerably weaker in the NLS results with employer provided pension data.

6. SOURCES OF JOINT RETIREMENT

In this model, it is difficult to compare directly the effects of the two spouse retirement variables with the effect of the correlation between the unobserved preferences of the two spouses. Both the

[15] The age coefficients in column 3 translate into percentage effects of 85% for each year of age for men, and 70% for women; while the coefficients in column 5 translate into percentage effects of 96 and 108% for each year of age for men and women respectively.

correlation coefficient and the coefficient of the wife retired variable in the husband's preferences are significant, and the coefficient of the husband retired variable in the wife's preference is close to significant. By themselves, the sizes or even the significance of these measures do not establish which is more important as a determinant of joint retirement. To determine the relative importance of each effect, we conduct simulations of retirement behaviour which include and exclude these effects.

To do the simulations, the procedure is as follows. The simulations are performed for the same couples who are used in the estimation, using the same values for the compensation streams and for the variables in the X vector. A random draw is made from the bivariate normal distribution of $\in_w$ and $\in_h$, allowing for the standard errors of the two $\in$'s and their correlation. This gives the retirement ages of the wife and husband corresponding to these values of the $\in$'s. This process is repeated 10,000 times for each couple in the sample.

Table III reports on the main results of these simulations for the HRS sample and for each of the NLS samples. The simulations in the first row of Table III are for the full model, and in subsequent rows for the model with one or another source of interdependence in preferences eliminated. In the HRS data, 16% of couples are simulated to retire in exactly the same year. Figure 1 shows the simulated distribution of relative retirement ages. The spike in the middle of the figure indicates the joint retirement. The part of the figure to the right refers to cases where the husband retires first, and the part to the left refers to cases where the wife retires first. The figure indicates that the incidence of joint retirement appears to be almost three times as great as the incidence of retirement one or two years apart.

The last row of Table III shows the results of simulations setting to zero the correlation in unobserved preferences and omitting the spouse retirement variables from the utility functions of the two spouses.[16] These results lower the spike at joint retirement to the same level as the adjacent values in Figure 1 and thus exhibit no evidence of joint retirement. Note that this simulation eliminates any preferences for joint retirement, but does not eliminate incentives for joint retirement that operate through the opportunity set. For instance, if couples tended to choose jobs that had the same early retirement date in their pensions, the pensions might still induce a tendency towards joint retirement even if the couples otherwise had no particular preferences towards retiring at about the same time. This simulation, however, effectively rules out the possibility that

Table III. Proportion of households with husband and wife retiring together

	HRS data with employer reported pensions	NLS with self-reported pensions	NLS with employer reported pensions
Full model	0.16	0.11	0.14
Without spouse retirement[a]	0.05	0.05	0.06
Without rho	0.15	0.10	0.14
Without both spouse retirement and rho	0.05	0.04	0.06

[a] When the spouse retirement variable is set equal to zero, the constants are increased so as not to cause an increase in the average retirement age.

[16] In this simulation, the constant in the linear form $X\beta$ is increased to offset the omission of the spouse retirement variable. Otherwise, the omission of the spouse retirement variable would reduce the coefficient of leisure in the utility function and lead to an increase in retirement ages generally.

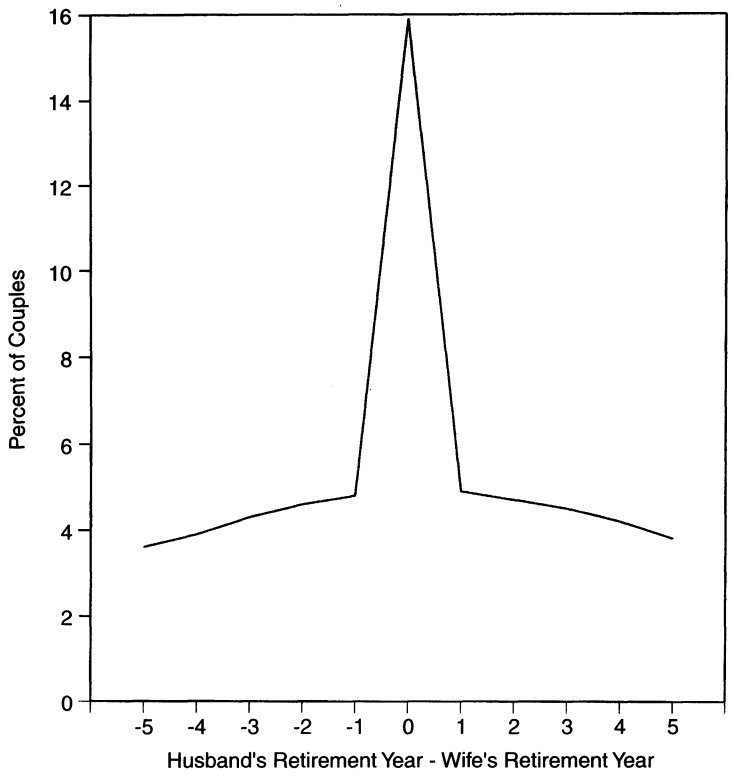

Figure 1. Distribution of differences in retirement dates between husband and wife using the model with the 'enjoy spouse retirement' variable

a significant proportion of joint retirement arises because of coordinated retirement incentives in the compensation profiles.

The other two simulations reported in Table III examine separately the omissions of the spouse retirement variables and setting the correlation of the unobserved preferences to zero. Row 2 omits the spouse retirement variables but keeps the correlation at the value found in the last row of Table II. The correlation parameter has almost no effect on joint retirement. In contrast, when in row 3 we include the spouse retirement variables but omit the correlation, the spouse retirement variables alone account for almost all of the spike in joint retirement that is evident in the full model.

7. SIMULATING THE EFFECTS OF ALTERNATIVE RULES FOR SHARING BENEFITS WITHIN HOUSEHOLDS

Policy makers are concerned with the rules governing the sharing of social security benefits between spouses. Under current provisions, when both spouses are alive each spouse is entitled to an amount equal to approximately half the benefits earned by the other, or to benefits based on own earnings, whichever is larger. When one dies, the other will receive either the survivor benefit (equal to the benefit the deceased was entitled to with some adjustment for early claiming),

or the benefit based on their own earnings, whichever is larger. It can be shown that, because of the progressivity of the social security benefit formula, a low earning worker will receive benefits based on the spouse's earnings if, very roughly, his or her lifetime earnings is one-third or less of the lifetime earnings of the higher earning spouse.

The incentive to continue to work depends in part on the marginal reward to continued work. Part of the marginal reward consists of any increase in social security benefits associated with an additional year of work. This, in turn, depends in a fairly complex way on whether the spouse is the higher or lower earning spouse, whether the spouses are currently eligible for benefits, and on the relative difference between the earnings amounts. At one extreme, an individual over 65 who is collecting spouse benefits would, by working, be giving up current benefits with little or no increase in future benefits. At the other extreme, an individual whose spouse has very low earnings can increase not only his or her own benefits, but also the spouse and potential survivor benefits of the spouse, by working an additional year.

The model we have estimated is structural and as a result allows us to isolate the effects both of current law and of alternative policies governing the crediting of benefits within the household. Some schemes for sharing benefits among spouses, including schemes that would simply divide credit for total earnings in a household evenly between the two spouses, will change the incentives for continued work for each spouse. A policy that would split the credit for earnings by either spouse evenly between both of them would increase the reward for work at older ages. For the higher income spouse, the reason is that after calculating the average indexed monthly earnings (AIME), a person's benefit in 2001 is 90% of the first $6732 of annualized AIME, 32% of the next $33,840, and 15% of the remainder of AIME up to maximum covered earnings. When benefits are jointly credited, this spouse is more likely to be in the 90% bracket rather than the 32% bracket or the 32% bracket rather than the 15% bracket, and this will make benefits respond more strongly with increased earnings from further work. The lower earning spouse may also see an increased incentive to work if he or she would collect spouse benefits under the current system. Under the current system, increased work by such an individual generates little or no increase in future benefits, whereas with a scheme to split the earnings credit, increased work by the lower income spouse would generate increased benefits for both spouses.

As with earnings splitting, private accounts accrue benefits more evenly over the lifetime than under the current 90%, 32%, 15% brackets, again raising the reward to work later in life relative to the current system.[17] The flatter accruals mean that the rewards for working later are higher relative to the rewards to working in the early years, and this should delay retirement.

Table IV presents cumulative retirement probabilities by age from retirement simulations under the current programme and under two alternative proposals. The first two columns present results under the current programme. In the next two columns, the results are simulated for a proposal where the accruals are simply equal to the contributions. This corresponds roughly to a situation where the entire amount is placed in a private account and allowed to grow at the interest rate.[18] In the last two columns, the results pertain to a proposal where there is simple earnings splitting. That is, credited earnings are divided equally between the husband and wife each year.

[17] A caveat should be noted. Because our analysis applies only to couples, it does not project the effects that private accounts would have on the behaviour of single individuals.

[18] Note that whether or not the benefit is annuitized at retirement is irrelevant in this model, since the only thing that matters in the model is the expected present value of the accrual. This also means that any liquidity effects are not accounted for. Thus these findings are not the same as those that would be observed were liquidity constraints included in the model.

Table IV. Effects of alternative social security schemes on cumulative retirements by age

Age	Current system		Private accounts		Divide earnings	
	Husband	Wife	Husband	Wife	Husband	Wife
55	9.7	25.6	8.9	23.8	8.9	23.7
56	13.2	31.3	12.1	29.4	12.3	29.4
57	17.5	37.9	16.3	35.9	16.4	36.0
58	22.9	45.0	21.4	42.9	21.7	43.1
59	29.3	52.0	27.7	49.9	28.0	50.2
60	36.8	59.5	35.0	57.5	35.4	57.9
61	44.1	66.0	42.2	64.6	42.7	65.0
62	51.8	73.8	49.8	71.3	50.3	71.7
63	59.4	79.5	57.4	77.4	58.1	77.8
64	66.5	84.5	64.6	82.7	65.6	83.0
65	74.0	89.0	72.1	87.2	73.7	87.9
66	79.7	92.1	77.9	90.7	79.5	91.4
67	85.1	94.5	83.4	93.4	85.0	94.1
68	89.2	96.3	87.7	95.5	89.1	96.0
69	92.5	97.6	91.2	96.9	92.4	97.4
70	94.2	98.1	93.8	98.0	94.0	98.1

As seen in Table IV, these alternative proposals reduce the ranks of the retired by one to two percentage points. At age 55 men are about eight-tenths of a percentage point less likely to have retired under a privatized system or one where credit for working is evenly split between spouses than under the current system. Wives are almost two percentage points less likely to have retired by age 55 under the alternative systems. By age 60 and 62, men are about 1.5 to 2.0 percentage points less likely to be retired under the alternative proposals. Wives are 2.0 to 2.5 percentage points less likely to have retired under the alternative proposals. Smaller differences are found at age 65. With half the male labour force retired by age 62 and more than two-thirds of the female labour force retired, these 1.5 to 2.0 percentage point differences in the share of the population retired translate into a 3–4% increase in the labour force around age 62. By age 65, given the lower base in number working, an almost two percentage point difference in the proportion retired translates into roughly a 6% increase in the size of the male labour force, and a 1.5 percentage point difference in the proportion retired translates into almost a 14% increase in the number of women working. Comparing outcomes between the two alternative proposals, a slightly larger increase in work effort is found under the private accounts proposal as compared to the proposal to split earnings between spouses.

In addition to the work incentives, either earnings splitting or private accounts will redistribute benefits away from families where one spouse is the primary earner. Under the current system, a family where one spouse is the primary earner will collect more benefits, including spouse and survivor benefits, than will a family with the same total income but where the two spouses earn more nearly equal amounts. In other words, the current system redistributes benefits towards families where one spouse is the primary earner, and this redistribution would be nullified under either of the two alternatives. However, note that this does not mean that a family with two workers is as well off as a family with a single worker earning the same total amount, since the financial calculations do not value the leisure of the stay-at-home spouse.

8. CONCLUSIONS

At the outset of this paper we emphasized the potential importance of having employer provided plan descriptions for identification of the incentives shaping the retirement decision. We find that the age coefficient is estimated to be lower when employer provided pension plan descriptions are matched for a large share of the pension covered workers. The lower age coefficient, in turn, means that retirement is estimated to be substantially more responsive to financial incentives when better measures of these incentives are used. To be sure, we obtain the same qualitative message whether employer provided plan descriptions are available or not. Interdependence in retirement is due to the appearance of spouse's retirement status in the preferences of both the husband and wife. But there is evidence of stronger interdependence in preferences with the improved HRS data, and the suggestion that social security policies change the relative rewards to work by each spouse will have a larger effect on retirement outcomes. In addition, when labour supply histories are reported independently by each spouse, as they are in the HRS, we also obtain an improved understanding of retirement decision making within the household.

Using a measure of how much each spouse values being able to spend time in retirement with the other, we find that this direct measure of preferences accounts for much of the apparent interdependence in retirement within the household. The wife's interdependence is due entirely to the difference between those who value spending time in retirement with their spouse and those who do not. Although it also remains true that husbands are more influenced by whether their spouse is retired than wives are, half the effect for the husband reflects whether he enjoys the idea of spending time in retirement with his wife.

Policy alternatives that would create private accounts under social security, or divide benefits between spouses, encourage work at older ages. Compared to the current system, these policies will have a limited but not trivial effect on retirement outcomes. At some ages, such as 65, there may be as much as a 6% increase in the old age work force under privatized accounts compared to the current social security programme.

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