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Expectation formation of older married couples and the rational expectations hypothesis

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Abstract

This paper tests the Rational Expectations (RE) hypothesis regarding retirement expectations of older married American couples, controlling for sample selection and reporting biases. In prior research we found that individual retirement expectation formation was consistent with the Rational Expectation hypothesis, but in that work spousal considerations were not analyzed. In this research we take advantage of panel data on expectations to test the RE hypothesis among married individuals as well as joint expectations among couples. We find that regardless of whether we assume that married individuals form their own expectations taking spouse's information as exogenous, or the reports of the couple are the result of a joint expectation formation process, their expectations are consistent with the RE hypothesis. Our results support a wide variety of models in economics that assume rational behavior of married couples.

JEL classification: D84; J26
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1. Introduction

Most of the literature on joint retirement is concerned with tests of the appropriate behavioral model to explain actual retirement behavior of married couples. There are

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numerous competing theoretical hypotheses regarding joint retirement behavior that vary in their treatment of the relationship between the utility functions of the two individuals. The motivating empirical phenomenon is that husbands and wives tend to retire together, but there is no conclusive evidence in favor of any of the competing hypotheses, which defend either some type of bargaining model or a leader-follower model, in explaining this phenomenon (Hurd, 1990; Blau, 1997, 1998; Blau and Riphahn, 1999; Berloffa, 1999; Coile, 1999; Gustman and Steinmeier, 2000; Benítez-Silva, 2000; Blundell et al., 2001; Blau and Gilleskie, 2001; Maestas, 2001) Most of these researchers seem to coincide on the importance of complementarity of leisure, and on the relevance of going beyond the individual-based model. In this paper we do not directly address the reasons behind the joint outcomes for married couples, but instead by analyzing joint expectation formation we focus on how the planning behind those future outcomes evolves.

We examine how couples' expectations of retirement evolve over time, and test whether they do in accordance with rationality. We test models of Rational Expectations (RE) using the first five waves of the Health and Retirement Study on married couples' plans for retirement. We do this for married individuals taking the spouse's information as exogenous as well as for joint expectations formation. This is the first study we are aware of that tackles the issue of joint retirement expectations. We find that the results are consistent with the RE hypothesis after controlling for measurement error and sample selection biases. The results are also robust to whether we model the retirement expectations of couples as a sequential or a joint process.

We also analyze the evolution of retirement expectations separately by gender to uncover potential differences in how expectations evolve for married males and females. From this analysis we can infer that the behavior of males and females in marriages, on average, is consistent with a Stackelberg-style leader follower framework that suggests that males are less likely to incorporate their wives expectations when forming their own expectations, since both female expectations and pension information continue to have an independent effect on male expectation formation, even after controlling for prior expectations.

There has been relatively little work done on expectation formation until recently.[1] In a prior paper we build on Bernheim's (1990) model of expectations formation, and on the tradition of Muth (1961), Lucas (1972), and the rational expectations revolution, to argue that testing whether past retirement expectations are a sufficient statistic for current retirement expectations is indeed a test of the RE hypothesis.[2] In that work we also use the

[1] There is a growing body of research that is using expectations variables for a variety of research endeavors, including an analysis of the connection between Social Security expectations and retirement savings (Lusardi, 1999; Dominitz et al., 2002), the relationship between retirement expectations and retirement outcomes (Bernheim, 1989; Dwyer and Hu, 1999; Disney and Tanner, 1999; Forni, 1999; Coronado and Perozek, 2001; Hurd and Retti, 2001; Dwyer, 2002; Mastrogiacomo, 2004), the analysis of fertility expectations and pregnancy outcomes (Van Hoorn and Keilman, 1997; Van Peer, 2000; Walker, 2003), the analysis of wage and income expectations (Dominitz and Manski, 1996, 1997; Das and van Soest, 1997, 2000), and to understand consumption patterns after retirement (Haider and Stephens, 2003; Hurd and Rohwedder, 2003).

[2] See Benítez-Silva and Dwyer (2004) for a discussion of the connections of this approach with the traditional rational expectations literature, Benítez-Silva et al. (2004) for an extension of the individual level results using different expectations questions with different populations and data sets, McCallum (1980) for a survey of the early contributions, Manski (2003) for a recent discussion of the importance of analyzing expectations formation, and Hamermesh (2004) for a short but interesting discussion of subjective outcomes in economics.

longitudinal Health and Retirement Study, and use Instrumental Variables and a modified selection Corrected IV estimator to deal with issues of selection and reporting biases. We find that individual plans are consistent with the RE hypothesis. One potentially important weakness of that work is that we treated each member of a married couple individually and only controlled for marital status, which was often significant in explaining retirement outcomes and expectations. In this work we extend that research to test for RE among married couples, allowing for the possibility that the reported expectations are the product of a potentially complex joint process.

Notice, that we do not directly address the issue of how to include the spouse's information into a behavioral model of retirement. We do not ask how the responses to retirement expectation in the survey came about, but rather test for the rationality of those responses. In doing so, we implement a RE test that suggests that all of the information should be captured in the previous period's expectations, even after controlling for the spouse's expectations, and that regardless of the process that each family member, or the family as a whole, used to come up with an expectation of retirement (either as the result of a bargaining process, or one of them being the leader and the other the follower, or some other process), that the relationship between the retirement expectations of husbands and wives evolves rationally over time.

Our results, along with the work we have done on individual expectations, can be interpreted to support the growing literature on dynamic modeling, and models that rely on some form of a rationality assumption to solve for, simulate, and eventually estimate the parameters of an economic model of behavior. Most of those models when applied to household retirement decisions assume rational expectations, and also assume that some type of joint model is more appropriate. Our prior work could not say anything about joint rational expectations. The results in this paper validate the underlying assumption of joint rationality and therefore support the household level approach to retirement research.

The conceptual model and the econometric specifications are presented in the next section. Section 3 provides information about the data used in the empirical analysis, and Section 4 reports our main findings. Section 5 presents some concluding remarks.

2. A model of expectations formation and a rational expectations test

As in Benítez-Silva and Dwyer (2004), we begin with a simple general model that builds upon the work by Bernheim (1990), but then extend its implications to the analysis of married couples' retirement expectations. Suppose first, that an individual and an econometrician are trying to predict a variable X that the individual has decided will be determined as a function of a sequence of random variables:

$$X = h(\omega_1, \omega_2, \ldots, \omega_T). \tag{1}$$

The sequence of vector-valued variables inside the parenthesis will be observed by the individual at time periods t=1,2,. . .,T. Then the individual will take action X after some or all the ω_t's have been observed. Let $\Omega_t=\{\omega_t\}_{t=1}^{t}$ be the information known at period t and let $\omega_t=(\omega_t^1,\omega_t^2)$ where all of ω_t is observed by the individual, but only ω_t^1 is observed by the econometrician. In the couples' framework, we will need to include spouse characteristics in the information set or the spouse's expectation, depending on the specification. Let then $\Omega_t^1=\{\omega_t^1\}_{t=1}^{t}$. Then we can define

$$X_t^e = E\langle X|\Omega_t\rangle. \tag{2}$$

This is the most commonly used representation of the RE hypothesis, which takes as the rational expectation of a variable its conditional mathematical expectation (Sargent and Wallace, 1976).[3] This specification states that errors in expectations will be uncorrelated with the set of variables known at time t.

Variables included in the vector representing the information set Ω, come from models of individual retirement behavior (see for example Lumsdaine and Mitchell, 1999) and might include socio-economic and demographic characteristics. Using the law of iterated expectations, and assuming that the new information is correctly forecasted by agents (its conditional distribution not just its mean), from (2) we get:

$$E\langle X_{t+1}^e|\Omega_t\rangle = E[E\langle X|\Omega_t,\omega_{t+1}\rangle|\Omega_t] = E\langle X|\Omega_t\rangle = X_t^e, \tag{3}$$

where ω_{t+1} represents information that comes available between periods t and $t+1$. Without this additional assumption expression (3) would not be correct. We are going to test this assumption jointly with the more standard RE hypothesis, once we also assume linearity of the process presented in (3). Notice that the assumption of correct forecasting is in essence no different from the assumption in the early RE literature; namely that forecast errors are normally distributed with mean zero, in a specification that regresses outcomes of a particular market variable on its expectations and a constant.

Then from (3) we can write the evolution of expectations through time as

$$X_{t+1}^e = X_t^e + \eta_{t+1}, \tag{4}$$

where $\eta_{t+1}=X_{t+1}^e - E[X_{t+1}^e|\Omega_t]$, and therefore $E(\eta_{t+1}|\Omega_t)=0$. Notice that η_{t+1} is a function of the new information received since period t, ω_{t+1}. From this characterization of the evolution of expectations we can test the RE hypothesis with the following regression:

$$X_{t+1,i}^e = \alpha + \beta X_{t,i}^e + \gamma\Omega_{t,i}^1 + \varepsilon_{t+1,i}, \tag{5}$$

where α is a constant, and γ is a vector of parameters that estimate the effect of information in period t on period's $t+1$ expectations. The RE hypothesis implies that $\alpha=\gamma=0$, and $\beta=1$. A weak RE test, in the terminology of Lovell (1986) and Bernheim (1990), assumes that γ is equal to a vector of zeros, and tests for $\alpha=0$ and $\beta=1$–effectively testing whether expectations follow a random walk. The strong RE test is less restrictive and also tests for $\gamma=0$.

In this setting married individuals are pooled with those divorced, single or never married, and only a binary indicator for marital status is included in (5) as part of Ω^1. However, in reality, spouse's information is likely to matter, including the spouse's retirement expectation. Assuming that the retirement expectation reported by the spouse is a summary statistic for the variables determining that expectation, we can try to integrate that response into the model presented above.

[3] Schmalensee (1976) using experimental data emphasizes the importance of analyzing higher moments of the distribution of expectations. Due to data limitations we are unable to do so in our analysis.

We can test the RE hypothesis in the same way as for individuals if the spouse's information and information set are exogenous to the individual's process. That means that if the individual takes the spouse's information as given and then forms expectations over that information, the spouse's variables can be treated as any other exogenous variables and the RE test remains essentially the same, where we would be estimating

$$X^{e,s1}_{t+1,i} = 3D\ \alpha + \beta X^{e,s1}_{t,i} + \gamma_{s1}\Omega^{1,s1}_{t,i} + \gamma_{s2}\Omega^{1,s2}_{t,i} + \varepsilon_{t+1,i}, \tag{6}$$

where we will assume that the information set of the variables corresponding to the spouse, $\Omega^{1,s2}$, are summarized by the retirement expectation response we observe in the sample.[4] Therefore, we can then write

$$X^{e,s1}_{t+1,i} = 3D\ \alpha + \beta X^{e,s1}_{t,i} + \gamma_{s1}\Omega^{1,s1}_{t,i} + \gamma_{s2}X^{e,s2}_{t,i} + \varepsilon_{t+1,i}, \tag{7}$$

and predictions of the model are still essentially the same as in the individual level model, $\alpha=\gamma_{s1}=\gamma_{s2}=0$, and $\beta=1$.

However, under the assumption that the spouse's information is summarized by the retirement expectation he or she reported, and if we believe that this expectation may be the product of the couple's joint planning, then the spouse's expectation would be endogenous in the specification of the RE test presented in (7). The error term would be correlated with both the spouse's expectation as well as the previous own expectation, thereby potentially biasing the main coefficient of interest, in this case β.

If couples plan jointly, then a more appropriate test of rationality would test for the rationality of joint expectations, so rather than starting with an expected retirement age for a given individual, X^e_t, we will use a measure of joint retirement age, in this case the average of the spouses' expected retirement age.[5] We will then be estimating the following equation

$$\left(X^e_{t+1,s1} + X^e_{t+1,s2}\right)\Big/2 = \alpha + \beta\left(\left(X^e_{t,s1} + X^e_{t,s2}\right)\Big/2\right) + \gamma_{s1}\Omega^1_{t,s1} + \gamma_{s2}\Omega^1_{t,s2} + \varepsilon_{t+1,i}, \tag{8}$$

where a weak RE test will assume that $\gamma_{s1}=\gamma_{s2}=0$, and test whether $\alpha=0$ and $\beta=1$. The strong RE test will also test whether $\gamma_{s1}=\gamma_{s2}=0$ along with the tests of the constant and the main coefficient of interest, β.

Notice that what we are testing is whether joint expectations evolve over time in a way consistent with rational expectations. Those expectations can be the product of any of the underlying models presented in the literature. However, it is also important to realize that all those models assume the rationality of those expectations, and therefore our test is highly relevant and valuable to that literature.

[4] However, we have estimated a specification where the spouse's variables are directly included as regressors, with essentially no effect on the results. These estimations are available from the authors upon request.

[5] In a previous version we used the difference between the years remaining until the person reaches the expected age of retirement, for each of the spouses. Although a richer measure in some respects, it had some drawbacks like underestimating the number of expectations changes for couples since it recorded no change when both members of the couples changed their expectations in the same way. We thank an anonymous referee for helping us realize this.

2.1. Econometric specifications

Estimating (5), (7), and (8) is in principle straightforward, for example by OLS of the pooled sample of observations controlling for clustering, but the likely presence of measurement error in the dependent variable and its lag and sample selection, complicate the methodology. We are concerned about reporting errors that may be correlated with measurement errors in other factors. We will be assuming that the measurement error that individuals incur is in no way correlated with the rationality of their expectations formation process but has more to do, for example, with the differences across individuals in the true meaning of retirement or particular characteristics of the interview.[6] Since people are reporting expectations over uncertain events, we expect some degree of reporting error that may be correlated with unobserved factors. In fact, Bernheim (1988) finds that expectations are reported with noise. Like in Bernheim (1990), we correct for this problem using instrumental variables analysis. The instruments must be correlated with the expected retirement age but not with the error term or any new information relevant to the $t+1$ expectation, these properties of the instrument set can be formally tested.

We use time t subjective survival to age 85 probabilities and an indicator of smoking behavior as instruments and exclusion restrictions for expected retirement age (exclusion restrictions likely to be correlated with the rate of time preference), and in the specifications of the strong test we also use the individual's age and the age of his or her spouse as instruments. All instruments pass tests of exogeneity (which are in fact tests of the overidentified restrictions) with respect to the error of the structural equation. These tests are possible precisely because the model is overidentified. Among the exclusion restrictions, the survival probabilities can be especially problematic since they are expectations themselves and may be subject to similar measurement error concerns, but they clearly pass the exogeneity tests. Furthermore, the results go through even if we rely on just smoking behavior as an exclusion restriction in a just identified model. We also test for the weakness of the variables used as exclusion restrictions and in all cases we find that we have robust instruments.

In the case of the selection problem we will be making the implicit assumption (and this is true in any econometric application that tries to solve the selection bias problem à la Heckman, 1979, and wants to make a statement about the general population under analysis) that those that do not respond to the question of interest would use the same process to analyze information if they were to actually answer the question as those that answer the question. Meaning that those that we do not observe answering the

[6] Individuals responded with a retirement expectation either as an expected retirement age, an expected year of retirement, or in years left to expected retirement. The last two ways of responding are likely to create considerable rounding errors, since they did not allow individuals to report a month or fractional answers. Also, if measurement error was not a problem we would expect the β coefficient of the IV estimator to be very close to the one from the OLS specification. However, we will see below that the coefficient changes dramatically and approximates the value predicted by the theory. Notice, that nothing constrains the β coefficient of the IV specification to move towards 1, and the fact that it does, can be interpreted as support of our estimation strategy to uncover the structural parameters of the models of rational expectations formation we are presenting.

expectations questions are not following a completely different model (maybe irrational) to decide their retirement ages, but instead that for a number of observable and unobservable reasons they did not report our dependent variable. These unobservables can potentially be correlated with the measurement error in the expectations, which we also control for. In any case, as we will see below we find that sample selection bias is not a concern in our specifications.

Here we follow the methodology presented in Wooldridge (2002, p. 567) to consistently estimate the effect of previous expectations on current expectations for married respondents and married couples. For married respondents, if we assume the spouse's information, in this case the retirement expectations reported by the spouse, is exogenous then we would estimate Eq. (7) by a modified 2SLS procedure

$$X_{t+1,i}^{e,s1} = 3D\ \alpha + \beta X_{t,i}^{e,s1} + \gamma_{s1} Z_{t,i}^{s1} + \gamma_{s2} X_{t,i}^{e,s2} + \varepsilon_{t+1,i}, \tag{9}$$

$$X_{t,i}^{e,s1} = \alpha_2 + \lambda_1 Z_{t,i}^{s1} + \lambda_2 Z_{t,i}^{s2} + \gamma_2 Z_{t,2i} + \varepsilon_{t,2i}, \tag{10}$$

$$Y_i = \alpha_3 + \gamma_3 Z_{t,3i} + \varepsilon_{3i}, \tag{11}$$

where we first estimate the selection Eq. (11) using a probit specification, where Y_i is equal to one if both the expectation in period t and the expectation in period $t+1$ are observed, which means that the individual answers a question about his or her future retirement. Z_3 in Eq. (11) includes all the exogenous variables and any exclusion restriction of the selection equation with respect to the structural Eq. (9). The exclusion restrictions in the selection equation include indicators for whether the father and mother of the respondent reached retirement age.[7] In the selection equation we have decided to only include covariates as of time t, we have experimented with including $t+1$ variables, and also a battery of residuals of the regressions of $t+1$ variables on their lagged values, which are then also included in the main equation. Although some coefficients in the main equation changed as a result of these modifications, the results we report in the paper are robust to this characterization of the selection process.

We then consistently estimate the structural Eq. (9) by performing a modified 2SLS procedure, where the first stage includes as instruments all the exogenous variables used in (11), the Inverse Mills' ratio from the probit equation, and any additional excluded instruments that identify the IV procedure, $Z_{t,2i}$ in (10), the validity of which will be tested.

[7] Defined to be age 65, consistent with a cohort likely to have retired during the 1970s. The inclusion of these variables is not necessary for identification of the selection corrected IV procedure, and if we rely purely on the nonlinearity of the Inverse Mill's ratio results do not change in any significant way. However, we follow the common practice of having some exclusion restriction to help better identify the model. These variables are not significant in a specification where they are included as exogenous variables in the structural equation.

Then, if we estimate the joint expectations model in the presence of measurement error and sample selection, we estimate the structural Eq. (8) with the following system of equations using the same modified 2SLS methodology

$$\left(X^e_{t+1,s1}+X^e_{t+1,s2}\right)\Big/2=\alpha+\beta\left(\left(X^e_{t,s1}+X^e_{t,s2}\right)\Big/2\right)+\gamma_{s1}Z_{t,s1}+\gamma_{s2}Z_{t,s2}+\varepsilon_{t+1,i} \quad (12)$$

$$\left(X^e_{t,s1}+X^e_{t,s2}\right)\Big/2=\alpha+\lambda_1 Z^{s1}_{t,i}+\lambda_2 Z^{s2}_{t,i}+\gamma_2 Z_{t,2i}+\varepsilon_{t,2i} \quad (13)$$

$$Y_i=\alpha_3+\gamma_3 Z_{t,3i}+\varepsilon_{3i}, \quad (14)$$

where the notation borrows from the other two characterizations of the problem, but where (14) is slightly different from (11) given the sample restrictions of this modified specification.

In all cases our main objective is to estimate consistently and efficiently the main parameter of interest, β, and in this paper we concentrate in the estimation of that parameter, and all other parameters in Eqs. (9) and (12). In the latter case we will only report specifications of the IV models instead of the corrected-IV procedure since selection bias does not appear to be a concern in any of the models we have estimated for married couples.

3. The data

The Health and Retirement Study (HRS) is a nationally representative longitudinal survey of 7700 households headed by an individual aged 51 to 61 as of the first round of interviews in 1992–93. So far five waves of data are available, and we use all of them in our analysis.[8] The primary purpose of the HRS is to study the labor force transitions between work and retirement with particular emphasis on sources of retirement income and health care needs. It is a survey conducted by the Survey Research Center at the University of Michigan and funded by the National Institute on Aging. The data for the respondents are merged across waves to construct an unbalanced panel of couples. We also construct a set of consistent variables on different sources of income, financial and non-financial wealth, health, health insurance, and socioeconomic characteristics that will be assigned to each decision maker appropriately.

We include any observation for respondents that are married and both individuals are working, full time or part time, in any wave and non-employed (but searching for jobs) that report retirement plans. We exclude respondents who do not report retirement plans for more than two consecutive years and for whom we observe relevant information, which results in around 11,000 person-period observations once missing values in the main variables of interest are considered. We construct relevant dependent and independent variables for each wave.

[8] Wave 6 of the data, collected in 2002 and early 2003, has recently become available as a preliminary release.

In each wave respondents are asked when they plan to fully or partially depart from the labor force.[9] They are also asked if they thought much about retirement. These questions are not mutually exclusive, but most of the people who have not thought about retirement do not report an expected age.[10] A non-trivial number of individuals report they will never retire, although some of them often change their minds in a later wave and report an age. The analysis could be sensitive to how we treat "never retire" since we need to put in some older age that we select arbitrarily. We have assigned an age of 77 for those who never retire (estimated longevity), but our results are robust to screening out this group and correcting for the selection into it.

Expected retirement ages are distributed similarly to actual retirement ages with peaks at ages 62 and 65 as well as a peak for the bunching at 77 for those who never plan to retire. Over time, and for the cross-section of individuals in each wave, these expectations converge to between 62 and 65 with fewer people maintaining plans of retirement before age 62 or after age 65. Table 1 provides an analysis of how these expectations compare with a number of retirement measures for the population of HRS respondents (see also Panis, 2002). Interestingly, expectations are much more concentrated on the traditional peaks than actual retirement which, except for a measure that uses the age at which individuals start to receive Social Security, is much smoother.

The model specification is not new and comes from the vast existing literature using models of retirement behavior and expectations for individuals and couples (Lumsdaine and Mitchell, 1999). As indicators of economic status, we construct variables of net worth and household wealth. We also control for income of the respondents. As theory suggests, we expect that economic factors have opposing income and substitution effects on work. If the opportunity cost of work is high, respondents will work longer, and if they are wealthy they can afford early retirement. We use health limitations, self-ratings, as well as a number of more objective disease indicators and activities of daily living to control for health status.[11] We also use the self-reported probability of living to age 85 as a measure of the individual's time horizon, which may be correlated with health status. Hurd and McGarry (1995) find this variable to be highly correlated with own health status and parent mortality. Health is expected to affect preferences for work, productivity, and the planning horizon, and its final effect is ambiguous.

Table 2 displays descriptive statistics on the pooled sample by sample selection criteria. Those who have thought about retirement are more educated and in higher socioeconomic groups than those who have not thought about retirement. They are in slightly better health and their spouses' are significantly healthier. They are also more likely to have health insurance tied to work. The average expected age of retirement is 64 for those who have thought about it and 65 for the spouse's of those who have not thought about it. The instruments we will use in the estimations are correlated with the

[9] In wave 1 they were only asked about a full departure.

[10] Many of them report that they will never retire. If they have not given it any thought, and they say they will never retire, we treat their expected retirement age as missing. If they give a retirement age we treat them as non-missing.

[11] Dwyer and Mitchell (1999), for example, discuss incorporating health in models of expected retirement.

Table 1
Distribution of retirement expectation and actual retirement ages

Retirement Age/Range	Expectations of Retirement					Actual Retirement Behavior			
	Exp W1	Exp W2	Exp W3	Exp W4	Exp W5	Self-R Ret.	Social Sec.	Fully Retired	Full and Partial Retirement
Age <50	0.19%	0.25%	0.14%	–	0.23%	9.11%	0.7%	11.8%	13.1%
Age 50	0.54%	0.34%	0.39%	0.22%	0.11%	2.1%	0.2%	2.51%	2.73%
Age 51–54	1.76%	1.14%	0.97%	0.9%	0.69%	11.3%	1.13%	12.7%	14.1%
Age 55	6.07%	4.7%	2.64%	2.24%	1.25%	6.4%	1%	6.18%	6.54%
Age 56–59	7.09%	7.34%	7.19%	5.43%	3.37%	**20.5%**	5.34%	**21.2%**	**21.5%**
Age 60	8.71%	9.71%	7.73%	7.13%	4.68%	7.4%	4.91%	7.22%	6.81%
Age 61	1.24%	1.1%	1.53%	1.48%	1.31%	7.51%	5.57%	6.56%	6.37%
Age 62	**30.8%**	**29.9%**	**27.5%**	**27.3%**	**22.6%**	**15.8%**	**49.4%**	**13.5%**	**12.9%**
Age 63–64	3.62%	4.79%	4.66%	5.29%	5.99%	9.63%	16.4%	9.18%	7.84%
Age 65	**19.2%**	**20.4%**	**23.1%**	**23%**	**23.3%**	**5.67%**	**10.6%**	**4.77%**	**4.54%**
Age >65	20.8%	20.3%	24.3%	27%	35.4%	4.54%	4.63%	4.36%	3.45%
Never	17.1%	15.8%	17.1%	14.8%	17.3%	–	–	–	–
# Obs.	3,708	3,256	2,808	2,230	1,753	5,346	3,967	4,902	6,404
# Not Think	3,273	2,366	2,079	1,668	1,398	–	–	–	–

All respondents.
W1 to W5: the expected retirement age reported in the respective rounds of data. In Wave 1 0.19% of the eligible sample reports they expect to retire before the age of 50.
Self-R Ret.: self reported age of actual retirement in the employment section of the survey. 9.11% of the sample reporting that they are retired is under the age of 50 (pooled sample of all waves). Respondents' answers were non-exclusive. This means that someone under 50 could report at the same time that he or she was retired and working, maybe indicating that they retired from their career job, but they could still be labor market participants.
Social Sec.: age at which they started to receive Social Security benefits. 0.7% of the sample reports receiving Social Security benefits before the age of 50. This is likely to reflect misreports regarding benefits other than retirement.
Fully Retired: answer to a direct question regarding when did they fully withdrawn from the labor force. 11.8% of the sample reporting that they are fully retired is under the age of 50. This could include disable individuals.
Full and Partial Retirement: includes those fully retired and those partially retired. This could include disable individuals.
Not Think: Number of individuals by wave reporting not having thought about retirement.

propensity to have thought about retirement since there are differences in age, smoking behavior and the parents' retirement status in the direction we would expect.

In Fig. 1, we see that many of the married couples in our sample are within 1 year of each other in age (over 30% of the sample), with over 18% being of the same age. In Fig. 2 we difference the years remaining until expected retirement for married respondents, and find that over 15% of them are planning to retire together, and about 30% of them are planning to retire within one year of each other.[12]

Fig. 3 gives us the distribution of our dependent variable for the joint analysis. Almost 50% of the couples have an average retirement age in the 60–64 range with the remainder skewed in the direction of later retirement. None of this is surprising given existing retirement policies and incentives. Interpretation of averaging expectations across spouses

[12] Many couples of the same age that retire in the same year can appear here as retiring within one year of each other because of the timing of their birthdates.

Table 2
Summary statistics by sample selection

Variables	Thought About (N=5,198)	Not Thought (N=6,628)
Retirement Plans and Outcomes		
Expected retirement age	64.641(6.692)	–
Spouse's Expected retirement age	63.933(6.509)	64.872(6.727)
Self employed	0.161(0.368)	0.215(0.411)
Financially Knowledgeable	0.549(0.498)	0.466(0.499)
Economic factors		
Net worth (in $100,000 of 1992)	2.699(4.983)	2.671(5.658)
Housing wealth (in $100,000 of 1992)	0.819(1.324)	0.808(1.518)
Respondent's Income (in $1,000 of 1992)	31.548(46.695)	26.168(41.177)
Has a private pension	0.653(0.476)	0.507(0.500)
Health Insurance		
Employer Provided	0.693(0.461)	0.601(0.490)
Retiree	0.807(0.394)	0.818(0.386)
Government	0.040(0.197)	0.064(0.244)
Private	0.172(0.378)	0.187(0.390)
No health insurance	0.050(0.218)	0.084(0.277)
Spouse	0.307(0.461)	0.343(0.475)
Health factors		
Health limitation	0.187(0.390)	0.179(0.383)
Good-Very Good-Excellent Health	0.892(0.310)	0.868(0.338)
Doctor visits	4.811(6.303)	4.897(7.271)
Probability of living to age 85	0.449(0.299)	0.463(0.303)
High blood pressure	0.187(0.390)	0.193(0.395)
Diabetes	0.049(0.216)	0.053(0.224)
Arthritis	0.241(0.428)	0.244(0.430)
Difficulty walking multiple blocks	0.068(0.252)	0.075(0.263)
Difficulty climbing stairs	0.032(0.177)	0.039(0.193)
Stroke	0.002(0.048)	0.003(0.052)
Heart Problems	0.070(0.256)	0.060(0.238)
Cancer	0.006(0.076)	0.007(0.083)
Smoke	0.183(0.387)	0.210(0.408)
Spouse has a health limitation	0.176(0.381)	0.187(0.390)
Spouse in Good-V. good-excellent health	0.904(0.295)	0.885(0.319)
Demographic factors		
Age	55.974(4.847)	55.802(5.549)
Male	0.518(0.500)	0.481(0.500)
Bachelor's degree	0.306(0.460)	0.243(0.429)
Professional degree	0.118(0.323)	0.077(0.266)
Mother reached retirement age	0.727(0.445)	0.701(0.458)
Father reached retirement age	0.602(0.489)	0.592(0.491)

Working married respondents.

is rather difficult. Therefore, the main objective of Fig. 3 is to show the variation in the dependent variable we use. We have tried alternative definitions of the dependent variable, but there are tradeoffs with any indicator we have developed that includes variation of both spouse's expectations and captures both over time. For example, if we use the variable created to produce Fig. 2, which is intuitively appealing, we lose information. Over time couples can adjust expectations together so that the difference in years left until retirement

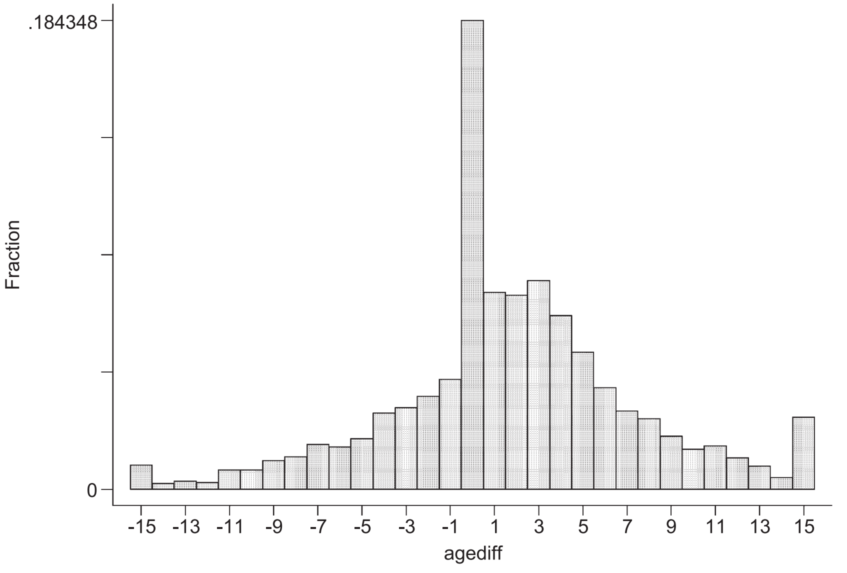

Fig. 1. Distribution of age differences between spouses.

remains constant even though they both responded to new information and changed their plans. So while Average Expected Age is not the most intuitive variable, it captures more of the variation. One drawback of this definition is that possible outliers on individual expectations may be mitigated by the averaging process. For example, if the ages of expected retirement for a husband and wife are 40 and 60, we still get an average age of 50. But these differences often mirror age differences. Implicit in Fig. 3 is the fact that about 24% of the sample is planning to retire at the same age, while in Fig. 2 we saw that only about 15% are planning to retire at the same time. So this does not appear to be much of a problem. The mean difference in expected retirement ages within couples is 0.1 year with a standard deviation of 8 years. The fact that a greater percentage of the sample is

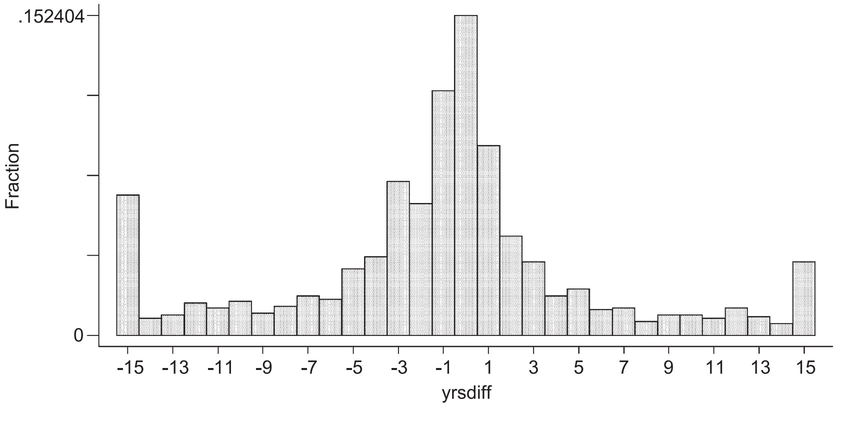

Fig. 2. Differences in years left until expected retirement for spouses.

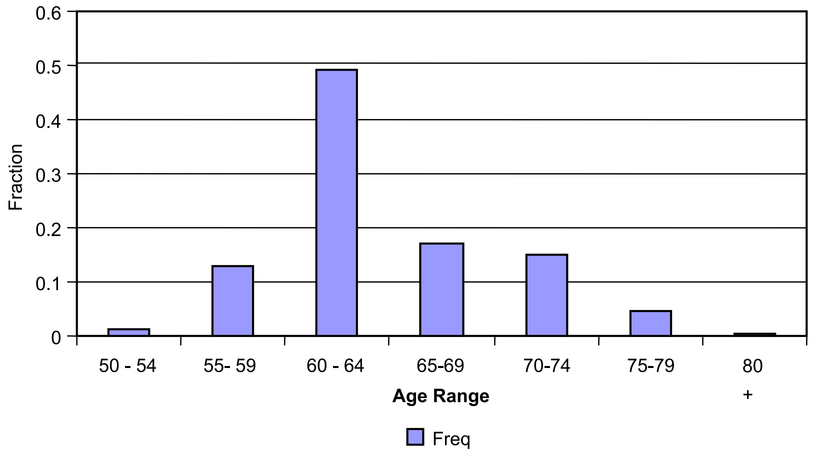

Fig. 3. Distribution of average expected retirement ages for couples.

planning to retire at the same age rather than at the same time is likely to indicate a possible response to incentives given benefit take-up eligibility rules.

4. Empirical results

4.1. Rational expectations of married individuals

Table 3 presents the estimates of Eq. (9), and reports the weak and strong RE tests for the full sample of married individuals.[13] In this case we assume that the spouse's information is exogenous to the formation of expectations of the married individual. The data support the weak and strong RE hypotheses only in the augmented model that corrects for measurement error in the report of expected retirement age by estimating Eqs. (9) and (10) by IV, and also in the model that also corrects for the possible selection bias, resulting in a Corrected IV specification.[14]

[13] In all the tables that follow the level of statistical significance of the coefficients is represented, as is customary, by asterisks indicating significance, or rejection of a null hypothesis of the coefficient being equal to zero. One * indicates significance at the 10% level, two ** indicate significance at the 5% level or better.

[14] The findings are robust across many specifications and empirical techniques including panel data methods. Much of the individual component is explained by time-invarying variables (there is no remaining individual component in a random effects model if we exclude these covariates). The justification for including these time-invarying components in the test is because they may be correlated with other time-varying unobservables. However, due to collinearity problems it was necessary to remove age from the list of covariates in the second stage of the IV and corrected IV procedure, and for comparison purposes also in the OLS estimation. As Vella (1998) discusses, this might be due to the fact that age in our sample has a fairly small range, leading to the apparent linearity of the inverse Mills' ratio. We are therefore assuming that age is a proxy for the information set, and only matters in terms of making you more or less likely to have thought about retirement, but does not directly affect the expected retirement age.

Table 3
Tests of rational expectations- all married respondents

Variables	Pooled OLS	IV	Corrected IV
Weak RE Test (H_0: Exp_t=1):	Reject	Cannot Reject	Cannot Reject
Constant	30.747(1.336)**	−5.801(2.551)**	−4.520(3.140)
Expected Retirement Age_t	0.5243(0.021)**	1.098(0.040)**	1.079(0.050)**
Inverse Mills' Ratio	–	–	−0.088(0.505)
Test of Over-Id Restrictions	–	Cannot Rej. P-v=.1333	Cannot Rej. P-v=.2109
Test of Weak Instruments	–	Reject P-v=.0000	Reject P-v=.0000
Strong RE Test (H0: Exp_t=1):	Reject	Cannot Reject	Cannot Reject
Constant	29.747(2.517)**	2.184(4.350)	3.956(6.864)
Expected Retirement Aget	0.454(0.039)**	1.041(0.085)**	1.059(0.083)**
Expected Ret. Aget of the Spouse	0.095(0.025)**	−0.057(0.036)	−0.0591(0.036)
Inverse Mills' Ratio	–	–	−1.681(3.152)
Economic factors at time t			
Net Worth (in $100,000)	0.045(0.038)	0.077(0.041)*	0.078(0.041)*
Respondent Income (in $1,000)	−0.002(0.002)	−0.002(0.001)	−0.002(0.002)
No Health Insurance	1.147(1.291)	0.466(1.456)	0.626(1.565)
Private Health Insurance	−0.027(0.335)	−0.624(0.411)	−0.603(0.418)
Self-employed	0.710(0.514)	−0.157(0.586)	−0.244(0.582)
Pension	−1.531(0.365)**	−0.747(0.411)*	−1.162(0.959)
Health factors at time t			
Health limitation	−0.408(0.327)	−0.396(0.358)	−0.361(0.354)
Good-V.Good-Exc. Health	−0.388(0.457)	−0.277(0.508)	−0.421(0.533)
Doctor visits	−0.004(0.024)	0.026(0.025)	0.027(0.025)
High blood pressure	0.261(0.341)	0.091(0.397)	0.022(0.410)
Diabetes	−0.755(0.583)	−1.219(0.753)	−1.245(0.752)*
Cancer	0.516(1.442)	0.639(1.252)	0.575(1.265)
Stroke	−0.350(1.288)	−0.690(0.956)	−0.128(0.911)
Heart Problems	0.500(0.602)	0.299(0.727)	0.184(0.725)
Arthritis	−0.187(0.313)	−0.498(0.365)	−0.562(0.381)
Difficulty walking multiple blocks	0.081(0.607)	0.431(0.685)	0.240(0.698)
Difficulty climbing stairs	1.406(0.724)*	0.296(0.782)	0.267(0.777)
Demographic factors at time t			
White	−0.099(0.352)	0.259(0.414)	0.102(0.442)
Male	1.518(0.291)**	0.056(0.357)	−0.134(0.491)
Bachelor's Degree	0.364(0.339)	−0.020(0.383)	−0.099(0.390)
Professional Degree	−0.505(0.409)	0.085(0.458)	−0.028(0.564)
Wave 1–2	−0.776(0.319)**	−0.199(0.373)	−0.106(0.397)
Wave 2–3	0.017(0.357)	0.131(0.426)	0.038(0.464)
Adjusted R^2	0.3119	–	–
Test of Joint Sig. of Covariates	Reject P-v=.0000	Cannot Rej. P-v=.683	Cannot Rej. P-v=.7083
Test of Over-Id Restrictions	–	Cannot Rej. P-v=.1796	Cannot Rej. P-v=.1217
Test of Weak Instruments	–	Reject P-v=.0000	Reject P-v=.0000
Number of Observations	1,524	1,462	1,456

Expected Retirement Age at time t+1.

Note: These are the results of 6 different models, 3 weak tests where there are no other regressors and 3 strong tests. The 3 columns show estimates of the following models: OLS, assuming no measurement error in the lagged dependent variable or sample selection bias; IV controlling for measurement error in the lagged dependent variable; and Corrected IV controlling for sample selection and measurement error in the lagged dependent variable.

Notice that we perform an F-test based on the null hypothesis that β=1 in Eq. (9), to test the RE hypothesis. We obtain coefficients for β of 1.08 for the weaker test, which cannot reject the hypothesis that expectations follow a random walk. For the pooled OLS estimation, which estimates Eq. (9) without jointly estimating it along with Eq. (10) or (11), the weak test is effectively a unit root test, and as such, and following the literature on testing unit roots in panel data surveyed by Bond et al. (2002), we have to perform a correction to obtain the appropriate critical value. However, this matters very little since the unit root hypothesis is soundly rejected.

In the OLS specification of the strong test, the spouse's previous expected retirement age plays a significant role in explaining future expectations along with own prior expectations. However, once we control for the measurement error that is potentially biasing these results, the effect of the spouse's information is not significantly different from zero, therefore this additional restriction of the RE hypothesis cannot be rejected, which suggests that the informational content of that variable is already embedded in the respondent's own expected retirement report.

For the strong test we estimate the model of Eqs. (9), (10), (11), using the Corrected IV procedure. The β parameter is estimated to be equal to 1.059, which fails to reject the RE hypothesis. Notice, however, that selection bias does not seem to be a major problem, since the Inverse Mills' ratio is estimated to be statistically indistinguishable from zero. The IV estimator delivers essentially the same results with a β parameter of 1.041. This is true in all specifications to follow, so we do not report the corrected IV results from hereon but they are available from the authors' upon request. We conclude that selection bias is less of an issue when the couple is the level of analysis. In our prior work the correction of the possible selection bias was important for the results and we found it to be strongly correlated with gender (Benítez-Silva and Dwyer, 2004).

We also report in the table tests that show that we cannot reject that we have robust instruments, so they are significant in the first stage of the 2SLS procedure as indicated by the large F statistic reported in the first stage of the procedure that we include in the Appendix, and that the overidentification in the 2SLS is correct, indicating the exogeneity of the instruments with respect to the error term in the structural equation.[15] In fact the reported results are the product of robustly estimating the system of equations via GMM, which provides robustness against unknown forms of heterokedasticity.

The strong test includes information available at time ***t*** that should not be significant after controlling for time ***t*** expectations. Significance would imply that this factor was not incorporated in the previous period's expectations and implies underutilized information. After controlling for sample selection and measurement error we find that most of these factors are no longer significant.[16] This is also true in the rest of the paper, therefore we do

[15] For a discussion of how to test the robustness of instruments and the overidentifying restrictions see Bound et al. (1995), Staiger and Stock (1997), Stock et al. (2002), and Baum et al. (2003).

[16] We do test the model specification for significance of relevant health and economic variables without the lagged endogenous variable and find they are significant in explaining variation. This concurs with findings of Dwyer and Mitchell (1999). We incorporate health variables as recommended in that study. Results are sensitive to the choice of health variables, only in how to interpret them. Health is always significant in retirement models, but various indicators are correlated with different components of underlying latent health. What turned out to contribute the most to retirement expectations are health problems associated with heart disease.

not discuss here, or below, these coefficients since our estimations indicate that their informational content is embedded in the period t retirement expectation as the theory predicts.[17] The joint hypothesis that all the coefficients are equal to zero cannot be rejected at any traditional level of significance in the IV or the Corrected IV specifications.[18] Notice also that in the strong test the constant is also estimated to be indistinguishable from zero, as predicted by the theory.

One source of potential unobserved heterogeneity is correlated responses due to macroeconomic shocks. In a micro survey this may pose a problem given the short panel, but not one that cannot be dealt with to pursue the test of the Rational Expectations Hypothesis. To control for this we include a time trend in our specifications, and we have also performed sensitivity analysis by including unemployment rates. Given that we are using micro survey data that spans only an eight year period from 1992–2000, we cannot be certain that there is sufficient variation in the macroeconomic effects. However, the earlier part of the nineties was very different from the later part of the survey period, leading us to believe we do indeed have reasonable proxies of macroeconomic shocks. In any case the findings do not change with the different characterization of these macroeconomic controls.

The IV and the selection Corrected IV specification deliver similar results.[19] This is not surprising, given the lack of statistical significance of the Inverse Mills' ratio. The first stage results, reported in Tables A.2 and A.3, in the Appendix, suggest that selection bias is present in the estimation of the weak test. Table A.1., also in the Appendix, presents the results of the selection equation used in estimating the Corrected IV specification.

For completeness, we also estimate the same specifications as in Table 3 for the strong RE test, but instead of including the expected retirement age of the spouse as an explanatory variable, we include a battery of spouse's variables, effectively estimating Eq. (6). The main results do not change much in this specification. Again, the IV results are the preferred ones, and the RE hypothesis cannot be rejected.[20]

Tables 4 and 5 present results of the same specification as Table 3 but for males and females, respectively.[21] Although we are assuming in all these specifications that the spouse's information is taken as exogenous, by estimating separate models for males and females we can analyze whether the spouse's expected retirement is internalized

[17] We also tested for joint significance of just the economic factors since some individual effects persist in some models, but we cannot reject the null hypothesis of lack of significance.

[18] It is true, however, as in Bernheim (1990) that this is trivially the case if individuals never adjust their expectations. But plenty of adjustment goes on in the data, and it seems implausible that all can be blamed on measurement error.

[19] Notice that in columns two and three of Table 3, and column two of Tables 4–7, we do not report the adjusted R^2 measure of fit. This is common practice, but it is rarely mentioned in empirical work. These types of measures do not have independent significance in structural estimation à la IV, given that we are after estimating population parameters, which we consider invariant to the particular way of identifying the parameters (instruments), not after minimizing a particular prediction problem. See Ruud (2000, p. 515–516) for a discussion.

[20] These results are available from the authors upon request.

[21] The first stage results of the IV specifications of Tables 4 and 5 are available from the authors upon request.

Table 4
Tests of rational expectations- all married male respondents

Variables	Pooled OLS	IV
Weak RE Test (H_0: Exp_t=1):	Reject	Cannot Reject
Constant	34.060(1.733)**	−3.855(3.458)
Expected Retirement Age_t	0.483(0.027)**	1.069(0.054)**
Test of Over-Id Restrictions	–	Cannot Rej. P-v=.1522
Test of Weak Instruments	–	Reject P-v=.0000
Strong RE Test (H_0: Exp_t=1):	Reject	Cannot Reject
Constant	34.492(3.453)**	2.198(5.723)
Expected Retirement Aget	0.436(0.052)**	1.047(0.101)**
Expected Ret Age_t Spouse	0.055(0.031)*	−0.080(0.044)*
Economic factors at time t		
Net Worth (in $100,000)	0.016(0.034)	0.038(0.037)
Respondent Income (in $1,000)	−0.010(0.005)**	−0.007(0.004)
No Health Insurance	2.823(1.679)*	2.292(1.835)
Private Health Insurance	0.172(0.482)	−0.420(0.556)
Self-employed	0.069(0.642)	−1.131(0.694)
Pension	−1.656(0.554)**	−1.345(0.604)**
Health factors at time t		
Health limitation	−1.050(0.473)**	−1.286(0.545)**
Good-V.Good-Exc. Health	−0.052(0.638)	0.231(0.763)
Doctor visits	0.013(0.038)	0.079(0.037)**
High blood pressure	0.875(0.498)*	0.767(0.579)
Diabetes	−0.123(0.779)	−0.847(1.004)
Cancer	3.187(3.529)	2.148(2.975)
Stroke	−0.527(1.236)	−0.754(1.029)
Heart Problems	−0.252(0.685)	−0.732(0.848)
Arthritis	0.298(0.490)	0.146(0.565)
Difficulty walk. multiple blocks	0.067(0.835)	0.709(0.971)
Difficulty climbing stairs	2.023(1.305)	2.910(1.466)**
Demographic factors at time t		
White	0.191(0.520)	1.197(0.613)*
Bachelor's Degree	0.542(0.463)	−0.022(0.528)
Professional Degree	0.095(0.515)	0.912(0.609)
Wave 1–2	−0.7341(0.4375)	0.3705(0.5455)
Wave 2–3	0.3019(0.4675)	0.3249(0.5386)
Adjusted R^2	0.2760	–
Test of Joint Sig. of Covariates	Reject. P-v=.0074	Cannot Rej. P-v=.1626
Test of Over-Id Restrictions	–	Cannot Rej. P-v=.1472
Test of Weak Instruments	–	Reject P-v=.0000
Number of Observations	782	748

Time t+1 expected retirement age is regressed against its lag for the weak test and against its lag with time t relevant factors for the strong test. IV is used to control for potential measurement error bias in the lagged dependent variable.

asymmetrically by the two genders. Almost all results are very similar in both tables, in both cases the predictions of the RE hypothesis cannot be rejected and the IV estimator is the preferred one. The main difference is that for males the spouse's retirement expectation as of time ***t*** still has informational content after controlling for own expected retirement, and a large number of covariates. This is not the case for females, where the point

Table 5
Tests of rational expectations- all married female respondents

Variables	Pooled OLS	IV
Weak RE Test (H_0: Exp_t=1):	Reject	Cannot Reject
Constant	29.712(2.111)**	−5.538(4.382)
Expected Retirement Age_t	0.528(0.034)**	1.091(0.070)**
Test of Over-Id Restrictions	–	Cannot Rej. P-v=.5074
Test of Weak Instruments	–	Reject P-v=.0000
Strong RE Test (H_0: Exp_t=1):	Reject	Cannot Reject
Constant	24.268(3.559)**	−0.874(6.062)
Expected Retirement Aget	0.471(0.057)**	1.050(0.122)**
Expected Ret Age_t Spouse	0.172(0.040)**	−0.003(0.051)
Inverse Mills' Ratio	–	–
Economic factors at time t		
Net Worth (in $100,000)	0.094(0.069)	0.116(0.077)
Respondent Income (in $1,000)	0.000(0.001)	0.000(0.001)
No Health Insurance	0.111(1.908)	−0.836(2.111)
Private Health Insurance	−0.277(0.477)	−0.732(0.576)
Self-employed	2.243(0.982)**	1.231(1.185)
Pension	−1.257(0.473)**	−0.080(0.561)
Health factors at time t		
Health limitation	0.413(0.459)	0.695(0.440)
Good-V.Good-Exc. Health	−0.797(0.654)	−0.518(0.667)
Doctor visits	−0.034(0.031)	−0.024(0.029)
High blood pressure	−0.287(0.441)	−0.470(0.494)
Diabetes	−1.366(0.772)*	−1.434(0.963)
Cancer	−0.570(1.010)	0.971(0.912)
Heart Problems	1.969(1.194)*	1.924(1.440)
Arthritis	−0.740(0.403)*	−1.276(0.467)**
Difficulty walk. multiple blocks	0.218(0.838)	0.210(0.893)
Difficulty climbing stairs	1.228(0.865)	−0.603(0.922)
Demographic factors at time t		
White	−0.287(0.471)	−0.498(0.552)
Bachelor's Degree	0.451(0.499)	0.203(0.530)
Professional Degree	−1.065(0.630)*	−0.587(0.643)
Wave 1–2	−0.893(0.465)*	−0.944(0.528)*
Wave 2–3	−0.333(0.545)	−0.339(0.648)
Adjusted R^2	0.3230	–
Test of Joint Sig. of Covariates	Reject P-v=.0254	Cannot Rej. P-v=.1625
Test of Over-Id Restrictions	–	Cannot Rej. P-v=.8733
Test of Weak Instruments	–	Reject P-v=.0000
Number of Observations	742	714

Time t+1 expected retirement age is regressed against its lag for the weak test and against its lag with time t relevant factors for the strong test. IV is used to control for potential measurement error bias in the lagged dependent variable.

estimates are considerably smaller and very close to zero, but estimated with much less precision. This result suggests that males form their retirement expectations more independently of the partner's expectations than females. However, the weak statistical significance of the results, prevent us from drawing more definite conclusions. The null hypotheses of lack of significance of covariates, is more soundly rejected in the female

Table 6
Tests of joint rational retirement expectations

Variables	Pooled OLS	IV
Weak RE Test (H_0: Exp_t=1):	Reject	Cannot Reject
Constant	20.553 (3.063)**	−1.338 (6.004)
Average Expected Ret.t	0.683 (0.049)**	1.034 (0.096)**
Test of Over-Id Restrictions	–	Cannot Rej. P-v=.7245
Test of Weak Instruments	–	Reject P-v=.0000
Strong RE Test (H_0: Exp_t=1):	Reject	Cannot Reject
Constant	24.357 (3.632)**	3.936 (6.243)
Average Expected Ret.t	0.654 (0.054)**	0.990 (0.097)**
Economic factors at time t		
Net Worth (in $100,000)	0.037 (0.057)	0.015 (0.051)
Respondent Income (in $1,000)	0.003 (0.008)	0.005 (0.008)
Spouse's Income (in $1,000)	−0.001 (0.001)	−0.001 (0.001)
No Health Insurance	2.474 (2.275)	2.951 (2.171)
Private Health Insurance	0.062 (0.465)	−0.475 (0.516)
Self-employed	−0.731 (0.646)	−0.488 (0.710)
Pension	−1.186 (0.532)**	−1.329 (0.539)**
Pension - Spouse	−1.114 (0.450)**	−0.809 (0.484)*
Health factors at time t		
Health limitation	−0.113 (0.428)	−0.162 (0.444)
Health limitation - Spouse	−0.646 (0.422)	−0.490 (0.423)
Good-V.Good-Excellent Health	0.142 (0.617)	0.434 (0.603)
Good-V.Good-Exc. Hlt. Spouse	0.032 (0.708)	0.099 (0.784)
High blood pressure	0.222 (0.434)	−0.007 (0.436)
High blood pressure - Spouse	0.006 (0.486)	−0.076 (0.521)
Diabetes	0.372 (0.681)	0.281 (0.683)
Diabetes - Spouse	0.052 (0.732)	−0.017 (0.711)
Stroke	−3.176 (0.619)**	−2.314 (0.670)**
Heart problems	0.017 (0.562)	−0.020 (0.610)
Heart problems - Spouse	0.115 (1.072)	0.630 (1.068)
Arthritis	−0.457 (0.431)	−0.486 (0.446)
Arthritis - Spouse	−0.720 (0.386)*	−0.931 (0.442)**
Demographic factors at time t		
White	−0.281 (0.540)	−0.422 (0.537)
Male	−0.338 (0.420)	−0.203 (0.418)
Bachelor's Degree	−0.396 (0.439)	−0.618 (0.419)
BA - spouse	0.653 (0.536)	0.677 (0.536)
Professional Degree	1.834 (0.612)**	1.793 (0.593)**
Prof. Degree - Spouse	−1.037 (0.627)*	−0.902 (0.615)
Time Trend:		
1994	−1.727 (0.679)**	−1.265 (0.682)*
1996	−0.768 (0.710)	−0.475 (0.700)
1998	−0.916 (0.642)*	−0.664 (0.629)
Adjusted R^2	0.4237	–
Test of Joint Sig. of Covariates	Reject P-v=.00	Cannot Rej. P-v=.4905
Test of Over-Id Restrictions	–	Cannot Rej. P-v=.9204
Test of Weak Instruments	–	Reject P-v=.0000
Number of Observations	432[a]	432

Average Expected Retirement of Couples.

[a] The sample size declines in the joint expectations model because we require 4 sets of reports to be observed. We need the time t+1 expectation for both partners as well as the time t for both partners.

Table 7
Tests of joint rational retirement expectations

Variables	Female	Male
Weak RE Test (H_0: Exp_t=1):	Cannot Reject	Cannot Reject
Constant	−1.264 (6.244)	−4.731 (5.190)
Average Expected Ret.t	1.033 (0.010)**	1.088 (0.083)**
Test of Over-Id Restrictions	Cannot Rej. P-v=.7395	Cannot Rej. P-v=.2897
Test of Weak Instruments	Reject P-v=.0000	Reject P-v=.0000
Strong RE Test (H_0: Exp_t=1):	Cannot Reject	Cannot Reject
Constant	2.540 (6.971)	−1.207 (6.560)
Average Exp Ret.t	1.001 (0.108)**	1.077 (0.100)**
Economic factors at time t		
Net Worth (in $100,000)	0.017 (0.052)	0.011 (0.057)
Respondent Income (in $1,000)	−0.000 (0.001)	−0.001 (0.007)
Self-Employed	0.924 (1.136)	−1.076 (0.640)*
No Health Insurance	3.500 (1.847)*	1.508 (1.760)
Private Health Insurance	−0.329 (0.543)	0.001 (0.512)
Pension	−0.592 (0.521)	−1.416 (0.491)**
Spouse's Pension	−0.795 (0.415)*	−0.801 (0.503)
Health factors at time t		
Health limitation	0.159 (0.405)	−0.599 (0.485)
Spouse's Health Limitation	−0.727 (0.511)	0.355 (0.411)
Good-V.Good-Excellent Health	0.214 (0.728)	0.803 (0.560)
Spouse's Good-V.Good-Ex. Health	0.364 (0.585)	0.033 (0.859)
High Blood Pressure	−0.288 (0.455)	0.255 (0.462)
Spouse's High Blood Pressure	0.550 (0.469)	−0.259 (0.480)
Diabetes	0.632 (0.551)	−0.533 (0.843)
Diabetes Spouse	0.050 (0.829)	0.523 (0.571)
Heart problems	0.825 (1.199)	0.067 (0.495)
Spouse's Heart Problems	−0.120 (0.493)	0.761 (1.211)
Arthritis	−1.253 (0.446)**	−0.148 (0.518)
Arthritis Spouse	0.074 (0.519)	−1.162 (0.437)**
Demographic factors at time t		
White	−0.441 (0.538)	−0.147 (0.529)
Bachelor's Degree	0.456 (0.463)	−0.509 (0.472)
Bachelor's Degree Spouse	−0.369 (0.448)	0.673 (0.480)
Professional Degree	0.318 (0.742)	0.765 (0.562)
Professional Degree Spouse	0.677 (0.559)	0.250 (0.689)
Time Trend		
1994	−1.250 (0.648)**	−1.179 (0.666)*
1996	−0.324 (0.714)	−0.613 (0.713)
1998	−0.830 (0.620)	−0.951 (0.632)
Test of Joint Sig. of Covariates	Cannot Rej. P-v=.6925	Cannot Rej. P-v=.2685
Test of Over-Id Restrictions	Cannot Rej. P-v=.9890	Cannot Rej P-v=.5310
Test of Weak Instruments	Reject P-v=.0000	Reject P-v=.0000
Number of Observations	427	416

The dependent variable is the average expected retirement age of the couple. By Gender. IV Specification Only. Time t+1 average expected retirement age is regressed against its lag for the weak test and against its lag with time t relevant factors for the strong test. IV is used to control for potential measurement error bias in the lagged dependent variable.

test, but it is also rejected for males suggesting that although spouse's expectation still have some informational content when all the estimates of the effects of the covariates are jointly tested they are not statistically different from zero.

4.2. Rational expectations test of joint expectations

Table 6 presents the results of estimating Eq. (12) by pooled OLS and IV to test the RE hypothesis of the evolution of joint expectations, defined as the average expected ages of retirement for the couple. We obtain a similar pattern of results for the strong and weak test, and we are unable to reject the RE hypothesis once we control for measurement error. In the IV specification, which jointly estimates Eqs. (12) and (13), the result of the weak test is a β coefficient of 1.034, and in the strong test is 0.990. From the table we can observe that due to the small number of observations, which is the result of just including one observation per couple when we do the joint analysis, the standard errors of these specifications are a bit larger than in Table 3. Notice, however, that after controlling for measurement error the estimate is very close to what the model under the RE hypothesis predicts.

The IV specification shows that we have robust instruments, that the overidentification restrictions cannot be rejected, and that the rest of the coefficients that complete the RE hypothesis also have the hypothesized magnitudes, which are not statistically different from zero. Finally, Tables A.4 and A.5 provide the first stage results for the weak and strong tests of the IV specifications presented in Table 6.

In Table 6 we choose the responses from the financially knowledgeable respondent. We also ran the joint expectations separately by gender, which are reported in Table 7. While in all cases we cannot reject the null RE hypothesis, the strongest support of the hypothesis is in models where we use the female reports. This is true for the strong and weak tests. The constant is always equal to 0 in all cases, and the test of joint significance of covariates is always in line with the theory. It is interesting to observe that in all cases reports in wave 2 (1994) when unemployment was relatively high, are lower, indicating earlier retirement. We conclude from this that while individuals' micro expectations evolve according to rational expectations, there remains uncertainty over macro events.

5. Conclusions

This is the first study we are aware of that analyzes joint retirement expectations. We use these expectations to test the RE hypothesis in the formation of retirement expectations for older married American couples using the HRS, and we cannot reject this hypothesis after controlling for reporting errors and sample selection. These results support the use of a wide variety of models that use this assumption to analyze joint retirement decisions, and for dynamic models of couples' decision making that are often heavily reliant on rational expectations assumptions.

Our research abstracts from the debate over the appropriate underlying model of decision making in the household, since our tests take the process followed to report a retirement expectation age by individuals and couples as given. We find that regardless of the process, the evolution over time of those expectations is consistent with the rational expectations paradigm. We also test the RE hypothesis separately by gender, and draw some tentative inferences about underlying models of decision-making in the household. The findings are consistent with a model that suggests males are less likely to incorporate their wives expectations when forming their own expectations.

The results in this analysis are meant to foster further discussion and research on the issues surrounding the role of expectations and rationality in economic modeling both for individuals and married couples. We have provided a methodology to test the validity of these variables, but in doing so we have also raised a number of other questions. For example, recent results using expectations for different populations and variables seem to indicate that both individuals and couples update their expectations, regarding micro level variables, according to the Rational Expectations hypothesis. However, at the same time the analysis of deviations between expectations and realizations seem to be pointing in the opposite direction. This can be considered a puzzle worthy of further investigation.

In this paper we have concentrated on how individuals form expectations over a micro-level variable, which they have some control over but that is affected by uncertainty over a number of dimensions. The challenge is to integrate this approach with the more traditional approach of forming expectations over market level or even aggregate macro variables. For example, how do expectations over possible Social Security reform affect the retirement behavior of individuals and couples?[22] Some researchers have started to analyze the role of expectations over social insurance reform (Bütler, 1999; Phelan, 1999) but the two types of expectations have been rarely modeled together.

Finally, a growing area of interest is trying to understand how these expectations can be used in models of individual behavior, paying special attention to the behavioral and econometric implications of including this type of variables in their models. These first efforts have focused on validating the use of these variables, the next step is to use the informational content they provide to better identify our economic models of interest.

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[22] Benítez-Silva and Heiland (2004) suggest that the presence of these expectations could explain part of the rather radical shift of the Social Security claiming age toward the Early Retirement Age.

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Appendix A

Table A.1. Selection equation – probability of thinking about retirement

Variables	Probit	Marg. Effects
Economic Factors		
Net wealth (in $100,000)	−0.001(0.002)	−0.0004
Income (in $1,000)	0.001(0.000)**	0.0004
No Health Insurance	−0.215(0.057)**	−0.065
Private Health Insurance	−0.026(0.034)	−0.008
Self-Employed	0.005(0.044)	0.002
Pension	0.356(0.034)**	0.112
Financially Knowledgeable	0.021(0.032)	0.007
Health Factors		
Health limitation	0.008(0.036)	0.003
Good-V.Good-Exc. Health	0.074(0.042)*	0.023
Doctor visits	−0.002(0.002)	−0.001
Probability of living to 85	−0.105(0.046)**	−0.034
Diff. walking multiple blocks	0.041(0.055)	0.013
Diff. climbing stairs	−0.007(0.072)	−0.002
High blood pressure	0.032(0.035)	0.010
Diabetes	−0.067(0.063)	−0.021
Cancer	0.032(0.144)	0.010
Stroke	−0.030(0.284)	−0.010
Heart problems	0.016(0.054)	0.005
Arthritis	0.048(0.0312)	0.016
Smoke	−0.109(0.037)**	−0.034
Demographic Factors		
Age	0.003(0.003)	0.001
Male	0.131(0.035)**	0.042
White	0.011(0.040)	0.004
Bachelor's degree	0.022(0.042)	0.007
Professional degree	0.154(0.059)**	0.052
Mother reached retirement age	0.094(0.034)**	0.030
Father reached retirement age	0.019(0.031)	0.006
Wave 2	−0.050(0.032)	−0.016
Wave 3	0.084(0.030)**	0.027
Constant	−1.208(0.195)**	–
Predicted Probability	0.2578	
Log Likelihood	−7886.14	
Pseudo-R^2	0.0329	
Number of Observations	14,092	

Table 3.

Table A.2. First stage results for weak RE test using IV

Variables	1st Stage of IV	1st Stage of Corrected IV
Constant	36.258(1.173)**	88.426(4.090)**
Prob. Of Living to 85	0.753(0.294)**	2.319(0.358)**
Smoking	0.968(0.228)**	1.865(0.334)**
Age	0.524(0.022)**	–
Age - spouse	−0.050(0.017)**	–
Inverse Mills' Ratio	–	−17.203(2.659)**
Economic factors at time t		
Net Worth (in $100,000)	–	0.004(0.016)
Respondent Income (in $1,000)	–	−0.013(0.002)**
No Health Insurance	–	4.835(0.648)**
Private Health Insurance	–	0.805(0.251)**
Self-employed	–	0.863(0.311)**
Pension	–	−6.116(0.761)**
Financially Knowledgeable	–	0.102(0.201)
Health factors at time t		
Health limitation	–	−0.138(0.263)
Good-V.Good-Exc. Health	–	−0.972(0.357)**
Doctor visits	–	0.004(0.016)
High blood pressure	–	0.192(0.252)
Diabetes	–	1.226(0.469)**
Cancer	–	0–.728(1.133)
Stroke	–	−2.426(2.112)
Heart Problems	–	−0.302(0.383)
Arthritis	–	−0.245(0.249)
Difficulty walk. multiple blocks	–	−0.063(0.424)
Difficulty climbing stairs	–	0.827(0.558)
Demographic factors at time t		
White	–	0.297(0.258)
Male	–	−0.017(0.351)
Bachelor's Degree	–	−0.363(0.251)
Professional Degree	–	−2.202(0.439)
Wave 1–2	–	−0.055(0.250)
Wave 2–3	–	−1.481(0.294)**
Adj. R^2	0.148	0.085
Test of Weak Instruments	F(4,3875)=169.46	F(26,3712)=13.59
Number of Observations	3880	3740

Married Respondents in Table 3.

Table A.3. First stage results for strong RE test using IV

Variables	1st Stage of IV	1st Stage of Corrected IV
Constant	27.308(2.280)**	24.981(7.085)**
Expected Ret. age of Spouse$_t$	0.208(0.023)**	0.208(0.024)**
Prob. Of Living to 85	−0.050(0.464)	−0.148(0.532)

Table A.3 (*continued*)

Variables	1st Stage of IV	1st Stage of Corrected IV
Smoking	0.771(0.365)**	0.653(0.500)
Age	0.4660(0.0384)**	0.471(0.040)**
Age-spouse	−0.0711(0.035)**	−0.072(0.035)**
Inverse Mills' Ratio	–	1.359(3.971)
Economic factors at time t		
Net Worth (in $100,000)	−0.067(0.029)**	−0.067(0.029)**
Respondent Income (in $1,000)	−0.000(0.002)	0.000(0.003)
No Health Insurance	1.143(0.891)	0.913(1.105)
Private Health Insurance	0.714(0.343)**	0.697(0.352)**
Self-employed	1.621(0.460)**	1.620(0.462)**
Pension	−0.912(0.343)**	−0.544(1.157)
Health factors at time t		
Health limitation	0.327(0.380)	0.355(0.384)
Good-V.Good-Exc. Health	0.617(0.494)	0.692(0.532)
Doctor visits	−0.032(0.022)	−0.034(0.022)
High blood pressure	0.061(0.354)	0.096(0.364)
Diabetes	0.659(0.700)	0.583(0.730)
Cancer	−1.253(1.696)	−1.249(1.700)
Stroke	−0.181(2.522)	−0.360(2.923)
Heart Problems	−0.091(0.545)	−0.052(0.551)
Arthritis	0.071(0.337)	0.104(0.366)
Difficulty walk. Mult. blocks	−0.559(0.606)	−0.531(0.617)
Difficulty climbing stairs	1.239(0.817)	1.226(0.819)
Demographic factors at time t		
White	−0.363(0.370)	−0.327(0.382)
Male	0.884(0.323)**	1.034(0.536)*
Bachelor's Degree	0.409(0.343)	0.433(0.356)
Professional Degree	−1.070(0.460)	−0.915(0.643)
Wave 1–2	−0.039(0.344)	−0.084(0.371)
Wave 2–3	0.006(0.355)	0.085(0.437)
Adj. R^2	0.2291	0.2290
Test of Weak Instruments	F(4,1433)=44.22	F(4,1426)=42.86
Number of Observations	1462	1456

Married Respondents in Table 3.

Table A.4. First stage results for weak RE test using IV in Table 6

Variables	1st Stage of IV
Constant	15.797(3.469)**
Age-Respondent	−0.079(0.065)
Age-Spouse	−0.132(0.052)**
Prob. Of Living to 85	−0.046(0.832)
Smoking	1.183(0.743)
Adj. R^2	0.030
Test of Weak Instruments	F(4428)=4.38
Number of Observations	433

Table A.5. First stage results for strong RE Test using IV in Table 6

Variables	1st Stage of IV
Constant	17.844(3.992)**
Age-Respondent	−0.044(0.076)
Age-Spouse	−0.180(0.060)**
Prob. Of Living to 85	−0.061(0.892)
Smoking	0.653(0.742)
Economic factors at time t	
Net Worth (in $100,000)	0.066(0.060)
Income (in $1,000)-Resp.	0.002(0.009)
Income (in $1,000)-Spouse	0.000(0.002)
No Health Insurance	−0.552(2.024)
Private Health Insurance	0.968(0.653)
Self-Employed	−0.526(0.877)
Pension-Respondent	−0.189(0.708)
Pension-Spouse	−2.371(0.587)
Health factors at time t	
Health limitation-Respondent	0.733(0.696)
Health limitation-Spouse	−0.557(0.726)
Good-V.Good-Exc. Hlt.-Resp.	1.561(1.014)
Good-V.Good-Exc. Htl.-Sp.	−0.696(1.139)
High blood pres.-Resp.	−0.454(0.640)
High blood pressure-Spouse	−0.262(0.700)
Diabetes-Respondent	−0.598(1.135)
Diabetes-Spouse	−0.251(1.684)
Stroke-Respondent	−3.229(3.630)
Heart Problems-Respondent	−0.283(1.010)
Heart Problems-Spouse	0.728(1.088)
Arthritis-Respondent	0.075(0.637)
Arthritis-Spouse	−0.241(0.645)
Demographic factors at time t	
White	−0.773(0.769)
Male	0.119(0.663)
Bachelor's Degree-Resp.	0.208(0.630)
Bachelor's Degree-Spouse	−0.122(0.697)
Professional Degree-Resp.	0.267(0.880)
Professional Degree-Spouse	−0.802(0.992)
Adj. R^2	0.054
Test of Weak Instruments	F(4, 387)=4.44
Number of Observations	419

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