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ABSTRACT

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Existing studies show that individuals who retire replace some private consumption by home production, but do not consider joint behaviour of couples. Here we analyze the causal effect of retirement of each partner on hours of home production of both partners in a couple. Our identification strategy exploits the earliest age retirement laws in France, enabling a fuzzy regression discontinuity approach. We find that own retirement significantly increases own hours of home production and the effect is larger for men than for women. Moreover, retirement of the female partner significantly reduces male hours of home production but not vice versa.

JEL Classification: J22, J26, J14

Keywords: time allocation, house work, couples

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Introduction

Existing studies argue that the drop in consumption expenditures upon retirement, known as the retirement consumption puzzle, may be at least partly explained by increased home production. The earlier literature focuses on retirement of the male head of the household and its effects on consumption and individual home production. However, retirement of one (or both) of the partners in a couple may change the time use of both partners.

In this paper we analyze the causal effect of retirement on hours of home production of individuals in a couple, allowing for endogeneity of the retirement decision. Our identification strategy exploits the legislation on the earliest age at which an old age pension can be drawn in France. This makes the probability to be in retirement a discontinuous function of age, with a substantial positive jump at age 60. We therefore can use a regression discontinuity approach: keeping retirement status constant, time spent on home production is assumed to be a continuous function of the age of both partners, whereas the probability of retirement is discontinuous at age 60 (of the individual and, possibly, the partner). In other words: the age at least 60 dummies for both partners can be excluded from the equations for the time spent on home production, but do have power in the equations for retirement.

Retirement may directly affect the marginal utility of home production and make it attractive to spend more time on it, while at the same time reducing expenditures on consumption goods and services bought in the market. Not only the home production of the partner who retires (and has more time available for home production, leisure activities, etc.) may increase – There may also be an effect on home production of the other partner, induced by the change in the retiree's home production, or to compensate for a reduction in household income. This is why our aim is to analyze how retirement of each partner in a couple affects the hours of home production of both partners and the household as a whole.

The relation between life cycle consumption or home production and retirement has been studied extensively (see, for example, Daniel Hamermesh, 1984; Eric Hurst, 2008; Erich Battistin et al., 2009; Mark Aguiar and Erik Hurst, 2005 and 2007a; Michael Hurd and Susann Rohwedder, 2008). None of these earlier studies considered the retirement of the partner. On the other hand, the scant literature on explaining joint retirement does consider time use of both partners, emphasizing externalities in leisure: joint retirement leads to utility from joint leisure activities exceeding the utility from leisure activities without the partner (Michael Hurd, 1990; Alan Gustman and Thomas Steinmeier, 2000 and 2009). These studies did not consider how joint retirement affects consumption or home production.

We analyze the effect of retirement of both partners on various home production activities, including shopping, cooking, gardening, and, more generally, doing household chores, and caring for adults and children. These activities differ in how enjoyable (or dislikeable) they are and have obvious market substitutes in the form of maids, gardeners, private enterprises, and public or private care providers.

The data for the analysis are drawn from the 1998-99 French Time Use Survey, carried out by the French National Statistical Offices (INSEE). The sample includes about 1,000 couples with both partners aged 50 to 70. In our data, age is available in months, which is helpful to identify respondents very close to the age threshold of 60.

We find that the probability to be retired and the expected number of hours of paid work have a substantial and statistically significant discontinuity at age 60, supporting our identification strategy. Our results show that retirement increases own house work time, but also affects the partner's time allocation. We therefore conclude that considering both partners' retirement and home production is crucial to understanding the effect of retirement on home production at the household level.

The next section presents the econometric approach. Description of the data follows. The last section discusses the results of the estimations and draws conclusions.

I. A Regression Discontinuity Approach

To identify the causal effect of retirement on home production, we exploit the legislation on early retirement in France, which sets 60 as the earliest retirement age for most workers. This creates a discontinuity in the probability of retirement as a function of age that enables us to apply a regression discontinuity (RD) framework (see, for example, David Lee and Thomas Lemieux, 2010, or Wilbert Van der Klaauw, 2008, for a review of RD).

In our data, year and month of birth were collected, so we can treat age as measured continuously. Our approach accounts for the fact that some people retire earlier than sixty – due to special early retirement schemes and sector specific agreements - and others later.[1] It follows that we face a "fuzzy" regression discontinuity design: the jump in the probability of retirement at age 60 is greater than zero but less than one.

Let R_m and R_f be dummies for retirement of the male (m) and female (f) partners, equal to one for individuals who have retired from market work and zero otherwise, and let T_{jm} and T_{jf} be the hours allocated to house work of type j. Our model is specified as follows:

$$(1) \qquad T_{jm} = \mathbf{Z_m}\,\boldsymbol{\beta}^{\mathbf{tjm}} + \mathbf{Z_f}\,\boldsymbol{\beta}^{\mathbf{tjf}} + R_m\,\gamma^{tjm} + R_f\,\gamma^{tjf} + \mathbf{Agepol_m}\,\boldsymbol{\psi}^{\mathbf{tjm}} + \mathbf{Agepol_f}\,\boldsymbol{\psi}^{\mathbf{tjf}} + \nu^{tjm}$$

$$(2) \qquad T_{jf} = \mathbf{Z_m}\boldsymbol{\lambda}^{\mathbf{tjm}} + \mathbf{Z_f}\,\boldsymbol{\lambda}^{\mathbf{tjf}} + R_m\,\delta^{tjm} + R_f\,\delta^{tjf} + \mathbf{Agepol_m}\,\boldsymbol{\zeta}^{\mathbf{tjm}} + \mathbf{Agepol_f}\,\boldsymbol{\zeta}^{\mathbf{tjf}} + \nu^{tjf}$$

$$(3) \qquad R_{im}^{*} = \mathbf{Z_m}\,\boldsymbol{\beta}^{\mathbf{rm}} + \mathbf{Z_f}\,\boldsymbol{\beta}^{\mathbf{rf}} + D_m\,\gamma^{rm} + \mathbf{Age_m}\,D_m\,\boldsymbol{\eta}^{\mathbf{rm}} + \mathbf{Age_m}\,(1\text{-}D_m)\,\boldsymbol{\pi}^{\mathbf{rm}} + D_f\,\gamma^{rf} +$$

[1] In France, labor force participation interruptions will not translate into later pension entitlement since unemployment and sick leave periods all contribute to the pension claim.

$$+ \mathbf{Age_f}\ D_f\, \boldsymbol{\eta}^{\mathbf{rf}} + \mathbf{Age_f}\,(1\text{-}D_f)\,\boldsymbol{\pi}^{\mathbf{rf}} + \nu^{rm};\ R_{im}=1 \text{ if } R_{im}^{*}>0 \text{ and } R_{im}=0 \text{ if } R_{im}^{*}\leq 0$$

$$(4) \qquad R_{if}^{*} = \mathbf{Z_m}\,\boldsymbol{\lambda}^{\mathbf{rm}} + \mathbf{Z_f}\,\boldsymbol{\lambda}^{\mathbf{rf}} + D_m\,\delta^{rm} + \mathbf{Age_m}\,D_m\,\boldsymbol{\tau}^{\mathbf{rm}} + \mathbf{Age_m}\,(1\text{-}D_m)\,\boldsymbol{\mu}^{\mathbf{rm}} + D_f\,\delta^{rf} +$$

$$+\mathbf{Age_f}\ D_f\,\boldsymbol{\tau}^{\mathbf{rf}} + \mathbf{Age_f}\,(1\text{-}D_f)\,\boldsymbol{\mu}^{\mathbf{rf}} + \nu^{rf};\ R_{if}=1 \text{ if } R_{if}^{*}>0 \text{ and } R_{if}=0 \text{ if } R_{if}^{*}\leq 0$$

Here $\mathbf{Age_m} = [(Age_m\text{-}60), (Age_m\text{-}60)^2, \ldots, (Age_m\text{-}60)^n]$,

$\mathbf{Age_f} = [(Age_f\text{-}60), (Age_f\text{-}60)^2, \ldots, (Age_f\text{-}60)^n]$

$\mathbf{Agepol_m} = [(Age_m), (Age_m)^2, \ldots, (Age_m)^n]$, and

$\mathbf{Agepol_f} = [(Age_f), (Age_f)^2, \ldots, (Age_f)^n]$

The vectors $\mathbf{Z_m}$ and $\mathbf{Z_f}$ contain control variables (other than age functions) such as education level, presence of children, and local labor market variables like the regional unemployment rate; D_m and D_f are dummies for whether the male and female partners have reached age 60 (720 months of age); Greek letters denote (vectors of) coefficients. The v's are normally distributed errors, independent of $\mathbf{Z_m}$ and $\mathbf{Z_f}$ and the ages of both partners but allowed to be correlated across equations. The equations for retirement are probits; the house work equations are linear equations.[2] The four equations are estimated jointly with simulated maximum likelihood. By allowing the error terms in equations (1) – (4) to be correlated in an arbitrary way, own and partner's retirement are allowed to be endogenous to house work.

Alternatively, we also analyze models in which retirement is replaced by hours of paid (market) work. This model uses the same explanatory variables and identification strategy, since reaching age 60, through retirement, leads to a discontinuous drop in average hours of market work (given the control variables).

We also use similar models for the sum of the male and female partner's hours of house work, using a system of three instead of four equations: two retirement equations (one

[2] We found similar results with tobit equations accounting for the bunching of some house work activities at zero.

for each partner) and one house work equation at the household level. The advantage of this is that it makes it easier to interpret the effect of retirement of one or both partners on the total hours allocated to home production by the couple.

Finally, since most individuals do not perform market work at weekends, retirement might simply lead to a reallocation of house work from weekends to week days. We therefore also consider observations on time use on weekend days, including a weekend dummy and its interactions with the retirement dummies (or market hours) in the home production equations, as well as interactions of the 'age at least 60' dummies and weekend diary dummies in the market hours equations.

II. The data

Sample selection and covariates

The data for the analysis are drawn from the 1998-99 French time use survey, carried out by the National Statistical offices (INSEE). This survey is a representative sample of more than 8,000 French households. We then applied the following criteria to select our estimation sample out of the 5,287 heterosexual couples surveyed:

- Both partners responded to the survey and were aged 50 to 70.
- Both partners filled in the time diary.
- The partners did not fill in the time diary on an atypical day, defined as a special occasion such as a vacation day, a day of a party, a funeral, or a sick day.
- None of the partners were unemployed or inactive.
- We dropped one man who reported to be a home-maker, but we kept housewives.

Applying these criteria led to a sample of 1043 couples. We distinguish the following time use categories collected in the diary:

1. Market work (at the workplace or at home, etc.)
2. House work, and its subcomponents:
   i. 'Core' household work, including cleaning, doing the laundry, ironing, cleaning the dishes, setting the table, and doing administrative paper work for the household
   ii. Shopping
   iii. Cooking
   iv. "Other" household work, including gardening, house repairs, knitting, sewing, making jam, and taking care of pets
3. Caring for children and/or adults living in the same or in other households

We separate cooking and shopping activities from other 'core' chores as these two activities are the ones that received most attention in the earlier literature on substituting home production for private expenditure (for instance, Aguiar and Hurst, 2005 and 2008). We also single out 'other' house work, sometimes named "semi-leisure' chores in the time use literature, since well be more enjoyable tasks than other sorts of house work (see, for example, Aguiar and Hurst, 2007b). Finally, we separate care tasks from other household chores since earlier studies for similar reasons.

The employment or retirement status is derived from the respondent's self-assessed occupational status. In particular, respondents were asked to choose among the following possible states: employment; unemployment; in education; in the military; retired or early-retired; housewife; other inactive. The indicator for retirement takes value one for respondents that self-reported to be retirees or early-retirees. In the analysis, housewives will be considered together with retired women,[3] as opposed to those employed and thus, still at

[3] Dropping couples where the female partner reported to be a housewife did not substantially affect the results, though the sample size drops to about 700 households.

work. This adds to the motivation for also looking at the drop in hours of paid (market) work, since being retired here does not automatically translate into a fall to zero paid hours.

Descriptive statistics

Descriptive statistics are given in Table1. We have selected a sample with both partners aged between 50 and 70 years (see Section 3.1). Women are on average two years younger than their husbands. About 57 per cent of the men and 43 of the women in a couple, in our sample, are aged 60 or above. About 64 per cent of the men and 67 per cent of the women in the sample have retired from market work (see Section 3.2 for our definition of retirement). The percentage employed is 36 for men and 32 per cent for women. Only a small minority of individuals were not born in France: 4 per cent of the men and 3 per cent of the women. The majority of individuals have less than high school (the benchmark). Men tend to be slightly more educated than women: 12 (10) per cent of husbands (wives) have completed high school (12 years of schooling) and 15 (11) per cent have a higher education level (over twelve years of schooling). Only 15 per cent of the sample have children still living in the parental home. Only 4 per cent of couples are cohabiting; the others are formally married. Very few couples (2 per cent) were living in central Paris. The mean level of unemployment at the time was pretty high, over 11 per cent.

These findings are due to a combination of having selected older generations and only those in a couple, as younger generations in France tend to be more educated and are more often cohabiting. Only three per cent of the men and five per cent of the women in our sample reported to have a bad general health status. About 23 per cent of the observations filled in the time diary on a weekend.

Descriptive statistics of participation and hours for the activities considered (see Section 3.2 for more details) are provided in Table 2.

In line with below average employment rates, only 30 per cent of the men and 22 per cent of the women report any market hours on the day the diary was collected, but note that 23 per cent of these days fell on a weekend. Average market work including the zeros is slightly over two hours a day for men and slightly less than an hour and a half for women. The median of hours of market work is zero for both partners. Using a standard definition of housework, that includes all chores, 87 per cent of the husbands and 99 per cent of the wives report doing some house work on the diary day. On average, husbands spends three hours on it and wives five hours, on a given day –which might be a weekend day. Excluding 'other' chores, the amount of 'core' housework (which includes cleaning, cooking, shopping, washing clothes, ironing, doing the dishes, and doing administrative paper work) done by husbands falls dramatically, to one hour and a quarter, on average, while for women the difference is only half an hour less. The median man spends indeed an hour on 'other' chores (gardening, house repairs, etc, see list in Section 3.2) against no time at all for the median woman in our couple sample. Participation in these tasks is almost 62 per cent for husbands against 44 per cent for wives. To give some order of reference, the participation rate in cooking is 93 per cent for women and 30 per cent for men while 41 per cent of the men and 52 per cent of the women do some shopping on the diary day.

Finally, we provide some information on care activities by the individuals in our sample. This variable includes care provided to children and adults living at home or belonging to other households and it includes performing house work for adults in other households for no charge (see Section 3.2 for more details). The participation rates are 15 per cent for men and 22 per cent for women; the average time allocated to it on the diary day is 18 minutes for men and 24 for women.

Of course, all these comparisons relate to our sample of older couples; the picture may be quite different for singles or younger people.

III. Results

First, we have carried out some exploratory graphical analysis of the discontinuities in retirement, market hours, and house work at age 60 for each partner (see Charts 1 and 2). We find evidence of a clear discontinuity in retirement and hours of paid work at the age cutoff of 60 for both men and women. There is also a substantial jump at age 60 for some of the home production activities considered.

Estimation results of the four equations model of retirement and hours of home production of each partner are summarized in Tables 3. We find that at (own) age 60, the probability to be retired increases significantly (by 23 and 13 percentage points for men and women, respectively), which supports our identification strategy. The fact that the partner reaches age sixty has no significant effect on individual retirement or market hours. A few other variables are significant: respondents living in Paris tend to retire later, as do respondents with higher education level.

We find that own retirement increases significantly husband's and wife's house work hours (Table 3), by more than three hours on a week day for men and by two hours and forty minutes for women. This large increase in house work hours partly reflects the fact that upon retirement a considerable amount of time is reallocated to other 'productive' activities. Moreover, the wife's retirement leads to a significant reduction of the husband's hours of home production of almost two hours per day, while her house work does not respond significantly to his retirement. Men living in Paris tend to do less housework than other men. For women, cohabiting instead of marriage and education are negatively related to the time spent on housework. Finally, the strongly significant and positive correlation between unobservables driving the retirement decisions of the two partners (Table 5) reflects a tendency to retire jointly. The positive and significant correlation between unobservables in

the two partners' house work equations suggests that shared preferences or prices of market alternatives to home production are more important than substitution patterns.

Estimation results for the model with hours of paid work instead of retirement are more or less the "mirror" image of this (see Table 4). Hours of paid work also drop significantly at age 60 (by 173 and 130 minutes on a week day for men and women, respectively. As expected, the drop in market hours at age 60 is much larger on week days than on weekends.[4] The individual's hours of paid work are not significantly affected by the partner's age at least 60 dummy.

Each additional hour of market work substantially reduces own house work hours for both partners, though the effect is significant at only the ten per cent level for women (Table 4). For men, a one hour drop in market work on a week day results in an increase of own home production of 26 minutes. For women, the effect is 19 minutes. On weekend days, the effects are smaller, particularly for men. Women hardly respond to a change in market hours of the husband. Men respond more to a change in female market hours, and the effect is positive, as expected, but it is significant only on weekend days. The larger response of male house work to the woman's hours of paid work than vice versa is in line with the larger response of male house work to the woman's retirement discussed above.

The effects of retirement of each partner on the total housework hours at the household level (Table 8) indicate that total house work increases by about four hours on a weekday

[4] As reflected by the large negative estimates for the dummy on weekend diaries, paid work hours are much lower in weekends than on weekdays, for both genders and before and after age 60. In other words, few people in couples aged 50-70 worked on a weekend day.

following retirement of the husband,[5] while the retirement status of the wife does not have a significant effect, since the negative effect on house work by the husband and the positive effect on own house work largely cancel. This shows the importance of considering house work of both partners in the couple - looking at the individual only would lead to misleading conclusions for home production at the household level.

Similar models were estimated for the separate home production activities (Tables 10 to 13). The results show that the men's hours of 'other' or 'semi-leisure chores' (mostly gardening and house repairs) and female hours of 'core' chores (mostly cleaning, ironing, washing dishes and clothes), cooking, and shopping increase substantially upon (own) retirement. On weekdays, men in a couple devote almost three extra hours per day to 'other' chores upon their retirement, though this falls (by almost two hours) if their wife also retires. Remarkably, hours devoted to cooking and shopping at the household level and by the woman increase significantly (by over one hour for cooking and almost 50 minutes for shopping) if the woman retires. The time devoted to caring for others increases significantly for both partners with own retirement. In the model with hours of paid work, caring time by the male partner is particularly responsive - it increases by 15 minutes for a drop in paid work hours by one hour. At the household level, the largest effect is found if the male partner retires (almost one hour per day).

IV. Conclusion

We have found that considering the effect of retirement on both partners in couple is crucial to understanding the effect of retirement on home production at the household level. There is

[5] A drop of one hour in the husband's paid work translates into half an hour more house work at the household level (Table 9).

a substantial increase in the hours of house work of males and females upon their own retirement and this increase is larger for males than for females. Retirement of the female partner also significantly and substantially reduces the house work done by the man, but not vice versa. This implies that ignoring the partner's retirement and its effect on home production may lead to a biased estimate of the scope for substitution between private expenditure and home production at the household level. Moreover, considering the effect of retirement of the male breadwinner only will also lead to an incomplete picture of how retirement affects time use and productive activities in the household.

Furthermore, our findings for specific types of house work like cooking, shopping, or gardening and doing house repairs suggest that the increase in house work hours of retired French men is mostly concentrated in activities such as gardening and house repairs, while for women in couple, mostly cooking and shopping increase at retirement. Thus, taking the retirement of women in a couple into account helps explaining the potential for substitution between consumption expenditures and home production upon retirement.

The asymmetry between responses of male and female partners is striking, both for home production (that is, house work at an aggregate level) and for more disaggregate time use categories such as shopping, cooking, and gardening. How these asymmetries can be explained from theories of household decisions is beyond the scope of the current paper but remains an interesting topic of future research. Time use data for couples seem a necessary condition for such a research direction.

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Development.

Table 1. Descriptive Statistics Estimation Sample

	Male partner		***Female partner***	
	Mean	***standard deviation***	***Mean***	***standard deviation***
Age (in years)	60.72	5.50	58.60	5.61
Age 60 or older	0.57	0.49	0.43	0.47
Retired	0.64	0.48	0.67	0.47
Housewife	0	0	0.35	0.46
Employed	0.36	0.48	0.32	0.47
Born in France	0.96	0.18	0.97	0.16
High School (12 years schooling)	0.12	0.32	0.10	0.30
College and more (over 12 years of schooling)	0.15	0.36	0.11	0.31
Bad health	0.03	0.18	0.05	0.23
		Household characteristics		
		Mean	***standard deviation***	
Number of children at home		0.15	0.51	
Cohabiting		0.04	0.19	
Resides in Paris		0.02	0.15	
Regional Unemployment rate (percent)		11.45	2.46	
Weekend diary		0.23	0.42	
Observations	***1043***			
Note: Sample selection steps and variables are discussed in Section II of the paper.				

Table 2. Participation Rates and Mean (median) Time Spent on Various Activities

	Male partner			***Female partner***		
	Participation rate (percent)	***Mean time spent in minutes per day (st. dev.)***	***Median time spent (minutes per day)***	***Participation rate (percent)***	***Mean time spent in minutes per day (st. dev.)***	***Median time spent (minutes per day)***
Market work	*29.82*	137.83 (235.46)	0	*21.67*	86.04 (182.88)	0
House work	*86.77*	183.70 (152.56)	160	*99.04*	310.60 (147.40)	310
House work , excluding 'semi-leisure'	*70.18*	77.19 (88.64)	40	*98.85*	264.85 (123.81)	260
'Core' Housework (excludes a, b, and c below)	*50.81*	36.38 (59.05)	10	*96.07*	145.04 (90.28)	140
Cooking, a	*29.63*	11.40 (24.09)	0	*93.38*	81.67 (49.15)	80
Shopping, b	*40.84*	29.42 (47.97)	0	*52.06*	38.14 (49.96)	10
'Semi-leisure', chores, c	*61.74*	106.51 (128.64)	60	*43.72*	45.75 (75.36)	0
Caring for children and/or adults	*14.67*	17.66 (66.12)	0	*21.76*	24.31 (65.13)	0
Observations	***1043***					

Note: Activities are measured in minutes on the diary day. The sample includes week and weekend day diaries (the same day for both partners. House work does not include caring for children and/or adults. See Section II of the paper for more details.

Chart 1. Retirement status and market work (in minutes per day): discontinuities at age 60

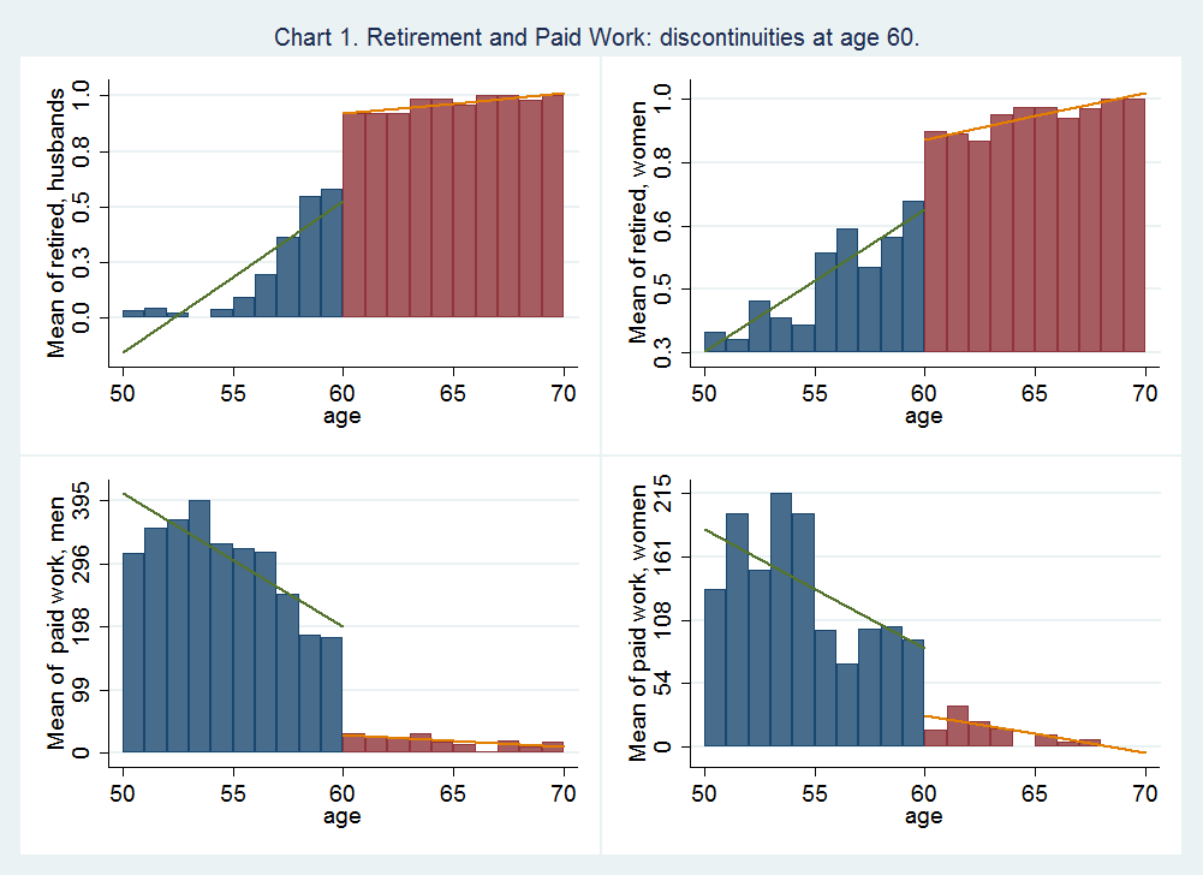

Chart 2. House work and care time (minutes per day): discontinuities at age 60

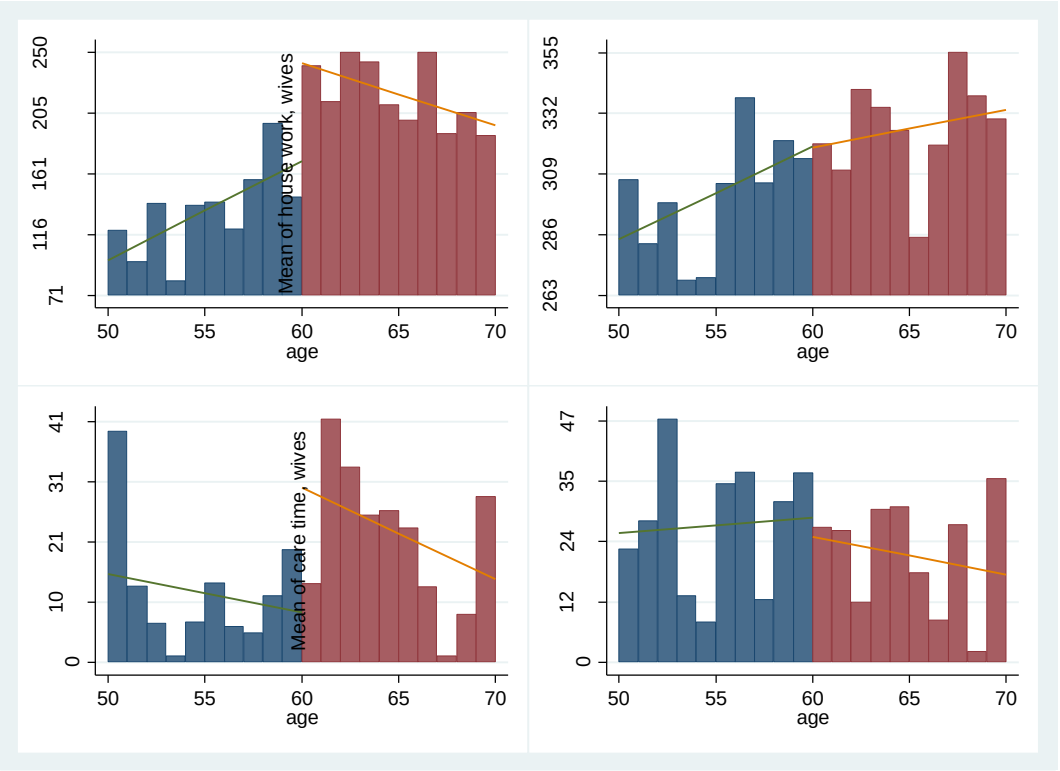

Table 3. Results of estimation of retirement and house work of partners: marginal effects

	He retired	She retired	His Housework	Her Housework
Paris	-0.377***	-0.106**	-79.57**	-13.42
	(0.384)	(0.326)	(33.26)	(30.96)
Unemployment rate	-0.003	0.003	-0.192	-2.032
	(0.0265)	(0.0198)	(1.817)	(1.735)
He high school	-0.059	0.031	0.930	-8.850
	(0.202)	(0.155)	(14.57)	(13.88)
He college and more	-0.115**	-0.037*	-5.911	-27.25*
	(0.229)	(0.163)	(16.78)	(15.70)
She high school	0.103**	-0.016	22.77	-38.92**
	(0.233)	(0.165)	(16.38)	(15.53)
She college and more	-0.009	-0.095***	-16.11	-36.94*
	(0.267)	(0.182)	(19.85)	(18.95)
Children number	-0.009	0.018*	9.100	19.92**
	(0.130)	(0.0841)	(9.433)	(9.008)
Cohabitant	0.014	0.036	-23.04	-55.50**
	(0.290)	(0.269)	(23.23)	(22.20)
He age 60 or over	**0.233*** **	**-0.040**		
	(0.396)	**(0.341)**		
She age 60 or over	**-0.108**	**0.128*** **		
	(0.453)	**(0.369)**		
He retired			**188.1*** **	**47.38**
			(61.17)	**(45.63)**
She retired			**-107.0** **	**159.4*** **
			(49.10)	**(46.60)**
Weekend Diary			59.81***	89.57***
			(18.37)	(18.00)
He retired*weekend diary			**-129.0*** **	**-10.41**
			(23.49)	**(22.96)**
She retired*weekend diary			**7.309**	**-131.9*** **
			(23.93)	**(23.41)**

Notes: The four equations are estimated simultaneously by simulated maximum likelihood, with 100 draws. The explanatory variables of the retirement equations also include left and right cubic polynomials in age of the two partners interacted with the dummy for being 60 or older (see Section I). The time use equations include cubic polynomials in age of each partner.

Retirement equations are specified as probit, the house work equations are linear. Marginal effects for the retirement equations are calculated at the mean value of the continuous explanatory variables and, for dichotomous ones, assuming less than high school (the reference category) for both partners, no residence in Paris, formally married (not cohabiting) and that both are aged 60 years or more.

House work is measured in minutes per day and it includes all subcomponents (see Section II).

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 4. Results of estimation of market and house work of partners

	His market work	Her market work	His House Work	Her House Work
Paris	135.8***	52.50	-50.99*	-26.58
	(35.31)	(33.79)	(29.77)	(27.85)
Unemployment rate	1.376	-3.770*	0.503	-1.622
	(2.124)	(2.032)	(1.849)	(1.722)
He high school	-10.01	-1.244	-7.598	-1.913
	(17.09)	(16.35)	(13.67)	(12.80)
He college and above	22.36	-24.30	-11.14	-25.55*
	(18.61)	(17.80)	(15.71)	(14.66)
She high school	-0.634	40.25**	18.45	-28.43*
	(19.02)	(18.19)	(16.88)	(15.70)
She college and above	28.53	76.44***	-3.045	-41.81**
	(20.87)	(19.96)	(19.60)	(18.19)
Children number	-11.08	-13.93	5.130	19.17**
	(10.83)	(10.36)	(8.828)	(8.259)
Cohabitant	11.29	-13.55	-17.46	-47.02**
	(27.52)	(26.34)	(21.92)	(20.52)
He age 60 or over	**-173.0*** **	**18.00**		
	(41.90)	**(39.39)**		
She age 60 or over	**41.04**	**-129.9*** **		
	(40.10)	**(38.98)**		
Weekend Day	-263.7***	-147.6***	-60.31***	-50.99***
	(18.03)	(17.21)	(14.92)	(13.87)
He age 60*weekend day	**224.7*** **	**59.67***		
	(32.75)	**(31.14)**		
She age 60*weekend day	**25.45**	**76.71** **		
	(33.46)	**(32.21)**		
His market work			**-0.437*** **	**-0.0901**
			(0.1000)	**(0.0915)**
Her market work			**0.253**	**-0.313***
			(0.180)	**(0.163)**
His market work* weekend			**0.118**	**0.0927**
			(0.0740)	**(0.0689)**
Her market work* weekend			**0.209** **	**0.117**
			(0.0873)	**(0.0813)**

Notes: The four equations are estimated simultaneously by simulated maximum likelihood, with 100 draws. They are four linear equations. The explanatory variables of the market work equations also include left and right cubic polynomials in age of the two partners interacted with the dummy for being 60 or older (see Section I of the paper). The house work equations include cubic polynomials in age of each partner.

Market work and house work are measured in minutes per day. House work includes all subcomponents but not caring for children and/or adults (see Section II of the paper). Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5. Correlations of the errors in the model of Table 3

	She is retired	**His housework**	**Her housework**
He is retired	0.256***	-0.025	-0.318
	(0.0918)	(0.025)	(0.206)
She is retired		0.386*	-0.093
		(0.218)	(0.218)
His housework			0.239***
			(0.0442)

Table 6. Correlations of the errors in the model of Table 4

	Her market work	**His house work**	**Her house work**
His market work	0.342***	-0.0573	0.262
	(0.0310)	(0.219)	(0.212)
Her market work		-0.276	-0.114
		(0.289)	(0.266)
His house work			0.341***
			(0.0987)

Table 7. Coefficients on the left and right age polynomials interacted with dummy age ≥ 60

	Retirement model (Table 3)		Market Work Model (Table 4)	
	He is retired	She is retired	His market work	Her market work
Dm = Husband is age 720 months (age 60)	1.060***	-0.311	-173.0***	18.00
	(0.396)	(0.341)	(41.90)	(39.39)
Dm * (Husband's age in months -720)	0.357	0.179	-12.16	-9.244
	(0.332)	(0.229)	(23.48)	(22.27)
Dm * (Husband's age in months -720)^2	-0.0438	-0.0259	2.452	1.171
	(0.0940)	(0.0580)	(5.505)	(5.244)
Dm * (Husband's age in months -720)^3	0.00254	0.00128	-0.142	-0.0379
	(0.00715)	(0.00410)	(0.364)	(0.347)
(1-Dm)* (Husband's age in months -720)	-0.250	0.477**	-16.06	-56.63**
	(0.270)	(0.225)	(28.60)	(26.78)
(1-Dm)* (Husband's age in months -720)^2	-0.193***	0.0979*	6.111	-10.85*
	(0.0710)	(0.0529)	(6.780)	(6.360)
(1-Dm)* (Husband's age in months -720)^3	-0.0157***	0.00551	0.664	-0.485
	(0.00501)	(0.00353)	(0.454)	(0.427)
Df = Wife is age 720 months (age 60)	-0.493	1.001***	41.04	-129.9***
	(0.453)	(0.369)	(40.10)	(38.98)
Df * (Wife's age in months -720)	0.572*	0.151	-38.77	-6.402
	(0.340)	(0.338)	(23.58)	(23.47)
Df * (Wife's age in months -720)^2	-0.0742	-0.0509	6.651	1.016
	(0.0940)	(0.106)	(5.753)	(5.645)
Df * (Wife's age in months -720)^3	0.00202	0.00642	-0.316	-0.0722
	(0.00695)	(0.00928)	(0.396)	(0.384)
(1-Df) * (Wife's age in months -720)	-0.0817	-0.256	-1.701	69.35***
	(0.282)	(0.175)	(23.61)	(22.13)
(1-Df) * (Wife's age in months -720)^2	-0.0197	-0.0682*	1.371	18.28***
	(0.0607)	(0.0389)	(5.182)	(4.889)
(1-Df) * (Wife's age in months -720)^3	-0.00132	-0.00399	0.0920	1.137***
	(0.00383)	(0.00247)	(0.327)	(0.309)

Notes: Estimates of the coefficients of the other covariates are provided in Tables 3 and 4.

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 8. Models of retirement and house work: estimated effects of retirement

	His house work[1]	Her house work[1]	His + Her house work[2]
He is retired	211.8**	61.46	287.0***
	(89.57)	(39.62)	(78.43)
She is retired	-118.0***	115.6***	71.13
	(45.56)	(42.93)	(117.7)
He is retired weekdays	188.1***	47.38	276.4***
	(61.17)	(45.63)	(94.22)
She retired weekdays	-107.0**	159.4***	116.2
	(49.10)	(46.60)	(115.2)
He is retired weekends	59.09	36.97	139.7
	(64.97)	(49.52)	(101.1)
She retired weekends	-99.71*	27.47	-9.725
	(52.66)	(40.50)	(117.2)

Notes:

(1) The four equations of partners' retirement and house work are estimated simultaneously by simulated maximum likelihood.

(2) The three equations of each partner's retirement and total house work at the household level (his plus her house work) are estimated simultaneously by simulated maximum likelihood.

The bottom blocks in the table show the effects for week and weekend days.

For both models, the explanatory variables of the retirement equations include dummies for age 60 and older and left and right cubic polynomials in age of the two partners interacted with the age 60 dummies (see Section I). The house work equations include cubic polynomials in age of each partner. Other regressors included in all equations are: an indicator for whether the couple resides in Paris; a cohabiting dummy; the regional unemployment rate; the number of children; and indicators for whether each partner has high school or college and more education.

House work is measured in minutes per day and it includes 'semi-leisure' chores, 'core' chores, cooking and shopping but not caring for children and/or adults.

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9. Models of market hours and home production: estimated effects of market hours on house work time

	His total housework[1]	Her total housework[1]	His + Her Total Housework[2]
His market work	-0.361**	-0.150	-0.528**
	(0.157)	(0.141)	(0.251)
Her market work	0.323	-0.295	0.0140
	(0.238)	(0.207)	(0.377)
His market work weekdays	-0.437***	-0.0901	-0.529***
	(0.1000)	(0.0915)	(0.158)
Her market work weekdays	0.253	-0.313*	-0.0589
	(0.180)	(0.163)	(0.286)
His market work weekends	-0.319**	0.00258	-0.319
	(0.129)	(0.118)	(0.203)
Her market work weekends	0.463**	-0.195	0.268
	(0.199)	(0.180)	(0.314)

Notes:

(1) The four equations of partners' market work and house work are estimated simultaneously by simulated maximum likelihood.

(2) The three equations of each partner's market work and total house work at the household level (his plus her house work) are estimated simultaneously by simulated maximum likelihood.

House work and market work are measured in minutes per day.

The bottom blocks in the Table show the effects for week and weekend days.

For both models, the explanatory variables of the market work equations include dummies for age 60 and older, and left and right cubic polynomials in age of the two partners interacted with the age 60 dummies a weekend day dummy also interacted with the age 60 dummies (see Section I). The house work equations include cubic polynomials in age of each partner. Other regressors included in all equations are: an indicator for whether the couple resides in Paris; a cohabiting dummy; the regional unemployment rate; the number of children; and indicators for whether each partner has high school or college and more education.

House work is measured in minutes per day and it includes 'semi-leisure' chores, 'core' chores, cooking and shopping but not caring for children and/or adults.

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 10. Models of retirement and 'core' chores : estimated effects of retirement

	His core chores[1]	Her core chores [1]	His + Her Core chores[2]
He is retired	-15.09	7.463	-36.53
	(12.34)	(28.04)	(31.31)
She is retired	51.00***	53.08**	91.69**
	(10.67)	(21.42)	(37.38)
He is retired weekdays	-13.20	17.41	-31.94
	(11.94)	(25.96)	(30.96)
She is retired weekdays	51.21***	59.34***	105.9***
	(10.25)	(20.94)	(36.00)
He is retired weekends	-34.97**	17.03	-55.73
	(14.60)	(29.61)	(34.55)
She is retired weekends	60.97***	-5.021	49.97
	(13.06)	(24.03)	(37.54)

Notes:

(1) The four equations of partners' retirement and house core chores are estimated simultaneously by simulated maximum likelihood.

(2) The three equations of each partner's retirement and total (his + her) core chores time at the household level are estimated simultaneously by simulated maximum likelihood.

The bottom blocks in the Table show the effects for week and weekend days.

For both models, the explanatory variables of the retirement equations include dummies for age 60 and older, and left and right cubic polynomials in age of the two partners interacted with the age 60 dummies (see Section I of the paper). The core chores equations include cubic polynomials in age of each partner. Other regressors included in all equations are: an indicator for whether the couple resides in Paris; a cohabiting dummy; the regional unemployment rate; the number of children; and indicators for whether each partner has high school or college and more education.

'Core' chores are measured in minutes per day and include cleaning, washing up dishes, doing the laundry and the ironing.

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 11. Models of retirement and 'semi-leisure' chores : effects of retirement

	His semi-leisure [1]	Her semi-leisure [1]	His + Her semi-leisure chores[2]
He is retired	162.7***	19.69	196.4***
	(33.60)	(26.89)	(48.98)
She is retired	-131.6***	22.53	-102.2*
	(23.70)	(16.26)	(54.26)
He is retired weekdays	170.9***	18.99	199.0***
	(34.32)	(26.40)	(50.02)
She retired weekdays	-117.9***	30.33*	-78.21
	(15.87)	(9.97)	(58.67)
He is retired weekends	106.0***	11.63	125.8**
	(38.83)	(28.91)	(56.31)
She retired weekends	-138.2***	9.158	-118.8*
	(29.67)	(19.35)	(62.28)

Notes:

(1) The four equations of partners' retirement and semi-leisure chores are estimated simultaneously by simulated maximum likelihood.

(2) The three equations of each partner's retirement and total (his + her) semi-leisure chores at the household level are estimated simultaneously by simulated maximum likelihood.

The bottom blocks in the table show the effects for week and weekend days.

For both models, the explanatory variables of the retirement equations include dummies for age 60 and older, and left and right cubic polynomials in age of the two partners interacted with the age 60 dummies (see Section I of the paper). The semi-leisure chores equations include cubic polynomials in age of each partner. Other regressors included in all equations are: an indicator for whether the couple resides in Paris; a cohabiting dummy; the regional unemployment rate; the number of children; and indicators for whether each partner has high school or college and more education.

'Semi-leisure' chores are measured in minutes per day and include gardening, house repairs, knitting, sewing, doing jams, care of pets.

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 12. Models of retirement and cooking: estimated effects of retirement

	His cooking [1]	Her cooking [1]	His + Her cooking [2]
He is retired	-18.36***	5.624	3.965
	(3.550)	(9.084)	(16.37)
She is retired	0.0558	66.85***	63.38***
	(10.90)	(11.63)	(11.95)
He is retired weekdays	-16.28***	6.583	5.059
	(3.509)	(8.676)	(16.35)
She retired weekdays	2.548	67.69***	64.64***
	(8.563)	(11.54)	(11.86)
He is retired weekends	-31.70***	8.851	-7.151
	(4.661)	(10.55)	(17.59)
She retired weekends	17.74*	41.98***	53.84***
	(9.172)	(13.34)	(13.59)

Notes:

(1) The four equations of partners' retirement and cooking are estimated simultaneously by simulated maximum likelihood.

(2) The three equations of each partner's retirement and total cooking at the household level (his plus her cooking) are estimated simultaneously by simulated maximum likelihood.

The bottom blocks in the table show the effects for week and weekend days.

For both models, the explanatory variables of the retirement equations include dummies for age 60 and older, and left and right cubic polynomials in age of the two partners interacted with the age 60 dummies (see Section I of the paper). The time spent on cooking equations include cubic polynomials in age of each partner. Other regressors included in all equations are: an indicator for whether the couple resides in Paris; a cohabiting dummy; the regional unemployment rate; the number of children; and indicators for whether each partner has high school or college and more education.

Cooking is measured in minutes per day.

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 13. Models of retirement and time spent on caring: estimated effects of retirement

	His care [1]	Her care [1]	His + Her Care [2]
He is retired	34.30***	13.97	51.20**
	(11.47)	(15.89)	(20.04)
She is retired	13.63	30.49**	39.43*
	(15.50)	(12.60)	(23.94)
He is retired weekdays	37.79***	15.23	55.45***
	(11.82)	(16.26)	(20.53)
She retired weekdays	13.08	31.75**	40.12*
	(15.34)	(12.92)	(24.25)
He is retired weekends	18.22	9.986	30.64
	(14.47)	(18.56)	(24.61)
She retired weekends	20.09	26.12*	41.44
	(17.40)	(15.32)	(27.47)

(1) The four equations of partners' retirement and care work are estimated simultaneously by simulated maximum likelihood.

(2) The three equations of each partner's retirement and total care work at the household level (his plus her care work) are estimated simultaneously by simulated maximum likelihood.

The bottom blocks in the Table show the effects for week and weekend days.

For both models, the explanatory variables of the retirement equations include dummies for age 60 and older, and left and right cubic polynomials in age of the two partners interacted with the age 60 dummies (see Section I). The care equations include cubic polynomials in age of each partner. Other regressors included in all equations are: an indicator for whether the couple resides in Paris; a cohabiting dummy; the regional unemployment rate; the number of children; and indicators for whether each partner has high school or college and more education.

Care is measured in minutes per day and it includes the provision of unpaid child and adult care, to individuals from the same or from other households.

Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$