Time devoted to home production and retirement in couples: A panel data analysis

A replication work

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1 Introduction

"Retirement is one of the main economic and social changes in the lives of most individuals and their households. Most people retire abruptly from a full-time job to a situation where they no longer take part in paid work. This not only affects their personal and household income, but also their social network and the activities on which they spend their time. For individuals in couples, retirement of husband or wife may have an important impact on the partner through household income, but also through the changes in the time spent by the retired partner on, for example, household production (e.g., errands, housework, care and support for other household members, repairs on and around the house, etc.) or (joint) leisure activities (Bonsang and Van Soest, 2020)."

There exists an extensive literature on the question of retirement and its effects on the time use of retirees. Hurst (2008) finds that after retirement, individuals spend more time on home production and Hurd and Rohwedder (2008) find evidence from the US where retirement increases the time men and women spend on shopping and preparing food. Additionally, they find that men spend more time on home improvements and gardening. For individuals in a couple, the retirement of the partner has an effect on the time use of the other partner (Stancanelli and van Soest, 2012). However, in the cross-section data they have from France, they find that men reduce significantly the time they allocate to home production when their wives retire, but there is no significant effect of the husband's retirement on the hours the wives spend on home production. Lastly, when considering a complex decision such as retirement, some authors have allowed for the potential endogeneity of the decision to retire (Aguiar and Hurst, 2005; Ciani, 2016) thus requiring more complex econometric tools to analyze its effects.

The paper we studied adds to the existing literature by exploiting the fact that the authors had longitudinal data at their disposal whereas previous studies relied on cross-sectional data. Indeed, Bonsang and Van Soest focus on the German pension system, due to the availability of a large panel data set. To better understand the following work, we need to briefly discuss how the German pension system works. At the time of the writing of the paper, the official pension age for men and women in Germany was 65 years old. At this age, individuals who retire receive full retirement benefits if they have contributed to the public pension system for at least five years. Early retirement at the age of 63 is possible if the individual has contributed for at least 35 years to the public pension system. Individuals with severe disability can claim retirement benefits from age 60 if they have qualified for 35 years. Women can retire from age 60 if they completed 15 years of qualifying period and paid pension contributions for more than 10 years since age 40. This means that the main thresholds for which we can expect a significant part of the population opts to retire are the ages of 60, 63 and 65. There are other thresholds for which individuals can retire, but as noted in the paper, 60, 63 and 65 still constitute the main retirement ages for most individuals in the sample. It should be noted that similar to other European countries, Germany is reforming their pension system and thus extending the age for full retirement, so new research on this topic for Germany will not find similar results to those in the paper for these same age thresholds.

For the purpose of this work we must define what we consider an individual being retired as there can be many possible definitions (see, e.g., Lazear, 1986; or Hurd, 1990). We use the same definition as Bonsang and Van Soest; a person who is retired is an individual who is not working (engaged in paid work) and receiving pension benefits. In the paper of Bonsang and Van Soest, retirement had two possible channels where it could affect the time use of households. Firstly, an individual or direct effect, whereby there is a change in the time allocated to home production and leisure after an individual's own retirement. Secondly a cross effect or indirect effect, whereby there is a change in the time allocated to home production, paid work and leisure as a result of the partner's retirement. This contributes to the idea that retirement is a joint decision and this is why the authors wish to study the existence of both of these effects. However, since we do not have any possibility in our data to identify couples, we must study a narrower issue. Indeed, we will try to understand how does an individual's own retirement affect their own time use.

2 Data

2.1 Initial dataset

For our work, our data comes from the same source as the authors: the German Socio-Economic Panel (GSOEP) from the German Institute for Economic Research (DIW Berlin). Our panel covers a period of 1991 to 2016 and we do not have data allowing to identify couples. Thus, we can only analyze the effect of an individual's own retirement on his time use. The individuals in our sample are aged between 45 and 75 years old. Prior to any cleaning of the dataset, we have 178 435 observations for a total of 26 361 individuals.

The dataset contains information on a persons gender, retirement status, age (in months), year of being surveyed, personal key identifier, time use per weekday, number of adults and children (less than 16 years old) in the household, household income (also in log) and a dummy indicating if an individual is older than a retirement threshold (60,63,65). The two notable differences of this dataset from the one of the authors is that we do not have couple key identifiers and information on time spent in care for persons in need of care. The information on time use comes from survey data from the GSOEP.

2.2 Cleaned dataset

We started by removing all the observations for which there were missing values in at least one the variables, which left us with 163 870 observations and 25 142 individuals. We then summed all the reported time use (h_total) which allowed us to create the residual time use category h_other that captures the remaining hours not reported in a 24 hour a day. We noticed that there was measurement error in the dataset concerning the reported time use variables as for instance, h_total was superior to 24 for a total of 462 observations (0.3% of the cleaned dataset). This is quite common when using time use surveys and even though we dropped observations for which total time use was impossible (superior to a 24 hour day), we proceeded to drop observations for which we found a value of h_total larger than 19. Indeed, as rest is not included in h_total (and is likely included in the residual h_other), we set a floor of 5 hours of sleep per day, which is also quite precautionary. This left us with 161,376 observations and 24,917 individuals and we observe on average an individual 6.5 times in the period 1991 to 2016. After all these modifications we dropped 10% of the initial dataset.

Our dataset either contains people that are retired or that are working, there are no individuals that are out of employment and that do not receive pension benefits. 51.51% of individuals in our sample are men (83,131 individuals) and 48.49% are female (78,245 individuals). In our sample 63.19% of men are working and 36.81% of them are retired. For women, 58.36% of them are working and 41.64% are retired. For men and women combined, 60.85% of the individuals in our sample are working and 39.15% of them are retired.
To check for the relevancy of using a linear regression model and not a censored regression model we created the variable home production as in the paper, and checked for men and women the percentage of individuals in our sample that report zero hours of home production. The paper defines home production as the sum of time spent on errands, housework and repairing or gardening following Schwerdt (2005) and Franzis and Stewart (2011). We found that 10.54% of men and 1.43% of women report zero hours of home production. Thus, it is reasonable to go forward with linear regression models. Our last modification was that we multiplied by five our time use variables to

obtain weekly time use variables and we then re-labelled our variables accordingly.
Lastly, Table 1 provides a summary of the mean values of our variables depending on labor force status and gender of an individual.

Table 1: Descriptive statistics

	Retired men	Retired women	Working men	Working women
Working hours per week	0	0	46.38	35.57
Home production per week	21.27	27.21	10.65	18.38
Hours of housework per week	6.253	15.58	3.066	10.10
Hours of education/training per week	0.428	0.292	0.797	0.753
Hours of repairing/gardening per week	8.903	4.655	4.170	2.910
Hours of leisure activities per week	17.31	15.75	7.912	8.496
Hours of child care per week	0.886	1.438	1.361	2.146
Hours of errand per week	6.119	6.972	3.419	5.367
Age(in months)	66.77	66.76	53.44	52.74
Number of adults in the household	2.034	1.829	2.388	2.268
Number of children in the household	0.0372	0.0289	0.483	0.286
Household income	2540.2	2366.5	3929.1	3588.1
Number of individuals	30603	32580	52528	45665

Most notably, we can already see that retired men and women have higher time spent on home production compared to working men and women. Retired individuals also spend more time on leisure activities than working individuals. Interestingly, working individuals spend more time on education/training per week than retired individuals which is in line with the Ben-Porath (1967) model of human capital. Additionally, working individuals spend more time on child care per week than retired individuals. Lastly, working individuals have a higher household income than retired individuals which is to be expected since the average net replacement rate of the German pension (the percentage of the average salary the pension equates to) is 51% and the maximum pension is capped at 70% of the average salary. Lastly, it should be noted that women spend more time on housework, child care and errands per week than men for either working or retired individuals. All of these data points were taken at the mean of the distribution and are purely descriptive.

3 Explanation of the econometric model

3.1 Observing a discontinuity

The conceptual idea behind a Regression discontinuity framework, is that for a continuous variable, in our case age, individuals that are just below and just above an arbitrarily defined threshold (here 60, 63 or 65) are essentially the same. There should be no systematic difference in characteristics between the two groups (Angrist and Pischke, 2008). Thus, if we observe any discontinuity in the potential outcome between individuals just below and just above the threshold, we can attribute the causality of this discontinuity to the arbitrarily defined rule. Consequently, we plotted our forcing variable age on the horizontal axis and our outcome variable, retirement and home production, on the vertical axis and observed if there are any discontinuities at the age thresholds in the potential outcomes. Figures 1. and 2. show the change in the predicted proportion of retired men and women by age and Figures 3. and 4. illustrate the change in the predicted number of hours spent on home production by age for men and women.

Fig. 1. Predicted proportion of retired women by age using a FE model.

Fig. 2. Predicted proportion of retired men by age using a FE model.

To obtain these figures, we estimated a Fixed Effect regression firstly with retirement status as the dependent variable and after weekly hours of home production. For this, we needed to correctly model the relationship between our dependent variable (or treatment variable) and our forcing variable ($E[Y_i|X_i]$) as it could be non-linear. Indeed, to find the functional form of age that best fits the data, we used the polynomial approach by Lee and Lemieux (2010). This approach consists in estimating a function for age and including the full set of bin dummies in our regression. If the null hypothesis that the bin dummies are equal to 0 is rejected, we add polynomial terms to our function until we can no longer reject the hypothesis. Following this approach, separately for men and women, led us to find the same age function as the authors, meaning a cubic function for before age 60 and after age 65 and a quadratic function for the age intervals [60;63] and [63;65]. This respects the requirement whereby the age function needs to differ on both sides of the threshold.

We notice a clear discontinuity in the probability to be retired at the three age thresholds for both men and women in Figures 1. and 2. We also find a discontinuity in the number of hours devoted to home production per week at the age thresholds for both men and women in Figures 3. and 4. These results suggest that it is the increased probability to retire at the age thresholds that is driving the increase in the number of hours spent on home production at those same age thresholds. To check our identifying assumption, we plotted using the same age function but using other variables; number of children and adults in the household, and household and log household income, as the outcome variables. We do not observe any discontinuity (besides at age 60 for men when household income and log household income are used as outcome variables) at the age thresholds thus adding to the validity of our strategy. It should be noted that these figures are purely descriptive and are not the result of an estimation strategy but they do add visual support to the research question at play.

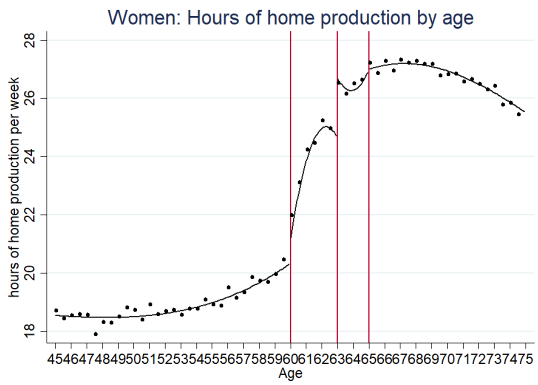

Fig. 3. Predicted number of hours spent on home production by age for women using FE model.

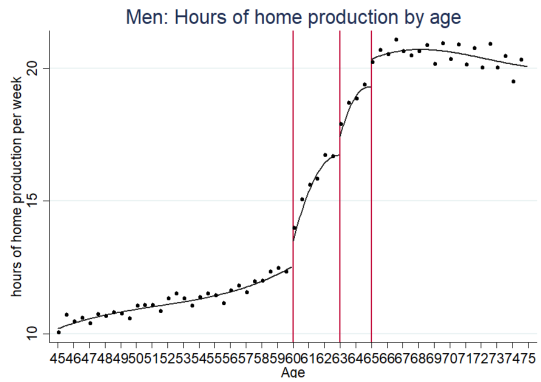

Fig. 4. Predicted number of hours spent on home production by age for men using FE model.

3.2 Econometric approach

We wish to study the impact of retirement on home production. Thus, we consider retired individuals as treated individuals and the number of hours spent on home production as our dependent variable of interest. As mentioned in section 3.1, we observe jumps in the probability of treatment (being retired) of an individual conditional on age, thus our Regression Discontinuity approach is better suited to a Fuzzy design. A Fuzzy Regression Discontinuity Design, essentially functions as an Instrumental Variable regression, due to the non-deterministic nature of treatment status that is the opposite to a Sharp RD setting. Indeed, in a Sharp RD setting, treatment status is a deterministic function of a covariate, in our case age, and this is not the case of our study as individuals do not retire for sure at a given age threshold but are simply more likely to do so. With a Fuzzy RD setup, the discontinuity we found in the probability of being retired conditional on age is used as an instrument for treatment status. Thus, the age thresholds will be used as instruments for being retired.

For our estimation, we use two different regression models:

- A FE model that assumes that retirement is exogenous from the time-varying error term but allows for correlation between the unobserved time-invariant error term and the explanatory variable of interest.
- A FE-IV model that relaxes the assumption that the explanatory variable of interest is exogenous from the time-varying error term.

We estimate two separate regressions for men and women:

$$h_{it}^{m} = \beta_1^m R_{it}^m + X_{it}\beta^m + g^m(age_{it}^m) + \alpha_i^m + v_{it}^m \tag{1}$$
$$h_{it}^{f} = \beta_1^f R_{it}^f + X_{it}\beta^f + g^f(age_{it}^f) + \alpha_i^f + v_{it}^f \tag{2}$$

Where h_{it} is the time in hours devoted to home production (unitary variable) for individual i at time t. R_{it} is a dummy variable indicating if the individual is retired, thus the benchmark is an individual who is currently employed. X_{it} is a row vector of control variables describing household characteristics of an individual. $g(age_{it})$ is a gender specific flexible age function. α_i represents the time-invariant unobserved heterogeneity term, i.e. the individual fixed effect. Lastly, v_{it} is the time-varying error term.
β_1 is the parameter of interest as it estimates the Local Average Treatment Effect (LATE) for the compliers of retirement on home production. The compliers being the individuals that once they reach the age threshold they are eligible for, they retire and would not retire if they did not reach the age threshold. The FE model however estimates an Average Treatment effect on the treated.

3.3 Main hypothesis behind the estimator and possible sources of bias

The estimator allows to check for the existence of a direct effect of retirement on home production. Thus, if we find positive and significant values of our point estimate β_1 then it will confirm the existence of a direct effect of own retirement on home production. However, it should be noted that in our FE model, we assume that retirement is exogenous, but it is highly likely it is endogenous. Indeed, unobserved preferences and fixed preferences for leisure or productivity in market or non market activities are potential drivers of both retirement and the allocation of non-working time. As a result, if retirement is endogenous, then our assumption of independence of retirement and the time-varying unobserved heterogeneity is likely not to hold for our FE model. Thus, we will have a biased point estimate.

Firstly, the FE model we estimate assumes there is no independence of retirement and the individual fixed effects we control for but assumes that retirement is independent (exogenous) of the error term. The longitudinal aspect of our data allows to control for the unobserved time-invariant heterogeneity that is normally a component of the error term, by including them in the regression. Indeed, this is possible as the FE model allows for correlation between fixed effects and the observable variables. Thus, the unobserved time-invariant heterogeneity are taken as parameters and each unit have their own specific fixed effect at the individual level. This allows to reduce the risk of omitted variable bias as the fixed effects are no longer in the error term. However, we also estimate a Random Effects model that has all the assumptions of a FE model but has the stronger assumption that the observable variables are also independent from the unobserved time-invariant heterogeneity.
Following the Conditional Independence Assumption, we add additional controls to the regression, being the number of children and adults in the household. Finally, we cluster the standard errors at the individual level to avoid cluster bias. Indeed, if we do not cluster our standard errors, they will no longer be homoscedastic and there will be correlation of errors between groups of individuals and as a consequence the OLS estimator won't be convergent.
Thus, respecting all the previous assumptions and the Gauss Markov assumptions, our regression

model can be estimated by OLS and will deliver unbiased and consistent estimators.

Secondly, our Fuzzy RD or in the authors' terms, the FE-IV model, requires different assumptions than our FE model described above and notably allows for the correlation of retirement with the error term. As mentioned in section 3.1, being slightly above the age thresholds creates a discontinuity: there is a jump in the probability of being treated (retired) conditional on a covariate (age). Thus, this discontinuity becomes an instrumental variable for determining treatment status. For this to work, the instrument needs to be exogenous, which is quite reasonable to assume since the age thresholds were arbitrarily chosen, and that there are no other confounding policy affecting the decision to retire in Germany at those age threshold. This means that absent the policy, we would not observe discontinuities in the probability to retire at the age thresholds. An example of a confounding policy would be the availability of widespread benefits when reaching an age threshold for retired individuals. For example free parking spaces and public transport for 65 year old retirees. To the best of the authors' knowledge, there are no other policies, tax and benefit changes, affecting these ages in Germany.
Our setup essentially works as a standard two stage least squares regression: we estimate the first stage, take the predicted values and estimate the second-stage to obtain our point estimates. Thus, as we are estimating a LATE, our model needs to satisfy the following assumptions:

- **Independence of the instrument**: the instrument is as good as randomly assigned and is independent of potential outcomes and potential treatment assignments.
- **The exclusion restriction**: the only pathway for causal effect is the effect of treatment (retired) on the dependent variable (home production) and not of the instrument (age thresholds) on the dependent variable. In other words, the instrument is independent of the error term, allowing for endogeneity of the treatment variable.
- **Strong first-stage**: there needs to be the existence of a first-stage, i.e. that the covariance between the instrument and the endogenous explanatory variable is significantly different from zero.
- **Monotonicity**: whilst it is possible that the instrument has no effect on some individuals, for those for which it does have, these individuals are affected in the same way. In other terms, there exists no defiers to the policy and only compliers.

For the independence assumption, we can reasonably assume that it is met, as the age thresholds are arbitrarily defined by the German government. For the exclusion restriction, as said before, the age thresholds have an effect on the probability to retire and not on the hours of home production per week. As shown in section 3.1, individuals reaching the age thresholds have a significant increase in their probability to retire compared to individuals who do not reach the thresholds meaning there exists a strong first stage. Lastly, it is quite reasonable to assume that there exists no defiers in our sample. Indeed, that would mean that we would have individuals who do not wish to retire when they reach an age threshold but do retire at any other age, which is quite unlikely.
Thus, with these assumptions met, the inclusion of controls for children and adults in the household, fixed-effects, the flexible age functions, and clustering the standard errors at the individual level, we can estimate the effect of retirement on home production through a FE-IV regression using the age thresholds as instruments for retirement.

4 Results

We ran separate regressions for the men and women of our sample. We used two main estimation methods: FE and FE-IV models. Both methods return similar and significant results. In this section we will discuss these results and establish their robustness.

4.1 First stage and Reduced form equations results

We present the results for the first stage (the population regression of retired on the age thresholds) and the reduced form (the regression of hours of home production on the age thresholds) for men and women in Table 2. The regressions also include an age function for each gender which consists in a cubic function before age 60 and after age 65 and a quadratic function for the age intervals [60,63] and [63,65] and the number of adults and children in the household as additional control variables. We estimate these equations through a fixed effect regression with standard errors clustered at the individual level. Columns (1) and (2) show the first stage results for being retired. As in the paper, we found that the age threshold dummies are positive and highly significant for both men and women. For women, it increases by 8.5 (3.2, 4.5, resp.) percentage points when they reach age 60 (63, 65, resp.). For men, the probability to be retired increases by 4.1 (4.0, 10.3, resp.) percentage points when the individual reaches age 60 (63, 65, resp.). These results highlight the fact that the retirement decision is highly sensitive to the three potential eligibility ages 60, 63 and 65.

Table 2: First-stage and reduced form estimates using age thresholds as instruments. FE models.

	Retired		Home Production	
	Man	Woman	Man	Woman
being 60 year-old or more	0.041***	0.085***	0.532*	0.732**
	(0.009)	(0.011)	(0.288)	(0.317)
being 63 year-old or more	0.040**	0.032**	0.364	1.457***
	(0.016)	(0.015)	(0.437)	(0.463)
being 65 year-old or more	0.103***	0.045***	1.384***	-0.075
	(0.014)	(0.012)	(0.428)	(0.430)
Number of individuals	8313	78245	83131	78245

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Concerning the results of the reduced form regressions for home production, they are presented in columns (3) and (4) of Table 2. As in our dataset we do not have couple identifiers, we can only analyze the impact of own retirement on home production. Thus, we can only check for the existence of an effect whereby reaching one of the three specific age threshold is likely to increase home production as it increases the probability to stop working, giving more time that can be devoted to home production. Results for women show the existence of such effect, as when reaching age 60, 63 or 65, hours of home production increase significantly (except for age 65 where it is negative and not significant). For men, hours of home production increase significantly when they

reach age 60 (at the 10%-level) and age 65 (at the 1%-level), also suggesting the existence of a direct effect of retirement on hours of home production. Indeed, it is at the ages where men and women are most likely to retire that hours of home production increases the most, thus adding further evidence in favor of the direct effect of retirement on hours of home production.
In results reported in the code, we estimated the first stage and reduced form equations by restricting the age bandwidth to be between 50 and 70 years old for both genders. Results are qualitatively the same as those presented above for both genders.

4.2 Main results

We now turn to the results of the regressions estimating the effects of retirement on the numbers of hours of home production for both genders. Columns (1) and (4) of Table 3 present the results for men and women of FE models that assumes that retirement is exogenous (i.e. not correlated to the time varying error term). Columns (2) and (5) show the results of FE-IV models that correspond to the reduced form and first stage regressions in Table 2, and columns (3) and (6) assess the robustness of the FE-IV when we restrict the age bandwidth and only use individuals aged between 50 and 70 years old. For men, own retirement increases the time devoted to home production by approximately 9.8 h per week (compared to a person who is working) according to the FE model. For women, this increase is about 8 h per week. Workers typically work much more than 10 h per week (see Table 1; the averages are more than 30 h for women and more than 40 h for men). The sizes of these effects therefore imply that a transition from work into retirement leads to a substantial increase of own time spent on home production or "leisure" (in a broad sense) as a result of not doing paid work anymore.

Turning to the FE-IV models, while they do have much larger standard errors, most of the point estimates of the FE-IV models are close to those in the FE models, but are slightly higher. The endogeneity test does not reject the hypothesis that own retirement is exogenous, suggesting that endogeneity due to reverse causality or time-varying unobserved confounding factors is not driving our main results. All the F-tests of the excluded instruments show that our instruments are relevant and strong predictors of our endogenous variables. However, we could have simply restricted ourselves to the FE models, since the point of using FE-IV models is to control for the possible endogeneity of retirement and that the endogeneity tests do not reject the hypothesis of the exogeneity of retirement. In addition, FE-models return more precise point estimates as they have smaller standard errors than the FE-IV models.

Table 3: Retirement and hours of home production per week by gender.

	Men			Women		
	(1)	(2)	(3)	(4)	(5)	(6)
	FE-Model 45-75	FE-IV 45-75	FE-IV 50-70	FE-Model 45-75	FE-IV 45-75	FE-IV 50-70
Own retirement	9.756***	12.282***	12.030***	7.982***	13.214***	15.157***
	(0.215)	(3.100)	(3.796)	(0.263)	(3.420)	(4.147)
Number of individuals	83131	83131	55241	78245	78245	50510

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

In addition to those two main specifications, we conducted a RE model and FD-IV model estimation for both genders. For the RE model, results reported in the code are qualitatively similar to those found for the FE model for both men and women. For the FD-IV, results are same-signed and significant but return lower point estimates in terms of the number of hours of home production than the FE-IV models. As our time period covers more than two periods (for two year observation samples, FD and FE models return the same results), FE models tend to be preferred than FD models. Thus, we chose to present only FE-IV results. Nevertheless, these results add more evidence to our findings.
Our estimated effects of retirement on home production are similar in magnitude to those found by the authors. Even though we found a higher increase in hours of home production as a result of own retirement (direct effect), this could be due to the fact that it was impossible for us to control for possible cross effects due to the retirement of the partner. Thus, this is why it is important to control for partner's retirement as the authors did, to avoid possible overestimation of the direct effect of retirement on home production.

4.3 Additional results and robustness tests

Tables 4 and 5 present the results of FE-IV models for each component of home production. We do not comment each result, but they are all reported in the code. Men increase time devoted to housework by about 3.6 h per week when they retire from work, compared to 6.9 h for women. Time devoted to errands increases by 4.2 h per week for men which is larger than for women (2.2 h). The increase in repairs/gardening is similar for both genders (4.4 h for men and 4.2 h for women) which is a different result for women than the one found by the authors. The final columns of Tables 4 and 5 show the effects of retirement on time spent on child-care, hobbies and other leisure activities, and on other unspecified time uses (most likely rest). Men and women increase their time spent on child care when they are retired. Men and women increase substantially their time spent on leisure activities (8.8 h and 7.7 h resp.). Lastly, there is a significant increase for both men and women (22.8 h and 15 h resp.) in terms of the hours they spend on unreported time uses, most likely the time they spend on rest. We also estimated with a FE model a regression for each component of home production and find similar but admittedly smaller point estimates.

We conducted two robustness checks for our main results by estimating a FE model and a FE-IV model. Firstly, we excluded controls for the number of adults and children in the household and found for both men and women similar results to those we found when including these controls. Secondly, we restricted our sample to individuals aged between 50 and 70 years old and also found qualitatively similar results to those found with the full sample. Thus, these robustness checks add support to our estimation strategy and our results.

Lastly, as mentioned in section 3.1 we did notice a discontinuity notably at the threshold age of 60 in terms of log household income. This is one reason for why we did not include revenue as a control in our equations for home production, as it is likely that we are dealing with a bad control issue. Indeed, as established in our first stage results, reaching an age threshold significantly increases the likelihood of retirement. Thus, it could be argued that the drop in terms of log household income observed at the age of 60 could be due to the increase in the likelihood of retiring at that age, as you start earning your pension which as discussed in section 2.2, is lower than your average salary. As a consequence, retirement directly affects the distribution of log household income creating a selection bias. Thus, controlling for log household income will bias our results for the effect of retirement on hours of home production. We tested for this by including lrevb as a control which reduced the coefficient of retirement in our estimations (results not reported in the code), and as a result excluded the variable from our specifications.

Table 4: Men: Retirement and hours spent per week on the different components of home production and other time use. FE-IV models using age thresholds as instruments.

	Components of home production			Other time use		
	(1)	(2)	(3)	(4)	(5)	(6)
	Housework	Errands	Repairs/Gardening	Child care	Leisure	Other
Own retirement	3.612**	4.217***	4.452**	1.703*	8.757***	22.753***
	(1.501)	(1.184)	(2.102)	(0.921)	(3.271)	(4.612)
Number of individuals	83131	83131	83131	83131	83131	83131

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5: Women: Retirement and hours spent per week on the different components of home production and other time use. FE-IV models using age thresholds as instruments.

	Components of home production			Other time use		
	(1)	(2)	(3)	(4)	(5)	(6)
	Housework	Errands	Repairs/Gardening	Child care	Leisure	Other
Own retirement	6.873***	2.174*	4.166**	2.592*	7.693**	15.027***
	(2.129)	(1.260)	(1.624)	(1.473)	(3.025)	(4.721)
Number of individuals	78245	78245	78245	78245	78245	78245

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5 Conclusion

We have analysed the direct effect of retirement of individuals on home production for each gender, using longitudinal German data from 1991 to 2016 with information on the time spent on several types of activities. Our models take account of the potential endogeneity of retirement and the decision to do paid work. Still, we find that fixed effect models provide results that are similar to the results using a regression discontinuity design or instrumental variable strategy based upon the threshold ages for retirement in the German pension system. However, endogeneity tests failed to reject the exogeneity of retirement suggesting we could have simply used a fixed effect model.
We found similar results to those found by the authors of the paper. Indeed, retirement substantially increases own time devoted to home production for both men and women, by approximately 8–14 h per week. Thus, as paid work entails on average more than 30 h per week, retirees use the time freed up from not working anymore to pursue activities such as resting, hobbies, and notably home production. The latter could help explain the retirement consumption puzzle as home production can be seen as a substitute to consumption.

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