Intra-household allocation of non-mandatory retirement savings

Christoph Metzger*

Institute for Public Finance I

Research Center for Generational Contracts

University of Freiburg

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Traditionally, households have been seen as acting as a single unit when it comes to savings. Although this might be correct for some parts of household savings, we question the correctness of the unitary model with respect to non-mandatory retirement savings. Therefore we analyze the intra-household allocation of retirement savings between partners in Germany taking an individualistic approach.

First, the decision to save at all is analyzed using a seemingly unrelated bivariate probit model, showing that the possession of retirement saving accounts among spouses is positively correlated, hinting at a "crowding-in" of saving accounts. However, this could be only due to some tax reasons. Thus, we analyze additionally the interaction of savings between spouses using three-stage least squares, allowing for endogeneity between the spouse's savings. These results additionally show a "crowding-in" of total retirement savings amounts between spouses, probably due to some "peer effect". The unitary model of household decision making can thus be rejected with respect to retirement savings.

JEL-Classification: D14, D91, H31

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*Institute for Public Finance I, Albert-Ludwigs-Universität Freiburg, Bertoldstr. 17, 79085 Freiburg, Germany (Tel: +49-761-203-9236, christoph.metzger@vwl.uni-freiburg.de). I would like to thank two anonymous referees as well as my colleagues Rene Petilliot and Lewe Bahnsen for helpful comments.

1. Introduction

Originally, households have been seen as acting economically as a single unit. This unitary model, implying a single decision making process among the individual household members, was applied for the analysis of household decisions ranging from labor supply to overall household savings. However, in the last years this simplifying approach has been questioned and disproved by many researchers (for example Vermeulen (2005), Attanasio and Lechene (2002) and Browning (1995), just to name some of them), because it neglects individual preferences almost completely. Alternative approaches have been proposed, recognizing household behavior as a result of a decision-making process reflecting different preferences among the household members. These collective approaches can be further divided into cooperative and non-cooperative models. In the first, spouses negotiate decisions taking each other's preferences into account. In the second, each household member takes the other members' behavior as given and maximizes his/her own utility.[1] While the collective model has been confirmed in a number of studies with respect to the labor supply decision at the extensive as well as the intensive margin,[2] evidence for the household decision-making process with respect to savings is scarce.[3] This may result from the fact that information on household savings largely originates from panel surveys, only measuring overall household savings. With data on individual retirement savings at hand, we will analyze the intra-household allocation of retirement savings from a cross-sectional perspective, modelling each spouses decision separately but allowing for mutual endogeneity at the same time. The question to be answered in this article is not a theoretical one but a somewhat more empirical one. How does the intra-

[1] For a more detailed overview on the different household models see e.g. Garcia et al. (2010) and for an overview on different collective models see Vermeulen (2002).
[2] See e.g. Garcia et al (2010), Bloemen et al. (2008) or Aronsson et al. (2001).
[3] Browning (1995) found that with a higher share of the wife in household income the total household saving rate declines. By contrast, Lee and Pocock (2007) conclude for South Korea that an increasing share of the wife's relative earnings leads to increasing total household savings. Lee and Pocock (2007) are to our knowledge the first to explicitly model and analyze the allocation of financial resources between spouses. Grabka et al. (2015) examined the distribution of wealth between couples in Germany, concluding that the intra-household wealth gap declines with the female taking financial decisions.

household allocation of retirement savings look like? And how are the spouse's savings related to each other? Does one spouse decrease savings if the other one saves more if controlled for common household statistics? Or does the other spouse also increase savings due to some recognition or peer effect? Given that some retirement savings are saved by the aggregate household by definition (e.g. real estate), we focus on saving accounts usually used to save for old-age reasons which can ultimately be attributed to a specific household member. In order to study the interaction between household members with regard to retirement savings in Germany, we use the Panel on Household Finances (PHF) provided by the Bundesbank. This data set allows us to analyze individual savings and simultaneously to consider the overall household situation as well as the partner's or spouse's retirement savings. The remainder of this article is structured as follows. First, the dataset is described in section 2.1. followed by the outlining of the empirical strategy in section 2.2.. After showing some descriptive statistics, the multivariate analysis with respect to the saving decision (section 3.2.) and saving amount (section 3.3.) is presented, followed by some robustness analysis in section 3.4.. The article finishes summarizing the results and presenting implications for further research.

2. Data and empirical strategy

2.1. The PHF dataset

The following analysis is based on the newly introduced "Panel on Household finances" (PHF) in Germany.[4] The PHF, conducted by the Bundesbank, is part of the Eurosystem's "Household Finance and Consumption Survey" (HFCS). In addition to the common European-wide questionnaire covering questions on household finance, wealth and consumption, the PHF puts special emphasis on two further topics, namely savings and old-age provision. Therefore,

[4] For more detailed information about the PHF see http://www.bundesbank.de/Navigation/EN/Bundesbank/Research_centre/Panel_on_household_finances/panel_on_household_finances.html

detailed information on an individual level is collected through different types of saving vehicles, as well as financial assets. This information is of special interest as it enables the analysis of savings specially linked to old-age pension provision. Besides information about individual retirement savings, the PHF also includes detailed household characteristics e.g. household net income, children, etc. This rare combination allows us to analyze the interaction between the retirement savings of spouses within the household context. The survey is designed to be a full panel with a survey frequency of three years. So far, two waves have been conducted in 2010/2011 and in 2014. We use both waves throughout the following analysis.

The problem of missing data caused by item non-response, generally present with surveys about financial data, was coped with by using multiple imputation (m=5) to fill these missing values and simultaneously considering the uncertainty of these imputations. Leading to five imputed datasets this has to be considered while analyzing the data.[5] However, for the purpose of analyzing the interaction between spouses, we refrain from using the imputed observations and stick to the original values, as the imputation procedure could eventually impose own assumptions about the correlation between the spouses' savings in retirement accounts.

2.2. Empirical Strategy

In general, all saving vehicles can be used to transfer present income to the own retirement period as e.g. saving accounts, private pension insurance, cash value life insurance, stocks, real estate etc. However, the saving reason cannot always be clearly distinguished. As this article puts special emphasis on retirement savings, only vehicles, which are directly linked to retirement, are analyzed in the following sections. These vehicles consist of state-subsidized private pension contracts (Riester or Rürup pensions),[6] all kinds of voluntary occupational

[5] For further information about the multiple imputation procedure in the PHF dataset and the appropriate analysis see Zhu and Eisele (2013).

[6] To facilitate the following sections, the term Riester pension will refer to both Riester as well as Rürup pension plans, because they are not further distinguished in the dataset. Rürup pension or 'Basis-Rente' refers to pension plans designed for self-employed individuals with tax-deductible contributions up to 22,172 Euros in 2015.

pension schemes, private non-subsidized pension insurances and cash value life insurance.[7] Occupational pensions of different types are summarized with the exception of direct pension insurances financed by the employer. As the decision for this type of occupational pension, as well as the contributions are made by the employer and not the employee, it can be regarded rather as employer saving than as individual rational decision.

The research question raised in this article is whether households act as a unit when it comes to retirement savings or whether these decisions are made independently on an individual level. If both partners jointly determine their retirement savings, as proposed by the unitary model, one could expect that due to transaction costs retirement savings would not be split up between the spouses. More precisely, one spouse makes a saving contract for the total household, what could be the case for example for cash value life insurances. However, due to subsidies or tax exemptions for some contracts (Riester or occupational pension contracts), it could also be rationale to split the savings between both spouses in order to maximize overall public subsidies if the maximum subsidy or tax exemption is already reached by one spouse. In these cases both spouses' savings would act as close substitutes and hence one would expect the savings of one spouse to crowd out the savings of the other spouse holding all other factors constant.

On the contrary, one could also think of a "crowding-in" of retirement savings among both spouses due to the so called "recognition effect" introduced by Cagan (1965). The reasoning behind is an increasing awareness of the need for additional savings as one spouse starts to save for retirement.[8] This effect could further be enhanced by the fact that if one spouse decides to

[7] This approach has the disadvantage of neglecting other saving instruments for retirement, especially investments in real estate, which constitutes a relevant part of private household wealth (see e.g. Grabka and Westermeier (2014), p. 159). However, with regard to the question of the interaction of individual retirement savings within a household, savings in real estate become irrelevant as these savings are usually determined only on the household level.

[8] For example Börsch-Supan et al. (2012) found a positive correlation between the possession of an occupational pension plan and a subsidized Riester or unsubsidized private pension plan for German households.

make a saving contract, the other spouse might get in touch with a financial advisor as well.[9] Thus, this "recognition effect" could also be labelled as a peer effect. As mentioned earlier, the possession of retirement saving contracts of both spouses does however not necessarily mean a "crowding-in" of retirement savings, but could also be owed to tax reasons. For a "crowding-in" to exist, we would additionally have to observe a positive correlation between each spouse's savings.

Hence, we apply a two-stage estimation procedure in order to analyze the intra-household composition of voluntary retirement savings for both the extensive margin (decision to save) and the intensive margin (amount being saved) of retirement savings. In the first stage we analyze the saving decision measured by a dummy variable equaling one if the individual is saving for retirement. Considering the possibility of mutual dependence between each spouse's decisions (correlated error terms), either positive in the case of a "crowding-in" of saving accounts or negative for a "crowding-out" as implied by the basic unitary model, we estimate both decisions simultaneously using a bivariate probit model. Both spouses share a common set of household variables (e.g. household income, children, real estate property) while they differ with respect to their individual educational and labor market characteristics. Thus, we estimate a seemingly unrelated bivariate probit model based on each spouses' individual X^{i}_{ind} as well as common household socio-economic characteristics X_{HH} as shown in Equation 1.[10] The mutual dependence of the error terms is reflected by the coefficient of ρ (rho).

Eq. 1

$$y_A^* = \propto_0 + \propto_1 * X^{A}_{ind} + \propto_2 * X_{HH} + \varepsilon^{A} \qquad y_A = 1 \text{ if } y_A^* > 0$$

$$y_B^* = \beta_0 + \beta_1 * X^{B}_{ind} + \beta_2 * X_{HH} + \varepsilon^{B} \qquad y_B = 1 \text{ if } y_B^* > 0$$

$$Cov(\varepsilon^{A}, \varepsilon^{B}) = \rho$$

[9] Pfarr and Schneider (2011) show for Germany that being in contact with a financial advisor increases the probability to possess a Riester pension contract as a sort of supplier-induced demand.

[10] For an overview on the detailed methodology of bivariate probit models see Greene (2003), section 21.6.

The set of individual socio-demographic variables comprise of age, age squared, a dummy for Eastern Germany, a dummy for an immigrant background[11],whether the individual is married or not and dummy variables covering various degrees of education. The set of labor market characteristics covers variables for gross income (gross income, gross income squared), type of employment (e.g. unemployed, civil servant, self-employed with or without employees), employment situation (full-time, part-time, marginally or fixed-term employed etc.) and a set of dummies covering the sector of employment[12].

Labor market characteristics first determine the need for additional retirement savings. For example civil-servants are members of a generous defined benefit system and thus do not need to save using retirement saving accounts but can also use other more flexible saving vehicles. On the contrary, for self-employed persons insurance in the statutory pension scheme is non-mandatory, hence they have an additional demand for retirement saving accounts.

Having analyzed whether the decision to save at all is influenced by the partner's decision, we turn our attention in the second stage to the question whether also the amount being saved is influenced by the spouse's savings or not. This question is equal to asking whether the unitary model is appropriate with regard to retirement savings or not. An observed "crowding-out" between the spouse's saving amounts could be interpreted in favor of income pooling or the unitary model or at least the collective model, whereas an observed "crowding-in" or no observed endogeneity would present weak evidence for a more or less individual decision-making process. Hence, we estimate the following set of equations (Eq. 2), where $\log s^A$ denotes the logarithm of the yearly retirement savings of individual A, X_{ind}^A is representing a vector of socio-economic variables of the same individual as e.g. demographics, labor market

[11] Individuals are defined as having an immigrant background if they either do not have a German citizenship or received it sometime after birth.

[12] The sector of employment probably plays a crucial role for the possession of an occupational pension plan as these pension plans are more commonly offered in some sectors than in others although every person has a legal entitlement at least for an occupational pension plan financed through deferred compensation.

characteristics etc. and X_{HH} is representing the common set of household characteristics. The respective error terms are denoted by ε^A and ε^B which are not restricted to be independent of each other.

Eq. 2

$$\log s^A = \propto_0 + X^A_{ind} * \propto_1 + X_{HH} * \propto_2 + \propto_3 * \log s^B + \varepsilon^A$$

$$\log s^B = \beta_0 + X^B_{ind} * \beta_1 + X_{HH} * \beta_2 + \beta_3 * \log s^A + \varepsilon^B$$

These equations can be regarded as being determined simultaneously and hence the partner's savings must be treated as endogenous variables. Considering this mutual endogeneity, we estimate the coefficients of this set of equations using three-stage least squares.[13]

Three-stage least squares (3SLS) presents an extension of two-stage least squares and allows for mutual dependence of the error terms between both equations. It combines two-stage least squares estimates with a correction for the mutual dependence. The first two steps consist of two-stage least squares estimations of each single equation and the estimation of the covariance matrix of the error terms in the system of equations. In the last stage these estimates are used to compute the Generalized least squares (GLS) estimator of the system.

Why to use the logarithm of savings and not nominal savings? Using the log of retirement savings has two relevant properties. Given the lognormal distribution of individual savings, coefficients are biased if we use the nominal values. Additionally, it restricts the analysis to households with both spouses saving. Analyzing the existence of either a "crowding-in" or a "crowding-out" of retirement savings between spouses, using observations with only one person saving would be unrewarding.

[13] For the exact properties of the three-stage least squares method see Wooldridge (2010), Chapter 8.

3. Results

In this section, the empirical estimates are presented first for the intra-household allocation of voluntary retirement saving accounts as well as for the corresponding saving amounts. With the focus lying on saving for retirement, the further analysis is restricted to households consisting of individuals not receiving a pension yet, leaving us with 2251 households.[14] In order to analyze the allocation of saving amounts and whether a "crowding-in" of retirement savings, a "crowding-out" or none of both exists, we restrict the sample in the second step to 781 households with both partners saving privately for retirement. In the multivariate analysis sections, all equations are estimated separately for male and female spouses, where the first equation or column always refers to the male spouse.

3.1. Descriptive Statistics

First, we present some descriptive statistics for the intra-household allocation of retirement saving contracts and saving amounts.

Table 1: Intra household distribution of saving accounts (in %)

		Female saving		
		No	Yes	Total
Male saving	No	31.9	10.4	42.4
	Yes	22.7	35	57.6
	Total	54.6	45.4	100

Source: PHF 2010/2011 and 2014.

Table 1 shows, that 57.6 percent of all men possess a retirement saving contract whereas this fraction amounts to only 45.4 percent for their female partners. In 31.9 percent of all households, neither the head of household nor his/her partner is saving for retirement at all. In

[14] This set of households includes married couples (about 88 percent) as well as unmarried partners. The results of the following multivariate analyses have been carried out for the subsample of married couples and have proven robust.

about a third of all households, at least one partner has a retirement saving account, whereof about 70 percent consist of households where only the male possesses a saving account. Finally, in 35 percent of households both partners have individual retirement saving contracts.

Looking at the annual household retirement savings, it becomes obvious that households, where only the male partner saves, are on average saving more than households where only the female partner possesses a saving account. This can probably be explained by the fact that males earn a higher gross income than their female partners, on average (see Table 5 in the Appendix for summary statistics of all other variables).

Table 2: Average annual household retirement savings (in Euro)

		Female saving		
		No	Yes	Total
Male saving	No	0	1467.8	361.7
	Yes	2377.3	5073.6	4013.8
	Total	986.8	4244.9	2466.7

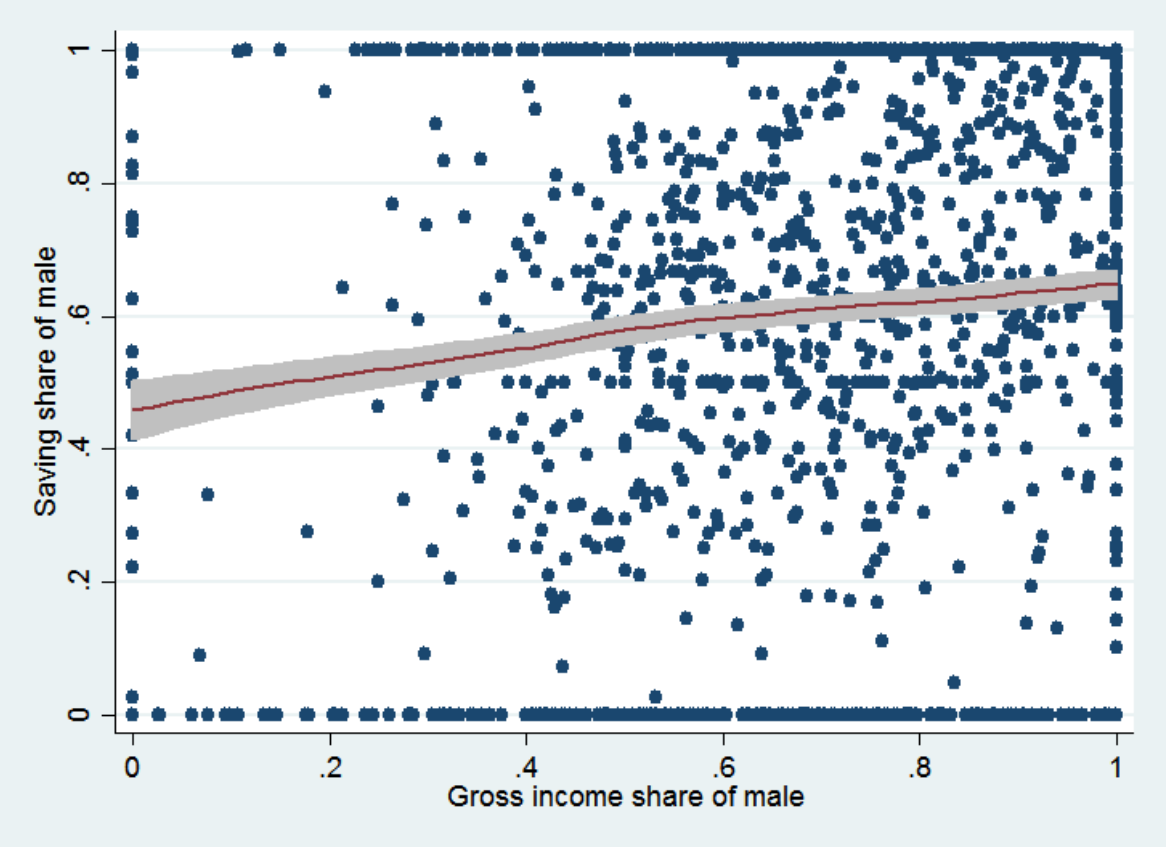
Source: PHF 2010/2011 and 2014.

Households with both partners saving, save on average more than just the average sum of both cases where only one partner is saving. One might be tempted to conclude that this provides evidence for a "crowding-in" of retirement savings among spouses, however, it could be the case that households with both partners saving are earning a higher income and thus have higher saving amounts.

The distribution of total household savings between spouses is shown in Figure 1 with respect to the man's share of aggregate household gross income. An increasing share of gross household income earned by the man does not necessarily imply a one by one increase in the

man's share of aggregate household retirement savings. Instead, only a significantly weaker correlation between gross income share and savings share is observable.

Figure 1: Household saving and gross income distributions



Source: PHF 2010/2011 and 2014.

From Figure 2 in the Appendix it becomes obvious that patterns are different for unsubsidized and tax exempted saving vehicles. While for tax exempted and subsidized saving vehicles (Riester and occupational pension plans) the saving share clearly correlates to the share of gross income, the saving share for unsubsidized contracts is nearly independent of the gross income share.

After these purely descriptive results, we will now turn our attention to the multivariate analysis first of the extensive and subsequently of the intensive margin of retirement savings, controlling for all other possible influences.

3.2. Intra-household distribution of saving accounts

Estimating the intra-household allocation of retirement saving accounts as a first hint for the intra-household allocation of retirement savings, one has to consider the possibility of one spouse's decision to save privately for retirement not being independent of the other spouse's decision. Therefore we estimate a seemingly unrelated bivariate probit model for a dummy indicating the possession of retirement saving accounts, using individual socio-demographic and labor market variables as well as common household variables as explanatory variables.

With focus on the intra-household allocation of retirement savings, we are primarily interested in the estimated correlation of the error terms[15], represented by ρ (rho) in Equation 1.[16]

Table 3: Seemingly unrelated bivariate probit estimation for possession of a retirement saving account

	Seemingly unrelated bivariate probit			
Dependent variable: Possession of saving account	Male		Female	
Share of household gross income	-0.0509	(0.150)	-0.0875	(0.183)
Monthly gross income (in 1000 Euro)	0.0245*	(0.0147)	0.0335	(0.0352)
Monthly gross income (in 1000 Euro)^2	0.000262*	(0.000147)	-0.000338	(0.00132)
Age	0.118***	(0.0271)	0.145***	(0.0278)
Age^2	-0.00137***	(0.000283)	-0.00168***	(0.000306)
Eastern Germany	-0.397***	(0.0902)	-0.279***	(0.0922)
Migrant background	-0.328***	(0.124)	-0.548***	(0.117)
Married	0.120	(0.107)	-0.0355	(0.105)
Full-time	-0.378	(0.233)	0.387**	(0.191)
Part-time	-0.194	(0.285)	0.397**	(0.181)
Marginally employed	-1.563***	(0.573)	0.0881	(0.198)
Fixed-term employment	-0.439***	(0.160)	-0.248*	(0.140)
Temporary out of employment	-0.186	(0.367)	0.352	(0.218)

[15] One has to consider the possibility that correlated error terms might rather represent an ommitted variable bias than correlated decisions. However, with our extensive set of explanatory variables we are confident that omitted variable bias is hopefully negelectable here.

[16] For a detailed discussion on factors influencing the possession of a retirement savings contract, see Metzger (2015).

Unemployed	-0.418*	(0.249)	-0.0686	(0.198)
Civil servant	-0.0222	(0.148)	0.0314	(0.145)
Self-employed	0.0622	(0.129)	0.166	(0.217)
Self-employed (without employees)	-0.0507	(0.117)	-0.124	(0.134)
Secondary school	0.0738	(0.119)	0.0980	(0.118)
University qualification	-0.0180	(0.114)	0.216*	(0.123)
Vocational training	0.492***	(0.134)	0.235**	(0.112)
University degree	0.314**	(0.159)	-0.00833	(0.139)
FL interest rate	-0.101	(0.122)	0.223*	(0.120)
FL inflation	0.0263	(0.129)	-0.127	(0.123)
FL diversification	0.374***	(0.100)	0.278***	(0.100)
HH equivalence net income (in 1000 €)	0.0858**	(0.0373)	-0.0117	(0.0301)
HH equivalence net income (in 1000 €)^2	-0.00000282***	(0.000000905)	0.000000629	(0.000000699)
Child in HH (Dummy)	0.0442	(0.0800)	0.0124	(0.0790)
Real estate possesion	0.191**	(0.0754)	0.00174	(0.0749)
Received bequest (Dummy)	0.116	(0.0718)	0.124*	(0.0702)
Sectoral dummies	Yes		Yes	
rho	.4571***	0.0363522		
Wald test of rho=0: chi2(1) = 115.406	Prob > chi2 = 0.0000			
N	1815			
AIC	4376.6			
BIC	4910.4			
ll	-2091.3			
chi2	483.9			
Standard errors in parentheses				
* p<0.1, ** p<0.05, *** p<0.01				

Source: Own estimations based on PHF 2010/2011 and 2014.

Interestingly, household equivalence net income[17] is only a significant factor for the probability of the male spouse of possessing a saving account. Likewise, individual gross income is only

[17] The disposable household equivalence income is constructed from the disposable household income using the new OECD scale of equivalence weights.

weakly significant for the male partner. Surprisingly, for the female spouse neither individual gross income nor household equivalence income is significant. The positive and highly significant coefficient of rho provides evidence for the individual possession of a retirement saving account being strongly correlated among partners even if controlled for both household and individual labor market characteristics. This "crowding-in" of saving contracts among household members, also found by Börsch-Supan et al. (2012) for German households generally, is probably due to some recognition effect or peer effect as discussed in section 2.2. However, this positive correlation might only be due to tax reasons and does not necessarily have to increase household savings at all. For example Riester pension plans are subsidized via a basic allowance of 154 Euro which is counted against the tax subsidy arising from the exemption of contributions to the Riester pension account. For a non-working spouse it might be rationale to open up an own account in order to get the basic allowance by just paying the minimum annual contribution of 60 Euro. Additionally, for occupational as well as Riester pension schemes there exists an upper ceiling of tax-deductible contributions. These ceilings might provide incentives to split the household retirement savings between two contracts, if the total saving amount exceeds this ceiling, and thus may lead to a "crowding-out" of the other spouse's savings. Hence, in the next section we will turn our attention to the amount of retirement savings and whether there exists a "crowding-in" or "crowding-out" of retirement savings among spouses.

3.3. Crowding-in or crowding-out of spouse's retirement savings?

If saving amounts of the spouses and thus household retirement savings are simultaneously determined, both equations outlined in section 3.2. have to be estimated controlling for endogeneity. Thus we estimate the coefficients using the method of three-stage least squares.

Being interested in the effect of the spouse's savings on own savings only, we need to control for all other possible influences carefully. Therefore, we include the same set of explanatory

variables used in the previous estimation of the intra-household allocation of retirement saving contracts, as control variables. These control variables comprise of individual socio-demographic and labor market characteristics including sectoral dummies as well as household characteristics, who all might have an influence on the savings amount. With the focus on studying the interaction between the spouses' savings, we use the logarithm of retirement savings, reducing the sample to 781 households with both spouses voluntarily saving for retirement.[18]

Table 4: Three-stage estimates for log savings

	Three-stage least squares			
Dependent variable: log savings	Male		Female	
log savings partner	0.431***	(0.0663)	0.356***	(0.0850)
Share of HH gross income	0.680***	(0.197)	-0.461*	(0.279)
Monthly gross income (in 1000 Euro)	-0.00841	(0.0172)	0.291***	(0.0570)
Monthly gross income (in 1000 Euro)^2	0.000676**	(0.000317)	-0.0142***	(0.00373)
Age	0.0247	(0.0370)	0.0579	(0.0395)
Age^2	-0.000178	(0.000384)	-0.000588	(0.000433)
Eastern Germany	-0.306***	(0.109)	-0.194	(0.128)
Migrant background	-0.165	(0.146)	-0.135	(0.156)
Married	-0.0348	(0.115)	-0.00840	(0.127)
Full-time	0.377	(0.275)	0.279	(0.197)
Part-time	0.154	(0.329)	0.224	(0.187)
Marginally employed	0	(.)	-0.194	(0.212)
Fixed-term employment	-0.327*	(0.191)	-0.0441	(0.178)
Temporary out of employment	0.662*	(0.387)	-0.0266	(0.232)
Unemployed	0.00757	(0.317)	-0.752**	(0.306)
Civil servant	-0.250*	(0.143)	-0.347**	(0.150)
Self-employed	0.400***	(0.110)	0.612***	(0.229)
Self-employed (without employees)	0.211*	(0.116)	0.356**	(0.144)
Secondary school	0.0601	(0.108)	0.137	(0.146)
University qualification	0.213**	(0.105)	0.433***	(0.154)
Vocational training	0.452**	(0.187)	0.119	(0.155)
University degree	0.625***	(0.205)	-0.0818	(0.176)

[18] With not all couples being married, one could argue that saving behavior in non-married households differ from married households. Thus, we additionally estimated the model only with married households (about 89 percent of the sample), which did not change the results.

FL interest rate	-0.110	(0.138)	0.129	(0.164)
FL inflation	0.403***	(0.155)	0.112	(0.170)
FL diversification	0.131	(0.114)	0.0448	(0.124)
HH equivalence net income (in 1000 €)	0.0877*	(0.0489)	0.0480*	(0.0290)
HH equivalence net income (in 1000 €)^2	-0.00000468**	(0.00000193)	-0.000000206	(0.000000304)
Child in HH (Dummy)	0.00370	(0.0836)	-0.162*	(0.0892)
Real estate possesion	0.178**	(0.0798)	-0.0582	(0.0923)
Received bequest (Dummy)	0.0638	(0.0720)	-0.110	(0.0796)
Sectoral dummies	Yes		Yes	
N	733			
R-sq	0.390			
AIC	3836.2			
BIC	4268.3			
ll	-1824.1			
chi2	493.0			

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

Source: Own estimations based on PHF 2010/2011 and 2014.

Male spouses living in the Eastern part of Germany save significantly less than a comparable person in the Western part. While for male spouses household net income plays a significant role in determining retirement savings, for their female partners individual gross income seems to be more important. Self-employed persons seem to save more whereas unemployed persons and civil servants save less for retirement as one would have expected. Interestingly, education or especially schooling only seems to increase savings of the male spouse, whereas only the dummy for university entrance qualification is significant on a five percent significance level for the female partner.

Controlling for all other variables potentially influencing the amount being saved, the coefficient of our variable of interest, the logarithm of the other spouse's savings, is significant for both spouses at the one percent significance level. The coefficient for the other spouse's saving is fairly high for both spouses, with 0.431 for male and 0.356 for female spouses. With

respect to the dependent variable, the logarithm of savings, this coefficient can be interpreted as the elasticity of retirement savings with respect to the savings of the partner. An additional increase of one percent in retirement savings of one spouse leads to an increase in savings of the other spouse of 0.431 or 0.356 percent respectively. This result shows that neither are both savings decisions independent of each other, nor does the spouse's retirement savings substitute each other. By contrast, there seems to exist a recognition or peer effect in savings also with respect to the chosen saving amount.[19]

3.4. Robustness analysis

The following section conducts several robustness checks for the previous results regarding the interaction between the partners' saving amounts. First, as we have seen from the previous analysis, saving patterns are different for self-employed and civil servants. Therefore, we estimate our simultaneous equations model excluding self-employed and civil servants, thus only considering households consisting of employees and non-employed individuals. Using this subsample, both spouses' savings still show positive and highly significant coefficients, as shown in Table 6 in the Appendix. However, the estimated coefficients are smaller if self-employed and civil servants are excluded.

Second, one might argue that non-working partners might either be restricted to adjust their individual savings or might simply not have the opportunity for example for an occupational pension plan. Thus we estimate our model using only the subsample of households with both partners working at least part or fulltime (results are shown in Table 6). Using this subsample confirms our results of the full sample analysis. Male savings are now even more heavily influenced by female spouse's savings with an elasticity of 0.517 on a one percent significance

[19] For example peer effects have been also shown to exist with respect retirement saving decisions by Duflo and Saez (2002) and with respect to the take up of paternity leave by Dahle et al. (2014).

level. The coefficient for the male spouse's savings also increases to 0.464 and is still significant on a one percent level.

Another reason for concern might be the existence of differences in intra-household behavior with respect to the type of saving contract. Subsidized contracts, either by direct subsidy (Riester pension) or by tax exemption for contributions (Riester and occupational pension plans) possess a ceiling for tax exemption and Riester pension plan additionally require a minimum saving rate in order to qualify for the full subsidy. Thus, there may exist incentives to shift savings from one partner to the other if the individual tax exemption ceiling for contributions is reached. In order to analyze, whether there exist differences with respect to the saving vehicles we estimate our model separately for somehow subsidized contracts (Riester and occupational pension plans) and unsubsidized contracts (cash-value life insurance and private unsubsidized pension plans). The results are presented in Table 7 in the Appendix and reveal slightly different patterns for both types of contract. The female spouse's saving amount to unsubsidized contracts significantly depends on male spouse's savings. By contrast, the coefficient for female spouse's savings is only half as large but still significant on a five percent level. Turning to tax-subsidized savings things reverse. Male spouse's savings are now significantly influenced by the female spouse's savings. The coefficient for the male spouse's savings is not significant for the female's savings amount anymore. The results for subsidized contracts must however be handled with caution, as the number of observations shrinks to 278.

One restriction of the presented results of the simultaneous equation model might be that they are based on pooled cross-sectional data so far. Maybe the dynamics of the reaction of individual savings to some common household optimization process takes place with a lag and is therefore not observable in cross-sectional data. Exploiting the panel structure of the two

waves of the PHF, we estimate a random-effects estimation for both spouses.[20] The results are shown in table 8 and confirm a "crowding in" of private retirement savings on a one percent significance level. However, the coefficient for the other spouse's savings are smaller than in the simultaneous equation model with pooled cross-sectional data.

[20] Applying the hausman test the zero hypothesis could not be rejected, recommending the use of a random-effects estimation.

4. Concluding remarks

We examined the intra-household allocation of retirement savings in Germany. First, we looked at the allocation of retirement saving accounts within the household and found that, controlled for other factors, possession of a saving account is positively correlated between spouses, giving some evidence for a "crowding-in" of accounts. This might be due to some peer or recognition effect, where the need to save for retirement becomes obvious if one spouse starts saving or as a sort of supplier-induced demand because of the contact to an insurance agent. Furthermore, there might exist tax reasons inducing a splitting up of household retirement savings among spouses. Thus, a "crowding-in" of saving accounts does not necessarily provide evidence for a "crowding-in" of savings at all and does not reject the unitary or collective household model. Analyzing the interaction of saving amounts in households with both spouses saving and allowing for endogeneity, revealed also the existence of a "crowding-in" of saving amounts. These results show some evidence for a possible multiplier effect of fiscal incentives within households, what has to be considered analyzing public policy with respect to retirement savings.

Our findings give no evidence in support of the unitary household model with respect to retirement savings. Instead, retirement saving decisions seem to take place on an individual level, with a "crowding-in" by the partner's savings, induced probably by updated information or preferences. However, the same could be true for the collective household model, where due to new information the optimal household saving amount may be altered leading to both spouses increasing their savings simultaneously. Or both spouses agree on a savings sharing rule, which also imply mutually increasing savings in order to maintain a certain savings share. How these empirical estimates fit into existing theoretical models and whether they favor a special decision-making process among spouses must be left to further research at this point.

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Appendix

Table 1: Descriptive statistics

Variable	Male N	Male mean	Male sd	Female N	Female mean	Female sd
Saving for retirement (Dummy)	2,251	0.550	0.498	2,251	0.491	0.500
Annual retirement savings	2,251	1,878	3,755	2,251	971.8	2,092
Gross income (in 1000 €)	2,033	4.231	7.204	2,053	1.645	2.430
Married	2,251	0.875	0.331	2,251	0.873	0.333
Migrant background	2,251	0.0729	0.260	2,251	0.0826	0.275
Female	2,251	0	0	2,251	1	0
Age	2,242	48.32	10.40	2,242	45.67	10.24
Eastern Germany	2,251	0.153	0.360	2,251	0.153	0.360
Secondary school	2,251	0.519	0.500	2,251	0.569	0.495
University qualification	2,251	0.363	0.481	2,251	0.335	0.472
Vocational training	2,251	0.591	0.492	2,251	0.623	0.485
University degree	2,251	0.339	0.474	2,251	0.268	0.443
Full-time	2,251	0.821	0.383	2,251	0.305	0.460
Part-time	2,251	0.0298	0.170	2,251	0.311	0.463
Marginally employed	2,251	0.00578	0.0758	2,251	0.0804	0.272
Temporary out of employment	2,251	0.0102	0.101	2,251	0.0502	0.218
Unemployed	2,251	0.0480	0.214	2,251	0.0302	0.171
Civil servant	2,251	0.0760	0.265	2,251	0.0697	0.255
Self-employed	2,251	0.0764	0.266	2,251	0.0240	0.153
Self-employed (without employees)	2,251	0.0906	0.287	2,251	0.0626	0.242
Fixed-term employment	2,251	0.0373	0.190	2,251	0.0511	0.220
HH equivalence net income (in 1000 €)	2,141	2.492	3.132	2,141	2.492	3.132
Received bequest (Dummy)	2,251	0.322	0.467	2,251	0.322	0.467
Real estate possession	2,251	0.658	0.474	2,251	0.658	0.474
Child in HH (Dummy)	2,251	0.259	0.438	2,251	0.259	0.438

Source: Panel on Household Finance (PHF) 2010/2011 and 2014.

Table 6: Three-stage least squares subsample estimations

	Both employed				Excluding self-employed and civil servants			
Dependent variable: log savings	Man		Woman		Man		Woman	
log savings partner	0.517***	(0.0917)	0.464***	(0.0989)	0.342***	(0.0873)	0.338***	(0.106)
Individual characteristics	Yes		Yes		Yes		Yes	
Household characteristics	Yes		Yes		Yes		Yes	
Sectoral dummies	Yes		Yes		Yes		Yes	
N	523				440			
R-sq	0.386				0.487			
AIC	2585.6				2329.0			
BIC	2956.2				2688.7			
ll	-1205.8				-1076.5			
chi2_1	43824.9				407.9			
chi2_2	34635.5				326.8			

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

Source: Own estimations based on PHF 2010/2011 and 2014.

Table 7: Three-stage least squares saving instrument estimations

	Subsidized contracts (Riester and occupational pensions)				Unsubsidized contracts (pension and cash-value life insurance)			
Dependent variable: log savings	Male		Female		Male		Female	
log savings partner	0.432***	(0.118)	0.189	(0.122)	0.195*	(0.104)	0.427***	(0.0890)
Individual characteristics	Yes		Yes		Yes		Yes	
Household characteristics	Yes		Yes		Yes		Yes	
Sectoral dummies	Yes		Yes		Yes		Yes	
N	278				464			
R-sq	0.455				0.371			
AIC	1554.5				2222.5			
BIC	1888.2				2611.7			
ll	-685.2				-1017.3			
chi2_1	230.2				274.7			
chi2_2	15503.4				264.8			

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

Source: Own estimations based on PHF 2010/2011 and 2014.

Figure 2: Household savings and gross income distribution – by type of saving

Tax subsidized (Riester and occupational pensions)

Unsubsidized (Cash-value life insurance and private pension insurance

Source: Own estimations based on PHF2010/2011 and 2014.

Table 8: Random-effects estimation

Dependent variable: log savings	Male		Female	
log savings partner	0.239***	(0.0301)	0.275***	(0.0393)
Share of HH gross income	0.393**	(0.194)	-0.679***	(0.261)
Monthly gross income (in 1000 Euro)	-0.0177	(0.0185)	0.320***	(0.0615)
Monthly gross income (in 1000 Euro)^2	0.000896**	(0.000355)	-0.0166***	(0.00422)
Age	0.0398	(0.0392)	0.0670	(0.0443)
Age^2	-0.000306	(0.000409)	-0.000682	(0.000487)
Eastern Germany	-0.368***	(0.114)	-0.221	(0.136)
Migrant background	-0.226	(0.163)	-0.234	(0.178)
Married	-0.0459	(0.119)	-0.0388	(0.137)
Full-time	0.752**	(0.298)	0.438**	(0.218)
Part-time	0.489	(0.362)	0.392*	(0.205)
Marginally employed	0	(.)	-0.0947	(0.230)
Fixed-term employment	-0.297	(0.211)	-0.192	(0.196)
Temporary out of employment	0.744*	(0.409)	-0.0654	(0.253)
Unemployed	0.178	(0.345)	-0.554	(0.343)
Civil servant	-0.260	(0.165)	-0.450**	(0.183)
Self-employed	0.396***	(0.121)	0.818***	(0.257)
Self-employed (without employees)	0.196	(0.130)	0.286*	(0.171)
Secondary school	0.0504	(0.125)	0.162	(0.168)
University qualification	0.277**	(0.120)	0.455***	(0.174)
Vocational training	0.471**	(0.202)	-0.00118	(0.170)
University degree	0.672***	(0.221)	-0.121	(0.196)
FL interest rate	-0.0912	(0.147)	0.115	(0.171)
FL inflation	0.250	(0.163)	0.159	(0.182)
FL diversification	0.183	(0.121)	-0.0277	(0.137)
HH equivalence net income (in 1000 €)	0.146***	(0.0545)	0.0494	(0.0301)
HH equivalence net income (in 1000 €)^2	-0.00000626***	(0.00000217)	-0.000000209	(0.000000317)
Child in HH (Dummy)	0.0223	(0.0858)	-0.139	(0.0940)
Real estate possesion	0.212**	(0.0831)	-0.0288	(0.0971)
Received bequest (Dummy)	0.00118	(0.0707)	-0.131	(0.0796)
Sectoral dummies	Yes		Yes	
N	746		742	
R^2 (within)	0.161		0.268	
R^2 (between)	0.433		0.374	
R^2 (overall)	0.418		0.386	

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Source: Own estimations based on PHF 2010/2011 and 2014.