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**Working Paper**

# Who is saving privately for retirement and how much? New evidence for Germany

Diskussionsbeiträge, Forschungszentrum Generationenverträge der Albert-Ludwigs-Universität Freiburg, No. 57

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# Who is saving privately for retirement and how much? – New evidence for Germany

Christoph Metzger

No. 57 – May 2015

# Who is saving privately for retirement and how much? – New evidence for Germany

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May 2015

Due to demographic change the replacement rates of the German statutory pension scheme will decrease over the next decades. Voluntary savings for retirement will therefore gain more and more relevance in order to maintain one's standard of living during retirement. This article examines the savings behavior for retirement on an individual level in Germany. As a first step the decision to save at all is analyzed, showing that the main determinants for saving are personal income as well as the disposable household income. Furthermore migrants and individuals living in the Eastern part of Germany turn out to be less likely to save additionally privately for retirement. In a second step the chosen gross saving rates are analyzed using a Tobit, a lognormal hurdle model and a Type II Tobit Model. The results suggest that the decisions to save at all and about the saving rate are independent of each other leading to a loss of information if only a standard Tobit model is used. For example personal income increases the probability to save for retirement but decreases the resulting saving rate. Modelling both decisions separately therefore leads to a better understanding of the determinants of saving for old-age.

*JEL-Classification*: D14, D91, H31

*Keywords*: Savings, retirement, life-cycle, two-part model, tobit, exponential type II tobit

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# 1. Introduction

Due to demographic change and especially to the big sized "baby-boom"-cohorts reaching the retirement age within the next 20 years, the pay-as-you-go (PAYG) financed statutory pension insurance in Germany (GRV) would have experienced financial trouble the next years. According to the latest official population projection of the Federal Statistical Office[1], the old-age dependency-ratio, serving as a crude measure of the ratio of pensioners to contributors, is projected to nearly double from 34 in 2009 to 62 in 2040 and 67 in 2060.[2] Being challenged by this development several reforms took place (starting in 2001) in order to ensure the long run fiscal sustainability of the statutory pension insurance. With the restriction of preventing contribution rates from exploding, these reforms came at the price of a decreasing pension level in general (in terms of replacement rates) and an enhanced self-responsibility for maintaining one's standard of living during retirement. With the "Altersvermögensgesetz (AVmG)" and the "Altersvermögensergänzungsgetz (AVmEG)" introduced in 2001, a substantial change in the German pension system took place, as employees shouldn't solely rely on the statutory pension insurance, but are also thought to save voluntarily for retirement using the newly introduced subsidized Riester pension or occupational pension plans. The newly introduced Riester scheme should compensate for a 4 percent cut in gross pension levels in the statutory pension scheme, which was introduced in return. Therefore the tax deduction for contributions to these schemes was set at 4 percent of the individual yearly gross wage.[3] The aim of these reforms was to share the responsibility for providing income during retirement between the three pillars of the pension scheme: the statutory pension schemes, state-subsidized private or occupational pensions and private savings. Realizing further need for reform in order to stabilize the long-

[1] The results refer to the middle scenario with an assumed net migration of 100.000 persons per year. See Statistisches Bundesamt (2009) for the underlying assumptions in detail.
[2] The old-age dependency ratio is here defined as number of persons aged 65 and older relative to the number of persons aged between 20 and 64 times 100.
[3] Furthermore a fixed minimum direct subsidy as well as a subsidy for children were introduced within the Riester pension scheme in order to make it more attractive for individuals with a low-income and households with children, who are not paying a lot of income tax at all.

term financial situation of the statutory pension scheme, with the "Rentenversicherungs-Nachhaltigkeitsgesetz (RVNG)" in 2004 the indexation of the pension level was connected to the demographic situation via the "Nachhaltigkeitsfaktor", leading to a substantial reduction in the gross pension level (replacement rate) in the future.

One question arising is whether additional private savings, either through subsidized pension schemes or complete private savings, are sufficient to compensate for the above mentioned reduction in gross pension level or whether large parts of future pensioner cohorts will have to rely on social welfare.[4] So far most research articles concentrate only on the development of statutory pensions and don't take consider private savings in the second or third pillar of the pension scheme. In order to close this gap an analysis of the individual saving behavior has to be done. Marking a turning point in the German pension policy, several studies analyzed the determinants of a take-up of Riester pension plans e.g. Pfarr and Schneider (2011), Lamping and Tepe (2009) and Börsch-Supan et al. (2008).[5] Dummann (2008) and Weber and Beck (2014) concentrated on the determinants of participation in occupational pension plans. Weber and Beck (2014) additionally analyzed the influenc factors of the amount of deferred compensation in occupational pension plans. So far only BMAS (2012) analyzed the take-up of Riester and/or occupational pension plans together based on a survey. Other popular saving vehicles as private pension or cash-value life insurances are however not included. Besides the propensity to use saving vehicles it is also important to have a closer look at the resulting saving rates, given that the possession of a saving plan doesn't necessarily ensure actual saving rates

[4] See e.g. Wissenschaftlicher Beirat BMWi (2012), Kumpmann et al. (2010), Himmelreicher and Frommert (2006) as well as Arendt and Nagel (2010).

[5] Pfarr and Schneider (2011) analyzed Riester participation based on the German Socio-Economic Panel (GSOEP) and find a positive impact of age and household income on Riester participation. Additionally they conclude that Riester participiation is especially high among households receiving child allowances what can be explained by the additional subsidy for the children. Furthermore they find some evidence that there exist some kind of supply-induced demand for Riester contracts, households in contact with insurance agents tend to have higher participation rates. Lamping and Tepe (2009) also use the GSOEP in order to analyze participation in Riester pension plans and state that the impact of age and income depend on the assessment of the appropriateness of their statutory pension as well as on the perceived job security.

being different from zero.[6] Saving behavior and saving rates on a household level have been analyzed several times. Corneo et al. (2009) tried to assess the impact of the introduction of Riester pension plans on household net saving rates using the GSOEP, analyzing other determinants as a by-product. Börsch-Supan and Essig (2005) used the SAVE survey to study household net saving rates in Germany in detail. However there has been no detailed research so far, at least to our knowledge, regarding overall private saving for retirement in detail. Additionally all studies have concentrated on net saving rates on a household level, ignoring individual aspects.

The remainder of this paper is organized as follows. Before turning to the data some working hypotheses are postulated in section 2. Subsequently the dataset as well as some descriptive statistics are presented in section 3, followed by the multivariate analysis in section 4. This analysis is split in two parts: First the question who is saving at all for retirement is analyzed using a logit model. In the second part the determinants of the gross saving rate are analyzed using three different models: The lognormal hurdle model, the Type II Tobit model and the standard Tobit model. Section 5 finally concludes.

## 2. Hypotheses

This section questions the theoretical determinants of an individual's saving behavior for retirement. What one would think first about is the existence of a budget constraint. If a person can barely afford everyday expenses one would hardly expect this person to save privately for the period of retirement. A low individual income per se is probably however not the crucial determinant of the saving behavior, disposable household income should be a better proxy of the possibility for saving instead. Both propensity to save and the resulting saving rate can be

[6] For example contributions to Riester pension plans can be suspended, what is according to BMAS (2013) probably true for approximately 19.5 percent of all contracts in 2011.

expected to be positively affected by disposable household income. The possible effect of the individual income is so far not clear, at least with respect to the resulting saving rate.

With regard to age, the first intuition suggests that the closer people come to retirement (the older they are), the higher is the probability that they are saving for old-age reasons as they are more aware of their retirement. The ex-ante correlation between age and the saving rate remains however unclear as the saving rate probably depends more on familial circumstances than on age itself.

According to Feldstein (1974) there are also two channels thinkable through which the statutory pension scheme influences the saving rates. First the "asset substitution effect", resulting in a lower savings propensity and also lower savings of individuals compulsory insured in a pension scheme as voluntary savings are substituted by these contributions. Secondly Feldstein (1974) points also out that with incentives to retire early the retirement period is prolonged and persons need to save more in order to smooth consumption over the life cycle. According to this "induced retirement effect" one would expect that people planning to retire before the regular retirement age, are more likely to have a saving contract for old-age and to save more in order to compensate for the longer period of retirement.

In addition to factor influencing the individual budget constraint, one could also assume that the individual's ability to plan over his/her life cycle has an effect on the propensity to save and eventually also on the saving rate. For example Lusardi and Mitchell (2011) found that better educated individuals are more likely to plan their period of retirement what is true for higher financial literacy as well. As a result higher education and/or financial literacy should increase the probability of saving and probably also lead to a higher resulting saving rate.

# 3. Data and descriptive statistics

## 3.1. The PHF dataset

The following analysis is based on the newly introduced „Panel on household finances" (PHF) in Germany.[7] The PHF is conducted by the Bundesbank and is part of the Eurosystem's "Household Finance and Consumption Survey (HFCS)". In addition to the common European-wide questionnaire about household finance, wealth and consumption, the PHF places special emphasis on two further topics: namely savings and old-age provision. Therefore detailed information on an individual level is collected about 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. The survey is designed to be a full panel with a survey frequency of three years. Up to now only the first wave was conducted in 2010 and 2011, enabling only cross-section analysis so far. With respect to the emphasis of saving and old-age pension provision, the PHF is quite similar to the SAVE study conducted by the Munich Center for the Economics of Aging (MEA).[8] However it shows two advantages compared to the SAVE study. First the first wave of the PHF covers a sample of 3,565 households whereas the sample of the SAVE study covered about 1,660 households in 2011/2012. The second advantage is the ability to analyze retirement saving behavior in the PHF representation on an individual level and not only on the household level. Another advantage is the representation of the highest wealth quintile due to oversampling. The problem of missing data, generally present with surveys about financial data, was coped with by using multiply imputation (m=5), leaving us with five imputed datasets.

[7] 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

[8] For an overview on the design of the SAVE-study see Börsch-Supan et al (2009).

## 3.2. Descriptive Statistics

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. The reason for saving can however not always be clearly distinguished. As this article puts special emphasis on saving for retirement, only vehicles which are directly linked to retirement are analyzed in the following sections. These vehicles are state-subsidized private pension contracts (Riester or Rürup pensions)[9], all kinds of voluntary occupational pensions, private non-subsidized pension insurances and cash value life insurance.[10] 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 more as employer saving than as an individual rational decision.

*Table 1: Descriptive statistics*

| | **Mean** | **Std. Err.** | **[95% Conf.** | **Interval]** |
|---|---|---|---|---|
| gross saving rate | 0.045 | 0.003 | 0.037 | 0.052 |
| number of contracts | 0.762 | 0.005 | 0.748 | 0.775 |
| more than one contract | 0.180 | 0.001 | 0.177 | 0.183 |
| saving for old-age | 0.631 | 0.002 | 0.627 | 0.636 |
| Riester-contract | 0.310 | 0.002 | 0.305 | 0.315 |
| occupational pension | 0.149 | 0.003 | 0.140 | 0.158 |
| private pension | 0.119 | 0.003 | 0.111 | 0.128 |
| life insurance | 0.349 | 0.002 | 0.345 | 0.353 |
| direct insurance (employer) | 0.025 | 0.002 | 0.019 | 0.031 |

Source: Panel on Household Finance (PHF), own estimations.

Mean, standard errors and the 95%-confidence interval are calculated using weights and the combination rules of Rubin (1987).

[9] Eligible for state subsidized Riester pension plans are in principle all individuals insured in the statutory pension system, their spouses and civil servants.

[10] 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).

The following analysis refers to individuals aged between 20 and 67 years not yet retired. About 63 Percent of this group is saving for retirement through at least one instrument and about 18 percent even possess two or more old-age saving contracts (see Table 1). The most frequently used saving vehicles are capital value life-insurances followed by state-subsidized private pension plans (Riester or Rürup), which are both used by more than 30 percent of all individuals.[11] Only about 15 percent participate in occupational pension plans and 12 percent have private pension insurances in order to save for retirement.[12] The fraction of individuals with occupational pension plans is much lower than the 39 percent reported in BMAS (2012, p.18) what can partly be explained by two facts. First, in this analysis unemployed individuals are by contrast considered in the denominator and secondly occupational pension plans eligible for and subject to "Riester-subsidies" are counted as Riester-contracts here. When it comes to employed persons the fraction of individuals with an occupational pension plan (all types of occupational pension plans) amounts to about 20 percent. This is in line with the result of Weber and Beck (2014) whose analysis is based on the "Verdienststrukturerhebung 2010" with 1.6 million observations. The saving rate amounts on average to 4.5 percent of the individual gross income.[13]

*Private pension schemes by age*

Figure 1 reveals different take-up patterns of private pension schemes for the different age groups. The participation in private saving vehicles rises from younger age groups until reaching a peak among the individuals aged between 40 and 49 years with 73 percent saving for retirement. This share declines again for older ages. The fraction of persons using more than

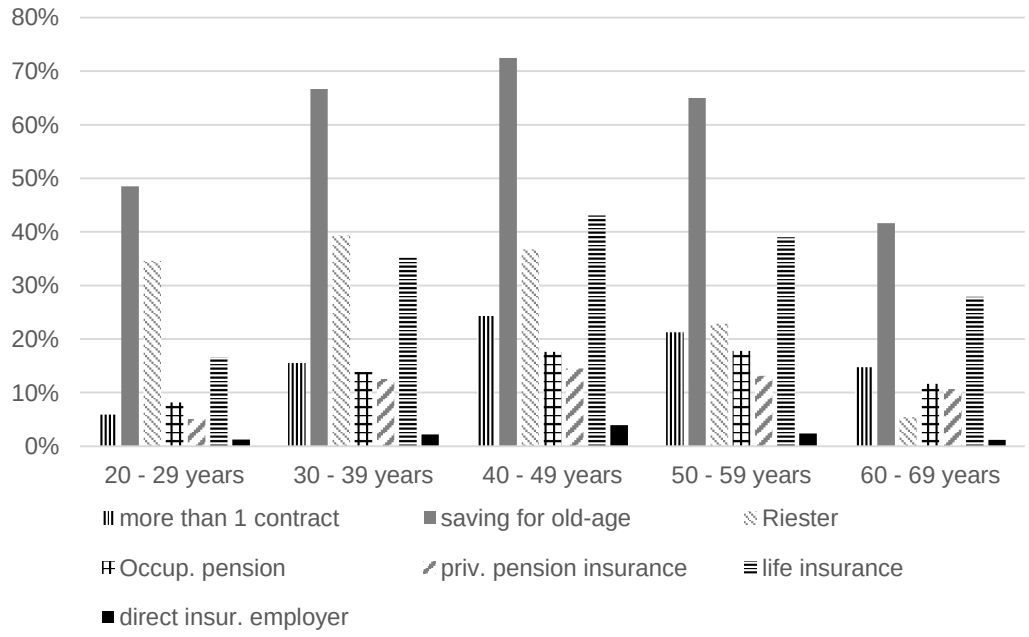
[11] For reasons of simplicity in the following sections the term Riester pension will refer to both Riester as well as Rürup pension plans because they are not further distinguished in the dataset. Rürup pension or 'Basis-Rente' refer to pension plans designed for self-employed individuals with tax-deductible contributions up to 22.172 Euro in 2015.

[12] As Lamla and Coppola (2013) point out, the low fraction of individuals using occupational pensions is probably to some extent due to the fact that not all workers are aware of their legal right to an occupational pensions and possess all the necessary and relevant information.

[13] The number of persons with valid gross saving rates –dependent on a non-zero gross income - lies between 4726 in the third and 4743 in the first imputed dataset.

one saving vehicle peaks also among the middle age group with about 25 percent. The proportion of people possessing a Riester pension scheme is highest for the middle and younger ages, what could have been expected as Riester pension plans were introduced as recently as 2001 but have spread wide over since then.[14] Occupational pension schemes on the contrary seem to be more relevant for the older ages. Whether this is due to the fact that the introduction of Riester pension schemes crowded-out occupational pension plans for younger ages as proposed by Schoder (2011, p.303) or whether occupational pension plans are still more common among persons with more years of company service and therefore mainly at older ages remains unclear.

*Figure 1: Proportion of persons with private pension schemes (in %) by age*




*Source: Own estimations based on PHF 2011.*

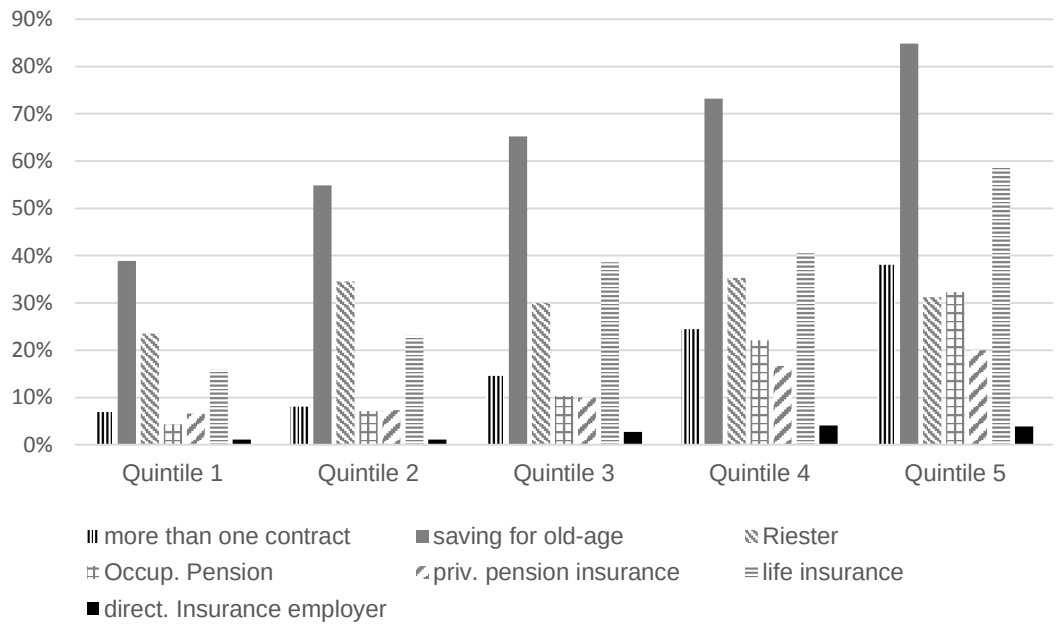
Cash value life insurances are especially widespread at ages between 40 and 60 with more than 40 percent of all individuals possessing such a contract.

[14] According to BMAS (2013) about 15.7 Million Riester contracts have been signed at the end of 2012.

*Private pension schemes by personal income*

With respect to income the results reveal what could have been expected: People with a higher income can save easier for old age without restraining from something else. From Figure 2 it becomes obvious that occupational pension schemes as well as capital value life insurance contracts are more popular among individuals with a higher gross income whereas Riester/Rürup pension plans and private pension plans are more evenly distributed among the quintiles of income what is in line with the results of BMAS (2012, p.40). The higher participation rates in the lower income quintiles can probably be explained by the relative higher subsidies for low income earners in the Riester pension scheme.[15]

*Figure 2: Proportion of persons with private pension schemes (in %) by individual gross income quintiles*




*Source: Own estimations based on PHF 2011.*

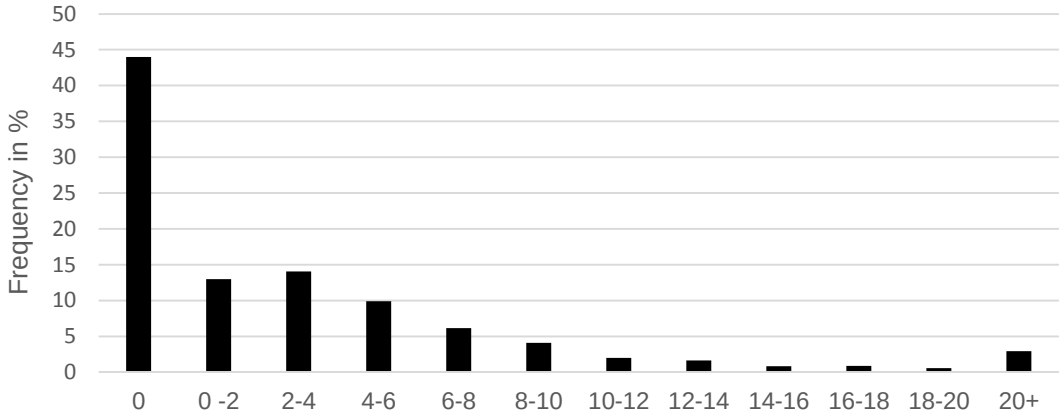
[15] The distribution of participation rates in Riester pension plan with respect to income quintiles is similar to the results in Geyer (2012, p.173) based on the German Socio -Economic Panel. However it differs to some extent from the results on a household level from Börsch-Supan et al. (2012) based on the SAVE-study who find rising Riester participation rates with respect to disposable household income. Taking a look at the individual participation rates in Riester pension plans with respect to the monthly disposable income shows also steadily increasing saving rates by disposable household income in the PHF.

Direct insurances financed by the employer are only relevant for a small part of individuals in the upper gross income quintiles. As one could have expected, the fraction of persons possessing more than one saving contract increases with a higher income probably due to a less binding budget constraint. Almost 40 percent of the individuals in the upper income quintile possess two or more saving contracts.

*Distribution of gross saving rates*

Looking at the distribution of individual gross saving rates in Figure 4 reveals the fact that about 45 percent of the persons considered aren't saving privately for retirement at all. The mean saving rate of about 4.5 percent is heavily influenced by some extreme outliers. [16]

*Figure 3: Distribution of individual gross saving rates (in %)*




*Source: Own estimations based on PHF 2011.*

Most people explicitly saving for retirement reasons seem to save between 0 to 10 percent of their gross income with a majority saving between zero and six percent of their gross income.

[16] These outliers (n=17) show a gross saving rate of more than 100 percent due to a gross income close to zero, which inflicts a huge volatility in the resulting saving rates. Therefore these observations are excluded in the following multivariate analysis. Excluding these observations yields a mean gross saving rate of 3.75 percent.

# 4. Multivariate Analysis

In the following section multivariate methods are applied to the PHF data in order to first identify the isolated determinants of privately saving for retirement at all and additionally to have a closer look at the factors influencing the amount being saved. With the focus lying on saving for retirement, the further analysis is restricted to individuals not already receiving a pension, leaving us with 4990 observations.

## 4.1. Who is privately saving for retirement?

Before analyzing how much is saved for retirement, it is worth answering the question who is privately saving for retirement at all. For this purpose a dummy variable is created equaling one if the person has a saving contract (Riester, occupational pension, private pension insurance or cash-value life insurance) and actually contributes to at least one of these saving vehicles.[17] Using this dummy as dependent variable the various influence factors can be analyzed using a binary logit model with the results shown in Table 2. [18] In the first column the only explanatory variables included are socio-demographic as well as income variables. In the second regression several variables concerning the employment situation are added whereas in the third model additional information about education status is included.

*Table 2: Propensity to save for old-age – logit estimation*

| | (1) Model 1 | | (2) Model 2 | | (3) Model 3 | |
|---|---|---|---|---|---|---|
| female | -0.135* | (0.0722) | -0.162** | (0.0807) | -0.180** | (0.0825) |
| age | 0.270*** | (0.0172) | 0.205*** | (0.0193) | 0.154*** | (0.0265) |
| age squared | -0.00324*** | (0.000196) | -0.00255*** | (0.000214) | -0.00228*** | (0.000240) |
| gross income | 0.000217*** | (0.0000223) | 0.0000966*** | (0.0000225) | 0.000101*** | (0.0000246) |

[17] Saving for retirement using real estate can unfortunately not be integrated in the analysis on an individual level as these savings are only recorded on a household level.

[18] The standard errors and test statics in Table 2 are calculated using the combination rules of Rubin (1987). Based on the Hosmer-Lemeshow test statistic with 10 subgroups, the model seems to be appropriate for all five imputations with a test statistic between 5.9 and 9.9. Another measure for the overall model fit, McFaddens adjusted R-Squared, yields values between 0.16 and 0.18 in all five imputed datasets.

| | | | | | | |
|---|---|---|---|---|---|---|
| gross income^2 | -4.29e-09*** | (6.08e-10) | -1.95e-09*** | (5.21e-10) | -2.18e-09*** | (6.41e-10) |
| married | 0.204** | (0.0896) | 0.168* | (0.0948) | 0.159* | (0.0954) |
| migration | -0.992*** | (0.107) | -0.929*** | (0.112) | -0.874*** | (0.115) |
| Eastern Germany | -0.309*** | (0.0935) | -0.340*** | (0.0981) | -0.346*** | (0.0991) |
| HH equivalence net income | 0.0000724*** | (0.0000235) | 0.0000692*** | (0.0000232) | 0.0000820*** | (0.0000269) |
| full-time | | | 0.777*** | (0.159) | 0.712*** | (0.162) |
| part-time | | | 0.675*** | (0.166) | 0.608*** | (0.169) |
| marginally employed | | | 0.227 | (0.225) | 0.211 | (0.231) |
| fixed-term employed | | | -0.301** | (0.147) | -0.263* | (0.150) |
| temporary out of employment | | | 0.583** | (0.251) | 0.516** | (0.254) |
| unemployed | | | -0.401** | (0.195) | -0.404** | (0.197) |
| In education | | | -0.482** | (0.196) | -0.338 | (0.213) |
| white-collar | | | 0.301*** | (0.107) | 0.306*** | (0.111) |
| civil-servant | | | 0.174 | (0.164) | 0.192 | (0.173) |
| trainee/internship | | | -0.504** | (0.249) | -0.316 | (0.257) |
| self-employed | | | 0.358* | (0.211) | 0.407* | (0.217) |
| self-employed (without employees) | | | 0.000591 | (0.147) | 0.0473 | (0.156) |
| family worker | | | 0.211 | (0.703) | 0.352 | (0.748) |
| secondary school | | | | | 0.0621 | (0.120) |
| university qualification | | | | | 0.0870 | (0.124) |
| vocational training | | | | | 0.356*** | (0.125) |
| university degree | | | | | 0.204 | (0.151) |
| TTR | | | | | -0.0263** | (0.0125) |
| _cons | -5.451*** | (0.321) | -4.436*** | (0.411) | -2.505** | (0.999) |
| N | 4990 | | 4990 | | 4902 | |

Standard errors in parentheses

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

*Source: Own estimations based on the PHF 2011.*

Women seem to have a lower propensity to save for retirement on an individual level. However this finding shouldn't be relied on to heavy as probably some financial decisions e.g. for a life insurance are made on a household level by the principal earner who is still most often the

husband. Throughout every model specification age turns out to have a negative quadratic relationship with saving for old age peaking at the age of 34 in the third specification. This result is in line with the descriptive statistics in the previous section so far.

As expected, the monthly gross income positively affects the individual's propensity to save for retirement. The negative coefficient of the squared individual gross income is also highly significant, indicating that the marginal effect of an additional Euro of gross income is decreasing. Until a monthly income of about 7 000 Euros the correlation is however nearly linear and positive. Net household income, per capita and weighted with the OECD equivalence scale, as a better measure of consumption possibilities has not surprisingly also a positive impact on the saving propensity, the coefficient is highly significant on a 1 percent significance level in all model specifications. [19] Including an additional variable about children wasn't significant, probably because the household composition is already captured in the equivalence weighted net household income. Independent of the model specification, there is also strong evidence that people living in the Eastern part of Germany (Neue Bundesländer) as well as people with an immigrant background[20] seem to have a lower probability to save for old age than their German counterparts in Western Germany. The size of the effect seems however to be much more substantial for individuals with an immigrant background.

Being full-time or part-time employed seems to be one of the most crucial factors explaining saving for retirement. Marginally employed persons have however no significant higher saving propensity than persons out of employment. Individuals who are only temporary out of employment and who are planning to return to employment save significantly more often for retirement. As saving contracts for old age need to build on a long time horizon, most individuals being temporarily absent from the labor market with a lower income probably

[19] The disposable household equivalence income is constructed from the disposable household income using the new OECD scale of equivalence weights.
[20] Individuals are defined as having an immigrant background if they either don't have a German citizenship or received it sometime after birth.

continue to pay contributions to these saving vehicles.[21] With regard to labor market characteristics one would expect a negative impact on the saving propensity from being unemployed or working on a fixed-term employment contract due to increased uncertainty and/or lower available income. The coefficient of being unemployed as well as the coefficient of working on a fixed-term contract have the expected negative sign and are both significant.[22] Individuals in an internship or in vocational training tend also to have a lower propensity to save for old age even when simultaneously taking income and age effects into account. The size of the coefficient is however decreasing and turning insignificant when considering additional information about education. By contrast the coefficient for the dummy variable indicating whether the person is a student or pupil or not (in education) also has a negative sign but is insignificant. Being a white-collar worker increases the probability to save for old-age compared to blue-collar workers (residual category). Other employment types like being a civil servant, an unpaid family worker or in internship don't seem to have a significant impact on the saving propensity for old age. There is however weak evidence that self-employed persons with employees are more likely to save privately for retirement.

While schooling itself doesn't seem to influence the propensity of saving for old age, individuals who finished vocational training are more likely to save for retirement. Surprisingly persons with a university degree are no more likely to save for old-age than persons who haven't finished school at all. Altogether there is hardly any evidence that education in general has a positive impact on the saving propensity for old-age what would have been expected to reflect enhanced financial literacy and therefore less myopic consumption behavior.[23] Additionally the individual timing of retirement has a significant impact on the saving propensity. The less time

[21] This is probably especially true for Riester-contracts, where non-employed spouses of Riester-entitled persons only have to pay a minimum contribution of 60 Euro in order to receive the full subsidy.
[22] These results on an individual level are in line with the results of Corneo et al. (2009) who found some evidence that unemployment decreases overall savings on a household level.
[23] The PHF dataset also contains a variable with the self-reported level of individual risk aversion and three questions regarding financial literacy with respect to inflation, interest rates and diversification of assets. These variables had surprisingly no significant effect on the propensity of saving for retirement in all specifications.

until the planned entry into retirement (TTR) is, the higher is the probability that he/she will save additionally privately for old age. This result can be interpreted in line with the induced retirement hypothesis of Feldstein (1974) postulating that the compulsory pension scheme induces early retirement and therefore additional savings as the period of retirement increases. [24]

## 4.2. How much are they saving?

As outlined in section 2, the recent reforms in Germany aimed to increase additional private saving for retirement via the pension schemes of the second pillar, Riester and occupational pension schemes. Therefore contributions to these schemes have been made tax-deductible up to 4 percent of the gross income with an upper limit of 2100 Euro in case of the Riester pension scheme. Contributions to occupational pensions up to 4 Percent of yearly gross employment income are additionally not subject to social security contributions. From the view of politics these tax laws seem to indicate a feasible individual gross saving rate of 4 percent which is reached or even exceeded by about 30 percent of all (also non-working) individuals (compare Figure 4). Given the declining pension levels of the statutory pension scheme (GRV) in the future, one's ability to maintain a desired standard of living during retirement is essentially connected not only to the decision to save for retirement at all but also to the share of income being saved for this purpose. Gross saving rates determine - given all other determinants e.g. rates of return, administrative costs etc. – the gross replacement rate of pensions relative to life-cycle earnings. For this reason we will now turn our attention to the amount individuals are saving and to their individual gross saving rate for old-age. For this purpose contributions to the schemes considered in the previous section (Riester pensions, occupational pensions,

[24] Cagan (1965) introduced also the „recognition effect", which states that private savings can be increased by a statutory pension scheme due to the fact that people realize the need for saving for retirement. The coefficients of a Dummy variable indicating whether the person is insured within a mandatory pension scheme and of the expected gross replacement rate relative to the current income were however insignificant.

private non-subsidized pensions and cash-value life insurances) are summed up and divided by the individual's gross income.

For saving rates for old-age reasons there exists a corner solution at zero resulting from the decision not to save at all. Accordingly the minimum gross saving rate is zero with a lot of observations piling up at this lower ceiling (compare Figure 4). Given this skewness of distribution, one popular choice for estimating saving rates has been the Tobit model introduced by Tobin (1958), jointly analyzing the savings decision and the resulting saving rate (e.g. Corneo et al. (2010)). One question arising with analyzing saving rates is whether the decision to save for old-age and the choice of the saving rate are influenced by the same determinants. In the framework of a "standard Tobit" or "Tobit type I model" the participation and consumption decisions are determined by the same explanatory variables whose coefficients are additionally restricted to having the same sign and size in both underlying processes. In order to model participation and consumption decisions separately, Cragg (1971) introduced the "two-tiered" or "double-hurdle" models, which allow for varying independent variables in the participation and the consumption equation and for different signs and sizes of the coefficients.[25] The crucial question is, to what extent the choice of the optimal saving rate depends on the participation decision (obvious through independence of the error terms). If these are two completely independent decisions, they can be modelled by analyzing separately the participation decision with an ordinary logit or probit model and the saving rate by using OLS on the natural logarithm of the gross saving rate and therefore only considering observations with strictly positive saving rates.[26] This approach is called the "lognormal

[25] For a detailed overview on the application of different models for limited dependent variables on tobacco expenditure data see Garcia and Labeaga (1996), Jones (1989) and with an application to saving rates Yoshida and Guariglia (2002).

[26] With the distribution of strictly positive saving rates still being right skewed, taking the logarithm of the saving rate leads to a normal distribution and enables the estimation of unbiased estimators.

independent two-tiered model" or the "lognormal independent hurdle model" or simply "two part model" as the two steps can also be regarded as taking place sequentially.[27]

In our analyses only individuals with a strictly positive saving rate are viewed as actively saving for old-age. This definition implies that there exists no corner solution with zero savings as a choice where individuals decide to save but with a saving rate equal to zero. This concept is known as "first-hurdle dominance", stating that the participation decision dominates the choice the saving rate in the sense that every individual deciding to save for old-age also shows a strictly positive gross saving rate. Given this first hurdle dominance and allowing for dependence between the participation decision and the decision about the saving rate leads to an Exponential Type II Tobit model (called Type II Tobit in the following sections).[28] The Exponential Type II Tobit model is equal to the lognormal independent hurdle model if the correlation between the participation and amount equation (represented by the coefficient of ρ) is equal to zero. The estimates for all three models specifications are presented in Table 3.[29]

*Table 3: Estimation of the gross saving rate*

| | (1)<br>Lognormal hurdle | | (2)<br>Exp. Type II Tobit | | (3)<br>Tobit | |
|---|---|---|---|---|---|---|
| Dependent variable | Log saving rate | | Log saving rate | | Saving rate | |
| female | 0.000953 | (0.0619) | 0.00139 | (0.0616) | 0.0457 | (0.0652) |
| age | 0.0133*** | (0.00249) | 0.0133*** | (0.00248) | -0.00124 | (0.00159) |
| gross income | -0.000236*** | (0.0000207) | -0.000237*** | (0.0000222) | 0.0000278* | (0.0000152) |
| gross income^2 | 3.70e-09*** | (6.26e-10) | 3.72e-09*** | (6.59e-10) | -8.12e-10** | (3.97e-10) |
| Eastern Germany | -0.234*** | (0.0742) | -0.231*** | (0.0761) | -0.198* | (0.113) |
| migration | -0.172* | (0.0952) | -0.167 | (0.102) | -0.371** | (0.175) |
| HH equivalence net income | 0.000234*** | (0.0000339) | 0.000234*** | (0.0000338) | 0.0000548* | (0.0000332) |
| HH equivalence net income^2 | -8.01e-09*** | (1.51e-09) | -8.00e-09*** | (1.50e-09) | -1.98e-09 | (1.31e-09) |

[27] See e.g. Wooldridge (2010).
[28] For a more detailed explanation see Wooldridge (2010, p.697-699).
[29] All model specifications were ran additionally with dummy variables about the civil status and the presence of children. However the coefficients were always insignificant, therefor they have been excluded in the final specification.

| | | | | | | |
|---|---|---|---|---|---|---|
| full-time | -0.416* | (0.216) | -0.433* | (0.244) | 1.494** | (0.711) |
| part-time | -0.540*** | (0.204) | -0.557** | (0.233) | 1.402** | (0.624) |
| marginally employed | -0.144 | (0.301) | -0.158 | (0.302) | 1.369** | (0.548) |
| fixed-term employed | -0.228* | (0.137) | -0.224 | (0.139) | -0.228* | (0.122) |
| temporary out of employment | -0.319 | (0.249) | -0.333 | (0.252) | 1.211** | (0.571) |
| unemployed | -0.962*** | (0.305) | -0.964*** | (0.303) | 0.463 | (0.291) |
| civil-servant | -0.375*** | (0.0978) | -0.375*** | (0.0970) | -0.0417 | (0.0607) |
| self-employed | 0.607*** | (0.113) | 0.608*** | (0.112) | 0.255 | (0.164) |
| self-employed (without employees) | 0.458*** | (0.106) | 0.460*** | (0.106) | 0.199 | (0.211) |
| secondary school | -0.127 | (0.101) | -0.128 | (0.0996) | -0.172 | (0.199) |
| university qualification | 0.109 | (0.0992) | 0.109 | (0.0985) | -0.0906 | (0.171) |
| vocational training | 0.0624 | (0.113) | 0.0563 | (0.114) | 0.611** | (0.285) |
| university degree | 0.169 | (0.134) | 0.164 | (0.130) | 0.435** | (0.187) |
| Planned deviation from regular retirement age | -0.0151* | (0.00833) | -0.0148* | (0.00853) | -0.0303* | (0.0158) |
| fl interest rate | 0.0816 | (0.0846) | 0.0813 | (0.0840) | 0.0544 | (0.0579) |
| fl inflation | 0.253* | (0.149) | 0.253* | (0.149) | 0.206 | (0.126) |
| fl diversification | 0.131* | (0.0775) | 0.130* | (0.0778) | 0.0941 | (0.0672) |
| $\rho$ | - | | -0.0178507 | (0.1202592) | - | |
| $\sigma$ | - | | 1.064779* | (0.0333293) | 1.478356** | (0.6484383) |
| N | 2174 | | 4641 | | 4641 | |

Standard errors in parentheses
* p<0.1, ** p<0.05, *** p<0.01
*Source: Own estimations based on the PHF 2011.*

What becomes obvious at a first glance, is the similarity between the estimated coefficients and standard errors in the lognormal model and the Type II Tobit Model. The coefficient for dependence between the participation and amount equation (rho) is small and not significant, indicating that both decisions are independent of each other and therefore yielding very similar results in both models. One has to bear in mind, that the coefficients of the Type II Tobit model describe the gross saving rate conditional on the fact that the person is saving, whereas the Tobit model and the lognormal hurdle model describe the unconditional saving rate. The difference

between these models is however that the lognormal hurdle model considers only observations with a strictly positive saving rate. The nesting of participation and saving rate decision in the tobit model yields different signs of the coefficients for some independent variables or different significance levels.

As some models are non-nested, testing between these models becomes additionally difficult besides the problems arising with multiple imputed data. In order to cope with these problems, the HPC-test, developed by Santos Silva et al. (2015), is applied separately to each imputation.[30] The Standard Tobit model is clearly rejected against the lognormal and the Tobit Type II model in each imputation, leaving no doubt that modelling the participation and amount decision separately leads to better results. Additionally the HPC-test rejects the Type II Tobit model in favor of the lognormal independent hurdle model in each imputation, confirming the insignificance of rho (the variable of dependence) in the Tobit Type II model. These results are also supported by looking at the log-likelihoods of the models (see Appendix Table 4 and Table 5). Taken together all evidence is pointing out that both decisions are independent of each other and should therefore be analyzed separately. Applying only a standard Tobit model in order to analyze saving rates may yield misleading results.

For example with respect to the gross income the Tobit model suggests that a higher individual gross income leads to higher saving rates what is driven by a an increasing propensity to have non-zero saving rates for higher incomes. Given that a person is saving, the other models propose a declining saving rate in line with an increasing gross income. The equivalence weighted household income appears however to have the expected positive impact on the savings rate in all model specifications. Different evidence applies also to variables covering the type of employment. The coefficients of the Tobit model state that saving rates are higher

[30] The HPC-test was implemented using the Stata-command 'hpc' written by Santos Silva et al. (2015). The results of the HPC-test as well as the log-likelihoods for each imputation are available from the author upon request.

for persons employed full- or part-time. The two-part models however reveal that the propensity to save at all is significantly higher for these individuals but the resulting saving rate is lower (compared to not economically active persons as reference category). For individuals living in the Eastern part of Germany (Neue Länder) all models are reporting lower saving rates. These lower saving rates are a result of lower participation rates in saving and lower saving rates conditional on saving as is obvious from the two-part models. For persons with a migrant background however the evidence is not that clear. In the previous part we have seen that they have a much lower propensity to save for old-age. Conditional on saving, the lognormal hurdle model provides weak evidence that also saving rates are lower. By contrast, considering possible dependence between the two equations in the Type II Tobit model, even if very small, disperses this weak significance.

Contrary to the participation decision, the occupational status has a significant influence on resulting saving rates, at least for civil servants and self-employed persons. In the two-part models civil servants tend to have lower saving rates if controlled for other variables. This observation might be explained by the fact that civil servants in Germany are not insured in the statutory pension scheme but receive a kind of further salary payment during retirement. As these payments depend on the last net salary before retirement and lead to much higher replacement rates than the statutory pension scheme, they may have a lower demand for annuity contracts and instead use more flexible saving contracts.[31] Self-employed individuals however have significantly higher saving rates probably due to the fact that for them private saving for old-age is a substitute for compulsory saving for retirement via a statutory pension scheme. This finding is more distinct for self-employed individuals with employees whose saving rate is –ceteris paribus - on average 83 percent higher than for employed persons. Self-employed

[31] Corneo et al. (2009) found using a Tobit model that households with a civil servant as household head also have lower overall saving rates but the coefficient was not significant.

persons without employees still have a 58 percent higher saving rate than dependently employed persons.

Whereas vocational training increases the probability of saving for old-age, education or schooling have no effect on the resulting saving rate, at least in the two-part models. What seems to be puzzling at a first glance, can be partly explained by the dummy variables covering financial literacy. There are three questions in order to assess financial literacy: The first question tests understanding of interest rates, the second one tests knowledge about inflation and the third one is about diversification of assets. Whereas the proper understanding of interest rates has no effect on the resulting saving rate, there is weak evidence that knowing the effect of inflation leads to higher saving rates in order to compensate for the real devaluation of pension payments during retirement or during the saving period. Additionally understanding the concept of risk diversification seems to have a positive impact, too. This may arise from the average higher amount of contracts than persons giving the wrong answer.

The positive and significant coefficient of age on the saving rate could be interpreted in the light of "the goal gradient hypothesis" by Katona (1965). According to this hypothesis individuals save more for retirement, the closer they come to retirement (the older they are), recognizing their need for additional old-age income. Weak evidence is also given for the induced retirement effect by the negative coefficient for the expected deviation from the regular retirement age (measured as planned age of retirement minus the regular retirement age), indicating that expected earlier retirement leads to increased saving rates.

## 5. Concluding remarks

This articles examines the saving behavior with respect to retirement on an individual level in Germany. The analysis consists of two parts: In a first step the decision to save for retirement is analyzed using a logit model. Afterwards we turn our attention to the amount being saved relative to the personal gross income, the gross saving rate. As expected the household

equivalence net income as proxy for the disposable income turns out to be the crucial factor determining the probability of saving as well as the saving rate. The higher the household equivalence income is, the higher is the probability for saving and also the resulting saving rate. The individual income increases the probability of saving for old-age, but has a negative impact on the saving rate if controlled for household income. Being employed increases the probability of saving for old-age but has not necessarily an impact on the saving rate. Self-employed persons are more likely to save additionally for retirement with significant higher saving rates in order to substitute for compulsory saving within the statutory pension scheme. The opposite is true for civil servants who appear to have a lower saving rate probably due to the higher replacement rate of their pensions. Education has surprisingly almost no impact on the probability to save or the resulting saving rate except for vocational training. There is however some weak evidence that increased financial literacy especially with regard to inflation and diversification results in higher saving rates. Katona 's (1965) 'goal gradient hyothesis' can be confirmed as people are more likely to save and have higher saving rates the more they approach the age of retirement. The 'induced retirement effect' introduced by Feldstein (1974) is observable in the higher saving rates of those who plan to retire before their cohort's regular retirement age. The question whether these individual savings are sufficient to maintain one's standard of living during retirement despite the decreasing pension level of the statutory pension scheme must remain unclear. To answer this question further research is needed, as we only analyze cross-sectional data ignoring life-cycle savings and the rate of return of the underlying assets. Analyzing saving behavior using also two-part models yields much more detailed and valuable insights into the saving decision process and the determinants of the saving rate than relying solely on the standard Tobit model.

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# Appendix

*Table 4: Log-Likelihood estimates by model and imputation*

| Imputation | Exp. type II tobit | Tobit | Lognormal hurdle |
|---|---|---|---|
| 1 | -8805.21 | -14911.81 | -8797.82 |
| 2 | -8835.52 | -14893.80 | -8738.36 |
| 3 | -8885.79 | -14895.07 | -8792.73 |
| 4 | -8777.46 | -14882.62 | -8776.79 |
| 5 | -8869.40 | -14888.34 | -8805.16 |

*Source: Own estimations based on PHF 011.*

*Table 5: HPC-Tests by imputations*

| | | Model A **Tobit** | Model B **Log-normal** | Model A **Tobit** | Model B **Exp. Tobit type II** | Model A **Log-normal** | Model B **Exp. Tobit type II** |
|---|---|---|---|---|---|---|---|
| Imputation | H0: | Model A is valid | Model B is valid | Model A is valid | Model B is valid | Model A is valid | Model B is valid |
| 1 | t-value | 1.97 | 0.77 | 1.693 | 1.526 | -0.664 | 1.93 |
| | prob>t | 0.02 | 0.22 | 0.045 | 0.064 | 0.747 | 0.027 |
| 2 | t-value | 2.04 | 0.68 | 1.714 | 1.607 | -0.962 | 2.199 |
| | prob>t | 0.02 | 0.25 | 0.043 | 0.054 | 0.832 | 0.014 |
| 3 | t-value | 2.22 | 0.08 | 1.708 | 1.643 | -0.805 | 1.957 |
| | prob>t | 0.01 | 0.47 | 0.044 | 0.05 | 0.79 | 0.025 |
| 4 | t-value | 1.97 | 0.76 | 1.602 | 1.59 | -0.301 | 2.181 |
| | prob>t | 0.03 | 0.23 | 0.055 | 0.056 | 0.618 | 0.015 |
| 5 | t-value | 2.31 | 0.51 | 1.749 | 1.892 | -0.824 | 2.245 |
| | prob>t | 0.011 | 0.304 | 0.04 | 0.029 | 0.795 | 0.012 |

*Source: Own estimations based on PHF 2011.*

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