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Selected Aspects of Household Savings in Germany: Evidence from Micro-Data

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ABSTRACT/RÉSUMÉ

Selected aspects of household savings in Germany – evidence from micro-data

This paper uses household level data from the German Socio-Economic Panel (GSOEP) over the period 1991 to 2008 to analyse the driving factors of movements in the German household savings rate. Specifically, it analyses the impact of the precautionary savings motive and the impact of the 2002 private pension reform (the so-called *Riester* reform) on households' savings rate as these factors are among the most discussed in the German context. There is evidence for both factors at work: *First*, households with a more volatile income stream tend to save more and the extent to which they do depends on their (subjectively assessed) risk aversion. *Second*, the introduction of the *Riester* pension scheme in 2002 was associated with a general increase in the household savings rate, both for households that signed up for private pension contracts and for those that did not. This effect is not found for low-income households, thus confirming the findings of other studies.

JEL classification codes: D12*;* D91*;* E21

Keywords: Household savings rate*;* GSOEP*;* precautionary savings*;* retirement savings*;* Riester reform

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Principaux aspects de l'épargne des ménages en Allemagne – indications fournies par les microdonnées

Ce document s'appuie sur des données recueillies auprès des ménages par le German Socio-Economic Panel (GSOEP) sur la période 1991-2008 afin d'analyser les déterminants des variations du taux d'épargne des ménages allemands. Il analyse en particulier l'impact du désir d'épargne de précaution et l'impact de la réforme des retraites privées de 2002 (« réforme *Riester* ») sur le taux d'épargne des ménages, ces facteurs étant parmi ceux qui présentent le plus d'intérêt dans le cas de l'Allemagne. Il apparaît que ces deux éléments jouent un rôle : *En premier lieu,* les ménages dont le revenu est plutôt irrégulier épargnent généralement plus et ce, en fonction de leur degré d'aversion au risque (évalué subjectivement). *En second lieu*, la mise en place du régime de retraite *Riester* en 2002 s'est accompagnée d'une hausse générale du taux d'épargne des ménages, aussi bien pour les signataires de contrats de retraite privés que pour les autres. Cet effet n'apparaît pas pour les ménages à faible revenu, ce qui confirme les résultats des autres études.

Classification JEL : D12*;* D91*;* E21

Mots clés : Taux d'épargne des ménages*;* GSOEP*;* épargne de précaution*;* épargne pour la retraite*;* réforme Riester

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TABLE OF CONTENTS

SELECTED ASPECTS OF HOUSEHOLD SAVINGS IN GERMANY – EVIDENCE FROM MICRO-DATA 5
1. Introduction 5
2. A review of the recent literature 5
2.1. Precautionary savings 6
2.2. Retirement savings 9
3. A first glance at household savings 10
4. Empirical approach and results 11
4.1. Baseline specification 11
4.2. Precautionary savings motive 14
4.3. Retirement savings smotive 15
5. Summary and conclusions 18
BIBLIOGRAPHY 19
ANNEX: DETAILS ON VARIABLE CONSTRUCTION 22

Tables

1. Empirical studies on precautionary savings 7
2. Estimation results – baseline specification 13
3. Estimation results – precautionary savings 15
4. Estimation results – retirement savings 17

Figures

1. Comparing aggregate survey-based savings rates with the national accounts measure 11
2. Savings behaviour by age 14

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SELECTED ASPECTS OF HOUSEHOLD SAVINGS IN GERMANY – EVIDENCE FROM MICRO-DATA

By Christina Kolerus, Isabell Koske and Felix Hüfner[1]

1. Introduction

1. The driving factors of the German household savings rate have been intensely studied on the macro level (*e.g.* Deutsche Bundesbank, 2007; Hüfner and Koske, 2010). This paper adds to this literature by focussing on two savings motives, precautionary savings and retirement savings. The study differs from the literature in several aspects. *First*, this paper uses microeconomic data (the German Socio-Economic Panel GSOEP). Since the macroeconomic savings rate by definition is the average of all individual household decisions, looking at the individual household level may offer more insights into the relevance of the different hypotheses. *Second*, while most microeconomic studies focus on single aspects driving the savings rate (mostly precautionary savings), this paper tests for the relevance of both retirement and precautionary savings motives.

2. The results suggest that precautionary savings are an important determinant: the more volatile the income stream of a household is, the higher its savings rate tends to be. This effect is amplified by the level of risk aversion with more risk-loving households raising their savings rate by less in response to income volatility. For the retirement savings motive, the results suggest that the introduction of the private pension scheme in 2002 (the so-called *Riester Rente*) was associated with a general increase in the household savings rate, both for households that signed up for private pension contracts and for those that did not. However, this effect is not found for low-income households, thus confirming the findings of other studies.

3. The remainder of this paper is structured as follows. Section 2 first provides an overview of the recent literature on the precautionary and retirement savings motives. Section 3 then presents the dataset and some preliminary descriptive statistics on households' savings behaviour. Section 4 discusses the empirical methodology as well as the estimation results and the final section concludes.

2. A review of the recent literature

4. While empirical studies on the determinants of countries' aggregate household savings rates have a long tradition, microeconomic data have only been used more recently. This section presents an overview of these recent studies, most of which focus on particular aspects or theories, in particular the impact of precautionary savings behaviour – evidence on the retirement savings hypothesis is much scarcer.

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1. Christina Kolerus is Economist at the IMF, Isabell Koske is Senior Economist at the OECD and Felix Hüfner is Deputy Director of Global Macro Analysis at the IIF. The views expressed in this paper reflect those of the authors and not necessarily those of the IMF, the OECD, the IIF or their member countries. The authors are grateful for comments by Andreas Wörgötter and Jens Arnold and the paper benefitted from discussions during an internal OECD seminar.

2.1. Precautionary savings

5. A vast array of literature has investigated the relevance of the precautionary savings motive, which states that households accumulate assets in response to uncertainty about their future income (see Table 1 for a summary). Most studies focus on income uncertainty and use regression analysis to estimate its impact on wealth, savings and/or household consumption. Results vary significantly across studies; while some cannot find any evidence in favour of the precautionary savings motive (*e.g.* Kuehlwein, 1991; Dynan, 1993), others find that it accounts for a large share of household savings (*e.g.* Lusardi, 1997). These differences partially reflect the difficulty in calculating an exogenous measure of income uncertainty. One strand of the literature uses subjective measures of income uncertainty from self-reported information on the future job or income situation of the respondent (*e.g.* Lusardi, 1997; Harris *et al.*, 2002; Carroll *et al.*, 2003; Murata, 2003; Benito, 2005). In order to control for potential selection bias that may arise from the fact that households who value job security might have chosen a safe job, most studies use an instrumental variable method.[2] Another approach, which is more common in the literature, is to employ some measure of income variability that is calculated from time series data (*e.g.* Guariglia and Rossi, 2002; Zhou, 2003; Hurst *et al.*, 2005; Bartzsch, 2006).[3] Essig (2005) is an example of a study that uses both subjective and objective measures of income uncertainty.

6. Other approaches include Lusardi (1998), who constructs a measure of earnings uncertainty based on the probability of losing the job, the level of earnings and the level of unemployment benefits and finds that people who face higher income risk save more, though the contribution of precautionary savings to wealth accumulation is not very large.[4] Engen and Gruber (2001) find that the extent of income insurance available to unemployed workers through unemployment insurance (which varies exogenously with the state of residence) has an impact on household savings. Fuchs-Schündeln and Schündeln (2005) exploit the event of German reunification to control for the presence of self-selection of risk-averse individuals into low-risk occupations in estimating the importance of precautionary savings. Assuming that no self-selection of risk-averse individuals into civil servant jobs took place in the former German Democratic Republic (where labour income risk was almost absent) the authors compare wealth holdings of civil servants in East Germany after reunification with the wealth holdings of individuals in other occupations and find evidence in favour of the precautionary savings motive.

7. While most of the precautionary savings literature has focused on the relationship between labour income risk and wealth accumulation, some studies also find evidence for an impact of risks such as health and longevity on wealth accumulation (see, for example, Murata, 2003, for evidence on the impact of uncertainty about the public pension system and Guariglia and Rossi, 2004, on the role of health risk for precautionary savings among British households). One study that does not rely on a regression of a measure of asset accumulation on risk to investigate the importance of the precautionary savings motive is Parker and Preston (2005).[5]

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2. For example, Lusardi (1997) employs subjective data on earnings variance provided in the Italian Survey of Household Income and instruments this variable by regional unemployment rates. Carroll *et al.* (2003) measure uncertainty by the probability of job loss and instrument this variable with the region in which the household resides.

3. For example, Guariglia and Rossi (2002) and Zhou (2003) measure income uncertainty by the variability of the household head's net earnings. Hurst *et al.* (2005) measure labour income risk by the permanent and transitory variance of income and instrument by variables such as occupation, industry, union membership and county unemployment. Bartzsch (2006) uses several alternative measures of income variability in a cross-section of households, taking into account the household's risk aversion.

4. The uncertainty measure is $p(1-p)(1-a)^2Y^2$ where p is the subjective probability of losing the job, Y is earnings and a is the unemployment benefit replacement rate. Guariglia (2001) applies a similar measure.

5. Parker and Preston (2005) derive a decomposition of consumption growth from the Euler Equation. Using data from the Family and Detailed Expenditure files of the US Department of Labor the authors find that

8. Most of the more recent studies that properly control for household characteristics and for a potential selection bias (risk-averse households may choose less-risky occupations) confirm that households accumulate wealth to shelter against sudden income losses. However, the size of this effect is generally found to be modest, at least for the average household. Precautionary savings to insure against health and longevity risks also seem to play an increasing role. A number of studies exploit direct survey questions about households' reasons to save to explore the relevance of the precautionary savings motive (*e.g.* Horioka and Watanabe, 1997; Alessie and Kapteyn, 2001; Börsch-Supan *et al.*, 2006; Schunk, 2009; Kennickell and Lusardi, 2006). These studies tend to find effects that are statistically significant and relatively large in size.[6]

Table 1. Empirical studies on precautionary savings

Study	Data source	Method	Dependent variables	Explanatory variables	Remedy for endogeneity of uncertainty measure	Results
Horioka and Watanabe (1997)	Survey on the Financial Asset Choice of Households (Japan)	Survey question for savings motives				Savings for illness and '*peace of mind*' each account for around 14% of average gross savings for all reported motives
Lusardi (1997)	Survey of Household Income and Wealth (Italy)	Regression	Wealth to permanent income	Survey question on expected earnings changes	IV (regional unemploy-ment rates)	Precautionary wealth accumulation = 20 to 24% of total wealth accumulation
Lusardi (1998)	Health and Retirement Study (US)	Regression	Wealth to permanent income	$p(1-p)(1-a)^2Y^2$	Inclusion of risk aversion variable in regression	Significant but not large; impact smaller for households with second earner
Alessie and Kapteyn (2001)	Socio-Economic Panel (SEP) & Center Saving Survey (CSS) (Netherlands)	Survey question for savings motives				SEP: 22% of households indicate unforeseen events as (one) reason to save; CSS: unforeseen circumstances & health expenditures are important savings motives
Engen and Gruber (2001)	Survey of Income and Program Participation (US)	Regression	Gross financial wealth to permanent income	Unemployment benefit replacement rate		Cutting benefits by half reduces wealth by 14%; effect stronger for single heads and for higher unemployment risk, weaker for older workers

the contribution of precautionary savings to consumption volatility is statistically significant, but that the decomposition leaves a range of uncertainty as to the economic importance of precautionary savings. The economic importance of precautionary savings increases in the assumed level of household risk aversion and prudence. Fuchs-Schündeln (2008) estimates a life-cycle consumption model using data from the GSOEP and shows that the reduction in the savings rate of East Germans approaching the level of West Germans after reunification is linked to the precautionary savings motive (the low stock of wealth after reunification induced East Germans to initially save more and then reduce savings over time as a buffer stock is built up).

6. For example, Schunk (2009) shows that 62% of all households rate the precautionary savings motive as very important. A regression of the savings rate of households on the importance of the different savings motives suggests that the precautionary savings motive is particularly operative for older age cohorts, which the authors explain by the increased health risk of that age group.

Table 1. Empirical studies on precautionary savings *(cont.)*

Study	Data source	Method	Dependent variables	Explanatory variables	Remedy for endogeneity of uncertainty measure	Results
Guariglia (2001)	British Household Panel Survey (UK)	Regression	Savings to permanent income	$p(1-p)(1-a)^2Y^2$, different measures of earnings variability over time	IV (job tenure, age, private/ public sector job, and others)	Precautionary savings motive is significant
Guariglia and Rossi (2002)	British Household Panel Survey (UK)	Regression	Consumption growth	Variability of net earnings		Precautionary savings motive is significant
Harris *et al.* (2002)	Melbourne Institute Survey (Australia)	Regression	Ordinal measure of financial situation of household	Future outlook for family finances, economy, unemployment		More pessimistic households are in higher savings category
Carroll *et al.* (2003)	Current Population Survey, Survey of Consumer Finances (US)	Regression	Net wealth to permanent income	Probability of job loss	IV (region of residence)	Significant effect for households with modest and higher income; no effect for low-income households
Murata (2003)	Japanese Panel Survey of Consumers (Japan)	Regression	Wealth to permanent income	Subjective assessments of future business outlook & reliability of public pension system		Precautionary savings to shelter against pension income uncertainty but not against labour income uncertainty
Zhou (2003)	Survey on the Financial Asset Choice of Households (Japan)	Regression	Consumption	Variance of household earnings within homogeneous groups of households		Precautionary savings account for 5.5% of total savings of salaried worker households; precautionary savings declines with age
Guariglia and Rossi (2004)	British Household Panel Survey (UK)	Regression	Savings	Private health insurance coverage		Private medical insurance crowds out private savings only in areas with poor medical facilities and few NHS providers
Benito (2005)	British Household Panel Survey (UK)	Regression	Consumption; consumption growth	Unemployment risk	IV (previous unemploy-ment experience, size of employer, union status, and others)	Increase in unemployment risk reduces consumption; effect stronger for the young and for those that are more reliant upon labour income
Essig (2005)	SAVE (Germany)	Regression	Savings rate; financial and total wealth to permanent income	Expectations about economic development, job loss & income; unemployment rate; precautionary savings motives		Inconclusive

Table 1. Empirical studies on precautionary savings *(cont.)*

Study	Data source	Method	Dependent variables	Explanatory variables	Remedy for endogeneity of uncertainty measure	Results
Fuchs-Schündeln and Schündeln (2005)	GSOEP (Germany)	Regression	Wealth	Civil servant dummy	Self selection controlled for by exploiting event of German reunification	Civil servants hold less wealth; self selection bias present in West German data
Hurst *et al.* (2005)	Panel Study of Income Dynamics (US)	Regression	Wealth	Permanent and transitory variance of income	IV (occupation, industry, union status, county unemploy-ment and others)	Precautionary savings account for less than 10% of wealth of business and non-business owners
Parker and Preston (2005)	Family and Detailed Expenditure files (US)	Decomposi-tion of consumption Euler equation				Contribution of precautionary savings to consumption volatility statistically significant
Bartzsch (2006)	GSOEP (Germany)	Regression	Net financial wealth and total non-business net wealth to permanent income	Different measures of income variability over time	Inclusion of risk aversion variable in regression	Precautionary savings account for 20% of net financial wealth; housing wealth not used for precautionary purposes
Börsch-Supan *et al.* (2006)	SAVE (Germany)	Survey question for savings motives	Savings rate			¼ of respondents indicate unforeseen events as most important savings motive
Kennickell and Lusardi (2006)	Survey of Consumer Finances (US)	Survey question for savings motives				Precautionary savings account for 8% of total net wealth and 20% of total financial wealth; reasons: health, income and longevity risk
Schunk (2009)	SAVE (Germany)	Survey question for savings motives + regression		Subjective importance of precautionary savings motive		Precautionary savings motive particularly operative for older age cohorts.

2.2. Retirement savings

9. Few studies focus on the relevance of retirement savings behaviour. For example, using survey data for Germany, Börsch-Supan *et al.* (2006) find that more than 30% of all respondents say that saving for retirement purposes is the most important reason to save. Using the same dataset, Schunk (2009) shows that saving for retirement is rated as very important by 59% of all households, with the importance being higher for 35-to-64 year-olds than for those younger than 35. By contrast, Alessie and Kapteyn (2001) show for the Netherlands that only 2% of all households save for old age. They explain this by the generous old age income provisions in the Netherlands which reduce the need to accumulate private wealth. Also looking at the Netherlands, Euwals (2000) finds that households with low pension wealth (from the mandatory public social security part or the mandatory private occupation specific part) find it more important to save in order to supplement possible low pension benefits. However, the authors only find weak evidence that this translates into actual behaviour through higher wealth accumulation.

10. Some papers study retirement savings behaviour in the context of the introduction of the subsidized private pension scheme in Germany (*Riester-Rente*). For example, Börsch-Supan *et al.* (2008) use the SAVE dataset to investigate which characteristics drive German households to make use of the *Riester* subsidy vs. other forms of private pensions. Using the same dataset as we do, Corneo *et al.* (2009) investigate the impact of the *Riester* reform in 2002 on the savings decisions of German households. They find that higher subsidies for low-income households do neither increase the share of households that save nor their savings rate, implying that the *Riester* subsidy substantially crowds out other forms of savings such as ordinary savings accounts. By contrast, Alessie *et al.* (1997) do not find evidence for such crowding out effects using data from the Dutch Socio-Economic Panel on private wealth and on pension wealth. In the same vein, Rossi (2009) finds that private pension schemes increased overall private savings. Attanasio and Brugiavini (2003) find for Italy that savings rates increase as a result of a reduction in pension wealth.

3. A first glance at household savings

11. The data source used in the empirical analysis is the German Socio-Economic Panel (GSOEP), a representative annual longitudinal study of around 11 000 private households which started in 1984 and is located at the German Institute for Economic Research (DIW). Our sample period starts in 1992, the first year when savings behaviour was introduced as a topic into the survey, and ends in 2008. The panel is unbalanced and includes a maximum number of 122 996 observations, depending on the precise specification. To make the sample more representative of the entire population, we drop the immigrant and high income sub-sample and eliminate outliers (most probably false answers) by dropping the highest percentile of each sub-sample's savings rate.[7]

12. The key variable is the amount of money that households save on a monthly basis. This variable is calculated based on respondents' answers to the question: *Do you usually have an amount of money left over each month for major purchases, emergencies, or savings? If yes, how much?*[8, 9] This is what we call financial savings and the variable is left-censored as negative savings are not reported. However, this variable neglects mortgage amortization payments for owner-occupied housing and other dwellings during the month, which is another element of total savings. Thus, in a second step the size of this second part of savings is calculated for each household, using information about homeownership and the existence of a mortgage from the GSOEP, assuming an average mortgage duration of 30 years, constant annuity amounts and a mortgage interest rate of 8%. This procedure follows Fuchs-Schündeln (2008). In the estimations, we report both results for financial savings only and for total savings (equal to financial plus mortgage amortization payments).

13. The yearly average of individual household savings rates is calculated using information on monthly disposable household income from the survey. In the sample, households' total savings rates range between 0% and 78% with a sample average of 11%. The resulting GSOEP savings rate broadly matches the level of the savings rate based on national accounts and decreases accordingly during the 1990s. It differs, however, in its movements in the early 2000s where the national savings rate depicts an

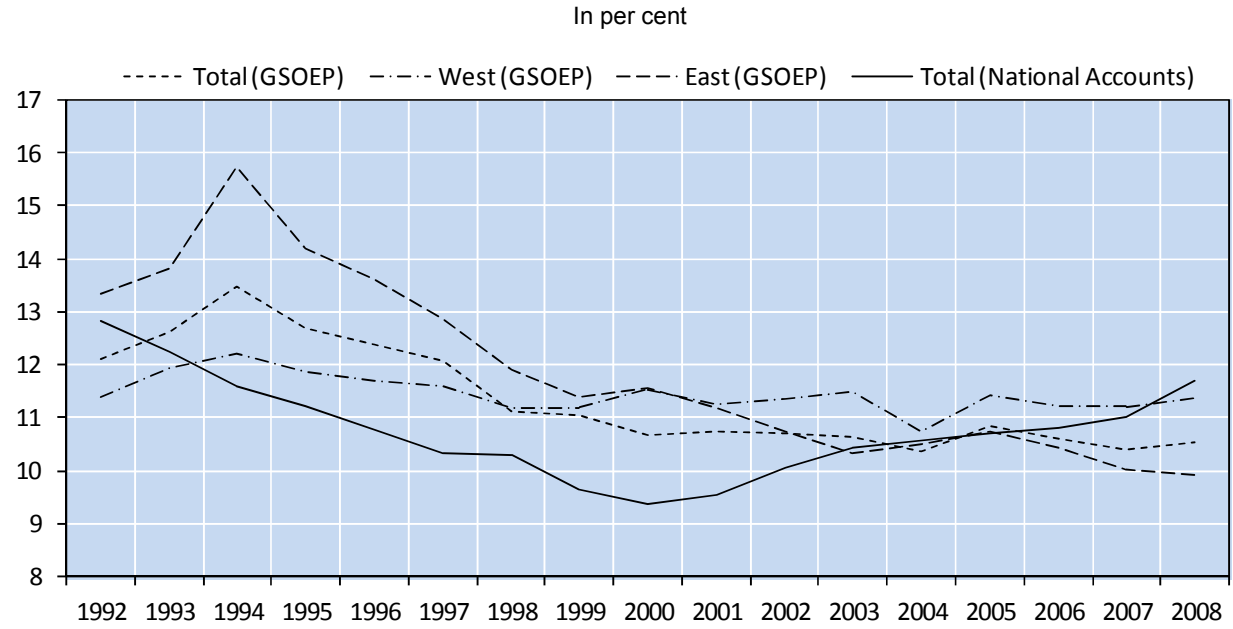
7. This procedure is only followed for the savings rate since this variable is by far the most difficult to assess for respondents (variables such as age, education level or household size are relatively easy to assess and thus less prone to measurement error).

8. Answers are given in euro; prior to 2002 answers were given in deutschmarks and were converted into euro using the irrevocable euro conversion rate fixed in 1998. All variables are inflation adjusted.

9. The phrasing of the question leaves room for interpretation which types of savings should be included in the answer and it cannot be ruled out that different respondents interpreted the question differently. However, it is the best information available and as shown in Figure 1, the implied aggregate savings rate is broadly in line with the one obtained from national accounts.

increase and the one based on the GSOEP shows a stagnation, a consistent finding in earlier studies (*e.g.* Stein, 2009; Bartzsch, 2006) (Figure 1). This deviation of the micro-based and the macroeconomic series may reflect the simplified assumptions made in the calculation of real savings based on the GSOEP. In addition the national accounts savings rate comprises more than just private households, namely non-incorporated enterprises and non-profit institutions serving households which are not part of the GSOEP.

Figure 1. Comparing aggregate survey-based savings rates with the national accounts measure



Source: National accounts. GSOEP, Total household savings over disposable household income, subsample averages over time. The West subsample includes refreshment samples from 1996, 2000 and 2006.

4. Empirical approach and results

4.1. Baseline specification

14. In order to explain the savings behaviour of households, a measure of household savings (*SAVE*) – the logarithm of savings or, alternatively, the savings rate – is regressed on the logarithm of an income measure – real income[10] or, alternatively, permanent income – and its squared value (*INC* and INC^2).[11] In addition, the baseline specification includes the following additional explanatory variables, which are common in the literature: age (*AGE*, AGE^2 and AGE^3), household size (*HSIZE*), marital status (*PART*) and the level of education (*EDUC*). The equations control for whether the household head is unemployed (*UNEMP*) or in retirement (*PEN*). We also include a dummy (*EAST*) that takes the value of one if the household is living in East Germany (see the Annex for more details on the construction of the variables). The baseline specification is thus as follows:

$$(1) \quad SAVE_{it} = \alpha_t + \beta_1 INC_{it} + \beta_2 INC_{it}^2 + \beta_3 AGE_{it} + \beta_4 AGE_{it}^2 + \beta_5 AGE_{it}^3$$

10. Income as reported in the questionnaire, inflation adjusted.

11. Following Fuchs-Schündeln and Schündeln (2005), permanent income is constructed by *i)* de-trending total non-capital household income by dividing it through the average income of all households in the corresponding survey year, *ii)* calculating the average de-trended income for every household over all available observation years and *iii)* multiplying this average de-trended household income with the average income of all households within each survey year.

$$+ \beta_6 HSIZE_{it} + \beta_7 EDU_{it} + \beta_8 PART_{it} + \beta_9 Controls_{it} + \varepsilon_{it}$$

where *i* denotes the household and *t* denotes time. All regressions include time fixed effects. Equation (1) is estimated using a Tobit estimator with robust standard errors (the equation is alternatively estimated with fixed effects or the Heckman procedure and results are very similar).

15. Table 2 shows the marginal effects obtained by estimating Equation (1) for six different measures of savings as the dependent variable: the logarithm of financial savings (*FS*) and total savings (*S*) (specifications (1) and (2)), the ratio of financial and total savings to actual income (*RINC*) (specifications (3) and (4)) and the ratio of financial and total savings to permanent income (*PINC*) (specifications (5) and (6)). The figures shown in Table 2 are the marginal effects. The results confirm the findings of earlier studies that the savings rate increases in income, but at a declining rate: The coefficient on the income variable is significantly positive in all specifications and the coefficient on the squared income term is significantly negative. The three age variables *AGE*, AGE^2 and AGE^3 are also significant in the majority of specifications. The magnitudes of the estimated coefficients imply a typical life cycle savings pattern with the savings rate first declining until the household reaches an age of about 40 years and then rising until after retirement. This pattern in somewhat more pronounced for financial savings (Figure 2). For total savings, there is some evidence of a falling savings rate at very old ages (from about 90 years onwards), but here the sample is too small to draw any robust conclusions. The finding of a continued high savings rate at older ages confirms the *German savings puzzle* as described in Börsch-Supan *et al.* (2006).

16. In line with other recent studies (*e.g.* Schunk, 2009) larger households are found to save less, possibly related to their higher consumption needs. The Tobit regressions imply that one additional household member reduces the total savings rate of that household between around ¼ and ½ percentage points when measured as a share of permanent income, and between 1 and 1¼ percentage points when measured as a share of real income. Households with a better educated household head tend to save more. The marginal effects imply that the savings rate increases between ½ and ¾ of a percentage point for each increase in the level of education (measured on a scale from 1 to 4). This result might be related to better information regarding savings instruments as well as the role of savings as a source of retirement income. East German households exhibit a higher savings rate (around 1¾ percentage points higher depending on the specification), which is consistent with the findings by Fuchs-Schündeln (2008) and explained by a catch-up process given the low initial capital stocks after reunification. Households with an unemployed head tend to save less (the effect amounting to between 1½ and 3¼ percentage points depending on the specification), which may reflects their temporarily reduced income level (even though the effect is even larger when measuring savings as a share of permanent income). Households whose head is in retirement tend to have a lower savings rate as predicted by the life cycle hypothesis and the effect amounts to between ½ and 1½ percentage points. Finally, being married raises the savings rate of the household by between ½ and 1½ percentage points.

17. Overall, the coefficient estimates for the financial and total savings rates are very similar and the same holds for the savings rate expressed as share of actual real income versus permanent income. Since the results for the savings rate as share of permanent income are somewhat more robust, the following sections report only estimations for this variable.

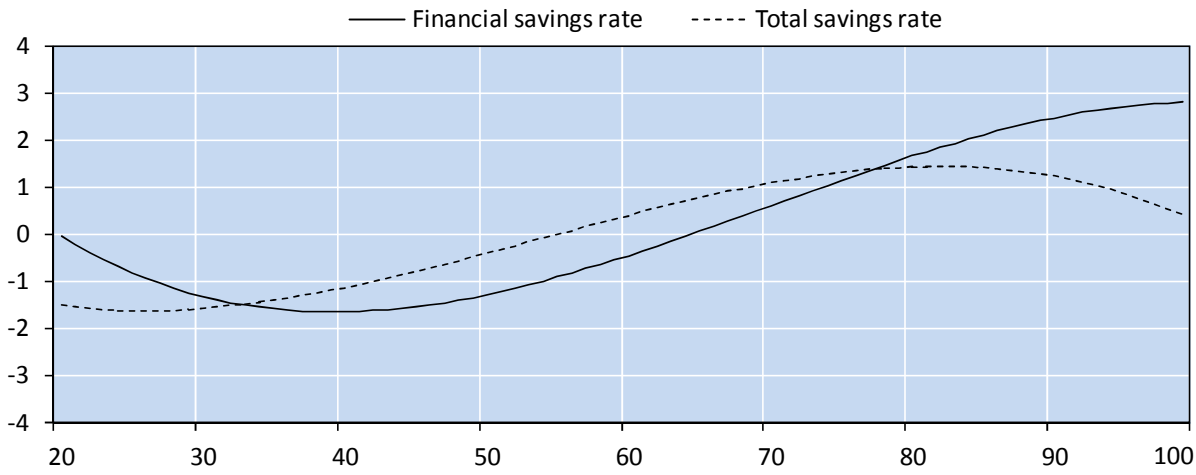
Table 2. Estimation results – baseline specification

Specification	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.	ln(F*S*)	ln(*S*)	*FS*/*RINC*	*S*/ *RINC*	*FS*/*PINC*	*S*/*PINC*
RINC			16.610***	16.264***		
			(1.219)	(1.848)		
$RINC^2$			-0.796***	-0.815***		
			(0.079)	(0.120)		
PINC	7.471***	7.452***			16.492***	12.869***
	(0.565)	(0.523)			(2.322)	(2.506)
$PINC^2$	-0.382***	-0.357***			-0.807***	-0.501***
	(0.038)	(0.034)			(0.156)	(0.168)
AGE	-0.044**	0.057***	-0.462***	-0.221***	-0.151**	0.086
	(0.019)	(0.020)	(0.059)	(0.068)	(0.074)	(0.080)
AGE^2	0.001***	-0.001	0.008***	0.006***	0.004***	0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.002)
AGE^3	-0.000**	0.000	-0.000***	-0.000***	-0.000**	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EAST	0.400***	0.352***	1.701***	1.313***	1.823***	1.732***
	(0.030)	(0.035)	(0.135)	(0.140)	(0.121)	(0.145)
HSIZE	-0.109***	-0.027**	-1.238***	-1.029***	-0.446***	-0.265***
	(0.013)	(0.011)	(0.048)	(0.042)	(0.046)	(0.045)
PART	0.319***	0.333***	0.570***	0.803***	1.350***	1.509***
	(0.027)	(0.031)	(0.104)	(0.098)	(0.106)	(0.144)
EDU	0.162***	0.132***	0.590***	0.703***	0.722***	0.657***
	(0.012)	(0.013)	(0.041)	(0.041)	(0.057)	(0.052)
UNEMP	-0.884***	-0.829***	-1.620***	-1.623***	-3.305***	-3.282***
	(0.036)	(0.040)	(0.120)	(0.087)	(0.125)	(0.122)
PEN	-0.227***	-0.283***	-0.158	-0.546***	-1.222***	-1.559***
	(0.033)	(0.037)	(0.141)	(0.126)	(0.130)	(0.153)
Observations	122996	122996	122996	122996	122996	122996

Notes: *, **, and *** denote significance at the 10%, 5%, and 1% significance level. Standard errors are in parentheses.

Figure 2. Savings behaviour by age

Normalised[1] savings rate (percentage points)



1. The savings rate is normalized with respect to the average savings rate across all ages for which observations exist (19 to 95 years) as implied by the coefficients on AGE, AGE^2 and AGE^3.

4.2. Precautionary savings motive

18. To test for the precautionary savings motive, the baseline specification is augmented with a variable that captures households' income uncertainty (*INCVAR*). *INCVAR* is a measure of income variance which is similar to the one used by Lusardi (1998) and Guariglia (2001). In the GSOEP, respondents are asked: *How likely is it that the following career change will take place in your life within the next two years: lose your job*. The possible answers range (in steps of 10) from 0 (*definitely not*) to 100 (*definitely*).[12] Denoting this probability as *UNP* and the income of the respective person as *INC*, a measure of earnings variance can be calculated as, $INCVAR = UNP(1 - UNP)INC^2$. Unemployed and retired individuals are excluded from the sample for this regression. To control for a potential selection bias (which may occur because less risk-averse individuals may select less risky occupations; see Fuchs-Schündeln and Schündeln (2005) and Bartzsch (2006)), the household head's risk aversion (*RISK*) is included into the regression. *RISK* is constructed from the survey question: *Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?* The variable can take on values between 0 (no willingness to take risk) and 10 (high willingness to take risk). Since this question was asked only twice (in 2004 and 2006) the average of both years is used for all years in the sample, 2002-08, assuming that the level of risk aversion is constant for each individual over time. To explore whether the savings response to a rise in the variance of income depends on the risk aversion of the household, a multiplicative interaction term between the two variables *INCVAR* and *RISK* is also included in the specification.

19. The results show that the signs of the remaining baseline variables are unchanged, even though significance levels drop somewhat (Table 3). Overall, we find support for the existence of a precautionary savings motive. Concerning the level of risk aversion, the results tend to support the view that more risk-loving individuals tend to have lower savings rates, even though the coefficient is only significant in one specification. Also, savings rates tend to increase with the variance of income and this result is highly significant. Finally, the interaction term of *RISK* and *INCVAR* is significantly negative, thus indicating that more risk-loving individuals increase their savings rates by less when faced with higher income variance compared to more risk-averse households.

12. Up to the 1998 wave of the GSOEP, the possible answers were *definitely*, *probable*, *improbable* and *definitely not*. These answers are translated into probabilities by setting *definitely* = 100, *probable* = 66.67, *improbable* = 33.33 and *definitely not* = 0.

Table 3. Estimation results – precautionary savings

Specification	(1)	(2)	(3)	(4)
Dep. var.	*FS/PINC*	*S/PINC*	*FS/PINC*	*S/PINC*
PINC	9.430*	5.919	9.168	5.697
	(5.717)	(5.037)	(5.733)	(6.339)
$PINC^2$	-0.386	-0.078	-0.369	-0.063
	(0.379)	(0.335)	(0.381)	(0.414)
AGE	-0.006	-0.143	-0.002	-0.14
	(0.196)	(0.188)	(0.209)	(0.231)
AGE^2	-0.002	0.003	-0.002	0.003
	(0.004)	(0.004)	(0.005)	(0.005)
AGE^3	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000
EAST	1.611***	1.445***	1.606***	1.441***
	(0.209)	(0.250)	(0.189)	(0.180)
HSIZE	-0.928***	-0.741***	-0.930***	-0.742***
	(0.078)	(0.080)	(0.078)	(0.084)
PART	1.509***	1.846***	1.507***	1.844***
	(0.202)	(0.209)	(0.184)	(0.206)
EDU	0.881***	0.826***	0.884***	0.829***
	(0.066)	(0.078)	(0.065)	(0.089)
RISK	-0.093**	-0.05	-0.053	-0.015
	(0.045)	(0.045)	(0.039)	(0.047)
INCVAR	0.075***	0.081***	0.107***	0.109***
	(0.006)	(0.008)	(0.017)	(0.019)
RISKxINCVAR			-0.006**	-0.005*
			(0.003)	(0.003)
Observations	28150	28150	28150	28150

Notes: *, **, and *** denote significance at the 10%, 5%, and 1% significance level. Standard errors are in parentheses.

4.3. Retirement savings motive

20. To test for the existence of a retirement savings motive among German households, we focus on the introduction of the private pension scheme (*Riester Rente*) in 2002. Whether households increase their savings rate in response to being offered a subsidised private pension scheme or whether they simply offset their savings in such schemes with lower private savings elsewhere remains an empirical question and the 2002 reform in Germany presents a natural experiment. To investigate what impact the *Riester* reform had on household savings, we make use of the fact that in the 2004, 2006 and 2007 waves of the questionnaire respondents were asked to indicate whether they have a *Riester* contract: *Did you sign a contract for a Riester pension plan after 31.12.2001?* Two dummy variables are constructed from the answers to this question:

- RIEST1: equal to unity over the whole sample period, 2002-08, if a household has at any time indicated that it has a *Riester* contract;
- REFORM: equal to unity after 2002 for all households.

21. Given the infrequent inclusion of the question in the survey, it is not always clear at what time since 2002 exactly a household signed up for a *Riester* contract. For example, if a household answered in 2004 that it signed up for such a contract, the starting point of the contract could have been in 2002, 2003 or in 2004. Given that the take-up of the *Riester* subsidy was initially very slow and just gained pace later on, especially after the simplification of the scheme in 2005, it seems important to allow for different timing options in our setup (Börsch-Supan *et al.*, 2006). Therefore, we create two additional dummy variables:

- RIEST2: equal to unity after 2002 if a household has at least once indicated that it has a *Riester* contract when the question was asked in 2004, 2006 or 2007; *e.g.* if a household answered in 2006 that it holds a *Riester* contract, it is assumed that it signed up for it right after this option was first available, *i.e.* in 2002;[13]

- RIEST3: equal to unity after a household has indicated for the first time that it has a *Riester* contract; *e.g.* if a household answered in 2006 that he holds a *Riester* contract, the dummy takes the value of 1 in 2006, 2007 and 2008.

22. Results for different specifications adding the various dummies to the baseline specification are presented in Table 4. Specifications (1) and (2) include *REFORM*, *RIEST*1 and their interaction term (*RIEST*2) and are thus tantamount to a difference-in-difference specification. Again, the coefficients on the baseline variables included in the specification remain mostly unchanged by this modification. There is some evidence that the introduction of the *Riester Rente* has increased household savings, although there are marked differences across household types. *First*, those households that at any time signed up for a *Riester* contract tended to be those that generally (*i.e.* over the whole sample period) have a lower savings rate (negative coefficient on the *RIEST*1 dummy).[14] *Second*, the introduction of the scheme in 2002 seems to have increased the overall savings rate, in particular among households which signed up for a *Riester* contract at any point in time (significantly positive coefficient on the *RIEST*2 dummy). The effect of the reform on the savings rate of households who signed up for a *Riester* contract is estimated to amount to around half a percentage point. This finding is in line with other studies on tax-deferred retirement savings vehicles. For example, Poterba *et al.* (1998) present microeconomic evidence supporting the view that the IRA and 401(k) plans in the United States represent largely new savings that would not otherwise have occurred.

23. To what extent the additional savings are due to the subsidy itself or to the intensive public debate about the importance of private retirement savings that was triggered by the reform, can, however, not be finally answered by our analysis. However, the positive coefficient on the *REFORM* dummy in at least one specification provides some indication that this is indeed the case. As stressed by Carroll and Summers (1987), tax-deferred savings vehicles can generate new savings because increased availability and intensive promotion of such vehicles can make consumers more aware of the benefits of saving and reshape their attitudes towards saving for retirement.

13. *RIEST*2 thus equals *RIEST*1**REFORM*.

14. This might be due to the fact that the *Riester Rente* was designed such that lower-income households and households with children (who tend to have lower savings rates) benefited the most from it.

Table 4. Estimation results – retirement savings

Specification	(1)	(2)	(3)	(4)	(5)	(6)
Dep. var.	*FS/PINC*	*S/PINC*	*FS/PINC*	*S/PINC*	*FS/PINC*	*S/PINC*
PINC	10.205***	7.248**	10.098***	7.044**	10.247***	7.307**
	(2.417)	(2.882)	(2.207)	(2.926)	(2.331)	(3.043)
$PINC^2$	-0.377**	-0.109	-0.370**	-0.101	-0.379**	-0.118
	(0.162)	(0.192)	(0.148)	(0.199)	(0.153)	(0.202)
AGE	0.256**	0.133	0.280**	0.163	0.278**	0.159
	(0.109)	(0.137)	(0.138)	(0.105)	(0.117)	(0.148)
AGE^2	-0.006**	-0.001	-0.007**	-0.002	-0.007***	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
AGE^3	0.000***	0.000	0.000**	0.000	0.000***	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
EAST	1.946***	1.835***	1.945***	1.837***	1.944***	1.838***
	(0.138)	(0.136)	(0.136)	(0.109)	(0.130)	(0.168)
HSIZE	-0.609***	-0.407***	-0.609***	-0.410***	-0.615***	-0.415***
	(0.059)	(0.054)	(0.059)	(0.051)	(0.057)	(0.056)
PART	1.635***	1.922***	1.631***	1.913***	1.629***	1.910***
	(0.130)	(0.144)	(0.137)	(0.130)	(0.133)	(0.141)
EDU	0.841***	0.816***	0.842***	0.817***	0.843***	0.817***
	(0.057)	(0.055)	(0.054)	(0.069)	(0.052)	(0.065)
UNEMP	-3.271***	-3.324***	-3.273***	-3.324***	-3.269***	-3.319***
	(0.125)	(0.126)	(0.162)	(0.121)	(0.115)	(0.141)
RIEST1	-0.291*	-0.461**				
	(0.166)	(0.193)				
RIEST2	0.449**	0.536***			0.760***	0.923***
	(0.191)	(0.196)			(0.195)	(0.181)
REFORM	-0.147	0.542***				
	(0.146)	(0.160)				
RIEST3			0.607***	0.904***		
			(0.173)	(0.212)		
LOWINC			0.080	-0.026	0.133	0.041
			(0.136)	(0.164)	(0.121)	(0.171)
RIEST3xLOWINC			-0.989***	-1.348***		
			(0.228)	(0.316)		
RIEST2xLOWINC					-1.109***	-1.446***
					(0.247)	(0.233)
Observations	86909	86909	86909	86909	86909	86909

Note: *, **, and *** denote significance at the 10%, 5%, and 1% significance level. Standard errors are in parentheses.

24. At first sight, this result seems at odds with the study by Corneo *et al.* (2009) who find that the *Riester* subsidy did not increase the household savings rate. One reason for the difference might be the focus of their study on low-income households. To investigate this hypothesis, we interact the *RIEST2* and *RIEST*3 dummies with a dummy variable, called *LOWINC*, which is equal to unity for households with a monthly income of less than EUR 2 000 (this threshold is very close to the one used by Corneo *et al.* (2009), EUR 25 000 per year). The *RIEST* dummies remain significantly positive, while the *LOWINC* coefficient is small and insignificant (most likely because *PINC* is also included in the regression). However, the interaction term between the two is significant and negative, suggesting that low-income households do not save more after signing up for a *Riester* contract but reduce other forms of savings in

exchange for subsidized savings under the *Riester* scheme. The results thus confirm the finding of Corneo *et al.* (2009) that low-income households with a *Riester* contract behave differently from others.

5. Summary and conclusions

25. To conclude, we present evidence that savings rates at the household level in Germany depend on a range of factors. The savings rate tends to increase with rising household income, but at a declining rate. Savings rates also differ by age group and our results broadly replicate the life-cycle theory. Households whose heads are married, have a higher education and are located in the eastern part of Germany tend to have higher savings rates. By contrast, unemployed and pensioners have lower savings rates and savings rates tend to decline with the number of household members.

26. Regarding the role of both the precautionary and the retirement savings motives in households' savings decisions, our results are as follows: *First*, results suggest that households with a more volatile income stream (calculated by adjusting income for the probability of job loss) tend to save more. However, this effect depends on a households' (subjectively assessed) risk aversion with more risk-averse households increasing their savings rate by more compared to less risk-averse households. *Second*, we find that the introduction of the private pension scheme in 2002 (the *Riester Rente*) was associated with a general increase in the household savings rate, both for households that signed up for private pension contracts and for those that did not. This may reflect that the general pension reform, which also included lower benefits in the public pension scheme, initiated an intense public debate about the need for private pension savings to supplement public pensions and thus induced more private savings in general, *i.e.* not only in subsidised private pension schemes. However, this effect is not found for low-income households, confirming the findings of other studies (*e.g.* Corneo *et al.*, 2009).

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Annex: Details on variable construction

Code	Description	Value	Construction/Survey question
AGE	Age of household head	Years	
EAST	Dummy east Germany	1=east Germany sample	
EDU	Education	1 (lowest level of education) – 4 (highest level)	Did you conclude education with a degree, certificate or diploma?
FS	Financial savings	EUR	Do you usually have an amount of money left over at the end of the month that you can save for larger purchases, emergency expenses or to acquire wealth? If yes, how much?
HSIZE	Household size	Number of persons in household	
LOWINC	Low income dummy	Equal to unity for households with a monthly income of less than EUR 2 000	If everything is taken together: How high is the total monthly income of all the household members at present? Please give the net monthly amount, in other words after the deduction of tax and national insurance contributions. Regular payments such as rent subsidy, child benefit, government grants, subsistence allowances, etc., should be included. If not known exactly, please estimate the monthly amount.
PART	Dummy for marital status	1=married; 0=separated, divorced, single, widowed	
PEN	Pensioner	1=pensioner	What is your current occupational status?
RINC	Actual income divided by CPI	EUR	If everything is taken together: How high is the total monthly income of all the household members at present? Please give the net monthly amount, in other words after the deduction of tax and national insurance contributions. Regular payments such as rent subsidy, child benefit, government grants, subsistence allowances, etc., should be included. If not known exactly, please estimate the monthly amount.
PINC	Permanent income	EUR	Following Fuchs-Schündeln and Schündeln (2005), permanent income is constructed by *i)* detrending total non-capital household income by dividing it through the average income of all households in the corresponding survey year, *ii)* calculating the average detrended income for every household over all available observation years and *iii)* multiplying this average detrended household income with the average income of all households within each survey year.
REFORM	Riester reform dummy	Equal to unity after 2002 for all households	Did you sign a contract for a Riester pension plan after 31.12.2001?

Annex: Details on variable construction *(cont.)*

Code	Description	Value	Construction/Survey question
*RIEST*1	Household has Riester pension plan	Equal to unity over whole sample period for households that at any time indicated that they have a Riester contract	Did you sign a contract for a Riester pension plan after 31.12.2001?
*RIEST*2	Household has Riester pension plan	Equal to unity after 2002 for households that at any time indicated that they have a Riester contract	Did you sign a contract for a Riester pension plan after 31.12.2001?
*RIEST*3	Household has Riester pension plan	Equal to unity after a household has indicated for the first time that it has a Riester contract	Did you sign a contract for a Riester pension plan after 31.12.2001?
RISK	Personal willingness to take risk	0 (no willingness to take risk) and 10 (high willingness to take risk); average of years 2004 and 2006 applied over whole sample	Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks?
S	Total savings	EUR	Equals financial savings plus real savings as described in text.
UNEMP	Unemployed		What is your current occupational status?
UNP	Probability of losing job	0 (definitely not) – 100 (definitely) in steps of 10. Up to the 1998 wave of the GSOEP, the possible answers were definitely, probable, improbable and definitely not. These answers are translated into probabilities by setting definitely = 100, probable = 66.67, improbable = 33.33 and definitely not = 0.	How likely is it that the following career change will take place in your life within the next two years: lose your job?

Note: Amounts in deutschmark are converted into euro using the irrevocable exchange rate 1.95883 DM/EUR.

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