The effect of health and employment risks on savings.*

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Preliminary version - not for quotation

Studies on precautionary savings (PS) have shown a variety of results which range from high shares of PS in total wealth to little or no PS at all. The plurality of results is probably caused by the many conceptual choices and problems that accompany this analysis. An important problem is to find a reliable measure of permanent income and future economic risks that corresponds to those perceived by the household at the time the savings decisions are made. In this paper we aim to model two ex-ante risk components, namely health and unemployment risk in a model of precautionary savings. Because employment and health risks are strongly interdependent, this extension can help to extend traditional risk measures. This is the first application using future unemployment as a measure of uncertainty for German data. A further contribution is to explicitly include health as a risk in a model of PS. As many studies before, we do not find any evidence for PS in response to the uncertainty measures of health and employment risks in Germany. This result holds for various specifications of the buffer-stock model and estimation samples.

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1. Introduction

The concept of precautionary savings can be considered a milestone in the theory of consumer behavior. It became important in the context of the life-cycle hypothesis of consumption (Modigliani and Brumberg, 2003). Recent research on the life-cycle model focused on the impact of income uncertainty on savings. The theory predicts that individuals accumulate precautionary wealth to insure themselves against expected future income shocks. The precautionary motive for accumulating wealth is not only an important reason to postpone consumption but it is also consistent with the life-cycle/permanent income model (a recent survey of the life-cycle model can be found in Browning and Crossley (2001)). The magnitude of the reaction of savings to income uncertainty is expected to be higher the more risk averse individuals are. If this holds true for the general economy, the quantitative relevance of the precautionary motive has important implication for government policies that have an impact on income uncertainty (Aiyagari, 1994; Kimball and Mankiw, 1989; Femminis, 2001).

Although the theoretical concept corresponds to common knowledge, empirical estimates of precautionary wealth are exceptionally diverse. Applied studies on the existence and significance of precautionary savings have to deal with a lot of conceptual and methodological problems which might have contributed to the plurality of results (Browning and Lusardi, 1996; Kennickell and Lusardi, 2004). The findings range from high shares of precautionary wealth in total wealth (e.g., Lusardi, 1998; Carroll and Samwick, 1997; Engen and Gruber, 2001) to little or no precautionary wealth at all (e.g., Dynan, 1993; Guiso et al., 1992).

The underlying assumption of the model is that individuals assess their need for precautionary savings conditional on their expectations of future income risks. An important empirical problem is to find a reliable measure of permanent income and future income risks that corresponds to those perceived by the household at the time the savings decisions are made. Although the concept of precautionary savings relates current wealth to future income and future shocks, and is thus related to individual expectations, the standard approach to model income risks in the literature, due to lack of reliable information on these expectations is based on ex-post income developments. The ex-post measure is likely to capture a part of the perceived ex-ante income path and its uncertainty. However, not all of individuals' expectations are realised as future economic shocks, and on the other hand some shocks which take place are not considered at the time of making savings decisions. This measurement error of uncertainty is likely to dampen the estimated effect of true uncertainty on precautionary savings. Only a few

studies have considered ex-ante measures of economic risks. Using the risk of becoming unemployed in the next period they can show that it has an influence on precautionary savings (see, e.g., Lusardi, 1998; Engen and Gruber, 2001; Carroll et al., 2003; Benito, 2006).

Furthermore, the focus on income risk might neglect other important risk factors. Perhaps the prevelance of income risk in the literature relates to the difficulty of specifying and measuring other risks. In this paper we aim to model two ex-ante risk components, namely health and unemployment risk in a model of precautionary savings. As Haan and Myck (2009) show, employment and health risks are strongly interdependent. In this paper we aim to extend the measure of uncertainty by developing an ex-ante measure of unemployment and health risks from their model. This is the first application using future unemployment as a measure of uncertainty for German data. A further contribution is to explicitly include health as a risk in a model of precautionary savings. This is an important factor for several reasons. First of all health plays a major role in determining labour market activity and as a result the financial situation of the individual and the household. Secondly, poor health is a risk about which individuals may have a lot of private information, and it seems straightforward to account for it in the analysis of precautionary savings. Moreover health and employment may be endogenously determined as labour market risks are affected by poor health and vice-versa (e.g. Haan and Myck (2009)) and so accounting for health risks will allow for better identification of labour market related uncertainty.

The paper is organized as follows. The next section provides a brief overview of previous research with a focus on different measures of uncertainty. Then we introduce our approach to model an ex-ante income risk measure. Section 3 presents the buffer-stock model of savings that we estimate. Section 4 gives an overview of the data we use and illustrates how we model the income and health risk according to the model and results in Haan and Myck (2009).Section 5 shows and discusses multivariate results of the estimated models. The final section summarises and gives an outlook on the development of this model.

2. Modelling uncertainty

Precautionary savings can be interpreted as a reaction of individuals to insure themselves against (uninsurable) future uncertainty. The resulting precautionary wealth stock is defined as the difference of total wealth holdings to the wealth stock that would be observed if there was no uncertainty (Kimball, 1990). A large number of studies focuses solely on

income risk in order to model uncertainty. A common approach is to use some stochastic panel data model of net household income and derive variance measures based on this income model (Hubbard et al., 1995; Kazarosian, 1997; Carroll and Samwick, 1998; Fossen and Rostam-Afschar, 2009) or to use the variability of expenditures (Dynan, 1993). Using this proxy it might be difficult to distinguish between transitory income and measurement error (Kennickell and Lusardi, 2004), and individuals may already be insured against the estimated income uncertainty (Browning and Lusardi, 1996; Caballero, 1991). Furthermore, these proxies may contain large adjustable elements that increase the variance of earning but do not reflect uncertainty but choice (Guiso et al., 1992; Carroll et al., 2003).

Some studies proxy uncertainty with the occupational status because certain jobs might imply higher/lower earnings variance or higher/lower unemployment risks (Skinner, 1988; Lusardi, 1997; Fuchs-Schündeln and Schündeln, 2005). Skinner (1988) finds no evidence for precautionary savings using US-data but he notes that self-selection of less risk-averse individuals into risky occupations might bias his estimates. Fuchs-Schündeln and Schündeln (2005) solve this problem by exploiting a natural experiment in which selection into risk-less occupations was exogenous. They use the same data as this study and find that about 20% of all financial savings in East Germany and 12% in West Germany follow a precautionary motive.[1] Another small part of the literature uses subjective measures of uncertainty (e.g., Guiso et al., 1992; Lusardi, 1997; Kennickell and Lusardi, 2004). Often these measure show only a small variance of income which renders identification difficult. These studies report modest values of precautionary wealth which range from 2% to 8% of the chosen savings measure.

A couple of studies use explicitly ex-ante measures of unemployment to model uncertainty. Carroll et al. (2003) for the US and Benito (2006) for the UK use the probability to become unemployed in the next period to proxy uncertainty. The results from Carroll et al. (2003) are mixed. Their results suggest that precautionary savings is income dependent. Low income households do not engage in precautionary savings but they do find evidence for precautionary savings as income rises. However, in the case housing is excluded from the measure of wealth the effect of unemployment risk disappears. It is plausibel that housing equity can be part of precautionary wealth but they do not provide an answer why they do not find any precautionary wealth in the more liquid assets. Benito (2006) uses weekly food consumption as the dependent variable which

[1] The above mentioned diversity of results is reflected in their study. They provide as a robustness check the results from a tobit specification in which zero-wealth observations were included. From this specification they do not find any precautionary wealth in West Germany and even 68% in East Germany.

might influence the comparability of his model with other cited studies. He models uncertainty with an estimated and a subjective measure of future unemployment probability. His results show that a one standard deviation increase in unemployment risk lowers weekly food consumption by 2.7%. And he shows that this effect is stroger for younger households. He interprets this result as evidence for a precautionary savings motive.

For Germany, only a few studies analysed the precautionary savings model and none of these used unemployment probabilities or health risks as a proxy for future uncertainty. Bartzsch (2006, 2008) using SOEP data from 2002 estimates a buffer-stock savings model and uses different measures of income variance to proxy uncertainty. He finds that 20% of net financial wealth traces back to the precautionary motive. His results suggest that housing equity is not used as a buffer against income shocks. As mentioned above, Fuchs-Schündeln and Schündeln (2005) proxy uncertainty with occupation and find evidence for precautionary savings particularly in East Germany. Using the same data for the years 2002 and 2007, the very recent study by Fossen and Rostam-Afschar (2009) does not find any evidence for precautionary savings. They explicitly account for heterogeneity between entrepreneurial and non-entrepreneurial households and show that the higher savings rate of self-employed can not be attributed to the precautionary savings motive. They argue that the effect of precautionary savings vanishes once net worth is used as a measure of wealth and that the significant effect on liquid assets could rather reflect portfolio decisions.

This section should briefly demonstrate the diversity of measures of economic uncertainty and show how heterogeneous the corresponding outcomes of these studies are. In this paper we contribute to the evolving literature by developing an ex-ante measure of economic risks that combines two interdependent labour market risks: future health and unemployment status. The following analysis draws heavily on the joint risks model estimated in Haan and Myck (2009) and aims to integrate ex-ante measures of risk probabilities in a precautionary savings model.[2]

2.1. Expected health and labour market risks as proxies for ex-ante income path

Haan and Myck (2009) estimate a dynamic joint model of health and labour market risks using the SOEP data 1996-2007. The model shows an important role of health

[2]Note that knowing the variance of incomes in various labour market and health states, the probabilities can also be used to generate ex-ante income variances and provide for evaluation of precautionary savings on a full set of ex-ante uncertainty measures.

in determining labour market outcomes and of employment in determining health. The estimation models the initial conditions, accounts for endogeneity of health and labour market risks, and controls observable characteristics and unobserved heterogeneity. The model allows us to compute expected measures of these risks several periods ahead from a certain point in time making them conditional on observed constant and time-variant characteristics. An example of such an exercise, taken from Haan and Myck (2009) is presented in Figure 2, where the rate of employment is given for a permanently healthy individuals and someone differing only in respect of health with onset of poor health at the age of 40. We can see how significant the effect of poor health may be on the probability of employment, in particular at age above 50.

Using the estimations from Haan and Myck (2009) (Specification 2) we compute the following expressions:

$$P(h=1,u=1|c^h,c^u)=\sigma_{11}=\frac{\exp(X_1\beta_1)}{1+\exp(X_1\beta_1)}\times\frac{\exp(X_2\beta_2)}{1+\exp(X_2\beta_2)} \tag{1}$$

$$P(h=1,u=0|c^h,c^u)=\sigma_{10}=\frac{\exp(X_1\beta_1)}{1+\exp(X_1\beta_1)}\times\frac{1}{1+\exp(X_2\beta_2)} \tag{2}$$

$$P(h=0,u=1|c^h,c^u)=\sigma_{01}=\frac{1}{1+\exp(X_1\beta_1)}\times\frac{\exp(X_2\beta_2)}{1+\exp(X_2\beta_2)} \tag{3}$$

$$P(h=0,u=0|c^h,c^u)=\sigma_{00}=\frac{1}{1+\exp(X_1\beta_1)}\times\frac{1}{1+\exp(X_2\beta_2)} \tag{4}$$

where X_1 and X_2 are the regressors in the health and labour market risk models respectively and they include lagged values of non-employment and poor health dummies. c^h and c^u are the mass points representing unobservable heterogeneity. At the moment the model assumes unobserved heterogeneity to be zero but at a later stage it will be used in the savings model. Using expected values for both probabilities one can then "simulate" expected health probabilities from a chosen base year into the future.

These expressions are then used to model economic uncertainty. There are several advantages related to the use of these measures. First of all they encompass a significant pool of information for each individual, since the models control for a number of observable characteristics including initial conditions. The measures generated as a result incorporate the information related to both health and employment and account for the correlation between these two. Nonlinearity of the relationships provides for further identification when the expected values are incorporated as additional variables in savings equations.

3. Modeling savings

We follow the literature and model precautionary savings in a buffer-stock model (see, e.g, Deaton, 1991; Carroll et al., 1992; Carroll and Samwick, 1998). The model is centered around a target wealth-to-income ratio $\frac{W}{P}$. In a steady state, when the target is reached, income uncertainty should have no effect on the savings rate (Carroll and Samwick, 1997). If wealth exceeds the target or is "too" low it depends positively on the uncertainty measures σ_j, in the former case it is expected to fall (dissaving) and in the latter case to increase (saving). We calculate four uncertainty measures, thus j refers to $\{11, 01, 10, 00\}$ as it is explained in section 2.1. Furthermore, the target ratio may depend on household characteristics x and unobserved factors ϵ:

$$\frac{W}{P} = f(\sigma, x, \epsilon) \tag{5}$$

We follow Carroll and Samwick (1998) who shows that the buffer-stock model predicts a roughly linear relationship between the log of target wealth and measures of future income uncertainty:

$$ln(W_{it}) = \alpha + \theta_j' \sigma_{jit} + \lambda ln(P_{it}) + \beta' x_{it} + \epsilon_{it} \tag{6}$$

Identification of the relationship in equation 6 strongly relates to the chosen measure of wealth and definition of the permanent income and uncertainty. In particular, the chosen uncertainty measure should exhibit enough variation. We estimate this equation at the household level as it is standard in the literature and use two different measures of wealth.

The first measure is net worth and includes all wealth components except for business assets, the second measure is a subset of the former and consists of net financial assets. In particular, liquid assets do not include housing equity. The common argument in the literature is that illiquid assets cannot serve as a short term insurance against income shocks. However, it is not obvious what an illiquid asset is. For example, a house might serve as a security to take out a short-term loan. If there is a precautionary savings motive that does not only reflect a portfolio decision we expect the effect of the unemployment probability to be higher for liquid assets but still significant for net worth.

Our approach is restrictive in the sense that we assume that these risks enter the savings model additively. For identification we have to drop one of the unemployment probabilities σ_j because they sum up to one. We choose σ_{00} to be the base category, i.e.,

the probability of not being in bad health and not being unemployed. The three other variables should show positive coefficients if there is a precautionary savings motive. Excluding σ_{00} implies that its coefficient equals $-\theta_{11}$ if we switched the base category to 11.

We use the permanent income measure proposed by Fuchs-Schündeln and Schündeln (2005). In a given year, net household income is detrended by dividing it through the average household income. In a second step, the average detrended net household income is calculated. The product of average annual net household income and the detrended average net household income results in our measure of permanent income.[3]

Both, the measures of uncertainty and permanent income are likely to include large measurement errors. Therefore we use a set of instruments that consists of qualification of the household head, firm and occupational characteristics.

4. Data and variables

Our analysis is based on data from the German Socio-Economic Panel Study (SOEP). SOEP is an annual household survey that started in 1984 and currently has a sample of about 12,000 households and 22,000 individuals. We use the data for years 1996-2007, and utilise the same sample as Haan and Myck (2009). Due to the nature of their model, the latest wave for which they estimate the model is 2006.

The SOEP data contains detailed information on a large number of German households, including details on income and employment status and several health indicators.[4] The analysis focuses on a sample of prime age men (30-59) in east and west Germany. Civil servants and women are excluded from their analysis since the risks model has only been developed for the male sample. In contrast to Haan and Myck (2009) we also exclude individuals (and the corresponding households) who are not the head or the spouse of the head of a household. The sample is then combined with the 2002 SOEP wealth survey which contains detailed information on household's financial and non-financial assets. This provides us with information for the estimation of the savings model.[5]

Table 1 shows descriptive statistics of the corresponding sample for the year 2002.

[3] As a robustness check we calculated a different measure of permanent income as in Bartzsch (2008). The results do not change significantly.

[4] See, e.g., Wagner et al. (2007) for more information on SOEP.

[5] Currently we do not use the data from the 2007 wealth module because the future health and employment states have yet to be simulated. These additional data could add more variation and improve identification.

The main model is estimated in logs, therefore the statistics refer to households with positive wealth holdings (here: net worth)[6]. We estimate a model for all observation and one for the subsample of those who were employed and healthy in the base year 2002. The restricted sample should show stronger reaction to economic uncertainty. The full sample consists of 2405 observations and the restricted sample of 2023 households.

The permanent income measure is based on annual net household income which includes, in addition to regular monthly income, components that are paid only once or irregularly in a year, like bonuses or vacation pay. Since our sample consists of prime age males and their households with positive wealth holdings, the average permanent income is relatively high and amounts to 46,540 (48,095) Euros per year in 2002. Average liquid assets do not include housing equity and are therefore lower than total net worth. Often, the largest asset in houshold portfolios is housing equity which is reflected in the higher mean values of net worth in table 1. The next section provides more details on the wealth variables.

The risk measures σ_j^{t+1} refer to the year 2003 for which we run the regressions. The average probabilitiy to be unemployed and unhealthy in 2003 (j=$\{11\}$) is 2.55% in the general sample. Conditional on employment and good health in 2002, the mean probability for j=$\{11\}$ decreases strongly (0.7%). We also observe a decreas in the probability to be unemployed in the next period for the restricted sample. This could reflect state dependence in the unemployment status. A smaller difference is found for bad health. The probability to be healthy and employed in the next period is about 80% in the general sample and increases to 86% in the restricted sample. Table 7 in the Appendix shows that if we do not condition on positive assets, we observe a higher probability to be unemployed in the next period and a lower value for σ_{00}^{t+1}.

In addition to the core variables we include several demographic and household characteristics.

The uncertainty measure has to show sufficient variability to identify any economic risk that might give rise to precautionary savings. As figure 4 shows, even between two years, there is considerable variation in the expected probabilities. Of course, each scatter plot shows a large part of the distribution centered around the 45 degree line. This show that the processes follow on average a certain path. However, we find considerable deviations from that path. The least variability is found for the change in the probability of being both unemployed and in bad health.

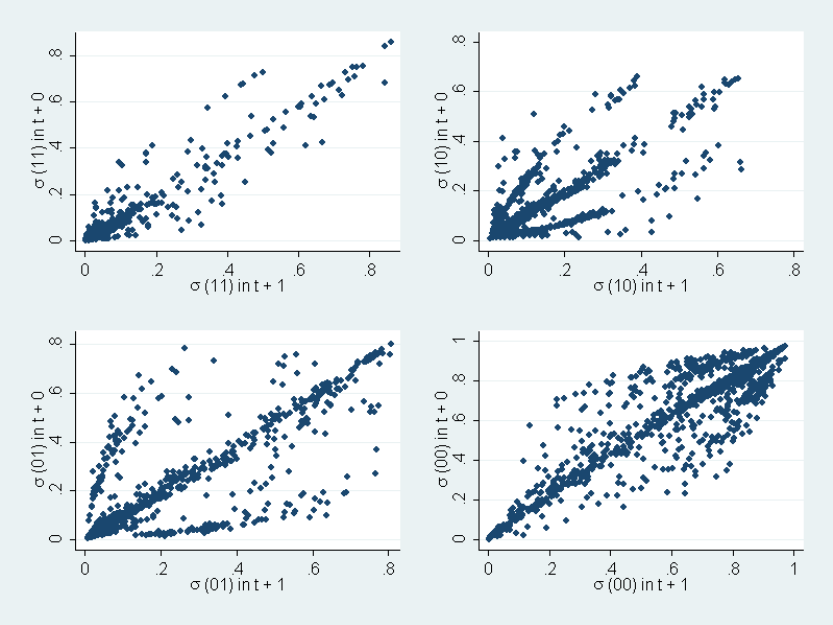
A further check relates to subjective indicators in the SOEP data the reflect job

[6]Since net worth includes more wealth components than liquid assets, we observe slightly more households with positive observations than in the sample for liquid assets.

Table 1: Descriptive statistics: Regression samples with positive net worth

	All	Healthy/employed
Y^p	46539.8	48094.8
Net liquid assets	55847.7	58088.6
Net worth	198501.1	202137.4
σ_{11}^{t+1}	2.55	0.68
σ_{01}^{t+1}	8.73	5.73
σ_{10}^{t+1}	8.96	7.63
σ_{00}^{t+1}	79.8	86.0
Home ownership	0.60	0.60
Age	43.6	42.9
Low education	0.29	0.26
Middle education	0.35	0.35
Higher education	0.37	0.39
Children, age 0-10	0.46	0.50
Children, age 11-18	0.68	0.66
Number of adults	1.94	1.95
Lived in GDR	0.25	0.24
Married	0.82	0.82
Single	0.13	0.13
Divorced	0.051	0.044
Widowed	0.0033	0.0025
Observations	2405	2023

Figure 1: Variation of expected risk measures between t+0 and t+1



insecurity. In 2001, 2003, and 2005 SOEP respondents were asked how likely it would be that they loose their jobs in the next two years. The answer was given in percent categories. We run a simple regression of this variable and include age, a dummy for East Germany, and year dummies in the model. Table 2 shows the results.

σ_{11} shows only an effect for $t+1$ and is not significant after that. The point estimate decreases in time. The probability to be employed and in bad health increases subjective job insecurity until t+3. The probability to be unemployed and healthy has the longest lasting effect. A coefficient of 53.12 means that an increase of one percentage point in (estimated) probability of unemployment (conditional on being healthy) increases subjective job insecurity by 0.5 percentage points. As mentioned above, the probabilities include measurement errors and these coefficient are likely to be underestimated. More importantly, they show that the estimated probabilities relate to individual expectations.[7]

[7]We did a similar excercise using job worries as the dependent variable. The resulting model confirmed our hypothesis that the uncertainty measure captures subjective expectations about economic risks.

Table 2: Subjective probability to loose the job within 2 years

	(1) E(t+1)	(2) E(t+2)	(3) E(t+3)	(4) E(t+4)
σ_{11}	34.99*	23.30	15.84	11.52
	(13.93)	(12.93)	(13.47)	(9.770)
σ_{10}	17.66***	15.61**	26.24***	13.05
	(4.455)	(4.839)	(5.402)	(6.862)
σ_{01}	53.12***	40.83***	37.23***	32.37***
	(5.172)	(5.393)	(5.583)	(7.440)
Observations	4178	2779	2453	1147
R^2	0.080	0.073	0.071	0.059

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.1. Savings and wealth data in SOEP 2002

SOEP included a set of detailed questions on private wealth holdings in the years 2002 and 2007. The following analysis focuses on the wave 2002 because unemployment probabilities are simulated only on the basis of the sample in Haan and Myck (2009).[8] Frick et al. (2007) provides an overview of the wealth data for 2002. The module conists of questions on seven components of wealth. These include information on owner-occupied housing (including mortgage debt), other property (including mortgage debt), financial assets, business assets, tangible assets, private pensions (including life insurance) and consumer credits.[9] The wealth information was collected on the level of the individual. For the subsequent analysis, the wealth components were aggregated to the household level. As explained in section 3 we create two measures of wealth that are commonly used in the literature. The first measure, net worth, consists of all wealth components mentioned above except for business assets. The second measure is a subset of net worth and refers to liquid assets. Here we include the information on financial assets, tangible assets, private pensions and consumer credits.

Table 3 provides some details on the wealth holdings in the general sample. The comparison between the mean, median and 95^{th} percentile of both wealth measures shows that their distribution is highly skewed, although we condition on positive wealth holdings.

For the precautionary savings motive it is interesting to compare wealth holdings with data on income. The median ratio of net liquid assets to permanent income is 0.71. That means that the median household possesses roughly 71% of its permanent annual income in net liquid assets. This relation increases markedly when housing equiy is included. The low median ratio of liquid assets to permanent income corresponds to the relatively high share of 10% of households which hold liquid assets of less than 1 month's income. Again, this number drops to 2% when housing equity is included.

It is important to note that - as the last row in the table shows - a considerable share of households does not report to hold positive net liquid assets (20%) or positive net worth (15%).[10] We follow the common approach in the literature and use log wealth as dependent variable and exclude these households from the analysis which might influence the estimated coefficients. In a second step, we include zero-wealth observations and test

[8] In order to improve our model we will need to reestimate the model with newer data and include the wave of 2007.

[9] The data lack information on pension entitlements for workers (statutory pension insurance and company pension plans) and civil servants.

[10] Only a negligible fraction of these households holds business assets.

the robustness of our results.

Table 3: Wealth - summary statistics (2002)

	Net liquid assets	Net worth
Mean	55848	198501
Median	29510	120000
95^th percentile	209000	615075
Median ratio of assets to permanent income	0.71	2.79
% with assets of less than 1 month's income	0.10	0.02
% with zero or negative wealth	0.20	0.15

All statistics except for the last row refer to the sample with positive wealth.

4.2. Descriptive evidence on precautionary savings in SOEP

SOEP provides some information on the subjective assessment of the financial security in case of sickness or unemployment and on the capacity to save for such emergencies. Studies that do not find evidence for precautionary savings often interpret this result as reflecting particular features of the welfare system. Particularly for the large German social security system this is an attractive conclusion. However, a non negligible share of the sample at hand assesses his financial security in the face of certain risks as insufficient as table shows. SOEP asks respondents the following question:

> The social security system in the FRG is split into several branches: Health care, unemployment insurance, and pension insurance. The social security and its corresponding private businesses are there to provide for emergencies and old age. How financially secure are you in the following situations? When sick; When unemployed; In old age; When needing nursing care.

The possible answers range from very good to bad on a five point scale.

5. Multivariate analysis of precautionary savings

Table 5 shows the results from estimating equation (6) by GMM using two different definitions of wealth. The first two columns shows the estimated coefficients using the logarithm of net liquid assets as dependet variable, the results in third and fourth column refer to the logarithm of total net worth. We report Hansen's J statistic at the bottom of the table to test for the validity of instruments. No specification is rejected by this test on a conventional significance level.

Table 4: Self assessed financial security, potential risks and wealth (2007)

	Share	$FW > 0$	$FW = 0$	$FW < 0$	Median
	Financial security when sick.				
Very good	0.06	0.84	0.07	0.09	58898
Good	0.38	0.80	0.12	0.07	36829
Satisfactory	0.38	0.75	0.15	0.10	28533
Poor	0.12	0.66	0.21	0.13	22720
Bad	0.06	0.57	0.24	0.19	20000
	Financial security when unemployed.				
Very good	0.02	0.82	0.07	0.11	66955
Good	0.12	0.79	0.12	0.09	42500
Satisfactory	0.29	0.74	0.15	0.11	31955
Poor	0.31	0.74	0.13	0.13	28186
Bad	0.26	0.68	0.15	0.16	25718

Based on SOEP 2007. Unweighted means.

The main variables of interest are our proposed measures of uncertainty σ_j. As explained, we estimate all equations with a general sample "All" and a restricted sample "Healthy/employed". We do not find any significant effect of future unemployemt and health risks in any model. Regardless of the chosen wealth measure or sample.[11]

However, the models show large and stable effects for other variables. Interestingly, the studies by Fuchs-Schündeln and Schündeln (2005) and Bartzsch (2008) show very similar estimates of many coefficients. For example, they estimated coefficients very similar in magnitude of permanent income. A common finding is also, that the dummy for single households has a significant positive impact. The presence of children is correlated with less wealth. The dummy for East Germany gets significant when the dependent variable includes houseing equity.

So far we dropped zero or negative wealth observations from the analysis. However, if these observation are non-randomly zero or negative it might bias our results. We choose a simple IV-Tobit model in levels to test the uncertainty measures including the additional observations. [12] Table 6 shows the estimated coefficients. The last row

[11] This result does not depend on the self-employed. When we excluded them from the sample, the results were basically unchanged.

[12] Note that it is not trivial to find a model that accounts for positive, negative and zero-wealth observations. A common approach in the literature is to add a positive constant to the wealth measure and to use the log-transformation (e.g. Fuchs-Schündeln and Schündeln, 2005; Fossen and Rostam-Afschar, 2009). But the choice of this constant is completely arbitrary and might have a strong impact on the estimated effects. For a different approach see Carroll et al. (2003).

Table 5: IV-GMM Regressions: Differen definitions of wealth

	All	Healthy/employed	All	Healthy/employed
Y^p	1.942***	1.967***	1.578***	1.575***
	(0.190)	(0.164)	(0.166)	(0.157)
σ_{11}^{t+1}	−0.014	0.035	−0.036	−0.140
	(0.035)	(0.232)	(0.032)	(0.235)
σ_{10}^{t+1}	0.023	0.029	0.025	0.035
	(0.018)	(0.027)	(0.016)	(0.027)
σ_{01}^{t+1}	0.007	−0.005	0.019	0.031
	(0.021)	(0.036)	(0.019)	(0.038)
Age	0.033	0.083	0.216	0.206
	(0.305)	(0.353)	(0.281)	(0.330)
$\text{Age}^2/100$	−0.028	−0.163	−0.410	−0.384
	(0.724)	(0.862)	(0.664)	(0.800)
$\text{Age}^3/100$	0.000	0.001	0.003	0.003
	(0.006)	(0.007)	(0.005)	(0.006)
Home ownership	0.223***	0.193**	1.798***	1.780***
	(0.060)	(0.059)	(0.059)	(0.055)
Children, age 0-10	−0.082	−0.081	−0.032	−0.029
	(0.043)	(0.046)	(0.036)	(0.040)
Children, age 11-18	−0.195***	−0.179***	−0.155***	−0.121***
	(0.030)	(0.034)	(0.026)	(0.028)
Number of adults	−0.169*	−0.149	−0.069	−0.003
	(0.076)	(0.080)	(0.072)	(0.072)
Lived in GDR	−0.131	−0.038	−0.232**	−0.194*
	(0.090)	(0.102)	(0.087)	(0.092)
Single	0.347***	0.403***	0.361***	0.429***
	(0.101)	(0.111)	(0.095)	(0.108)
Divorced	−0.023	−0.026	0.108	0.179
	(0.144)	(0.159)	(0.137)	(0.149)
Widowed	0.353	−0.271	0.446	0.591
	(0.468)	(0.406)	(0.253)	(0.338)
Constant	−11.309*	−12.199*	−10.458*	−10.479*
	(4.782)	(5.105)	(4.470)	(4.892)
Observations	2252	1913	2405	2023
p-value: Hansen J statistic	.69	.62	.66	.49

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

reports the results from a wald test on the exogneity of the instruments set. As for the models in logs, no set of instrumentst or specification is rejected. Again we do not find any significant effect of the uncertainty measures. Looking at significance and signs, the results do not differ strongly from the log-models.

Table 6: IV-Tobit Regressions: Differen definitions of wealth

	All	Healthy/employed	All	Healthy/employed
Y^p	11.723***	11.449***	30.322***	28.280***
	(1.243)	(1.197)	(4.303)	(3.952)
σ_{11}^{t+1}	0.060	0.401	0.239	2.574
	(0.139)	(0.554)	(0.481)	(1.831)
σ_{10}^{t+1}	0.080	0.198	0.371	0.495
	(0.118)	(0.147)	(0.408)	(0.486)
σ_{01}^{t+1}	−0.026	−0.152	−0.058	−0.463
	(0.078)	(0.103)	(0.270)	(0.341)
Age	−0.648*	−1.061**	−2.466*	−2.407*
	(0.301)	(0.356)	(1.042)	(1.175)
$\text{Age}^2/100$	0.907**	1.398***	3.226**	3.167*
	(0.321)	(0.406)	(1.112)	(1.337)
Home ownership	1.809***	1.476***	23.583***	21.966***
	(0.389)	(0.408)	(1.347)	(1.347)
Children, age 0-10	−0.163	−0.151	0.382	0.449
	(0.287)	(0.295)	(0.996)	(0.973)
Children, age 11-18	−0.876***	−0.842***	−1.082	−1.011
	(0.222)	(0.245)	(0.770)	(0.808)
Number of adults	−1.289*	−0.697	−3.282	−1.165
	(0.521)	(0.521)	(1.810)	(1.722)
Lived in GDR	−0.772	−0.276	−4.299*	−4.098*
	(0.591)	(0.550)	(2.042)	(1.812)
Single	2.702***	2.922***	7.671***	8.432***
	(0.665)	(0.716)	(2.316)	(2.372)
Divorced	0.087	0.617	1.514	2.131
	(0.785)	(0.879)	(2.709)	(2.913)
Widowed	1.862	−2.624	4.478	5.444
	(2.660)	(3.294)	(9.344)	(10.830)
Constant	−108.647***	−98.570***	−272.347***	−254.532***
	(12.880)	(13.469)	(44.620)	(44.404)
Observations	2819	2281	2819	2281
Uncensored	2254	1917	2407	2027
p-value: wald test of exogeneity	.84	.37	.23	.24

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

5.1. Discussion

We do not find any evidence for precautionary savings in response to the uncertainty measures of health and employment risks. This result holds for various specifications of the buffer-stock model and estimation samples. This finding is not unusual in the research on precautionary savings. As mentioned before, Fossen and Rostam-Afschar (2009) could not find any effect of income risk on wealth using the same data for Ger-

many. However, it would be too easy to reject the precautionary motive given that we face so many empirical problems to estimate this model. One explanation why we do not find precautionary savings relates to the welfare system. As Engen and Gruber (2001) show, the precautionary motive is stronger the less generous the unemployment insurance is. In the period we analysed, Germany had a very generous unemployment insurance and that could have contributed to our findings. For future research, it would be interesting to compare these results with the data of 2007 because the unemployment insurance was heavily reformed in 2005. For most individuals, the new unemployment insurance is less generous than the previous system. The same argument can be made for the health insurance. Due to the universal health coverage in Germany individuals could perceive the probability of health problems as already insured risks.

On the other hand, several methodological problems could have caused our findings. For example, the year-to-year variation in probabilities may not be large enough to identify precautionary wealth in the buffer-stock model. One factor that could have contributed to small variation is that we assumed individual heterogeneity in the model by Haan and Myck (2009) to be zero. Furthermore, the way these probabilities enter the buffer-stock model could be problematic. As we argued, individuals develop ex-ante expectations about future economic risks to assess the need for precautionary savings. But how do they operationalize this measure? With our model, we suggested four probabiities that enter the model additively. But it is also plausible that individuals aggregate these probabilities in a certain form. Of course, aggregation in this model makes only sense when we a weighting mechanism exists that generates variation across possible labour market states. Thus, it would be interesting to extend the model by a measure of income that is associated with each probability. Benito (2006) tested a raw measure of ex-ante income variance in his model of unemployment expectations. He calculates the income variance as $p(1-p)(1-RR)Y^2$ where p represents the probability to become unemployed, RR the corresponding replacement ratio, and Y the current labor income. But in lack of a simulated future income, he assumes the replacement ratio to equal zero. That could be the reason why he does not find a significant effect. In our case, the variance measure would follow a similar logic but we would need "replacement ratios" that vary across the four labor market states.

6. Summary and outlook on further research

The theory of precautionary savings predicts that individuals accumulate precautionary wealth to insure themselves against expected (uninsured) future income shocks. Empir-

ical evidence on precautionary savings might be important for government policies that have an impact on income uncertainty. The concept has a string theoretic foundation but the empirical results show an exceptionally rich diversity ranging from zero precautionary savings to more than half of all wealth. The few studies for Germany are no exception and show very different results.

A potential reason for the observed divergent findings are the methodological problems associated with the precautionary savings model. We suggested that the prevelance of ex-post measures of economic risks and the focus on income uncertainty in particular is liekly to neglect important aspects of the precautionary motive. As an alternative we modeled two ex-ante risk components, namely health and unemployment risk in a model of precautionary savings. The main innovations of this study are therefore the use of future unemployment as a measure of uncertainty for German data and to include health as a risk in a model of precautionary savings. Health does not only influence labour market activity and the financial situation of the individual/household, it is also a risk about which individuals have a lot of private information.

We estimate a buffer-stock model of savings and test various specifications unsing either liquid assets or net worth as the dependent variable. No specification shows evidence for an influence of our proposed measures of uncertainty. We discuss potential reasosns. It could be either the case that the social security system provides enough insurance against these labour market risks (from the point of view of the household) or that our chosen measure of uncertainty is only a poor proxy of the associated economic risks. To improve the model we suggest several potential extensions. The most important would be to connect the estimated labour market risks with information on income. That could provide an ex-ante measure of income uncertainty that traces back to unemployment and health related labour market risks.

7. Literature

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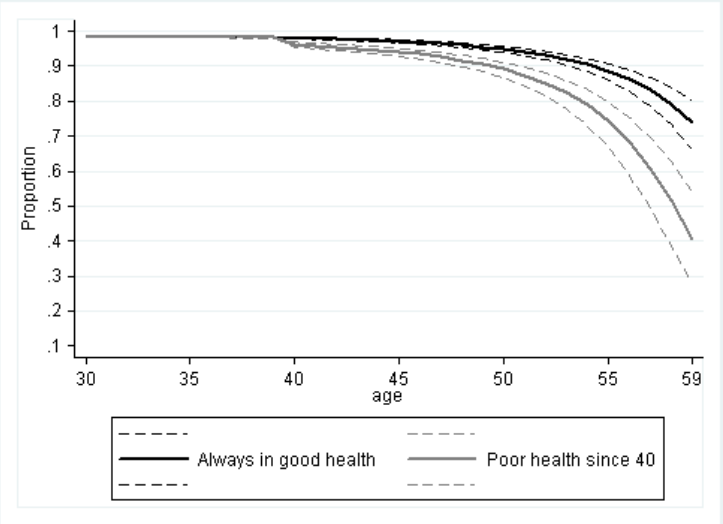
A. Tables and figures

Table 7: Descriptive statistics: Regression sample with positive liquid assets and with zero or negative net worth

	Positive liquid assets	Zero or negative net worth
Y^p	46878.5	43966.0
Net liquid assets	60731.6	44690.2
Net worth	199039.3	167092.5
σ^{t+1}_11	2.44	3.10
σ^{t+1}_01	8.48	10.2
σ^{t+1}_10	8.95	8.98
σ^{t+1}_00	80.1	77.7
Home ownership	0.57	0.52
Age	43.6	43.2
Low education	0.28	0.31
Middle education	0.35	0.34
Higher education	0.38	0.35
Children, age 0-10	0.46	0.46
Children, age 11-18	0.67	0.66
Number of adults	1.94	1.92
Lived in GDR	0.24	0.26
Married	0.81	0.80
Single	0.13	0.14
Divorced	0.049	0.060
Widowed	0.0036	0.0039
Observations	2252	2829

Figure 2: Employment simulations conditional and onset of (permanent) poor health at the age of 40



*Source:*Haan and Myck (2009), Figure 3B.

Notes: Dashed lines represent the respective 95% confidence intervals.