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Subjective Uncertainty and Precautionary Savings*

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Abstract

This paper estimates the effect of income uncertainty on assets held in accounts and cash, and finds substantial empirical evidence for precautionary savings. Using household-level panel data, it explicitly distinguishes between 'real' income uncertainty the household is actually exposed to, and 'perceived' income uncertainty. It finds that the latter substantially increases precautionary savings above and beyond the effect of 'real' income uncertainty. The effect of subjective economic uncertainty on behaviour has only begun to show up after the Great Recession. The economic crisis appears to have shifted households' willingness to forgo current consumption for insurance purposes. Our results imply that households save above their optimal level especially after and during a crisis, potentially exacerbating the economic downturn.

JEL classification: D84, D14

Keywords: Subjective uncertainty, precautionary savings, HILDA, CASiE

1. Introduction

After the Great Recession started in 2008, many industrialised countries have seen a steep increase in private household savings. Within Europe, the Baltic states, Ireland and Spain were among those hit the hardest, and they all saw massive increases in net household savings relative to disposable income (OECD, 2015): private savings increased from -2.1% in 2007 to 9.8% in 2009 in Ireland, and from -1.0% in 2007 to 7.9% in 2009 in Spain. The Baltic States saw even more extreme changes in the savings rate, starting from even more negative savings in 2007. In comparison, private savings in the UK and the U.S. increased somewhat less dramatically, but still very substantially. Increased savings, and in turn decreased consumption, can only exacerbate the original downturn. This paper analyzes how determinants of household savings behaviour changed before, during and after the Great Recession.

One possible explanation for increased private savings is that they are a response to income uncertainty. Households set some of their income aside in order to reach a target level of wealth, a 'buffer' that insures them against income shocks (Carroll et al. 1992, Kazarosian 1997, Lusardi 1997, Carroll and Samwick 1998, Ventura and Eisenhauer 2006, Mastrogiacomo and Alessi 2014). Experiencing such a shock will cause them to draw down on that wealth, creating the need to refill the buffer again. Precautionary savings can thus serve as an explanation for increased household savings during recessions. Mody et al. (2012) have analysed aggregate savings data across OECD countries, and find that the Great Recession has indeed materially increased household savings through the channel of income uncertainty. Carroll et al. (2012) come to the same conclusion using household level data from the U.S.

In addition to that, this paper considers two further contributing factors. For households to accumulate their optimal precautionary wealth, i) they must evaluate their income uncertainty correctly, and ii) they must be willing to respond optimally. Households may have saved more after the Great Recession not only in response to the income uncertainty they were objectively exposed to, but also in response to their *subjectively perceived* income uncertainty. And furthermore, the Great Recession might have caused not only a response to uncertainty; it also could have increased the *responsiveness* to such

uncertainty. Behavioural economics has introduced the idea that individuals tend to over-consume liquid assets, deviating from the consumption path they consider themselves optimal (Laibson 1997).[1] After a long period of economic stability, households might become complacent, less willing to exercise self-restraint, and thus more willing to deviate from what they believe to be optimal. All combined, an economic shock could change real uncertainty, perceived uncertainty, and the willingness to respond to any uncertainty.

This paper analyses households' savings responses to perceived income uncertainty using Australian longitudinal household level data from 2002-2014. It makes two main contributions to the current literature. First, this is the first paper that controls household responsiveness to both 'real' and 'perceived' uncertainty and compares their strength. Second, for the first time we examine whether households have become more sensitive to uncertainty after the Great Recession. These questions are important from a policy perspective. In a nutshell, households are likely to save "too much, too late"' if they a) respond to perceived uncertainty above and beyond the real uncertainty they experience, and b) show increased responsiveness during a recession. Both effects combined provide a strong rationale for counter-cyclical fiscal policy or public insurance systems.

Even if households respond to objective uncertainty only and the strength of their response does not change over time, there is a risk of precautionary 'over-saving' during recessions. Carroll et al. (2012) argue that households with low levels of wealth (caused by a recent economic shock that depleted their precautionary assets) need to temporarily increase their savings rate above their long-term savings rate, in order to reach their permanent target wealth reasonably quickly. This 'over-shooting' in savings rates dampens consumption further at a time when economic activity is already slow. Obviously, additional savings that result from mere *perceived* uncertainty add to that problem. Fiscal policy may be needed in order to off-set the drop in consumption that results from such 'panic'-savings. Alternatively, the same effect could be achieved by public insurance systems, since more generous unemployment

[1] Benhabib and Bisin (2005) developed a neuroeconomic life-cycle model based on the assumption that a consumer can decide to override their automatic consumption choices with a cognitively controlled choice. This is related to the concept of 'mastery' or 'locus of control' (that is the belief that oneself can affect one's future economic outcomes) which has been shown empirically to affect wealth accumulation (Cobb-Clark et al. 2013). Exercising such self-restraint, however, is costly.

insurance schemes reduce precautionary household savings (Engen and Gruber 2001).[2] The issue of 'over-shooting' in savings behaviour increases further if households' responsiveness to uncertainty increases during a crisis. In addition, if people start to increase their savings only after a crisis has hit, this is obviously too late in order to effectively insure themselves. Policy intervention may thus be needed to counteract households saving "too much, too late".

Our estimation approach relies on a subjective measure of economic uncertainty while controlling for objective future and past income variation. Many previous analyses have relied either on objective measures of income uncertainty, typically using longitudinal data to derive income uncertainty from variation in income over time (for example, Kazarosian 1997 and Carroll and Samwick 1998), others on subjective measures, typically derived from direct survey questions (for example, Guiso et al. 1992, Lusardi 1998, Lusardi 1997, Mastrogiacomo and Alessi 2014). Our study combines both: we are explicitly interested in finding out whether the shock of the Great Recession has changed peoples' savings behaviour because of their *perceptions* of uncertainty, above and beyond their *actual exposure* to income shocks. Two other advantages of our estimation approach are that first, in contrast to many other studies that analyse wealth *levels*, the use of panel data allows us to assess the effect of perceived income uncertainty on wealth *accumulation* over time. The change in wealth from one point in time to the next gives a clearer indication of the behavioural choices that drive wealth accumulation than the level of wealth at one point in time can provide.[3] And second, we include a number of cognitive and non-cognitive skills, as well as personality traits in the estimation that have been shown to affect wealth accumulation, but have been missing from the literature on precautionary savings.

The next section outlines the strategy for estimating the effect of subjective economic uncertainty on precautionary savings over time. Section 3 describes the data set, sample selection and construction of subjective economic uncertainty, and presents household assets by perceived uncertainty. Section 4

[2] This should be particularly important for low-income households that struggle to build up sufficient savings; those households often rely on increased unsecured debt in the event of unemployment (see Sullivan 2008). Low-income household's reliance on (typically expensive) unsecured debt could have long-term, undesirable distributional effects.

[3] The level of wealth at any given point in time is the result not only of a series of behavioural choices, but also of a history of income shocks, starting conditions, and luck in terms of investment returns.

presents the results: we find that households increase their cash savings in response to real and perceived uncertainty, and that households' responsiveness to perceived uncertainty has increased strongly after the Great Recession. Section 5 concludes.

2. Empirical Approach

We will estimate household cash savings rates as a function of subjective economic uncertainty, objective income uncertainty, current wealth levels, cognitive and non-cognitive skills, and other household characteristics:

$$E\left(\frac{ac_{iT}-ac_{it}}{\sum_{s=t}^{T} y_{is}}\right) = b_0 + b_1 \cdot subj_{it} + b_2 \cdot lvarly_{itT} + b_3 \cdot ly_{itT} + b_4 \cdot \ln(ac_{it}) + \mathbf{b_5} \cdot \mathbf{ln(wealth_{it})} + \mathbf{b_6} \cdot \mathbf{CNC_{it}} + \mathbf{b_7} \cdot \mathbf{X_{it}} \quad (1)$$

ac_{it} is household i's assets held in accounts and cash at time t. y_{it} is the income of household i at time t; thus $\frac{ac_{iT}-ac_{it}}{\sum_{s=t}^{T} y_{is}}$ corresponds to a household's cash savings rate between periods t and T. $subj_{it}$ represents the household's subjective economic uncertainty at the beginning of t. It will be derived from a consumer attitudes' survey that includes a question on the overall economic development next year, to which interviewees give responses on a 5-point-scale. The details of constructing subjective economic uncertainty are described in section 3.2 when the data set has been described.

If households make precautionary savings to insure themselves against variation in income, they should draw down on wealth in case of an income loss. The accumulation of wealth over time is then affected not only by the households expectations of income uncertainty, but also by their actual experience of income shocks. Because we are interested in the effect of perceived uncertainty above and beyond the effect of real income experiences, we must control the income stream that actually followed the formation of expectations about them. The model controls ly_{itT} and $lvarly_{itT}$, two measures that describe the distribution of income the household will receive between $s = t$ and $s = T$: the average logarithmic income and the logarithmic variance of the logarithmic income. $lvarly_{itT}$ is a commonly used, objective measure of income uncertainty as applied for example by Carroll and Samwick (1998).

An ad hoc measure of objective income uncertainty, it has the advantage over other, more complex measures that it is simple to derive and requires no assumptions about the specific form of a household's utility function.

ac_{it} captures the household's history, as reflected in current levels of precautionary assets. If individuals try to build a target level of liquid assets as a 'buffer-stock', then current precautionary assets should affect future savings: a household that has recently drawn down on precautionary assets because of a temporary loss of income might make an increased effort to re-build the assets they had previously held. Households that hold higher levels of assets in accounts and cash already have less reason to do so.

Since it is generally possible to convert assets of different types into each other, we also control a vector of other household assets $\mathbf{ln(wealth_{it})}$, including both financial and non-financial assets. These include, for example, equity investments, real estate, or assets held in trust funds. They will be described in detail in section 3.3. Finally, $\mathbf{CNC_{it}}$ includes a set of cognitive and non-cognitive skills, and $\mathbf{X_{it}}$ comprises standard socio-economic controls such as age and education.

Estimating equation (1) shows whether households respond to objective and subjective economic uncertainty. We re-estimate the model while interacting $subj_{it}$ and $lvarly_{itT}$ with time indicators, in order to yield an estimate of whether housholds' responsiveness increased after the Great Recession.

$$E\left(\frac{ac_{iT}-ac_{it}}{\sum_{s=t}^{T} y_{is}}\right) = b_0 + \mathbf{b_1} \cdot subj_{it} \cdot \mathbf{year_{it}} + \mathbf{b_2} \cdot lvarly_{itT} \cdot \mathbf{year_{it}} + b_3 \cdot ly_{itT} + b_4 \cdot \ln(ac_{it}) + \mathbf{b_5} \cdot \mathbf{ln(wealth_{it})} + \mathbf{b_6} \cdot \mathbf{CNC_{it}} + \mathbf{b_7} \cdot \mathbf{X_{it}} \quad (2)$$

Our data allows us to observe three different periods: before, during, and after the Great Recession. We will be able to compare coefficients on subjective and objective uncertainty to understand how households' responsiveness changed over the course of the crisis and in its aftermath.

Finally, we also re-estimate equations (1) and (2), with the increase in total cash savings being replaced by the increase in unsecured debt, which might be an alternative strategy to deal with temporary income shocks.

3. Data

This paper draws on two data sets. The main part of the analysis is based on the Household, Income and Labour Dynamics in Australia (HILDA) Study. HILDA began in 2001 as a nationally representative household panel study, with 19,194 individuals in 7,682 households surveyed. The study members are followed over time, interviews are conducted annually. The survey collects information on individuals' labour market activity, family circumstances, income situation, and various measures of well-being. Special modules are included in each wave that collect more in-depth information about varying topics. Waves 2002, 2006, 2010 and 2014 included special modules about assets, debt and net wealth in various asset classes; this information gives a detailed picture of wealth accumulation strategies over time.[4] The HILDA data is augmented with information from the Consumer Attitudes, Sentiments & Expectations (CASiE) Survey. CASiE is a cross-sectional, monthly telephone-survey that collects information on individual's own financial situation and intentions to make major purchases, together with respondents' economic expectations. The sample of respondents is nationally representative.

3.1. Sample selection

The main sample is selected from HILDA data.[5] Assets and wealth are measured at the household level; for each household, we will measure wealth accumulation over the interval [t,t+4]. Households interviewed in wave 2002, 2006 and 2010 thus form the basis of the analysis. A total of 21,701 household-year-observations are available in 2002, 2006, and 2010. In order to identify wealth accumulation over time, the same household has to be observed again four years later in order to be useful for the analysis. As individuals move in and out of households - and assets may or may not be split or pooled as a result - it is not clear under which circumstances a given household can be classified as still being the same household as in an earlier wave. Moreover, assets may be collectively owned by all household members or be owned individually. We thus restrict the analysis to stable households for

[4] For detailed information on the HILDA Study, its survey design and collected information see Summerfield et al. (2015).
[5] The data was extracted using *PanelWhiz*, a software that provides a graphical interface for assessing many panel data sets from around the world in Stata. Haisken-DeNew and Hahn (2010) provide a general introduction to the use of *PanelWhiz*, and Hahn and Haisken-DeNew (2013) discuss the software's usage specifically for Australian datasets including HILDA.

which collective ownership of assets can be plausibly assumed. Multi-family households as well as non-family households are excluded, as are one-family households living together with other relatives.[6] Where children reside in the household, all assets are assumed to be owned by the parent generation and interviews of children are discarded. The remaining couples or lone persons are only included if their relationship status (and where applicable, their partner) does not change between 2002 and 2006, between 2006 and 2010, or between 2010 and 2014. These restrictions drop around 17% of the original household-year-observations, predominantly due to changes in relationships. As a result, this analysis cannot shed light on asset accumulation to the extent that it is used as an insurance against relationship breakdown, or acquired through relationship formation.

Furthermore, we exclude 13% of household-year observations if the household has at least one self-employed member, as it is unclear for the purposes of this study to what extent business assets should be considered part of the collectively owned household wealth. Hurst et al. (2010) show that wealth accumulations strategies of self-employed individuals differ fundamentally from employees' strategies, and both groups should thus be analysed separately. A further 7% of observations are dropped because information on household income or household assets or key control variables are unavailable or implausible.[7] After restricting the sample to one-family-households with stable relationships, with useful asset and income information and no self-employed members, 13,462 household-year observations are left for the analysis.

Among those household, we focus on households of young adults aged 25 to 50. The purpose of this analysis is to study the effect of economic expectations on wealth accumulation as a precautionary measure. Saving as a form of insurance against short-term variations in income should become the less relevant the closer a household is to retirement age. 5,514 households fall within this age range of

[6] This leaves a sample of one-family households, where this family is a couple-family with or without children, a lone-parent-family or a lone person without children.
[7] The income or asset information is considered implausible, a) if the household's reported *unsecured* debt exceeds A$200,000 and exceeds twice the annual household income, or b) if household overall assets minus debt exceed 50 times the annual household income. The reported household income is considered implausible if it is less than 75% of the minimum income support payable to a couple or lone person, respectively. These restrictions drop a total of 155 observations.

interest. Households in wave t are only included if they are also observed in wave t+4; this leaves 3,861 observations.

3.2. Imputing subjective uncertainty and describing other controls

HILDA does not directly contain information on economic expectations. We thus augment the HILDA data with information from CASiE, which includes information on economic expectations that we can use as a measure of perceived uncertainty. To link the information gathered in both data sets, we use socio-economic information that is available in both. We estimate economic expectations as a function of socio-economic characteristics based on CASiE data. The same socio-economic characteristics are available for respondents in HILDA; using these characteristics together with the coefficients obtained from the estimation based on CASiE allows us to make a prediction for the economic expectations of respondents in HILDA.

Interviewees in CASiE are asked about their expectations in different economic dimensions and over different time-frames. This analysis of savings behaviour used responses to the following question: "Thinking of economic conditions in Australia as a whole. During the next 12 months, do you expect we'll have good times financially, or bad times, or what?" Respondents can answer on a 5-point scale with lower values indicating more positive expectations, which we interpret as less subjective economic uncertainty.

Additionally, CASiE provides a number of personal characteristics, namely the state of residence, age and gender, occupation and education, household size and income. Most importantly, respondents are asked to estimate the probability of losing their job in the next 12 months, the probability of leaving their jobs voluntarily in the next 12 months, and the probability of finding a job at least as good as their current one in the next 12 months. Moreover, CASiE contains an indicator for the respondent's self-rated financial situation compared to last year's: whether they are better-off, worse-off, or the same as twelve months ago. These estimated probabilities and self-rated financial situation are strongly correlated with overall economic expectations; it is thus possible to form predictions about individual's overall economic expectations. Table 1 shows information on the regression of economic expectations

on the indicators described above. Figure 1 shows boxplots of predicted expectations across the actual expectations measured in CASiE.

All characteristics that were used as explanatory variables for expectations in the regression described in Table 1 are also available in HILDA. The model coefficients combined with individually observed characteristics in HILDA are used to impute the expectations that are not directly included in our main data set. These estimated expectations will be used in the estimation of households' savings rates as measure for subjective economic uncertainty$subj_{it}$.[8]

Table 2 shows the average prediction of subjective economic uncertainty, which is about 3 on average, on a 1-5 scale, with a standard deviation of 0.46; that is, there is substantial variation in predicted uncertainty across households in our sample that allows us to estimate uncertainty's effects on savings. The table also reports measures of future income experiences: over the following four years, households will receive on average A$81,000 to A$98,000 annually, with an overall standard deviation of 50,000. The within-household variance of those income streams over a four-year period represents the objective uncertainty the households faced, which was 13,000 on average (that is, unsurprisingly, much smaller than the overall variance). The within-household variance also differs substantially across households,

[8] This imputation procedure is, although drawing on two different data sets, conceptually similar to a two-stage instrument variable estimation, and the prediction of expectations can be interpreted to represent the 'first-stage' estimation results, while the main estimation of equation (1) represents the 'second stage'. In that sense, our analysis follows Lusardi (1997) and Mastrogiacomo and Alessi (2014) who use instruments to deal with attenuation bias in measures of subjective uncertainty. The 'first stage'-estimation includes controls for state of residence, age, gender, occupation, education, household size and income; these characteristics are also controlled in the 'second stage' - the main estimation of equation (1) ($\mathbf{X_{it}}$and ly_{itT}), with the exception of gender. In addition, the probability of losing one's job, leaving it voluntarily and finding a new one at least as good, as well as one's self-rated financial situation compared to last year's, are included in the first stage, but excluded from the second stage. For this strategy to be valid, these 'instruments' must, first, be strongly correlated with economic expectations, and second, the household's subjective assessment of the future state of the economy must be the *only* link between the 'instruments' and the household's savings rate. The F-statistic for a test on joint significance of these variables in the first stage is 68.10 (see Table 1), indicating that the first criterion is indeed fulfilled. In order to fulfil the second condition, a number of other crucial variables have to be controlled in the second stage: in particular variables that describe the households' past and future *real* financial situation. As already discussed in Section 2, the estimation equation (1) will include current assets held in accounts and ac_{it}, other wealthln($\mathbf{wealth_{it}}$), future income ly_{itT}, and the variance of future income $lvarly_{itT}$ to ensure that these conditions hold.

as indicated by the variance's variance, allowing us to estimate the uncertainty's effect on behaviour. [9,10]

In addition to current assets and future income, the main estimation of equation (1) includes all variables in vector $\mathbf{X_{it}}$: state of residence, age, occupation, education and household size.[11] These are shown in the upper panel of Table 3, which describes the main socioeconomic characteristics of this sample in both waves. Around 60% of all households are couple households, the average age of the lone person or of the older member of the couple is 39 years. Average annual household income increased from A$74,500 in 2002 to A$93,600 in 2010, corresponding to an increase in real income of about 3.0% per annum. Occupation and education are reported for the lone person or for the couple member with the highest education and occupation.

The lower panel of the table shows cognitive and non-cognitive characteristics, namely measures of cognitive skills, trust, risk aversion, the 'Big 5'-personality traits. These are included in the vector $\mathbf{CNC_{it}}$. They are described in detail in the Appendix.

3.3. Measures of household wealth - descriptives

The measurement of household assets and debt is included in HILDA's household questionnaire; where possible, these items are asked of the household member who knows the most about household finances. Assets include bank accounts[12], cash and equity investments, life insurances and trust funds, mandatory pension savings, owner-occupied homes and investment properties, business assets, collectibles and vehicles.[13] The wealth data is of very high quality. Average household wealth in waves 2002, 2006 and

[9] Income is transformed into 2014 Australian dollars using the Consumer Price Indices provided by the Australian Bureau of Statistics.
[10] Where income information is not available in one or two of the four waves, it is assumed to be equal to the average household income as calculated from the waves for which the information was available. If income was missing in more than two of the four waves, observations have been removed from the sample. The within-household variance of income is calculated using true income observations only.
[11] We have run robustness checks that additionally include the number of dependent children. Results do not change, and are available from the authors on request.
[12] This includes individually as well as jointly owned cheque accounts, savings accounts, keycard/EFTPOS accounts, other transaction accounts, fixed term deposits and cash management trusts.
[13] All asset components have been transformed into 2014 Australian dollars using the Consumer Price Indices provided by the Australian Bureau of Statistics.

2010 as measured in HILDA are consistent with aggregate household wealth measured by the Reserve Bank of Australia in both levels and growth rates (Finlay 2012) and with measures produced by the Survey of Income and Housing (Wilkins 2013). The response rate is high[14], and where items are missing, these have been imputed.[15]

We distinguish between three broad classes of assets: i) financial assets that are relatively easy to convert to cash (albeit possibly at a loss): money held in bank accounts, cash investments, equity investments, trust funds and life insurances, ii) non-financial assets that are difficult to convert to cash: real estate, cars, collectibles and business assets and iii) pension savings which are not legally accessible. Only the first category can serve as precautionary savings.

Table 4 shows financial assets for 'low uncertainty' and 'high uncertainty' households, where 'low uncertainty' and 'high uncertainty' corresponds to the households with subjective economic uncertainty below and above the median. The table also reports current household income and unsecured debt, which includes credit card debt, overdue household bills, and other personal debt such as car loans. The average income in both groups is very similar at around A$85,000 per year. Likewise, the 25-percentile and 75-percentile for both groups do not differ much; overall, subjective economic uncertainty does not seem to be tied strongly to households being better or worse off in terms of income.

However, we do see differences in liquid financial assets: counterintuitively, households hold lower levels of liquid assets if they perceive economic uncertainty to be greater - about A$44,500 compared to A$52,100, equivalent to 5.5 versus 6.5 monthly household incomes. Notably, households with greater subjective uncertainty hold substantially less in cash and accounts - the asset class most suited to serve

[14] A number of items are missing in less than 1 per cent of all cases; these are rare items for which most individuals indicate to not have this asset type or debt category at all: cash investments, and the value of and debt on investment properties. For somewhat more commonly held assets and debt categories, exact values are missing in more than 1 per cent and less than 5 per cent of all cases; these are the value of and debt on an owner-occupied home, the value of businesses, collectibles and vehicles, as well as the financial assets 'equity investments', 'life insurances' and 'trust funds'. The most commonly held types of assets and debt, which are missing in more than 5 per cent of all cases, are positive and negative balances on bank accounts and credit card accounts, other forms of personal debt (including unpaid household bills), and pension savings. Among these categories, values are missing for 7.9% (other debt) to 18.3% (pension savings) of all observations.

[15] The imputation is based on nearest-neighbour regression (separately for zero-values and non-zero-values), improved by imputation according to the 'Little and Su'-method where this was possible. Summerfield et al. (2015) and Hayes and Watson (2009) provide details.

as precautionary savings. At the same time, both types of households hold about the same level of unsecured debt, and assets in equity investments, trust funds and life insurances. This is true both in absolute values and relative to household income.

However, differences in current wealth levels may reflect not only differences in behaviour, but also differences in past income streams, income shocks, and returns on past investment choices. Households that were 'luckier' in the past might also tend to form more positive opinions about the future. To get a better understanding of the relationship between subjective economic uncertainty and wealth accumulation, current subjective uncertainty should be related to increases in wealth that *follow* these expectations.

Table 5 shows growth in asset types relative to total household income. That is, the amount of money held in an asset type is measured in one wave, and then again four years later; the increase from the first wave to the next is set in relation to the total income the household earned in that four-year-period. The increase in immediately accessible wealth over time equals 3.1% of the income the household earned in that same period. Broken down by finer asset classes, differences by economic expectations emerge that are consistent with stronger precautionary behaviour by households with greater subjective uncertainty: households that faced low subjective uncertainty saved about 1.38% of their income over a four-year-period in accounts and cash; those that faced high uncertainty saved nearly a quarter more in that asset class, with 1.69% of their income. They also invested nearly 50% more (in relation to their income) in life insurances. These higher investments in very safe or easily accessible assets was mirrored by lower investments in the risky asset class of equity investments, which are unsuited to serve as an insurance.

Subjective economic uncertainty in 2002 and 2006 predates the Great Recession; in contrast, subjective economic uncertainty in 2010 would have been greatly affected by the very recent crisis. The lower panels of Table 5 show asset growth separately for the three years of observation. Households that experienced high subjective economic uncertainty in 2002 and 2006 actually accumulated a little less of the income they would receive in the following four years in cash and accounts than the households

with lower subjective uncertainty did, albeit not by much. More pronounced, however, were the differences between groups in terms of accumulating equity investments or assets held in life insurances - those who felt uncertain invested in the latter, the others in the former. After the Great Recession had hit, in the period 2010 to 2014, this pattern changed: now households who reported greater subjective uncertainty began to hold much more of their income in cash and accounts, with 2.58% compared to 1.32%.

These descriptive results suggest that subjective uncertainty might lead a household to increase the amount held in cash, and to accumulate less risky asset types, but only after a period of economic stability had ended. They also lend weight to the story that subjective uncertainty has begun to play a role only after the crisis had hit. It stands to question whether these results hold when other factors, such as objective economic uncertainty and current wealth and income levels, are controlled. The next section presents the estimation results to test this.

4. Estimation Results

The first two columns of Table 6 show the results from estimation equation (1), not controlling for $\mathbf{CNC_{it}}$. The coefficient on subjective economic uncertainty is positive; the point estimate implies that if uncertainty is perceived to be greater by 'one unit', the household's savings rate increases by 1.31 percentage points. Subjective economic uncertainty has a mean value of 3.11 (see Table 2) with a standard deviation of 0.46; subjective uncertainty for the least uncertain decile and the most uncertain decile is 1.16 units apart. That means, the least and most uncertain decile differ in their cash savings rate (relative to disposable household income) by 1.52 percentage points. In comparison, the average savings rate in our sample is 1.53%. The effect of subjective uncertainty on the savings rates is thus of clear economic significance.

The next coefficient describes the effect of objective income uncertainty, measured by the logarithmic variance of logarithmic future income. If this variance increases by 1%, the cash savings rate increases by .028 percentage points. If an average households saves A$153 out of every $10,000 they earn, a household with the same average income but a 10% higher variance of income would save $180 instead.

Again, this effect is highly economically significant. It is also statistically significant at the 1%-level and in line with previous analyses that study the effect of objective income uncertainty on precautionary savings Carroll and Samwick (1998), Mastrogiacomo and Alessi (2014).

We also find a strongly significant impact of the average future income on accumulation of cash savings, as is to be expected: as annual household income increases by 1%, the four-yearly cash savings rate increases by 0.057 percent of that increased income.[16] In accordance with theoretical expectations, households with higher income save more cash, as do households with less certain income. The significant, positive responsiveness to uncertainty implies that households' cash accumulation will go up during a recession, when such uncertainty typically goes up.

Furthermore, we see that accumulation of assets held in cash and accounts is significantly negatively related to the level of assets in the same category already held by the household. This supports the 'buffer-stock' hypothesis: households save up to a certain precautionary target wealth, and the higher their current precautionary wealth already is, the less they will accumulate in addition. If the experience of an income shock has just depleted a household's cash reserves, they will increase their savings efforts to make up for this. The negative relationship between current cash reserves and future cash accumulation implies that households will temporarily increase their savings above their optimal long-term rate during an economic downturn, in order to 'make up for their losses'. This could potentially further exacerbate the problem of high savings – and thus low consumption – in response to an economic downturn.

Other liquid assets (money held in trust funds, life insurances and equity investments) are unrelated to households' cash accumulation. This suggests that these asset classes are not seen as a substitute for accounts and cash for insurance against income shocks; that is, they do not serve as precautionary savings. The same is true for pension savings, which is unsurprising as they cannot be legally accessed before age 55. Somewhat surprisingly though, the more non-financial assets a household already holds,

[16] Evaluated at all other variables set to zero, this would imply a cash savings rate of 5.7%, which is substantially higher than the empirical observed value of 1.5%. However, a household with all controlled characteristics at zero does not exist in the data.

the *higher* the households' precautionary savings are. There are two possible explanations for this relationship, based on the fact that the vast majority of non-financial wealth is held in real estate, mostly owner-occupied homes. Home ownership could i) capture a household's "prudence", which is otherwise omitted from the estimation, or ii) *require* higher precautionary savings in order to ensure on-going mortgage repayments can be made in case of a negative income shock. Renters are more flexible to decrease their consumption of living space instead, since they have no past investments to lose.[17]

The next two columns present the results of estimating equation (2), in which the effects of subjective and objective economic uncertainty are interacted with year dummies. The years of observation 2002, 2006 and 2010 all capture fundamentally different periods in terms of how they were affected by the Great Recession or not. For households in 2002, we estimate further cash accumulation until the next interview in 2006; this period was entirely unaffected by the Great Recession and coefficients on both subjective and objective economic uncertainty measure household responsiveness to uncertainty during a period of economic stability. In 2006, we observe the accumulation of precautionary wealth until 2010. Subjective economic uncertainty in 2006 predates the Great Recession, which came entirely unanticipated, and the coefficient on subjective economic uncertainty in 2006 thus has to be interpreted as the level of responsiveness to uncertainty that is still unaffected by the shock, before the crisis. At the same time, our measure of objective economic uncertainty measured in the period 2007-2010 captures the peak of the Great Recession and can be interpreted as households' responsiveness *during* the crisis. Finally, subjective economic uncertainty in 2010 would have been greatly affected by the very recent crisis, and the corresponding coefficient measures "after-crisis-responsiveness", as does the coefficient on objective uncertainty.

Turning first to the coefficients on subjective uncertainty, we learn that the significant effect we found in model (1) is exclusively caused by household behaviour *after* the shock of the Great Recession. In

[17] To explore which of the two explanations is likely at play, we repeated the estimation adding a dummy-variable that indicates whether a household is currently serving a mortgage. In that specification, the coefficient on non-financial assets is reduced by about 50% and becomes insignificant at the 10%-level; at the same time, households that currently pay off a mortgage are observed to accumulate on average 1.26 percentage points more cash relative to their income than other households. However, the underlying estimated coefficient is insignificant at the 10%-level.

2002 and 2006, the coefficients are small and insignificant; in 2010, it increases in size dramatically. Compare again the least and most uncertain decile of households, which were 1.16 units apart in their predicted subjective expectations: they would differ in their rate of cash accumulation between 2010 and 2014 by 3.3 percentage points. This is comparable with the estimated effect of doubling objective income uncertainty; that is, the income uncertainty households are actually exposed to. Responsiveness to perceived uncertainty has thus increased to a very substantial degree after the Great Recession.

Turning to the coefficients on objective income uncertainty, we see that responsiveness seems to increase *during* the actual crisis, and return back to 'normal', pre-crisis levels afterwards, in the period 2010-2014. However, the coefficient in 2006 is not estimated very precisely, and the confidence levels of all three coefficients overlap comfortably. It is not possible to determine for sure whether household responsiveness to *real* uncertainty has remained constant before, during and after the crisis, or whether it went up temporarily. While we do find strong evidence for a *positive* relationship between cash savings and objective uncertainty, with the implication of potentially problematic pro-cyclical household behaviour, our estimates provide only weak evidence that this problem is further exaggerated by *increasing* household responsiveness.

The coefficients on future average income and current wealth levels remain stable and their interpretation is unchanged. Columns (3) and (4) repeat the same estimations with controls for cognitive and non-cognitive skills included. None of them turn out to be significantly related to the cash savings rate. This may be partly because all included traits are fairly stable over time, and their effect on wealth accumulation might be controlled in the estimation already through the pathway of other asset levels.

Table 7 shows the results of estimating equations (1) and (2) with the dependent variable being accumulation of unsecured debt in relation to income, rather than precautionary savings. The most important finding is that the estimation does not explain how much unsecured debt households accumulate: neither subjective nor objective uncertainty seem to play a role, nor do current wealth levels. The only relationship unveiled by the estimation is that households acquire higher levels of unsecured debt if they have higher incomes, and less if they have high levels of debt already.

Our estimation results do not show evidence that unsecured debt is used as a substitute for precautionary savings; the observed pattern is more consistent with households taking up e.g. car loans to a level they feel they can afford, and then not taking up any more. This could be the case because households do indeed not rely on unsecured debt to deal with income shocks, or because the data does not adequately measure credit card debt and unpaid bills. Although the survey question technically includes this, respondents may not always take it fully into account during the interview.

5. Conclusions

This study examines the impact of economic uncertainty on the accumulation of cash reserves in a nationally representative household panel survey. This is the first paper that uses subjective and objective measures of economic uncertainty simultaneously, to find out whether households respond to a perception of uncertainty that goes above and beyond the objective uncertainty they are actually exposed to. For the first time, the study also analyses whether such household behaviour can be 'triggered' by a crisis, such as the Great Recession.

We find that on average, 1.5% of a household's yearly income is used toward precautionary savings; we show that a substantial increase in subjective economic uncertainty (moving from the 10th percentile to the 90th percentile in the distribution) impacts substantially on real economic savings behaviour, increasing the cash savings rate by a 1.1 percentage points. This effect of subjective uncertainty comes above and beyond that of objective uncertainty.

Moreover, the additional effect of subjective uncertainty only appears after the crisis had hit. There is no effect of subjective uncertainty during the observed periods of economic stability, yet after the Great Recession began, experiencing subjective uncertainty at the very top of the distribution rather than the very bottom, elicited a behavioural response equivalent to objective variance in income being more than doubled. This provides evidence for 'panic'-savings that result from mere perception over actual experience, and that materialise only during periods of economic upheaval.

Many previous analyses have shown that income uncertainty increases precautionary savings; there has been some debate over whether subjective or objective measures of uncertainty should be employed

(Mastrogiacomo and Alessi 2014), as they often yield quite different results - ranging from uncertainty being hardly relevant for wealth accumulation (Guiso et al. 1992) to uncertainty explaining half of a household's wealth (Carroll and Samwick 1998). However, this study shows that the *joint* effect of subjective and objective uncertainty needs to be considered - and how it evolves over time - in order to see a more complete picture of how uncertainty affected precautionary savings during the Great Recession. Any analysis that is focused on objective or subjective measures alone, or that assumes responsiveness to uncertainty to be constant over time, cannot uncover the strong 'over-shooting' in households' savings behaviour after a crisis, as we find it in this study.

These findings have important policy implications, particularly due to the timing of the households' behavioural response to uncertainty. If households aim for a target level of cash reserves, and increase their cash accumulation rate once their cash reserves have been depleted, their savings rate during a recession will exceed their long-term, optimal savings rate. Moreover, if they accumulate precautionary savings not only in response to 'real' uncertainty but also in response to mere perceived uncertainty, such 'panic'-savings only worsens the problem of over-saving. Add to that households not only experiencing greater uncertainty (real or otherwise), but also responding more strongly to that uncertainty, and the case for policy interventions that directly aim to increase household consumption becomes quite strong - be it in the form of counter-cyclical fiscal policy or in the form of public insurance schemes.

References

Agarwal S, Mazumder B (2013) Cognitive abilities and household financial decision making. American Economic Journal: Applied Economics, 5:193--207.

Benhabib J, Bisin A (2005) Modeling internal commitment mechanisms and self-control: A neuroeconomics approach to consumption--saving decisions. Games and Economic Behavior, 52: 460--492.

Carroll CD, Slacalek J, Sommer M (2012) Dissecting saving dynamics: Measuring wealth, precautionary, and credit effects. Manuscript, John Hopkins University. http://econ.jhu.edu/people/ccarroll/papers/cssUSSaving/.

Carroll CD, Samwick AA (1998) How important is precautionary saving? Review of Economics and Statistics, 80: 410--419.

Carroll CD, Hall RE, Zeldes SP (1992) The buffer-stock theory of saving: Some macroeconomic evidence. Brookings papers on economic activity,1992(2): 61--156.

Christelis D, Jappelli T, Padula M (2010) Cognitive abilities and portfolio choice. European Economic Review, 54: 18--38.

Cobb-Clark DA, Schurer S (2012) The stability of big-five personality traits. Economics Letters, 115: 11--15.

Cobb-Clark DA, Kassenboehmer SC, Sinning M (2013). Locus of control and savings. Ruhr Economic Paper 455, Bochum: Ruhr University Bochum (RUB).

Engen EM, Gruber J (2001) Unemployment insurance and precautionary saving. Journal of Monetary Economics, 47: 545--579.

Finlay R (2012) The distribution of household wealth in Australia: Evidence from the 2010 HILDA Survey. RBA Bulletin: 19--27.

Guiso L, Jappelli T, Terlizzese D (1992) Earnings uncertainty and precautionary saving. Journal of Monetary Economics, 30: 307--337.

Guiso L, Sapienza P, Zingales L (2008) Trusting the stock market. The Journal of Finance, 63: 2557--2600.

Hahn MH, Haisken-DeNew JP (2013) Panelwhiz and the Australian longitudinal data infrastructure in economics. Australian Economic Review, 46:379--386.

Haisken-DeNew JP, Hahn MH (2010). Panelwhiz: Efficient data extraction of complex panel data sets-an example using the German SOEP. Schmollers Jahrbuch-Zeitschrift fur Wirtschafts und Sozialwissenschaften 130: 643-654.

Hayes C , Watson N (2009) HILDA Imputation Methods. HILDA Project Technical Paper 2/09, Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Hurst E, Lusardi A, Kennickell A, Torralba F (2010) The importance of business owners in assessing the size of precautionary savings. The Review of Economics and Statistics, 92: 61--69.

Kazarosian M (1997) Precautionary savings - a panel study. Review of Economics and Statistics 79: 241--247.

Laibson D (1997) Golden eggs and hyperbolic discounting. The Quarterly Journal of Economics 112: 443--477.

Lusardi A (1997) Precautionary saving and subjective earnings variance. Economics Letters 57: 319--326.

Lusardi A (1998) On the importance of the precautionary saving motive. American Economic Review 88: 449--453.

Mastrogiacomo M, Alessie R (2014) The precautionary savings motive and household savings. Oxford Economic Papers 66: 164--187.

Mody A, Ohnsorge F, Sandri D (2012) Precautionary savings in the Great Recession. IMF Economic Review 60: 114--138.

OECD, 2015. National accounts at a glance 2015. OECD Publishing.

Saucier G (1994) Mini-markers: A brief version of Goldberg's unipolar big-five markers. Journal of Personality Assessment 63: 506--516.

Smith JP, John J McArdle, and Robert Willis, 2010. Financial decision making and cognition in a family context. The Economic Journal 120: F363--F380.

Sullivan, James X, 2008. Borrowing during unemployment - unsecured debt as a safety net. Journal of Human Resources 43: 383--412.

Summerfield, Michelle, Simon Freidin, Markus Hahn, Ning Li, Ninette Macalalad, Laura Mundy, Nicole Watson, Roger Wilkins, and Mark Wooden, 2015. HILDA User Manual Release 14. Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

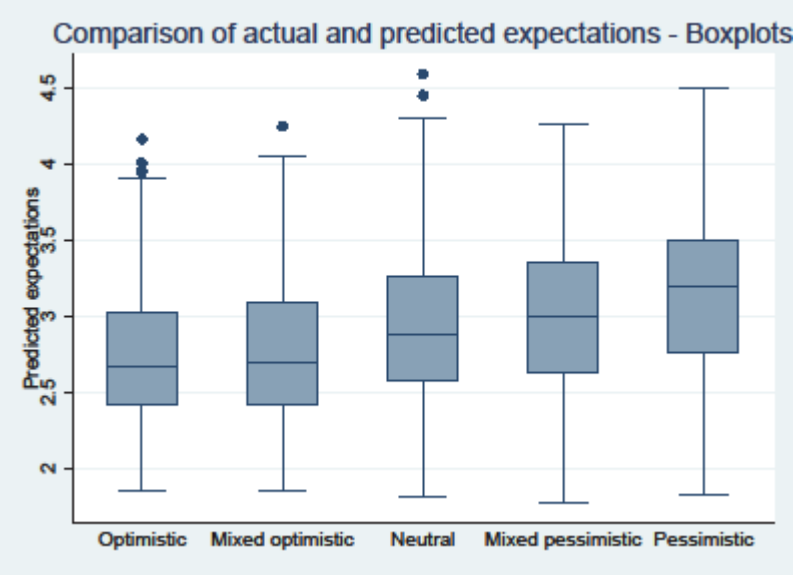
Ventura, Luigi and Joseph G Eisenhauer, 2006. Prudence and precautionary saving. Journal of Economics and Finance 30: 155--168.

Wilkins, Roger, 2013. The distribution and dynamics of household net wealth. Families, Incomes and Jobs Volume 8 - A Statistical Report on Waves 1 to 10 of the Household, Income and Labour Dynamics in Australia Survey: 73--81. Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Wooden, Mark, 2013. The Measurement of Cognitive Ability in Wave 12 of the HILDA Survey. HILDA Project Discussion Paper 1/13, Melbourne: Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Tables and Figures

Figure 1 Comparison of actual and predicted expectations - Boxplots



Source: Consumer Attitudes, Sentiments and Expectations Survey - February, May, August and November of 2002, 2006 and 2010. Economic expectations are measured on a 5-point scale form 1 to 5 with lower values indicating more optimistic expectations. The figure shows model predictions for the estimation sample based on the estimation results reported in Table 1, plotted against the observed values.

Table 1 OLS estimation of economic expectations in CASiE

Variable	Coefficient	[Std. Err.]
State; Ref.: NSW		
VIC	-0.005	[0.038]
QLD	0.047	[0.042]
SA	0.033	[0.046]
WA	-0.135	[0.046]
TAS	0.029	[0.069]
ACT	0.131	[0.105]
Equivalised annual household income (in AUD1,000)	-0.052	[0.026]
... household income (squared)	0.002	[0.003]
Age; Ref: 18-34 years		
35-44 years	0.024	[0.124]
45-49 years	0.068	[0.127]
50-54 years	-0.004	[0.126]
55-64 years	-0.09	[0.124]
65 years or older	-0.171	[0.125]
HH size; Ref: 1 person		
2 persons	0.023	[0.041]
3 persons	-0.015	[0.054]
4 persons	-0.084	[0.056]
5 persons	-0.044	[0.071]
6 persons	-0.048	[0.113]
7 persons and more	-0.144	[0.166]

Continued on next page

Table 1 - continued

Variable	Coefficient	[Std. Err.]
HH size, interacted with age 18-34; Ref: 1 person		
2 persons	-0.015	[0.136]
3 persons	0.112	[0.144]
4 persons	-0.036	[0.145]
5 persons	-0.145	[0.168]
6 persons	0.087	[0.249]
7 persons and more	0.379	[0.306]
Occupation; Ref: Managers		
Professionals	0.063	[0.047]
Tradespersons	0.132	[0.074]
Clerks	0.154	[0.076]
Salespersons	0.036	[0.065]
Machine Operators	0.051	[0.095]
Labourers	0.119	[0.080]
Out of the Labour Force	0.022	[0.051]
Education; Ref <=Year 11		
Full secondary	-0.142	[0.042]
Certificate, non-trade	-0.058	[0.081]
Certificate, trade	-0.092	[0.060]
(Under-)graduate degree	-0.153	[0.040]
Postgraduate Degree	-0.192	[0.056]
Gender; Ref: Male		
Female	0.246	[0.029]
Year; Ref.: 2002		
2006	0.084	[0.035]
2010	-0.167	[0.040]
Self-assessed financial situation compared to previous year Ref.: Better off		
Same	0.299	[0.036]
Worse off	0.889	[0.036]
Probability of job loss is positive	0.044	[0.069]
Probability of leaving job voluntarily is positive	0.145	[0.077]
Probability of finding job at least as good is positive	-0.097	[0.094]
Probability of job loss is missing	-0.071	[0.206]
Probability of leaving job voluntarily is missing	0.047	[0.220]
Probability of finding job at least as good is missing	-0.112	[0.154]
Probability of job loss, if positive (1-100)	0.006	[0.001]
Probability of leaving job voluntarily, if positive (1-100)	-0.002	[0.001]
Probability of finding job at least as good, if positive (1-100)	-0.002	[0.001]
Observations	10,713	
R-squared	0.102	
F-Statistic for significance of full model	23.677	
F-Statistics for significance of variables excluded from main estimation	68.1	

Source: Consumer Attitudes, Sentiments and Expectations Survey - February, May, August and November of 2002, 2006 and 2010.The dependent variable, economic expectations, is measured on a 5-point scale from 1-5 with lower values indicating more optimistic expectations.

Table 2 Measures of economic uncertainty

	2002	2006	2010	Total
Subjective Economic Uncertainty (Scale 1-5), Mean	3.18	3.21	2.95	3.11
Subjective Economic Uncertainty, Std.Dev.	0.42	0.47	0.43	0.46
Household income (t+1,t+4), Mean (in A$ 100,000 (Sept	0.81	0.96	0.98	0.91
Household income, Std.Dev.	0.45	0.51	0.53	0.5
Within-HH Variance of HH income (t+1,t+4), Mean	0.13	0.15	0.12	0.13
Within-HH Variance of HH income, Std.Dev.	0.91	0.99	0.87	0.92
N	1,322	1,204	1,335	3,861

Source: HILDA, waves 2002, 2006, 2010 and 2014. Notes: For sample selection criteria see Section 3.

Table 3 Socioeconomic, cognitive and non-cognitive characteristics

	2002	2006	2010	Total
Couple household (0/1)	61.00%	60.00%	59.00%	60.00%
Age of lone person or oldest member of couple (years)	39.39	39.35	38.48	39.06
Annual Household income (in A$10,000 (Sept 2014))	7.45	8.61	9.36	8.47
Highest occupation				
Managers and Administrators	11.90%	15.90%	16.70%	14.80%
Professionals	26.60%	26.90%	28.20%	27.30%
Tradespersons	13.80%	12.40%	11.60%	12.60%
Clerks	11.80%	11.80%	11.70%	11.80%
Salespersons and personal service workers	9.70%	12.50%	12.10%	11.40%
Plant and machine operators and drivers	6.20%	3.90%	4.20%	4.80%
Labourers and related workers	4.50%	5.60%	5.00%	5.10%
Out of the labour force	15.50%	10.90%	10.50%	12.30%
Highest education level				
Postgraduate	15.10%	18.20%	17.80%	17.00%
(Honours) Bachelor	18.90%	19.90%	20.90%	19.90%
Cert III/IV, (Advanced) diplomas	35.10%	36.20%	36.30%	35.80%
Year 12, Cert I/II	10.10%	9.50%	11.20%	10.30%
Year 11 or less	20.70%	16.20%	13.90%	17.00%
Household size				
One	18.80%	19.20%	20.70%	19.60%
Two	19.70%	22.20%	22.80%	21.60%
Three	17.90%	16.50%	18.10%	17.50%
Four	27.80%	27.00%	25.20%	26.70%
5 or more	15.70%	15.10%	13.10%	14.60%
Cognitive and non-cognitive characteristics				
Cognitive ability (Index Mean=0 Std.Dev.=1)	-0.05	-0.01	0.03	-0.01
Trust (Scale 0-7)	4.64	4.61	4.57	4.61
Risk Aversion (Scale 0-4)	2.66	2.75	2.68	2.69
Agreeableness (Scale 0-7)	5.27	5.27	5.31	5.28
Conscientiousness (Scale 0-7)	5.01	5.02	5.03	5.02
Emotional Stability (Scale 0-7)	5.06	5.04	5	5.03
Extroversion (Scale 0-7)	4.24	4.31	4.33	4.29
Openness (Scale 0-7)	4.09	4.16	4.2	4.15
N	1,322	1,204	1,335	3,861

Source: HILDA, waves 2002, 2006, 2010 and 2014. Notes: see Notes to Table 2. For couples, occupation and education refer to the highest occupational status/educational degree for a member of the couple. Cognitive and non-cognitive skills refer to averages across couple members.

Table 4 Financial Assets by Subjective Economic Uncertainty

	Low uncertainty	High uncertainty	Total
Current Household income			
Mean (10,000$)	8.418	8.523	8.47
25-percentile (10,000$)	4.917	5.259	5.061
75-percentile (10,000$)	10.543	10.346	10.431
Liquid Assets - Absolute Value (100,000 Dollar)			
Accounts and Cash investments	0.219	0.15	0.185
Equity Investments	0.19	0.18	0.185
Trust funds	0.02	0.019	0.02
Life insurances	0.091	0.096	0.094
Total liquid assets	0.521	0.445	0.483
Unsecured debt	0.113	0.117	0.115
Total liquid wealth	0.408	0.328	0.368
Liquid Assets - Relative to household income (0-1)			
Accounts and cash investments	0.264	0.179	0.222
Equity Investments	0.178	0.174	0.176
Trust funds	0.017	0.013	0.015
Life insurances	0.093	0.094	0.094
Total liquid assets	0.552	0.46	0.506
Unsecured debt	0.134	0.146	0.14
Total liquid wealth	0.419	0.314	0.366
N	1,931	1,930	3,861

Source: HILDA, waves 2002, 2006, 2010 and 2014. Notes: see Notes to Table 2.

Table 5 Growth in immediately accessible household wealth relative to total household income by subjective uncertainty (in per cent)

	Low uncertainty	High uncertainty	Total
	All Years: Growth t, t+4		
Accounts and cash investments	1.375	1.687	1.531
Equity investments	1.076	0.29	0.683
Trust funds	0.174	0.096	0.135
Life insurances	0.856	1.292	1.074
Unsecured debt	0.375	0.257	0.316
Total	3.108	3.108	3.108
	Observations 2002: Growth 2002-2006		
Accounts and cash investments	1.027	0.985	1.006
Equity investments	2.659	0.812	1.735
Trust funds	0.094	-0.25	-0.078
Life insurances	0.216	1.352	0.784
Unsecured debt	0.896	0.919	0.908
Total	3.1	1.979	2.54
	Observations 2006: Growth 2006-2010		
Accounts and cash investments	1.819	1.474	1.646
Equity investments	-0.289	-0.73	-0.51
Trust funds	0.468	-0.026	0.221
Life insurances	0.652	1.89	1.271
Unsecured debt	0.067	0.108	0.088
Total	2.582	2.499	2.54
	Observations 2010: Growth 2010-2014		
Accounts and cash investments	1.32	2.576	1.948
Equity investments	0.742	0.695	0.718
Trust funds	-0.013	0.548	0.268
Life insurances	1.674	0.693	1.184
Unsecured debt	0.135	-0.263	-0.064
Total	3.588	4.776	4.181

Source: HILDA, waves 2002, 2006, 2010 and 2014. Notes: see Notes to Table 2.

Table 6 The effect of income uncertainty on households' accumulation of wealth held in accounts and cash

Variable	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
	(1)		(2)		(3)		(4)	
Subjective economic uncertainty	1.308**	0.032			1.308**	0.034		
Subjective uncertainty, 2002			0.451	0.596			0.495	0.560
Subjective uncertainty, 2006			0.197	0.826			0.128	0.888
Subjective uncertainty, 2010			3.286***	0.006			3.317***	0.006
Log(Var(log(income t+1,t+4))	2.750***	0.004			2.741***	0.005		
Log(Var(log(income 2003-06))			2.056**	0.036			2.010**	0.047
Log(Var(log(income 2007-10))			4.540*	0.088			4.514*	0.090
Log(Var(log(income 2011-14))			2.009**	0.031			2.048**	0.026
Log(income t+1,t+4)	5.676***	0.000	5.645***	0.000	5.664***	0.000	5.626***	0.000
Accounts and Cash	-0.794***	0.000	-0.791***	0.000	-0.853***	0.000	-0.850***	0.000
Liquid Assets Other than Accounts/Cash	0.051	0.466	0.050	0.465	0.067	0.360	0.067	0.355
Pension Savings	-0.237	0.151	-0.236	0.154	-0.286*	0.083	-0.284*	0.085
Non-Financial Assets	0.349***	0.003	0.352***	0.003	0.345***	0.003	0.349***	0.003
Cognitive Skills					0.372	0.435	0.390	0.415
Trust					0.313	0.342	0.322	0.328
Risk Aversion					0.915*	0.099	0.940*	0.089
Agreeableness					0.234	0.538	0.236	0.526
Conscientiousness					0.113	0.778	0.102	0.798
Emotional Stability					-0.012	0.966	0.001	0.996
Extroversion					-0.058	0.871	-0.053	0.884
Openness					-0.011	0.973	-0.034	0.915
Observations	3861		3861		3861		3861	

*Source: HILDA, waves 2002, 2006, 2010 and 2014. Notes: Accumulation of wealth in accounts and cash is relative to household income. Subjective uncertainty is measured on a scale from 1 to 5; variance of future household income is included in the model as logarithmic variance of the logarithmic income; future household income, currently held assets in accounts and cash, other financial assets, non-financial assets and pension savings are included as logarithmic values. *, ** and *** denote significance at the 10%-level, 5%-level and 1%-level. In addition to the reported coefficients, all models control the sociodemographic vector X: year dummies, state of residence, current household income and household size, age, education and occupation of the lone person or of the member of the couple with higher education, occupation or age. Standard errors are clustered over households.*

Table 7 The effect of income uncertainty on households accumulation of unsecured debt

Variable	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
	(1)		(2)		(3)		(4)	
Subjective economic uncertainty	0.095	0.781			0.083	0.807		
Subjective uncertainty, 2002			0.437	0.48			0.429	0.483
Subjective uncertainty, 2006			0.031	0.956			-0.006	0.991
Subjective uncertainty, 2010			-0.164	0.747			-0.153	0.764
Log(Var(log(income t+1,t+4))	-0.027	0.922			-0.045	0.874		
Log(Var(log(income 2003-06))			-0.368	0.423			-0.399	0.403
Log(Var(log(income 2007-10))			-0.161	0.755			-0.199	0.712
Log(Var(log(income 2011-14))			0.399	0.437			0.408	0.426
Log(income t+1,t+4)	1.448***	0.001	1.454***	0.001	1.485***	0.001	1.492***	0.001
Accounts and Cash	-0.487***	0	-0.486***	0	-0.488***	0	-0.487***	0
Liquid Assets Other than Accounts/Cash	-0.107	0.121	-0.108	0.12	-0.096	0.152	-0.096	0.151
Pension Savings	0.022	0.783	0.022	0.781	0.027	0.732	0.027	0.732
Non-Financial Assets	-0.067	0.181	-0.066	0.192	-0.064	0.213	-0.062	0.225
Cognitive Skills					-0.026	0.903	-0.028	0.894
Trust					-0.228	0.165	-0.228	0.167
Risk Aversion					0.132	0.673	0.138	0.658
Agreeableness					-0.097	0.614	-0.1	0.606
Conscientiousness					-0.201	0.191	-0.203	0.186
Emotional Stability					0.217	0.23	0.219	0.227
Extroversion					-0.025	0.865	-0.023	0.876
Openness					-0.009	0.954	-0.008	0.959
Observations	3861		3861		3861		3861	

*Source: HILDA, waves 2002, 2006, 2010 and 2014. Notes: Accumulation of unsecured debt is relative to household income. Subjective uncertainty is measured on a scale from 1 to 5; variance of future household income is included in the model as logarithmic variance of the logarithmic income; future household income, currently held assets in accounts and cash, other financial assets, non-financial assets and pension savings are included as logarithmic values. *, ** and *** denote significance at the 10%-level, 5%-level and 1%-level. In addition to the reported coefficients, all models control the sociodemographic vector X: year dummies, state of residence, current household income and household size, age, education and occupation of the lone person or of the member of the couple with higher education, occupation or age. Standard errors are clustered over households.*

Appendix - Cognitive and non-cognitive skills

There are a number of cognitive and non-cognitive skills that we will control in the estimation of wealth accumulation strategies. The lower panel of Table 3 shows all cognitive and non-cognitive indicators that are included in the estimations.

First, we include cognitive skills in the estimation, which play a role in investment strategies: individuals with higher mathematical skills are less likely to make financial mistakes (Agarwal et al. 2013), and higher cognitive skills are correlated with stock market participation (Christelis et al. 2010). HILDA contains three measures of cognitive skills; the tests and their implementation in HILDA are described in detail in Wooden (2013). The 'Backwards Digit Span' test (which is part of many intelligence tests, such as the Wechsler Adult Intelligence Scales) tests respondents' memory by reading out strings of single-digit numbers, which participants are meant to repeat in reverse order. In the 'Symbol Digits Modalities' test, participants match symbols to numbers using a printed key as quickly as possible. The last test gauges intelligence by assessing reading ability: participants are asked to pronounce irregularly spelled words.[18] We recode all three test scores so that the new score is a variable with mean zero and variance one; afterwards, the average of all three measures with equal weights is calculated to represent a person's overall cognitive skills. For couples, the higher cognitive score is used to represent the couple's cognitive skills, as Smith et al. (2010) have shown that in married couples, the spouse with higher cognitive skills is most likely the dominant financial decision maker.

A second dimension of cognitive and non-cognitive skills that has been shown to impact on wealth accumulation, and may be correlated with economic expectations, is an individual's level of trust (Guiso et al. 2008). A loss on an investment can occur not only because of a negative development of the market, but also because of fraud; thus an individual's trust in the market has to be sufficiently high for them to participate. HILDA provides a measure of trust in respondent's level of agreement with the statement "Generally speaking, most people can be trusted". Agreement or disagreement can be given

[18] While this is not a measure of intelligence per se, the test's predictive power for general intelligence tests is very high. The main advantage of this test compared to more direct measures of intelligence is that it is quick to administer in a survey setting.

on a scale from 1 to 7. For couples, the average response between both members is used to represent the couple's level of trust.

Third, we control for an individual's level of risk aversion when it comes to financial investment strategies. Respondents in HILDA are asked what best describes the amount of risk they are prepared to take when it comes to spare cash used to save or invest. They can then choose between the options: taking "substantial", "above-average" or "average" risks, in order to earn "substantial", "above-average" or "average" returns, or "I am not willing to take risk". We have translated these into values from 1 to 4. For couples, we take the average. Interviewees also have the option to respond that they never have spare cash to save or invest, in which case we consider the item missing.

Finally, we include a measure of five dimensions of personality: Agreeableness, conscientiousness, emotional stability, extroversion and openness to new experiences (the 'Big Five'). Respondents state how well 36 different adjectives describe them; the inventory of items was developed by Saucier (1994). Factor analysis is used to combine these items into five indicators, representing one personality dimension each. The indicators range from 1 to 7. Measures of personality are included in waves 2005, 2009 and 2013. Again, we assume that personality is fixed in the medium-term (Cobb-Clark and Schurer 2012); for each personality dimension, the average level of the corresponding indicator over all available waves is used to represent a person's personality for the entire observation period. For couples, the average indicator within each personality dimension across both couple members is used to represent the couple.