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Abstract

While it is common to use income uncertainty to explain household saving decisions, there is much disagreement about the importance of precautionary saving. This paper suggests that income uncertainty is not an important motive for saving, although households do have other precautionary reasons to save. Using a question from the Survey of Consumer Finances that asks how much households want for precautionary purposes, this paper shows that expressed household preferences, and liquid savings, are much lower than predicted by standard modeling assumptions. Households rarely list unemployment as a reason to save. Perceived income uncertainty does not affect liquid savings or precautionary preferences. Neither does being in an occupation with higher income volatility. Instead, households seem very concerned with expenditure shocks.

Keywords: Income uncertainty; precaution; buffer-stock model; household saving; consumption

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1 Introduction

Understanding how uncertainty about the future affects decisions today is central to many areas of economics. One area where uncertainty has played a large role is the complex decision of how much to save. Households that face risks that they cannot insure may want to save more now to keep from having to make painful sacrifices in the future. Such precautionary savings act as self-insurance, providing a buffer of wealth that helps protect the household. Precautionary behavior, which can arise directly from preferences or from borrowing constraints, has been a crucial component in understanding many different phenomena, and is now nearly ubiquitous in household savings and consumption models that incorporate uncertainty.[1]

It is generally assumed that the primary motivation for precautionary saving is income uncertainty. Yet that approach, despite its common use, does not have consistent empirical support. Relying on the model implication that households that face higher income risks should want to save more (Huggett, 2004), estimates of precautionary savings range from very large (Kazarosian, 1997; Carroll and Samwick, 1997, 1998) to very small (Guiso, Jappelli, and Terlizzese, 1992; Lusardi, 1998). It is difficult to find exogenous changes in household risks, since riskier occupations may attract those who care less about the risks. In addition, the unique behavior of the self-employed, who generally face higher income volatility, but also have higher observed wealth, may explain many of these differences (Hurst et al., 2010).[2]

[1] Precaution been used in explanations of such diverse phenomena as why consumption tracks income over the life-cycle (Attanasio et al., 1999; Gourinchas and Parker, 2002), the varying behavior of German households following reunification (Fuchs-Schündeln, 2008), the uses of micro-credit in Thailand (Kaboski and Townsend, 2011), or the effects of banks in India (Fulford, 2013a), and in generating inequality in models with aggregate capital (Aiyagari, 1994; Krusell and Smith, 1998). Precaution has also been invoked to understand aggregate movements in income and consumption (Carroll, Hall, and Zeldes, 1992), consumption fluctuations (Parker and Preston, 2005) and departures from the simplicities of the life-cycle model (Deaton, 1992; Hubbard, Skinner, and Zeldes, 1995; Carroll, 1997; Ludvigson and Michaelides, 2001; Attanasio and Weber, 2010) and so precaution has been central to some of the most important questions of macroeconomics (Gourinchas and Parker, 2001) and for understanding household savings behavior.

[2] A different approach popular early was to rely on estimates of the Euler equation as in Dynan (1993). These approaches relied on Taylor expansions and tended to miss higher order terms (Ludvigson and Paxson, 2001) and so were incapable of capturing the correct values even from data created from the theory (Carroll, 2001a).

Yet the only direct empirical test of whether households use savings to provide a buffer of self-insurance against income fluctuations has flatly rejected the model (Jappelli, Padula, and Pistaferri, 2008).

This paper begins with a puzzle. Since 1995 the Survey of Consumer Finances (SCF) in the United States has asked households how much they want in savings for "emergencies and other unexpected things that may come up." The median household wants only a little over a month of income in such precautionary savings and 40% of households want less than a month. The median household only barely reaches this amount in liquid savings and available credit, although many households also have additional illiquid assets.

The puzzle is that this level of precaution is much too low for models that take standard preferences and estimates of income uncertainty from survey panels or administrative data. Using parameters from several papers, I simulate the simplest version of a buffer-stock model that excludes all other reasons to save except income uncertainty. Standard parameters predict a precautionary target several times higher than households actually want and save for. The answer households give for their savings target is not a revealed preference, but if we thought that the respondents to the survey were giving unrealistic answers about their precautionary target because respondents do not take into account how hard it is to save, that suggests their answers would typically be too high, not too low.

Why do households seem far less precautionary than the models predict? The evidence in this paper suggests that the reason for the discrepancy is that households do not keep much, if any, precautionary savings because of income uncertainty. Several pieces of evidence suggest that income uncertainty is not a primary savings motive and does not drive what precautionary savings does exist. First, asking households directly why they save suggests that income uncertainty is not an important motive. While 37% of employed households give a precautionary reason for saving, when asked to list as many as six reasons, less than 3% suggest that possible unemployment is a reason to save. Instead, the predominant precautionary reasons to save are for "rainy days," unexpected needs, emergencies, and

illness. These questions are asked independently from the precautionary savings question, so it seems that respondents rarely think about income shocks and savings together. Indeed, it suggests that the reason the precautionary target is so low is that households do not include income shortfalls as "emergencies or other unexpected things" since they do not seem to see income shocks as a reason to save.

Since savings can have multiple uses and households may save for many reasons, it is useful to examine whether precaution varies with income uncertainty. The second piece of evidence is that those who say they usually know their incomes save more than those who do not usually know their income—the opposite of the model prediction. Households that say they usually know their incomes do not have a lower target either. While these results are correlations, they continues to hold even after controlling for many household characteristics including attitudes towards risk. Third, comparing across occupations as in Carroll and Samwick (1998), those in occupations with higher income volatility tend to be less precautionary, not more. Being in an occupation with higher risk does not lead to a higher precautionary savings target, nor does is it associated with higher liquid savings. Of course, there is a great deal of heterogeneity in the expressed precautionary motive and in actual savings, and it is possible that for some asset classes (Carroll, Dynan, and Krane, 2003) or some groups income uncertainty matters a great deal. Yet income uncertainty does not seem to matter on average for either the expressed preferences or the liquid assets which would be the most obvious way to self-insure for short term shocks.

The conclusion examines briefly some reasons why income uncertainty might not be matter, but it is important to note that the results do not show that income uncertainty never matters, only that it does not appear to matter given the institutions in place. Households work and save in a particular institutional environment, so the answer may not extend to other countries. Yet the Italian households studied in the Survey of Household Income and Wealth studied by Jappelli, Padula, and Pistaferri (2008), which has a question on precaution similar to the SCF, show many similarities to households in the U.S. In addition,

precautionary savings protects against unexpected increases in marginal utility. While it is common to focus on income shortfalls as the primary source of volatility in marginal utility, they need not be the only source. So it is possible for households not to care or be well insured over income shocks, yet still save small amounts for precautionary purposes against other shocks. The evidence suggests that it is expenditure shocks, such as for car repairs or health care, that matter for saving.

That income uncertainty does not appear to matter for household savings decisions, even though households do hold precautionary preferences, has important implications. First, since most households do not maintain or want funds sufficient to smooth over any but the most minor income fluctuations, a substantial fraction of households are living "hand-to-mouth" (Campbell and Mankiw, 1990) where income is concerned, even if they can smooth over other small shocks. In the bottom three income quintiles, half of households report that spending equaled income in the past year and around a third are planning for no more that a few months in advance. The consumption of such households will tend to track income over the life cycle and over the business cycle. Since households do not keep funds in case of income shortfalls and have low savings for other reasons, U.S. households are very exposed to income shocks if social insurance is not complete. That even to reach their small desired precautionary target savings most households need to rely on available credit suggests just how precarious life has become for the majority of U.S. households (Sullivan, Warren, and Westbrook, 2000). Indeed, in related work (Fulford, 2013b) I show that the bottom three income quintiles of U.S. households have larger precautionary targets but, even relying extensively on credit, do not save enough to insulate themselves from even minor shocks.

The second implication is that the marginal utility shocks that households do save for—expenditure shocks according to the surveys—are unlikely to vary over the business cycle. Precautionary preferences, however, do seem to positively vary with the business cycle or available credit, and increase robustly with age. Finally, wealth inequality generated by precautionary savings is likely to be only a small part of total inequality. Perhaps instead we

should look to more permanent sources of inequality (Huggett, Ventura, and Yaron, 2011).

2 The buffer-stock model

This section develops a standard intertemporal consumption problem, with income fluctuations and incomplete markets, and shows how the assets that households want for precautionary purposes vary with a measure of long-term income. This model is often called the "buffer-stock" model because consumers use a buffer of wealth to self-insure against shocks. It is the purest expression of precautionary savings behavior since it excludes all other reasons to save; without income fluctuations the impatient consumers would eventually consume any initial wealth away. The basic theory is well understood (Schechtman and Escudero, 1977; Deaton, 1991), and there are a number of variations and extensions (Rabault, 2002; Carroll, 2001b) to the model in different directions. The basic idea of the model is that faced with uninsurable income shocks, the consumer has to save in order to self-insure and so develops a buffer of wealth to protect against bad shocks. Sufficiently wealthy consumers feel well insured and, being impatient, draw down their savings, while those with little wealth try to build up a larger buffer. The dividing line between saving and dissaving is the "precautionary target" because, through their savings and consumption decisions, consumers are always moving towards it in expectation.

2.1 The basic model

The household faces an infinite horizon, intertemporally additive, expected utility maximization problem with exponential discounting:

$$\max_{\{C_t\}_{t=0}^{\infty}} E_0 \left[\sum_{t=0}^{\infty} \beta^t u(C_t) \right],$$

where C_t is consumption which in period t is limited by the available assets A_t, t-measurable disposable income Y_t and the borrowing constraint B_t so that: $A_t + Y_t + B_t \geq C_t$. Assets

evolve according to: $A_{t+1} = R(A_t + Y_t - C_t)$, where R is the real return on savings. The income process has a random walk component and a transitory component $Y_t = P_t U_t$ where the shock U_t is independent and identically distributed and of mean one; and $P_t = GP_{t-1}N_t$ where G is the constant growth rate, and the N_t is independent and identically distributed. In keeping with standard practice, I refer to the random walk component of income P_t as permanent income. Borrowing scales with permanent income: $B_t = bP_t$.

A solution to the problem expressed in relation to permanent income exists under fairly general conditions. It is possible to rewrite the constraints in terms of available resources at time t or "cash-at-hand:" $W_t = A_t + Y_t + B_t$ (Rabault, 2002; Aiyagari, 1994), which makes the household decision explicitly in terms of the resources it can consume today. If preferences display constant relative risk aversion $u(c) = c^{1-\gamma}/(1-\gamma)$, then it is possible to express the household problem in terms of ratios to permanent income: $c_t = C_t/P_t$ and $w_t = W_t/P_t$. As long as the household is impatient enough relative to the return on savings and the risks, a consumption function in ratios to permanent income $c_t = c(w_t)$ exists and there is an ergodic distribution of w_t.[3]

Households with high wealth eventually spend down their extra wealth; households without many resources feel insufficiently insured and try to acquire additional wealth. The dividing line w^* is where resources are neither increasing or decreasing in expectation next period. Defining $R_{t+1} = R/(GN_{t+1})$, then w^* is the fixed point of:

$$w^* = E_t[R_{t+1}(w^* - c(w^*)) + U_{t+1} - (R_{t+1} - 1)b]. \tag{1}$$

Rearranging it is the point where the line $((\bar{R}-1)(w-b) + \bar{U})/\bar{R}$ crosses the consumption function where $\bar{R} = E_t[R_{t+1}]$ is constant over time since N_{t+1} is i.i.d. Above w^*, cash-at-hand

[3]The conditions are necessary for the value function or Euler equation to be contraction mappings and to keep the w_t from growing without bound. One set of conditions in Deaton (1991) is that the household must be sufficiently impatient so that it does not want to accumulate indefinitely $\beta R E[G N_{t+1}^{-\gamma}] < 1$ and income must be bound away from zero. Carroll (2004) and Rabault (2002) examine other specifications. The relevant differences are whether the borrowing constraint will ever bind and whether the income process puts positive mass at zero income. Although this paper develops the problem when the borrowing constraint may bind occasionally, none of the precautionary target relationships depend on this choice.

will decline (in expectation) since consumption is higher than expected income; below w^*, it will tend to increase.

The ratio of available resources to permanent income changes over time for each household, but because the wealthy eventually consume down their wealth, the wealth to income ratio is ergodic and stationary. A mass of households that are identical except for their past history of shocks will form the same distribution in the cross-section as each individual household will over time. Since the consumption function is concave (Carroll and Kimball, 1996), the mean of the stationary distribution is larger than w^*. The distribution of w_t has a long right tail since the costs of having too much wealth are smaller than the costs of having too little, so households are slow to spend down extra wealth. The concavity of the consumption function implies that the the mean savings of such consumers will be larger than their target savings.

2.2 Empirical relationships and implications

For a given household i the desired precautionary target cash-at-hand is $W^*_{it} = w^*_i P_{it}$, where w^*_i is the fixed point that combines all of the risks and preferences of that household. So the target precautionary-savings-to-permanent-income ratio—which crucially includes the ability to borrow—is a function of all of the preferences, prices, and processes that drive its overall savings and consumption decisions and has an i subscript because households may face different risks and have different preferences. The size of w^*_i and what shifts it give insight into the concerns of households. The actual savings target also depends on the current realization of permanent income; households with high permanent incomes should want more savings than otherwise identical households with lower permanent incomes. The rest of this section examines how to turn these model relationships into potentially observable empirical relationships.

Target cash-at-hand to target assets. Cash-at-hand is a useful theoretical construct, but the amount carried forward period-to-period A_{it} captures something closer to savings as it

is generally defined. It is the amount people leave in wealth after they have received their income and done their consumption. Then define $a_i^* = w_i^* - \bar{U} - b_i$ as the target precautionary assets: the amount which the household wants to keep above expected income and the ability to borrow. a_i^* is the assets to permanent income ratio at which the household will consume the same amount next period as this period if it receives the mean income. Note that a_i^* is defined in relation to w_i^* not as a fixed point on its own. This is because the assets that hold w^* fixed are a function of today's shock U_t and so will vary with time. Subtracting out the ability to borrow means that a_i^* is the net position. With a large enough credit line b, it is not necessary to keep positive assets around, only some extra ability to borrow, and so the theory suggests it is possible to have a negative target for precautionary assets. How consumers think about borrowing as a precautionary asset, however, may depend on whether the ability to borrow is certain (Fulford, 2014).

Model frequency. Since household income and major expenses (such as the rent, mortgage, credit card and utility bills) often comes at a monthly frequency, the model timing is most naturally at a monthly frequency. Much of the literature on buffer-stock saving has concentrated on a yearly frequency since income is typically reported at a yearly frequency. In appendix A, I briefly examine how changing frequencies affects the decision making. It generally does not, but that result is conditional on the monthly income volatility being consistent with the yearly income volatility. A reasonably good approximation is that transitory income shocks should have twelve times the variance at a monthly level as at a yearly level since shocks from month to month tend to cancel out. Permanent income shocks accumulate from month to month and so at a monthly frequency need to have approximately one twelfth the variance at a yearly level.

Assuming iso-elastic additive preferences, different frequencies of consumption and income do not change the target assets a^*. The target cash-at-hand w^* changes substantially, but for a purely mechanical reason. At a yearly frequency of consumption and income, cash-at-hand includes all of yearly income as well as any assets left from the previous year. At a

monthly frequency, it only contains the income from the previous month.

Since a monthly frequency matches the timing of decisions and income frequency better, I present all estimates and simulation results in their relationship to monthly income. Even at a monthly frequency there is an accounting complication: in the model cash-at-hand includes all of the income from the previous month since consumption occurs only after income is realized. The target assets or actual assets are measured after all consumption has occurred. Yet the data measure savings at a moment of time (often as of the last bank statement). Savings may include some of that month's income or it may be the amount from the previous month after all consumption such as the rent or mortgage has been paid. So measured savings at any point in time may include some consumption that will occur within the month and so may be larger than the theoretical assets by as much as a month of income. How much larger depends on the household, since when in their income and bill paying cycle households respond differs.

What changes the target? The target for precautionary assets is driven by the preferences, risks, and returns of the household. a_i^* summarizes all of these into a single number for a given household. Increases in the risks of transitory income shocks tend to increase a_i^*, and so increase the accumulated assets. A large literature has focused on how different risks to income shift wealth accumulation (Carroll and Samwick, 1997; Huggett, 2004; Hurst et al., 2010; Guiso, Jappelli, and Terlizzese, 1992). Jappelli, Padula, and Pistaferri (2008) examine whether those below w^* try to save more, and those above consume more and find that they move much more slowly than the theory would predict.

While much work has focused on how income risk may affect savings, changes in other parameters affect it as well. A higher psychological discount rate β makes households more patient and so increases a^*, while a larger coefficient of relative risk aversion γ increases the costs of bad states and so increases a^*. A higher return on savings R has an opposite effect to the psychological discount, increasing the marginal utility of delaying consumption.

Less obviously, a higher growth rate lowers the precautionary target, assuming the house-

hold ever saves. I show this result in appendix B. The intuition is that growth makes tomorrow better than today, and so effectively makes the consumer more impatient and so lowers the target just like a fall in the the discount rate. While the simple model does not contain life-cycle motive, one implication is that precaution should be lower among the young who expect higher future income growth, than the old (see for, for example, Murphy and Welch (1990), for age-earnings profiles that grow quickly from age 25-40).

3 The data and descriptive statistics

This section presents descriptive statistics on the income, savings and precautionary targets of households. Since the results in this paper are based on the relationships between these variables, I present them in substantial detail and show how they vary for different groups.

The Survey of Consumer Finances is collected every three years by the Federal Reserve Board of Governors (see Federal Reserve Board of Governors (2007) for the data and the excellent survey documentation). The goal of the surveys is to get a complete view of the financial holdings of a representative sample of U.S. households. Each survey year contains about 4,000 households weighted to be nationally representative. Partly to obfuscate incomes to protect anonymity for high income earners, and partly to allow for incomplete surveys and answer ranges, the SCF is reported with multiple imputations for each household. All of the regression results and tables correctly account for the multiple imputations and for the survey weighting. Correctly weighting matters, since the surveys over-sample the wealthy.[4] The summary tables contain data from five surveys (1995, 1998, 2001, 2004, 2007, and 2010). In the regressions in the next section, I explicitly allow for changes over time by including year effects. All dollar values are converted to 2010 real dollars.

[4]See Rubin (1987) and Schafer (1997) for an explanation of multiple imputation, and Kennickell (1998) for an explanation of the multiple imputation procedure in the SCF.

3.1 Income and income volatility

Table 1 provides summary statistics for the income of U.S. households. The first column includes all households and, since it is calculated using survey weights, is nationally representative of households in the United States from 1995-2010. The second column restricts the sample to households with an employed head which make up 58% of all households.[5] The other columns show households with self-employed heads (10%), and retired heads (20%). Households with a head who is not employed make up approximately 12% of the population according to the surveys. The last two columns break the population into income quintiles and show the bottom 60% of the population and the top 40%.

The survey asks households their income in the previous year and for their "normal" income, if that is different from their actual income. Since households act on what they think is their normal income, it represents the current expectations of the household and so may be a good representation of what households think is their permanent or long-term income. The household may be learning what its income process is and what growth will look like, as in Guvenen (2007), and one natural interpretation is that "normal" income is its best guess, given past realizations, of the persistent part of income. Table 1 shows how normal income and income differ across groups.

Although the SCF is not a panel, the comparison between income and normal income is useful for understanding income volatility. The difference between normal income and actual income gives an estimate of how different the income in the past year is from what the household considers normal. Income is typically normal: normal income is equal to income for 73% of households. Moreover, the difference appears to match employment differences in income uncertainty: only 64% of self-employed households report that income is normal, while 84% of retired households do. Actual income is more likely to be a shortfall

[5]The definition of head is specific to the SCF and is used to decide who is coded first without necessarily a judgment about who is in charge. To quote the 2010 codebook: "The head is taken to be the single core individual in a PEU [Primary Economic Unit] without a core couple; in a PEU with a central couple, the head is taken to be either the male in a mixed-sex couple or the older individual in the case of a same-sex couple."

from normal income than to be too large; on average actual income is about 5% lower than normal income.

The variance of the difference between income and normal income gives a useful measure of how much perceived income variance there is. Within the model we might interpret the difference between log actual income and log normal income as the unexpected component of income ($\ln U_t$ in the model). Across households the mean log variance of non-normal income is 0.09. For employed households the variance is 0.076. This value corresponds well to standard estimates of income volatility for the employed, which generally calculate the yearly variance of (log) income in the range of 0.10, with half or more due to transitory income variance (see, for example, Carroll and Samwick (1997) or Sabelhaus and Song (2010)). The SCF also asks the respondent directly: "Do you usually have a good idea of what your (family's) next year's income will be?" and it is clear that those who do usually know their incomes have much lower non-normal income variance. The retired are particularly likely to know usually know their incomes, and have a correspondingly low variance.

In any given year about 15% of households spend more than their incomes, while 40% spent about their incomes. When spending was greater, about 40% borrowed and 41% relied on savings. While households do use savings to smooth, it is clear than credit is also of central importance. Some form of default is also important for household smoothing strategies, and much more important than any co-insurance from others. Included in default are any delay or reduction of debts, including for utilities and rent, and so it catches partial defaults and loosening of terms beyond outright default or bankruptcy.

3.2 Savings

Table 2 briefly examines household savings for comparison to the precautionary target. Wealth and financial assets have an extremely skewed distribution, with a few households holding much of the wealth. So while the mean household has 2.47 months of normal income in a checking or savings account, the median household has only half a month. Households

may use different kinds of assets to help smooth and provide returns, so table 2 shows different definitions of assets. Liquid savings include money market funds as well as checking and savings account. Financial assets also include stocks, bonds, and liquid retirement accounts. While some households, particularly the retired, have large amounts of financial assets, the median household has only 4.84 months of normal income in financial assets.

Because of the skewed distribution, most of the analysis is in logarithms. To allow for households who may not have a particular account or may have nothing saved, when taking logs each household first receives one dollar. Table 2 reports the difference in logs between the asset measures and monthly normal income. The average household holds substantially less (in log terms) than one month of income in liquid assets. Including available credit, the mean household holds only slightly more than one month's income. Including all financial assets, households do hold more than one month's income, but in log terms the mean household is not holding much more.

The SCF does not track cash. Households hold widely different amounts of cash, but the amount of cash is not necessarily large. Foster, Schuh, and Zhang (2013) report that the average cash held on person or on property was $340 (exclusive of very large holdings) in 2010, while the median is only $70 per person. 17% of the households do not report having a checking account in the SCF, however, and cash is likely to be a more important asset for smoothing for these households.

3.3 The precautionary target savings

Starting in 1995 the surveys included a question asking: "About how much do you think you (and your family) need to have in savings for emergencies and other unexpected things that may come up?" Kennickell and Lusardi (2004) argue that this question can help understand the strength of the precautionary motive and examine how many different covariates affect it. Jappelli, Padula, and Pistaferri (2008) use a similar question from the Italian SHIW.

Figure 1 shows the distribution of the precautionary target reported by households scaled

in months of normal income. 40% of all households want less than a month of normal income in "savings for emergencies and other unexpected things that may come up." Some households want substantial amounts (or have very low incomes), however, and so the distribution has a long right tail. Descriptive statistics for the precautionary target and how it relates to income and savings are shown in table 3. The median household has a precautionary target savings of 1.3 months of income. As figure 1 shows, the precautionary target is highly skewed, so the median is much smaller than the mean. For this reason, although I provide summary statistics of the levels, all of the actual analysis takes place in logarithms. For households with an employed head the the target is even lower; the median employed households wants only slightly over one month. Indeed, it is retired households which have the highest target. Yet in table 1, retired households are much more likely to know their incomes, and have a lower variance of non-normal income, and so are not the obvious group to have the highest precautionary target.

The second section of table 3 examines how the target and different measures of assets compare. Taking the logarithm, the mean household has less than its precautionary target in liquid assets, but comes close to the target including available credit (the credit card limit minus credit card debt). Using a broader definition of assets that also includes investments such as stocks, bonds, and liquid retirement accounts, the mean household has 21 months of normal income more than its precautionary target. The mean is driven by a few high wealth households, however. The median household has 2.78 months of normal income more than its target.

4 How precautionary are U.S. households?

The previous section provided descriptive evidence on the amount that U.S. households want to have for precautionary purposes and how much they actually save compared to their incomes. This section compares these amounts to the advice of financial planners and to the

predictions of the buffer-stock model using parameters from several papers. Households in the U.S. display very low precaution, much lower than the model with standard parameters predicts.

The median household in table 3 wants only 1.3 months of normal income. The median employed household wants only about a month. These preferences are low considering the advice of the financial planners who typically suggest between three and six months of income in emergency savings. For example, Suze Orman (Orman, 2006) suggests having 6-8 months of income; Dave Ramsey suggests building a $1000 emergency fund and then and building liquid savings of 3-6 months worth of expenses (Ramsey, 2010); and David Bach recommends having savings worth at least three months of expenses (Bach, 2004).[6] Even compared to the personal financial advise they are getting, American households want to save surprisingly little for precautionary purposes.

Moreover, these preferences are low compared to the predictions of much of the literature which embeds or estimates a precautionary motive. I examine the parameters from four papers (Gourinchas and Parker, 2002; Carroll, Dynan, and Krane, 2003; Storesletten, Telmer, and Yaron, 2004; Jappelli, Padula, and Pistaferri, 2008) that match reasonably closely with the simple model presented and span a larger literature which uses similar parameters. I choose these papers because they offer important contributions of their own, yet have an underlying model that matches reasonably with the basic buffer-stock model. From each paper, I take the parameters that best apply to the simplest form of the buffer-stock model. For example, for Storesletten, Telmer, and Yaron (2004) I use the income process adjusted for other possible insurance arrangements. The mapping is not always perfect since these papers examine phenomena beyond purely precautionary savings. In particular, one area the simple

[6] It is useful to quote them directly to understand the risks these financial advisors are concerned about and how these relate to the precautionary target from the SFC. "There's no way to predict when an emergency will strike, or to know how expensive it will be. But you can plan. An emergency cash fund is your best line of defense" writes Suze Orman (Orman, 2006), advocating having 6-8 months of income. Other advisers have similar suggestions. Dave Ramsey suggests building a $1000 emergency fund as step one, paying off debt as step 2, and building liquid savings of 3-6 months worth of expenses for "incidents that would have a major impact on you and your family" (Ramsey, 2010).

model does not capture is life-cycle savings. Nonetheless, it is useful to understand how well the preferences in common use match the data. The goal is not to exactly replicate the models used in each paper, but to check what "standard" parameters predict and compare that to the survey data. The results from numerically simulating the decisions of a large population with the given parameters are shown in table 4. The table shows the corresponding values from the surveys for all US households and employed households. The papers used are generally trying to understand the savings and consumption decisions of households with a working age head, and so these households provide the best comparison.

The parameters used by each paper produce a precautionary target that is substantially larger than the desired precautionary target as expressed in the survey. Even the lowest precautionary target from the lowest estimate of the coefficient of relative risk aversion in Gourinchas and Parker (2002) predicts a precautionary target 0.467 in logs higher than what employed households say they want, or nearly 60% more, and more common parameters are several times higher.[7] There appears to be a substantial disconnect between how much savings American households say they want for precautionary purposes and how much models with a precautionary motive and standard parameters suggest they should have.

The standard parameters also tend to over-predict the amount that American households keep in liquid assets and available credit, but come closer for overall financial wealth. As discussed in section 2.2, there is a model timing complication that the measured assets may be savings from month-to-month or may include some income. The simulations can create either cash-at-hand or assets. I construct the closest empirical analog to the observed data by taking the assets implied by the simulations (in months of income) and adding half a month of average income. This comparison would be exact if everyone in SCF had received their income, and spent half of what they planned to spend that month. While the difference between between log liquid assets and log income for the average employed household is 0.10,

[7]The tables report the difference in logs or equivalently the log of the ratio. Far away from zero, the difference in logs is not a good approximation for percentages. For comparison, a log difference of 0.50 is a 65% difference, while a log difference of 2 is a 640% difference. These comparisons are best made in logs, not months, since doing so allows for the large differences in normal income.

the parameters examined predict a log difference between 0.345 and nearly 2. Of course, liquid assets are not the only way people save. Including financial assets, as shown in table 2, the average employed household has a log difference between assets and income of 1.19, much closer to the model predictions.

Since one purpose of these models is to generate savings close to what households hold, it is not a surprise that they deliver substantial savings. The problem is that to deliver so much savings, the model parameters are assuming a precautionary motive that is much stronger than what households say they want. The next section examines the reason for this discrepancy.[8]

The last three columns of table 4 examine what parameters would generate the expressed precautionary preferences of employed households. Households have to either be much more impatient than is normally assumed ($\beta = 0.701$), extremely risk tolerant (CRRA $\gamma = 0.433$), or face much less income variance (transitory $\sigma_u^2 = 0.0073$ and no chance of a very low income shock). With a lower risk tolerance, the simulations also match the relationship between liquid savings and income, and liquid savings and the precautionary target of employed households Of course, some combination of these changes, or a very different model may be necessary as well.

5 Does income uncertainty matter for precaution?

While the precautionary motive expressed by U.S. households and their liquid savings is weak compared to the model predictions, there are many possible reasons for this discrepancy. This section begins by asking why households say they save, then examines what household

[8]Comparing a household's liquid assets to its precautionary target helps establish that the models parameters are predicting substantial assets by relying on a strong precautionary motive. Employed households have about 18% less in liquid assets and credit than their precautionary target. Standard model parameters predict a log difference between assets and the target approximately within this range. This suggests that the liquid assets of the households match their preferences fairly well, its just that those preferences are quite low. Note that within the buffer-stock model the mean of cash-at-hand ($\bar{w}$) in the stationary distribution should always be larger than the precautionary target (w^*). The mean of the *log* of cash-at-hand or assets need not be larger than the log target since cash-at-hand has substantial variance.

characteristics predict changes in the precautionary target and savings across households.

5.1 Survey evidence on why households save

People may save for many reasons, and accumulated assets can satisfy many motives for saving at the same time. The reasons respondents to the surveys give for saving may help understand what might be driving the difference between the model predictions and expressed preferences. The bottom half of table 5 examines reasons that households give for saving. Precaution is important, but hardly the dominant reason for saving: approximately a quarter of households list a precautionary reason for saving first, and 37% give any precautionary reason to save. Yet when households give a precautionary reason for saving, they almost never suggest unemployment. Only 2.4% of all households list reserves in case of unemployment as a reason to save when asked to list as many as six (only 15% list more than two reasons), Even conditional on listing a precautionary reason first, only 4% suggest unemployment is the reason to save. Instead, over 80% of households with a precautionary reason for saving are worried about emergencies, "rainy days" or other unexpected needs. The respondent may interpret the question as why the household is actively saving—increasing the amount of wealth it holds—rather than as why it keeps that wealth around rather than consuming it. Even under that interpretation, very few households are actively accumulating in case of unemployment. The implication is that they are satisfied with the level of protection against unemployment their current savings or other sources of insurance offer. It does not seem that many households view income shortfalls from unemployment as an important motive for their savings.

5.2 Income uncertainty and the precautionary target

Descriptive evidence. While households do not list unemployment as an important reason for saving, other income shocks may still be important. Table 3 shows how the precautionary target varies with whether or not the household usually knows its income. For comparison,

table 3 also shows how the target varies with other household characteristics that might affect the target. Whether a household usually knows its income is a subjective assessment. Yet table 1 shows that households who do not usually know their incomes have double the variance of the difference between their income and normal income. These households are much more likely to have income they view as non-normal, and difference from their normal incomes are larger. Moreover, it is the *perceived* income uncertainty that matters for household decisions, not the actual uncertainty.

Do households that perceive their income as being more uncertain want more precautionary savings? No. In fact, households that say they usually know their income want slightly more in savings, although this difference is driven largely by the retired. Households who usually know their income and have an employed head do want slightly less in savings.

Other characteristics do display differences in ways one might expect from the model, so the precautionary target is not purely noise. Households that list some precautionary reason to save do have a higher precautionary target, even though that precautionary reason almost never includes unemployment. Households that are willing to borrow to smooth over shocks have a lower target. Households that are willing to take on more risk also have a lower target.

Estimation evidence. The descriptive statistics in table 3 can only allow one characteristic to vary at a time and do not test for statistical differences. It is possible that other household characteristics vary in ways that are strongly correlated with perceived income uncertainty and with the precautionary target. Table 6 includes additional household demographic, income, preference, and occupational variables. The first column includes only year effects and whether the household usually knows its income. It is therefore the regression equivalent of the mean comparison in table 3 and suggests nearly the same effect: those households that usually know their incomes want slightly more in precautionary savings, although the difference is not significant. Including demographic variables as in the second column, those who usually know their income have a lower precautionary target.

The difference is statistically significant, but given the low mean precautionary target, and the large difference in non-normal income variance between those who usually know their incomes and those who do not, it is a very small effect. Moreover, it is not robust: adding employment, income, and health insurance variables leave it insignificant and with a point estimate nearly zero. Adding household views on savings, risk, and credit (column four with the coefficients displayed on the second page), or occupation, conditional on being employed (column five), does not change the conclusion that the target precautionary savings are not generally correlated with perceived income uncertainty.

One should be careful about interpreting the coefficient as anything beyond correlations: usually knowing your income could be correlated with unobserved household characteristics which are also related to the target. For such factors to cause the estimated coefficient to be zero, instead of the large negative effect suggested by the model, they would need to be positively correlated with the target, and positively correlated with the usually knowing next year's income (alternatively negatively correlated with both). One possibility is attitudes towards risk. Households that are more tolerant of risk may take jobs that have more income uncertainty, and may have a lower precautionary target. Yet controlling for self-employment status or occupations, which have very different amounts of income volatility, still leaves the coefficient nearly zero. So does including whether the household is willing to take financial risks, or whether it is planning long into the future and so is potentially more patient.

Other variables are significant both economically and statistically. Different attitudes towards risk change the target, as does age, employment status, the number of children, and the level, but not the uncertainty, of income. I discuss the other correlates of precaution in the next section, but it is important to point out that the precautionary target is not pure noise, with no relationship to other household characteristics.

Whether a household normally knows its income captures important elements of income uncertainty. While it is binary and self-reported, it is perceived income uncertainty that should drive precaution. Moreover, any self-selection in reporting—those who care more

about income uncertainty report having higher income uncertainty—should work towards finding a larger effect of knowing your income. In addition, table 1 shows that calculating the variance of log non-normal income (log income-log normal income), those households that do not usually know their income have much higher variance at all income levels. That such large differences in income uncertainty do not cause large changes in precaution suggests that income uncertainty is not an important factor in the precautionary target.

Evidence from other surveys further supports the conclusion that income uncertainty is not an important factor in determining the precautionary target, so these results are not just from the SCF. Brobeck (2008) describes a survey of the emergency savings of low and moderate income households and finds few differences in the unreliability of income between those with high emergency savings and those with low savings.

5.3 Income uncertainty and savings

The precautionary target is not a revealed preference, so it is useful to see whether households with more perceived income uncertainty actually save more. Within the simple buffer-stock model in section 2, there is a tight link between the expressed target assets and the average savings. Of course, the model leaves out many other reasons for saving and does not include any portfolio decisions which may trade off liquidity with return. Table 7 shows regression estimates using two measures of savings which could reasonably be interpreted as being for precautionary purposes: (1) liquid assets, which are the totals in checking, savings, and money market accounts plus available credit card credit (the credit limit minus credit debt); and (2) financial assets, which are liquid assets plus any stocks, bonds, and liquid retirement accounts. Each column in table 7 corresponds to adding the same variables as in table 6: the first column includes only perceived income uncertainty and year effects, the second adds demographic variables, the third adds income, employment, and health insurance, the fourth adds attitudes to savings and investment, the fifth includes occupations for households with an employed head.

Households who report that they usually know their incomes hold more of both type of assets relative to their incomes, not less. They also report holding more savings relative to their target. Since according to the model, the log precautionary target should just be a linear function of log permanent income (see Fulford (2013b) for an examination of this prediction), it is not a surprise that the two sets of regressions are nearly the same. Households may hold other less illiquid assets which could be used to smooth over some shocks (Carroll, Dynan, and Krane, 2003), yet there is no evidence that households which perceive their incomes as uncertain save more in the type of asset that would be the most useful for such smoothing. Indeed, a portfolio approach might suggest that the only reason to have such low return assets when higher return, but less liquid assets, are available would be for smoothing.

The relationship between savings and income, or savings and the target is complicated by current shocks. If a household has just suffered a negative income shock, it may perceive its income as being particularly uncertain just as it is using its savings to smooth over the shock. On the other hand, a positive income shock would increase savings at the same time that perceived income uncertainty increases. Negative shocks may have greater salience, however, suggesting that there may be an negative correlation between having low savings and perceiving income as being uncertain, perhaps explaining the positive coefficients. The last row of table 7 restricts the sample only to those households who report that their income in the last year was their normal income. By their own account, such households have not suffered a shock in the past year, yet may still view their incomes as uncertain. While the coefficients are all somewhat smaller, they are are all still large and positive. Even for those who have not suffered a shock over the past year, those who perceive their incomes as more certain have more savings compared to their incomes, not less.

5.4 Occupation, savings, and the precautionary target

One source of variation in income uncertainty is the industry or occupation of the household since some occupations have much higher volatility than others. The last column of table 6 allows the precautionary target to shift with occupation (the coefficients are on the second page). Figure 2 plots these coefficients against the transitory variance as estimated by Carroll and Samwick (1997) from the PSID.[9] Using the Carroll and Samwick (1997) estimates of permanent and transitory variances, I also simulate how much each occupation would want as its precautionary target compared to the Professional, Technical and Managerial occupation which is the base case in the regressions. With the parameter assumptions Farmers and Farm Laborers would not have a stationary distribution; their permanent income variance is so high that a psychological discount of 0.95 is not sufficient to keep even very wealthy households from wanting to save more. Deaton (1991) provides a useful formula for checking stationarity with log normal income processes.

The coefficients from the regression shown in figure 2 demonstrate that income uncertainty from different occupations is not a driving force of reported precautionary preferences. Moving from an occupation with lower transitory income variance to an occupation with higher variance tends to reduce the precautionary target, exactly the opposite of the model prediction. The simulations from the precautionary model, however, have a clear upward trend. The simulated targets do not increase monotonically with transitory variance because the variance of the random walk component is also changing.

The second panel of figure 2 shows the coefficients on occupation from the relationship

[9]The occupations from Carroll and Samwick (1997) and the PSID do not match exactly with the SCF occupational categories, but I use the category that corresponds most closely. Using different associations does not change the overall conclusions. Carroll and Samwick (1997) separately report Professional and Technical, and Managers (not self-employed) and I use their Professional and Technical in the graph. Managers (not self-employed) have a permanent variance of 0.018 and transitory of 0.0357, slightly higher than the Professional and Technical with transitory variance of 0.0331. The SCF reports Operators and a separate category for Laborers and Craftsmen, while Carroll and Samwick (1997) report categories for Operators and Laborers, and Craftsmen. I associate Operators in the SCF with Operators and Laborers, and Laborers and Craftsmen in the SCF with Craftsmen. While the permanent variance of these occupations is very different and is responsible for the differences from simulations (0.0299 for Operatives and Laborers, 0.0175 for Craftsmen), the transitory variance is close.

between liquid assets and income that come from the regression in the fifth column of the second row in table 7. The simulated coefficients show the average savings corresponding to the transitory variances. The simulated savings increase with transitory variance, again with some variation because of different permanent variances for different occupations. Actual savings do not.

The evidence in 2 suggests that, for the employed, neither the expressed preference of the precautionary target, nor the revealed preference of actual savings, are positively correlated with changing the variance of income of different occupations. It is again important to point out that it is difficult to make a causal conclusion from these relationships, although including other household attitudes does not change these results. Households may self-select into risky occupations so that those with lower precaution are in more risky occupations, for example. Yet if this self-selection is the case, income uncertainty is still unimportant for savings, since only those who do not care about income uncertainty need to face any.

6 What does matter for precaution?

While the previous sections have suggested that income uncertainty seems to play little or no role in precaution, other household characteristics are important. This section briefly examines what is correlated with with the precautionary target to understand what does appear to influence precaution. Table 6 shows how many household characteristics are related to the precautionary target, while table 3 shows comparative means. While these results are correlations, they do help understand what factors do worry U.S. households. The results suggest that households do attempt to smooth over unexpected expenditure shocks, and so, even if income uncertainty is unimportant, other shocks to marginal utility do matter.

Having more children increases the target substantially. Children are financial dependents and so increasing the number of children does not affect income uncertainty directly. More

people in the household does increase the likelihood of other shocks such as medical bills or school expenses, however, and so is consistent with the household smoothing over shocks other than income.

Compared to not having a spouse or partner in the household, having a not-employed spouse increases the target, while an employed spouse decreases it. Like having additional children, having an additional non-earning person in the household exposes the household to an additional source of non-income shocks. On the other hand, an employed spouse exposes the household to additional income shocks, so these relationships are again inconsistent with income uncertainty being a primary motive for precaution. Two independent incomes added together will typically have a larger variance. However, they may have a smaller chance of a zero or very low income shock with high marginal utility, and so the theoretical effect of having a two income household on income volatility driven precautionary savings is ambiguous. Households with a not-employed spouse have an additional source of insurance—the other spouse going to work—to smooth over income shortfalls. Having both spouses working thus tends to expose the household to additional income risk. Indeed, this "two income trap" has received some attention among those concerned with an increasingly precarious middle-class (Warren and Tyagi, 2004).

The employment status of the head also plays a significant role. Those who are retired want around 30% more than employed and not-employed households, which do not seem to be significantly different. By their own account, the retired face very low income uncertainty (see table 1) and so by themselves suggest a problem with viewing income uncertainty as what drives precaution. The self-employed also have a higher precautionary target.

Increasing income tends to decrease the precautionary target, although the effect is non-linear for employed households. Fulford (2013b) examines this phenomenon and suggests it is because households become increasingly exposed to shocks such as fines and fees that do not scale with income. Then as income declines, the precautionary target to income ratio increases, since a small fine for a traffic violation, for example, which might be a minor

annoyance to a high-income or wealthy household, is a major hardship for a low-income household.

Having health insurance seems to play a relatively minor role. Having insurance is correlated with income, and higher deductibles may mean that those with lower incomes are exposed to more shocks even with health insurance.

Age has a large positive effect. After the first column, all estimates in table 6 include an age quadratic. Over the age range 25 to 75 the increase in precaution by age is nearly linear. Figure 3 shows the estimated age effects from column 3. The quadratic is significant, but adds almost no curvature for reasonable ages. Adding additional age polynomial terms does not change these results. At age 50, adding a year to the household head's age increase the precautionary target by almost 1%.

The basic buffer-stock model predicts such an increase. Even without an explicit life-cycle model, the higher expected income growth of the young should make them less precautionary as shown in appendix B. While the model offers a simple explanation that income growth is slowing, it seems that there must be more to the story. First, the relationship between age and the precautionary target is approximately linear, yet income growth for most education groups has largely ended by age 50 in the US. Age-income profiles in the SCF shows a similar pattern to other work which examines age and experience in the cross-section (Murphy and Welch, 1990). While income may may fall slightly among some education groups, after approximately age 50 it is mostly constant. This pattern suggests that while income growth might explains the increase in the precautionary motive with age up until age 50, it cannot explain the increase after age 50. Second, different education groups have different life-cycle income profiles, yet they have the same rate of growth in precaution. Education has a level effect on precaution—the college educated have a 20% larger target than those with high-school degrees or those who did not go to high school—but the growth rate of precaution with age does not vary with education. It is clear that an assumption of constant precaution or constant risks over the life-cycle is problematic.

Between 1995 and 2007, US households became progressively less precautionary as shown in the second panel of figure 3. After the financial crisis of 2008, however, there was a large upturn in the target precautionary assets. One explanation for the change may be that credit, which was consistently more available between 1995 and 2007, became much harder to obtain after that (Fulford, 2014).

7 Conclusion

The expressed precautionary preferences and actual liquid savings of U.S. households are surprisingly low compared to the predictions of standard models that assume that households try to smooth over income shocks. The evidence suggests that the reason for the discrepancy is that households do not have a precautionary motive to save against shocks in income. They do not list unemployment as a reason for saving, even while they list other precautionary motives. More perceived income uncertainty is not associated with a higher precautionary target or with higher savings. Households whose head is in an occupation that displays higher income volatility do not have a higher precautionary target or higher savings. Given the recent findings that precautionary savings are low and households do not seem to buffer in ways predicted by the model assuming income uncertainty (Jappelli, Padula, and Pistaferri, 2008), the results in this paper suggest that we should no longer assume that income uncertainty is a major reason for saving.

Why does income uncertainty not seem to matter? I consider briefly several possibilities for why income uncertainty is not important: social insurance, a miss-specified or error filled income process, and the ability to smooth on other margins. Each reason for the limited importance of income uncertainty can help explain some aspects, but leaves others unexplained. Households work and save in a particular institutional environment, so the answer may not extend to other countries. Yet the Italian households in the Survey of Household Income and Wealth, which has a question on precaution similar to the SCF, show

many similarities to households in the U.S., including very low precaution.

One possibility is that households feel well insured by unemployment or more informal social insurance. The self-employed who, by their own account, face higher risks, and are often excluded from unemployment benefits, do have higher precaution given their incomes, but so do the retired, who face very low income uncertainty by their own account (table 1). Younger households are typically less well covered since unemployment insurance is often based on work history, yet precaution is increasing with age rather than decreasing. Moreover, even for employed households, there seems to be plenty of uninsured income variance since income includes unemployment compensation. It is possible that informal social insurance may play a large role. Social insurance may explain the low precaution of the young, for example, who may be able to depend on parents. Yet households rarely use help from friends or family (see table 1), and including a question from the SCF about whether the household can borrow $3,000 from friends or family does not shift the precautionary target much.

Perhaps the extent or uncertainty of income variance is not measured correctly. There has been much recent work reexamining the income process that households face and it may be that households face lower uncertainty than was previously thought. One possibility is that a substantial portion of what looks like temporary shocks are actually expected or due to measurement error and so, as suggested by Guvenen and Smith (2010), households may face far less uninsurable income risk than is commonly assumed. Yet households report that the variance of the difference between their actual income and their "normal" income (table 1) is about the same as the total income variance calculated from the PSID by Carroll and Samwick (1997). In addition, 28% of all households say they do not usually know their income for the next year. So it seems that at least some households do face substantial uncertainty in their incomes. Alternatively, much of what looks like temporary income shocks may actually be permanent, at least from the household perspective. Households that view income shocks like involuntary unemployment as large and permanent may simply

expect to adjust their lifestyles, even as they keep cash and credit around for smaller things like car repairs. Yet not all changes in income are permanent, and it seems that households could save more to smooth over at least some shocks.

Finally, households may be able to better smooth marginal utility by sending additional household members to work, working longer hours, or retiring later. Such smoothing is also a form of self-insurance, but does not take place through savings and so can leave precautionary savings low and only used for the very short-term or non-income shocks. Swanson (2012) demonstrates that the additional margin of adjustment can dramatically reduce risk aversion for income shocks. It is not clear, however, that many employed have the ability to adjust their hours in the short term, and the self-employed, who might be able to adjust, are more precautionary, not less. There is also no obvious pattern across occupations that may be able to adjust more in figure 2. Having a not-employed spouse in the household does not decrease precaution compared to a single adult household. An employed spouse does decrease precaution, but being already employed limits the ability to adjust by sending additional members to work. Perhaps of greater concern, if the income shock comes from unemployment, that removes the option to work longer just as income declines, and so does not seem to be a good way to smooth marginal utility.

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A Smoothing frequency and precaution

This appendix examines how changing the frequency of consumption and income changes the precautionary target in the basic model. In particular, it examines the assumptions necessary to keep risks and preferences comparable. Some preferences have a clear frequency relationship: if ν is the frequency of consumption and income periods per year, then $\beta_\nu = \beta^{1/\nu}$ so that the household discounts a year ahead in the same way. For example, $\nu = 12$ might be monthly decision making to match the timing of monthly paychecks and rent, mortgage payments, or credit cards. Growth and interest rates at a ν frequency behave the same way as the discount rate.

Comparing income volatility requires additional care. The sum of the shocks at a ν frequency should add up to the income at a yearly frequency. Then it should not matter whether we measure 12 monthly incomes or a total yearly income, they should produce the same variance at a yearly level. What is the relationship between the income process at a ν and yearly level? Let each of the ν transitory shocks have variance $\sigma^2_{\nu,u}$ and the permanent shocks a variance$\sigma^2_{\nu,n}$, and income is realized ν times a year: $Y_{i,t}$ for $i = 1$ to ν. Then $Y_t = \sum_{i=1}^{\nu} Y_{i,t} = P_{\nu,t-1}N_{1,t}U_{1,t} + P_{\nu,t-1}N_{1,t} * N_{2,t}U_{2,t} + \ldots + U_{\nu,t}P_{\nu,t-1}\Pi_{i=1}^{\nu}N_{i,t}$. So the yearly income is the sum of ν transitory shocks, and the accumulated product of ν permanent shocks.

Even if each of the ν shocks is log normal, Y_t will not be. But if we were to approximate a log normal income process at a ν frequency with a log normal yearly income process, the transitory components will tend to cancel and so the ν process will need to have a transitory variance approximately ν times as large to produce the same yearly variance. The permanent components accumulate, however, so the permanent variance at a ν level will need to be approximately $1/\nu$ as large.

This approximation turn out to be very accurate. In table 8, I report the underlying variances that would result in an econometrician finding a yearly transitory variance of 0.044 and a permanent variance of 0.022 if she were to only observe yearly income and use the method of moments approach of Carroll and Samwick (1997) to estimate the permanent and transitory components. The underlying "true" variances are always very close to the the variance from the simple divisions.

In practice, moving from a yearly to a more frequent income and consumption process appears to have little affect on precautionary behavior. Table 8 shows the simulated target for a range for frequencies. The assets a^*that households target does not change much as the frequency changes. Since w^*must contain all the amount passed from period to period, and all of the consumption over the period, it is both larger than a^*, and declines with ν for purely mechanical reasons.

B Growth and the precautionary target

This section examines how growth rates affects the consumer's precautionary target. Consumption is the (functional) solution to the Euler equation:

$$u'(c) = \max\{u'(w), E_t[\beta R(GN_{t+1})^{-\gamma}u'(c)]\}.$$

Consumption is a function of the available resources and growth $c(w; G)$. Note that the consumption in the next period depends on future growth, and so the entire growth path matters. If G is larger, then in expectation marginal utility next period is lower and so consumption this period increases if it is unconstrained. Higher income growth makes the future relatively better, and so one should consume more now to smooth.

The precautionary target is the fixed point solution in equation 1. Then consider a change from lower growth to higher growth $G' > G$. For all w, $c(w; G') \geq c(w; G)$ and the relationship is strict if $c(w, G) < w$ so the consumer is not just consuming all available resources. A change in G also affects the fixed point w^*. Higher G lowers the effective interest rate because a given wealth to permanent income ratio today will be smaller tomorrow since permanent income has growth. Rearranging the fixed point problem and taking expectations defining $\tilde{R} = E_t[R/N_{t+1}]$ and $\bar{U} = E_t[U_{t+1}]$ gives: $c(w^*; G) = (1 - G/\tilde{R})(w^* - b) + (G/\tilde{R})\bar{U}$. Without loss of generality, set $b = 0$. While higher growth increases consumption, the right hands side both increases in intercept and decreases in slope, so it is not immediately clear whether w^* goes up or down. For any G, however, the right hand side equals one when $w^* = \bar{U}$. So for w^* higher than $\bar{U}$, the right hand side is lower if G is higher. For all w, $c(w; G) \leq w$, and if the solution to the fixed point is $c(w^*; G) = w^*$ then $w^* = \bar{U}$. Then the minimum possible fixed point is $\bar{U}$. When $w^* > \bar{U}$, an increase in G means that the right hand side falls and the left hand side rises, and so w^* must fall.

Table 1: Household income, normal income, and income volatility

Group		Emp-	Self-		Income Quintile	
	All	loyed	Emp.	Retired	I-III	IV-V
Fraction of population	1.00	0.58	0.10	0.20	0.60	0.40
Income (1000 $2010)	78.2	79.9	159.7	58.4	30.9	149.7
Normal income (1000 $2010)	77.6	78.9	158.6	56.0	31.9	146.8
Fraction inc. = norm. inc.	0.73	0.73	0.64	0.85	0.74	0.73
Log inc.-Log norm. inc.	-0.05	-0.04	-0.09	-0.01	-0.06	-0.05
Variance of log income - log normal income						
All	0.090	0.076	0.144	0.054	0.097	0.079
Usually know income	0.067	0.058	0.115	0.045	0.068	0.065
Don't usually know	0.143	0.121	0.182	0.094	0.148	0.129
Fraction usually know income	0.71	0.72	0.57	0.82	0.65	0.80
Over the past year did spending exceed income?						
Spending greater	0.15	0.14	0.14	0.13	0.18	0.11
Equal	0.40	0.40	0.35	0.39	0.47	0.30
Income greater	0.44	0.46	0.51	0.48	0.35	0.59
If spending greater than income, how did you deal with shortfall?						
Borrowed money	0.40	0.45	0.48	0.17	0.40	0.39
From savings	0.41	0.36	0.39	0.67	0.37	0.51
Some form of default	0.13	0.15	0.09	0.10	0.15	0.08
Help from others	0.06	0.05	0.03	0.06	0.08	0.01
Households in surveys	28,465	14,195	6,521	4,933	13,020	15,393

Notes: The variance of log income - log normal income excludes households with abs(log income - log normal income)>2 which reduces the sample by around 100 households and reduces the variance. The mean of log income - log normal income is unaffected, but the variance of the lowest quintiles is sensitive to the inclusion of these households. "Some form of default" includes partial default (getting behind on payments, not paying bills, doing nothing) as well as bankruptcy. Quintiles divisions are calculated using the pooled surveys, rather than the quintiles in each year. The results are not sensitive to alternative definitions. Employment divisions are based on the household head. Source: The pooled Survey of Consumer Finances from 1995, 1998, 2001, 2004, 2007, and 2010. All calculations are survey weighted. All dollar values adjusted to real 2010 dollars.

Table 2: Household savings

Group	All	Emp-loyed	Self-Emp.	Retired	Income Quintile I-III	Income Quintile IV-V
Fraction of population	1.000	0.582	0.105	0.196	0.602	0.398
Checking +savings (months inc.)	2.47	1.61	2.15	5.88	2.87	1.87
median	0.53	0.47	0.66	1.23	0.42	0.68
Liquid assets (months inc.)	3.84	2.27	4.18	9.32	4.07	3.49
median	0.70	0.60	0.99	2.08	0.49	1.06
Financial wealth (months inc.)	27.25	17.25	28.20	65.04	26.40	28.54
median	4.84	4.30	6.91	16.47	1.99	10.98
Available credit (months inc.)	3.02	2.61	3.16	4.77	3.30	2.59
median	0.80	0.76	1.24	1.97	0.05	1.51
Log (liq. assets)/(monthly inc.)	-0.84	-1.02	-0.34	0.43	-1.37	-0.03
Log (fin. wealth)/(monthly inc.)	0.90	0.81	1.41	2.21	0.09	2.14
Log (liq. assets+credit)/(monthly inc.)	0.03	-0.10	0.57	1.29	-0.56	0.94
Log (fin. wealth+credit)/(monthly inc.)	1.27	1.19	1.77	2.56	0.52	2.42
Have checking account?	0.83	0.85	0.87	0.87	0.78	0.92
Have savings account?	0.49	0.55	0.46	0.41	0.41	0.60
Have stocks/bonds/liq. Retirement act.	0.71	0.75	0.76	0.74	0.58	0.90
Have credit card?	0.69	0.72	0.79	0.72	0.55	0.90
Households in surveys	28,465	14,195	6,521	4,933	13,020	15,393

Notes: Having a savings or checking account is having an account with a non-zero balance (very few accounts have zero balances). When taking logs, all households get $1 in the asset class. Monthly income is normal income divided by 12. Source: The pooled Survey of Consumer Finances from 1995, 1998, 2001, 2004, 2007, and 2010. All calculations are survey weighted. All dollar values adjusted to real 2010 dollars.

Table 3: The precautionary target

Group	All	Emp-loyed	Self-Emp.	Retired	Income Quintile I-III	Income Quintile IV-V
The precautionary target and normal income						
Mean target months of norm. income	3.41	2.28	3.44	6.52	4.05	2.457
median	1.33	1.05	1.57	2.92	1.55	1.108
Precautionary target (1000 $2010s)	25.79	17.36	53.35	41.34	14.92	42.18
median	5.88	5.24	11.51	10.00	4.00	10.48
Log (target / monthly normal income)	0.391	0.085	0.522	1.158	0.538	0.168
median	0.306	0.059	0.465	1.123	0.456	0.115
Implied monthly target ratio	1.48	1.09	1.69	3.18	1.71	1.18
Log (target) / (monthly income) by whether usually know next year's income						
Usually know	0.399	0.069	0.518	1.175	0.585	0.170
Don't usually know	0.373	0.127	0.528	1.084	0.453	0.161
Log (target / monthly income) by whether list any precautionary reason to save						
Precautionary reason	0.491	0.160	0.639	1.218	0.647	0.229
No precautionary reason	0.329	0.041	0.459	1.111	0.467	0.134
Log (target / monthly income) by willing to borrow to cover expenses when income cut						
Willing borrow	0.288	0.018	0.484	1.194	0.414	0.081
Not willing borrow	0.486	0.157	0.558	1.141	0.659	0.242
Log (target / monthly income) by willingness to take financial risk to get higher return						
Some risk	0.343	0.173	0.325	0.501	0.409	0.242
No risk	0.457	0.077	0.500	1.123	0.556	0.059
The precautionary target and savings						
Log (checking + savings)-log target	-1.70	-1.48	-1.62	-1.45	-2.22	-0.91
Log (liquid assets)-Log target	-1.23	-1.10	-0.86	-0.71	-1.90	-0.21
Log (financial wealth)-log target	0.52	0.73	0.89	1.07	-0.43	1.95
Log (liquid+credit)-log target	-0.35	-0.18	0.04	0.15	-1.09	0.75
Log (financial+credit)-log target	0.88	1.10	1.25	1.42	-0.01	2.23
Liquid assets -target (months inc.)	-2.50	-1.07	-1.32	-4.12	-4.31	0.23
median	-0.31	-0.23	-0.29	-0.35	-0.58	0.02
Financial assets -target (months inc.)	20.93	13.95	22.74	51.78	18.13	25.17
median	2.78	2.68	4.41	11.24	0.35	9.31
Liq. assets+ credit -target (months inc.)	0.51	1.54	1.81	0.69	-0.99	2.79
median	0.52	0.57	1.02	1.87	-0.12	1.74
Fin. wealth + credit -target (months inc.)	23.94	16.56	25.85	56.59	21.44	27.73
median	5.11	4.68	7.58	15.95	1.63	12.04

Notes: When taking logs, all households get $1 in the asset class. Monthly income is normal income divided by 12. Source: The pooled Survey of Consumer Finances from 1995, 1998, 2001, 2004, 2007, and 2010. All calculations are survey weighted. All dollar values adjusted to real 2010 dollars.

Table 4: Comparison of precautionary model predictions to the preferences of US households

	Paper or population								
	All U.S.	Employed	STY (2004)	CDK (2003)	JPP (2008)	GP (2002)	Match with discount	Match with CRRA	Match with inc. vol.
log (precautionary target / permanent income)	0.391	0.085	2.033	1.409	1.230	0.552	0.085	0.085	0.085
Median precautionary target to income ratio (months)	1.33	1.05	7.637	4.091	3.420	1.737	1.089	1.089	1.089
log (liquid assets + credit / permanent income)	0.03	-0.10	1.957	1.399		0.345	0.144	-0.120	-0.011
log (liquid assets + credit / precautionary target)	-0.35	-0.18	-0.076	-0.010		-0.207	0.059	-0.205	-0.096
Parameters:									
CRRA γ			2.0000	2.0000		0.5140	2.0000	0.4331	2.0000
Discount β			0.9620	0.9700		0.9598	0.7011	0.9600	0.9600
Interest rate R			1.0400	1.0300		1.0340	1.0300	1.0300	1.0300
Growth rate G			1.0150	1.0300		1.0197	1.0200	1.0200	1.0200
Transitory σ_U^2			0.0500	0.0100		0.0440	0.0440	0.0440	0.0073
Permanent σ_N^2			0.0129	0.0100		0.0212	0.0212	0.0212	0.0212
Probability low income p_l			0.0000	0.0200		0.0030	0.0030	0.0030	0.0000
Low-income				0.0100		0.0100	0.0100	0.0100	

Notes: STY (2004): Storesletten, Telmer, and Yaron (2004); CDK (2003): Carroll, Dynan, and Krane (2003); JPP (2008): Jappelli, Padula, and Pistaferri (2008); GP (2002): Gourinchas and Parker (2002). For JPP, the target wealth is from their figure 1 using their base parameters. Given the preferences and income process each column calculates the precautionary target and the mean of the distribution of assets implied by those preferences and income at a monthly frequency. When there is a probability of low income, it occurs with with probability p_L and the household receives the low income as a fraction of its permanent income. Otherwise the transitory shock is approximated with a 5 point Gaussian quadrature of a lognormal with mean 1 and variance parameter σ_U^2; and the random walk component has variance parameter σ_N^2 and the mean of $\ln N_{t+1} = 0$. The All US, and Employed columns are copied from tables 2 and 3 for easy comparison.

Table 5: Reasons for saving

Group	All	Emp-loyed	Self-Emp.	Retired	Income Quintile I-III	Income Quintile IV-V
What are your most important reasons for saving? (First reason given)						
Education and bequests	0.14	0.16	0.15	0.07	0.14	0.15
Expected expenses	0.15	0.15	0.10	0.17	0.20	0.09
Investment	0.02	0.02	0.03	0.03	0.03	0.02
Retirement/old age	0.31	0.34	0.39	0.23	0.21	0.45
Precaution/liquidity	0.26	0.24	0.23	0.35	0.29	0.22
Vague: No reason, "For the future"	0.11	0.09	0.10	0.15	0.13	0.08
Frac. more than one reason to save	0.46	0.52	0.45	0.35	0.41	0.54
Frac. more than two reasons	0.15	0.18	0.14	0.08	0.13	0.18
Frac. with unemployment reason	0.024	0.033	0.021	0.005	0.024	0.023
Frac. with precautionary reason	0.38	0.37	0.35	0.44	0.40	0.36
Conditional on listing a precautionary reason to save first, which reason:						
Reserves in case of unemployment	0.04	0.07	0.05	0.01	0.04	0.05
In case of illness; medical/dental expenses	0.09	0.05	0.07	0.16	0.11	0.06
Emergencies; "rainy days"; unexpected needs	0.81	0.83	0.82	0.74	0.79	0.83
Wise/prudent thing to do	0.02	0.01	0.02	0.04	0.02	0.02
To have cash available/on hand Liquidity	0.04	0.03	0.04	0.05	0.03	0.04
Willingness to take financial risks to get higher returns?						
Substantial risk	0.04	0.04	0.07	0.01	0.03	0.05
Above average	0.16	0.19	0.21	0.07	0.10	0.25
Average	0.38	0.41	0.44	0.32	0.30	0.48
Not willing to take risk	0.43	0.36	0.28	0.59	0.57	0.22
Households in surveys	28,465	14,195	6,521	4,933	13,020	15,393

Notes: The survey asks households to list reasons to save and records up to six from 35 possible responses. These answers are combined into the six broad categories in the first section of the table for the first reason given for saving. The "fraction with unemployment reason" and "fraction with precautionary reason" are the fraction of households who list unemployment or precaution as a reason to save among all six possible reasons, not just the first reason. Source: The pooled Survey of Consumer Finances from 1995, 1998, 2001, 2004, 2007, and 2010.

Table 6: The precautionary target and other observables

	Log precautionary target-log normal income				
	[1]	[2]	[3]	[4]	[5]
Usually know next year's	0.0310	-0.120***	-0.00603	-0.0203	-0.0156
income? (Yes=1)	(0.0233)	(0.0232)	(0.0229)	(0.0228)	(0.0274)
High School		0.0255	0.230***	0.202***	0.0832*
		(0.0337)	(0.0341)	(0.0340)	(0.0448)
College		0.200***	0.545***	0.482***	0.332***
		(0.0345)	(0.0373)	(0.0373)	(0.0506)
Race: Black		0.0393	-0.0882***	-0.0586*	-0.0486
		(0.0318)	(0.0308)	(0.0309)	(0.0358)
Race: Hispanic		0.104***	0.0499	0.0956***	0.0842**
		(0.0352)	(0.0345)	(0.0346)	(0.0393)
Race: Other		0.184***	0.146***	0.166***	0.292***
		(0.0531)	(0.0522)	(0.0523)	(0.0631)
Number of kids		1.203***	0.910***	0.957***	1.046***
		(0.0338)	(0.0422)	(0.0422)	(0.0729)
Age		0.515***	-0.433***	-0.341***	-0.296
		(0.0875)	(0.0979)	(0.0982)	(0.184)
Age^2		-0.0574***	-0.0313***	-0.0244***	-0.0315***
		(0.00840)	(0.00829)	(0.00825)	(0.00985)
Employed			-0.0481	-0.0687**	
			(0.0343)	(0.0340)	
Self-Employed			0.265***	0.241***	
			(0.0420)	(0.0417)	
Retired			0.323***	0.299***	
			(0.0483)	(0.0480)	
Not-Employed Spouse			0.140***	0.135***	0.0744**
			(0.0279)	(0.0277)	(0.0350)
Employed Spouse			-0.0719***	-0.0808***	-0.0768***
			(0.0243)	(0.0242)	(0.0291)
Self-Employed Spouse			0.199***	0.182***	0.147**
			(0.0439)	(0.0439)	(0.0589)
Log normal income			-1.695***	-1.676***	-2.117***
			(0.0891)	(0.0874)	(0.131)
Log normal $income^2$			0.0817***	0.0779***	0.106***
			(0.00512)	(0.00503)	(0.00757)
Everyone in household			-4.06e-05	-0.0258	0.0107
has health ins.			(0.0254)	(0.0254)	(0.0316)

(continued)

(continued)

	Log precautionary target-log normal income				
	[1]	[2]	[3]	[4]	[5]
Willing to borrow				-0.0122	
when income cut?				(0.0189)	
Planning period:					
Next year				0.00739	
				(0.0344)	
Next few years				0.157***	
				(0.0290)	
Next 5-10 years				0.217***	
				(0.0305)	
Longer than 10 years				0.288***	
				(0.0344)	
Willingness take finanical risks:					
Above average risks/returns				-0.0105	
				(0.0503)	
Average risks/returns				-0.00379	
				(0.0478)	
No risks				-0.181***	
				(0.0501)	
Occupation (if employed)					
Clerical and sales					-0.106***
					(0.0323)
Services					-0.0974**
					(0.0400)
Laborers					-0.121***
and Craftsmen					(0.0391)
Operators					-0.203***
					(0.0393)
Farmers and					0.0291
farm laborers					(0.121)
Year effects	Yes	Yes	Yes	Yes	Yes
Obs	28083	28083	28083	28083	14088
Imputations	5	5	5	5	5

Notes: The coefficients are relative to the group excluded for colinearity. The excluded effects are: 1995; white; employment is not-employed; spouse employment is no spouse in household; education is less than a high school degree; planning period is next few months; willingness to take risks is "substantial risks;" occupation is professional, technical, and managerial. Age is normalized to be 0 at 50 by: (Age-50)/50. Source: The pooled Survey of Consumer Finances from 1995, 1998, 2001, 2004, 2007, and 2010. All regressions account for multiple imputation by the SCF and are survey weighted to be nationally representative.

Table 7: The precautionary target and savings

	[1]	[2]	[3]	[4]	[5]
	Log (liquid assets + credit) - log precautionary target				
Usually know next year's income? (Yes=1)	1.449***	0.855***	0.605***	0.478***	0.538***
	(0.0494)	(0.0471)	(0.0459)	(0.0452)	(0.0599)
	Log (liquid assets + credit) - log normal income				
Usually know next year's income? (Yes=1)	1.484***	0.738***	0.607***	0.465***	0.529***
	(0.0483)	(0.0441)	(0.0443)	(0.0432)	(0.0563)
	Log (financial wealth + credit) - log precautionary target				
Usually know next year's income? (Yes=1)	1.573***	0.881***	0.556***	0.408***	0.517***
	(0.0520)	(0.0492)	(0.0474)	(0.0461)	(0.0623)
	Log (financial wealth + credit) - log normal income				
Usually know next year's income? (Yes=1)	1.604***	0.760***	0.551***	0.389***	0.503***
	(0.0514)	(0.0466)	(0.0464)	(0.0446)	(0.0580)
	Log (financial wealth + credit) - log normal income if last year's income equal to normal income				
Usually know next year's income? (Yes=1)	1.459***	0.647***	0.415***	0.279***	0.365***
	(0.0615)	(0.0546)	(0.0543)	(0.0523)	(0.0684)
Demographics		Yes	Yes	Yes	Yes
Income and employment			Yes	Yes	Yes
Attitudes				Yes	Yes
Occupation for employed					Yes
Year effects	Yes	Yes	Yes	Yes	Yes
Obs	28127	28127	28060	28060	14086
Imputations	5	5	5	5	5

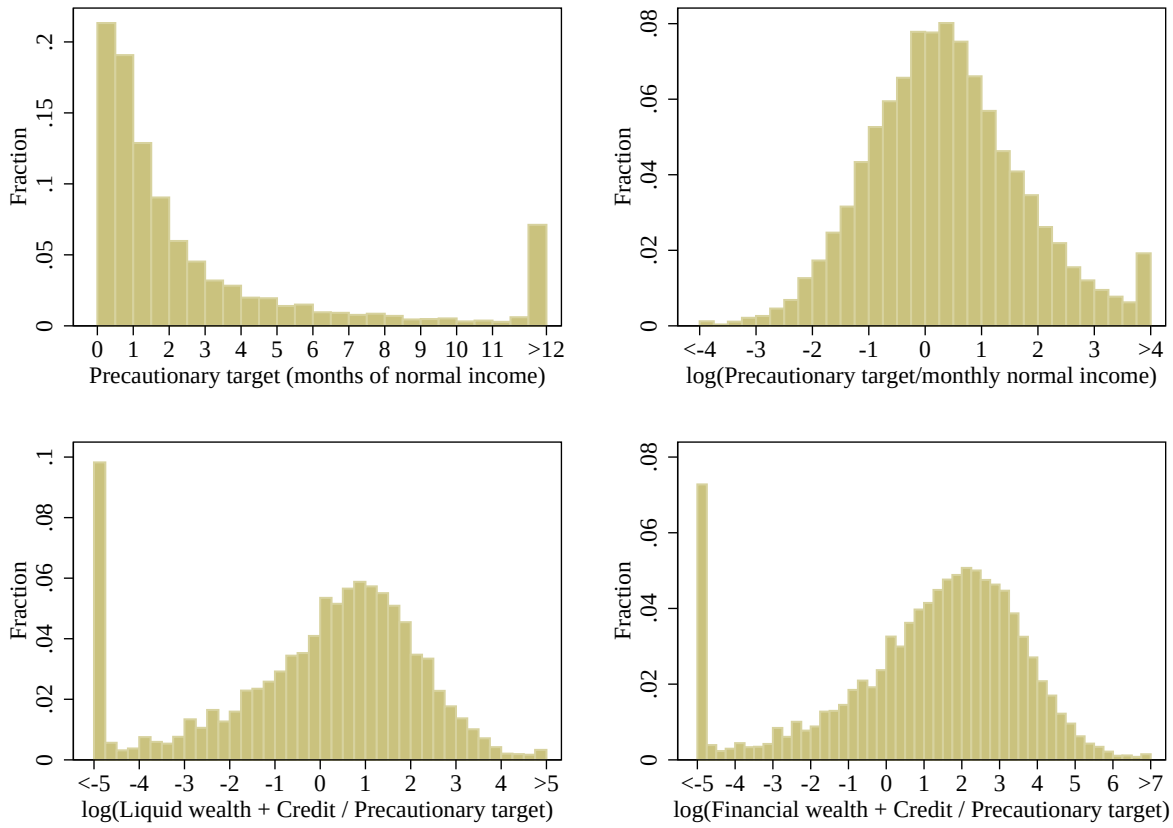
Notes: Each row and column is a separate regression. The regressions in each column contain the same variables as the regressions in table 6. Source: The pooled Surveys of Consumer Finances from 1995, 1998, 2001, 2004, 2007, and 2010. All regressions account for multiple imputation by the SCF and are survey weighted to be nationally representative.

Table 8: Changing frequency

Frequency per year ν	Transitory Variance σ_u^2	Permanent Variance σ_n^2	$0.044 * \nu$	$0.022/\nu$	Target w^*	Target w^* (months)	Target a^* (months)
1	0.0429	0.0228	0.0440	0.0220	2.47	29.64	17.64
2	0.0894	0.0113	0.0880	0.0110	3.84	23.02	17.02
3	0.1327	0.0076	0.1320	0.0073	5.51	22.02	18.02
4	0.1745	0.0057	0.1760	0.0055	6.79	20.36	17.36
6	0.2533	0.0038	0.2640	0.0037	9.55	19.10	17.10
12	0.4584	0.0019	0.5280	0.0018	19.37	19.37	18.37

Notes: The transitory and permanent variances are the variances that would result in an econometrician finding the yearly sum of ν incomes had a transitory variance of 0.044 and a permanent variance of 0.022 using a sample of 10,000 individuals observed over 60 years. The target w^* is first reported in units of ν and then converted to months of income.

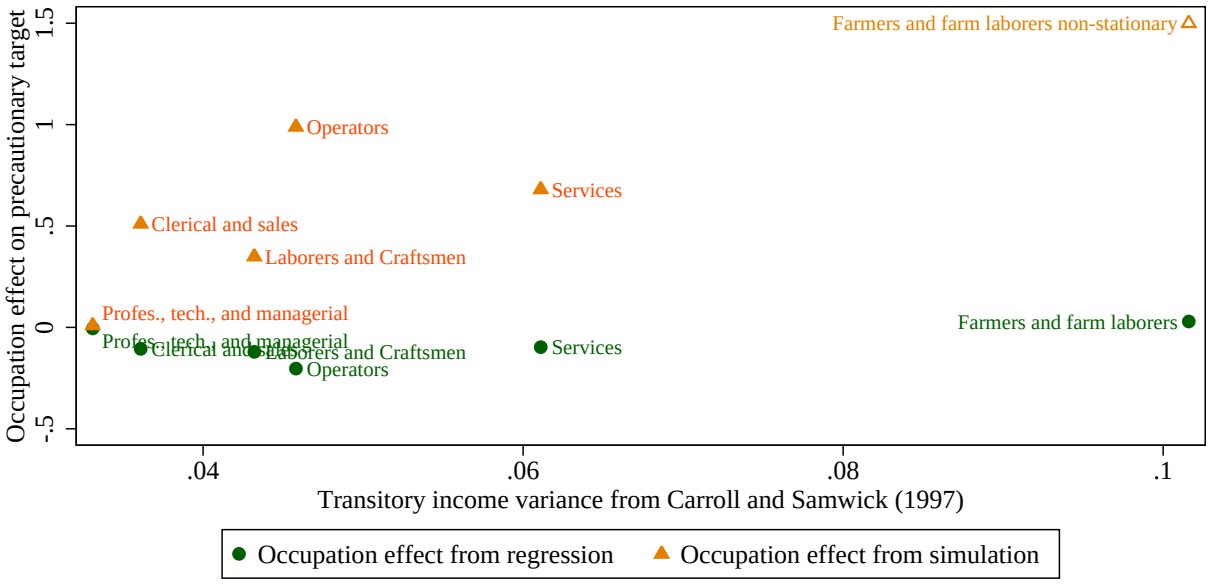
Figure 1: Distribution of the precautionary target



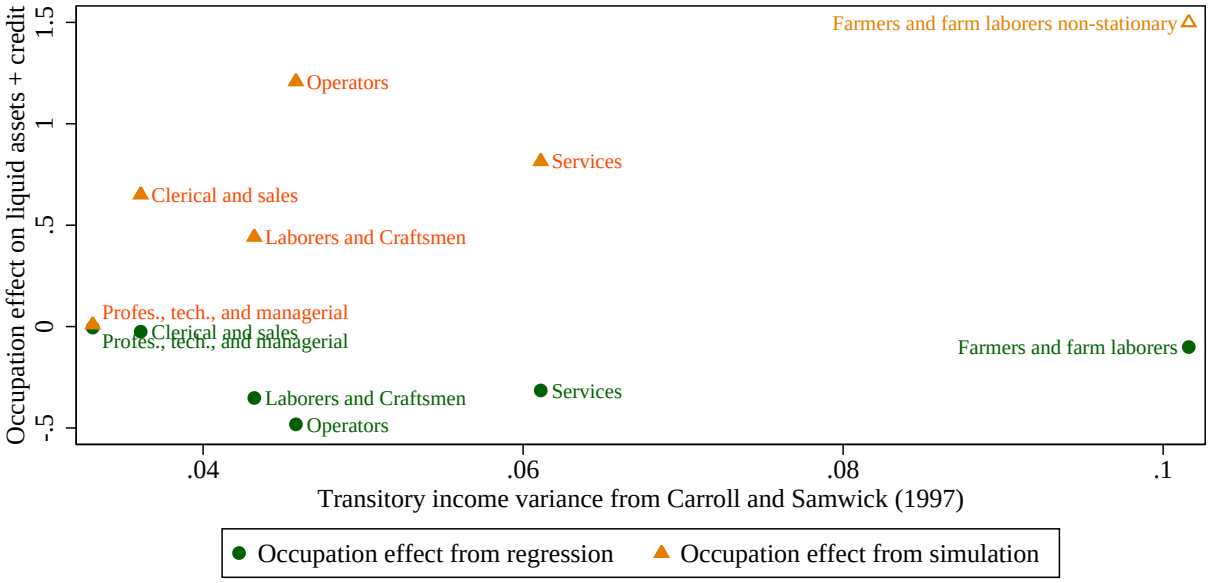
Notes: Households are survey weighted to be nationally representative (the histogram is calculated using the weights as the number of households represented by the surveyed household). Source: The pooled Survey of Consumer Finances from 1995, 1998, 2001, 2004, 2007, and 2010.

Figure 2: Occupation, income variance, and the precautionary target

(A) Simulation and estimation effects on the precautionary target

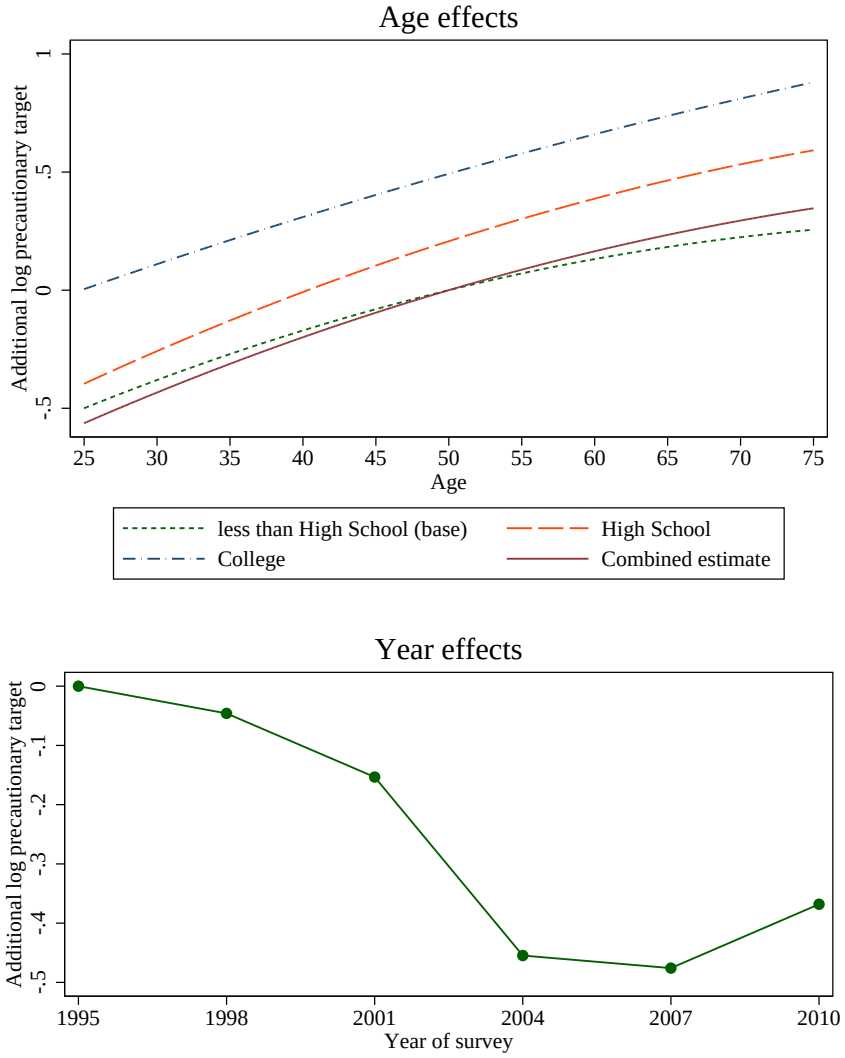


(B) Simulation and estimation effects on liquid savings



Notes: The regression effects are the occupation effects from column 5 of table 6. The x-axis gives the transitory variance of income for that occupation as calculated by Carroll and Samwick (1997) from the PSID. See text. The simulation effects show the effect of changing the permanent and transitory income for each occupation, and calculated relative to Professional, Technical and Managerial to match the regression effects. The other simulation parameters are: $\gamma = 2$, $\beta = .95$, $R = 1.03$, $G = 1.02$, and a five node Gaussian approximation of the income process. Given these parameters Farmers and farm laborers do not have an ergodic distribution: they want to accumulate indefinitely. The simulations use code from Miranda and Fackler (2002).

Figure 3: Age and year effects on the precautionary target



Notes: Shows the age and year effects from table 6 column 3 as well as separate estimation that allows the age function slope to vary with education (not shown in table 6). The effects with education include the level effect of education. The level of the combined effect estimate in table 6 is the below HS effect since that is the excluded group. Year effects are 0 in 1995 (the excluded year).