Expectations Uncertainty and Household Economic Behavior

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Abstract

We show that there exists significant heterogeneity across U.S. households in how uncertain they are in their expectations regarding personal and macroeconomic outcomes, and that uncertainty in expectations predicts households' choices. Individuals with lower income or education, more precarious finances, and living in counties with higher unemployment are more uncertain in their expectations regarding own-income growth, inflation, and national home price changes. People with more uncertain expectations, even accounting for their socioeconomic characteristics, exhibit more precaution in their consumption, credit, and investment behaviors.

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1 Introduction

Households differ in their economic expectations, in terms of the levels of these expectations but also in terms of the uncertainty surrounding these levels (Dominitz and Manski (1997a), Dominitz and Manski (1997b)). Theoretically, uncertainty matters for households' economic behavior. Uncertainty regarding variables that impact future consumption should induce prudent behaviors, including increased precautionary savings and liquidity, lower levels of consumption, and lower exposure to risky financial investments, when the risks associated with these variables can not be fully hedged (e.g., Kimball (1993), Gollier and Pratt (1996), Carroll and Samwick (1998), Bertola, Guiso, and Pistaferri (2005), Fulford (2015a)).

Prior work has studied the drivers and consequences of the heterogeneity across households in the levels of their expectations regarding variables such as income growth, stock market returns, inflation, or unemployment (e.g., Souleles (2004), Piazzesi and Schneider (2012), Malmendier and Nagel (2016), Das, Kuhnen, and Nagel (2019)). However, there is scant evidence as to why households differ in their perceived uncertainty around their economic expectations, and how this uncertainty influences their choices. The lack of data sources containing measures of uncertainty as well as household economic choices has been a critical impediment for the empirical investigation of these questions.

In this paper we provide novel empirical evidence regarding the factors that explain differences across U.S. households in the uncertainty of their expectations regarding personal and macro-level economic outcomes, and we document the effects of this uncertainty on a broad set of household economic behaviors.

Specifically, we find that people with lower income, lower education, facing more precarious work and financial situations, or living in areas with worse economic conditions are more uncertain when constructing distributions of future outcomes for their own income growth, the rate of inflation in the country, and the rate of growth of national home prices. Moreover, uncertainty perceptions regarding different economic outcomes are correlated within-individual. Our search for the drivers of differences across households in

how uncertain they are when forecasting economic variables is guided by recent findings in cognitive science which show that life adversity can influence people's uncertainty across domains, as the instability of one's own environment permeates perceptions of instability or unreliability elsewhere (Kidd, Palmeri, and Aslin (2013), Sturge-Apple et al. (2016)). The novel hypothesis that stems from this literature is that experiencing adversity, generally characterized by instability in personal economic outcomes, leads to heightened perceptions of uncertainty about macro-level outcomes, an effect akin to extrapolation in the second moment of beliefs. Our results provide evidence consistent with this hypothesis. Moreover, we find that people with higher uncertainty in their economic forecasts engage in more cautious behaviors in terms of consumption, use of credit markets, and financial portfolio allocations. All else equal, individuals who have wider subjective distributions regarding future personal or macro-level economic outcomes plan to reduce consumption, secure additional credit lines, and have lower exposure to the stock market.

These findings provide novel evidence in support of existing theoretical models which predict that uncertainty about variables that could influence consumption in the future will lead to precautionary behaviors. While correlational in nature, the results we document here are a useful first step in assessing these predictions, and suggest that future theory work should account for the significant and predictable heterogeneity observed across households in terms of how uncertain they are about their economic expectations.

Evidence regarding the drivers and consequences of uncertainty in economic expectations has been lacking, in large part due to a scarcity of measures of subjective uncertainty. Most proxies for households' uncertainty in economic expectations have been based on the ex-post realized volatility in the variable of interest, which typically was income growth (e.g., Carroll and Samwick (1997) and Pistaferri (2016)).[1] The indirect nature of proxies for subjective uncertainty made it difficult to unambiguously interpret empirical results meant

[1]Several recent studies deviate from this paradigm. Proxies for household perceived uncertainty have been constructed from observed consumer choices, as in Guvenen and Smith (2014), or forecast errors, as in Feigenbaum and Li (2012).

to test the theoretical links between ex-ante uncertainty and household economic behavior. In a seminal paper, Dominitz and Manski (1997b) provided a novel approach using survey data to measure the subjective uncertainty of U.S. households, specifically regarding their future income levels, and found significant heterogeneity across those surveyed. Around the same time, Guiso, Jappelli, and Terlizzese (1996) used survey data from the Bank of Italy regarding people's assessments for the distribution of their future incomes to study the link between income risk and equity markets exposure. A decade and a half after these early papers a new data set containing measures of household-level uncertainty regarding several economic outcomes was made possible through the creation in 2013 of the Survey of Consumer Expectations (SCE) by the Federal Reserve Bank of New York. These uncertainty measures, which we use in our analysis, are constructed in the SCE following closely standard belief elicitation procedures developed in the economics literature (e.g., Engelberg, Manski, and Williams (2009)).[2]

We use the SCE survey data collected during 2013 – 2020. The dataset provides measures of the uncertainty in respondents' forecasts regarding their own-income growth, the national rate of inflation, and the rate of growth in national home prices over the subsequent 12 months. We find that the degrees of uncertainty expressed by respondents across the three measures of economic outcomes are positively correlated within-person, and this permeation of uncertainty from one economic domain to another is stronger among people in more adverse situations. We then show that uncertainty across all three economic expectations is higher among individuals with lower income, lower education, a more precarious financial situation as measured by their likelihood of defaulting on debt, those not working either full or part-time, and those living in counties with higher unemployment at the time of the survey. For example, having a college degree, or having $100,000 higher income per

[2]The SCE has so far been used mainly to understand beliefs about inflation. Specifically, De Bruin, Manski, Topa, and Van Der Klaauw (2011) and Binder (2017a) found that uncertainty in inflation expectations is higher among women and lower-income individuals. Aspects of the data relating to other economic variables aside from inflation have not yet been used much in the literature. An exception is Adelino, Schoar, and Severino (2018), who examine the connection between people's uncertainty regarding returns to housing as an asset class, and their interest in becoming a home owner.

year correspond to a third of a standard deviation decrease in uncertainty about economic outcomes. These results indicate that people faced with more economic adversity are more uncertain in their economic forecasts. Moreover, we document significant county fixed effects in people's uncertainty, suggesting the existence of persistent local factors that drive the degree of confidence that people have when assessing economic prospects for themselves and for the nation as a whole. Better numeracy helps reduce people's uncertainty across all of their forecasts, and also, it lowers the influence of people's specific economic situation on the degree of uncertainty that they have when making macro-economic predictions. We find that the respondents whose subjective uncertainty is closer to the objective volatility of the economic outcomes forecasted are those with higher incomes and higher education. Finally, we show that people's uncertainty in their micro- and macro-economic forecasts predicts their economic decisions. Households that are more uncertain in their economic expectations, even accounting for their socioeconomic characteristics or the level (i.e., the first moment) of their expectations, are more likely to engage in precautionary behaviors. Namely, they plan to reduce consumption in the subsequent 12 months, are concerned about the availability of credit in the future and plan to secure additional credit lines but not use them for consumption currently, and have lower exposure to equity market investments.

We contribute to the literature in two main ways. First, we show that there is a high degree of correlation between how uncertain a person feels about their future income, which is a micro-level variable, and how uncertain the person is about macro-level variables such as inflation and home price appreciation at the national level, and that variation across people in their level of uncertainty comes in part from their socioeconomic situation.[3] Hence, the way

[3]De Bruin, Manski, Topa, and Van Der Klaauw (2011) find that individual forecast uncertainty regarding inflation expectations is highly persistent over time—that is, there is a positive correlation over time in uncertainty regarding a specific economic outcome. Focusing on point estimates, rather than on uncertainty, Dominitz and Manski (1997a) study individuals' assessment of the probability of three types of near-term economic misfortune: the absence of health insurance, victimization by burglary, and job loss. They find that respondents that assign a high probability to one adverse outcome tend also to assign a high probability to the other outcomes. Hence, our results together with these prior findings suggest that within-individual there seems to exist a positive correlation across expectations, in terms of point estimates, as well as in the uncertainty around these estimates.

people construct distributions of future outcomes may cause spillovers from one domain to another that our theories currently do not include, as they typically examine uncertainty with respect to one economic variable only (e.g., own-income growth, as in Carroll and Samwick (1997)). Our results suggest that people are influenced by their own or local economic adversity when forecasting distributions of personal as well as macroeconomic outcomes, and thus similar levels of uncertainty will permeate these individuals' forecasts about variables that fundamentally may be unrelated. Our findings about expectations uncertainty (i.e., the second moment of belief distributions) complement the existing literature that shows that personal experiences influence the formation of expectations levels (i.e., the first moment of belief distributions). For example, Malmendier and Nagel (2016), Kuchler and Zafar (2019), and Das, Kuhnen, and Nagel (2019) show that people's levels of expectations about macroeconomic outcomes relate to the economic events they experienced as a cohort, or as residents in a specific locality, or as a result of idiosyncratic economic shocks.

Second, we provide novel evidence on the effects of people's expectations uncertainty on several behaviors—specifically, consumption, investment, and borrowing decisions. Unlike prior papers, where typically only one household decision could be observed in the data (e.g., the share of wealth invested in equities, as in the case of Guiso, Jappelli, and Terlizzese (1996)), here we have information regarding several interdependent behaviors that in theory should be impacted by people's uncertainty about future economic outcomes. Thus, we provide a broader assessment of the effects of uncertainty in expectations on households' economic behavior relative to the prior literature. Overall, our results indicate that uncertainty in economic expectations predicts general caution in households' behavior, as suggested by theoretical work. These results add to the prior empirical literature on the effects on uncertainty on household actions, which is scarce and inconclusive, in part perhaps due to the lack of ex-ante measures of household uncertainty. For example, the connection between uncertainty regarding economic variables and consumption decisions has so far been empirically weaker than predicted by theory (e.g., Knotek and Khan (2011), Christelis, Georgarakos,

Jappelli, and van Rooij (2019)).[4] Moreover, contrary to theoretical predictions, households' precautionary savings, especially in liquid assets, are not significantly related to income or unemployment risk (Carroll, Dynan, and Krane (2003), Fulford (2015b)). At the same time, exposure to equity markets is lower for those with higher income risk (Guiso, Jappelli, and Terlizzese (1996), Betermier, Jansson, Parlour, and Walden (2012)), as the theory would suggest. The effects of uncertainty on household behaviors in credit markets have not been addressed directly in the literature. However, the few existing empirical papers suggest that households may act in a precautionary manner in their credit-related activities, as borrowing constraints could bind at times when bad income or consumption shocks occur.[5] Specifically, Fulford (2015a), Gorbachev and Luengo-Prado (2016), and Druedahl and Jorgensen (2017) document that households expecting less access to credit in the future hold low-interest rate savings while carrying expensive debt.

Our finding that uncertainty in expectations correlates with economic actions complements the results of recent studies documenting that expectations levels, or point estimates, relate to behaviors. This prior work shows that households with higher inflation expectations have higher durable goods consumption (D'Acunto, Hoang, and Weber (2017)), accumulate less wealth, are less leveraged, invest less in non-liquid assets (Vellekoop and Wiederholt (2017)), and tilt their exposure toward liabilities with fixed nominal rates (Malmendier and Nagel (2016)). Households expecting higher home price growth are more likely to buy larger and more expensive homes, with higher downpayments (Bailey, Davila, Kuchler, and Stroebel (2019), Armona, Fuster, and Zafar (2019), Bailey, Cao, Kuchler, and Stroebel (2018)). We add to this literature by documenting that uncertainty (i.e., the second moment of expectations) leads to precautionary behaviors across several economic choices, and has effects

[4] A similar tension between theoretical predictions and empirical patterns is also found at the aggregate level. For example, Carroll and Dunn (1997) and Knotek and Khan (2011) find that the response of aggregate consumption to increases in uncertainty regarding income or general business conditions is much less pronounced than predicted by theory.

[5] Di Maggio, Kermani, Ramcharan, and Yu (2017) provide evidence that credit limits faced by households are volatile. They find that increased uncertainty regarding local labor market conditions leads to a reduction in leverage for high-risk borrowers, suggesting that lenders reallocate credit towards safer borrowers when uncertainty spikes.

which are independent of those of expectations levels (i.e., the first moment).

Our results suggest that policy interventions or messages meant to encourage household behaviors related to consumption, investment, or credit decisions may not have equal effects on all households. Examples of such policies or messages include central bank forward guidance, changes in disclosure to consumers about aspects of credit products, and changes in consumers' ease of access to investment products or in the tax implications of such investments. Our findings imply that whether or not such policies will achieve the desired outcome at the household level will depend critically on how uncertain each household is about the future economic outcomes related to the variables that policy makers are attempting to influence. The evidence in this paper also suggests that certain segments of the population—based on socioeconomic characteristics, or location in the United States—may benefit significantly more than others from interventions that help reduce perceived economic uncertainty. Lastly, our findings indicate that aggregate macro-level indices of uncertainty (e.g., Baker, Bloom, and Davis (2016)), Binder (2017b)) could mask important differences across U.S. households, and hence, that it would be beneficial to construct and track over time measures of uncertainty for specific subgroups of the population.

2 Data

2.1 Sample overview

We use the Survey of Consumer Expectations from the Federal Reserve Bank of New York (FRBNY). The SCE is an internet-based survey designed to collect rich, timely information about consumer expectations and behavior. The SCE uses a rotating panel structure where respondents are interviewed for up to 12 consecutive months.[6] Each month, new respondents are added to the panel as existing respondents rotate out.

[6]Respondents are household heads. They are defined as "the person in the household who owns, is buying, or rents the home." See Armantier, Topa, van der Klaauw, and Zafar (2016) for a full overview of the survey.

Our core survey sample contains observations from June 2013 to April 2020. The full sample spans 83 months, with an average of 1,282 observations per month, and a total of 106,362 person-month observations. The SCE has a core survey component and various special modules. Questions in the core survey are administered monthly in all years while the special modules are fielded only for specific months. The core survey contains the key personal and macroeconomic expectations variables. We focus on expectations for national inflation and national house price growth as well as personal income growth.[7] Respondents are asked to provide a point estimate and a distribution of the growth rate for each of these variables over the next 12 months. Specifically, they provide three responses: a directional indicator (increase or decrease), a numerical estimate, in percent (point estimate), and a subjective distribution (i.e., probability weights) over an exhaustive set of pre-defined outcomes (see Appendix A for details).

In addition to the core SCE survey, we use three special modules in our analysis: the Credit Access Survey run three times a year (February, June, and October), the Household Spending Survey fielded 3 times per year (April, August, December), and the annual Household Finance Survey administered each August. The Credit Access Survey covers from October 2013 to February 2019 (17 waves; on average 1,100 observations per wave), the Household Spending Survey covers from December 2014 to August 2018 (12 waves; on average 1,000 observations per wave), and the Household Finance Survey covers from 2014 – 2018 (5 waves, on average 1,000 observations per wave).

2.2 Uncertainty measures

We measure uncertainty regarding individuals' 12-month expectations using the subjective distributions they provide. Respondents provide probabilities over a support of 10 symmet-

[7] An additional subjective distribution for stock return expectations is collected in the Household Finance Survey. However, these data were only collected in two waves (in separate years), with no repeated observations for respondents, and contain only 1900 observations, less than 5% of the sample size of the three variables we examine in the paper. For these reasons, we do not use stock return distribution assessments in our analysis.

rical bins of possible values of national inflation, national house price growth, or personal income growth ranging from −12% to +12% (see Appendix A). Using these probabilities, the FRBNY estimates parametric subjective densities using a method developed by Engelberg, Manski, and Williams (2009), as described in Armantier, Topa, van der Klaauw, and Zafar (2016). We use the standard deviation of the subjective distributions as our uncertainty measure for each expectation variable. We also use the mean of these distributions to control for expectations levels.[8]

To obtain our analysis sample, we first assess the internal consistency of expectations and distributions by determining if an individual's point estimates are within the support of the subjective distributions they provide. If the point estimate is not in the support, we set the point estimate of inflation, national home price growth, and personal income growth to missing. Second, we trim the tails of the cross-sectional distribution of point estimates in each month at the 0.5% level. Respondents with point estimates that lie in the 0.5% tails are also set to missing. The questions for personal income growth are only asked to a subsample of individuals that are *actively* employed. For those seeking work, retired, studying, on disability, or otherwise not working, no question is asked regarding personal income growth. However, all participants are asked to estimate the growth rate, but not the distribution, of their *household* income. We find that the personal income growth rate and the household income growth rate point estimates have a correlation of 0.50 ($p < 0.01$). Thus, our third pass through the data replaces the missing point estimates of personal income growth with the data on household income growth to increase the sample size of our analysis and to enable us to control properly for employment status.[9] This combined income growth point estimate is denoted as $Income\ Growth\ Pt\ Est_{it}$ in our analyses.

Summary statistics for density means and standard deviations are presented in Panel A

[8]Survey participants are also asked to provide a point estimate for each of these forecasts. These point estimates, while not identical to the means of the subjective densities calculated by the FRBNY, are significantly correlated with these means: for inflation, the correlation is 0.56, for national home prices it is 0.71, and for personal income growth it is 0.69 ($p < 0.01$ for all correlations).

[9]If we limit our sample to individuals who are actively employed, we find similar results to those observed in the unrestricted sample.

of Table 1. Density means—for individual i in month t—are denoted as: $Expected\ Personal\ Income_{it}$, $Expected\ Inflation_{it}$, and $Expected\ Natnl\ Home\ Prices_{it}$. Similarly, the subjective density standard deviations are denoted as: $SD(PersonalInc)_{it}$, $SD(Inflation)_{it}$, and $SD(NatnlHP)_{it}$. Panel A shows that over the next 12 months respondents expect, on average, personal income to grow 3.15%, national inflation to be 3.52%, and national home prices to grow 4.28%, and that there is substantial cross-sectional heterogeneity for each of these subjective means. Likewise, average uncertainty for personal income growth is 1.98%, for inflation it is 2.48%, and for national home prices growth it is 2.80%.

Our main uncertainty measure, $Uncertainty_{it}$, is calculated as the average of the standard deviations of the three distributions of economic outcomes that participants are asked to provide. Namely, $Uncertainty_{it}$ is the average of $SD(PersonalInc)_{it}$, $SD(Inflation)_{it}$, and $SD(NatnlHP)_{it}$ for each individual i in month t who is employed as of that time.[10] These three standard deviations are based on probability responses elicited using the exact same bins for all three (see Appendix A), and same methodology for calculating the moments of the distributions. As such, it is not necessary to rescale them before taking their average. Our second measure, $Uncertainty_{it}^{macro}$, is calculated by averaging the standard deviations for the two macroeconomic variables only, namely, inflation and national home price growth. Since $Uncertainty_{it}$ and $Uncertainty_{it}^{macro}$ are the average of several standard deviations of quantities measured in percentage points (i.e., growth rates, all of similar order of magnitude), then these two measures are also quantities measured in percentage points. Panel A in Table 1 shows that the two measures are very similar in terms of their distribution across the sample. The correlation between the two uncertainty measures is 0.97 ($p < 0.01$).

2.3 Household characteristics and behaviors

We present summary statistics for demographic and socioeconomic characteristics of respondents in the SCE in Panel B of Table 1. We observe respondents' age (Age_{it}), gen-

[10] In unreported analyses we also use their first principal component, leading to similar findings.

der ($Female_i$), and race ($White_i$). Measures of respondents' socioeconomic status include their household income, expressed in tens of thousands of dollars ($Income/10,000_{it}$), and an indicator for whether the respondent has a college education ($College_{it}$). Income is reported in categorical bins in several \$10,000, \$25,000, and \$50,000 increments, with the last bin including all households with income greater than \$200,000 (see Appendix B for details). We also construct an indicator $Is\ Working_{it}$, which is equal to one if the person is working full-time, part-time, or is on temporary / sick leave but has a job to which they can return, and zero otherwise. Moreover, as measures of precarious financial or economic conditions at the household or the community level, we use the probability an individual believes they will not make the minimum payment on their consumer credit in the following 3 months, $\mathbb{P}(default3months)_{it}$, and the county-level monthly unemployment rate, $County\ \%\ Unempl_{it}$, obtained from the Bureau of Labor Statistics (BLS).[11] The SCE also includes a measure of respondents' numeracy, as given by their ability to answer five basic questions about probabilities and compound interest. The numeracy measure is standard in the literature (e.g. Lusardi (2009)) and is used in other studies using the SCE such as Armona, Fuster, and Zafar (2019) and Crump, Eusepi, Tambalotti, and Topa (2019). Participants who answer at least four of the five questions correctly are deemed to have high numeracy. In our sample, 73% of observations come from high numeracy respondents. We use this variable to assess whether it moderates of the effects of people's socioeconomic characteristics on their uncertainty in their economic expectations.

The economic behaviors that we study are related to consumption and the use of credit and equity markets. These aspects of household decisions are not assessed all in one survey by the SCE, as certain modules are only implemented in specific months. Hence, different samples of respondents will be used in analyses that address each of these economic behaviors.

Consumption decisions are obtained from the Core, Household Spending, and Household Finance modules. From the Core survey, we obtain an indicator of whether respondents plan

[11] See the BLS Local Area Unemployment county file, available at `https://www.bls.gov/lau/`.

to increase total household spending in the coming 12 months, $Will\ Increase\ Spending_{it}$. This variable is available every month from 2013 to 2020 and the wording of the question emphasizes total spending on a variety of items such as: groceries, clothing, housing, medical expenses, transportation, and education, among others. We also create an indicator of whether respondents plan to increase everyday spending (e.g. essential items), $Will\ Increase\ Everyday\ Spending_{it}$, or non-essential spending (e,g, hobbies, leisure, vacation, items not absolutely needed), $Will\ Increase\ Nonessential\ Spending_{it}$, over the coming 12 months. Both variables come from the Household Spending survey. The samples are smaller because of the infrequent administration of this special module (only 3 times per year). In addition, the Household Spending survey elicits a probability density about potential changes in total household spending. We generate an indicator for whether respondents put more weight on positive values, $More\ Density\ On\ Spending\ Increase_{it}$. Panel C in Table 1 shows that the average willingness to increase spending ranges from 74% to 91% across these four measures (all indicators are scaled by 100 for ease of interpretation).

We obtain additional measures of specific types of consumption from the Household Spending and Household Finance surveys to use as dependent variables in our analysis. Specifically, we use questions that elicit the percent chance of purchasing home renovations, vehicles, trips, or home durables on two horizons: 4 months after and 12 months after the interview date[12]. These consumption measures are present in all waves of both the Household Spending and Household Finance surveys from 2014 – 2018. The Household Spending survey has roughly 2.5 times more observations since it is run every 4 months versus the annual frequency of the Household Finance survey. Overall, the average probability of consumption for these various goods across the two horizons varies between 10% to 40%.

We use the SCE core survey as well as the Credit Access module of the SCE to investigate

[12]Specifically, the questions ask: "In the next X months, what is the percent chance that you will purchase" home renovations, vehicles, trips, or home durables. We construct the home durables measure by averaging the responses for individual questions asking about appliances, electronics, and furniture. $X = 4$ if the question is asked in the Household Spending survey and $X = 12$ if the question is posed in the Household Finance Survey

behavior related to credit markets. The core survey includes data regarding people's perceptions as to whether in general it will be easier, or more difficult, to obtain loans or other forms of credit in the subsequent 12 months following the survey. We denote this variable as $Perceived\ Future\ Credit\ Market\ Conditions_{it}$. Specifically, this variable is a score from 1 to 5, indicating how easy the respondent believes that it will generally be for people to obtain credit or loans in the subsequent 12 months.[13] From the Credit Access module we obtain two measures of credit seeking behaviors. The first measure, $Seeks\ Credit\ Line\ Increase_{it}$, is a score from 1 to 5 indicating how likely the respondent is to seek an increase in available credit lines, either by asking for an increase in their credit card or other loan limits, applying for a new credit card, or for a home equity based-loan.[14] The second measure, $Seeks\ Credit\ To\ Consume_{it}$, is a score from 1 to 5 indicating how likely the respondent is to seek credit to either purchase a car or pay for education.[15] Summary statistics for each of these variables can be found in Panel D of Table 1. We observe that, on average, individuals perceive slightly tighter credit markets (2.91 Likert points) and have relatively low likelihoods of demanding more credit or obtaining credit for consumption (1.56 and 1.49 Likert points, respectively) in the following 12 months. However, there is substantial variation across respondents, as the standard deviation is about 0.8 Likert points for each of the three credit variables.

We use data from the Household Finance module to study the effects of uncertainty on three investment decisions: participation in equity markets, the proportion of equity holdings to total assets, and the value of equity holdings. We construct the variable $Invests\ in\ Equities_{it}$ as an indicator for whether the value of the respondent's equity holdings is greater than zero. We calculate the total value of equity as the sum of equity investments in defined contribution, IRA, and savings / investment accounts. Panel E of Table 1 shows that 64% of the sample participates in equity markets. We also construct the variable

[13] This score is obtained from item Q32 in the Core survey.

[14] Specifically, this variable is the average of the responses provided in items N17a1, 2, 4, 5 and 6 in the Credit Access survey module.

[15] This variable is the average of the responses provided in items N17a3 and 7 in the Credit Access survey module.

$EquityHoldings/Assets_{it}$ as the ratio of the dollar value of equity holdings and the dollar value of total assets of the respondent. We calculate total assets as the sum of the balances in respondents' defined contribution, IRA, and savings or investment accounts, the value of their farm or small business, the value of their vehicles (e.g., cars, boats, trailers), the value of the primary home and additional real estate or land owned, and the value of other assets (e.g., estate, trust, collectibles). In the sample, equity holdings are roughly 13% of total assets. $EquityInvestments_{it}(log)$ is the natural logarithm of one plus the sum, in dollars, of equity investments.

The Household Finance module also allows us to get measures of people's liabilities, and net wealth, which we will use as controls in our analyses related to investment decisions. Specifically, respondents' liabilities, $Debt_{it}$, are calculated as the sum of total real estate-related debt on primary and other real estate or land, total consumer debt (e.g., credit cards, auto loans, student loans, other personal loans, and legal or medical bills, and total debt for which they have co-signed. The respondents' net worth is measured by the variable $NetWorth_{it}$, which is the difference between the dollar value total assets and total liabilities, divided by 100,000 (for legibility of regression coefficients).[16]

3 Results

3.1 Commonality in uncertainty across economic outcomes

The SCE provides us with measures of uncertainty in expectations (i.e., standard deviations of subjective distributions) that an individual has about their own income growth, the rate of inflation in the country, and the rate of growth of national home prices in the subsequent

[16]To minimize the effects of outliers in our analysis, in our regression models where we control for participants' assets or debt we use the logarithm of 1 dollar plus the amount of either assets or debt reported by these individuals. For the same purpose of minimizing the effects of outliers, when calculating the net worth of an individual, $NetWorth_{it}$, we take the difference between the dollar value of the person's assets and the dollar value of their debt (not log units), and only do so if these values are not in the top 1% of the distribution of assets or debt.

12 months. As detailed in the Data section, to capture the uncertainty across these multiple outcomes, we compute the average of the three standard deviations, and refer to this as $Uncertainty_{it}$, or of the two standard deviations that apply to the macro-level variables only (inflation and home prices), and refer to this as $Uncertainty_{it}^{macro}$. This approach of summarizing uncertainty in one variable, rather than using two or three separate standard deviation measures, implicitly relies on the ex-ante hypothesis that uncertainty permeates across domains. Indeed, we find this to be the case, particularly for individuals who are in more adverse situations.

As the results in Table 2 show, the three standard deviations of the distributions that participants construct for their own future income growth and for national inflation and home prices changes are positively correlated. The standard deviation of inflation and the standard deviation of national home price growth have a pairwise correlation of 0.73 ($p < 0.01$). For those respondents with non-missing values for their standard deviation of personal income growth (i.e., those currently employed), this quantity has a correlation of 0.62 ($p < 0.01$) with the person's standard deviation of national home price growth, and a correlation of 0.58 ($p < 0.01$) with the person's standard deviation of the national inflation rate. Therefore, uncertainty in terms of these three dimensions of economic outcomes, personal or at the macro level, is highly correlated within person.

We observe smaller within-person correlations for respondents' point estimates (i.e., distribution means or expected values) for the three economic variables. The correlations between either expected personal income growth or household income growth, on the one hand, and expected inflation or national home price growth on the other, are no larger than 0.18. This indicates more than a four-fold drop relative to the correlations observed within-person in terms of the uncertainty that people have about these variables. The point estimates for inflation and national home price growth rates have a correlation of 0.39 ($p < 0.01$), which again indicates these quantities are relatively more distinct within-person than the levels of uncertainty regarding these estimates, whose correlation is equal to 0.73. These correlations

can be seen in Table 2.

Moreover, we find that within-person correlations across the uncertainty measures for the three economic variables examined in the survey decrease with respondents' income level. This is shown in Figure 1. For example, the correlation between uncertainty about inflation and house prices is 0.84 ($p < 0.01$) for respondents in the lowest income category, and it is 0.57 ($p < 0.01$) for respondents in the highest income category. A Wald test indicates that these correlation levels are significantly different at $p < 0.001$. Similarly, we find that the correlation between uncertainty about inflation and uncertainty about personal income growth is significantly higher ($p < 0.001$) for individuals in lower income bins: it is 0.76 ($p < 0.01$) for respondents in the lowest income category, and 0.30 ($p < 0.01$) for those in the highest income category. The same pattern holds when examining the correlation between respondents' uncertainty about their personal income growth and national home price growth. For people in the lowest income bin, this correlation is 0.80 ($p < 0.01$), while for people in the highest income bin it is 0.39 ($p < 0.01$). The two values are significantly different at $p < 0.001$.

We conduct a similar exercise as that in Figure 1 where we split respondents by their education level, rather than by income, and find a similar pattern: the correlations between how uncertain a person is about one economic variable (e.g., own income growth) and how uncertain they are about other variables (e.g., macro-level inflation or home prices) are significantly higher among people without a college degree than among those with college education. For example, the within-person correlation between uncertainty about personal income growth and uncertainty about national home price growth is 0.70 ($p < 0.01$) in the sample of people without a college degree, and it is 0.51 ($p < 0.01$) in the sample of people with a college degree. A Wald test shows these correlations are significantly different at $p < 0.001$.

Altogether, these results show that, within a person, the permeation of uncertainty from one economic concept to another is the strongest among individuals in more adverse situa-

tions, as measured by one's income or education. This is in line with our hypothesis driven by findings in psychology and neuroscience, that adversity leads to a perception of heightened uncertainty that generalizes across domains.

An alternative explanation for these findings, however, is that individuals with low income or low education are confused about issues relating to economics, and they would answer questions about any economic variable in the same manner, for example, by writing down the same probability for a specific bin of possible income growth, or possible inflation rate, or possible rate of change in national home prices. This would mechanically lead to similar values of $SD(PersonalInc)_{it}$, $SD(Inflation)_{it}$, and $SD(NatnlHP)_{it}$ for such a respondent. This would therefore be an effect driven by confusion, or lack of understanding of economics-related questions, and not an effect driven by experiencing adversity per se. To tease apart the effect of adversity from possible confusion effects, we repeat the analysis in Figure 1, but only for the subsample of respondents who have high numeracy, in the sense that they answered at least 4 out of 5 questions administered by the NY Fed to assess people's understanding of probabilities and finance knowledge. The results are shown in Figure 2. Even in this sample of high-numeracy individuals, we continue to find that people with lower incomes exhibit higher correlations across their uncertainty levels with regard to the three economic issues considered, namely, own income growth, inflation, and national home price growth. For example, the correlation between uncertainty about inflation and house prices is 0.79 for high-numeracy respondents in the lowest income category, and it is 0.57 for high-numeracy respondents in the highest income category. The correlation between uncertainty about inflation and uncertainty about personal income growth is 0.65 for high-numeracy respondents in the lowest income category, and 0.29 for high-numeracy respondents in the highest income category. These correlation levels are significantly different across income samples at $p < 0.001$. Hence, while numeracy may lessen people's propensity to mechanically perceive similar levels of uncertainty across different economic outcomes, it does not eliminate the effect that adversity (here, proxied by low income levels) is associated

with stronger permeation of uncertainty across economic domains.

3.2 Expectations uncertainty differences across U.S. households

So far we have documented that within person there exists a tendency to have similar levels of uncertainty when considering different economic outcomes, personal or at the macro level. That is uncertainty permeates across domains, akin to people extrapolating from one domain to another in terms of the second moment of the distribution of possible outcomes. We now investigate the factors that may lead some individuals to be more uncertain than others when thinking about future economic outcomes.

In cross-sectional analyses, we document that there is significant and predictable variation in how much uncertainty individuals in the U.S. population have in their micro- and macro-level economic expectations. The variation in uncertainty of expectations is closely linked to the socioeconomic status (SES) and environment of these individuals. As can be seen in the top panel of Figure 3, plotting the average uncertainty by location shows that counties with respondents whose uncertainty is in highest quartile of the distribution are found across the entire U.S. map. That being said, when data is aggregated at the state level, as in the bottom panel of Figure 3, a prevalence of high uncertainty respondents is observed in South-East states, suggesting the importance of geography for the formation of economic expectations.

At the respondent level, our SES measures, income and college education, are strongly associated with uncertainty of economic expectations. The top panel of Figure 4 shows that the average within-person uncertainty—measured using the average of all three SD measures, $Uncertainty_{it}$—declines appreciably as income rises. The average level of uncertainty for individuals in the lowest two income bins is about 5% compared to roughly 2% in the top two income bins; a 60% decline. We observe a similar pattern even when we split based on income and college education in the lower panel of Figure 4. The lower panel shows that individuals with a college degree, for the same level of income, have lower uncertainty in their economic forecasts compared to individuals without a college degree. However, the

difference in uncertainty by college education is particularly pronounced for those with low incomes ($\leq \$45,000$).

Moreover, Figure 5 shows that a similar pattern is observed for each of the three components of our main uncertainty measure: lower income individuals form more uncertain expectations. The same pattern is also observed if we were to construct this figure by classifying respondents based on education (i.e., college degree or not), rather than on income.

We further examine, using OLS regressions, the effects of SES and individual- and county-level proxies for economic precariousness on respondents' uncertainty in their economic expectations. The general regression model is shown below in Equation 1. We are primarily interested in estimating the effects of SES, measured by $Income_{it}$ and $College_{it}$, on a respondent's expectations uncertainty, $Uncertainty_{it}$, and the effects of proxies for financial or economic precariousness at the household and the community levels, as captured by variables $County\ \%\ Unempl_{it}$ and $\mathbb{P}(default3months)_{it}$. As controls we include exogenous individual characteristics (Age_{it}, Age_{it}^2, $Female_i$, and $White_i$), the point estimates, or means, of their expectations, as well as fixed effects for the county where the individual i lives at the time t of the survey.[17] We also include year-month fixed effects, denoted as μ_t. Standard errors are corrected for heteroskedasticity and clustered at the respondent level. The results of this baseline regression specification are shown in Table 3.

$$Uncertainty_{it} = \alpha + \beta Income_{it} + \gamma College_{it} + \mathbf{\Phi}' \mathbf{X}_{it}^{default,unemp} + \mathbf{\Psi}' \mathbf{X}_{it}^{controls} + \mu_t + \varepsilon_{it} \quad (1)$$

The first column of Table 3 shows the regression of our main uncertainty measure on exogenous individual characteristics. The estimated coefficients on Age_{it} and Age_{it}^2 suggest a U-shaped life-cycle pattern of expectations uncertainty, implying that young and old

[17] As a measure of the mean of personal income growth we use the point estimate and for national inflation and home prices we use the means of the expectation densities. As noted in the Data section, own-income growth expectation distributions, and thus distribution means, are only elicited from respondents that are working, which is roughly 60% of the overall sample. By using the point estimate—which is asked of all respondents—we can reasonably control for the central tendency of respondent's beliefs about their personal income growth, given that we observe these measures are highly correlated with one another.

consumers have higher uncertainty than middle-aged individuals.[18]

In addition, female respondents have greater uncertainty in their expectations than male respondents. Holding all else constant, uncertainty for females is, on average, 0.48 percentage points higher than males, or 0.20 standard deviations higher.[19] Moreover, white individuals are significantly less uncertain in their predictions of economic variables than their non-white counterparts. Uncertainty among white respondents is 0.98 percentage points (i.e., 0.42 standard deviations) lower, on average, than among non-white respondents. Year-month fixed effects do not have significant predictive power for uncertainty during the sample we study here.

The second column in the table shows SES variables are strongly negatively correlated with uncertainty, a similar pattern to the one observed in Figure 4. Uncertainty among college-educated individuals is 0.53 percentage points (i.e., 0.23 standard deviations) lower than among non-college educated individuals. Uncertainty also decreases with the income level, such that an $100,000 increase in annual income corresponds to a decrease in uncertainty of 0.74 percentage points, or a third of a standard deviation.

The third column includes regressors for the respondents' employment status, the precariousness of their own finances, as well as county-level unemployment. The level of uncertainty in economic expectations of people who are currently working is about a quarter of a standard deviation lower than the level of uncertainty of people who do not have a job, and this effect is statistically significant ($p < 0.01$). Financial fragility and economic weakness in the county of residence also increase a respondent's uncertainty about future personal or macro-level economic variables. A one-standard deviation increase in the respondent's expected probability of near-term default is correlated with a 12 basis point (i.e., 0.01 standard deviations) increase in uncertainty. Similarly, a one-standard deviation increase in the

[18]This U-shape life-cycle pattern in uncertainty across macro and micro-level expectations is in line with the finding in Feigenbaum and Li (2012) that the variance of projection errors of future income conditional on the information available to the households when the projection is made is a U-shape function of age.

[19]This is obtained by dividing the coefficient of 0.48 by the standard deviation of $Uncertainty_{it}$, which is 2.35.

county unemployment rate is associated with a 46-basis point (i.e., 0.02 standard deviations) increase in uncertainty.

In the fourth column we include as controls expectation point estimates to absorb any effects of central tendency on uncertainty measures. Moreover, we add county fixed effects to account for geographical factors on economic uncertainty. In line with the results in Figure 3, we find that there exists a significant dependence of the degree of people's uncertainty on where in the U.S. they reside, even controlling for their own income, education, and other demographics. Most of the 15-percentage point increase in the R^2 between the third and fourth columns stems from the inclusion of county fixed effects which indicates the existence of significant local influences on how confident people are when envisioning their own and the country-level changes in economic conditions. The inclusion of county fixed effects leads to a loss of significance for the coefficient on the variable measuring county-level unemployment in the month of the survey, which was highly significant in the specification in the third column. This suggests that the effect of local unemployment on respondents' uncertainty is driven by persistent levels of unemployment in county, rather than by month-to-month changes in this local variable. In the remainder of the analysis, where we include county fixed effects, we no longer also include county-month unemployment levels, as these are to a large extent subsumed by the county fixed effects.[20]

In the last column, we use the uncertainty measure that only relates to macroeconomic expectations since that is collected for all individuals regardless of employment status. Our main results for our SES predictors hold with similar coefficients and statistical strength as in the fourth column, and the same is true for individual characteristics and point estimates.

To further investigate whether the effects of economic adversity variables are robust across each uncertainty measure, and across subsamples of respondents, in Table 4 we run similar regressions as in Table 3 separately for individuals who are in the workforce and those

[20]One county characteristic that has been shown to correlate with people's perceptions about the uncertainty of national house price movements is the volatility of house prices in the county (Kuchler and Zafar (2019)), which is captured by county fixed effects in our short panel.

who are not. As dependent variables we use uncertainty in each specific economic variable, rather than a composite index of uncertainty. In the first three columns in the table we examine the drivers of uncertainty about personal income growth, inflation and national home prices among respondents who are working. In the last two columns we examine the drivers of uncertainty about inflation and national home prices among respondents who are not working (as these individuals are not asked to provide distributions for own income growth). We continue to find that in each subsample, and for each uncertainty measure, people who are more uncertain in their economic forecasts are those who face more economic adversity, as proxied by lower household incomes, a lack of a college degree, a higher chance of default on existing debt, or by living in a county with higher unemployment.

Forming expectations about future income, national inflation, and national house prices may be more difficult for individuals with low numeracy, a characteristic that may also be positively correlated with income or college education. Table 5 documents that high numeracy indeed reduces uncertainty of respondents economic expectations whether we use uncertainty over all three economic variables (first column) or just the macroeconomic quantities (second column). We show that, on average, high numeracy reduces respondents' expectations uncertainty by 1.78 percentage points (i.e., 0.76 standard deviations). In addition, the relationship between uncertainty and SES characteristics—income, education, and active working status—is significantly lower by about two-thirds for respondents with high numeracy. However, the numeracy of the individual does not have a significant effect on the strength of the impact of the person's perceived probability of default in the following three months on their expectations uncertainty.

3.3 Within-person effects of adversity on expectations uncertainty

The results so far document that cross-sectional variation in proxies for individuals' adversity explains observed variation across people in the degree to which they are uncertain about several economic outcomes. Given that a respondent is in the survey for no more than 12

consecutive months, it is not possible to examine the effects of certain changes in a person's situation on their perception of uncertainty. For example, for all individuals in the sample, there is no variation within-person over time in whether they have a college degree, due to the short span during which the person is followed in the survey. However, there may exist dimensions of a person's situation that relate to the degree of adversity they face which change in the months when the person is included in the survey. A respondent could lose a job or may experience a financial shock.

We seek to examine the effects of such within-person changes in adversity, from one month to the next, on these individuals' assessment of uncertainty regarding personal and macro-level economic outcomes. In Table 6 we estimate regression models where the dependent variable is either the person's uncertainty regarding all three economic variables considered ($Uncertainty_{it}$) or just regarding the two macro-level variables ($Uncertainty_{it}^{macro}$), and where we now include respondent fixed effects as explanatory variables. County and year-month fixed effects, as well as the expectations point estimates are also included as controls, as in prior analyses. As expected, given the lack of within-person variation in the level of education during the months of participating in the survey, the coefficient on the college education dummy is omitted from the regression as it is subsumed by the respondent fixed effects. Similarly, the respondents' income in the prior 12 months, $Income/10,000_{it}$, which has little variation from one month to the next, as it is a backward-looking measure, does not have a significant effect.

However, we find that changes in financial fragility, as measured by changes in respondent's probability of financial distress, and changes in employment status from one month to the next correlate as expected with the respondents' assessment of uncertainty. The within-person effects we find in Table 6 are about one quarter to one-half the size of the effects estimated in the cross-sectional analyses in Table 3. For example, the effect of the variable $IsWorking_{it}$, which indicates whether the person currently has a job, on the person's uncertainty across all three economic variables is -0.45 (a decrease of a quarter of a standard

deviation) in the cross-sectional regression in Table 3 and -0.21 (a decrease of a tenth of a standard deviation) in the respondent fixed effects regression in Table 6. Hence, our results show that uncertainty varies predictably with adversity across the U.S. population, but also within a person if that individual's level of financial difficulties change over time.

3.4 Dynamics of respondent expectations

Our analysis assumes that our uncertainty measure—the standard deviations of the distributions of subjective expectations—indeed reflects the degree to which respondents lack confidence in their forecasts for the three economic variables studied here. A necessary condition for this assumption to be correct is that consumers will update their expectations in a manner consistent with Bayesian learning. That is, when people are more uncertain, upon receiving additional information about the quantity they are predicting, they rely less on the prior forecast and more on the new information.[21] In other words, over time we should observe larger changes, in absolute value, in the point estimate produced by an individual in month t relative to that produced by the same person in month $t-1$, if this individual was more uncertain in his or her point estimate in month $t-1$.

The results in Table 7 show that this indeed the case. For each of the three expectations we examine, we find a strong and positive correlation between the standard deviation around the forecast produced for that variable in month $t-1$, and the absolute value of the change in the point estimate from month $t-1$ to t, by the same respondent. This pattern is consistent whether we examine the update in expectations about personal income growth (first column), the rate of inflation (second column), or the growth rate of national home prices (third column), over the 12 months following the time of the survey. For example, a one-percentage point larger uncertainty for personal income expectations in month $t-1$ leads

[21] There is a high degree of overlap between the quantities estimated in months $t-1$ and t, as they refer to outcomes (e.g., the rate of inflation) over the subsequent 12 months—hence the time horizon of the two predictions overlaps by 11 months. This is very close to a setting where the person attempts to forecast the same variable repeatedly as new information arrives. Hence, we can use straightforward intuition from Bayesian learning regarding the effect of prior uncertainty on the extent to which the person weights their prior when forming their posterior belief.

to an absolute revision of 0.79 percentage points in month t. We find that the correlation between the level of uncertainty in a point estimate and the size of the revision of that estimate from one month to the next is between 0.31 and 0.44, depending on which of the three quantities are estimated. Correcting for the panel nature of the data, these correlations are significant at $p < 0.01$ or better.

3.5 Subjective versus objective uncertainty

Our results so far indicate that lower SES households have expectations about personal and macro-level economic variables that are characterized by more uncertainty, relative to households with higher SES. Here we examine how the subjective uncertainty of people of low and high SES compares to objective benchmarks for uncertainty, or volatility, regarding these economic outcomes. Given the short time during which a respondent is in the SCE panel, we do not have sufficient data to calculate the objective volatility of the respondent's own income. Hence, we will focus on the two macro-level outcomes that these individuals forecast, namely, the rate of inflation, and the growth rate in national home prices over the subsequent year. We present this analysis in Table 8.

The table shows subjective uncertainty (i.e., volatility) values for the rate of inflation and for the rate of growth in national home prices, averaged across participants in various SES categories, as well as objective measures of uncertainty, based on realized volatilities of these variables. These objective volatility measures are calculated for two time windows: several years prior to the SCE survey (January 2000 to December 2012), and during the SCE sample period (June 2013 to December 2019). For inflation, the objective volatility is calculated following the procedure used by the Federal Reserve Board, and detailed in Hulseman and Detmeister (2017). Briefly, we obtain the 1-month annualized change in the seasonally-adjusted Consumer Price Index (CPI), then calculate the change in the annualized growth rate of the CPI for a given month t as the rate in the current month minus the rate in the previous month, and compute the standard deviation of the changes of the growth rate

over the previous 60-months. We average the rolling-window standard deviations separately for the in-sample and the out-of sample periods. For national home price growth rates, we calculate the standard deviation of monthly percent changes in the seasonally-adjusted U.S. Case-Shiller Home Price index (HPI), for the out-of-sample and for the in-sample period separately, and then we annualize the monthly standard deviation by multiplying the result by the square root of 12.

The first column in Table 8 shows average values for subjective uncertainty regarding the inflation rate, while the second column shows average values for subjective uncertainty regarding the growth rate in national home prices, separately for each income and education category. The bottom two rows of the table show the objective values for the volatility of inflation and national home prices for years before and during the survey. For CPI inflation, the in-sample (i.e., 2013-2020) objective volatility is 0.86% and for the Case-Shiller HPI the in-sample objective volatility is 0.56%. The out-of-sample (i.e., 2000-2012) values for realized volatility for inflation and national home price growth rates are 1.41% and 2.44%, respectively. As can be seen from these two columns, higher SES respondents have levels of subjective uncertainty about these two macro-level outcomes that are closer to the objective volatility of these outcomes, whether the objective value is based on data from 2000 to 2012, or from 2013 to 2020. Specifically, college-educated respondents have, on average, 2.05% volatility around their forecasts for inflation, and 2.51% volatility around their national home price growth rate forecasts, whereas the subjective volatilities for people without a college degree are 3.08% and 3.19%, respectively. Moreover, respondents in higher income categories are consistently closer to the objective volatility for either macro-level outcome, relative to those at lower income levels. For example, among people earning $25,000 per year, subjective uncertainty is 3.35% in the case of inflation, and 3.55% in the case of national home price growth rates, whereas the subjective uncertainty for these two outcomes among people earning $125,000 per year is 1.87% and 2.27%, respectively.

Overall, the evidence in Table 8 indicates that individuals with higher SES have subjective

distributions about macroeconomic outcomes characterized by volatility levels that better match the objective volatility observed in these outcomes.

3.6 Expectations uncertainty and economic behavior

In this section we examine the relation between the uncertainty in individuals' economic expectations and several aspects of economic behavior, namely, their consumption, credit, and investment decisions. Extant theory models predict that uncertainty should relate to a wide range of economic behaviors, if it cannot be fully insured against. Specifically, all else equal, more uncertain households should plan on consuming less (e.g., Carroll and Samwick (1998), Bertola, Guiso, and Pistaferri (2005)). Also, more uncertain households should attempt to secure liquidity by using credit markets in a precautionary manner (e.g., Fulford (2015a)). Finally, more uncertain households should have lower exposure to risky financial assets (e.g., Kimball (1993), Gollier and Pratt (1996)). We examine each of these three predictions in the analyses below, and find evidence supporting the theoretical links between uncertainty, on the one hand, and consumption, credit, and investment decisions of households, on the other.

Our analysis uses the following OLS regression specification, where the dependent variable Y_{it} is the measure of the economic behavior under study, such as an indicator variable equal to 1 if the respondent expects total household spending to increase in the coming 12 months, $Will\ Increase\ Spending_{it}$, and $Uncertainty_{it}$ is an explanatory variable. The coefficient of interest is, θ, and represents the effect of a 1 percentage point increase of uncertainty on the outcome. For the example given, the estimate $\hat{\theta}$ would be interpreted as the change in the probability of increasing total household spending in the next 12 months.

$$\begin{aligned} Y_{it} = \alpha + \theta Uncertainty_{it} + \beta Income_{it} + \gamma College_{it} + \\ \mathbf{\Phi}' \mathbf{X}_{it}^{default,unemp} + \mathbf{\Psi}' \mathbf{X}_{it}^{controls} + \mu_t + \varepsilon_{it} \end{aligned} \tag{2}$$

3.6.1 Expectations uncertainty and consumption decisions

We being our analysis by studying the consumption plans of respondents. We find that individuals with more uncertainty in their economic expectations are significantly less likely to increase their total spending, their everyday spending, and their non-essential spending in the following 12 months. In addition, they are less likely to place probability mass on positive values in a distribution of spending outcomes, that is, their distributions are skewed towards negative values. The results are presented in Table 9. The first column uses data from the Core Survey and shows a one-percentage point increase in uncertainty predicts a 0.85 percentage points decrease in the likelihood an individual will increase total household spending in the coming year[22]. In other words, a one-standard deviation increase in uncertainty corresponds to a 0.05 standard deviation decrease in the likelihood to increase spending. To put this in perspective, going from not employed to actively employed leads to a 0.03-standard deviation increase in the likelihood of increased spending. Income and college education do not have significant correlations with the dependent variable. The second and third columns show a similar effect of uncertainty on everyday spending and non-essential spending using the Household Spending Survey.[23] The results in columns 2 and 3 show that a one-percentage point (standard deviation) increase in uncertainty predicts a –0.91 percentage point (–0.08 standard deviations) change in probability to increase essential spending. The effect is larger for non-essential spending. A one-percentage point (standard deviation) increase in uncertainty is correlated with a –1.3 percentage point (0.07 standard deviation) decrease in the probability to non-essential spending. Consistent with

[22]This variable asks respondents to consider total spending as a broad basket of goods and services that are essential and non-essential. Answers could be increase or decrease followed by an associated percent. The indicator variable is equal to 1 if the respondent states a percentage >= 0.

[23]The question regarding everyday spending (Q7c3 and Q7c3part2) is worded as: "Over the next 12 months, what do you expect will happen to your everyday spending on essential items? By everyday spending, we mean your daily living expenses related to what you absolutely need." Similarly, the question for non-essential spending (Q7c4 and Q7c4part2) is as follows: "What do you expect will happen to your non-essential spending (such as on hobbies, leisure, vacation, and other items that you do not absolutely need) over the next 12 months?" For both questions answers could be increase or decrease followed by an associated percent. We create an indicator equal to 1 if the respondent states a percentage >= 0 for each question.

these findings, a one-percentage point increase in subjective uncertainty is correlated with a –1.2 percentage point (0.10 standard deviation) lower likelihood to place probability mass on spending increases when asked to form a distribution of expected changed to total spending in the next 12 months.[24].

As indicated in Equation 2, we include fixed effects for counties where participants live and fixed effects for year-month to account for any time-related variation in aggregate spending patterns. Controlling for these fixed-effects, we find that people with higher income expect to spend more on non-essential spending, but not for total or essential spending. College educated respondents expect to increase essential spending and also place more probability mass on spending increases in their consumption distributions. Employment is positively correlated with an increase in total spending in column 1. Financial fragility measured by $\mathbb{P}(default3months)_{it}$ is negatively correlated with all spending measures implying that the short-run (3 month) financial situation of the household has an important link with long run (12 month) expected consumption plans.

In Table 10 we analyze respondents' expected consumption plans on both short (4 month) and long (12 month) horizons. The Household Spending survey asks respondents about the percent chance they will purchase a member of the household will make large purchases such as home durables, home renovations, vehicles, and trips in the next 4 months[25]. The Household Finance survey asks the exact same question except for a 12 month horizon[26]. Columns 1 to 4 show the estimates on the 4 month horizon and columns 5 - 8 show estimates on the 12 month horizon. All dependent variables take values between 0 and 100 (i.e., measured

[24]The question in the Household Spending survey (QSP7dens) is worded as follows: "Now we would like you to think about the different things that may happen to the total spending of all members of your household (including you) over the next 12 months. What do you expect will happen to the total spending of all members of your household (including you) over the next 12 months?"

[25]We construct the variable for home durables by taking the average of the respondent's answers to the three individual spending questions for appliances, electronics, and furniture. Responses are taken from question QSP4 which asks: "What do you think is the percent chance that you or a member of your household will make any of the following large purchases within the next 4 months? Please enter an answer between 0 and 100 for each item below.".

[26]The question in the Household Finance survey is also called QSP4 and has the exact same wording except that the horizon is looking ahead 12 months into the future.

in percentage points). Overall, respondents with higher subjective uncertainty – which is measured on a 12 month horizon – are less likely to make large purchases in the future. In the near term, spending on home renovations and trips (non-durables) exhibit significantly lower probabilities of purchase, but uncertainty does not affect short-run consumption of durable goods such as vehicles and home durables. For example, a one-percentage point (one-standard deviation) increase in uncertainty predicts a –0.25 percentage point (–0.02 standard deviation) and –1.00 percentage point (–0.06 standard deviation) decline the probability of a home renovation or trip purchase, respectively, in the following 4 months. However, on the 12 month horizon, uncertainty has a larger magnitude reduction in the likelihood of making large purchases for home renovations and trips. In addition, there is a significant reduction in the likelihood of purchasing a vehicle, but there remains no statistically significant effect on home durable consumption. Interpreting the coefficients, a one-percentage point (one-standard deviation) increase in uncertainty predicts a –0.82 percentage point (–0.06 standard deviation), –0.67 percentage point (–0.05 standard deviation), and –1.48 percentage point (–0.09 standard deviation) decline the probability of a home renovation, vehicle purchase, or trip purchase, respectively, in the following 12 months. These results support existent theory models, such as Carroll and Samwick (1998) and Bertola, Guiso, and Pistaferri (2005), which predict that uncertainty leads to precautionary behavior in terms of consumption.

Across our models, we find that people with higher incomes are more likely to consume in the future across all types of good studied and over both horizons. Once income is accounted for, the level of education does not impact the decision to increase spending for most consumption measures. However, the anticipated likelihood of purchasing a trip is strongly positively correlated with education on both horizons (+5.29 percentage points and +7.89 percentage points).

Financial fragility of the households' finances is negatively correlated with most expected purchases. For instance, a one-percentage point (standard deviation) increase in the probability of the respondent defaulting on debt obligations in the near future predicts a 0.13

percentage point (0.07 standard deviation) reduction of the probability purchasing a trip in the short run. Age exhibits an inverted-U pattern with home renovation and vehicle consumption plans, but is U-shaped for trip and home durable consumption. In contrast, gender, race, and expectation density means do not exhibit a consistent pattern across consumption plans and horizons.

In our final consumption analysis, we study the link between uncertainty and non-discretionary and discretionary spending. The Household Spending survey contains a set of questions on how respondents expect monthly spending in several categories to change between the survey date at time t and 12 months in the future[27]. We form indicators for each spending category that are equal to 1 if the percentage change is $>= 0$ to use as dependent variables. Table 11 shows the results. Non-discretionary spending such as housing (e.g. mortgage, rent), food, and transportation (e.g. gasoline, public transport fare) are not expected to change for individuals with more subjective uncertainty. However, a one-percentage point (standard deviation) increase in subjective uncertainty is associated with a decrease of 0.35 percentage points (0.03 standard deviation) decrease in the probability of increased spending on utilities and a 0.37 percentage point (0.04 standard deviation) decrease in the probability of increased spending on education / child care. Non-discretionary spending on clothing and recreation are also negatively correlated with uncertainty. A one-percentage point (standard deviation) increase in subjective uncertainty reduces the probability of increased clothing or recreation / entertainment consumption by 0.45 and 0.43 percentage points (0.04 and 0.04 standard deviations), respectively. Similarly, a one-percentage point (standard deviation) increase in subjective uncertainty reduces the probability of increased spending on medical care (e.g. insurance, bills, prescription drugs) by 0.35 percentage points (0.04 standard deviations).

To summarize, we find that increased subjective uncertainty leads to a reduction in con-

[27]The survey question is QSP6b and asks respondents: "And looking ahead, how do you think your monthly household spending 12 months from now, will compare to your current monthly spending in each category? Please enter a number greater than 0 or equal to 0 for each item. Please enter 0 if your spending in a certain category did not change."

sumption, across a variety of spending measures and time horizons. Respondents' consumption plans measured in aggregate or disaggregated into essential and non-essential spending or by specific spending categories such as durable and non-durable, or non-discretionary and discretionary spending all exhibit a precautionary response to uncertainty, as predicted by theory.

3.6.2 Expectations uncertainty and credit decisions

We examine whether people's uncertainty in economic expectations can help predict their behaviors in the credit markets. Specifically, we expect to observe, in accordance to existing theory (e.g., Fulford (2015a)) that, all else equal, more uncertainty leads to more cautious choices in terms of securing and using credit. We report our findings in Table 12. The empirical patterns in the table are in line with the theoretical predictions.

The core survey includes data regarding people's perceptions on whether, in general, it will be easier or more difficult to obtain loans or other forms of credit in the subsequent 12 months following the survey. Specifically, this measure of credit market perceptions is a score from 1 to 5, indicating how easy the respondent believes that it will generally be for people to obtain credit or loans in the subsequent 12 months.[28] The first column of Table 12 shows that a one-percentage point increase in uncertainty corresponds to a more pessimistic outlook about future credit availability by about 0.02 Likert points. Expressed differently, a one-standard deviation increase in uncertainty corresponds to a 0.06-standard deviations decrease (i.e., a more pessimistic outlook) in perceived future credit market conditions. For comparison, a one-standard deviation increase in income (roughly three bins) results in a 0.06-standard deviations more optimistic outlook for credit access, with a similar magnitude for college vs. no college education. Furthermore, a higher probability of default significantly negatively predicts future credit access outlook. A one-standard deviation increase in the probability of default is correlated with a 0.13-standard deviations more pessimistic outlook.

[28]This score is obtained from item Q32 in the core SCE module. A value of 1 corresponds to "Much Harder" and a value of 5 corresponds to "Much Easier". A value of 3 is neutral.

If we re-estimate our analysis using an ordered logit instead of OLS, we find similar results (omitted here for brevity). Individuals with higher subjective uncertainty are 6% less likely (using proportional odds ratios) to have a positive or neutral outlook on future credit market conditions than they are to have a negative outlook on future credit market conditions.

More details regarding credit market behaviors are available in the Credit Access module deployed by the SCE in a subset (about a fifth) of the months in the sample. Hence, when examining these additional variables, the sample size is reduced, due to the lower frequency with which these data are collected. Nonetheless, this additional module is useful for assessing the degree to which individuals attempt to use credit either as a means of precautionary behavior or as a means for current consumption. We examine these decisions in the second and third columns in the table. The dependent variable in the second column is a score from 1 to 5 indicating how likely the respondent is to seek an increase in available credit lines, either by asking for an increase in their credit card or other loan limits, applying for a new credit card, or for a home equity based-loan.[29] The dependent variable in the third column is a score from 1 to 5 indicating how likely the respondent is to seek credit to either purchase a car or pay for education.[30]

We find that uncertainty is positively correlated with seeking credit line increases. For each one-percentage point increase in uncertainty, individuals are 0.02 Likert points more likely to seek an increase in their credit lines (second column). Put differently, a one-standard deviation increase in uncertainty is correlated with a 0.06-standard deviations increase in the Likert score to seek credit line increases. However, we do not observe that more uncertain individuals have a higher propensity to use credit for consumption (third column). Income is a positive predictor of both seeking credit in general and seeking credit for consumption. Standardized coefficients are about 0.06 and 0.12, respectively. College education positively predicts seeking credit, but negatively predicts seeking credit for consumption uses with

[29]Specifically, this variable is the average of the responses provided in items N17a1,2,4,5 and 6 in the Credit Access survey module.

[30]This variable is the average of the responses provided in items N17a3 and 7 in the Credit Access module.

standardized coefficients of 0.03 and –0.02, respectively. Overall, the (standardized) impact of uncertainty on credit decisions is on a similar order of magnitude of those of common predictors such as income and education level.

Age has a U-shaped relationship with the perceived ease of credit availability in general, and with the interest in increased credit lines, but it does not relate to the person's interest in getting credit for immediate consumption. Being a female is a significant and negative predictor of the perceived future credit market conditions and the interest in seeking an increase in credit lines.

The point estimate for the person's income growth rate is a positive predictor of the individual's perceived ease of general credit availability, their interest in having increased credit lines, and in seeking credit to finance consumption. The respondents' point estimate for the rate of inflation over the subsequent year is a significant and negative predictor of their perceived ease with which credit will generally be available over that horizon, whereas their point estimate for the growth rate in national home prices has the opposite effect. The person's interest in securing increased credit lines or in using credit for consumption is unrelated either their point estimate for inflation or for the growth in national home prices.

3.6.3 Expectations uncertainty and investment decisions

To analyze investment decisions, we use data from the Household Finance module of the SCE that was administered in August from 2014 to 2018. While the number of observations drops significantly relative to our main sample due to the infrequent administration of this module, this subsample provides detailed information regarding respondents' assets and liabilities. Thus, we can construct a control variable that is not available for the main sample: the respondents' net worth. Moreover, this module allows us to assess the relationship between uncertainty and the portfolio decisions of these individuals. Specifically, we examine participation in equity markets, the value of equities held, and the proportion of equities held to assets to understand the degree to which respondents' uncertainty in their

economic expectations affects these financial decisions. We eliminate the top and bottom 1% of observations in terms of net worth, to minimize the effect of outliers.

The results of the investment decision analysis are reported in Table 13 and they confirm theoretical predictions in prior models, such as Kimball (1993) and Gollier and Pratt (1996) that uncertainty leads to reduced exposure to risky financial investments.

We use three measures of exposure to equities: an indicator equal to 1 if the value of equity holdings of the respondent is greater than zero[31] (first column); the dollar value of equity holdings scaled by total assets (second and third columns), and the natural logarithm of the dollar value of equity holdings (fourth and fifth columns). Aside from characteristics used in the prior analyses, we include the person's net worth, calculated as either the difference between their assets and debt (the first three columns) or the log value of assets and the log value of debt (the last two columns).

We document that individuals with higher values of uncertainty in their economic expectations are significantly less likely to invest in equities: a one-percentage point increase in uncertainty leads to a 1.43 percentage point lower likelihood of investing in equities (first column). Expressed differently, a one-standard deviation increase in uncertainty leads to a 0.07-standard deviations decrease in the likelihood of participating in equity markets. For comparison, a one-standard deviation increase in income results in a 0.20-standard deviations increase in the likelihood of investing in equities. Similarly, comparing college vs. non-college educated individuals, a college education predicts an expected increase of 0.06 standard deviations in the likelihood of investing in equities. Further, active employment predicts an expected 0.10-standard deviations increase in participation and a one-standard deviation increase in net worth (roughly $610,000) predicts an expected 0.19-standard deviations increase in participation.

Table 13 also shows that more uncertain respondents also have a significantly lower fraction of their assets invested in equities (–0.63 percentage points), whether we examine all

[31]Dollar value of total equity holdings is determined by the sum of equity holdings in defined contribution or investment accounts.

respondents (second column) or focus only on those who do participate in the stock market (–0.82 percentage points in the third column). Put another way, a one-standard deviation increase in uncertainty predicts an expected 0.08-standard deviations lower fraction of equities, unconditionally, and a 0.10-standard deviations lower fraction of equities, conditional on participation. For context, unconditionally, a one-standard deviation change in income, college, employment, or net worth each predict a *ceteris paribus* an increase in the fraction of equity share by 0.12-, 0.05-, 0.05-, and 0.15-standard deviations, respectively. Conditional on participation, uncertainty has standardized effects similar to or larger than those of college education (0.05) and net worth (0.07).

Finally, people with more uncertain economic expectations have a lower dollar amount invested in equities. When we examine all respondents (fourth column), we observe that each one-percentage point increase in uncertainty predicts an 10.8% decrease in the dollar value of a respondent's equity holdings. The coefficient is 8.6% if we condition on just those who invest in stocks (fifth column). Recast in standardized form, a one-standard deviation increase in uncertainty corresponds to a 0.05-standard deviations decrease in log equity holdings, unconditionally. Conditional on participation in equity markets, a one-standard deviation increase in uncertainty predicts a 0.04-standard deviations decrease in log equity holdings. For perspective, a one-standard deviation increase in income predicts an unconditional 0.24-standard deviation increase and a conditional 0.07-standard deviation increase in log equity holdings, respectively. Also, a one-standard deviation increase in the probability of default predicts a 0.04-standard deviation unconditional decrease in log equity holdings while a one-standard deviation increase in log assets corresponds to a 0.37-standard deviation (unconditional) and 0.46-standard deviation (conditional on participation) increases in log equity holdings.

To summarize, across these models, we find that in general, higher income or education levels, active employment, and a lower probability of financial distress lead to higher exposure to equity markets. Age is not significantly related to the degree to which participants are

invested in equities, but gender plays a significant role, with female respondents having less exposure to the stock market. The point estimates for income growth, inflation and national home price growth rates are not consistently related to the respondents' exposure to equities across the various specifications in the table. As expected, we find that there exists a substantial wealth effect on portfolio allocation. Specifically, people with higher net worth, or equivalently, those with higher asset levels, or those with lower levels of debt, have a larger exposure to stocks, whether this exposure is measured as the probability of participating in the stock market, the fraction of assets held in equities, or total equity holdings.

4 Alternative Hypotheses and Robustness Checks

4.1 Uncertainty in beliefs versus risk aversion

We investigate whether uncertainty in economic expectations is simply a proxy for individuals' risk aversion. Starting in April 2015, respondents in our main sample were asked two questions that capture their self-reported willingness to tolerate financial risk and their willingness to tolerate risk in general in their daily activities. These questions are administered upon a respondent's first entry into the Core survey and about 65% of the sample was asked these questions. The answers are on a scale from 1 to 7, with 7 indicating the highest level of risk tolerance. The two risk tolerance measures have a correlation coefficient of 0.48. We present the results of our analysis using only the risk preference measure defined as the willingness to tolerate financial risk in Table 14.[32]

The first column in Table 14 shows that risk tolerance is not significantly correlated with uncertainty in expectations. These two concepts are therefore orthogonal personal characteristics which may have different effects on individuals' behaviors. The next three

[32]Repeating the analysis using the risk preference measure about the willingness to tolerate risks in daily activities yields similar results.

columns show that risk tolerance also positively affects the planned consumption of the respondent in the following 12 months, in particular regarding the purchasing of durables and travel. The fifth column shows that risk tolerance has a positive and significant effect on the perceptions of ease of future credit access. Furthermore, risk tolerance has a significant and positive effect on people's exposure to equity markets, measured by whether they participate in the stock market (sixth column) or by the log value of equity positions conditional on participation (last column).[33]

Importantly, the results in Table 14 indicate that while risk tolerance impacts some of the behaviors we examine, uncertainty in expectations continues to be significantly related to households' consumption, credit or investment behaviors, even after we control for risk preferences. The effects of uncertainty on any of these behaviors in specifications where risk tolerance is included as a control are similar in size to the effects documented in the main analyses in Tables 9 through 13.

4.2 Measuring economic behaviors using survey answers

Our study, while relying on rich data regarding people's economic expectations, is limited to survey-based measures of these individuals' consumption, credit, and equity market behaviors. Unfortunately, as of now there exist no data sources that provide measures of subjective expectations uncertainty, as well as administrative data for all of these behaviors, at the individual level. It is necessary for such data sources to be constructed, but at this time attempts to relate expectations to actual economic behavior at the household level are rare. A recent notable exception is Giglio, Maggiori, Stroebel, and Utkus (2019), who combine administrative data regarding equity investments and subjective expectations about stock market returns. Hence, due to lack of administrative data regarding individuals' consumption, credit, and equity investment decisions, in this paper we rely on self-reported measures of these economic behaviors, and relate them to expectations uncertainty measures.

[33]The results obtained if other measures of equity market exposure are used (as in Table 13) are similar, so we omit them here for brevity.

This approach brings about a potential concern that the self-reported economic behaviors may not be related to what respondents actually plan to do. Survey answers about how people plan to consume, use credit, or how much they have allocated to equities could all be randomly generated, or generally untruthful. The results we have shown so far suggest that answers are not random, all of these self-reported measures of economic behaviors relate to individual characteristics as expected. For example, individuals with higher income report investing more in equities and are more likely to plan on doing home renovation projects (see Tables 13 and 9). We also find evidence that people end up following through with their planned economic behaviors. This is a feasible approach, because in the case of specific behaviors, survey respondents are not only asked what they plan on doing in the next 12 months, but, in a later wave of the survey, they are also asked about what they did in the recent past regarding that type of behavior. The behaviors we can examine the ex-ante plan and the ex-post realization are in the context of credit market decisions because for consumption and equity investments there are no measures of "look-back" behaviors.

Therefore, we check whether respondents' declared intentions about whether they are seeking to line up extra credit lines, or whether they seek credit to consume are truly what these individuals plan on doing. To verify that respondents' answers about their credit market behavior relate to their true intentions we look up these individuals' credit-related responses in future waves of the Credit Access module of the SCE. If respondents answer the survey truthfully, there should be a positive correlation between the extent to which a person declares in month t that over the subsequent 12 months they will seeking additional credit, and their answer at a later time to questions regarding whether they sought additional credit in the prior 12 months. Since participants are only included in the panel for up to 12 months, this later time is either four or eight months after month t, depending when a respondent is asked for the last time, while in the panel, to answer the Credit Access module. We find that the ex-ante intended credit increase variable and the ex-post credit sought variable have a correlation of 0.24 ($p < 0.01$).

We conduct a similar exercise with respect to investigating the link between the ex-ante plan of respondents in month t to seek credit to consume in the next 12 months, and the ex-post measure of whether in prior 12 months they sought such credit. Due to the same data limitations (i.e., participants are only in the panel for up to 12 months, and the Credit Access module of the SCE is only administered in select months), the ex-post variable is measured either four or eight months after month t, and not 12 months, which would be ideal given the way the survey questions are formulated. Nevertheless, even with this imperfect measure of the ex-post variable, we find that the ex-ante intention to seek credit to consume, and the ex-post measure of whether people indeed had sought such credit is 0.22 ($p < 0.01$).

These positive correlations provide evidence that survey respondents' answers regarding how they plan to use credit markets are not random or deceiving, but rather, they are indeed related to what these individuals actually plan to do. These results suggest that our survey-based measures of economic behaviors correlate positively with objective actions of individuals. Hence the effects we document in our analyses in Tables 10, 12, and 13 are likely to be informative about the role of uncertainty in households' expectations in their actual economic decisions.

4.3 Attention during the survey

It is possible that respondents do not attempt to answer the SCE questions to the best of their abilities and therefore we might misinterpret the data. For example, what we infer to be true uncertainty about a particular economic forecast may in fact be a measure of people's level of disinterest in the survey. A stringent manner to test whether this is the case is to examine whether there is positive correlation between people's expectations and what eventually happens. If people simply provide noise when answering the survey questions, their answers should not correlate with the realized values of the economic variable forecasted. We investigate whether responses regarding income growth expectations (personal and household) are correlated with realized changes in actual household income. We calculate realized

income growth on four horizons: 1 month, 3 months, 6 months, and 11 months. Growth is calculated as: $\frac{Income_t - Income_{t-k}}{Income_{t-k}}$ where $k \in 1, 3, 6, 11$. For each realized income growth horizon we require respondents to be in the survey for at least 2, 4, 7, and 12 months, respectively.[34] When running our correlation tests we remove outlier values by trimming the 1% tails of the expectation and realized income growth variables. The correlations between personal income growth expectations and realized income growth for the 3-month, 6-month, and 12-month horizons are 0.05, 0.05, and 0.07, respectively ($p < 0.05$). The equivalent correlations for household income expectations on the same horizons are 0.07, 0.09 and 0.08 ($p < 0.05$), respectively. These positive correlations suggest that survey respondents, on average, do not provide answers that are simply noise.

5 Conclusion

We document that households across the U.S. differ significantly in their uncertainty when forecasting micro- and macro-level economic variables, and that uncertainty perceptions within an individual permeate across economic domains. A significant part of the heterogeneity in uncertainty across the U.S. population is predicted by the degree of economic adversity faced by these individuals. Specifically, people with lower incomes, education, more precarious work and financial situations, and living in counties with higher unemployment are more uncertain when asked to forecast their personal income growth as well as the rate of inflation and the rate of growth of national home prices. Better numeracy helps reduce people's uncertainty across all of their forecasts, and also, it lowers the influence of these individuals' own economic situation on the degree of uncertainty that they have when making macro-economic predictions. Moreover, we find that people with higher uncertainty in their economic forecasts engage in more cautious behaviors in terms of consumption, use of credit markets, and financial portfolio allocations.

[34]The maximum income growth interval is 11 months, as respondents appear in the survey for up to 12 months. For example, a respondent entering the survey in June 2013 has data from June 2013 to May 2014.

Our findings suggest that it is important to understand which households are more uncertain in their expectations, as this uncertainty will impact households' responses to policy changes targeting these economic expectations or the behaviors driven by these expectations. The fact that lower socioeconomic status individuals and those from communities with worse economic conditions are the most uncertain in the population suggests that a reduction of uncertainty would have a high impact on the decisions of these individuals.

It is also possible that uncertainty in expectations may vary with the business cycle, and differently so depending on households' socioeconomic standing, which may lead to a countercyclical divergence in the consumption, borrowing or investment behaviors across the US population. Uncertainty may be a particularly important driver of the cyclical nature of economic outcomes for households faced with more adversity. These implications are corroborated by the evidence in Pistaferri (2016) who documented that households felt less secure following the recession of 2008–2009, and in Mian, Rao, and Sufi (2013), who report that the post-2008 consumption decline was sharpest in areas with the greatest home prices decline and highest levels of leverage, and attribute these effects to households' increased income uncertainty and their presumed precautionary response.

Overall, these results point to the importance of both the first and the second moment of expectations when either modeling theoretically or interpreting empirically the economic choices of households. In part due to lack of data regarding the second moment in beliefs, the literature has not made as much progress in studying the causes and effects of uncertainty on household actions, as it did in terms of studying expectations levels. Novel data on uncertainty provided by large scale surveys can offer useful insights and help move the literature forward in better assessing the formation and role of expectations on household decisions.

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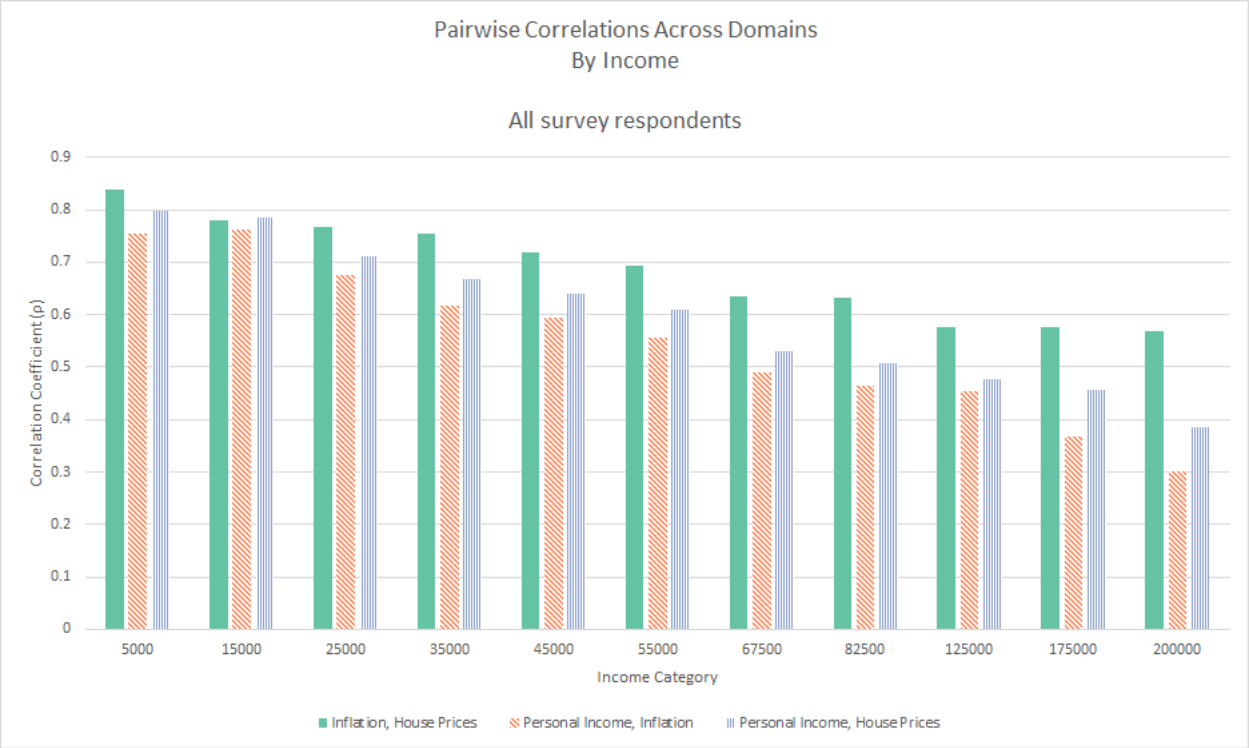

Figure 1
Correlation in uncertainty across domains, by income

The figure shows the within-person correlations across uncertainty measures for the three domains, for respondents in each income bin. The correlation between uncertainty about inflation and uncertainty about national house prices for respondents in each income category is shown by green solid bars. The correlation between uncertainty about inflation and uncertainty about personal income growth is shown by red shaded bars, and the correlation between uncertainty about national home price growth and uncertainty about personal income growth is shown by blue shaded bars.

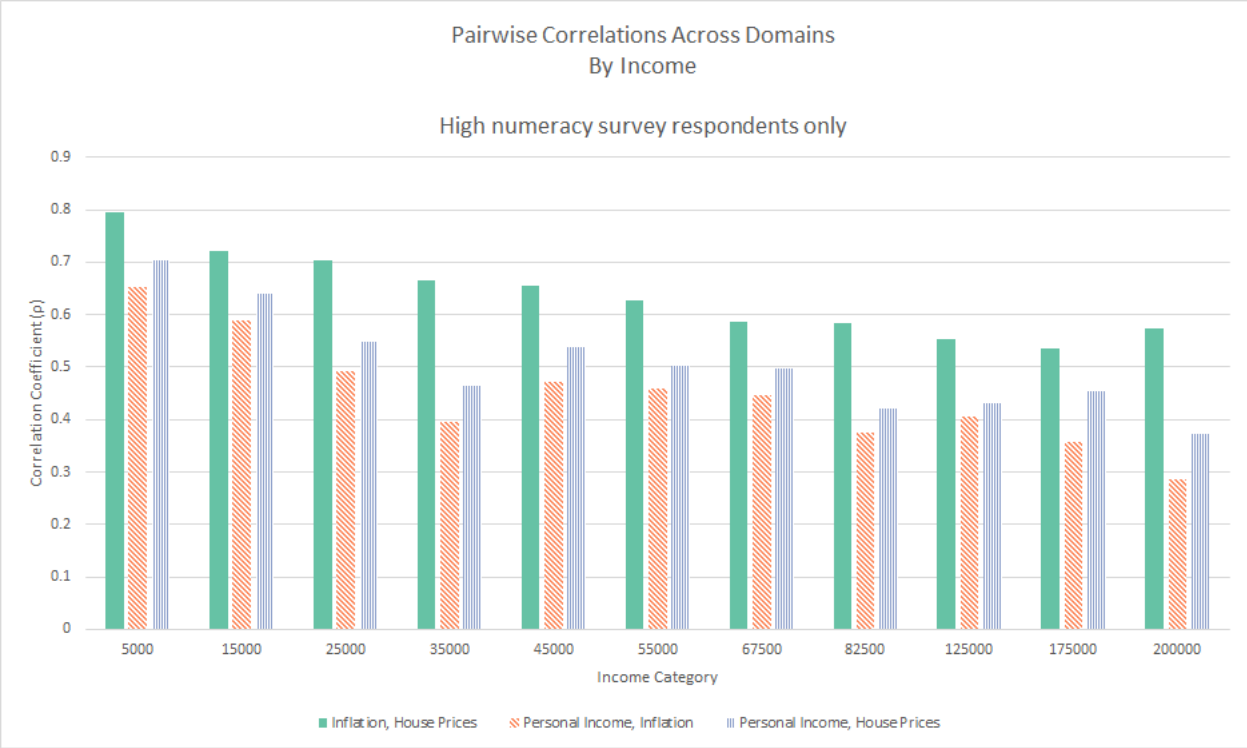

Figure 2
Correlation in uncertainty across domains, by income, for high-numeracy respondents only

The figure shows the within-person correlations across uncertainty measures for the three domains, for respondents in each income bin, only for individuals who have high numeracy (i.e., answered correctly at least 4 of the 5 questions about basic probabilities and finance knowledge). The correlation between uncertainty about inflation and uncertainty about national house prices for respondents in each income category is shown by green solid bars. The correlation between uncertainty about inflation and uncertainty about personal income growth is shown by red shaded bars, and the correlation between uncertainty about national home price growth and uncertainty about personal income growth is shown by blue shaded bars.

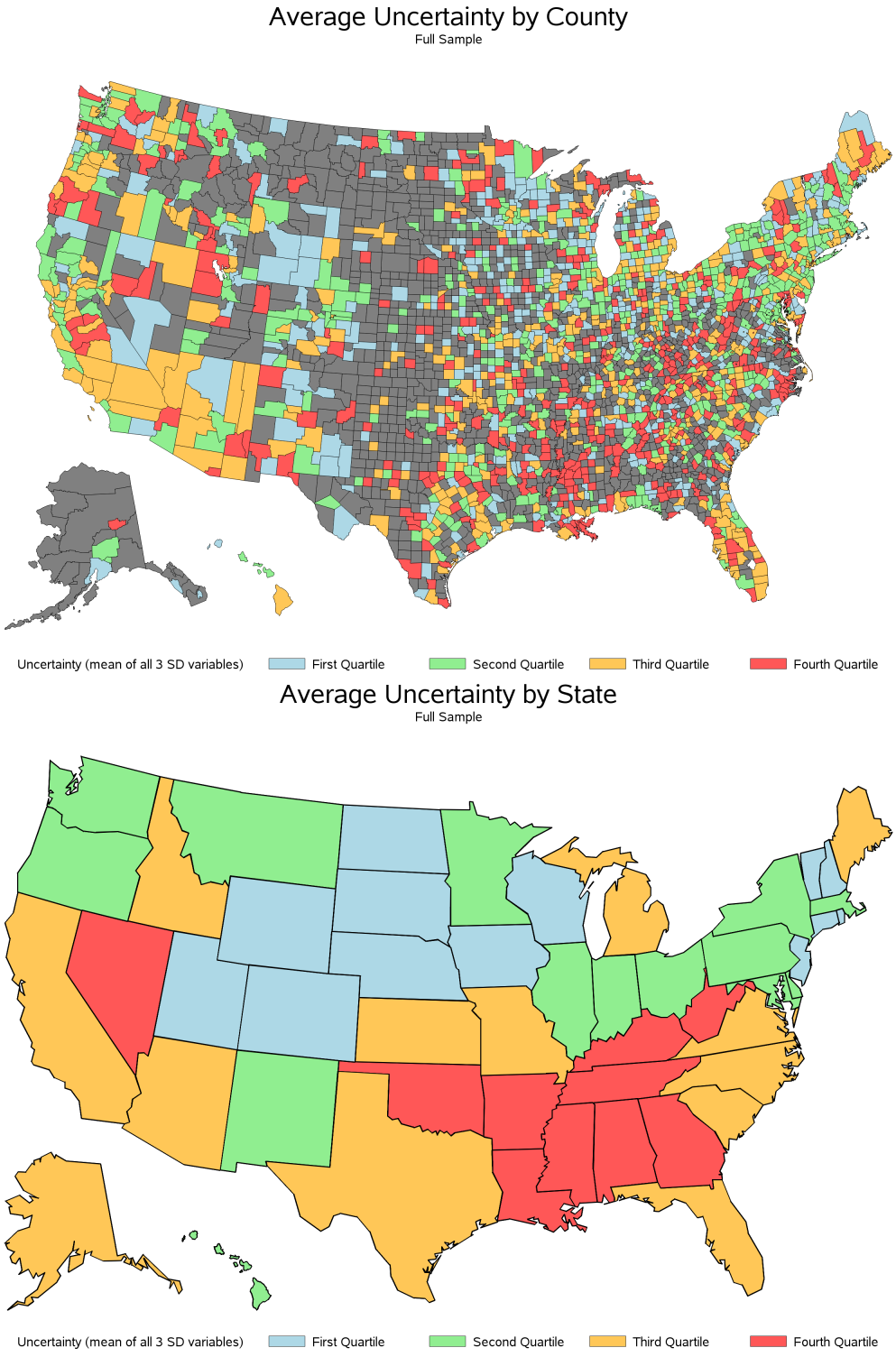

Figure 3
Geographic heterogeneity in uncertainty

This figure is constructed by averaging the level of uncertainty across all individuals in a location (county or state) and across time to calculate the average uncertainty in that location during the entire sample period. Quartiles of these averages are calculated and correspond to the colors in the legend shown above. Areas in gray have no data.

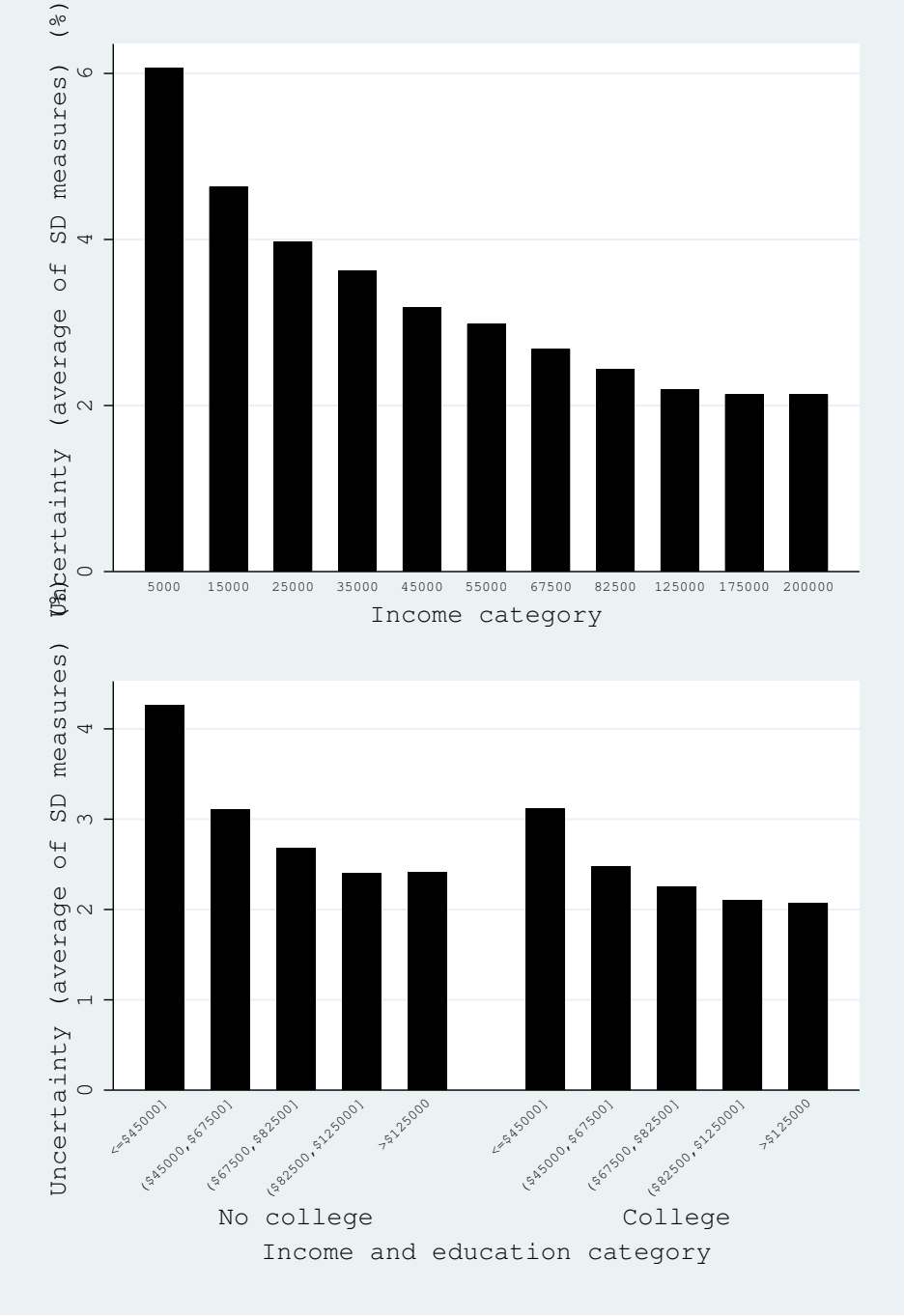

Figure 4
Uncertainty by income and education levels

This figure shows the average levels of uncertainty of participants across various levels of income and education. For the purpose of the figure, for each participant the income and education level are set to be equal to their maximum values across all the months when the individual was included in the survey.

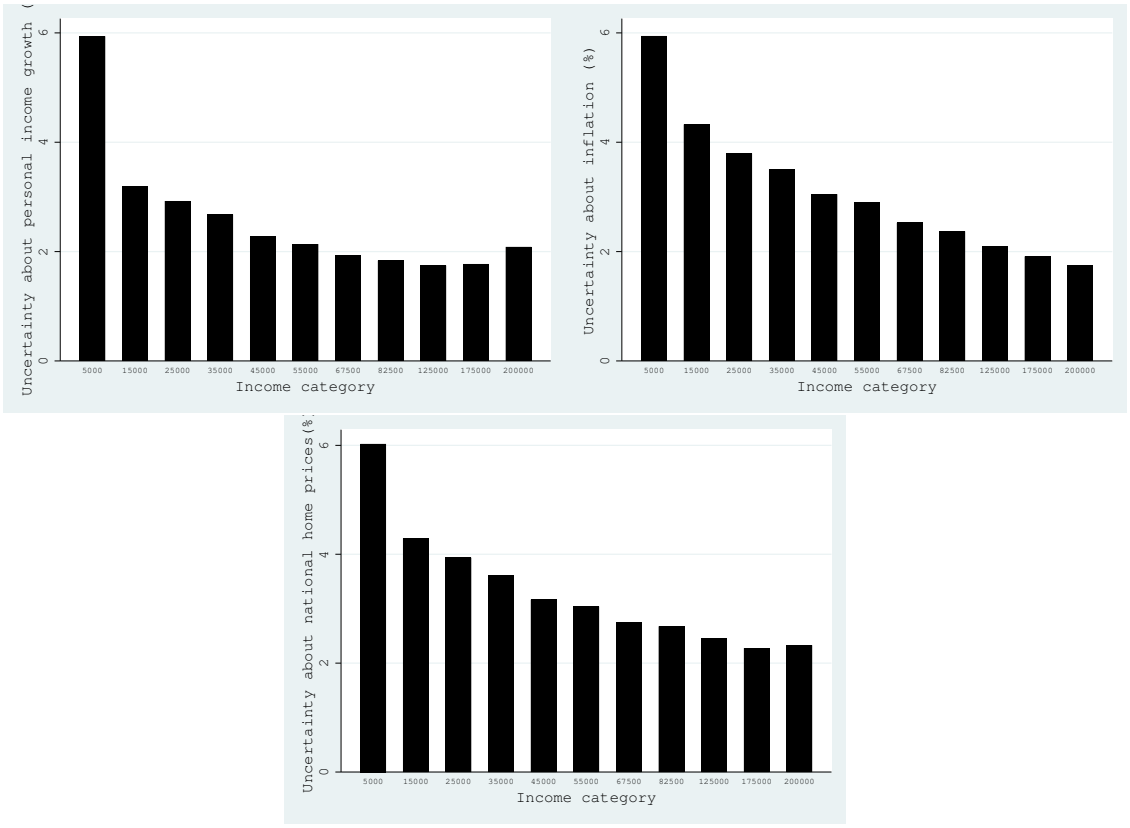

Figure 5
Uncertainty measured separately for personal income growth, inflation rate, and growth rate of national home prices, by income

This figure shows the average levels of uncertainty of participants in their forecast for their personal income growth (first panel), inflation rate (second panel), and the growth rate of national home prices (third panel) across various levels of income. For the purpose of the figure, for each participant the income level is set to be equal to its maximum values across all the months when the individual was included in the survey.

Table 1

Summary statistics

Summary statistics for expectations point estimates and uncertainty, respondent characteristics, and behaviors. Panel A shows beliefs variables, measured in percentage points. Those with the prefix "Expected" are subjective distribution means. The SD variables are the standard deviations of the subjective distributions. $Uncertainty_{it}$ and $Uncertainty_{it}^{macro}$ are constructed by taking the average of all three SD measures or just the two macro measures, respectively. Panel B shows socioeconomic and demographic variables. $Income/10,000_{it}$ is the midpoint value of the bin selected by respondents (see Appendix B). $College_{it}$ is an indicator for higher education. Panels C, D, and E show variables related to consumption, credit, and equity markets behaviors.

	Mean	Std Dev.	Min	Max	N
Panel A: Beliefs					
$Expected\ Personal\ Income_{it}$	3.15	4.23	-29.68	36.28	54105
$Expected\ Inflation_{it}$	3.52	4.20	-25.00	36.28	80271
$Expected\ Natnl\ Home\ Prices_{it}$	4.28	4.94	-25.23	36.28	80271
$SD(PersonalInc)_{it}$	1.98	2.37	0.37	20.83	54105
$SD(Inflation)_{it}$	2.48	2.68	0.37	21.92	80271
$SD(NatnlHP)_{it}$	2.80	2.59	0.37	21.93	80271
$Uncertainty_{it}$	2.52	2.35	0.42	20.93	80271
$Uncertainty_{it}^{macro}$	2.64	2.44	0.42	20.93	80271
Panel B: Socioeconomic Status and Demographics					
$Income/10,000_{it}$	8.10	5.34	0.50	20.00	80271
$College_{it}$	0.58	0.49	0.00	1.00	80271
Age_{it}	50.93	15.15	18.00	99.00	80271
$Female_i$	0.45	0.50	0.00	1.00	80271
$White_i$	0.87	0.34	0.00	1.00	80271
$Is\ Working_{it}$	0.67	0.47	0.00	1.00	80271
$\mathbb{P}(default3months)_{it}$	10.12	20.23	0.00	100.00	80119
$County\ \%\ Unempl_{it}$	4.92	2.03	1.40	41.20	80271
$High\ Numeracy_{it}$	0.73	0.44	0.00	1.00	80271
Panel C: Consumption					
$Will\ Increase\ Spending_{it}$	83.64	36.99	0.00	100.00	80271
$Will\ Increase\ Everyday\ Spending_{it}$	91.32	28.16	0.00	100.00	9410
$Will\ Increase\ Non-essential\ Spending_{it}$	73.68	44.04	0.00	100.00	9402
$More\ Density\ On\ Spending\ Increase_{it}$	90.26	29.65	0.00	100.00	9397
$\%\ Chance\ Purchase\ Home\ Reno\ Next\ 4\ months_{it}$	24.07	30.97	0.00	100.00	10291
$\%\ Chance\ Purchase\ Vehicles\ Next\ 4\ months_{it}$	9.58	20.41	0.00	100.00	10255
$\%\ Chance\ Purchase\ Trips\ Next\ 4\ months_{it}$	32.44	37.76	0.00	100.00	10301
$\%\ Chance\ Purchase\ Home\ Durables\ Next\ 4\ months_{it}$	14.04	16.77	0.00	100.00	10298
$\%\ Chance\ Purchase\ Home\ Reno\ Next\ 12\ months_{it}$	29.60	33.03	0.00	100.00	4431
$\%\ Chance\ Purchase\ Vehicles\ Next\ 12\ months_{it}$	23.62	29.26	0.00	100.00	4431
$\%\ Chance\ Purchase\ Trips\ Next\ 12\ months_{it}$	39.94	39.24	0.00	100.00	4431
$\%\ Chance\ Purchase\ Home\ Durables\ Next\ 12\ months_{it}$	20.69	21.43	0.00	100.00	4431
$\mathbb{1}(Housing >= 0)_{it}$	91.25	28.26	0.00	100.00	11305
$\mathbb{1}(Utility >= 0)_{it}$	93.00	25.52	0.00	100.00	11309
$\mathbb{1}(Food >= 0)_{it}$	92.52	26.31	0.00	100.00	11311
$\mathbb{1}(Transp >= 0)_{it}$	90.41	29.44	0.00	100.00	11306
$\mathbb{1}(Educ >= 0)_{it}$	94.84	22.12	0.00	100.00	11262
$\mathbb{1}(Clothing >= 0)_{it}$	92.23	26.77	0.00	100.00	11299
$\mathbb{1}(Rec >= 0)_{it}$	91.15	28.40	0.00	100.00	11290
$\mathbb{1}(Medical >= 0)_{it}$	94.51	22.79	0.00	100.00	11303
Panel D: Credit-related variables					
$Perceived\ Future\ Credit\ Market\ Conditions_{it}$	2.91	0.82	1.00	5.00	80250
$Seeks\ Credit\ Line\ Increase_{it}$	1.55	0.75	1.00	5.00	15083
$Seeks\ Credit\ To\ Consume_{it}$	1.49	0.77	1.00	5.00	15081
Panel E: Investment-related variables					
$Invests\ in\ Equities_{it}$	63.64	48.11	0.00	100.00	4326
$EquityHoldings/Assets_{it}$	12.82	19.00	0.00	100.00	4326
$EquityInvestments_{it}(log)$	6.62	5.34	0.00	18.13	4326
$Assets_{it}(log)$	11.85	2.84	0.00	18.63	4417
$Debt_{it}(log)$	9.22	4.04	0.00	18.52	4405
$NetWorth_{it}$	3.99	6.18	-5.85	47.97	4309

Table 2

Commonality across uncertainty measures and across distribution means

The table shows the pairwise correlations between uncertainty measures and expected values (based on the distributions) for the three economic variables measured in the core survey: personal income growth, the rate of inflation, and the rate of growth of national home prices in the 12 months following the time of the survey. Variables with the "Expected" prefix are subjective distribution means. The SD variables are the standard deviations of the subjective distributions.

	$Expected\ Personal\ Income_{it}$	$Expected\ Inflation_{it}$	$Expected\ Natnl\ Home\ Prices_{it}$	$SD(PersonalInc)_{it}$	$SD(Inflation)_{it}$	$SD(NatlHP)_{it}$
$Expected\ Personal\ Income_{it}$	1.0000					
$Expected\ Inflation_{it}$	0.0992***	1.0000				
$Expected\ Natnl\ Home\ Prices_{it}$	0.1786***	0.3888***	1.0000			
$SD(PersonalInc)_{it}$	0.2591***	-0.0778***	-0.0655***	1.0000		
$SD(Inflation)_{it}$	-0.0306***	0.1977***	0.0163***	0.5757***	1.0000	
$SD(NatnlHP)_{it}$	0.0042	0.0426***	0.1914***	0.6167***	0.7262***	1.0000

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3

Uncertainty differences across the U.S. population

In the first four columns of the table the dependent variable, $Uncertainty_{it}$, is the average of the uncertainty each participant i has at the time of the survey, time t, regarding their point estimate for their personal income growth ($SD(PersonalInc)_{it}$, if elicited), for the rate of inflation ($SD(Inflation)_{it}$), and for the growth rate of national home prices ($SD(NatnlHP)_{it}$), all estimated over the subsequent 12-month period. In the last column, the dependent variable is the average of only the latter two variables, namely, $SD(Inflation)_{it}$ and $SD(NatnlHP)_{it}$. Standard errors are corrected for heteroskedasticity and clustered at the respondent level.

	$Uncertainty_{it}$	$Uncertainty_{it}$	$Uncertainty_{it}$	$Uncertainty_{it}$	$Uncertainty_{it}^{macro}$
$Income/10,000_{it}$		-0.074***	-0.056***	-0.047***	-0.053***
		(-19.91)	(-15.52)	(-12.16)	(-13.32)
$College_{it}$		-0.532***	-0.489***	-0.511***	-0.541***
		(-11.96)	(-11.06)	(-10.92)	(-11.23)
$Is\ Working_{it}$			-0.497***	-0.445***	-0.246***
			(-9.09)	(-8.26)	(-4.52)
$\mathbb{P}(default3months)_{it}$			0.012***	0.010***	0.011***
			(11.54)	(10.32)	(10.67)
$County\ \%\ Unempl_{it}$			0.046***	0.020	0.022
			(3.46)	(1.15)	(1.22)
Age_{it}	-0.057***	-0.044***	-0.036***	-0.036***	-0.032***
	(-6.05)	(-4.72)	(-3.87)	(-3.76)	(-3.33)
Age_{it}^2	0.001***	0.000***	0.000**	0.000***	0.000**
	(5.94)	(3.93)	(2.54)	(2.60)	(2.09)
$Female_i$	0.477***	0.286***	0.253***	0.246***	0.327***
	(11.08)	(6.80)	(6.06)	(5.83)	(7.52)
$White_i$	-0.981***	-0.940***	-0.888***	-0.701***	-0.735***
	(-11.79)	(-11.93)	(-11.38)	(-8.93)	(-9.14)
$Income\ Growth\ Pt\ Est_{it}$				0.021***	0.009***
				(11.83)	(5.02)
$Expected\ Inflation_{it}$				0.026***	0.042***
				(5.32)	(8.41)
$Expected\ Natnl\ Home\ Prices_{it}$				0.020***	0.036***
				(5.63)	(9.31)
Year-Month FEs	Yes	Yes	Yes	Yes	Yes
County FEs	No	No	No	Yes	Yes
Adjusted R^2	0.04	0.09	0.10	0.25	0.25
Observations	80271	80271	80119	80030	80030

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4

Uncertainty among working and non-working respondent subsamples

In the table, we separately examine the determinants of uncertainty about specific economic variables for the subsamples of respondents who are working (the first three columns), and those who are not working (the last two columns). Only working respondents in the survey are asked about the distribution of their own income growth over the subsequent 12 months. Non-working respondents are only asked about the distribution of the two macro-level variables, inflation and national home price growth. In each column in the table, the dependent variable is the uncertainty each participant i has regarding their point estimate for their personal income growth ($SD(PersonalInc)_{it}$), the rate of inflation ($SD(Inflation)_{it}$), or the growth rate of national home prices ($SD(NatnlHP)_{it}$), all estimated for the 12-month period following the time of the survey, i.e., month t. Standard errors are corrected for heteroskedasticity and clustered at the respondent level.

	Subsample: Working Respondents			Subsample: Non-working Respondents	
	$SD(PersonalInc)_{it}$	$SD(Inflation)_{it}$	$SD(NatnlHP)_{it}$	$SD(Inflation)_{it}$	$SD(NatnlHP)_{it}$
$Income/10,000_{it}$	-0.031***	-0.054***	-0.042***	-0.069***	-0.061***
	(-6.47)	(-11.46)	(-8.89)	(-8.37)	(-7.65)
$College_{it}$	-0.260***	-0.550***	-0.296***	-0.851***	-0.589***
	(-4.48)	(-9.05)	(-5.05)	(-9.57)	(-7.02)
$\mathbb{P}(default3months)_{it}$	0.009***	0.011***	0.010***	0.009***	0.010***
	(7.74)	(9.13)	(8.86)	(4.68)	(5.03)
Age_{it}	-0.066***	-0.051***	-0.062***	-0.043**	-0.053***
	(-4.56)	(-3.66)	(-4.52)	(-2.08)	(-2.74)
Age^2_{it}	0.001***	0.000***	0.001***	0.000	0.000*
	(4.28)	(3.08)	(3.63)	(1.38)	(1.87)
$Female_i$	-0.109**	0.328***	0.110**	0.593***	0.409***
	(-2.32)	(6.56)	(2.25)	(6.44)	(4.71)
$White_i$	-0.539***	-0.703***	-0.584***	-1.197***	-0.974***
	(-6.04)	(-7.77)	(-6.56)	(-6.83)	(-5.88)
$Expected\ Personal\ Income_{it}$	0.149***				
	(20.58)				
$Expected\ Inflation_{it}$		0.120***		0.089***	
		(15.00)		(8.79)	
$Expected\ Natnl\ Home\ Prices_{it}$			0.109***		0.088***
			(18.04)		(11.49)
Year-Month FEs	Yes	Yes	Yes	Yes	Yes
County FEs	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.23	0.26	0.22	0.33	0.32
Observations	53898	53898	53898	25991	25991

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5

Numeracy effects on uncertainty

The dependent variable is $Uncertainty_{it}$, measured as the average of the SD of income growth, inflation and national home price growth in the first column, and, $Uncertainty_{it}^{macro}$, the average of the SD of inflation and national home price growth in the second column. Variable $High\ Numeracy_{it}$ is an indicator equal to 1 if respondent i at time t answered at least 4 of the 5 numeracy questions in the survey correctly, and 0 otherwise. The regressions control for gender, age, age squared, county fixed-effects, year-month fixed-effects, and for the point estimates (i.e., means) provided by the respondent regarding personal (or household) income growth, inflation and national home price growth rates over the 12 months following time t. Standard errors are corrected for heteroskedasticity and clustered at the respondent level.

	$Uncertainty_{it}$	$Uncertainty_{it}^{macro}$
$Income/10,000_{it}$	-0.101***	-0.108***
	(-9.95)	(-10.37)
$Income/10,000_{it}$ X $High\ Numeracy_{it}$	0.075***	0.077***
	(6.98)	(6.99)
$College_{it}$	-0.807***	-0.831***
	(-8.06)	(-8.10)
$College$ X $High\ Numeracy_{it}$	0.614***	0.613***
	(5.67)	(5.50)
$Is\ Working_{it}$	-0.604***	-0.284***
	(-5.73)	(-2.66)
$Is\ Working_{it}$ X $High\ Numeracy_{it}$	0.304***	0.131
	(2.76)	(1.18)
$\mathbb{P}(default3months)_{it}$	0.010***	0.011***
	(5.46)	(5.56)
$\mathbb{P}(default3months)_{it}$ X $High\ Numeracy_{it}$	-0.002	-0.001
	(-0.87)	(-0.67)
$High\ Numeracy_{it}$	-1.772***	-1.721***
	(-13.87)	(-13.32)
Age_{it}	-0.041***	-0.038***
	(-4.43)	(-3.99)
Age_{it}^2	0.000***	0.000***
	(3.27)	(2.74)
$Female_i$	0.173***	0.248***
	(4.20)	(5.86)
$White_i$	-0.594***	-0.622***
	(-7.92)	(-8.10)
$Income\ Growth\ Pt\ Est_{it}$	0.021***	0.009***
	(12.24)	(5.17)
$Expected\ Inflation_{it}$	0.024***	0.040***
	(5.06)	(8.21)
$Expected\ Natnl\ Home\ Prices_{it}$	0.021***	0.036***
	(5.84)	(9.58)
Constant	5.887***	5.775***
	(22.54)	(21.64)
Year-Month FEs	Yes	Yes
County FEs	Yes	Yes
Adjusted R^2	0.27	0.27
Observations	80030	80030

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6

Uncertainty and adversity: Respondent fixed effects estimation

In this table we examine whether month-to-month changes in people's adversity can help predict month-to-month changes in these individuals' degree of uncertainty regarding future personal and macro-level economic outcomes. The dependent variable in the first column, $Uncertainty_{it}$, is a respondent's uncertainty regarding all three economic variables (personal income growth, inflation, and the growth rate of national home prices). The dependent variable in the second column, $Uncertainty_{it}^{macro}$ is the respondent's uncertainty regarding the two macro-level outcomes (inflation and the growth rate of national home prices). The analysis includes respondent fixed effects, year-month fixed effects, as well as county fixed effects. Standard errors are corrected for heteroskedasticity and clustered at the respondent level.

	$Uncertainty_{it}$	$Uncertainty_{it}^{macro}$
$Income/10,000_{it}$	-0.005	-0.004
	(-1.30)	(-0.98)
$College_{it}$	0.000	0.000
	(.)	(.)
$Is\ Working_{it}$	-0.213***	-0.062*
	(-6.10)	(-1.93)
$\mathbb{P}(default3months)_{it}$	0.003***	0.003***
	(5.42)	(5.27)
$County\ \%\ Unempl_{it}$	-0.001	-0.004
	(-0.16)	(-0.35)
$Income\ Growth\ Pt\ Est_{it}$	0.009***	0.002*
	(9.42)	(1.71)
$Expected\ Inflation_{it}$	0.046***	0.061***
	(12.83)	(14.91)
$Expected\ Natnl\ Home\ Prices_{it}$	0.053***	0.069***
	(19.05)	(22.09)
Year-Month FEs	Yes	Yes
County FEs	Yes	Yes
Respondent FEs	Yes	Yes
Adjusted R^2	0.81	0.80
Observations	78680	78680

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7

Uncertainty and point estimate revisions over time

The dependent variable in the linear regression models in the table is the absolute value of the change between month $t-1$ and month t in the point estimates provided by respondents regarding their personal income growth (first column), inflation rate (second column), and rate of growth of national home prices (third column), over the subsequent 12 months. The independent variable in each model is the uncertainty the respondent had in their point estimate in month $t-1$. Standard errors are corrected for heteroskedasticity and clustered at the respondent level.

	$\lvert\Delta Personal\ Income\ Growth\ Point\ Estimate_{it-1,it}\rvert$	$\lvert\Delta Inflation\ Rate\ Point\ Estimate_{it-1,it}\rvert$	$\lvert\Delta National\ Home\ Price\ Point\ Estimate_{it-1,it}\rvert$
$SD(PersonalInc)_{i,t-1}$	0.791***		
	(23.61)		
$SD(Inflation)_{i,t-1}$		1.070***	
		(44.89)	
$SD(NatnlHP)_{i,t-1}$			0.559***
			(34.32)
Constant	0.634***	0.136***	1.416***
	(12.53)	(2.99)	(36.14)
Adjusted R^2	0.12	0.20	0.10
Observations	46936	75423	65640

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8

Subjective versus objective volatility

The table presents subjective uncertainty (i.e., volatility) values for the rate of inflation and for the rate of growth in national home prices, averaged across participants in various SES categories, as well as objective measures of uncertainty, based on realized volatilies of these variables. These objective volatility measures are calculated for two time windows: several years prior to the SCE survey (January 2000 - December 2012), and during the SCE sample period (June 2013 - December 2019). For inflation, the objective volatility is calculated according to a procedure employed by the Federal Reserve Board, which is detailed in Hulseman and Detmeister (2017). Namely, we first obtain the 1-month annualized change in the seasonally-adjusted Consumer Price Index, then calculate the change in the annualized growth rate for a given month t as the rate in the current month minus the rate in the previous month, and then compute the standard deviation in changes of the growth rate over the previous 60-months from month t. We average the rolling-window standard deviations separately for the in-sample and the out-of sample periods. For national home price growth rates, we calculate the standard deviation of monthly percent changes in the seasonally-adjusted Case-Shiller Home Price index, for the out-of-sample and for the in-sample period separately, and then we annualize the monthly standard deviation by multiplying the result by the square root of 12. The first column shows average values for subjective respondent inflation uncertainty and the second column shows average values for subjective national house prices uncertainty, separately for each income and education category. The bottom two rows of the table show the objective values for the volatility of inflation and that of the growth rate of national house prices, for the out-of-sample and the in-sample periods. All values in the table are reported in percent.

	In-Sample Expectation Uncertainty For:		
	Inflation Rate (%)	National House Prices (%)	N
SES by Education			
No College	3.08	3.19	33537
College	2.05	2.51	46734
SES by Income			
5000	5.02	5.11	1996
15000	3.90	3.99	4684
25000	3.35	3.55	6655
35000	3.06	3.23	6668
45000	2.71	2.94	7142
55000	2.51	2.71	7135
67500	2.29	2.61	9890
82500	2.11	2.46	12419
125000	1.87	2.27	13005
175000	1.75	2.21	5670
200000	1.61	2.23	5007
Benchmark Uncertainty (2000 - 2012)	1.41	2.44	
Benchmark Uncertainty (2013 - 2019)	0.86	0.56	

Table 9

Uncertainty and consumption decisions

The dependent variables in the first three columns are indicators for increases in spending in general, spending on essential items, and spending on non-essential items. The indicator in column 1 is constructed using the core SCE survey using monthly data from June 2013 to April 2020 and is equal to 1 if the expected increase to household spending for a basket of goods will be ≥ 0 over the subsequent 12 months following time t. The dependent variables in columns 2 to 4 use data from the Household Spending survey which is fielded 3 times per year from December 2014 to August 2018. The indicators in column 2 and 3 are equal to 1 if the expected increase in essential or non-essential spending are ≥ 0 over the subsequent 12 months following time t. The dependent variable in column 4 is equal to 1 if the respondent places more probability on the positive values in the density of likely changes to their total household spending over the subsequent 12 months following time t. The dependent variables in all columns are scaled to equal 0 or 100, for ease of coefficient interpretation. Standard errors are corrected for heteroskedasticity and clustered at the respondent level.

Dependent variable	$Will\ Increase\ Spending_{it}$	$Will\ Increase\ Essential\ Spending_{it}$	$Will\ Increase\ Nonessential\ Spending_{it}$	$More\ Density\ Weight\ Spending\ Increase_{it}$
	data from core survey	data from household spending module		
$Uncertainty_{it}$	-0.852***	-0.910***	-1.314***	-1.234***
	(-7.72)	(-4.01)	(-4.58)	(-5.10)
$Income/10,000_{it}$	-0.091	0.091	0.652***	-0.071
	(-1.64)	(1.24)	(5.23)	(-0.85)
$College_{it}$	0.309	2.314***	0.680	1.979**
	(0.52)	(2.84)	(0.51)	(2.26)
$Is\ Working_{it}$	2.728***	1.544	1.226	0.956
	(4.33)	(1.53)	(0.79)	(0.93)
$\mathbb{P}(default3months)_{it}$	-0.055***	-0.058***	-0.184***	-0.063***
	(-4.34)	(-2.87)	(-5.85)	(-2.80)
Age_{it}	-0.491***	-0.439***	-0.399	-0.234
	(-4.36)	(-2.79)	(-1.50)	(-1.38)
Age_{it}^2	0.005***	0.005***	0.003	0.003
	(4.64)	(3.11)	(1.26)	(1.58)
$Female_i$	-2.620***	-1.778**	-3.278***	-1.280
	(-4.79)	(-2.32)	(-2.68)	(-1.59)
$White_i$	4.206***	4.827***	7.535***	3.875***
	(4.89)	(3.88)	(4.19)	(3.11)
$Income\ Growth\ Pt\ Est_{it}$	0.313***	0.039	0.308***	0.127***
	(11.97)	(0.93)	(5.57)	(2.81)
$Expected\ Inflation_{it}$	0.079	-0.095	-0.236	0.282**
	(1.57)	(-0.77)	(-1.48)	(2.44)
$Expected\ Natnl\ Home\ Prices_{it}$	0.184***	0.078	0.233*	0.196**
	(4.29)	(0.90)	(1.85)	(2.14)
Year-Month FEs	Yes	Yes	Yes	Yes
County FEs	Yes	Yes	Yes	Yes
Adjusted R^2	0.07	0.07	0.09	0.07
Observations	80030	9162	9153	9149

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10

Uncertainty and consumption decisions

The data used for the analysis shown in the table below comes from the Household Spending module (first four columns), and the Household Finance Module (last four columns). The dependent variables measure the likelihood, in percent, that in the following 4 months (in the first four columns), or 12 months (in the last four columns) the respondent will purchase home renovations, vehicles, trips, or home durables. Home durables consists of appliances, electronics, and furniture and is the average of the individual likelihoods, in percent. Standard errors are corrected for heteroskedasticity and clustered at the respondent level.

	*In Next **4** months, % chance will purchase:*				*In Next **12** months, % chance will purchase:*			
Dependent variable	$Home\ Reno_{it}$	$Vehicles_{it}$	$Trips_{it}$	$Home\ Durables_{it}$	$Home\ Reno_{it}$	$Vehicles_{it}$	$Trips_{it}$	$Home\ Durables_{it}$
	data from household spending module				data from household finance module			
$Uncertainty_{it}$	-0.247*	0.125	-1.007***	-0.108	-0.820***	-0.665***	-1.475***	-0.168
	(-1.69)	(1.15)	(-5.66)	(-1.31)	(-3.78)	(-3.20)	(-5.79)	(-1.12)
$Income/10,000_{it}$	1.395***	0.366***	1.863***	0.570***	1.175***	0.191	2.359***	0.757***
	(15.03)	(6.07)	(17.97)	(11.91)	(9.33)	(1.63)	(16.71)	(9.13)
$College_{it}$	1.743**	0.207	5.239***	0.739	1.472	1.634	7.889***	0.804
	(1.98)	(0.37)	(5.11)	(1.55)	(1.19)	(1.43)	(5.65)	(1.02)
$Is\ Working_{it}$	0.728	1.517**	-0.976	1.256**	0.834	2.810**	-2.776*	0.569
	(0.73)	(2.42)	(-0.85)	(2.43)	(0.58)	(2.10)	(-1.74)	(0.62)
$\mathbb{P}(default3months)_{it}$	-0.063***	0.036***	-0.125***	-0.008	-0.072***	0.081***	-0.158***	-0.004
	(-3.87)	(2.77)	(-6.11)	(-0.85)	(-2.69)	(2.98)	(-5.14)	(-0.24)
Age_{it}	0.870***	0.023	-0.873***	-0.259***	0.624***	0.435**	-0.879***	-0.330**
	(5.15)	(0.21)	(-4.26)	(-2.78)	(2.65)	(1.99)	(-3.18)	(-2.22)
Age_{it}^2	-0.008***	-0.001	0.008***	0.001	-0.006**	-0.006***	0.007**	0.001
	(-4.97)	(-1.08)	(3.85)	(1.08)	(-2.45)	(-2.64)	(2.49)	(0.55)
$Female_i$	1.214	-0.696	-1.077	0.325	-0.318	-1.644	-2.316*	-0.019
	(1.45)	(-1.32)	(-1.12)	(0.73)	(-0.27)	(-1.57)	(-1.78)	(-0.03)
$White_i$	1.809	-0.915	-0.750	-1.634**	5.002***	1.884	2.755	0.771
	(1.58)	(-1.05)	(-0.54)	(-2.38)	(3.21)	(1.23)	(1.43)	(0.70)
$Income\ Growth\ Pt\ Est_{it}$	-0.030	0.045*	0.119***	0.069***	0.012	0.109	0.136*	0.147***
	(-0.83)	(1.79)	(2.86)	(3.13)	(0.20)	(1.50)	(1.95)	(3.47)
$Expected\ Inflation_{it}$	-0.059	-0.052	-0.102	-0.029	-0.074	0.120	-0.256	-0.072
	(-0.64)	(-0.83)	(-0.92)	(-0.54)	(-0.56)	(0.82)	(-1.56)	(-0.86)
$Expected\ Natnl\ Home\ Prices_{it}$	0.080	-0.036	0.177*	0.066	0.000	0.020	0.050	-0.023
	(1.02)	(-0.65)	(1.85)	(1.48)	(0.00)	(0.15)	(0.34)	(-0.29)
Year-Month FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.13	0.04	0.16	0.11	0.08	0.02	0.17	0.12
Observations	10063	10027	10076	10074	3893	3893	3893	3893

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11

Uncertainty and consumption decisions: Discretionary, non-discretionary, and medical spending

The data used for the analysis in the table below comes from the Household Spending SCE module. This additional module was fielded every 4 months from December 2014 to August 2018. The dependent variables come from a set of questions asking about how several categories household spending will evolve over the next 12 months compared to current, time t spending. We categorize spending into non-discretionary, discretionary, and medical spending. The on-discretionary categories include: housing (mortgage, rent, maintenance, insurance); utilities (water, sewer, electricity, heating); food (groceries, dining out, beverages); transportation (gasoline, public transport fares, car maintenance). Discretionary spending includes: clothing, footwear, and personal care and recreation and entertainment. We classify medical care (health insurance, medical bills, prescription drugs) separately. Each indicator is equal to 1 if the percent change is ≥ 0 reported by the survey respondents. The indicator is scaled to equal 0 or 100 for ease of coefficient interpretation as percent. In addition, the regression samples for each column only include observations where the percentages used to construct the indicators like within the 1% and 99% percentile bounds of the distribution of responses. Standard errors are corrected for heteroskedasticity and clustered at the respondent level.

	non-discretionary spending					discretionary spending		
	$\mathbb{1}(Housing >= 0)_{it}$	$\mathbb{1}(Utilities >= 0)_{it}$	$\mathbb{1}(Food >= 0)_{it}$	$\mathbb{1}(Transp >= 0)_{it}$	$\mathbb{1}(Educ >= 0)_{it}$	$\mathbb{1}(Clothing >= 0)_{it}$	$\mathbb{1}(Rec/Ent >= 0)_{it}$	$\mathbb{1}(Medical >= 0)_{it}$
$Uncertainty_{it}$	-0.129	-0.347**	-0.157	-0.079	-0.370***	-0.452***	-0.425***	-0.350***
	(-0.93)	(-2.41)	(-1.32)	(-0.54)	(-3.09)	(-3.30)	(-3.04)	(-2.98)
$Income/10,000_{it}$	-0.025	-0.012	-0.011	-0.105	-0.171***	0.043	-0.063	0.005
	(-0.40)	(-0.20)	(-0.20)	(-1.55)	(-3.60)	(0.73)	(-0.97)	(0.10)
$College_{it}$	-0.845	0.357	-0.538	-0.080	-0.230	-0.460	-1.143*	0.023
	(-1.27)	(0.59)	(-0.97)	(-0.12)	(-0.52)	(-0.78)	(-1.78)	(0.05)
$Is\ Working_{it}$	-0.396	1.469**	-0.004	0.346	0.312	0.242	1.088	0.484
	(-0.53)	(2.06)	(-0.01)	(0.43)	(0.59)	(0.36)	(1.48)	(0.83)
$\mathbb{P}(default3months)_{it}$	-0.006	-0.024*	0.005	-0.005	-0.022**	0.004	-0.023	-0.012
	(-0.44)	(-1.79)	(0.40)	(-0.32)	(-2.03)	(0.29)	(-1.64)	(-1.08)
Age_{it}	0.008	-0.015	-0.178	-0.109	-0.041	-0.111	-0.156	0.025
	(0.05)	(-0.12)	(-1.64)	(-0.78)	(-0.46)	(-0.96)	(-1.21)	(0.25)
Age_{it}^2	0.000	0.001	0.002**	0.001	0.001	0.001	0.002*	0.000
	(0.28)	(0.82)	(2.14)	(0.77)	(1.56)	(1.00)	(1.82)	(0.49)
$Female_i$	-0.414	-0.062	-0.769	1.276**	-0.458	-1.049*	0.806	0.046
	(-0.65)	(-0.11)	(-1.44)	(2.00)	(-1.03)	(-1.90)	(1.34)	(0.10)
$White_i$	1.856*	2.860***	0.878	0.285	0.525	2.512***	1.370	1.723**
	(1.95)	(3.08)	(1.05)	(0.31)	(0.75)	(2.74)	(1.47)	(2.32)
$Income\ Growth\ Pt\ Est_{it}$	-0.122***	-0.100***	-0.049	-0.039	-0.011	0.021	0.048	-0.109***
	(-3.17)	(-2.89)	(-1.58)	(-1.11)	(-0.55)	(0.73)	(1.64)	(-3.85)
$Expected\ Inflation_{it}$	0.039	0.101	0.166***	0.227***	0.131**	0.154**	0.199***	0.166***
	(0.56)	(1.57)	(2.67)	(3.12)	(2.40)	(2.48)	(2.99)	(3.10)
$Expected\ Natnl\ Home\ Prices_{it}$	0.102*	0.132**	0.054	0.098	0.149***	0.144***	0.173***	0.115**
	(1.84)	(2.26)	(1.13)	(1.64)	(3.65)	(2.86)	(3.21)	(2.56)
Year-Month FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.03	0.03	0.01	0.03	0.03	0.01	0.02	0.02
Observations	12027	12045	11806	11989	11985	11829	12009	12036

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12

Uncertainty and credit decisions

The dependent variable in the first column is a score from 1 to 5, indicating how easy the respondent believes that it will generally be for people to obtain credit or loans in the 12 months following the survey (item Q32 in the core survey). The dependent variable in the second column is a score from 1 to 5 indicating how likely the respondent is to seek an increase in available credit lines (item N17a1,2,4,5 and 6 from the credit access survey module). The dependent variable in the third column is a score from 1 to 5 indicating how likely the respondent is to seek credit to either purchase a car or pay for education (item N17a3 and 7 from the credit access survey module). Standard errors are corrected for heteroskedasticity and clustered at the respondent level.

	Perceived Future Credit Market Conditions$_{it}$	*Seeks Credit Line Increase*$_{it}$	*Seeks Credit To Consume*$_{it}$
$Uncertainty_{it}$	-0.023***	0.018***	0.001
	(-8.74)	(4.84)	(0.30)
$Income/10,000_{it}$	0.007***	0.003**	0.006***
	(5.33)	(1.99)	(3.23)
$College_{it}$	0.051***	0.015	-0.039**
	(3.54)	(0.86)	(-2.18)
$Is\ Working_{it}$	0.041***	0.060***	0.050***
	(2.75)	(3.10)	(2.60)
$\mathbb{P}(default3months)_{it}$	-0.005***	0.002***	0.002***
	(-18.45)	(4.46)	(4.85)
Age_{it}	-0.021***	-0.026***	-0.001
	(-7.42)	(-7.19)	(-0.40)
Age^2_{it}	0.000***	0.000***	-0.000**
	(6.92)	(3.86)	(-2.22)
$Female_i$	-0.064***	-0.079***	-0.025
	(-4.83)	(-4.79)	(-1.52)
$White_i$	0.068***	0.030	-0.052*
	(3.25)	(1.15)	(-1.93)
Income Growth Pt Est$_{it}$	0.003***	0.003***	0.002**
	(6.58)	(3.68)	(2.48)
Expected Inflation$_{it}$	-0.018***	-0.000	-0.001
	(-13.95)	(-0.24)	(-0.69)
Expected Natnl Home Prices$_{it}$	0.008***	-0.000	-0.002
	(7.19)	(-0.17)	(-0.93)
Year-Month FEs	Yes	Yes	Yes
County FEs	Yes	Yes	Yes
Adjusted R^2	0.14	0.12	0.08
Observations	80009	14788	14786

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13

Uncertainty and equity investment decisions

The dependent variable in the first column is an indicator (equal to 0 or 100, for ease of coefficient interpretation) for whether the value of stock market holdings of the respondent is greater than zero. In the second and third columns the dependent variable is the respondents' value of equity holdings, scaled by the total value of their assets, expressed as percentage points (i.e., up to 100). In the last two columns the dependent variable is the log of the dollar value of equity holdings (log(1+amount)) of the respondent. Control variables include net worth, which is the difference between the person's assets and debt (first three columns), or the log value of assets and the log value of debt (last two columns). Balance sheet data is only available in the SCE Household Finance Survey. Standard errors are corrected for heteroskedasticity and clustered at the respondent level.

	$Invests\ in\ Equities_{it}$	$EquityHoldings/Assets_{it}$	$EquityHoldings/Assets_{it}\ if\ Invests\ in\ Equities_{it}=1$	$Equity\ Holdings_{it}\ (log)$	$Equity\ Holdings_{it}\ (log)\ if\ Invests\ in\ Equities_{it}=1$
$Uncertainty_{it}$	-1.431***	-0.625***	-0.815***	-0.108***	-0.086***
	(-3.75)	(-4.68)	(-3.38)	(-3.02)	(-3.53)
$Income/10,000_{it}$	1.808***	0.442***	0.134	0.240***	0.065***
	(9.68)	(5.31)	(1.20)	(12.78)	(7.16)
$College_{it}$	6.081***	2.004***	1.974*	0.642***	0.235**
	(3.37)	(2.78)	(1.81)	(3.61)	(2.55)
$Is\ Working_{it}$	10.193***	2.077**	1.194	0.296	-0.060
	(4.87)	(2.54)	(0.90)	(1.47)	(-0.49)
$\mathbb{P}(default3months)_{it}$	-0.186***	-0.002	0.056	-0.010***	-0.003
	(-4.56)	(-0.09)	(1.62)	(-2.58)	(-1.12)
Age_{it}	-0.341	-0.066	-0.007	0.023	0.026
	(-1.00)	(-0.46)	(-0.03)	(0.69)	(1.45)
Age_{it}^2	0.002	0.001	0.000	-0.000	-0.000
	(0.58)	(0.37)	(0.10)	(-0.72)	(-1.05)
$Female_i$	-4.057**	-2.582***	-2.912***	-0.694***	-0.245***
	(-2.56)	(-3.83)	(-2.95)	(-4.41)	(-3.07)
$White_i$	-1.437	0.621	1.969	0.011	0.434***
	(-0.60)	(0.61)	(1.32)	(0.05)	(3.39)
$Income\ Growth\ Pt\ Est_{it}$	-0.135	-0.086***	-0.144**	-0.005	-0.001
	(-1.49)	(-3.04)	(-2.52)	(-0.62)	(-0.29)
$Expected\ Inflation_{it}$	-0.739***	-0.143*	-0.110	-0.057***	-0.003
	(-3.24)	(-1.85)	(-0.69)	(-2.65)	(-0.21)
$Expected\ Natnl\ Home\ Prices_{it}$	0.193	0.022	-0.006	0.007	-0.000
	(1.07)	(0.32)	(-0.05)	(0.43)	(-0.04)
$NetWorth_{it}$	1.464***	0.465***	0.227***		
	(9.81)	(6.83)	(2.81)		
$Assets_{it}(log)$				0.705***	0.857***
				(23.76)	(22.92)
$Debt_{it}(log)$				-0.035	-0.041***
				(-1.55)	(-3.84)
Year-Month FEs	Yes	Yes	Yes	Yes	Yes
County FEs	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.21	0.12	0.06	0.37	0.49
Observations	3691	3691	2243	3691	2243

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14

Uncertainty in expectations versus risk preferences

Risk tolerance is measured in the first month of participation in the core survey, as well as in the months when respondents also complete the household finance module. We use the former in the first and fifth columns, and the latter in the other columns, since the dependent variables there are obtained from the Household Finance module. Each regression contains the same set of control variables as in Tables 10, 12, and 13 (i.e., demographics, point estimates, year-month as well as county fixed effects.) Standard errors are corrected for heteroskedasticity and clustered at the respondent level. t-statistics are shown in parentheses.*, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

		*In Next **12** months, % chance will purchase:*					
	$Uncertainty_{it}$	*Home* $Reno_{it}$	$Vehicles_{it}$	$Trips_{it}$	*Perceived Future Credit Market* $Conditions_{it}$	*Invests in* $Equities_{it}$	*Equity* $Holdings_{it}$ *if Invests in* $Equities_{it} = 1$
$Uncertainty_{it}$		-0.820***	-0.682***	-1.461***	-0.025***	-1.390***	-0.085***
		(-3.79)	(-3.28)	(-5.79)	(-7.43)	(-3.62)	(-3.47)
$FinancialRisk - HHFinance_{it}$		1.398***	0.717**	1.971***		4.781***	0.111***
		(3.68)	(2.02)	(4.64)		(9.16)	(4.31)
$FinancialRisk - Core_i$	0.011				0.017***		
	(0.58)				(2.93)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year-Month FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.29	0.09	0.03	0.19	0.15	0.24	0.49
Observations	51246	3859	3859	3859	51231	3685	2239

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix

A. Eliciting point estimates and subjective distributions in the SCE

As an example we show the questions used in the SCE to elicit point estimates (first excerpt below) and subjective distributions (second excerpt) regarding the change in national home prices over the 12 months following the survey. The questions regarding the point estimates and distributions for personal income growth, and for the rate of inflation, are constructed similarly to the questions regarding home prices.

Q31v2

Next we would like you to think about home prices nationwide.

Over the next 12 months, what do you expect will happen to the average home price nationwide?
Instruction H8.

Over the next 12 months, I expect the average home price to...

❍ increase by 0% or more

❍ decrease by 0% or more

Q31v2part2

By about what percent do you expect the average home price to [increase/decrease as in Q31v2]? Please give your best guess.

Instruction H9.

Over the next 12 months, I expect the average home price to [increase/decrease as in Q31] by __ %

And in your view, what would you say is the percent chance that, **over the next 12 months,** the average home price nationwide will...

Instruction H4.

increase by 12% or more	_____	percent chance
increase by 8% to 12%	_____	percent chance
increase by 4% to 8%	_____	percent chance
increase by 2% to 4%	_____	percent chance
increase by 0% to 2%	_____	percent chance
decrease by 0% to 2%	_____	percent chance
decrease by 2% to 4%	_____	percent chance
decrease by 4% to 8%	_____	percent chance
decrease by 8% to 12%	_____	percent chance
decrease by 12% or more	_____	percent chance
Total	**100**	

B. Income bins

Below are the bins that respondents in the SCE use to report their total annual household income. The same question is also asked to repeat respondents.

Q57

[if new respondent] Which category represents the total combined pre-tax income of all members of your household (including you) during the past 12 months?

Please include money from all jobs, net income from business, farm or rent, pensions, interest on savings or bonds, dividends, social security income, unemployment benefits, Food Stamps, workers compensation or disability benefits, child support, alimony, scholarships, fellowships, grants, inheritances and gifts, and any other money income received by members of your household who are 15 years of age or older.

Instruction H5.

- ❍ Less than $10,000
- ❍ $10,000 to $19,999
- ❍ $20,000 to $29,999
- ❍ $30,000 to $39,999
- ❍ $40,000 to $49,999
- ❍ $50,000 to $59,999
- ❍ $60,000 to $74,999
- ❍ $75,000 to $99,999
- ❍ $100,000 to $149,999
- ❍ $150,000 to $199,999
- ❍ $200,000 or more