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How Do Expectations About the Macroeconomy Affect Personal Expectations and Behavior?

Christopher Roth, Johannes Wohlfart

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Abstract

Using a representative online panel from the US, we examine how individuals' macroeconomic expectations causally affect their personal economic prospects and their behavior. To exogenously vary respondents' expectations, we provide them with different professional forecasts about the likelihood of a recession. Respondents update their aggregate economic outlook in response to the forecasts, extrapolate to expectations about their personal economic circumstances and adjust their consumption behavior and stock purchases. Extrapolation to expectations about personal unemployment is driven by individuals with higher exposure to macroeconomic risk, consistent with sticky information models in which people are inattentive, but understand how the economy works.

JEL-Codes: D120, D140, D830, D840, E320, G110.

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Christopher Roth
Institute on Behavior and Inequality
(briq)
Germany – 53113 Bonn
christopher.roth@economics.ox.ac.uk

Johannes Wohlfart
Department of Economics
Goethe University Frankfurt
Germany – 60323 Frankfurt am Main
wohlfart@econ.uni-frankfurt.de

1 Introduction

Households' expectations about future income affect their consumption and financial behavior, and should be shaped by perceptions of both idiosyncratic and aggregate risk. Policymakers attach an important role to the macroeconomic outlook of households, and persistently low consumer confidence about the aggregate economy is central to many accounts of the slow recovery of consumption after the Great Recession. However, macroeconomic models of imperfect information predict a large degree of inattention to the aggregate economic outlook (Maćkowiak and Wiederholt, 2015; Reis, 2006; Sims, 2003) due to the dominant role of idiosyncratic risk. This raises several questions: are relevant pieces of news about the macroeconomy, such as professional forecasts about economic growth, part of households' information sets? Do people change their expectations about their personal economic situation and economic behavior in response to changes in their expectations about the aggregate economy?

Correlational evidence on these research questions could be confounded by omitted variables, reverse causality and measurement error. For instance, Kuchler and Zafar (2017) show that individuals extrapolate from their personal situation to their macroeconomic outlook. We sidestep these issues through a randomized information experiment embedded in an online survey on a sample that is representative of the US population in full-time employment. Our experiment proceeds as follows: first, we elicit our respondents' prior beliefs about the likelihood of a recession. We define a recession as a fall in US real GDP around three months after the time of the survey. Subsequently, we provide our respondents with one of two truthful professional forecasts about the likelihood of a recession taken from the micro data of the Survey of Professional Forecasters (SPF). While respondents in the "high recession treatment" receive information from a very pessimistic forecaster, respondents in the "low recession treatment" receive a prediction from a very optimistic forecaster. Thereafter, we measure our respondents' expectations about the evolution of aggregate unemployment and their personal economic situation over the 12 months after the survey, and elicit their consumption plans as well as their posterior

beliefs about the likelihood of a recession. We re-interview a subset of our respondents in a follow-up survey two weeks after the information provision.

Our experimental design allows us to study whether people adjust their personal job loss and earnings expectations and their economic behavior in response to changes in their macroeconomic outlook. Moreover, the setup enables us to shed light on different predictions of macroeconomic models of imperfect information, which parsimoniously explain many stylized facts in macroeconomics (Carroll et al., 2018; Maćkowiak and Wiederholt, 2015) and dramatically change policy predictions relative to standard models (Wiederholt, 2015). In such models, people are imperfectly informed about the state of the economy, due to either infrequent updating of information sets (Carroll, 2003; Mankiw and Reis, 2006; Reis, 2006) or receiving noisy signals (Maćkowiak and Wiederholt, 2015; Sims, 2003; Woodford, 2003). For example, if our respondents adjust their beliefs in response to the information, this implies that they are imperfectly informed about the professional forecasts even though those forecasts are relevant for their economic outlook.

We document several findings on people's recession expectations and their relationship with people's personal economic outlook and behavior: first, we find that our respondents have much more pessimistic and dispersed prior beliefs about the likelihood of a recession compared with professional forecasters. Respondents update their beliefs about the likelihood of a recession in the direction of the forecasts, putting a weight of around one third on the forecast. Learning rates are significantly higher for respondents who are less confident in their prior beliefs, in line with Bayesian updating. These findings lend support to models of imperfect information in which people are initially inattentive but update rationally from new information. In addition, we observe a decline in disagreement among respondents after the information provision, consistent with models of sticky information (Reis, 2006; Wiederholt, 2015).

Second, we explore the degree of extrapolation from macroeconomic to personal economic expectations. We find that a negative macroeconomic outlook has a negative causal effect on people's subjective financial prospects for their household and increases people's perceived chance of becoming personally unemployed. A back-of-the-envelope calculation

suggests that 11.3 percent of our respondents would need to become unemployed in case of a recession for their expectations to be accurate on average. This effect is relatively large, but still close to the increase in the job loss rate by 7 percentage points during the last recession. However, there is no significant effect on people's expected earnings growth conditional on keeping their job. People's updating of expectations decreases in size, but mostly remains economically and statistically significant in the two-week follow-up survey.

Third, we characterize heterogeneity in the effect of recession expectations on personal expectations. The negative effect on perceived job security is driven by individuals with a higher exposure to recessions in the past, such as people with lower education and lower earnings, as well as men. Individuals who are more strongly exposed to macroeconomic risk (e.g. those with previous unemployment experience, those living in counties with higher unemployment or working in more cyclical industries) more strongly update their expectations about personal unemployment. Thus, updating of personal expectations is data-consistent in terms of size and heterogeneity, indicating that our respondents have an understanding of how the economy works, which is a key feature of imperfect information models.

Fourth, we provide evidence of adjustments in behavior in response to the information. We find that a more pessimistic macroeconomic outlook causes a significantly lower planned consumption growth, in line with recent evidence that recessions can entail shocks to permanent income (Krueger et al., 2016; Yagan, 2017). We also find suggestive evidence of actual changes in spending using data from the follow-up. Furthermore, we document surprisingly large effects of our treatment on active adjustments in people's stockholdings between the main intervention and the follow-up survey as measured through self-reports.

Finally, we provide causal evidence on the relationship between people's expectations about economic growth and inflation.[1] There was substantial disinflation during most recessions in the past (Coibion and Gorodnichenko, 2015b) and many macroeconomic

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[1]We build upon existing work by Carvalho and Nechio (2014), Dräger et al. (2016) and Kuchler and Zafar (2017) who examine how beliefs about unemployment correlate with beliefs about interest rates and inflation.

models predict a co-movement of inflation and unemployment in response to shocks. However, our fifth main finding is that changes in beliefs about the likelihood of a recession do not causally affect people's inflation expectations.

We contribute to a growing literature that uses survey experiments to study the expectation formation process and the importance of information rigidities. This literature has mainly focused on expectations about inflation (Armantier et al., 2016, 2015; Binder and Rodrigue, 2018; Cavallo et al., 2017; Coibion et al., 2018a) and house prices (Armona et al., 2018; Fuster et al., 2018) and documents that consumers and firms update their expectations in response to the provision of publicly available information. Our paper is the first to exogenously shift households' expectations about future GDP growth to assess whether people extrapolate from expectations about aggregate conditions to their personal economic outlook, and whether these expectations causally affect consumer and financial behavior.[2] A key contribution of our paper is to document that people have a basic understanding of their exposure to business cycle fluctuations, as indicated by the size and heterogeneity of updating of job loss expectations in response to a revised macroeconomic outlook.

A larger literature uses observational data to study how people's macroeconomic expectations are formed (Das et al., 2017; Kuchler and Zafar, 2017; Malmendier and Nagel, 2011, 2016; Manski, 2017; Mian et al., 2017; Tortorice, 2012), and how these expectations shape household behavior, such as the effect of home price expectations on housing-related behavior (Bailey et al., 2017a,b) or the effect of inflation expectations on consumption behavior (Bachmann et al., 2015; D'Acunto et al., 2018). A literature in finance uses survey data to study the extent to which optimism and pessimism about stock returns and the macroeconomic outlook can explain households' investment behavior (Das et al., 2017; Dominitz and Manski, 2007; Greenwood and Shleifer, 2014; Hurd et al., 2011; Malmendier and Nagel, 2011; Vissing-Jorgensen, 2003).[3] Our paper also contributes to a literature

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[2]Individuals' expectations about uncertain future income are at the core of many models of household behavior, such as the probability of unemployment in models of precautionary savings behavior (Carroll, 1992) or income risk in models of portfolio choice (Cocco et al., 2005; Guiso et al., 1996; Heaton and Lucas, 2000; Polkovnichenko, 2006; Viceira, 2001). Uncertainty about future income also has important implications for asset prices (Constantinides and Duffie, 1996; Heaton and Lucas, 1996).

[3]We also contribute to a literature in labor economics on the determinants of subjective job security

that uses observational data to study the importance of information rigidities in macroe-conomics (Andrade and Le Bihan, 2013; Carroll, 2003; Coibion and Gorodnichenko, 2012, 2015a; Mankiw et al., 2003). Finally, our paper relates to work studying different models of belief formation about macroeconomic variables (Bordalo et al., 2018a,b; Fuster et al., 2012, 2010).

The rest of the paper is structured as follows: in Section 2 we describe the design of the main experiment. In Section 3, we provide details on the data collection. In Section 4, we present evidence on belief updating in response to the professional forecasts. Section 5 presents the results on the causal effect of expectations about a recession on people's personal economic outlook, behavior and other macroeconomic expectations. Section 6 concludes.

2 Experimental design

In this section we present our experimental design and explain the structure of the main survey and the follow-up survey. The full experimental instructions are available at `https://goo.gl/1C9vLK`. Figures A.1 and A.2 show detailed timelines of the experiment and the relevant reference periods for behavioral outcomes and expectations.

2.1 Baseline experiment

Prior beliefs: Likelihood of a recession First, we ask subjects to complete a ques-tionnaire on demographics, which includes questions on gender, age, income, education, and region of residence. Subsequently, we give our respondents a brief introduction on how to probabilistically express expectations about future outcomes, and also explain several relevant economic concepts, such as "recession" and "GDP". Then, we ask our respondents to estimate the likelihood that there will be a fall in US real GDP in the

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(Campbell et al., 2007; Dickerson and Green, 2012; Geishecker et al., 2012). This literature finds that individual job loss expectations strongly predict actual transitions into unemployment.

fourth quarter of 2017 compared to the third quarter of 2017.[4] The survey was conducted in the summer of 2017, so this corresponds to a fall in real GDP three to six months after the survey. Thereafter, we ask our respondents how confident they are in their estimate.

Information treatment: Professional forecasters The Federal Reserve Bank of Philadelphia regularly collects and publishes predictions by professional forecasters about a range of macroeconomic variables in their Survey of Professional Forecasters (SPF) (Croushore, 1993). The SPF is conducted in the middle of each calendar quarter, and forecasters have to estimate the likelihood of a decline in real GDP in the quarter of the survey as well as each of the four following quarters. The average probability assigned to a drop in GDP in the quarter after the survey has had high predictive power for actual recessions in the past. In our survey we randomly assign our respondents to receive one of two forecasts taken from the microdata of the wave of the SPF conducted in the second quarter of 2017, the most recent wave of the SPF available at the time of our survey. To make the forecast more meaningful to respondents, we tell them that it comes from a financial services provider that regularly participates in a survey of professional forecasters conducted by the Federal Reserve Bank of Philadelphia.

In the "high recession treatment", respondents receive a forecast from the most pessimistic panelist in the SPF, who assigns a 35 percent probability to a fall in US real GDP in the fourth quarter compared to the third quarter of 2017. In the "low recession treatment", respondents receive information from one of the most optimistic forecasters, who expects a fall in US real GDP with a probability of 5 percent.[5] In order to make the treatment more meaningful to our respondents, we provide them with a figure that contrasts their prior belief with the prediction from the professional forecaster (see Figure 1 for an illustration of the treatment screen).

An alternative experimental design would have provided one forecast to respondents

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[4]We refer to these beliefs as recession expectations throughout the paper. We slightly deviate from the definition of a recession by the NBER as two consecutive quarters of negative real GDP growth to keep the belief elicitation simple and easy to understand.

[5]The professional forecasts correspond to SPF panelists' beliefs about a drop in real GDP two quarters after this wave of the SPF was conducted.

in the treatment group, while giving no information to individuals in a pure control group. The variation in beliefs in this alternative design would stem from differences between individuals whose beliefs have been shifted, and those who still hold their prior beliefs. Thus, the alternative design identifies the causal effect of beliefs on outcomes of individuals who hold unrealistic priors ex-ante, as the treatment only shifts beliefs for this group. This could threaten the external validity of results obtained under the alternative design. By contrast, our design also generates variation in beliefs among individuals with more realistic priors, and therefore identifies average causal effects for a broader population. In addition, receiving a forecast may not only shift the level of individuals' beliefs but may also have side-effects, such as reducing the uncertainty surrounding the level of their beliefs, making respondents think about the source of the forecast (in our case the Philadelphia Fed), or evoking a feeling of "having been wrong" relative to professional forecasters. In our design, the only difference between the two treatment arms is the percent chance assigned to the event of a recession by the professional forecast our respondents receive, while side-effects of receiving a forecast should be common across treatment arms.[6]

Personal expectations, economic behavior, and macroeconomic expectations
After the information provision all respondents are asked to estimate the likelihood that the unemployment rate in the US will increase over the 12 months after the survey, as well as a qualitative question on how they expect unemployment to change. This is followed by questions on personal economic expectations, other macroeconomic expectations and their consumption plans. While we elicit most expectations probabilistically, we also include some qualitative questions with categorical answer options.[7]

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[6]Moreover, since in the alternative design the treatment intensity is correlated with the level of the prior belief, heterogeneous effects would conflate differences in priors and differential extrapolation from macroeconomic to personal expectations across groups. Our design enables a clean analysis of heterogeneous extrapolation from aggregate to personal economic expectations across groups, as treatment intensity is orthogonal to prior beliefs.

[7]The question framing we use to elicit people's expectations closely follows the New York Fed's Survey of Consumer Expectations (SCE). The question framing was optimized after extensive testing (Armantier et al., 2017) and follows the guidelines on the measurement of subjective expectations by Manski (2017).

We first ask our respondents whether they think that their family will be better or worse off 12 months after the survey. Subsequently, we elicit people's density forecast about their earnings growth conditional on working at the same place where they currently work.[8] We ask our respondents to assign probabilities to ten brackets of earnings growth over the next 12 months, which are mutually exclusive and collectively exhaustive. Respondents could not continue to the next screen if the entered probabilities did not sum up to 100 percent. The elicitation of a subjective probability distribution allows us to measure both mean expected earnings growth and uncertainty about earnings growth.[9] Thereafter, respondents estimate their subjective probability of job loss and their subjective probability of finding a new job within three months in case they lose their job over the next 12 months. In addition, we elicit density forecasts of inflation over the next 12 months using the same methodology as for earnings expectations.

Subsequently, we ask our respondents some qualitative questions related to their consumption behavior. First, we ask them whether they think that it is a good time to buy major durable goods. Second, our respondents are asked how they plan to adjust their consumption expenditures on food at home, food away from home and leisure activities during the four weeks after the survey compared to the four weeks prior to the survey. Thereafter, our respondents answer a qualitative question on how they expect firm profits to change over the next 12 months, and they estimate the percent chance that unemployment in their county of residence will increase over the next 12 months. Finally, we re-elicit beliefs about the likelihood of a fall in real US GDP in the fourth quarter of 2017 compared to the third quarter of 2017. At the end of the survey, our respondents complete a series of additional questions on the combined dollar value of their spending on food at home, food away from home, clothing and leisure activities over the seven days before the survey, the industry in which they work and their tenure at their employer, as well as a set of questions measuring their financial literacy.[10] Moreover, we ask them

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[8]In contrast to the question in the SCE, we also allow for changes in hours worked as well as for job promotions or demotions at their workplace as this provides us with additional variation.

[9]Means of density forecasts are easy to interpret, while point forecasts could capture mean, mode or some other moment of our respondents' subjective probability distributions (Engelberg et al., 2009).

[10]We use the three questions on interest compounding, inflation and risk diversification that have now become standard to measure financial literacy (Lusardi and Mitchell, 2014).

a series of questions on their assets, their political affiliation as well as their zipcode of residence.

2.2 Follow-up survey

We designed our main survey to minimize concerns about numerical anchoring and experimenter demand. First, instead of eliciting posterior beliefs about the likelihood of a recession immediately after the information provision, respondents first answer a range of other questions and only report posteriors at the end of the survey, roughly 10 minutes after the information. This should make it less likely that posterior beliefs are affected by numerical anchoring. Second, all of our respondents receive information from a professional forecaster, i.e. all respondents receive a signal from the same source. Third, we elicit both probabilistic and qualitative economic expectations to ensure the robustness of our findings to different question framing and numerical anchoring.

While we believe that these design features already address some concerns regarding experimenter demand effects and numerical anchoring, we further mitigate such concerns by conducting a two-week follow-up survey in which no additional treatment information is provided. We chose to have a two-week gap between the main study and the follow-up to trade off between testing for persistence and maximizing statistical power in the follow-up survey.

In the follow-up survey, we re-elicit some of the key outcome questions from the main survey, such as the likelihood of an increase in national- and county-level unemployment, expectations about firm profits, as well as personal economic expectations, such as subjective job security and earnings expectations. We re-elicit our respondents' estimated likelihood of a fall in real GDP in the fourth quarter of 2017 compared to the third quarter of 2017. Moreover, we collect data on our respondents' consumer and financial behavior in the time between the main intervention and the follow-up survey. First, we ask our respondents about their combined spending on food at home, food away from home, clothing and leisure activities over the seven days before the follow-up survey. Second,

we ask them whether they bought any major durable goods and whether they actively increased or reduced their stockholdings during the 14 days prior to the follow-up. Finally, we elicit our respondents' beliefs about their employers' exposure to aggregate risk, their personal unemployment history, as well as their beliefs about the most likely causes of a potential recession.

3 Data

Survey administration We collect a sample of 1,124 respondents that is representative of the US population in full-time employment in terms of gender, age, region and total household income through the market research company "Research Now" which is widely used in economics research (Almås et al., 2016). We only invite people who have a paid job and who work full-time. The data were collected in the summer of 2017. We conducted the follow-up survey approximately two weeks after the main survey was administered and managed to recontact 737 respondents, which corresponds to a recontact rate of 65 percent.

Representativeness Table A1 provides summary statistics for our sample for a large set of variables. Around 80 percent of our respondents indicate that they are the main earner in their household. Moreover, Table A2 in the online Appendix[11] displays the distributions of a range of individual characteristics among respondents in full-time employment in the 2015 American Community Survey (ACS) and in our data.[12] We match the distributions of gender, age, region and total household income very precisely. In addition, the composition of our sample is quite close to the composition of the population in full-time employment along non-targeted dimensions, such as industry and hours worked. The main difference is that our sample is more educated and has higher labor earnings on average than the US population in full-time employment.

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[11]The online Appendix is available at `https://goo.gl/MTJ8hG`.

[12]In the ACS, we classify as full-time employed individuals who report working at least 30 hours per week.

Definition of variables In what follows, we define the main variables used in our analysis. First, we generate a variable measuring the perceive chance of becoming personally unemployed over the next 12 months as the product of people's perceived probability of losing their main job within the next 12 months and their perceived probability of not finding a new job within the following three months. For each respondent we calculate the mean and standard deviation of expected inflation and expected earnings growth using the mid-points of the bins to which the respondent has assigned probabilities.[13] Moreover, we create an index of people's planned change in non-durable consumption from the four weeks prior to the main survey to the four weeks after the survey, using their qualitative spending plans for food at home, food away from home, and leisure activities. Finally, we create a measure of people's actual changes in spending on food at home, food away from home, clothing and leisure based on their self-reported spending during the seven days before the main survey and the seven days before the follow-up survey.[14] The questions on expected firm profits, the expected financial situation of the household or the change in stockholdings between main survey and follow-up were elicited on five- and seven-point scales. We code these variables such that higher values refer to "increase" or "improve" and lower values refer to "decrease" or "worsen". These qualitative outcome variables are normalized using the mean and standard deviation separately for the main survey and the follow-up survey. For the quantitative measures we do not normalize outcome variables as they have a natural interpretation.

Integrity of the randomization Our sample is well-balanced for a set of key characteristics and pre-treatment beliefs about the likelihood of a recession (Table A4). The means do not differ significantly across treatment arms for any of these variables and we cannot reject the Null hypothesis that the partial correlations of the variables with a dummy for being in the high recession treatment are jointly zero. Moreover, we observe

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[13]We elicit probabilities over eight closed bins between -12 percent and 12 percent and two open bins for outcomes outside this range. For the open bins we assign -14 percent and 14 percent, respectively.

[14]We take the difference in log spending from the follow-up and the baseline survey, so this variable measures the percent change in spending. We deal with outliers by setting spending growth to missing for respondents in the top and bottom two percent of observed spending growth. We obtain qualitatively similar results if we instead use one or five percent as cutoff, or if we winsorize the variable.

no differential attrition in our main survey across treatment arms, and response to the follow-up survey is not related to treatment status in the main experiment. The sample of individuals in the follow-up is balanced across the two treatment arms in terms of key covariates (Table A5). There are marginally significantly more individuals with a college degree and more men in the low recession treatment arm in the follow-up sample, but we cannot reject the Null hypothesis that the correlations of the covariates with the high recession dummy are jointly zero. To rule out any concerns, we include a set of control variables in all of our estimations.

Data quality We provide evidence that our expectations data on earnings and inflation are of high quality by comparing our data with a panel survey by the New York Fed launched as a predecessor of the Survey of Consumer Expectations (SCE) (Armantier et al., 2013). For example, for inflation expectations 80 percent of our respondents assign positive probability to more than one bin (89.4 percent in the Fed survey) and the average number of bins with positive probability is 4.24 (3.83). While a larger share of our respondents assign positive probability to non-contiguous bins (6.9 percent vs 0.9 percent), this still accounts for a very small fraction of our sample. Only 0.4 percent, 6.5 percent and 0.3 percent of our respondents enter a prior probability of a fall in real GDP of 0 percent, 50 percent and 100 percent, respectively, which may indicate mental overload (de Bruin et al., 2000; Manski, 2017).[15]

4 Updating of recession expectations

4.1 Prior beliefs

Stylized facts Respondents in our sample have a much more pessimistic macroeconomic outlook than professional forecasters (Figures 2 and A.3 and Table A3). The median professional forecaster in the second quarter of 2017 reports a likelihood of a

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[15]Figures A.10 to A.15 display the distributions of future unemployment and inflation expectations, inflation uncertainty, expected earnings, earnings uncertainty and subjective job loss and job finding probabilities.

recession in the fourth quarter of 2017 of just 15 percent, while the median respondent in our sample assigns a probability of 40 percent. Indeed, the most pessimistic professional forecast of 35 percent is below the median forecast in the online panel. While there is a large dispersion in beliefs about the likelihood of a recession among consumers, the dispersion of beliefs is much smaller in the sample of professional forecasters, ranging from four professional forecasters estimating a 5 percent chance of a recession to one forecaster assigning a 35 percent chance. We confirm these patterns using a second survey conducted with an online convenience sample from Amazon Mechanical Turk (MTurk) in the summer of 2018.[16] The median professional forecaster in the second quarter of 2018 reports a likelihood of a recession in the fourth quarter of 2018 of 10 percent, while the median respondent in our MTurk sample assigns a probability of 45 percent (Figure A.6). The distribution of recession expectations in the MTurk sample is remarkably robust to incentivizing the consumers' forecast using a quadratic scoring rule (see A.7).[17] A Kolmogorov-Smirnov test confirms that the distributions of incentivized and unincentivized beliefs are not statistically distinguishable (p=0.319). The finding of greater pessimism and a higher dispersion of beliefs among consumers than among professional forecasters is in line with previous findings on inflation expectations (Armantier et al., 2013; Mankiw et al., 2003) and with qualitative expectations on aggregate economic conditions over a longer time period from the Michigan Survey of Consumers (Das et al., 2017).[18]

Correlates of recession expectations We next examine how pessimism about the macroeconomy is correlated with individual characteristics. Neither education nor age are related to people's recession expectations, but females have a significantly more pessimistic macroeconomic outlook than men (Table A6). Interestingly, Democrats are much more pessimistic compared to Independents, while Republicans are much more optimistic, consistent with evidence on partisan bias in economic expectations (Bullock et al., 2015;

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[16]Amazon Mechanical Turk is an online labor market widely used in experimental research.

[17]Specifically, respondents in the incentive condition are told that they can earn up to $1 depending on the accuracy of their forecast.

[18]In section B in the online Appendix we confirm the external validity of these findings using data from the New York Fed's Survey of Consumer Expectations.

Mian et al., 2017; Prior et al., 2015). People who have been personally unemployed in the past are significantly more pessimistic about aggregate economic conditions, in line with Kuchler and Zafar (2017), who find that individuals who lose their jobs become significantly less optimistic about the aggregate economy. Taken together, it is reassuring that the correlations between covariates and recession expectations are in line with previous literature.[19]

4.2 Updating of recession expectations

Do our respondents update their recession expectations upon receiving the professional forecasts? Figure 2 shows our first main result:

Result 1. *The information provision strongly shifts expectations towards the professional forecast in both treatment arms, and cross-sectional disagreement within the treatment arms declines. This implies that the respondents were initially uninformed about the professional forecasts and that the forecasts are relevant for the respondents' economic outlook.*

Figure 3 displays scatter plots of prior and posterior beliefs. Observations along the red horizontal lines indicate full updating of beliefs towards the professional forecast, while respondents along the 45 degree line do not update at all. We observe more updating of beliefs among respondents in the low recession treatment, where the average absolute distance of prior beliefs to the signal of 5 percent is greater than in the high recession treatment which provides a forecast of 35 percent. 11.5 percent of respondents in the low recession treatment and 19.5 percent of respondents in the high recession treatment do not update their beliefs at all, while 68.6 percent (47.8 percent) of respondents either fully or partially update their beliefs towards the signal (see Table A7). The remaining respondents either "over-extrapolate" from the signal or update into the opposite direction. However, part of these observed changes in beliefs could be due to typos or due to respondents changing their beliefs because taking a survey on macroeconomic topics

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[19]We find similar patterns in univariate regressions (Table A6 column 1) and in a multivariate regression (Table A6 column 2) of priors on observables.

makes them think more carefully about the question. Finally, the cross-sectional dis-agreement in posterior beliefs as measured through the interquartile range and standard deviation declines within both treatment arms compared to prior beliefs (see Table A3).

Magnitudes What is the magnitude of the updating of expectations? We quantify the degree of updating by regressing the difference in people's posterior and prior expectations on the "shock", which is defined as the difference between the professional forecast and the prior belief:

$$\text{shock}_i = \begin{cases} 35 - \text{prior}_i & \text{if} \quad \text{highrecession}_i = 1 \\ 5 - \text{prior}_i & \text{if} \quad \text{highrecession}_i = 0 \end{cases}$$

where highrecession_i is an indicator taking value one for individuals who received the pessimistic professional forecast, and value zero for respondents receiving the optimistic forecast.

People who hold higher priors, and are subject to a more negative shock, should mechanically display more negative changes in their expectations, since the maximum probability of a recession is 100 percent. In order to avoid mechanical correlations between people's updating and the shock, we control linearly for people's prior belief. Moreover, we include a vector of additional control variables $\mathbf{X}_i$, which increases our power to precisely estimate treatment effects and which allows us to control for the slight imbalance in the follow-up sample.[20] Specifically, we estimate the following equation using OLS:

$$\text{updating}_i = \alpha_0 + \alpha_1 \text{shock}_i + \alpha_2 \text{prior}_i + \mathbf{\Pi}^T \mathbf{X}_i + \varepsilon_i \tag{1}$$

where ε_i is an idiosyncratic error term. We report robust standard errors throughout the paper. Under the assumptions of Bayesian updating under squared loss and normally distributed prior beliefs, people follow a linear learning rule and α_1 identifies the weight

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[20]The controls are as follows: age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats.

that respondents place on the new information (Cavallo et al., 2017).[21] Our respondents' beliefs move towards the professional forecasts (Table 1) and the estimated learning rate is highly significant, amounting to about one third of the shock to individual beliefs. Thus, our information treatment generates a difference of about 10 percentage points in people's average posterior beliefs across treatment arms. The fact that respondents only partially adjust towards the forecasts suggests that they understand that one professional forecast is a noisy signal about the future state of the economy.

Are changes in expectations consistent with Bayesian updating? Next, we examine whether changes in expectations are consistent with Bayesian updating. First, Bayesian updating predicts that respondents should adjust their expectations partially or fully towards new signals that they find informative, i.e. that learning rates should lie in the interval $[0, 1]$. Our estimated learning rate of one third is in line with this prediction. Second, Bayesian updating implies that respondents who are less confident in their prior belief should react more strongly to new signals. We examine this prediction by constructing a dummy indicating whether the respondent is at least "sure" about his or her prior estimate. Consistent with Bayesian updating, the estimated learning rate is significantly lower for respondents who are more confident in their prior belief (column 2 in Table 1).[22] Moreover, respondents who report that they usually do not follow news on the national economy place significantly higher weight on the signal (column 3), consistent with the idea that information acquisition prior to the experiment increases the strength of people's prior belief.

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[21]Consistent with normally distributed priors, we found no response of updating to higher order terms of the shock in unreported regressions. The cross-sectional distribution of prior beliefs shown in Figure 2 can be approximated by a beta distribution. However, these beliefs should reflect means over unobserved individual-level prior distributions over the parameter "probability of a recession", which could still be normally distributed.

[22]We examine whether individuals put differential weight on signals that are more optimistic or more pessimistic than their prior belief. We interact the individual-specific shock with a dummy variable taking value one if shock < 0, and zero otherwise. There is no asymmetric updating from relatively positive and relatively negative signals. Similarly, we find that the weight put on the prior belief does not differ systematically between the two treatment arms (p=0.443), indicating that our respondents do not differentially weight signals that are more or less positive in absolute terms. Results on these estimations are available upon request.

Heterogeneous updating across demographic groups We also examine whether the degree of learning from professional forecasts differs across demographic groups. Women and individuals with lower education update more strongly from the forecasts, while there are no differences according to income, industry, personal unemployment experiences, the unemployment rate in the county of residence and financial literacy (see Table A8). Heterogeneity in learning rates could stem from differences in trust towards experts, different learning rules or differential ex-ante informedness about the professional forecasts across groups.[23]

Do changes in recession expectations persist? Following Cavallo et al. (2017) we employ a two-week follow-up survey in which no treatment information is administered. The medium-run learning rate (calculated using the follow-up) amounts to about 40 percent of the short-run learning rate (column 5 of Table 1), in line with respondents receiving new relevant signals about the macroeconomy between the two surveys or imperfect memory (Bordalo et al., 2017) (see also Figures 2 and A.4). Moreover, learning rates still differ significantly between respondents with different confidence in the prior.

Implications for macroeconomic models Our results have several implications for macroeconomic models. The finding that respondents use the professional forecasts to persistently update their beliefs implies i) that the professional forecasts were not part of our respondents' information sets before the treatment and ii) that our respondents consider the information relevant for their expectations about the future. This provides evidence that consumers are inattentive to relevant signals about future economic growth. At the same time, our respondents update from the information in line with the predictions of Bayesian updating. Taken together, these findings are consistent with models in which agents form their expectations rationally upon receiving new information, but are

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[23]According to theories of rational inattention, individuals with greater exposure to macroeconomic risk and individuals with lower cost of acquiring information should hold stronger prior beliefs about the likelihood of a recession. We cannot disentangle these two forces in our data. Note that our analysis in section 5 examines whether for a *given* change in expectations about a recession more exposed respondents extrapolate more strongly to their personal job loss expectations, which enables us to abstract from differences in information acquisition or trust towards experts across groups.

imperfectly informed due to either infrequent updating of information sets as in models of sticky information (Mankiw and Reis, 2006; Reis, 2006; Wiederholt, 2015) or observing imprecise signals about the economy as in models of noisy information (Maćkowiak and Wiederholt, 2015; Sims, 2003). Our findings are inconsistent with more traditional models of full-information rational expectations (Muth, 1961).

Our evidence on expectations about a recession complements similar findings from experimental studies of information rigidities in consumers' inflation expectations (Armantier et al., 2016; Cavallo et al., 2017). Which type of information friction is more likely to explain our findings? Noisy information models predict constant disagreement in response to the information provision if the forecasts are perceived with individual-level noise (Armantier et al., 2016) and therefore cannot by themselves account for the substantial and persistent reduction of disagreement among our respondents after receiving the information. By contrast, sticky information models predict decreasing disagreement in response to a common signal. Thus, while it is still plausible that the forecasts are perceived with individual-level noise, our findings suggest that there is an important role for frictions in the form of infrequent updating of information sets.[24] Finally, in line with the model and time series evidence in Carroll (2003), our findings imply that consumers exhibit some trust towards experts.

5 The causal effect of recession expectations

5.1 Empirical specification

In the previous section we have established that our respondents durably update their beliefs about the likelihood of a recession in response to professional forecasts. This provides us with a first stage to examine the causal effect of recession expectations on expectations about personal economic outcomes. Specifically, we examine whether people's subjective economic model as measured through the size and heterogeneity of extrapolation to ex-

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[24]However, the fact that our respondents hold substantially more pessimistic prior beliefs than professional forecasters suggests that respondents either update their information sets only very rarely or are disproportionately exposed to negative macroeconomic news.

pectations about their personal situation is in line with empirical facts. As a first step, we examine how these expectations, $\exp_i$, are correlated with our respondents' posterior beliefs about the likelihood of a recession, posterior_i:

$$\exp_i = \beta_0 + \beta_1 \text{posterior}_i + \mathbf{\Pi}^T \mathbf{X}_i + \varepsilon_i \tag{2}$$

where $\mathbf{X}_i$ is a vector of the same control variables that we included in our previous estimations. The OLS estimate of β_1 cannot be given a causal interpretation. For example, it is possible that people who are generally more optimistic or pessimistic respond differently to both the question on the posterior as well as the questions related to the evolution of other economic outcomes. It is also conceivable that the direction of causality runs from the personal situation to macroeconomic expectations, as suggested by recent evidence in Kuchler and Zafar (2017). Finally, the estimate of β_1 could be biased towards zero because of measurement error in the posterior belief. To deal with omitted variable bias, reverse causality and measurement error, we instrument our respondents' posterior beliefs with the random assignment to the different professional forecasts. Specifically, we use two-stage least squares and estimate the following equation:

$$\exp_i = \beta_0 + \beta_1 \widehat{\text{posterior}}_i + \mathbf{\Pi}^T \mathbf{X}_i + \varepsilon_i \tag{3}$$

where

$$\widehat{\text{posterior}}_i = \hat{\alpha}_0 + \hat{\alpha}_1 \text{highrecession}_i + \hat{\mathbf{\Theta}}^T \mathbf{X}_i$$

5.2 Do recession expectations affect personal expectations?

Consistent with the evidence on updating of recession expectations, we establish that the experimental variation successfully shifts the respondents' expectations about aggregate unemployment. Posterior beliefs about a recession significantly affect people's beliefs about the probability that the national unemployment rate will increase. In the IV specification a one percentage point higher likelihood of a recession causes a 0.895 percentage point increase in the perceived chance that national unemployment will increase (Panel B of Table 2; column 1). We find similar effects if we use the categorical measure which

is immune to numerical anchoring (column 2). The effect size is 0.536 for the subjective probability that unemployment in the respondent's county of residence will increase (column 3), slightly lower than for aggregate unemployment. The results on national and county-level unemployment expectations are significant and of similar magnitude in the OLS and IV specifications.

Do recession expectations affect people's beliefs about their personal economic outcomes? Table 2 shows our second main result:

Result 2. *People extrapolate from their recession expectations to their households' financial prospects and to expectations about personal unemployment. The estimated effect sizes are large but close to job transitions during the last recession.*

People who think that a recession is more probable are also more likely to hold pessimistic beliefs about their household's financial prospects and expect lower earnings growth in their job. They also report lower levels of subjective job security. The estimated effects in the IV specifications are very similar in size to the OLS estimates, but the effects on expected earnings growth become statistically insignificant (Panel B). The effect size on subjective job security is substantial, but in line with job losses during the last recession: a one percentage point increase in the likelihood of a recession leads to an increase in subjective unemployment risk of 0.113 percent. To illustrate the magnitude of this effect, consider moving from a situation with zero risk of a recession to a situation in which a recession will happen with certainty. 11.3 percent of our respondents would need to become unemployed for their expectations to be accurate on average. For comparison, the job loss rate increased by 7 percentage points during the Great Recession 2007-09, and most laid-off workers remained unemployed for several months (Farber, 2011). Thus, although the magnitude of our estimated effect is relatively large, it is still close to the increase in unemployment during the last recession.[25]

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[25]Figure A.16 displays local polynomial regressions of people's expectations about personal economic circumstances on their *prior* beliefs about the likelihood of a recession. The correlations are all strong and go into the expected directions, indicating that non-experimentally manipulated recession expectations correlate with personal economic prospects in a meaningful way.

5.3 Heterogeneous extrapolation to personal expectations

Actual differences in risk exposure across groups Actual exposure to macroeconomic risk should affect the extent to which people extrapolate from news about the macroeconomy to their personal expectations. Therefore, we examine changes in unemployment rates over the Great Recession for different demographic groups using data from the Merged Outgoing Rotation Groups of the Current Population Survey (CPS). The unemployment rate increased much more strongly among individuals without college degree and among males (Figure A.8), consistent with previous literature (Hoynes et al., 2012).[26] There were similar changes in unemployment rates for individuals aged 25 to 44 and those aged 45 to 55.[27] Moreover, the increase in unemployment during the Great Recession was concentrated among workers previously employed in "cyclical industries" such as manufacturing, construction and services, while industries such as health and education were less affected (Takhtamanova and Sierminska, 2016). Therefore, we expect respondents with lower education, male respondents and respondents working in more cyclical industries to update their expectations regarding personal unemployment more strongly in response to a change in their macroeconomic outlook.

Who extrapolates from macroeconomic to personal expectations? In order to test whether differences in actual exposure to recessions are reflected in differences in people's extrapolation to their personal outcomes, we interact the posterior belief with several individual characteristics. We only consider IV estimations, where we use the "high recession" indicator and its interaction with the given dimension of heterogeneity as instruments.[28] Our third main result is as follows:

Result 3. *People extrapolate from their macroeconomic outlook to their expected chance*

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[26]All figures based on the CPS account for seasonality by partialling out month dummies.

[27]Individuals younger than 25 were hit strongly by the Great Recession, among others due to a sharp reduction in hiring and due to employment of younger men in heavily affected industries (Hoynes et al., 2012). Due to our sample size and our focus on people in full-time employment, we have very few individuals aged younger than 25 in our sample.

[28]The IV specifications account for differential first stage effects of the "high recession" treatment on posterior beliefs about the likelihood of a recession across groups, and are able to isolate differential second stage effects of posterior beliefs on personal outcomes. Reduced form specifications would conflate differential first and second stage effects across groups.

of personal unemployment in line with their exposure to macroeconomic risk. Thus, up-dating of personal expectations is data-consistent in terms of size and heterogeneity, in-dicating that our respondents have an understanding of how the economy works, in line with imperfect information models.

For example, the perceived chance of becoming unemployed responds strongly for people with lower education, while there is no such effect for people with high education (Figure 4 and Table A9). We find qualitatively similar differences if we instead examine hetero-geneity according to the level of earnings. While we find no differential response across age groups, men seem to be more strongly affected than women, even though this is noisily measured. These patterns of heterogeneity in updating of personal unemployment expectations are in line with differences in exposure to past recessions across demographic groups.

Moreover, the effects of an expected economic downturn on personal unemployment expectations are driven by individuals working in "cyclical industries", those with previ-ous unemployment experiences and those living in counties with higher unemployment (Figure 5 and Table A10).[29] A personal unemployment history and high county-level un-employment could proxy for exposure to risk: individuals living in counties with higher unemployment could find it more difficult to find re-employment in case of job loss, while a personal unemployment history could proxy for being more "marginal". In line with this intuition, the effects on expected personal unemployment are driven by job loss expecta-tions for individuals with a personal unemployment history, and by reduced conditional job finding expectations for individuals living in areas with high unemployment (see Table A10).

Further, individuals with higher earnings, older individuals and men expect a reduced earnings growth conditional on keeping their jobs as a result of an economic downturn (Figure 6 and Table A11). The effects for these subgroups are significantly different from

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[29]We classify health and education as well as "other industries", which mostly comprise public admin-istration, as non-cyclical industries, while construction, manufacturing, services, retail and wholesale, transportation as well as finance are classified as cyclical industries, in line with empirical evidence (Guvenen et al., 2017; Takhtamanova and Sierminska, 2016).

zero and significantly larger than the effects on individuals with lower earnings, younger individuals, and women. These patterns are in line with higher trend growth in earnings among men and individuals with higher earnings as well as downward rigidity in wages. Accordingly, an economic downturn could lead to lower, but still non-negative earnings growth at the top of the distribution, while individuals at the bottom of the distribution are affected through job loss, potentially because their wages cannot fall, e.g. due to binding minimum wages.[30]

Finally, there is no heterogeneity in the effect of beliefs about the likelihood of a recession on the perceived chance that national unemployment will increase (Table A12). Hence, while more exposed groups extrapolate more strongly from recession expectations to their personal economic outlook, they expect similar changes in aggregate unemployment as less exposed groups.

5.4 Do the effects persist over time?

In Table 3 we show that most of our results on people's updating of expectations decrease in size, but remain economically and statistically significant in the two-week follow-up survey. The table shows reduced-form estimates obtained from regressing the different outcome variables on an indicator for the "high recession"-treatment and controls.[31] People who receive more pessimistic forecasts about the likelihood of a recession still report a significantly higher probability of an increase in unemployment. For expectations about national- and county-level unemployment the effect sizes in the follow-up are about 50 percent and about 42 percent of the original effect sizes in the main study, respectively. The treatment effects for all personal outcomes are not statistically distinguishable from the treatment effects in the main experiment. However, the coefficients are less precisely estimated in the follow-up and are about 50 percent (financial prospects) and about 25

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[30]We also examined heterogeneity according to people's prior beliefs about the likelihood of a recession. Across outcomes, we found insignificantly larger effects of recession expectations on personal and macroeconomic expectations of individuals with lower priors, i.e. with priors that are more aligned with professional forecasts.

[31]We present reduced form results rather than instrumental variable estimates as the first-stage for an IV regression where we instrument posterior beliefs with random treatment assignment could suffer from weak instrument problems in the smaller follow-up sample.

percent (personal unemployment expectations) smaller in size compared wiith the main study. This still reflects a substantial degree of persistence, given that our intervention was mild and that people likely received other relevant signals about macroeconomic conditions and their personal situation between the two surveys. Indeed, 65 percent of our respondents agree that they followed news about the economy in the time between the main survey and the follow-up survey.[32] In addition, we are naturally less powered to detect significant treatment effects in the smaller sample of respondents who completed the follow-up. Taken together, the persistence of the treatment effects suggests that our information treatment leads individuals to truly update their beliefs, while concerns about numerical anchoring, short-lived emotional responses to the treatment, or experimenter demand are mitigated.

5.5 Do macroeconomic expectations affect behavior?

Recessions as shocks to permanent income According to a standard Euler equation, an innovation to expected future economic resources should induce households to immediately adjust their consumption. Recent evidence indicates that earnings reductions experienced during recessions are large (Farber, 2011), that recessions can accelerate pre-existing adverse trends in the labor market situation of subgroups (Charles et al., 2016; Hershbein and Kahn, 2016), and that recessions can have scarring effects that induce workers to permanently drop out of the labor force (Yagan, 2017). Combined, these findings suggest that economic downturns can entail substantial shocks to people's permanent income. Therefore, we expect individuals to revise their consumption plans when they change their expectations regarding an economic downturn.[33]

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[32]If all respondents received the same perfectly informative signal between the main survey and the follow-up survey, they would put a weight of 100 percent on the new signal and we would not observe any difference in follow-up beliefs between the two treatment arms.

[33]By contrast, expected transitory reductions in income should be smoothed over all future periods and therefore should have no large effect on current consumption. If households are liquidity-constrained or behave in a hand-to-mouth fashion, changes in future economic resources should have an asymmetric or muted effect on current consumption.

Response of behavior: Margins of adjustment In this section, we examine whether updating of recession expectations leads people to adjust their behavior. First, we examine whether updating of recession expectations affects our measures of planned and actual changes in non-durable spending around the main intervention. We focus on non-durables as for this category consumption plausibly equals expenditure. Second, we examine whether updating of recession expectations leads our respondents to report a more negative climate for durables purchases or to postpone the actual adjustment in their stock of durables (Bertola et al., 2005). Third, we analyze whether updating of recession expectations leads households to actively adjust their stockholdings. For instance, individuals could sell stocks when they become more pessimistic about the macroeconomy, due to either a lower expected equity premium, a higher perceived riskiness of stocks or higher consumption risk. Given the well-documented inertia in household portfolios (Bilias et al., 2010; Calvet et al., 2009), the reaction of stock purchases should be small.

Empirical specification and results Our independent variable in these estimations is the difference between posterior and prior expectations, as our outcome variables refer to changes in individual behavior instead of levels of expectations. We exploit the exogenous variation created by the random treatment assignment by instrumenting the updating of expectations with the individual-level shock, which is defined as the difference between the signal and people's prior belief. As a respondent's shock is correlated with her prior belief, we also control for the prior. We estimate the following equation using two-stage least squares:

$$\text{behavior}_i = \beta_0 + \beta_1 \widehat{\text{updating}}_i + \beta_2 \text{prior}_i + \mathbf{\Pi}^T \mathbf{X}_i + \varepsilon_i \tag{4}$$

where

$$\widehat{\text{updating}}_i = \hat{\alpha_0} + \hat{\alpha_1}\text{shock}_i + \hat{\alpha_2}\text{prior}_i + \hat{\mathbf{\Theta}}^T \mathbf{X}_i$$

and $\text{updating}_i = \text{posterior}_i - \text{prior}_i$. We include the same set of control variables as in our previous estimations. Table 4 shows our fourth main result:

Result 4. *People's macroeconomic outlook affects their consumption plans and stock*

purchases.

Specifically, becoming more pessimistic about the aggregate economy has a significantly negative effect on our respondents' consumption plans for non-durable goods (column 1). A 10 percentage point increase in the perceived likelihood of a recession leads to a decrease in planned consumption growth by 13 percent of a standard deviation. This is in line with the effect size of 11 percent of a standard deviation on the expected change in the financial situation of the household in Table 2 column 4.[34] We find suggestive evidence that people reduce their actual spending on non-durables relative to the week before the main intervention, although this effect is noisily measured (column 2). We find no evidence that macroeconomic expectations affect people's assessment of the consumption climate for durable goods (column 3), or their actual durables purchases (column 4).

Moreover, increased pessimism about the economy strongly affects people's self-reported net purchases of stocks between the main survey and the follow-up survey (column 5). The large reaction despite inertia in household portfolios can be explained by the fact that respondents in both treatment arms were extremely pessimistic before the treatment, and the information provision implied a shift towards a lower subjective probability of a recession that was sufficiently strong to trigger adjustments in individuals' portfolios. Consistent with this explanation, the effect is fully driven by higher net purchases of stocks in the treatment arm that received the more optimistic forecast, while there is no significant difference for net sales of stocks (columns 6 and 7).[35] A 10 percentage point increase in the likelihood of a recession reduces the likelihood of purchasing stocks by 5 percentage points.

Thus, a higher expected probability of a recession reduces consumption growth and should, for a given income, increase saving. Higher saving and lower net purchases of stocks should be reflected in a reduction of the risky portfolio share.[36] Survey measures

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[34]Splitting the index into the three underlying variables, the effects are the strongest for spending on leisure, intermediate for food away from home and the weakest for food consumed at home, in line with differences in income elasticities across the three categories of goods.

[35]Only 12 individuals in our sample report net sales of stocks, while 54 individuals (41 individuals) in the more optimistic (pessimistic) treatment report net purchases of stocks. These numbers are not unrealistic, given that many households invest a fixed amount in risky assets in each month.

[36]Given that our variables on consumption plans and stock purchases are categorical, this is not

of consumers' expected stock returns behave procyclically and co-move with expectations about general economic conditions, even though this is at odds with theory, market measures of expected returns, and the actual equity premium in the US (Amromin and Sharpe, 2013; Greenwood and Shleifer, 2014). Moreover, consumers' subjective risk surrounding future returns behaves countercyclically. This suggests that higher and less uncertain expected returns could be driving our results. Alternatively, a higher perceived probability of a recession could increase perceived consumption risk or reduce the expected level of consumption, both of which lead to a lower risky portfolio share in standard portfolio choice problems with CRRA utility.

Overall, beliefs about the likelihood of a recession significantly affect our respondents' consumption plans and we find suggestive evidence of adjustments in actual consumption growth. We also find strong and significant effects of beliefs about the economy on net purchases of stocks. These results suggest that the macroeconomic outlook is a relevant determinant of household behavior.[37]

5.6   Subjective beliefs about the macroeconomy

Our experimental design also allows us to shed light on how expectations about different macroeconomic variables are causally related. Many macroeconomic models incorporate a Phillips Curve, namely a negative relationship between unemployment and inflation. An implicit assumption in most models is that individuals form their expectations according to the true model. Moreover, during most recessions in the past there was a substantial decline in inflation (Coibion and Gorodnichenko, 2015b). Thus, a higher perceived likelihood of a recession should lower people's inflation expectations. Table 5 shows our fifth

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guaranteed and depends on the fractions of people changing their behavior and the conditional amounts by which people adjust.

[37]We also examined heterogeneity in the effect of beliefs about a recession on consumption behavior. However, there are several complications in the interpretation of these results. First, a recession entails differential shocks to expected future economic resources for different groups of households. Second, for any *given* shock to expected future economic resources, there could be heterogeneous consumption responses across groups due to life-cycle effects, liquidity constraints or differential availability of insurance. Third, many of our behavioral outcomes are only available for the follow-up sample, which is too small to meaningfully estimate heterogeneous effects. Overall, heterogeneous responses in consumption plans are in line with most proxies for risk exposure, but these results are noisily measured. Results are available upon request.

main result:

Result 5. *People's inflation expectations are not causally related to their expectations about the likelihood of a recession.*

While mean expected inflation is positively correlated with people's recession expectations (Panel A column 1), this relationship is not statistically significant in the IV specification (Panel B). A higher perceived likelihood of a recession is positively correlated with inflation uncertainty, but again this effect vanishes in the IV specification (column 2). These results mirror the findings by Coibion et al. (2018a) who show that firms do not update their expectations about GDP growth and unemployment when their inflation expectations are shocked.[38]

There are several potential explanations for the zero finding on people's inflation expectations. First, the reference time horizon of 12 months for our expectations questions may be too short. Second, our respondents could think that a potential recession is caused by a negative technology shock or a cost-push shock, which entail a negative co-movement of the output gap and inflation in standard New-Keynesian models. Our data on beliefs about recession causes that we collected in the follow-up survey (see Figure A.9) shows that a decline in consumer confidence and political turmoil are the most frequently mentioned causes, while supply-side factors, such as an oil price increase, are not mentioned as frequently.[39] Third, consumers may not be sufficiently sophisticated to account for complex relations between macroeconomic variables in their belief formation.

Finally, the perceived likelihood of a recession has a negative causal effect on our respondents' expectations regarding firm profits (column 3). A 10 percentage point increase in the likelihood of a recession leads to a decrease in expected firm profits by 13 percent of a standard deviation. The fact that our respondents expect part of an economic downturn to be absorbed by firm profits is in line with recent empirical evidence that firms partially insure their workers against negative shocks (Fagereng et al., 2017a,b). In section A in

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[38]We examine the effect of recession expectations on inflation expectations for a variety of different subgroups, but find little evidence of differential effects across groups (Tables A14 and A15).

[39]In unreported regressions we find no heterogeneous responses of inflation expectations depending on whether respondents think that the recession will be caused by supply- or demand-side factors.

the online Appendix we provide additional results on our respondents' subjective beliefs about insurance within the firm.

5.7   Experimenter demand effects and numerical anchoring

Experimenter demand effects   Treatment effects in experiments that shift respondents' expectations could be biased as a result of experimenter demand effects. Specifically, respondents in the different treatment groups may form different beliefs about the experimenter's expectations and try to conform with these expectations (de Quidt et al., 2018).[40]

We provide two pieces of evidence against the relevance of experimenter demand effects. First, we assess the sensitivity of our respondents' economic expectations to "demand treatments" (de Quidt et al., 2018) through which we try to deliberately shift our respondents' beliefs about the experimenters' hypothesis about the participants' responses. We conducted an experiment on MTurk in which a random subset of our respondents is assigned to receive a "demand treatment" before we elicit their recession expectations, their qualitative financial expectations and their consumption plans. In the demand treatment respondents are provided with the following message: "In this experiment people are randomly assigned to receive different instructions. We hypothesize that participants who are shown the same instructions as you report more optimistic expectations about the US economy." The demand treatment does not significantly affect any of the outcome measures and the estimated effect sizes are close to zero (Table A13).

Second, the patterns of heterogeneity in extrapolation from macroeconomic to personal expectations that we documented in Section 5.3 imply that our findings could only be explained by experimenter demand effects that are systematically related to people's actual exposure to aggregate risk. In addition, the heterogeneity in updating of recession expectations in response to the professional forecasts documented in Section 4.2 (e.g. by people's confidence in their prior) is also only consistent with differential experimenter

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[40]Recent evidence suggests that respondents in online surveys and experiments respond only very moderately to explicit signals about the experimenter's wishes, suggesting a limited quantitative importance of experimenter demand effects (de Quidt et al., 2018; Mummolo and Peterson, 2018).

demand effects across these groups, which we find unlikely.

Numerical anchoring   An additional methodological concern for our quantitative outcome measures, such as posterior beliefs about the likelihood of a recession, is numerical anchoring. We alleviate concerns about numerical anchoring in two ways: First, we follow the approach suggested by Coibion et al. (2018b) and Cavallo et al. (2017). In an additional MTurk experiment a random subset of our respondents receives the following irrelevant numerical anchor before we elicit their recession expectations, their qualitative financial expectations and their consumption plans: "We would like to provide you with some information about the share of illegal immigrants in the United States. According to the Department of Homeland Security, 3 percent of the total U.S. population are illegal immigrants." The numerical anchor does not significantly affect any of the three outcome variables and the estimated effect sizes are close to zero (Table A13). Second, as documented in Section 5.4, changes in beliefs remain economically and statistically significant in the two-week follow-up. Since numerical anchoring is a very short-lived phenomenon by definition, this provides additional evidence against the possibility that our treatment effects are driven by numerical anchoring.

6   Conclusion

We conduct an information experiment in which we provide respondents with different professional forecasters' assessment of the probability of a fall in real GDP. We use the exogenous variation generated by the information treatment to examine the causal effect of recession expectations on expectations about personal outcomes and behavior. Respondents extrapolate to their perceived chance of becoming personally unemployed in a data-consistent manner. The magnitude of the effect is consistent with job losses during the last recession, and there is strong heterogeneity in line with proxies for actual exposure to risk. Finally, we provide suggestive evidence that people's expectations about the macroeconomy causally affect their consumption behavior and stock purchases.

Our findings are consistent with models of sticky information (Mankiw and Reis, 2006; Reis, 2006): first, we find that consumers are initially uninformed about relevant signals about the macroeconomy. Second, people update their economic expectations in response to news about the macroeconomic environment in line with the predictions of Bayesian updating. Third, updating of personal expectations is data-consistent in terms of size and heterogeneity, indicating that our respondents have an understanding of how the economy works. At a practical level, our findings identify specific groups that policymakers can expect to react to an improved macroeconomic outlook. Specifically, groups with the largest exposure to aggregate risk, such as individuals working in cyclical industries, are most likely to respond to an improved macroeconomic outlook, while a large fraction of the population is unlikely to react. Policymakers could maximize the effectiveness of their communication strategies by targeting these groups.

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Main Figures

Figure 1: Information treatment: High recession group
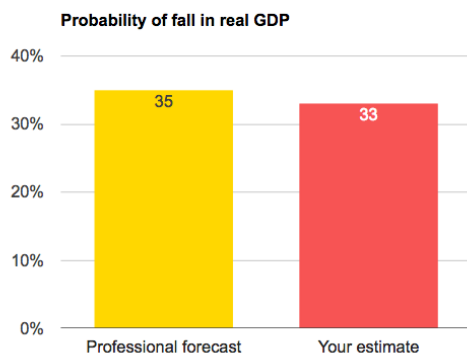
Notes: Treatment screen for people in the "high recession treatment". In this example screen the prior belief about the likelihood of a recession was 33 percent.

Figure 2: Prior and posterior beliefs about the likelihood of a recession
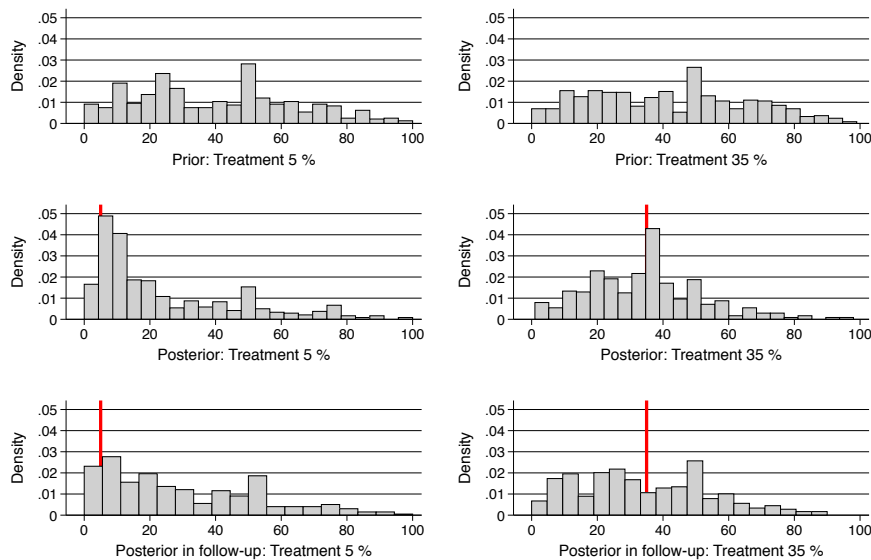
Notes: This figure displays the distributions of prior and posterior beliefs in the two treatment arms.

Figure 3: Scatter plots of prior and posterior
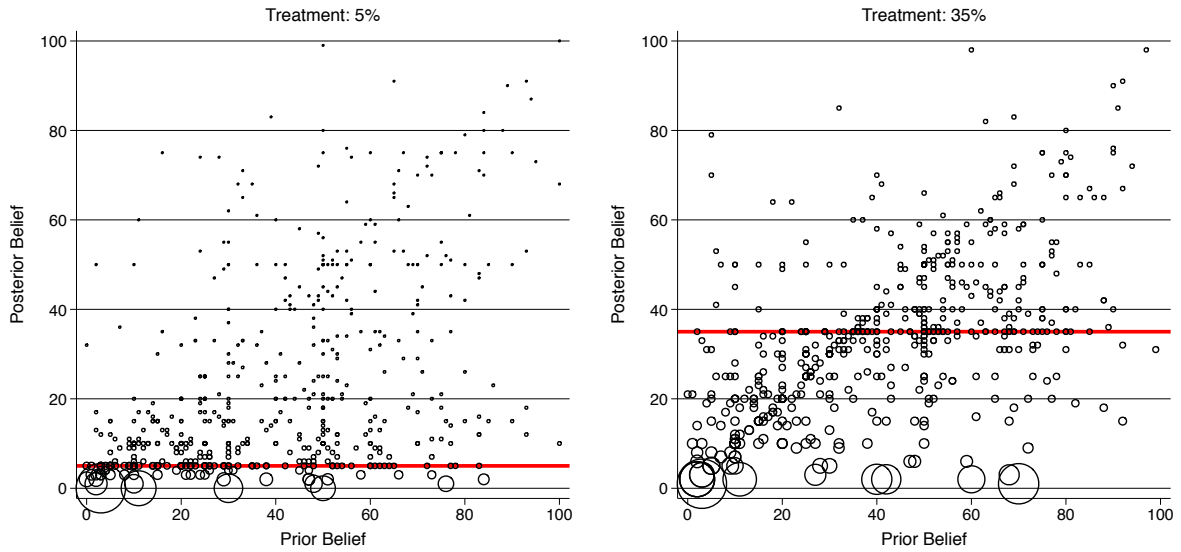
Notes: This figure displays scatter plots of prior and posterior beliefs in the two treatment arms. The size of the circles corresponds to the mass of data points for any combination of priors and posteriors. The red lines correspond to the signal provided to the respondents in the "high recession" and "low recession" treatments respectively.

Figure 4: Extrapolation to personal unemployment expectations: Heterogeneity across demographic groups (IV)
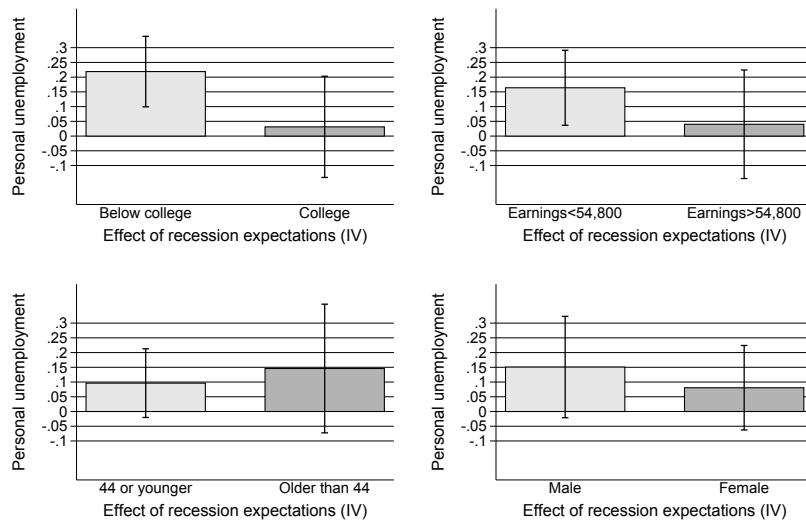
Notes: This figure displays IV estimates of the effect of posterior beliefs about the likelihood of a recession on people's subjective chance of being unemployed for different demographic groups, including 90-percent confidence bands. The estimates are based on IV estimations, where the posterior likelihood of a recession is interacted with education (top left), earnings (top right), age (bottom left) and gender (bottom right). These results are also shown in Table A9 in the online Appendix.

Figure 5: Extrapolation to personal unemployment expectations: Heterogeneity according to proxies for exposure to risk (IV)
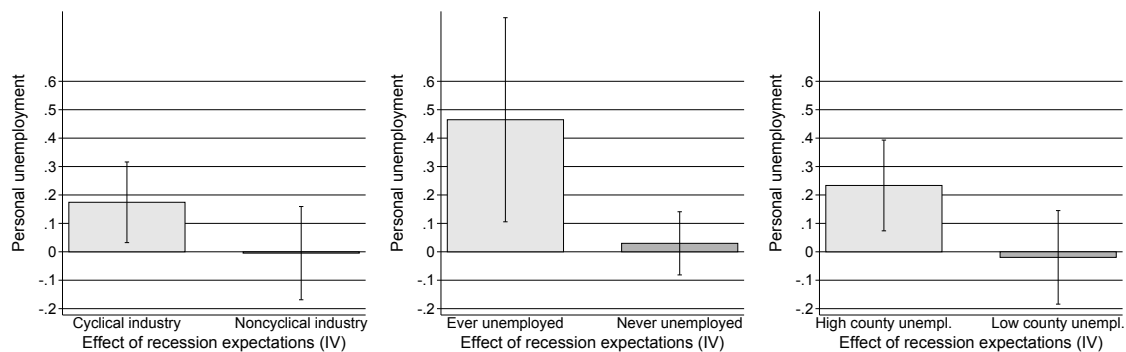
Notes: This figure displays IV estimates of the effect of posterior beliefs about the likelihood of a recession on people's subjective chance of being unemployed for groups with different exposure to risk, including 90-percent confidence bands. The estimates are based on IV estimations, where the posterior likelihood of a recession is interacted with working in a noncyclical industry (left), having no personal unemployment history (middle) and living in a county with low unemployment (right). These results are also shown in Table A10 in the online Appendix.

Figure 6: Extrapolation to mean expected earnings growth conditional on working at the same job: Heterogeneity across demographic groups (IV)
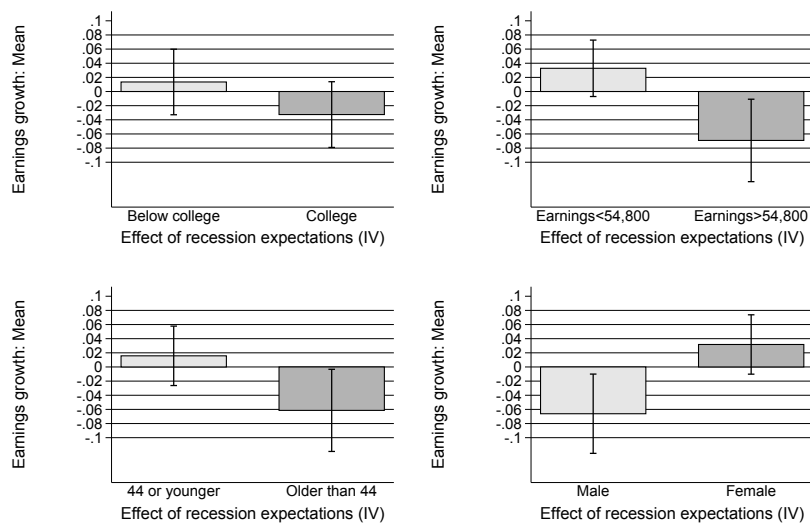
Notes: This figure displays IV estimates of the effect of posterior beliefs about the likelihood of a recession on people's expected mean earnings growth conditional on working at the same job for different demographic groups, including 90-percent confidence bands. The estimates are based on IV estimations, where the posterior likelihood of a recession is interacted with education (top left), earnings (top right), age (bottom left) and gender (bottom right). These results are also shown in Table A11 in the online Appendix.

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Main tables

Table 1: Main results: Learning rates

	Updating (Main Survey)				Updating (Follow-up)	
	(1)	(2)	(3)	(4)	(5)	(6)
Shock	0.318***	0.397***	0.397***	0.358***	0.131***	0.191***
	(0.034)	(0.040)	(0.058)	(0.041)	(0.050)	(0.058)
Shock × Confident		-0.152***				-0.137**
		(0.044)				(0.059)
Confident		-0.641				-5.451***
		(1.041)				(1.748)
Shock × Follow news			-0.102*			
			(0.057)			
Follow news			0.070			
			(1.488)			
Observations	1124	1124	1124	737	737	737
Sample	Baseline	Baseline	Baseline	Follow-up	Follow-up	Follow-up

Notes: The table shows OLS estimates of the learning rate from the professional forecasts based on specification 1. All specifications control for the respondent's prior belief, age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. The outcome in columns 1-4 is the difference between the posterior belief measured in the main study and the prior belief. The outcome in columns 5 and 6 is the difference between the posterior measured in the follow-up study and the prior belief. "Confident" takes value one for respondents saying that they are "very sure" or "sure" about their estimate of the likelihood of a recession. "Follow news" takes value zero if respondents somewhat or strongly disagree with the statement "I usually follow news on the national economy" and value one otherwise. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table 2: Main results: Extrapolation to personal economic expectations

	National unemployment (percent)	National unemployment (categorical)	County unemployment (percent)	Household financial prospects	Earnings growth: Mean	Earnings growth: Uncertainty	Personal unemployment (percent)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: OLS							
Posterior: Recession	0.528***	0.014***	0.508***	-0.011***	-0.010**	0.010***	0.112***
	(0.033)	(0.001)	(0.035)	(0.001)	(0.005)	(0.004)	(0.018)
Panel B: IV							
Posterior: Recession	0.895***	0.030***	0.536***	-0.012**	-0.013	0.002	0.113*
	(0.131)	(0.006)	(0.118)	(0.005)	(0.020)	(0.013)	(0.066)
Observations	1124	1124	1124	1124	1118	1118	1123
Mean dep. var.	32.09	0.01	29.55	0.02	2.64	1.79	6.61
SD dep. var.	24.18	0.99	23.20	1.00	3.42	2.41	11.47
First stage F-stat	75.16	75.16	75.16	75.16	74.56	74.56	75.25

Notes: The table shows OLS estimates based on specification 2 (Panel A) and IV estimates based on specification 3 (Panel B) of the effect of recession expectations on expectations about macroeconomic and personal outcomes. All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. The outcomes in columns 2 and 4 are z-scored using the mean and standard deviation of our sample. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table 3: Persistence of changes in expectations (reduced form)

	Posterior: Recession (percent)	National unemployment (percent)	County unemployment (percent)	Firm profits (categorical)	Household financial prospects	Personal unemployment (percent)
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Main complete sample						
Recession: High	10.203***	9.128***	5.467***	-0.130**	-0.127**	1.150*
	(1.169)	(1.390)	(1.344)	(0.055)	(0.057)	(0.685)
Observations	1124	1124	1124	1124	1124	1123
Panel B: Main follow-up sample						
Recession: High	10.861***	9.843***	6.670***	-0.199***	-0.115	1.465*
	(1.429)	(1.670)	(1.661)	(0.068)	(0.071)	(0.883)
Observations	737	737	737	737	737	736
Panel C: Follow-up						
Recession: High	3.946**	4.962***	2.755	-0.191***	-0.060	1.025
	(1.540)	(1.837)	(1.723)	(0.069)	(0.071)	(1.032)
Observations	737	737	737	737	737	736

Notes: The table shows reduced form estimates of the effect of the random treatment assignment on expectations about macroeconomic and personal outcomes. All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. Outcomes in columns 4 and 5 are z-scored using the mean and standard deviation from our sample for the main sample and the follow-up separately. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table 4: Behavioral outcomes (IV)

	Consumption growth (planned)	Consumption growth (actual)	Durable purchase climate	Durable purchase (actual)	Stocks net purchases (scale)	Stocks net purchases (dummy)	Stocks net sales (dummy)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Updating: Recession	-0.013**	-0.007	-0.006	-0.001	-0.014**	-0.005**	0.001
	(0.006)	(0.005)	(0.006)	(0.002)	(0.007)	(0.002)	(0.001)
Prior	-0.013***	-0.003	-0.012***	0.000	-0.003	-0.001	0.001
	(0.004)	(0.003)	(0.004)	(0.001)	(0.004)	(0.001)	(0.001)
Observations	1124	705	1124	732	732	732	732
Mean dep. var.	0.03	-0.02	-0.00	0.13	-0.01	0.13	0.02
SD dep. var.	0.98	0.73	0.98	0.34	0.99	0.34	0.13
First stage F-stat	85.76	77.63	85.76	72.57	72.57	72.57	72.57

Notes: The table shows IV estimates based on specification 4 of the effect of updating of recession expectations on changes in people's behavior. All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. Outcomes in columns 1, 3 and 5 are z-scored using the mean and standard deviation from our sample. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table 5: Additional results: Other macroeconomic expectations

	Inflation: Mean	Inflation: Uncertainty	Firm profits (categorical)
	(1)	(2)	(3)
Panel A: OLS			
Posterior: Recession	0.013***	0.013***	-0.009***
	(0.004)	(0.004)	(0.002)
Observations	1121	1121	1124
Panel B: IV			
Posterior: Recession	0.014	0.006	-0.013**
	(0.018)	(0.015)	(0.005)
Observations	1121	1121	1124

Notes: The table shows OLS estimates based on specification 2 (Panel A) and IV estimates based on specification 3 (Panel B) of the effect of recession expectations on expectations about inflation and firm profits. All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. The outcome in column 3 is z-scored using the mean and standard deviation of our sample. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Online Appendix: How Do Expectations About the Macroeconomy Affect Personal Expectations and Behavior?

Christopher Roth[1]   Johannes Wohlfart[2]

Additional figures

[1]Christopher Roth, Institute on Behavior and Inequality (briq), Bonn, e-mail: christopher.roth@economics.ox.ac.uk

[2]Johannes Wohlfart, Department of Economics, Goethe University Frankfurt, e-mail: wohlfart@econ.uni-frankfurt.de

Figure A.1: Timeline of the experiment: Reference periods for economic expectations

Reference period for personal and macroeconomic expectations

Follow-up Survey

Baseline Survey | +3 months | +6 months | +9 months | +12 months → Months
Information Provision

Reference period for belief about a recession
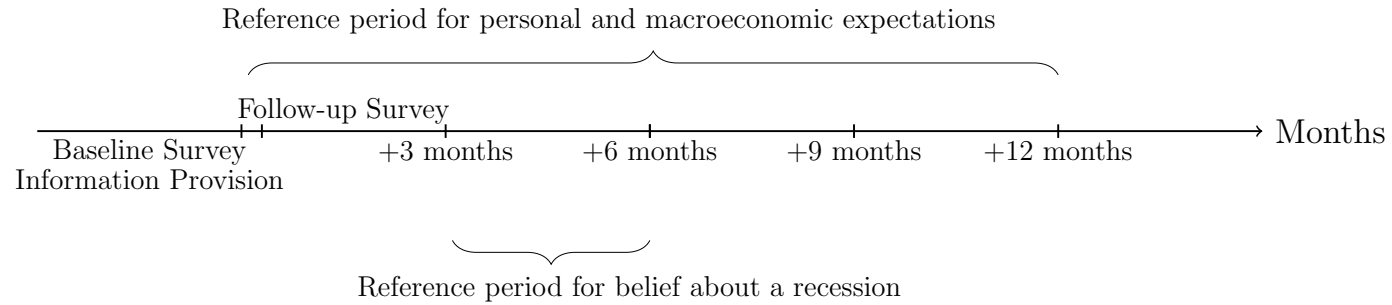
Figure A.2: Timeline of the experiment: Reference periods for behavioral outcomes

Reference period for net asset purchases and durables purchases (follow-up)

Reference period for planned non-durable consumption growth (baseline) | Reference period for planned non-durable consumption growth (planned)

-4 weeks | -3 weeks | -2 weeks | -1 week | Baseline Survey | +1 week | +2 weeks | +3 weeks | +4 weeks → Weeks
Information Provision
Follow-up survey

Reference period for actual non-durable consumption (follow-up)

Reference period for actual non-durable consumption (baseline)

Figure A.3: Distribution of predictions from the Survey of Professional Forecasters
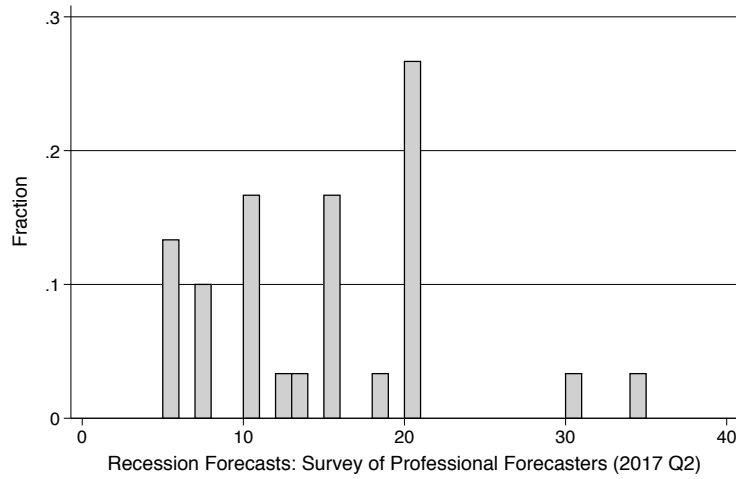
Notes: This figure displays predictions on the likelihood of a fall in US real GDP in the fourth quarter of 2017 compared to the preceding quarter among professional forecasters in the SPF. Source: Survey of Professional Forecasters, wave 2017Q2.

Figure A.4: Scatter plots of prior and posterior (from follow-up)
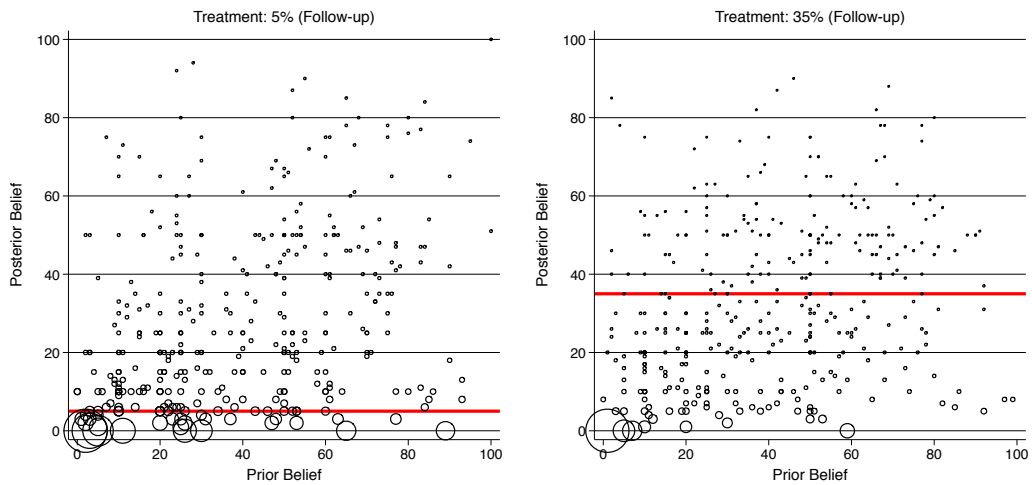
Notes: This figure displays scatter plots of prior and posterior beliefs in the two treatment arms in the two-week follow-up survey. The size of the circles corresponds to the mass of data points for any combination of prior and posterior. The red lines correspond to the signal provided to the respondents in the "high recession" and "low recession" treatments respectively.

Figure A.5: Updating of recession beliefs across treatment arms

Notes: This figure displays the distribution of belief updating in the two treatment arms using posteriors from both the baseline survey and the follow-up survey.

Figure A.6: Distribution of predictions from the Survey of Professional Forecasters from 2018 Q2 compared to predictions from online convenience sample
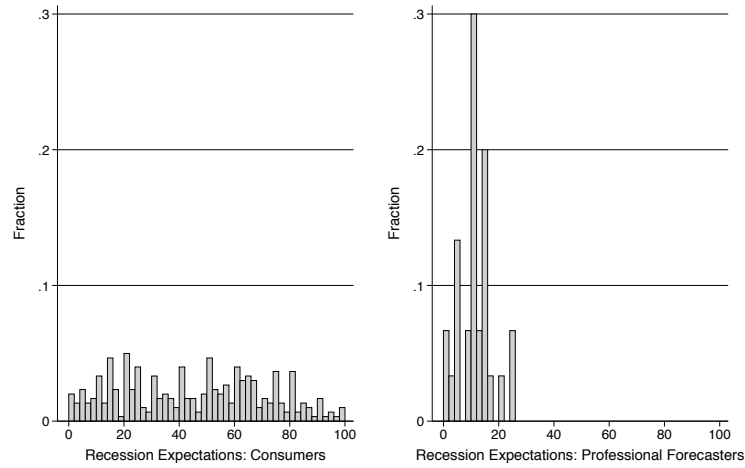
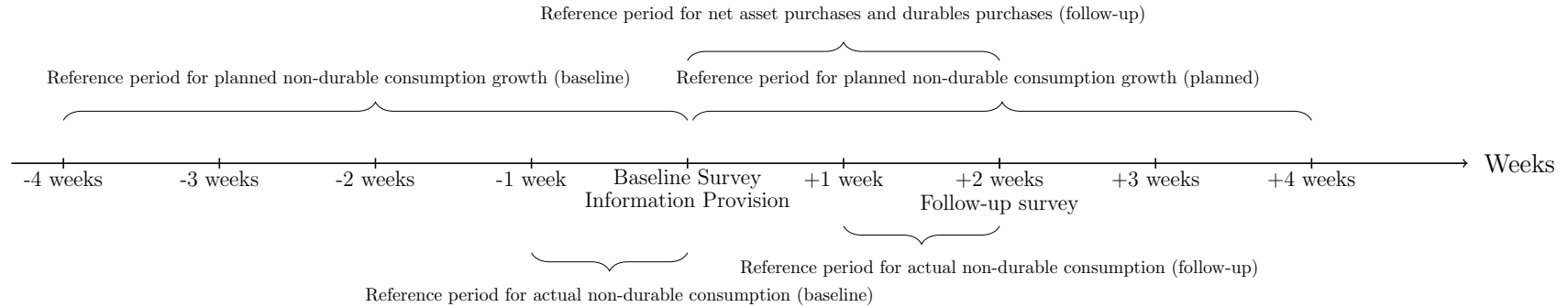*Notes:* The left panel shows the distribution of predictions about the likelihood of a fall in US real GDP in the fourth quarter of 2018 compared to the preceding quarter among 300 MTurk participants collected in the summer of 2018. The right panel displays predictions on the likelihood of a fall in US real GDP in the fourth quarter of 2018 compared to the preceding quarter among professional forecasters in the SPF. Source: Survey of Professional Forecasters, wave 2018Q2.

Figure A.7: Distribution of recession expectations: incentivized vs. unincentivized

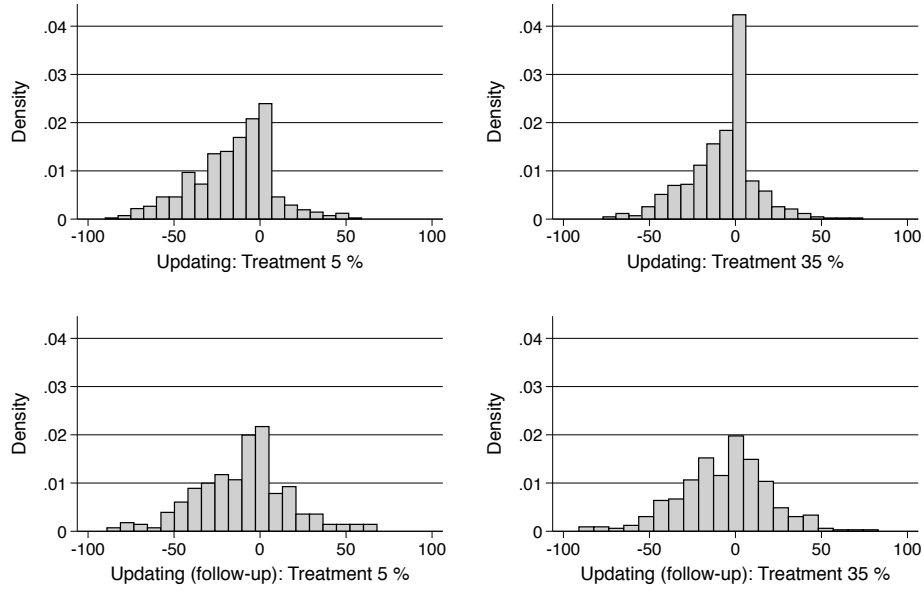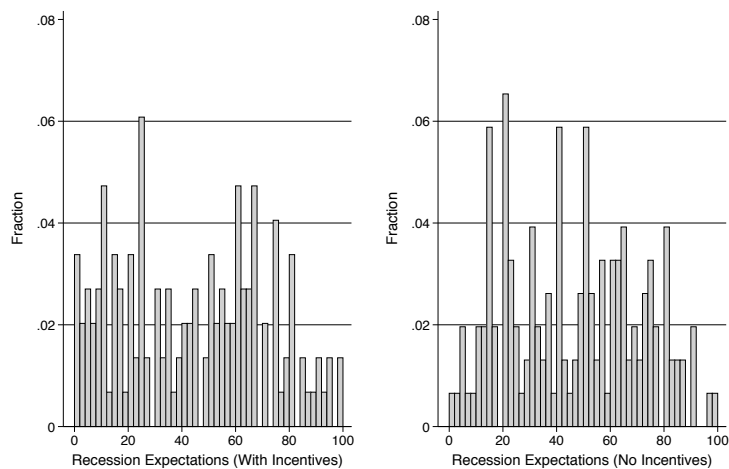*Notes:* The figures show the distribution of predictions about the likelihood of a fall in US real GDP in the fourth quarter of 2018 compared to the preceding quarter among 300 MTurk participants collected in the summer of 2018. The predictions shown in the left figure were incentivized using a quadratic scoring rule (respondents could earn up to $1), while the predictions shown in the right figure were unincentivized.

Figure A.8: Unemployment rates across subgroups over time
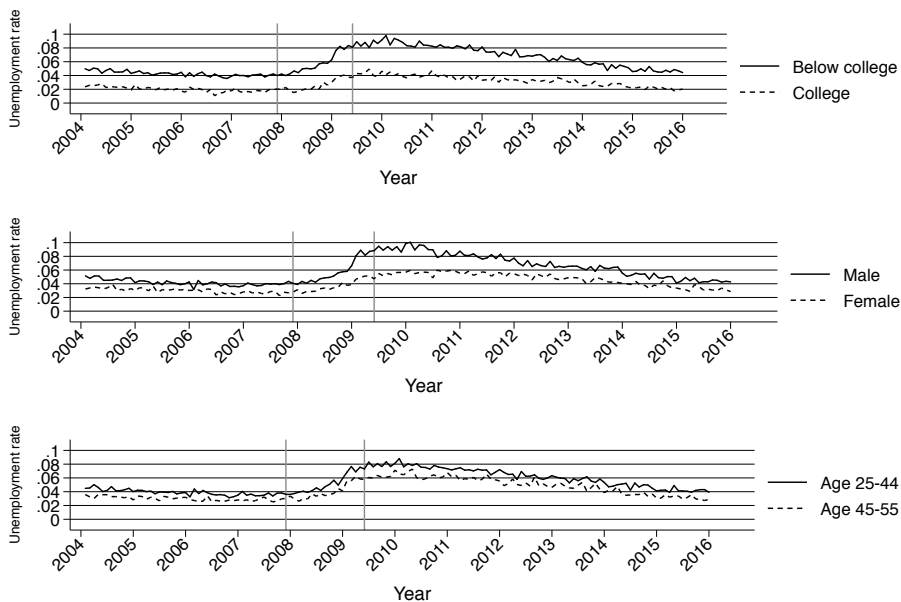
Notes: This figure displays the evolution of unemployment rates among (i) individuals with a college degree and without a college degree aged 25-55 during the Great Recession; (ii) individuals aged 25-44 and among individuals aged 45-55 during the Great Recession (iii) men and women aged 25-55 during the Great Recession. The numbers are seasonally adjusted by partialling out the effect of month dummies. Source: Merged outgoing rotation files of the Current Population Survey (CPS).

Figure A.9: Beliefs about the likely causes of a recession
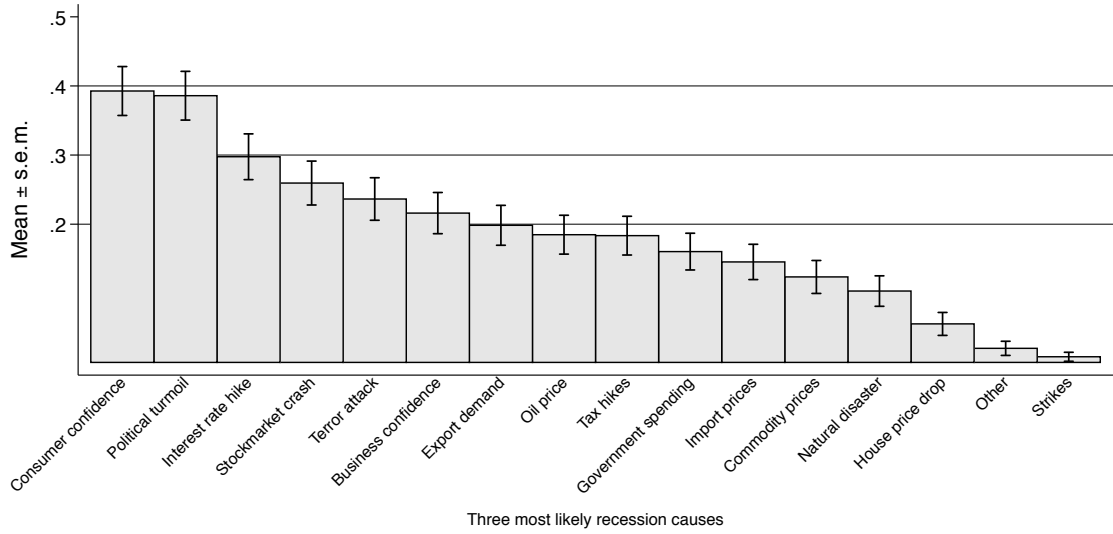
Notes: This figure displays the beliefs about the likely causes of a recession, ranked from most often mentioned to least often mentioned.

Figure A.10: Distribution of unemployment expectations
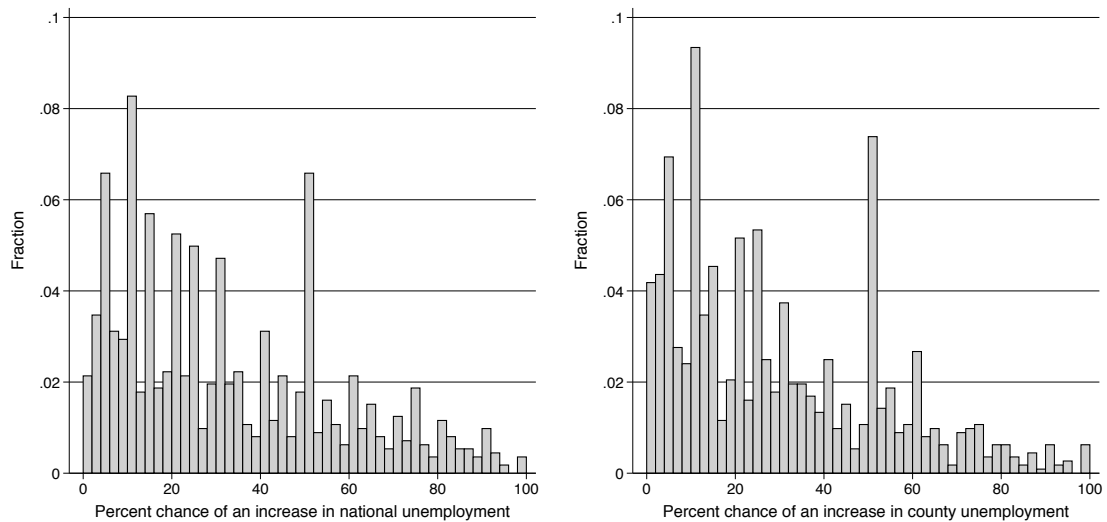
Notes: This figure displays the distribution of expectations about the likelihood of an increase in national unemployment (left panel) and county unemployment (right panel).

Figure A.11: Distribution of inflation expectations
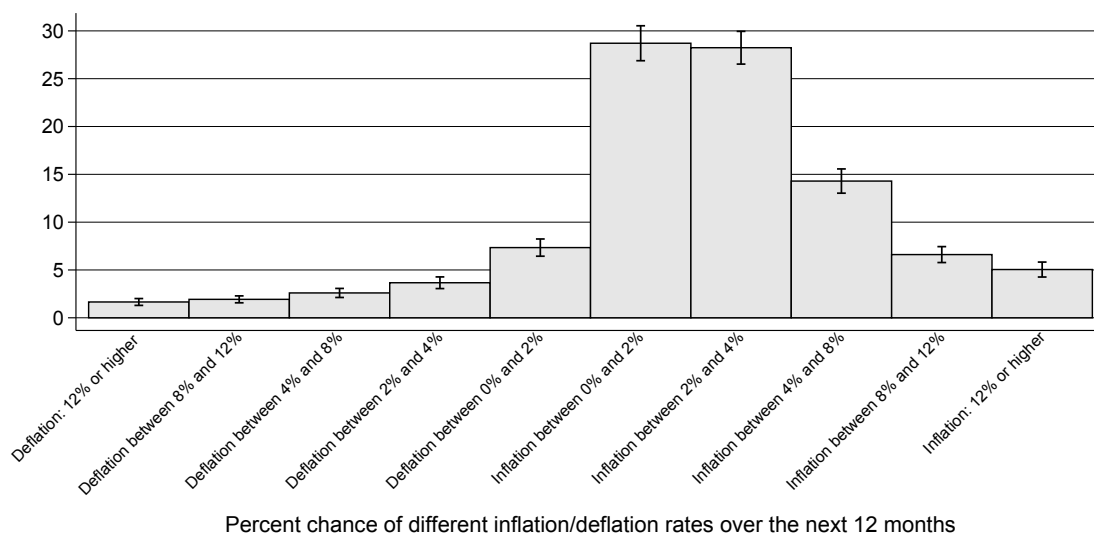
Percent chance of different inflation/deflation rates over the next 12 months

Notes: This figure displays the average probabilities assigned to different ranges of inflation and deflation rates in the main survey.

Figure A.12: Mean expected inflation and inflation uncertainty
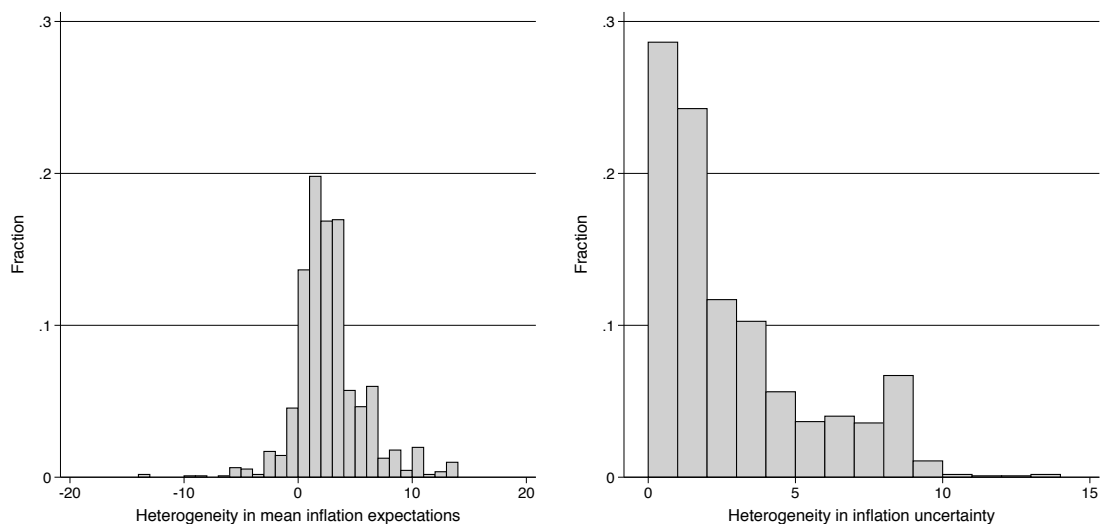
Notes: This figure displays the distributions of means (left panel) and standard deviations (right panel) of individual subjective probability distributions over future inflation in the main survey.

Figure A.13: Distribution of earnings expectations

Percent chance of different changes in earnings over the next 12 months
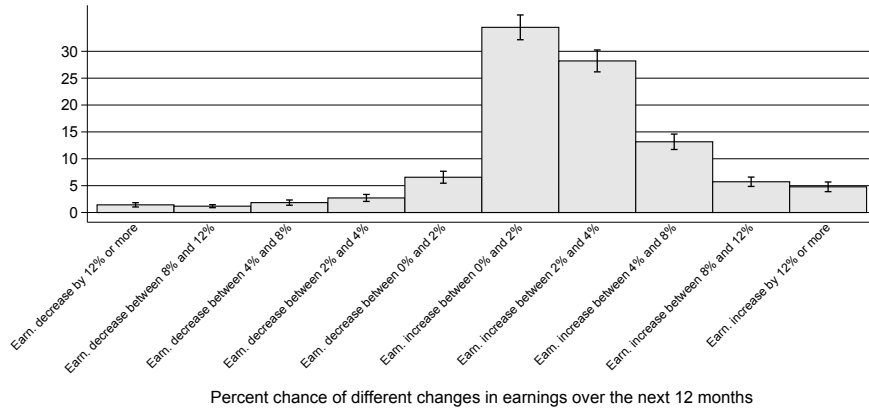
Notes: This figure displays the average probabilities assigned to different ranges of earnings growth in the main survey.

Figure A.14: Mean expected earnings growth and earnings uncertainty
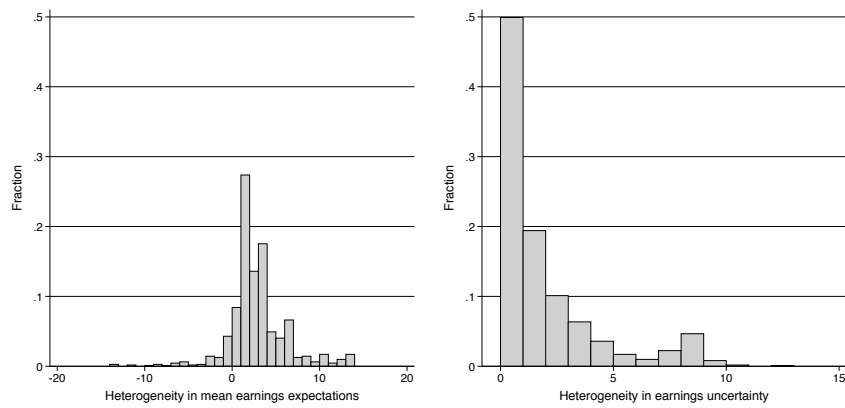
Notes: This figure displays the distributions of means (left panel) and standard deviations (right panel) of individual subjective probability distributions over future earnings growth in the main survey.

Figure A.15: Job finding and job loss expectations
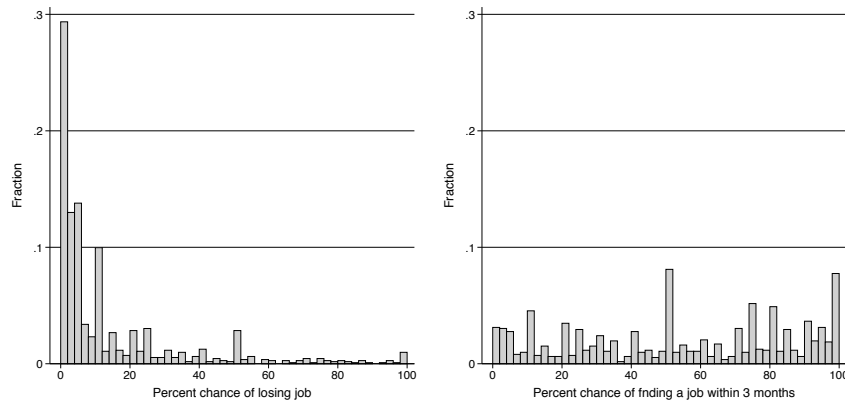
Notes: This figure displays the distribution of people's beliefs about the likelihood of losing their job or finding a job within 3 months after a job loss.

Figure A.16: Prior beliefs about the likelihood of a recession and expectations about personal outcomes
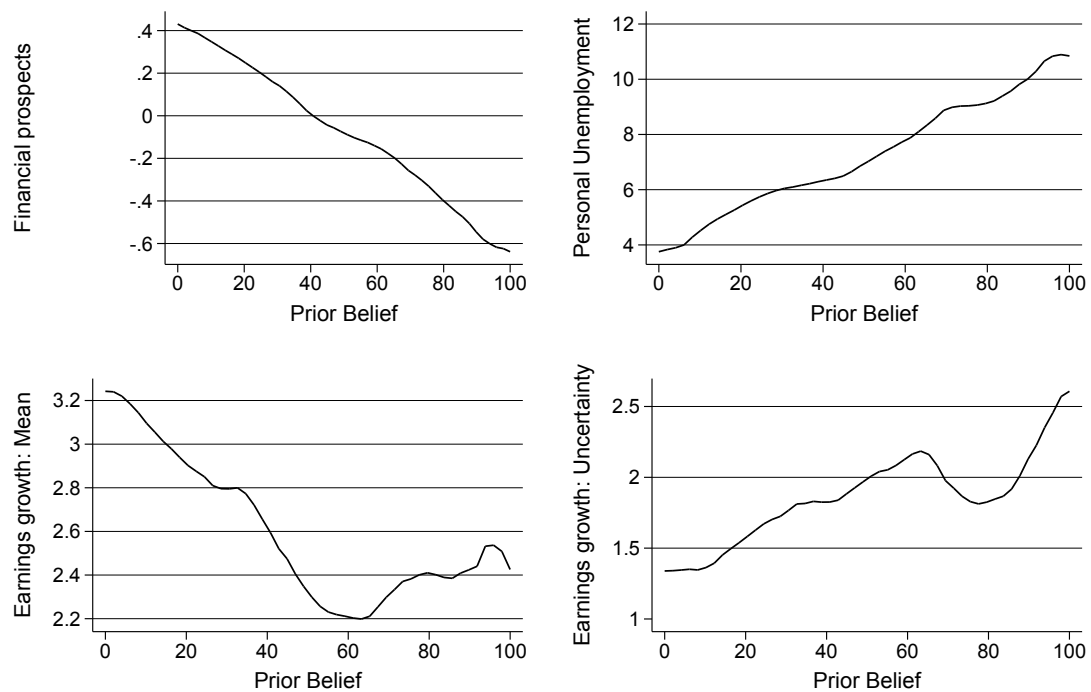
Notes: This figure displays local polynomial regressions of people's expectations about personal economic outcomes on the prior belief about the likelihood of a recession.

Additional tables

Table A1: Summary statistics: Representative online panel

	Mean	SD	Median	Min.	Max.	Obs.
Female	0.46	0.50	0.00	0.00	1.00	1124
Age	42.61	12.56	42.00	19.00	76.00	1124
At least bachelor's degree	0.71	0.45	1.00	0.00	1.00	1124
Household net income	99597.93	64962.47	87500.00	7500.00	250000.00	1113
Liquid assets	72164.44	92034.09	12500.00	250.00	250000.00	1049
Familiy size	2.57	1.34	2.00	1.00	11.00	1114
Single	0.31	0.46	0.00	0.00	1.00	1122
Married	0.55	0.50	1.00	0.00	1.00	1122
Separated	0.09	0.29	0.00	0.00	1.00	1122
Divorced	0.02	0.15	0.00	0.00	1.00	1122
Widowed	0.01	0.09	0.00	0.00	1.00	1122
Midwest	0.23	0.42	0.00	0.00	1.00	1124
West	0.20	0.40	0.00	0.00	1.00	1124
South	0.39	0.49	0.00	0.00	1.00	1124
Northeast	0.18	0.39	0.00	0.00	1.00	1124
Individual gross earnings	69813.07	52503.80	54748.15	1012.61	506303.81	1124
Weekly hours worked	41.31	7.15	45.00	5.00	65.00	1120
Industry: Construction	0.03	0.16	0.00	0.00	1.00	1088
Industry: Nondurable manufacturing	0.05	0.22	0.00	0.00	1.00	1088
Industry: Durable manufacturing	0.07	0.25	0.00	0.00	1.00	1088
Industry: Transportation	0.07	0.25	0.00	0.00	1.00	1088
Industry: Retail and wholesale	0.08	0.27	0.00	0.00	1.00	1088
Industry: Finance	0.09	0.29	0.00	0.00	1.00	1088
Industry: Services	0.24	0.43	0.00	0.00	1.00	1088
Industry: Health and education	0.26	0.44	0.00	0.00	1.00	1088
Industry: Other	0.12	0.33	0.00	0.00	1.00	1088
Public employer	0.32	0.47	0.00	0.00	1.00	1120
Private employer	0.59	0.49	1.00	0.00	1.00	1120
Other employer	0.10	0.30	0.00	0.00	1.00	1120
Tenure	8.71	7.67	7.50	0.50	25.00	1120
Democrat	0.40	0.49	0.00	0.00	1.00	1114
Republican	0.37	0.48	0.00	0.00	1.00	1114
Fin. literacy: Interest compounding - Correct	0.87	0.33	1.00	0.00	1.00	1117
Fin. literacy: Inflation - Correct	0.70	0.46	1.00	0.00	1.00	1117
Fin. literacy: Diversification - Correct	0.67	0.47	1.00	0.00	1.00	1117
Employer's hiring depends on aggregate economy	4.17	1.50	4.00	1.00	7.00	731
Employer's firing depends on aggregate economy	3.80	1.53	4.00	1.00	7.00	731
Employer's profits depend on aggregate economy	4.47	1.52	5.00	1.00	7.00	731
Ever involuntarily unemployed	0.22	0.42	0.00	0.00	1.00	730
Prior belief: Recession	41.01	23.59	40.00	0.00	100.00	1124
Higher unemployment: Categorical	2.97	0.88	3.00	1.00	5.00	1124
Higher unemployment: Probability	32.09	24.18	25.00	0.00	100.00	1124
Higher unemployment (county): Probability	29.55	23.20	25.00	0.00	100.00	1124
Financial prospects: Categorical	4.35	1.14	4.00	1.00	7.00	1124
Earnings expectations: Mean	2.64	3.42	2.23	-14.00	14.00	1118
Earnings expectations: Std. dev.	1.79	2.41	1.00	0.00	12.45	1118
Personal unemployment: Probability	6.61	11.47	1.77	0.00	100.00	1123
Job loss: Probability	13.33	20.15	5.00	0.00	100.00	1124
Job finding: Probability	53.62	31.76	53.00	0.00	100.00	1123
Inflation expectations: Mean	2.60	3.05	2.22	-14.00	14.00	1121
Inflation expectations: Std. dev.	2.74	2.71	1.79	0.00	14.00	1121
Higher profitability all firms: Categorical	3.38	0.76	3.00	1.00	5.00	1124
Non-durable spending last week	201.92	184.85	150.00	0.00	2000.00	1122
Non-durable spending growth (percent)	6.62	70.48	0.00	-200.00	200.00	732
Bought durable goods	0.13	0.34	0.00	0.00	1.00	731
Increased stockholdings	0.13	0.34	0.00	0.00	1.00	731
Decreased stockholdings	0.02	0.13	0.00	0.00	1.00	731

Notes: This table shows summary statistics using data from the main experiment and the follow-up survey.

Table A2: Comparison of the representative online panel with the 2015 American Community Survey

Variable	ACS (2015) Mean	Rep. online panel Mean
Female	0.457	0.459
Age	41.75	42.56
At least bachelor's degree	0.353	0.709
Single	0.311	0.308
Married	0.534	0.547
Separated	0.022	0.090
Divorced	0.117	0.023
Widowed	0.016	0.008
Household net income	97839	99597
Family size	2.934	2.571
Northeast	0.18	0.182
Midwest	0.216	0.229
South	0.374	0.385
West	0.23	0.202
Individual gross earnings	54871	69806
Weekly hours worked	42.65	41.31
Industry: Construction	0.06	0.027
Industry: Nondurable manufacturing	0.079	0.048
Industry: Durable manufacturing	0.072	0.067
Industry: Transportation	0.074	0.066
Industry: Retail and wholesale	0.185	0.076
Industry: Finance	0.068	0.089
Industry: Services	0.19	0.242
Industry: Health and education	0.208	0.257
Industry: Other	0.064	0.125
Employer: Public	0.165	0.317
Employer: Private	0.753	0.585
Employer: Other	0.084	0.096

Notes: This table compares the distributions of individual characteristics in our sample and in the ACS. Our sample only contains individuals in full-time employment. The ACS sample is restricted to individuals working at least 30 hours per week.

Table A3: Recession expectations in the Survey of Professional Forecasters and the representative online panel

	Mean	SD	Median	IQR	Min.	Max.	Obs.
Probability: Recession (SPF)	14.01	7.65	15.00	13.00	0.00	35.00	31
Prior: Recession (online panel)	41.01	23.59	40.00	36.50	0.00	100.00	1124
Posterior: High Recession (online panel)	34.29	17.48	35.00	24.00	1.00	98.00	569
Posterior: Low Recession (online panel)	24.28	22.14	15.00	31.00	0.00	100.00	555

Notes: This table displays summary statistics of the perceived probability of an fall in real GDP in the fourth quarter of 2017 relative to the third quarter among professional forecasters in the SPF and among consumers in our representative online panel (prior to the information treatment). The data from the SPF are from the wave conducted in the second quarter of 2017. The data from the representative online panel were collected in summer 2017.

Table A4: Balance across the two treatment arms

	Recession: High	Recession: Low	P-value(High - Low)	Observations
Female	0.47	0.45	0.417	1124
Age	42.45	42.77	0.667	1124
At least bachelor's degree	0.70	0.72	0.327	1124
Log(Income)	11.29	11.29	0.898	1113
Republican	0.37	0.36	0.811	1114
Democrat	0.40	0.39	0.695	1114
Midwest	0.24	0.22	0.444	1124
South	0.37	0.40	0.260	1124
West	0.22	0.19	0.203	1124
Prior belief: Recession	41.82	40.18	0.244	1124

Notes: The p-value of a joint F-test when regressing the treatment dummy on all covariates is 0.7336.

Table A5: Balance across the two treatment arms in the follow-up sample

	Recession: High	Recession: Low	P-value(High - Low)	Observations
Female	0.46	0.40	0.097	736
Age	42.92	44.13	0.201	736
At least bachelor's degree	0.70	0.76	0.086	736
Log(Income)	11.29	11.33	0.441	732
Republican	0.38	0.36	0.575	728
Democrat	0.40	0.39	0.831	728
Midwest	0.24	0.23	0.908	736
South	0.38	0.39	0.666	736
West	0.21	0.16	0.104	736
Prior belief: Recession	40.72	39.77	0.589	736

Notes: The p-value of a joint F-test when regressing the treatment dummy on all covariates is 0.4391.

Table A6: Correlates of expectations about the likelihood of a recession

	Probability of a recession (univariate) (1)	Probability of a recession (multivariate) (2)
High education	-1.443	-0.453
	(1.549)	(1.678)
Female	10.319***	6.778***
	(1.379)	(1.592)
Age	-0.349***	-0.061
	(0.055)	(0.479)
Age squared	-0.004***	-0.001
	(0.001)	(0.005)
Log income	-1.372**	-0.655
	(0.537)	(1.186)
Republican	-12.317***	-7.074***
	(1.416)	(1.777)
Democrat	12.155***	6.223***
	(1.394)	(1.773)
Financial literacy	-9.909***	-2.430
	(2.242)	(2.419)
County unemployment	0.703	0.256
	(0.525)	(0.591)
Ever unemployed	1.678	3.094
	(1.858)	(1.936)
Confidence in prior	-0.451	0.890
	(0.752)	(0.742)
Observations	1124	1124

Notes: Column 1 shows regression coefficients from separate univariate regression for the different covariates. Column 2 shows regression coefficients from a multivariate regression. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A7: Belief updating

	"Wrong sign"	None	Partial	Full	"Over-extrapolation"	
	Posterior<Prior<Signal or Signal<Prior<Posterior	Posterior = Prior	Prior<Posterior<Signal or Signal<Posterior<Prior	Posterior = Signal	Prior<Signal<Posterior or Posterior<Signal<Prior	Total
Forecast 5 percent	72	64	303	78	38	555
Forecast 35 percent	78	111	201	71	108	569
Total	150	175	504	149	146	1,124

Notes: This table classifies the respondents in the two treatment arms according to their updating behavior.

Table A8: Learning rates: Heterogeneity across groups

	Updating							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Shock (a)	0.415***	0.327***	0.337***	0.266***	0.315***	0.261***	0.294***	0.375***
	(0.049)	(0.041)	(0.040)	(0.039)	(0.039)	(0.061)	(0.043)	(0.071)
Shock × (b) High education	-0.130***							
	(0.047)							
Shock × (b) High earnings		-0.018						
		(0.045)						
Shock × (b) Age>44			-0.047					
			(0.045)					
Shock × (b) Female				0.116**				
				(0.045)				
Shock × (b) Non-cyclical industry					0.025			
					(0.045)			
Shock × (b) Never unemployed						0.070		
						(0.059)		
Shock × (b) Low county unemployment							0.034	
							(0.045)	
Shock × (b) High financial literacy								-0.077
								(0.080)
Pr(a+b)=0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	1124	1124	1124	1124	1088	1124	1106	1124

Notes: The table shows OLS estimates of the learning rate from the professional forecasts for different groups. All specifications control for the respondent's prior belief, age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. The outcome is the difference between the posterior belief measured in the main study and the prior belief. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A9: Extrapolation to personal unemployment expectations: Heterogeneity across demographic groups (IV)

	Personal unemployment (percent)			
	(1)	(2)	(3)	(4)
Posterior: Recession (a)	0.219***	0.164**	0.096	0.154
	(0.073)	(0.077)	(0.071)	(0.105)
Posterior: Recession × (b) High education	-0.188 (0.129)			
Posterior: Recession × (b) High earnings		-0.124 (0.136)		
Posterior: Recession × (b) Age>44			0.050 (0.149)	
Posterior: Recession × (b) Female				-0.072 (0.138)
Pr(a+b)=0	0.765	0.721	0.272	0.352
Observations	1123	1123	1123	1123
First stage F-stat (a)	54.66	48.82	50.62	28.15
First stage F-stat (b)	75.12	71.66	68.29	69.42

Notes: This table displays IV estimates of the effect of posterior beliefs about the likelihood of a recession on people's perceived chance of becoming personally unemployed for different demographic groups. The estimates are based on IV estimations, where the posterior likelihood of a recession is interacted with education (column 1), earnings (column 2), age (column 3) and gender (column 4) . All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A10: Extrapolation to personal unemployment expectations: Heterogeneity according to proxies for exposure to risk (IV)

	Personal unemployment	Job loss	Job finding
	(1)	(2)	(3)
Panel A: Industry			
Posterior: Recession (a)	0.174**	0.213	-0.101
	(0.086)	(0.149)	(0.216)
Posterior: Recession × (b) Non-cyclical industry	-0.179	-0.343	-0.072
	(0.133)	(0.254)	(0.403)
Pr(a+b)=0	0.962	0.523	0.610
Observations	1087	1088	1087
Panel B: Personal unemployment history			
Posterior: Recession (a)	0.465**	0.693**	-0.636
	(0.218)	(0.352)	(0.420)
Posterior: Recession × (b) Never unemployed	-0.435*	-0.743**	0.565
	(0.228)	(0.374)	(0.470)
Pr(a+b)=0	0.659	0.686	0.734
Observations	1123	1124	1123
Panel C: County unemployment			
Posterior: Recession (a)	0.233**	0.176	-0.510*
	(0.097)	(0.164)	(0.270)
Posterior: Recession × (b) Low county unemployment	-0.253*	-0.214	0.653*
	(0.139)	(0.239)	(0.382)
Pr(a+b)=0	0.845	0.829	0.597
Observations	1105	1106	1105

Notes: This table displays IV estimates of the effect of posterior beliefs about the likelihood of a recession on expectations about the personal job situation for groups with different exposure to risk that are underlying Figure 5. The estimates are based on IV estimations, where the posterior likelihood of a recession is interacted with working in a non-cyclical industry (Panel A), not having been unemployed in the past (Panel B) and living in a county with low unemployment (Panel C). All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A11: Extrapolation to mean expected earnings growth conditional on working at the same job: Heterogeneity across demographic groups (IV)

	Earnings growth: Mean (percent)			
	(1)	(2)	(3)	(4)
Posterior: Recession (a)	0.013	0.033	0.016	-0.066*
	(0.028)	(0.024)	(0.026)	(0.034)
Posterior: Recession × (b) High education	-0.046 (0.040)			
Posterior: Recession × (b) High earnings		-0.102** (0.043)		
Posterior: Recession × (b) Age>44			-0.077* (0.043)	
Posterior: Recession × (b) Female				0.098** (0.043)
Pr(a+b)=0	0.249	0.051	0.082	0.214
Observations	1118	1118	1118	1118
First stage F-stat (a)	52.66	47.90	50.07	28.02
First stage F-stat (b)	74.26	71.18	67.37	68.92

Notes: This table displays IV estimates of the effect of posterior beliefs about the likelihood of a recession on people's perceived chance that national unemployment will increase for different demographic groups. The estimates are based on IV estimations, where the posterior likelihood of a recession is interacted with education (column 1), earnings (column 2), age (column 3) and gender (column 4) . All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A12: Effects of recession expectations on national unemployment expectations: Heterogeneity across groups (IV)

	National unemployment (percent)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Posterior: Recession (a)	0.671***	0.728***	0.759***	1.043***	0.977***	1.132***	0.872***
	(0.151)	(0.155)	(0.147)	(0.239)	(0.169)	(0.341)	(0.186)
Posterior: Recession × (b) High education	0.395 (0.263)						
Posterior: Recession × (b) High earnings		0.391 (0.284)					
Posterior: Recession × (b) Age>44			0.385 (0.312)				
Posterior: Recession × (b) Female				-0.272 (0.282)			
Posterior: Recession × (b) Non-cyclical industry					-0.223 (0.275)		
Posterior: Recession × (b) Never unemployed						-0.294 (0.371)	
Posterior: Recession × (b) Low county unemployment							0.032 (0.267)
Pr(a+b)=0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Observations	1124	1124	1124	1124	1088	1124	1106
First stage F-stat (a)	54.66	48.83	50.58	29.03	49.47	14.52	37.18
First stage F-stat (b)	74.95	71.54	68.18	69.22	67.85	69.28	68.07

Notes: This table displays IV estimates of the effect of posterior beliefs about the likelihood of a recession on people's perceived chance that national unemployment will increase for different groups. The estimates are based on IV estimations, where the posterior likelihood of a recession is interacted with education (column 1), earnings (column 2), age (column 3), gender (column 4), working in a non-cyclical industry (column 5), not having been unemployed in the past (column 6) and living in a county with low unemployment (column 7). All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A13: Demand and Anchoring Experiment

	Probability of a recession (percent)	Household financial prospects	Consumption growth (planned)
	(1)	(2)	(3)
Demand Treatment	3.662	-0.092	-0.021
	(3.460)	(0.147)	(0.104)
Anchoring	-0.018	-0.070	-0.135
	(3.526)	(0.142)	(0.108)
Observations	296	301	301

Notes: This table displays treatment effects of receiving a "demand treatment" (de Quidt et al., 2018) or receiving an irrelevant numerical anchor. In the demand treatment respondents are told: "In this experiment people are randomly assigned to receive different instructions. We hypothesize that participants who are shown the same instructions as you report more optimistic expectations about the US economy." The irrelevant numerical anchor is given as follows: "We would like to provide you with some information about the share of illegal immigrants in the United States. According to the Department of Homeland Security, 3 percent of the total U.S. population are illegal immigrants." The outcomes in columns 2 and 3 are z-scored using the mean and standard deviation in our sample. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A14: Recession Expectations and Mean Inflation Expectations: Heterogeneity

	Inflation: Mean							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Posterior (a)	0.032	0.027	0.006	-0.023	0.006	0.026	0.043	0.037
	(0.028)	(0.025)	(0.023)	(0.026)	(0.023)	(0.044)	(0.027)	(0.075)
Posterior × (b) High education	-0.035 (0.035)							
Posterior × (b) High earnings		-0.030 (0.035)						
Posterior × (b) Age>44			0.016 (0.038)					
Posterior × (b) Female				0.065* (0.037)				
Posterior × (b) Non-cyclical industry					0.025 (0.038)			
Posterior × (b) Never unemployed						-0.016 (0.048)		
Posterior × (b) Low county unemployment							-0.057 (0.036)	
Posterior × (b) High financial literacy								-0.032 (0.085)
Pr(a+b)=0	0.920	0.909	0.474	0.111	0.325	0.616	0.603	0.778
Observations	1121	1121	1121	1121	1085	1121	1103	1121

Notes: This table displays IV estimates of the effect of posterior beliefs about the likelihood of a recession on people's mean inflation expectations. The estimates are based on IV estimations, where the posterior likelihood of a recession is interacted with education (column 1), earnings (column 2), age (column 3) and gender (column 4), industry (column 5), previous unemployment (column 6), low-county unemployment (column 7) and high financial literacy (column 8). All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A15: Recession Expectations and Inflation Uncertainty: Heterogeneity

|	Inflation: Uncertainty							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Posterior (a)	-0.026	-0.022	-0.016	0.023	0.027	-0.010	-0.009	-0.086
	(0.023)	(0.022)	(0.021)	(0.021)	(0.019)	(0.031)	(0.024)	(0.073)
Posterior × (b) High education	0.057*							
	(0.029)							
Posterior × (b) High earnings		0.063**						
		(0.030)						
Posterior × (b) Age>44			0.056*					
			(0.031)					
Posterior × (b) Female				-0.031				
				(0.030)				
Posterior × (b) Non-cyclical industry					-0.033			
					(0.031)			
Posterior × (b) Never unemployed						0.020		
						(0.035)		
Posterior × (b) Low county unemployment							0.028	
							(0.030)	
Posterior × (b) High financial literacy								0.120
								(0.083)
Pr(a+b)=0	0.134	0.068	0.095	0.690	0.821	0.603	0.350	0.087
Observations	1121	1121	1121	1121	1085	1121	1103	1121

Notes: This table displays IV estimates of the effect of posterior beliefs about the likelihood of a recession on people's inflation uncertainty. The estimates are based on IV estimations, where the posterior likelihood of a recession is interacted with education (column 1), earnings (column 2), age (column 3) and gender (column 4), industry (column 5), previous unemployement (column 6), low-county unemployment (column 7) and high financial literacy (column 8). All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

A Beliefs about insurance within the firm

Our evidence that the subjective likelihood of a recession has a negative causal effect on people's expectations regarding the evolution of firm profits relates to a recent literature which has established that firms provide their workers with substantial insurance against shocks (Fagereng et al., 2017a,b). In line with this, our respondents think that part of a macroeconomic downturn would be absorbed by lower firm profits. Moreover, we ask our respondents whether they think that their employer's profits, hiring decisions and firing decisions depend on how the aggregate economy is doing. As can be seen in Figure A.17, workers believe that their employer's firing decisions are less dependent on the state of the aggregate economy than their employer's profits. This highlights that workers believe that their employer provides them with a certain degree of insurance against macroeconomic shocks. In addition, our respondents believe that their employers' hiring decisions are more dependent on the aggregate economy than their employers' firing decisions. This is consistent with empirical evidence showing that the job-finding rate behaves more pro-cyclically than the separation rate (Shimer, 2005). In addition, we examine heterogeneity in the effect of recession expectations on personal unemployment expectations according to a subjective measure of the degree to which our respondents are insured against macroeconomic shocks by their employers. We construct this measure as the difference in the respondent's agreement that his or her employer's profits depend on the aggregate economy, and that the employer's firing decisions depend on the aggregate economy.[3] We rescale this measure to lie between 0 and 1. As shown in Table A16, respondents who report a lower degree of insurance through their employer extrapolate more strongly from recession expectations to personal unemployment expectations.

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[3]We neglect people working for the government in this exercise.

Figure A.17: Subjective beliefs about how firing, hiring and profits of firms depend on the aggregate economy
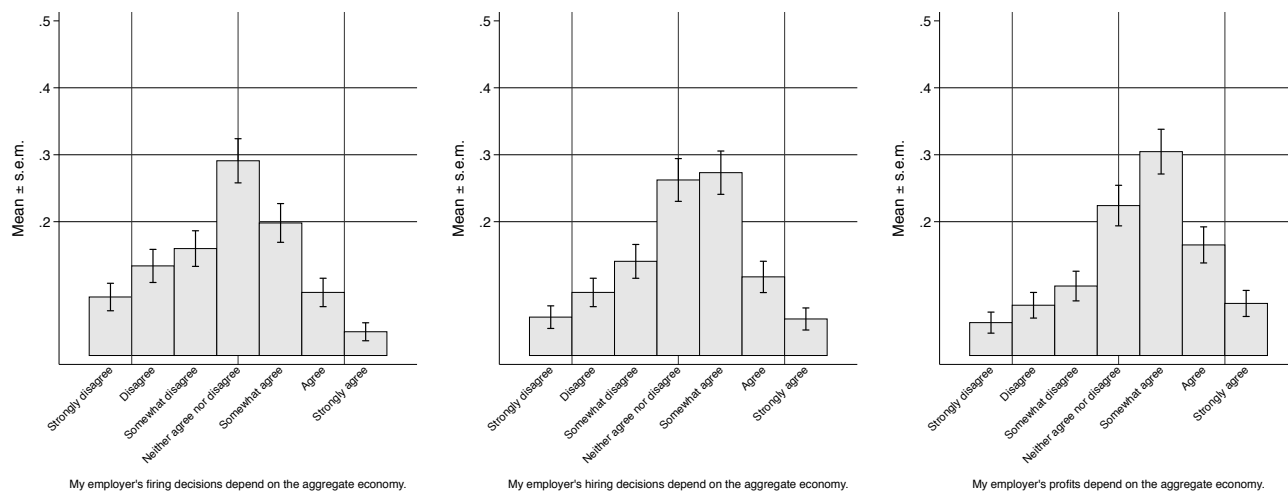
Notes: This figure shows the distribution of beliefs about how firms' firing decision, hiring decisions and profits depend on how the aggregate economy is doing.

Table A16: Additional results: Heterogeneity by subjective insurance within the firm (IV)

	Personal Unemployment	Job Loss	Job Finding
	(1)	(2)	(3)
Posterior: Recession (a)	0.526**	0.900**	0.692
	(0.266)	(0.428)	(0.700)
Posterior: Recession × (b) High firm insurance	-0.822	-1.443*	-1.376
	(0.527)	(0.822)	(1.359)
Pr(a+b)=0	0.306	0.220	0.347
Observations	639	640	639

Notes: The table shows IV estimates of heterogeneous effects of recession expectations on individuals who perceive a high and a low degree of insurance through their employer. All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree, dummies for the respondent's Census region of residence, a measure of the respondent's financial literacy as well as a dummy for Republicans and a dummy for Democrats. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

B Evidence from the Survey of Consumer Expectations

We confirm the external validity of the findings of greater pessimism and higher dispersion of beliefs among consumers than among professional forecasters using data on the probability of an increase in aggregate unemployment estimated by respondents in the Survey of Professional Forecasters (SPF) and by respondents to the New York Fed's Survey of Consumer Expectations (SCE). While professional forecasters in the SPF have to assign probabilities to different brackets in which the unemployment rate over the next calendar year could be on average, respondents to the SCE are asked about the probability of an increase in unemployment over the 12 months after the survey. To make these two numbers as comparable as possible, we focus on the SPF waves conducted in the second quarter and the SCE waves conducted in May. Figure A.18 plots distributions of the forecasts in the SPF and the SCE in the years 2014, 2015 and 2016. Summary statistics are shown in Table A17. In each year, the median consumer is more pessimistic than the median professional forecasters, and the interquartile range (IQR) of the professional forecasts is smaller than the IQR of the predictions by the consumers.

Figure A.18: Unemployment predictions in the Survey of Professional Forecasters and the Survey of Consumer Expectations
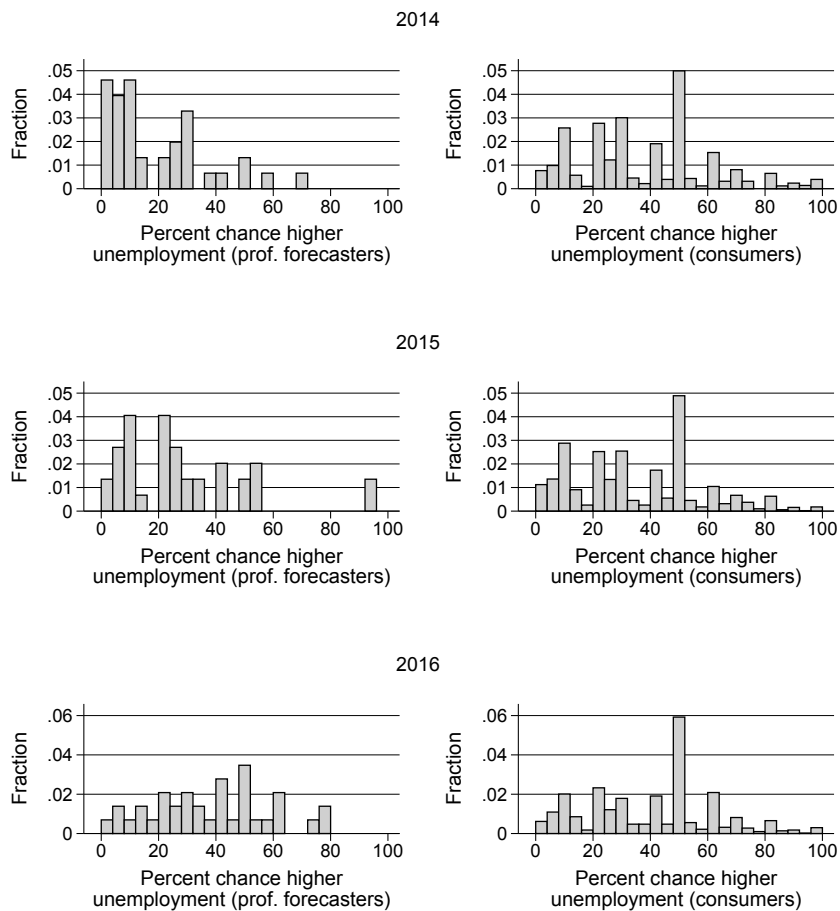
Notes: This figure displays distributions of the perceived probability of an increase in aggregate unemployment over the next year among professional forecasters in the SPF (left) and among consumers in the SCE (right) for the years 2014 until 2016. The data from the SPF are from the waves conducted in the second quarter of the year and refer to expectations about average unemployment over the next calendar year. The data from the SCE are from the waves conducted in May and refer to expectations about unemployment 12 months after the survey.

Table A17: Unemployment predictions in the Survey of Professional Forecasters and the Survey of Consumer Expectations

	Mean	SD	Median	IQR	Min.	Max.	Obs.
2014							
SPF	18.54	17.91	10.25	25.00	0.00	70.00	38
SCE	38.55	23.37	40.00	30.00	0.00	100.00	1272
2015							
SPF	27.74	22.83	21.00	30.00	0.00	96.00	37
SCE	34.63	22.44	30.00	35.00	0.00	100.00	1268
2016							
SPF	37.61	20.54	29.00	39.50	0.00	80.00	36
SCE	39.56	21.98	30.00	40.00	0.00	100.00	1258

Notes: This table displays summary statistics of the perceived probability of an increase in aggregate unemployment over the next year among professional forecasters in the SPF and among consumers in the SCE for the years 2014 until 2016. The data from the SPF are from the waves conducted in the second quarter of the year and refer to expectations about average unemployment over the next calendar year. The data from the SCE are from the waves conducted in May and refer to expectations about unemployment 12 months after the survey.

C Imputation for heterogeneity analysis

We elicit people's personal unemployment history in the follow-up survey and the variable is missing for respondents we could not re-contact. When we examine heterogeneous effects of recession expectations according to previous unemployment we rely on an imputation procedure. Specifically, we estimate a logit model of the effect of dummies for age brackets, dummies for brackets of tenure, an indicator for credit constraints, and log liquid assets on the likelihood of having never been unemployed on the sample of 731 respondents who answered to this question in the follow-up. All of the included covariates have high predictive power and 80 percent of the respondents in the follow-up are classified correctly by model. We use the coefficient estimates to make an out-of-sample prediction of having never been unemployed for the 393 respondents who did not complete the follow-up, which we use in our analysis.