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

Christopher Roth Johannes Wohlfart

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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 macroeconomic outlook in response to the forecasts, extrapolate to expectations about their personal economic circumstances and adjust their consumption plans and stock purchases. Extrapolation to expectations about personal unemployment is driven by individuals with higher exposure to macroeconomic risk, consistent with macroeconomic models of imperfect information in which people are inattentive, but understand how the economy works.

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* Christopher Roth, Institute on Behavior and Inequality (briq), Bonn, e-mail: chris.roth@briq-institute.org; Johannes Wohlfart, Department of Economics, Goethe University Frankfurt, e-mail: wohlfart@econ.uni-frankfurt.de. We would like to thank the editor, Olivier Coibion, as well as two anonymous referees for thoughtful comments that improved the paper considerably. We thank Goethe University Frankfurt and Vereinigung von Freunden und Förderern der Goethe Universität for financial support. Johannes Wohlfart thanks for support through the DFG project "Implications of Financial Market Imperfections for Wealth and Debt Accumulation in the Household Sector". We received ethics approval from the University of Oxford. The online Appendix is available at <https://goo.gl/MTJ8hG> and the experimental instructions are available at <https://goo.gl/1C9vLK>.

1 Introduction

Households' expectations about their 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 low consumer confidence about the aggregate economy is central to many accounts of the slow recovery of consumption after the Great Recession. However, aggregate risk only accounts for a small fraction of the total income risk faced by households. Macroeconomic models of imperfect information therefore predict that households are typically uninformed about news that are relevant for the macroeconomic outlook (Maćkowiak and Wiederholt, 2015; Reis, 2006; Sims, 2003). This raises two questions: First, are relevant pieces of news about the macroeconomy, such as professional forecasts about economic growth, part of households' information sets? Second, do households adjust their expectations about their own economic situation and their behavior in response to changes in their expectations about aggregate economic growth?

In this paper, we use experimental methods to test for the causal effects of households' expectations about future macroeconomic conditions on their personal economic prospects and behavior.¹ We propose a randomized information experiment embedded in an online survey on a sample that is representative of the portion of the US population that is employed full-time. 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). Respondents in the "high recession treatment" receive information from a very pessimistic forecaster, while respondents in the "low recession treatment" receive a prediction from a very optimistic forecaster. Thereafter, we measure our respondents' expectations

¹ Identifying this causal channel is important as research shows that people's personal situation affects their macroeconomic expectations (e.g., see Kuchler and Zafar (2018)).

Further, omitted variables could affect both macroeconomic and personal expectations.

about the evolution of aggregate unemployment and their personal economic situation over the 12 months after the survey, and elicit both 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, an adjustment of our respondents' beliefs in response to the information 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 to 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. Among those with a college degree, learning rates are significantly higher for respondents who are less confident in their prior beliefs, in line with Bayesian updating. For those without a college degree, there is no such heterogeneity. The findings for highly educated respondents are in line with models of imperfect information in which people are initially inattentive but update rationally after receiving new information.

Second, we explore the degree of extrapolation from recession expectations 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

their 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 large, but still relatively close to the increase in the job loss rate by 7 percentage points during the last recession. However, there is no significant average effect on people’s expected earnings growth conditional on keeping their job. In the two-week follow-up survey, differences in expectations decrease in size, but mostly remain economically and statistically significant.

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 past recessions, 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 those working in more cyclical industries) more strongly update their expectations about personal unemployment. Similarly, we provide evidence of updating of earnings expectations conditional on working in the same job for groups that should not be constrained by downward rigidity in wages. Thus, the updating of personal expectations is data-consistent in terms of size and heterogeneity, indicating that our respondents have an understanding of their actual exposure to recessions. The assumption that people understand the true model of the economy 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, 2018). 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, measured with self-reports.

Finally, we provide causal evidence on the relationship between people’s expectations

about economic growth and inflation.² There was substantial disinflation during most past recessions (Coibion and Gorodnichenko, 2015b) and many macroeconomic models predict a co-movement of inflation and unemployment in response to shocks. However, our fifth main finding is that exogenous changes in beliefs about the likelihood of a recession do not decrease 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), documenting 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. A key contribution of our paper is to document that updating of personal expectations in response to a revised macroeconomic outlook is driven by those groups who are actually more strongly exposed to macroeconomic risk, suggesting that households have a basic understanding of their exposure to business cycle fluctuations.

A larger literature uses observational data to study how people’s macroeconomic expectations are formed (Das et al., 2018; Goldfayn-Frank and Wohlfart, 2019; Kuchler and Zafar, 2018; Malmendier and Nagel, 2011, 2016; Manski, 2017; Mian et al., 2018; Tortorice, 2012), and how these expectations shape household behavior, such as the effect of home price expectations on housing-related behavior (Bailey et al., 2018a,b) or the effect of inflation expectations on consumption behavior (Bachmann et al., 2015; D’Acunto et al., 2018a). A literature in finance uses survey data to study the extent to

² We build upon work examining how beliefs about unemployment correlate with beliefs about interest rates and inflation (Carvalho and Nechio, 2014; Dräger et al., 2016; Kuchler and Zafar, 2018). Andre et al. (2019) measure respondents’ beliefs about how unemployment and inflation change in response to different macroeconomic shocks.

which optimism and pessimism about stock returns and the macroeconomic outlook can explain households' investment behavior (Das et al., 2018; Greenwood and Shleifer, 2014; Malmendier and Nagel, 2011; Vissing-Jorgensen, 2003). In a different context, namely managerial decision-making, Coibion et al. (2018b) provide causal evidence showing that higher inflation expectations lead firms to raise their prices, increase their utilization of credit, and reduce their employment.

Our paper also contributes to a literature that uses observational data to study the importance of information rigidities in macroeconomics (Carroll, 2003; Coibion and Gorodnichenko, 2012, 2015a; Mankiw et al., 2003).

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

2 Experimental design

In this section we describe the survey administration, present our experimental design and explain the structure of the main survey and the follow-up survey. The full experimental instructions for all experiments (including robustness experiments 1, 2, and 3) 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 Survey

We collect a sample of 1,124 respondents that is representative of the full-time employed US population in terms of gender, age, region and total household income through the widely used market research company "Research Now". We only invite people who both have a paid job and 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.

2.2 Baseline experiment

Prior beliefs: Likelihood of a recession First, we ask subjects to complete a questionnaire 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 fourth quarter of 2017 compared to the third quarter of 2017. 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.³ 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 pes-

³ One concern could be that quarterly GDP also fell outside actual recessions in the past, so eliciting beliefs about this outcome could not really capture beliefs about the likelihood of a recession. However, a fall in US real GDP in the fourth quarter happened only during actual recessions since World War II.

simistic 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.⁴ 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 A.3 for an illustration of the treatment screen).

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.⁵

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. 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.⁶

⁴ The professional forecasts correspond to SPF panelists’ beliefs about a drop in real GDP two quarters after this wave of the SPF was conducted.

⁵ 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).

⁶ Means of density forecasts are easy to interpret, while point forecasts could capture mean, mode or some other moment of our respondents’ subjective probability distri-

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.⁷

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-elicited 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 (Lusardi and Mitchell, 2014). Moreover, we ask them a series of questions on their assets, their political affiliation as well as their zipcode of residence.

2.3 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

⁷ We ask our respondents about inflation, as done in the New York Fed's Survey of Consumer Expectations, instead of changes in the general price level, as done in the Michigan Survey of Consumers. Asking consumers to think about prices results in more extreme and disagreeing self-reported inflation expectations (de Bruin et al., 2011).

range of other questions and only report posteriors at the end of the survey, roughly 10 minutes after the information. Second, we elicit both probabilistic and qualitative 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 numerical anchoring, we further mitigate such concerns by conducting a two-week follow-up survey in which no additional information is provided. We chose to have a two-week gap between the main study and the follow-up to balance the trade-off between testing for persistence and maximizing the recontact rate in the follow-up.

In the follow-up survey, we re-elicited some of the key outcomes from the main survey, such as the likelihood of increases 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-elicited 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. 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.⁸ 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 and about the most likely causes of a potential recession, as well as their personal unemployment history.

2.4 Discussion of the experimental design

In our experiment we provide respondents with different individual professional forecasters' assessments of the likelihood of a recession. An alternative experimental design

⁸ We chose to have a one-week time horizon as this mitigates concerns about measurement error due to imperfect memory and as we were constrained by the time window between the main survey and the follow-up. One caveat is that our measure includes categories that are quite lumpy, such as clothing, and therefore may vary greatly across individuals at the weekly frequency, which could lead to noisier estimates.

would provide the average professional forecast to respondents in the treatment group, while giving no information to individuals in a pure control group. We believe that our design provides important advantages for studying the causal effect of recession expectations on personal economic expectations and behavior.

The variation in recession expectations in the 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 recession expectations 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 recession expectations among individuals with more realistic priors, and therefore identifies average causal effects of recession expectations 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 or priming respondents on recessions and professional forecasts. 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.⁹

There are two disadvantages of not having a pure control group. First, a pure control group would allow us to assess whether the questions and procedures of the experiment per se induce a change in subjects' beliefs about a potential upcoming recession. While this would give an indication of the external validity of our findings, we note that such changes in expectations should be common across treatment arms and do not threaten the internal validity of our results. Second, a pure control group would provide us with a potentially more meaningful benchmark to interpret the magnitudes of the experimentally estimated causal effects of subjects' recession expectations on their macroeconomic and

⁹ Moreover, since in the alternative design the treatment intensity is correlated with the level of the prior belief, heterogeneous effects across groups would conflate differences in priors and differential extrapolation from macroeconomic to personal expectations.

personal expectations as well as their behavior.

Under which conditions will our experimental design generate variation in respondents' recession expectations? As further discussed in online Appendix D.2 we require i) that respondents do not fully “de-bias” the signals and thereby perfectly learn about the average professional forecast and ii) that respondents believe that the professional forecasts provide a relevant signal about the future state of the economy that is not yet fully incorporated into their information sets.

2.5 Data

Representativeness Table A2 in the online Appendix provides summary statistics for our sample. Around 80 percent of our respondents indicate that they are the main earner in their household. Moreover, Table A3 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. Our sample matches 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. One caveat is that our sample has higher labor earnings and is more educated than the US population in full-time employment, similar to the New York Fed Survey of Consumer Expectations. We address this issue by conducting heterogeneity analyses according to education and by demonstrating the robustness of our results to re-weighting (Section 5).

Definition of variables 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.¹⁰ Moreover, we create an index of people's planned change in non-durable

¹⁰ We elicit probabilities over eight closed bins between -12 percent and 12 percent and two open bins to which we assign -14 percent and 14 percent.

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.¹¹ The questions on expected firm profits, the expected financial situation of the household and 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 A5). 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 no differential attrition in our main survey across treatment arms, and participation in 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 A6). 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

¹¹ 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.

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 that was launched as a predecessor to 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). Although 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).

3 Updating of recession expectations

3.1 Prior beliefs

Stylized facts Respondents in our sample have a much more pessimistic macroeconomic outlook than experts (Figures 1 and A.4 and Table A4). The median professional forecaster in the second quarter of 2017 reports a likelihood of a recession in the fourth quarter of 2017 of just 15 percent. By contrast, our median respondent assigns a probability of 40 percent, as pessimistic as professional forecasters were for the last time in the second quarter of 2009. 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 robustness experiment 1 (described in more detail in Table A1), which was conducted with an online convenience sample from the online labor market Amazon Mechanical Turk (MTurk), which is widely used in experimental economics research (Cavallo et al., 2017; D’Acunto, 2018; Kuziemko et al., 2015; Roth et al., 2019). We discuss the advantages and disadvantages of MTurk samples in appendix

Section C.1. 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.8). The distribution of recession expectations in the MTurk sample is remarkably robust to incentivizing the consumers' forecast using a quadratic scoring rule (see A.9).¹² 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., 2018).¹³

Correlates of recession expectations Neither education nor age are related to people's recession expectations, but females have a significantly more pessimistic macroeconomic outlook than men (Table A7). Interestingly, Democrats are much more pessimistic compared to Independents, while Republicans are much more optimistic, consistent with evidence on partisan bias in economic expectations (Mian et al., 2018). People who have been personally unemployed in the past are significantly more pessimistic about aggregate economic conditions, in line with Kuchler and Zafar (2018), 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.

3.2 Updating of recession expectations

Do our respondents update their recession expectations upon receiving the professional forecasts? Figure 1 shows our first main result:

¹² Respondents in the incentive condition are told that they can earn up to \$1 depending on the accuracy of their forecast.

¹³ In section E.1 in the online Appendix we confirm the external validity of these findings using data from the New York Fed's Survey of Consumer Expectations.

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 not fully informed about the forecasts and that the forecasts are relevant to the respondents' economic outlook.*

Figure A.5 displays scatter plots of prior and posterior beliefs. Observations along the 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 A24). The remaining respondents either “over-extrapolate” from the signal or update in the opposite direction. However, part of these observed changes in beliefs could be caused by typos or by respondents changing their beliefs because taking a survey on macroeconomic topics makes them think more carefully about the question. Finally, the cross-sectional disagreement in posterior beliefs as measured through the interquartile range and standard deviation declines within both treatment arms compared to prior beliefs (Table A4).

Magnitudes We quantify the degree of updating of recession expectations by estimating a Bayesian learning rule that we derive in online Appendix D.1. We define updating_i as the difference in people's posterior and prior expectations, and the “shock” as the difference between the professional forecast and the prior belief, i.e. $(35 - \text{prior}_i)$ for people in the “high recession treatment” and $(5 - \text{prior}_i)$ for people in the “low recession treatment”. We assume that people's prior beliefs about the probability of a recession follow a beta distribution and that the loss function is quadratic. Under these assumptions, people should follow a linear learning rule, $\text{updating}_i = \alpha_1 \text{shock}_i$, where α_1 lies in the interval $[0, 1]$ and depends negatively on the strength of the respondent's prior belief.

The individual-level shock depends on the respondent's prior, which introduces two

problems: First, the prior is measured with error, thereby leading to attenuation bias in the estimated learning rate α_1 . Second, self-reported expectations could differ between the prior and the posterior for reasons that are unrelated to the treatment but potentially correlated with the prior. Most importantly, people who hold higher priors and are subject to a more negative shock, should mechanically display more negative changes in their expectations since the probability of a recession is bounded to be in the interval $[0, 100]$, leading to an upward bias in the estimate of α_1 . Controlling linearly for people’s prior belief removes attenuation bias and mechanical correlations between people’s updating and the shock, while not changing the interpretation of the estimated coefficient α_1 as the learning rate. 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.¹⁴ Specifically, we estimate the following equation using OLS:

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

where ε_i is an idiosyncratic error. We report robust standard errors throughout the paper.

We estimate a highly significant learning rate equal to about one third of the shock to individual beliefs (Table 1). Our estimated learning rate from professional forecasts is in the range of estimates in related literature (Armantier et al., 2016; Coibion et al., 2018a; Fuster et al., 2018). Thus, our information treatment generates a difference of about 10 percentage points in people’s average posterior beliefs across treatment arms. The size and significance of the estimated learning rate implies that the respondents found that the forecasts contain some relevant information that was not already incorporated into their priors. Online Appendix D.2 provides a more detailed discussion of the estimated learning rate in the context of different corner cases and estimates in related literature.

¹⁴ 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.

Are changes in expectations 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 (Table 1 column 2). 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.¹⁵ In robustness experiment 3 described later we also find support of two more predictions of Bayesian updating: i) receiving a forecast makes respondents more confident in their beliefs; ii) changes in confidence are positively related to the individual-level learning rate (Table A19).

Heterogeneous updating across demographic groups Individuals with lower education update more strongly from the forecasts, while there are no significant differences according to income, gender, industry, personal unemployment experiences, the unemployment rate in the county of residence and financial literacy (Table A10). Heterogeneity

¹⁵ 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 $\text{shock} < 0$, and zero otherwise. There is no asymmetric updating from relatively positive and relatively negative signals. Similarly, the weight put on the prior does not differ systematically between the two treatment arms ($p=0.443$), indicating that our respondents do not differentially weigh signals that are more or less positive in absolute terms. Finally, we find no significant differences in learning rates according to the prior. Results are available upon request.

in learning rates could stem from differences in trust towards experts, differential ex-ante informedness about the professional forecasts across groups,¹⁶ or different learning rules.

One way in which learning rules could differ across individuals is that less sophisticated individuals could find it more difficult to rationally learn from the information. As shown in Table A11, the heterogeneity in learning rates according to confidence in the prior is fully driven by individuals with a college degree, while those without a college degree weigh the new information independently of their confidence in their priors. The coefficients on the interaction terms between the shock and confidence in the prior are significantly different between the two groups ($p < 0.01$). Thus, while learning from information is consistent with Bayesian updating for more sophisticated individuals, less sophisticated individuals seem to follow simpler learning rules. Similarly, heterogeneity in learning rates by news consumption is fully driven by highly educated respondents.

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 (Table 1 column 5), in line with respondents receiving new relevant signals about the macroeconomy between the two surveys or imperfect memory (see also Figures 1 and A.6). Moreover, learning rates still differ significantly by confidence in the prior and news consumption prior to the main survey.

Implications for macroeconomic models Our results presented in this section 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 fully incorporated into our respondents' information sets before the survey and ii) that our respondents consider the information relevant for their expectations about the future. This finding suggests that there exist costs of information acquisition,

¹⁶ 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.

as in micro-founded sticky information models (Reis, 2006).¹⁷ Our experiment sets these costs to zero for a particular piece of news about aggregate economic growth.

Conditional on acquiring information, we observe heterogeneity in learning rates across groups. This is in line with the idea that our respondents perceive the piece of information with individual-specific noise, as in models of noisy information (Maćkowiak and Wiederholt, 2015; Sims, 2003). In addition, we also observe heterogeneity in learning *rules*: On the one hand, highly educated respondents put lower weight on the information when they hold stronger priors, in line with the predictions of Bayesian updating. Rational learning from new information is a key feature of both sticky and noisy information models, so these models may be able to proxy the expectation formation of more sophisticated individuals in a reasonable manner. On the other hand, less highly educated respondents' learning from the information does not seem to be well captured by Bayesian updating, highlighting a role for cognitive limitations and heterogeneity in belief formation mechanisms in macroeconomic models. These findings are consistent with recent evidence that individuals with cognitive limitations display larger biases in their expectation formation (D'Acunto et al., 2019a,b,c). Our findings are inconsistent with more traditional models of full-information rational expectations (Muth, 1961) or models with no heterogeneity.¹⁸

Finally, in line with the model and time series evidence in Carroll (2003), our findings imply that households exhibit some trust towards experts in the context of expectations

¹⁷ Our evidence on information acquisition costs in the context of expected economic growth complements findings from experimental studies of households' expectations about inflation (Armantier et al., 2016; Cavallo et al., 2017) and house prices (Armona et al., 2018; Fuster et al., 2018) or firm expectations (Coibion et al., 2018a).

¹⁸ Our findings suggest that in a setting where individuals observe one specific piece of information once, more highly-educated respondents' learning from information may be well approximated by Bayesian updating. However, in general, salience could also matter for how much weight individuals put on information. For instance, D'Acunto et al. (2018b) document that the price changes of more frequently purchased goods matter more for the formation of inflation and interest rate expectations.

about general economic conditions.

4 The causal effect of recession expectations

4.1 Empirical specification

In the previous section we 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 expectations 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 :

$$\text{exp}_i = \beta_0 + \beta_1 \text{posterior}_i + \mathbf{\Pi}^T \mathbf{X}_i + \varepsilon_i \quad (2)$$

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 (2018). 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, 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. Specifically, we use two-stage least squares and estimate the following equation:

$$\text{exp}_i = \beta_0 + \beta_1 \widehat{\text{posterior}}_i + \mathbf{\Pi}^T \mathbf{X}_i + \varepsilon_i \quad (3)$$

where

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

We have a strong and highly significant first-stage on people’s post-treatment beliefs about the likelihood of a recession based on the random assignment of the different professional forecasts (F-Stat = 75.16; see Table 2).

4.2 Do recession expectations affect personal expectations?

Consistent with the evidence on updating of recession expectations, the experimental variation successfully shifts the respondents’ expectations about aggregate unemployment. Posterior beliefs about a recession significantly affect people’s subjective 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 (0.536) percentage point increase in the perceived chance that national (county-level) unemployment will increase (Panel B of Table 2; columns 1 and 3). We find similar effects using the categorical measure which is immune to numerical anchoring (column 2). The results on national and county-level unemployment expectations are significant and of similar size in OLS and IV estimations.

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 own households’ financial prospects and to expectations about personal unemployment. The estimated effect sizes are large, but still 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 own 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, yet 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 then 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.¹⁹

4.3 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 a college degree and among males (Figure A.10), consistent with previous literature (Hoynes et al., 2012). There were similar changes in unemployment rates for individuals aged 25 to 44 and those aged 45 to 55. Moreover, the increase in unemployment during the Great Recession was concentrated among workers who were 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 extrapolation to expectations about personal economic outcomes is driven by respondents who are more strongly exposed to macroeconomic risk, we interact the

¹⁹ Figure A.18 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.

posterior belief with dummies for several dimensions of heterogeneity, het_i . Specifically, we estimate the following IV specification:²⁰

$$\text{exp}_i = \beta_0 + \beta_1 \widehat{\text{posterior}}_i + \beta_2 \widehat{\text{posterior}}_i \times \text{het}_i + \beta_3 \text{het}_i + \mathbf{\Pi}^T \mathbf{X}_i + \varepsilon_i \quad (4)$$

where

$$\widehat{\text{posterior}}_i = \hat{\gamma}_0 + \hat{\gamma}_1 \text{highrecession}_i + \hat{\gamma}_2 \text{highrecession}_i \times \text{het}_i + \hat{\gamma}_3 \text{het}_i + \hat{\Theta}^T \mathbf{X}_i$$

$$\widehat{\text{posterior}}_i \times \text{het}_i = \hat{\delta}_0 + \hat{\delta}_1 \text{highrecession}_i + \hat{\delta}_2 \text{highrecession}_i \times \text{het}_i + \hat{\delta}_3 \text{het}_i + \hat{\Xi}^T \mathbf{X}_i$$

Our third main result is as follows:

Result 3. *People extrapolate from their macroeconomic outlook to their expected chance of personal unemployment. These effects are driven by those individuals most strongly exposed to macroeconomic risk. Thus, updating of personal expectations is data-consistent in terms of size and heterogeneity, indicating that households have an understanding of their exposure to macroeconomic risk.*

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 2 and Table A12). We find qualitatively similar patterns if we instead examine heterogeneity according to the level of earnings. While these differences across groups are large in terms of magnitudes, they are statistically insignificant, potentially due to low power. We find no strong differential response across age groups or gender.

Moreover, the effects of an expected economic downturn on personal unemployment expectations are driven by individuals working in “cyclical industries”, those with previous unemployment experiences and those living in counties with higher unemployment (Figure 2 and Table A13).²¹ These differences are large in magnitude and statistically significant

²⁰ The IV specifications account for differential first stage effects of the “high recession” treatment on posterior recession expectations 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.

²¹ We classify health, education and “other industries” (mostly public administration) as

for previous unemployment experiences ($p < 0.1$) and county-level unemployment ($p < 0.1$), and insignificant for industry of employment ($p = 0.18$). The effects are driven by job loss expectations for individuals with a personal unemployment history, and by conditional job finding expectations for those living in areas with high unemployment (Table A13). This is in line with the idea that high county-level unemployment could make it more difficult to find re-employment in case of job loss, while a personal unemployment history could proxy for being “marginal”. Overall, the effects on personal unemployment expectations are driven by those with larger exposure to macroeconomic shocks.

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 2 and Table A14). The effects for these subgroups are significantly different from zero and significantly larger than the effects on individuals with lower earnings ($p < 0.05$), younger individuals ($p < 0.1$), and women ($p < 0.05$). 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.

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 A15). Hence, while more exposed groups drive the results on extrapolation from recession expectations to their personal economic outlook, they expect changes in aggregate unemployment similar to less exposed groups.

4.4 Do the effects persist over time?

Table A9 shows that most of our results on updating of expectations decrease in size, but remain economically and statistically significant in the two-week follow-up survey.

non-cyclical industries, while construction, manufacturing, services, retail and wholesale, transportation and finance are classified as cyclical industries, in line with empirical evidence (Guvenen et al., 2017; Takhtamanova and Sierminska, 2016).

The table shows reduced-form estimates obtained from regressing the different outcome variables on an indicator for the “high recession”-treatment and controls.²² 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 percent (personal unemployment expectations) smaller than in the main study.

This 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.²³ An alternative explanation for the reduced effect sizes is that survey respondents could forget about the forecasts and revert back to a default level of their expectations. 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 to true belief updating, while concerns about numerical anchoring, short-lived emotional responses to the treatment, or experimenter demand are mitigated.

²² 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 would suffer from weak instrument problems in the smaller follow-up sample, i.e. the first-stage F-stat is 6.37, below 10.

²³ If all respondents received the same perfectly informative signal between the main survey and the follow-up, they would put a weight of 100 percent on the new signal, leading to identical follow-up beliefs in the two treatment arms.

4.5 Do macroeconomic expectations affect behavior?

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 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, 2018). 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 a recession.

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. Given the well-documented inertia in household portfolios (Bilias et al., 2010; Calvet et al., 2009), the reaction of stock purchases should be small.

We estimate the same IV specification 3 as for our previous analysis, except that our independent variable is now the difference between posterior and prior beliefs about the likelihood of a recession, as our outcome variables refer to changes in individual behavior instead of levels of expectations. In addition we control for people's prior belief. Table 3 shows our fourth main result:

Result 4. *People's macroeconomic outlook causally 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. While there seem to be increases in actual consumption growth, these effects are noisily measured and statistically insignificant (column 2). This noisy measurement could arise from i) the fact that our measure includes some categories that are quite lumpy and at the weekly frequency vary a lot across individuals (such as clothing), ii) imperfect memory about actual spending and iii) the smaller sample size in the follow-up compared to the main survey. 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 (column 5). The large reaction despite inertia in household portfolios may be due to the fact that respondents in both treatment arms were extremely pessimistic before the treatment, and thus the information provision implied a shift towards a lower subjective probability of a recession that was strong enough to trigger adjustments in 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).²⁴ 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 planned 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.²⁵ Sur-

²⁴ 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. This corresponds to a 36 percent higher fraction of respondents with net purchases in the “low recession treatment” compared to the “high recession treatment”.

²⁵ Given that our variables on consumption plans and stock purchases are categorical, this is not guaranteed and depends on the fractions of people changing their behavior

vey measures 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.

4.6 Expectations and news consumption

An increase in macroeconomic risk should lead rationally (in-)attentive economic agents to allocate more of their attention to macroeconomic news (Maćkowiak and Wiederholt, 2015; Sims, 2003). However, we find no evidence that expectations about the likelihood of a recession causally affect people’s consumption of news about the general economy as measured in the follow-up survey (Table A22).²⁶

We also study whether updating of recession expectations between the main survey and the follow-up survey is affected by people’s consumption of news between the surveys. Columns (2) and (3) shows that news consumption between the two surveys is uncorrelated with people’s updating defined as the difference between the posterior belief in the follow-up and the prior belief in the main survey.

4.7 Subjective beliefs about the macroeconomy

Our design also allows us to shed light on how expectations about different macroeconomic variables are causally related. Many macroeconomic models incorporate a Phillips Curve, a negative relationship between unemployment and inflation. An implicit assumption in most models is that agents form their expectations according to the true model.

and the conditional amounts by which people adjust.

²⁶ We find no significant heterogeneity in treatment effects on respondents’ news consumption by proxies for people’s exposure to macroeconomic risk or proxies for people’s information acquisition costs. Results are available upon request.

Moreover, there was substantial disinflation during most recessions in the past (Coibion and Gorodnichenko, 2015b). Thus, a higher likelihood of a recession could lower people's inflation expectations. Columns 8 and 9 of Table 2 show our fifth main result:

Result 5. *There is no significantly negative causal effect of people's expectations about the likelihood of a recession on their inflation expectations.*

While mean expected inflation is positively correlated with people's recession expectations (Panel A column 8), this relationship is statistically insignificant in IV specification (Panel B). In the IV specification we can reject effects below -0.015 at a significance level of 10 percent. Recession expectations are positively correlated with inflation uncertainty, but again this effect vanishes in the IV specification (column 9). 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.

There are several potential explanations for why we do not find a negative effect of recession expectations on expected inflation. 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, both of which entail a negative co-movement of the output gap and inflation in standard New-Keynesian models. In our data on beliefs about likely causes of a recession, collected in the follow-up, 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 (Figure A.11).²⁷ Third, consumers may not be sufficiently sophisticated to account for complex relations between macroeconomic variables in their belief formation. Indeed, the high standard errors of our estimates suggest that there is a lot of disagreement among respondents on how a recession will affect inflation.

Finally, recession expectations causally affect our respondents' expectations regarding firm profits (column 10). 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

²⁷ We find no heterogeneous responses of inflation expectations dependent on whether respondents think that the recession will be caused by supply- or demand-side factors.

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 appendix Section E.2 we provide additional results on our respondents’ subjective beliefs about insurance within the firm.

5 Robustness

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.²⁸ We provide several 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 additional experiment on MTurk (robustness experiment 2, described in more detail in Table A1) in which a random subset of our respondents is assigned to receive a “demand treatment”, while a control group does not receive any information or signal. Neither of the two groups is shown a professional forecast. 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.” Afterwards we elicit all respondents’ recession expectations, their qualitative household financial prospects and their consumption plans. The demand treatment has very small and insignificant effects on the outcome measures (Table A21). This suggests that respondents’ self-reported expectations in a setting close to ours are not responsive to explicit signals about the experimental hypothesis.

Second, the patterns of heterogeneity in extrapolation from macroeconomic to personal expectations that we documented in Section 4.3 imply that our findings could only

²⁸ Evidence suggests that respondents in online surveys respond only very moderately to explicit signals about the experimenter’s wishes (de Quidt et al., 2018).

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 3.2 (e.g. by people’s confidence in their prior) is also only consistent with differential experimenter demand effects across these groups, which we find unlikely.

Third, within-designs may induce stronger experimenter demand effects than between-designs. In our main experiment we elicit priors only for recession expectations, while we rely on a between-design for all other outcomes. In robustness experiment 3 (described in more detail in Table A1) we also examine whether updating of recession expectations depends on whether a within-design or a between-design is employed. For this purpose we cross-randomize whether people are asked about their prior belief on top of the random assignment of the professional forecast predicting a 5 percent probability of a recession. We find no significant difference in updating of recession expectations in response to a 5 percent forecast regardless of the design employed (Table A18 Column 5). This suggests that it is unlikely that the within-design employed induces strong demand effects.

Fourth, in our initial experiment we displayed people’s prior belief using a red bar and the professional forecast using a yellow bar. In robustness experiment 3, we instead display people’s prior with a blue bar, and the professional forecast with a yellow bar, which potentially helps to avoid giving respondents the impression that their priors are the “wrong” beliefs (Bazley et al., 2018). Our estimated learning rates from professional forecasts of 5 percent and 30 percent from robustness experiment 3 are remarkably close to our estimates from the main experiment (Table A18 column 3). This suggests that our findings are robust to the exact graphical illustration of the treatment information.

Finally, in robustness experiment 3 we also modified our experimental instructions to provide an even briefer explanation of economic concepts to our respondents in the beginning of the survey. Next to the quantitative similarity in learning rates from the forecasts, the estimated causal effects of recession expectations on expectations about national unemployment and firm profits in IV estimations remain highly significant (Table A20). Taken together, despite the changes in the experimental instructions, different

colors of bars, the different survey populations and the different times, we find very similar effects of our intervention on respondents' expectations.

Numerical anchoring An additional methodological concern for our quantitative outcome measures, such as posterior beliefs about the likelihood of a recession, is unconscious numerical anchoring. We alleviate concerns about numerical anchoring in several ways. First, we follow the approach of providing irrelevant numerical anchors suggested by Coibion et al. (2018c) and Cavallo et al. (2017). In robustness experiment 3, we randomly assign our respondents to receiving (i) a professional forecast predicting a 5 percent probability of a recession, (ii) an irrelevant numerical anchor stating that “according to official statistics, 5 % of the total U.S. population in 1970 were legal immigrants”, or (iii) no information. While provision of the professional forecast strongly shifts respondents' expectations, the effect of the irrelevant numerical anchor is a precisely estimated zero and the difference in learning rates is significant at the 1 percent level (Table A18). In robustness experiment 2 we show that the provision of a different irrelevant numerical anchor does not significantly shift respondents' recession expectations, their household financial prospects or their consumption plans (Table A21).²⁹

Second, our treatment has significant and strong effects on categorical measures of expectations about national unemployment, firm profits and the household's financial situation, all of which are naturally immune to numerical anchoring. This suggests that changes in quantitative measures of expectations are not driven by numerical anchoring.

Finally, as documented in Section 4.4, 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.

External validity Our sample is representative of the full-time employed US population in terms of age, gender, region and income, but not in terms of education. In order

²⁹ We tell our respondents “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.”

to check the external validity of our findings, we use the 2015 American Community Survey to create weights that make our sample also representative in terms of education. Specifically, we create weights based on the following 64 cells: gender (2) \times aged above 42 (2) \times above median income (2) \times at least college degree (2) \times region of residence (west, south, northeast, midwest) (4). Reweighting has no appreciable effects on our main findings (Table A23). In our main analysis we therefore focus on unweighted results, which should be less sensitive to outliers.

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 heterogeneity in line with proxies for actual exposure to risk. Finally, we provide evidence that people's expectations about the macroeconomy causally affect their consumption plans and stock purchases.

Overall, our findings are consistent with macroeconomic models of imperfect information (Maćkowiak and Wiederholt, 2015; Reis, 2006; Sims, 2003; Woodford, 2003): first, we find that consumers are initially uninformed about relevant signals about the macroeconomy. Second, respondents update their economic expectations in response to news about the macroeconomic environment in line with the predictions of Bayesian updating, although this is not the case for individuals with lower education. Third, updating of personal expectations is data-consistent in terms of size and heterogeneity, indicating that our respondents have an understanding of their own exposure to macroeconomic risk. 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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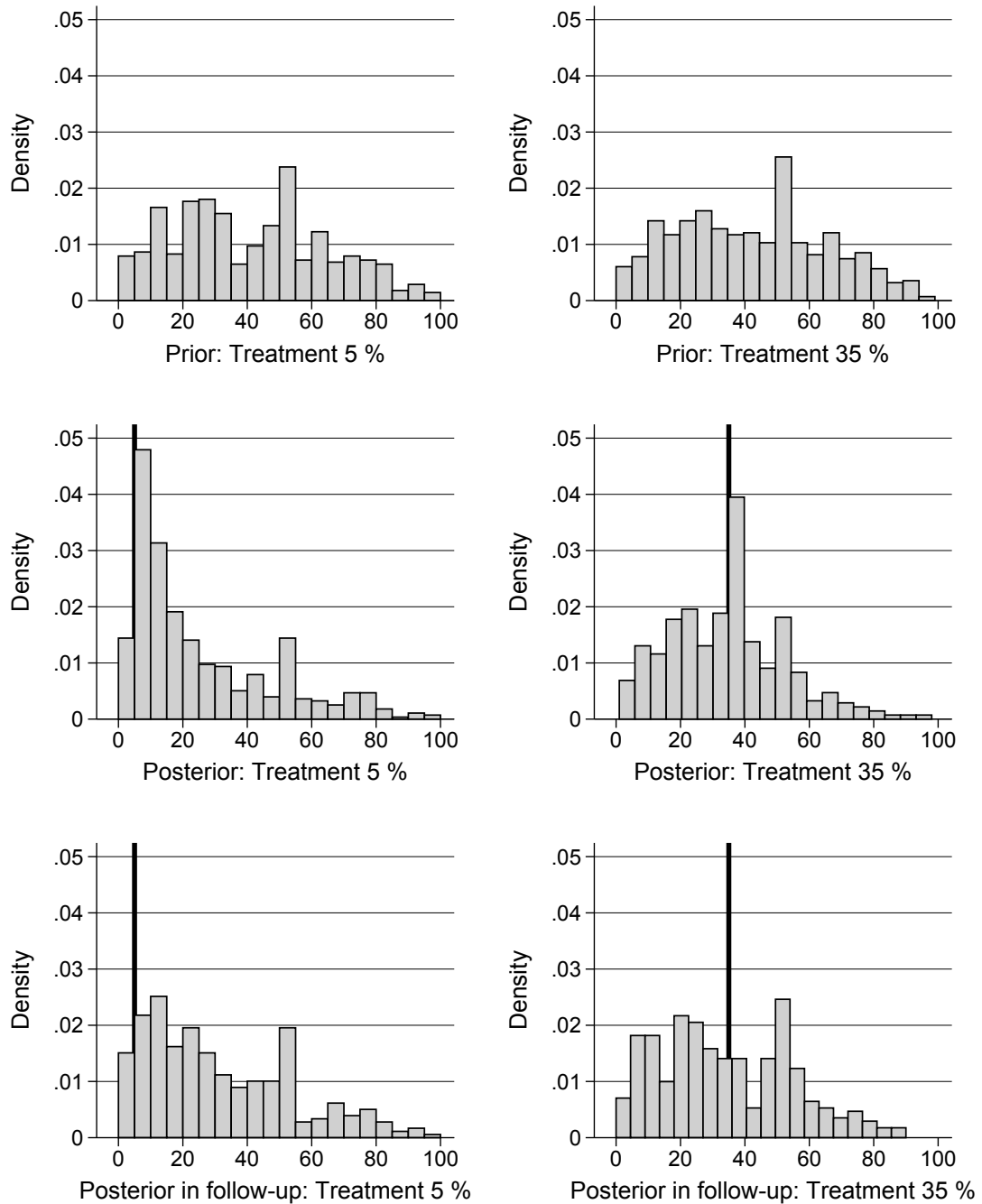
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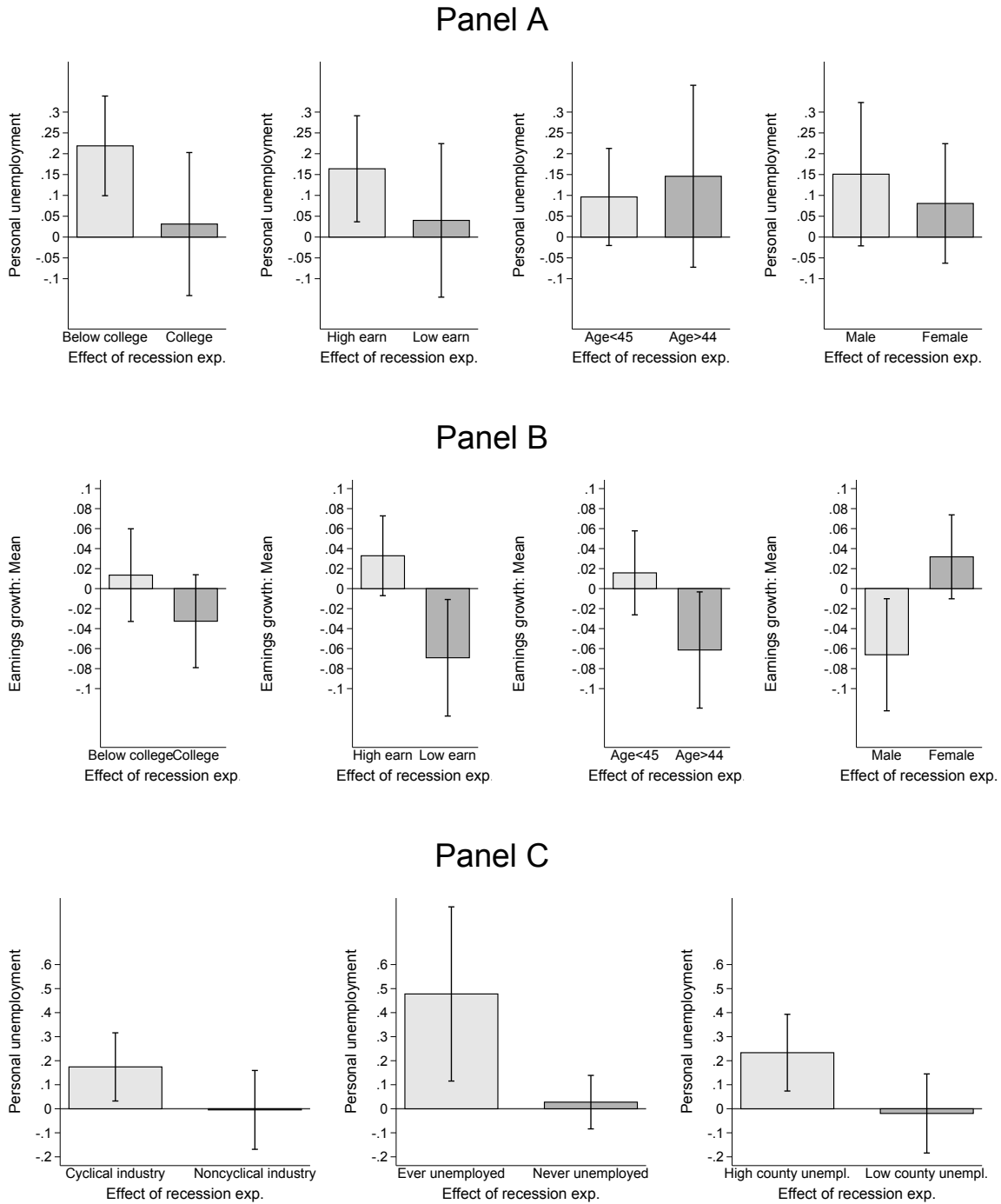
Main Figures and Tables

Figure 1: 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 2: Heterogeneity in extrapolation to personal expectations



Notes: This figure displays IV estimates of the effect of posterior beliefs about the likelihood of a recession on people’s (i) subjective chance of being unemployed (Panel A) and (ii) expected mean earnings growth conditional on working at the same job (Panel B) for different demographic groups, including 90-percent confidence bands. Individuals with above median earnings (\$54,800) are classified as having high earnings. Panel C 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. Health, education and public administration are classified as non-cyclical industries, while construction, manufacturing, services, retail and wholesale, transportation and finance are classified as cyclical industries. “High county unemployment” indicates living in a county with an above median unemployment rate (4.5 percent). The estimates are based on IV estimations, where the posterior likelihood of a recession is interacted with the dimension of heterogeneity of interest. These results are also shown in Table A12 in the online Appendix.

Table 1: Main results: Learning rates

	Updating (Main Survey)				Updating (Follow-up)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Shock	0.318*** (0.034)	0.417*** (0.047)	0.436*** (0.076)	0.358*** (0.041)	0.128** (0.050)	0.263*** (0.073)	0.371*** (0.117)
Shock \times Confident		-0.187*** (0.068)				-0.273*** (0.101)	
Confident		0.752 (2.258)				0.453 (3.658)	
Shock \times Follow news			-0.150* (0.085)				-0.293** (0.130)
Follow news			1.798 (2.740)				2.176 (4.178)
Prior	-0.247*** (0.038)	-0.242*** (0.057)	-0.198** (0.081)	-0.205*** (0.048)	-0.640*** (0.059)	-0.549*** (0.093)	-0.450*** (0.125)
Observations	1124	1124	1124	736	736	736	736
Sample	Baseline	Baseline	Baseline	Basel. (compl. follow-up)	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. Specifications 2, 3, 6 and 7 also control for interactions of the prior with the dimension of heterogeneity. 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 5-7 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: Macroeconomic and personal economic expectations

	National unemployment (percent)	National unemployment (categorical)	County unemployment (percent)	Household financial prospects	Earnings growth: Mean	Earnings growth: Uncertainty	Personal unemployment (percent)	Inflation: mean	Inflation: Uncertainty	Firm profits (categorical)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A: OLS										
Posterior: Recession	0.528*** (0.033)	0.014*** (0.001)	0.508*** (0.035)	-0.011*** (0.002)	-0.010** (0.005)	0.010*** (0.004)	0.112*** (0.018)	0.013*** (0.004)	0.013*** (0.004)	-0.009*** (0.002)
Panel B: IV										
Posterior: Recession	0.895*** (0.131)	0.030*** (0.006)	0.536*** (0.118)	-0.012** (0.006)	-0.013 (0.020)	0.002 (0.013)	0.113* (0.066)	0.014 (0.018)	0.006 (0.015)	-0.013** (0.005)
Observations	1124	1124	1124	1124	1118	1118	1123	1121	1121	1124
Mean dep. var.	32.09	0.01	29.55	-0.01	2.64	1.79	6.61	2.60	2.74	-0.01
SD dep. var.	24.18	1.00	23.20	1.00	3.42	2.41	11.47	3.05	2.71	1.00
First stage F-stat	75.16	75.16	75.16	75.16	74.56	74.56	75.25	75.71	75.71	75.16

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, 4 and 10 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: 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** (0.006)	-0.007 (0.005)	-0.006 (0.006)	-0.001 (0.002)	-0.014** (0.007)	-0.005** (0.002)	0.001 (0.001)
Prior	-0.013*** (0.004)	-0.003 (0.003)	-0.012*** (0.004)	0.000 (0.001)	-0.003 (0.004)	-0.001 (0.001)	0.001 (0.001)
Observations	1124	706	1124	732	732	732	732
Mean dep. var.	-0.01	-0.02	-0.00	0.13	-0.01	0.13	0.02
SD dep. var.	1.00	0.73	1.00	0.34	0.99	0.34	0.13
First stage F-stat	85.76	79.20	85.76	73.45	73.45	73.45	73.45

Notes: The table shows IV estimates 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. The outcomes in columns 1, 2, 3 and 5 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.

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

Christopher Roth¹ Johannes Wohlfart²

Summary of the online appendix

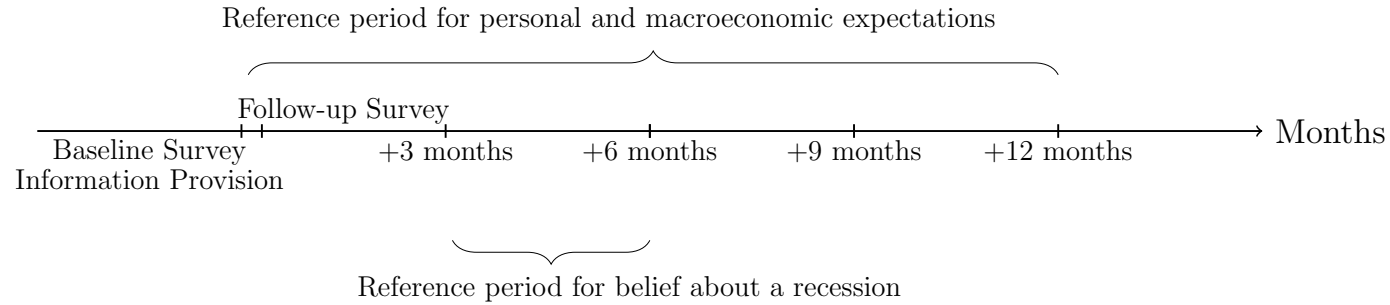
Section A provides additional figures. Section B provides additional tables. In section B.1 we provide summary statistics, balance checks and descriptive evidence. Section B.2 provides evidence on heterogeneous treatment effects. Section B.3 provides evidence on the robustness of our findings, e.g. to numerical anchoring, experimenter demand effects and the use of population weights to match the general population in terms of income, education, region, age, and gender. Section B.4 shows additional results on people's macroeconomic expectations and their news consumption. Section C.1 describes the MTurk sample used in our experiment and discusses advantages and disadvantages of using MTurk as a subject pool. Section C.2 describes the imputation for the heterogeneity analysis. Section D.1 derives a Bayesian learning rule under the assumption of beta distributed prior beliefs. Section D.2 provides some benchmarks for our estimated learning rate based on different assumptions on people's interpretation of the signal and their trust in professional forecasts. Section E.1 provides evidence on the external validity of our descriptive finding of pessimism among consumers relative to professional forecasters using the New York Fed's Survey of Consumer Expectations. Section E.2 provides additional descriptive evidence on people's beliefs about insurance within the firm.

¹ Christopher Roth, Institute on Behavior and Inequality (briq), Bonn,
e-mail: chris.roth@briq-institute.org

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

A Additional figures

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



2

Figure A.2: Timeline of the experiment: Reference periods for behavioral outcomes

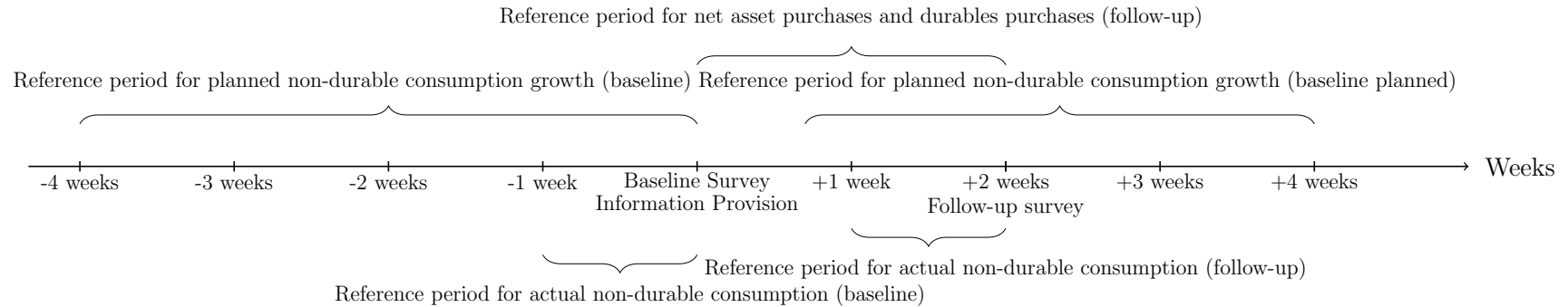
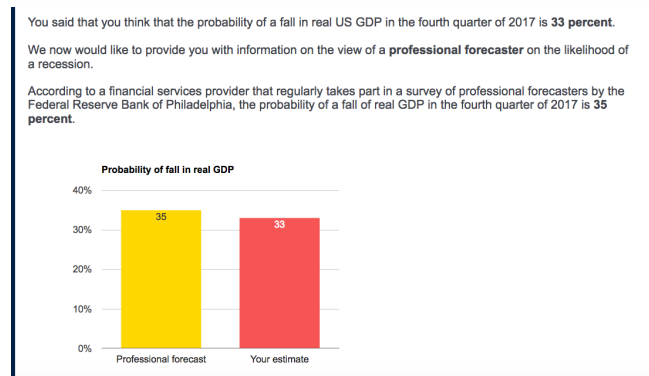
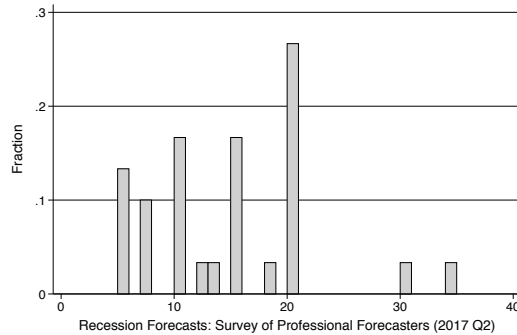


Figure A.3: Information treatment: High recession group



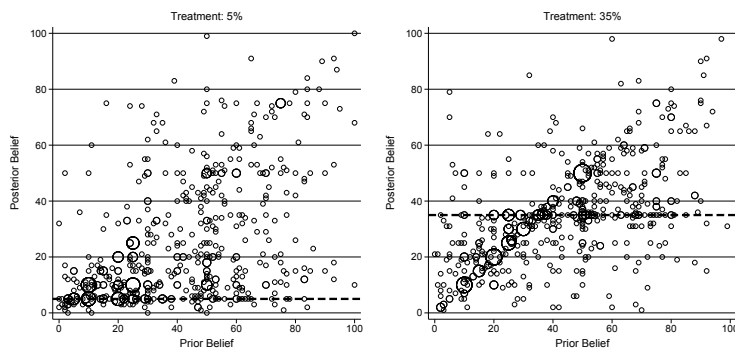
Notes: Treatment screen for people in the “high recession treatment”. In this example screen the prior belief about the likelihood of a recession was 33 percent.

Figure A.4: Distribution of predictions from the Survey of Professional Forecasters



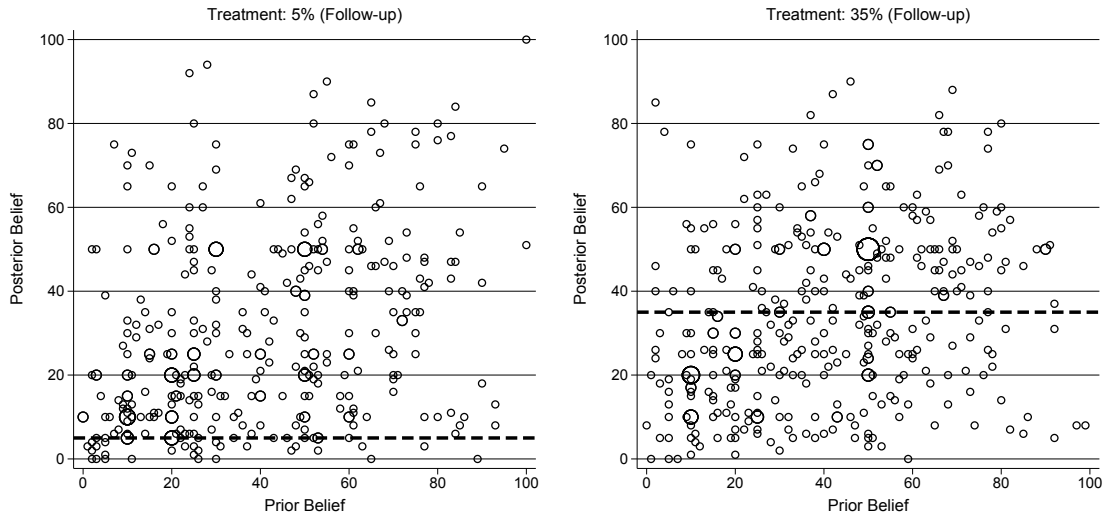
Notes: This figure displays predictions on the likelihood of a fall in US real GDP in the fourth quarter of 2017 compared to the preceding quarter among professional forecasters in the SPF. Source: Survey of Professional Forecasters, wave 2017Q2.

Figure A.5: Scatter plots of prior and posterior



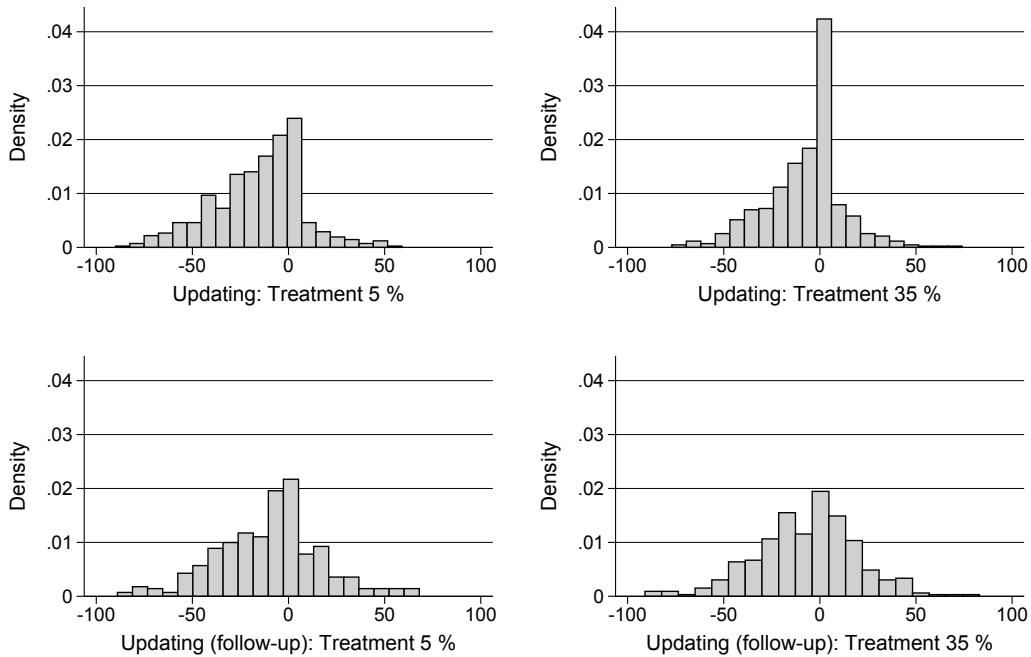
Notes: This figure displays scatter plots of prior and posterior beliefs in the two treatment arms. The size of the circles corresponds to the mass of data points for any combination of priors and posteriors. The dashed horizontal lines correspond to the signal provided to the respondents in the “high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

Figure A.6: Scatter plots of prior and posterior (from follow-up)



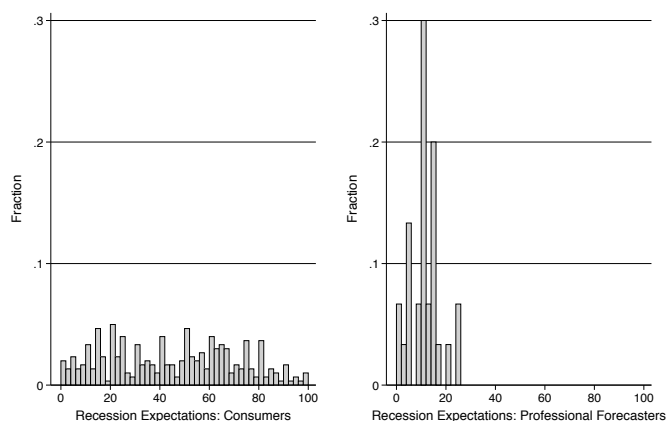
Notes: This figure displays scatter plots of prior and posterior beliefs in the two treatment arms in the two-week follow-up survey. The size of the circles corresponds to the mass of data points for any combination of prior and posterior. The dashed horizontal lines correspond to the signal provided to the respondents in the “high recession” and “low recession” treatments respectively.

Figure A.7: Updating of recession beliefs across treatment arms



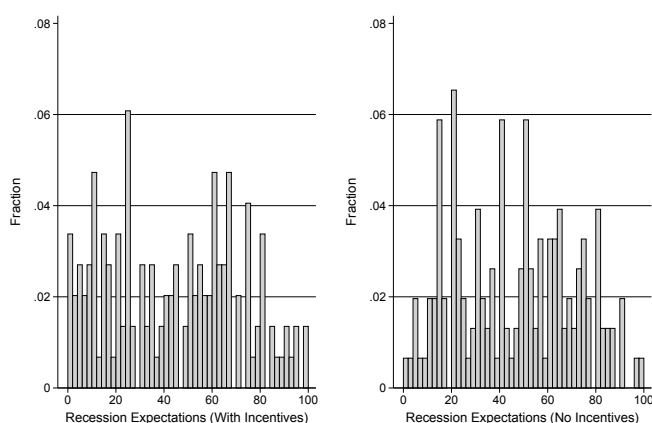
Notes: This figure displays the distribution of belief updating in the two treatment arms using posteriors from both the baseline survey and the follow-up survey.

Figure A.8: Distribution of predictions from the Survey of Professional Forecasters from 2018 Q2 compared to predictions from online convenience sample (robustness experiment 1)



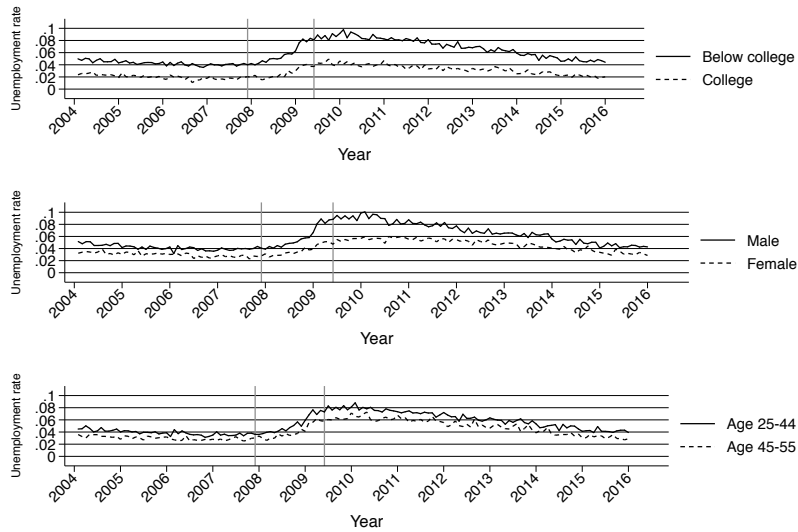
Notes: The left panel shows the distribution of predictions about the likelihood of a fall in US real GDP in the fourth quarter of 2018 compared to the preceding quarter among 300 MTurk participants collected in the summer of 2018 in robustness experiment 1. The right panel displays predictions on the 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.9: Distribution of recession expectations: incentivized vs. unincentivized (robustness experiment 1)



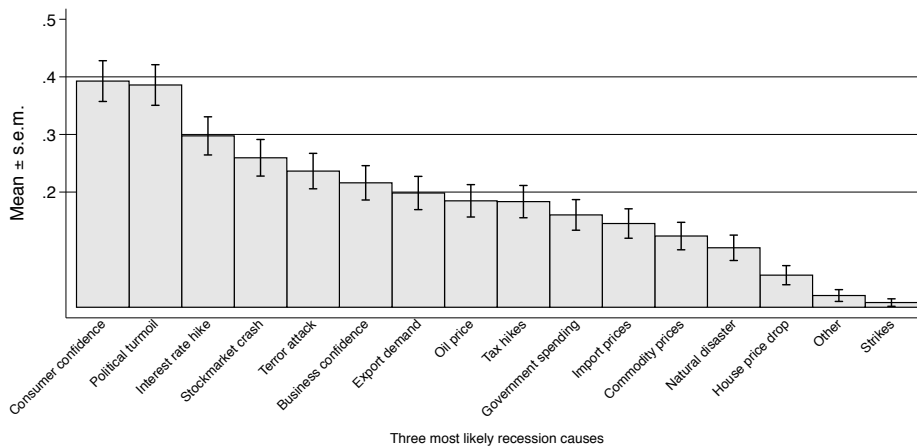
Notes: The figures show the distribution of predictions about the likelihood of a fall in US real GDP in the fourth quarter of 2018 compared to the preceding quarter among 300 MTurk participants collected in the summer of 2018. The predictions shown in the left figure were incentivized using a quadratic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

Figure A.10: Unemployment rates across subgroups over time



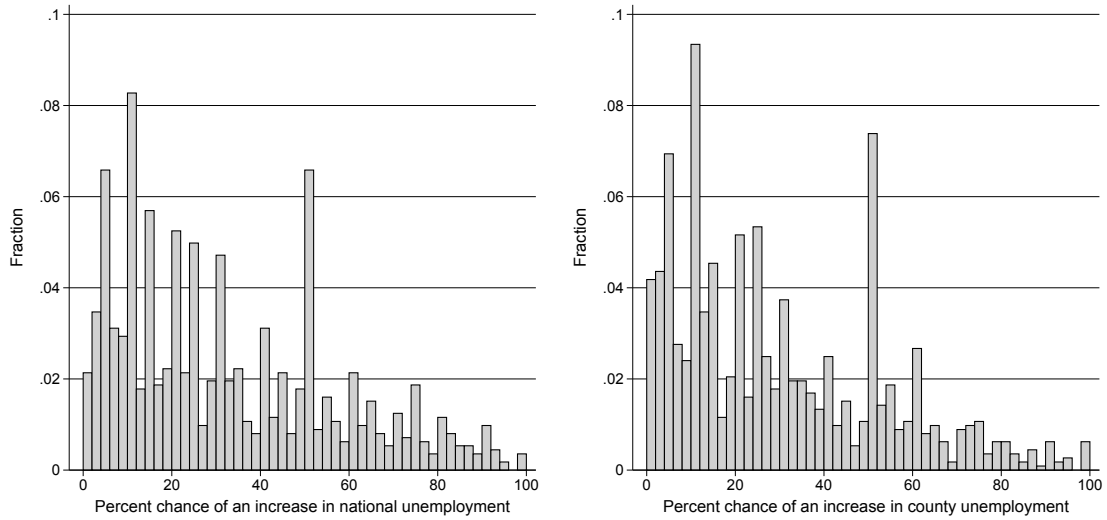
Notes: This figure displays the evolution of unemployment rates among (i) individuals with a college degree and without a college degree aged 25-55 during the Great Recession; (ii) individuals aged 25-44 and individuals aged 45-55 during the Great Recession (iii) men and women aged 25-55 during the Great 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.11: Beliefs about the likely causes of a recession



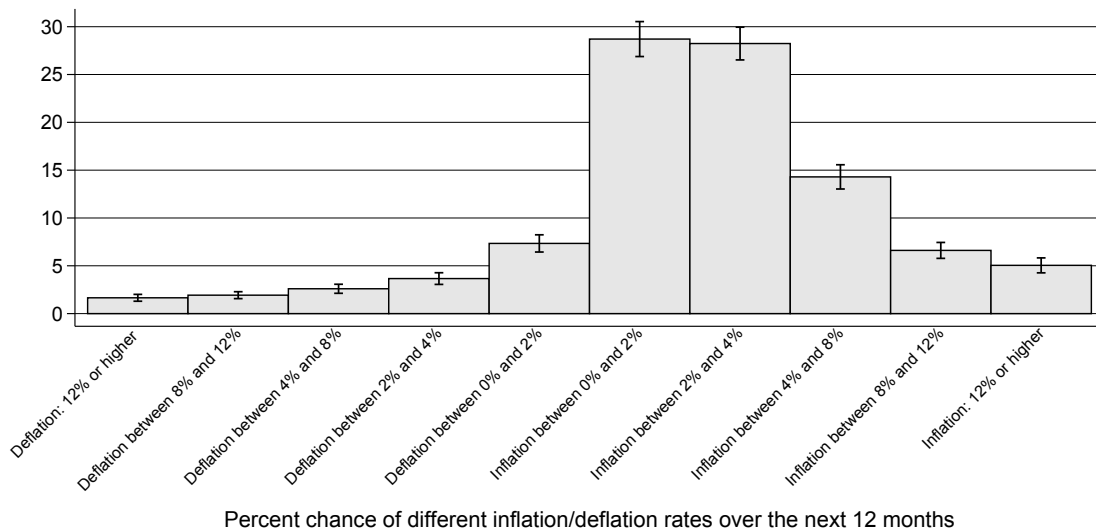
Notes: This figure displays the beliefs about the likely causes of a recession, ranked from most often mentioned to least often mentioned.

Figure A.12: Distribution of unemployment expectations



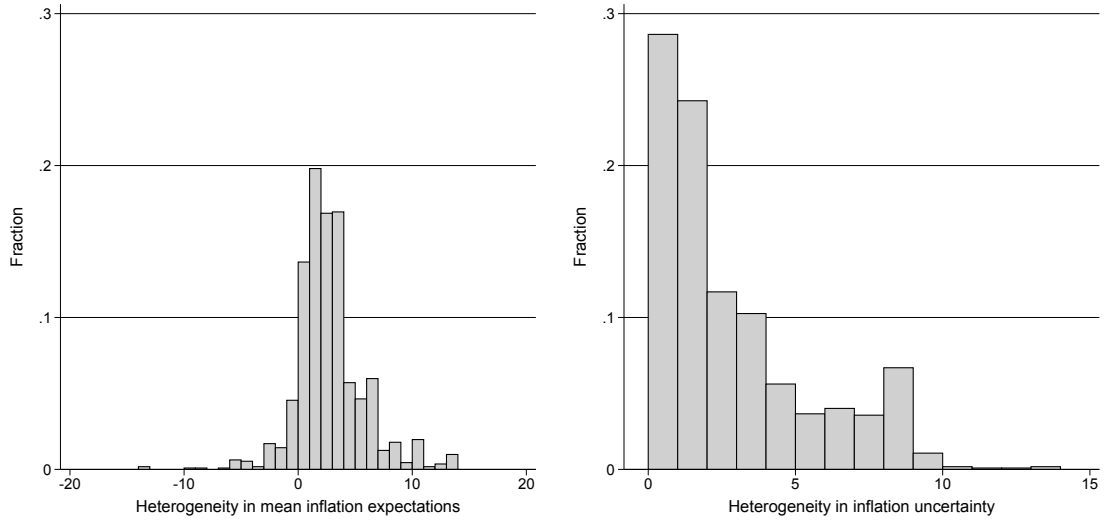
Notes: This figure displays the distribution of expectations about the likelihood of an increase in national unemployment (left panel) and county unemployment (right panel).

Figure A.13: Distribution of inflation expectations



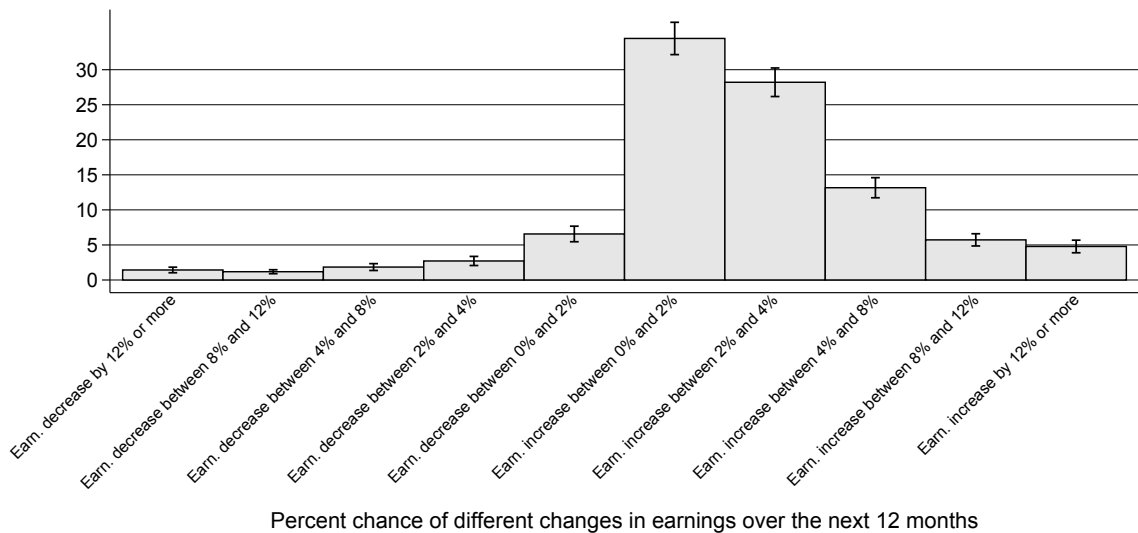
Notes: This figure displays the average probabilities assigned to different ranges of inflation and deflation rates in the main survey.

Figure A.14: Mean expected inflation and inflation uncertainty



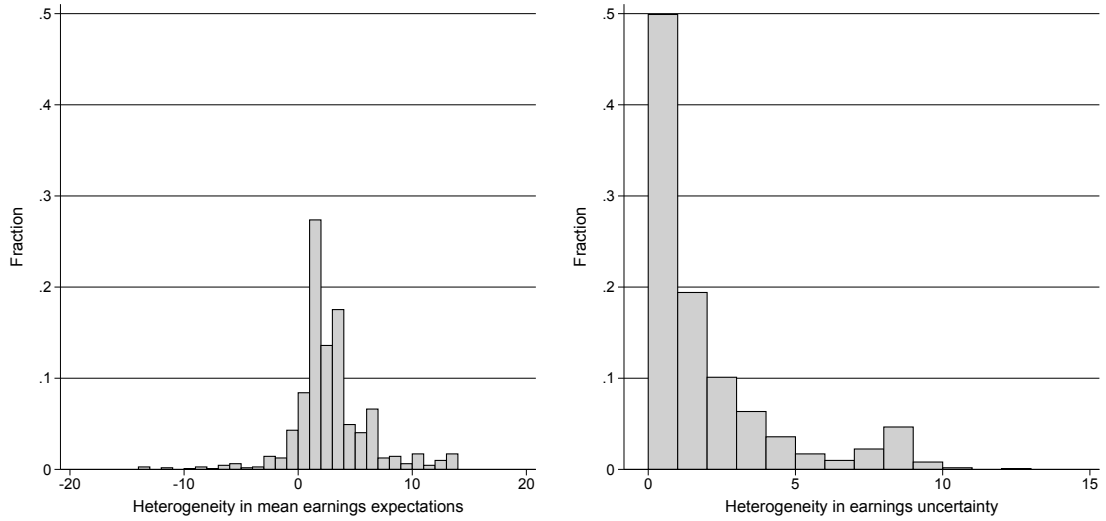
Notes: This figure displays the distributions of means (left panel) and standard deviations (right panel) of individual subjective probability distributions over future inflation in the main survey.

Figure A.15: Distribution of earnings expectations



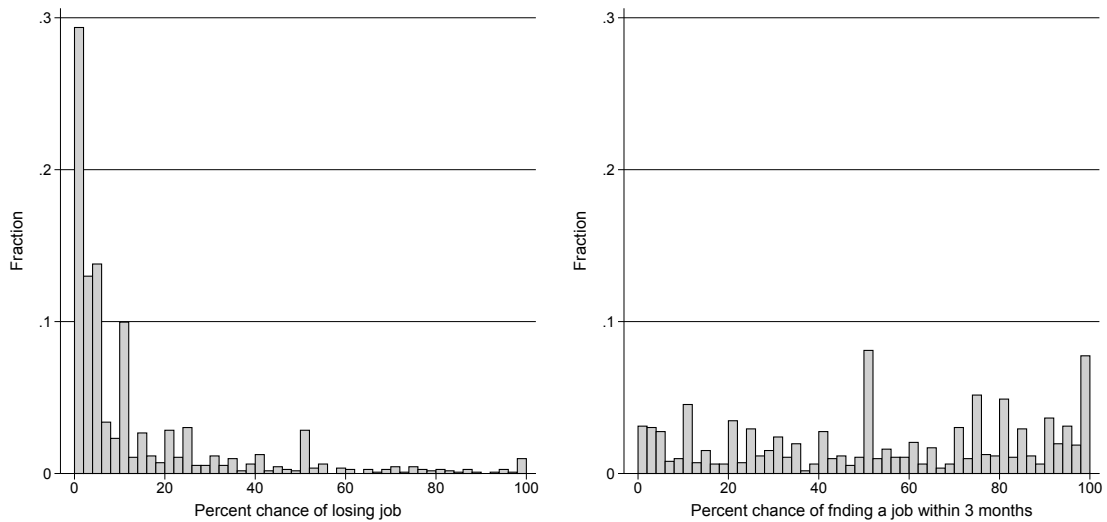
Notes: This figure displays the average probabilities assigned to different ranges of earnings growth in the main survey.

Figure A.16: Mean expected earnings growth and earnings uncertainty



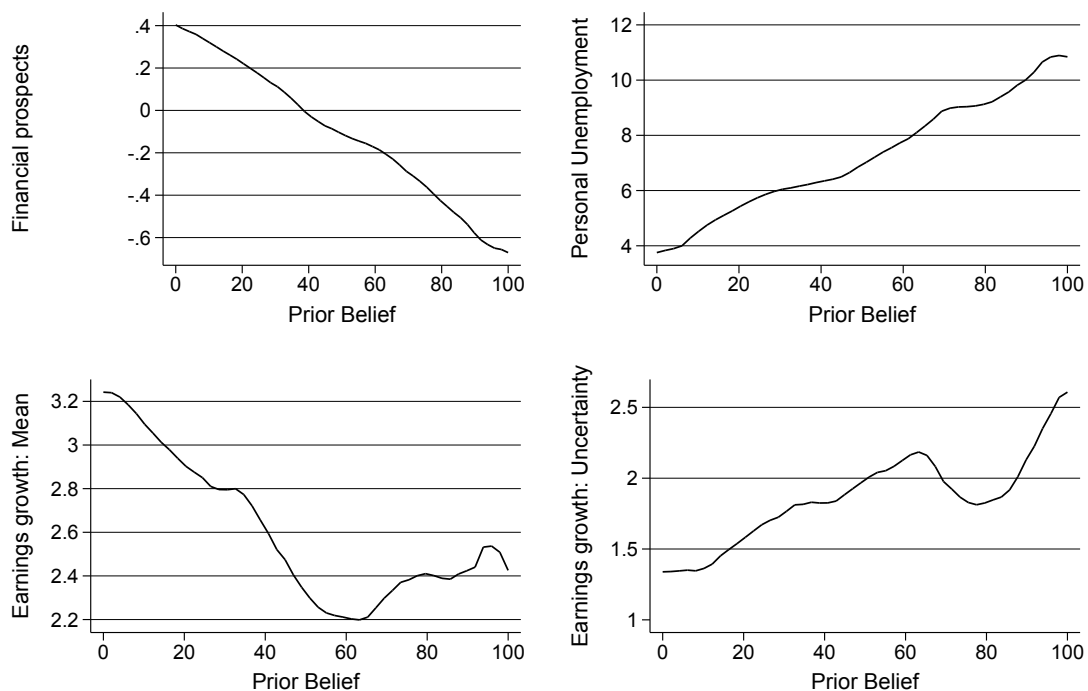
Notes: This figure displays the distributions of means (left panel) and standard deviations (right panel) of individual subjective probability distributions over future earnings growth in the main survey.

Figure A.17: 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.18: 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.

B Additional tables

Table A1: Overview of Experiments

Experiment	Sample	Treatments Arms
Main Experiment (June and July 2017)	Research Now (N=1,124)	5 percent forecast (T5), 35 percent forecast (T35)
Main Experiment: Follow-up (June and July 2017)	Research Now (N=737)	No additional treatment administration
Robustness Experiment 1 (July 2018)	MTurk (N=300)	Incentivized vs. unincentivized elicitation of beliefs about the likelihood of a recession
Robustness Experiment 2 (September 2018)	MTurk (N=301)	Irrelevant numerical anchor and “demand treatment” and pure control
Robustness Experiment 3 (January 2019)	MTurk (N=710)	5 percent forecast (T5), 30 percent forecast (T30), Average of all forecasts (T15), 5 percent forecast (T5 no prior), Only prior but no forecast, No prior and no forecast (Pure control), irrelevant numerical anchor

Notes: This table provides an overview of the different experiments conducted.

B.1 Summary statistics, balance, and descriptives

Table A2: 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
Family 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	69932.23	52518.79	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	0.13	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	732
Employer's firing depends on aggregate economy	3.80	1.53	4.00	1.00	7.00	732
Employer's profits depend on aggregate economy	4.47	1.52	5.00	1.00	7.00	732
Ever involuntarily unemployed	0.22	0.42	0.00	0.00	1.00	731
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)	6.63	70.45	0.00	-200.00	200.00	733
Bought durable goods	0.13	0.34	0.00	0.00	1.00	732
Increased stockholdings	0.13	0.34	0.00	0.00	1.00	732
Decreased stockholdings	0.02	0.13	0.00	0.00	1.00	732

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

Table A3: 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 A4: 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 respondents 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 A5: 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 A6: 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 A7: 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 (1.549)	-0.522 (1.613)
Female	10.319*** (1.379)	7.034*** (1.494)
Age	-0.349*** (0.055)	0.021 (0.349)
Age squared	-0.004*** (0.001)	-0.002 (0.004)
Log income	-1.372** (0.537)	-0.403 (1.152)
Republican	-12.317*** (1.416)	-7.028*** (1.774)
Democrat	12.155*** (1.394)	6.437*** (1.768)
Financial literacy	-9.909*** (2.242)	-2.404 (2.400)
County unemployment	0.715 (0.554)	0.345 (0.597)
Ever unemployed	2.003 (1.851)	2.980 (1.906)
Confidence in prior	-0.451 (0.752)	0.889 (0.736)
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 A8: Belief updating

	“Wrong sign”	None	Partial	Full	“Over-extrapolation”	Total
	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	
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 A9: 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*** (1.169)	9.128*** (1.390)	5.467*** (1.344)	-0.133** (0.056)	-0.127** (0.058)	1.150* (0.685)
Observations	1124	1124	1124	1124	1124	1123
Panel B: Main follow-up sample						
Recession: High	10.861*** (1.429)	9.843*** (1.670)	6.670*** (1.661)	-0.202*** (0.069)	-0.116 (0.071)	1.465* (0.883)
Observations	737	737	737	737	737	736
Panel C: Follow-up						
Recession: High	3.992*** (1.540)	5.109*** (1.835)	2.699 (1.723)	-0.197*** (0.069)	-0.062 (0.071)	0.948 (1.036)
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 in 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.

B.2 Heterogeneity

Table A10: Learning rates: Heterogeneity across groups

	Updating							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Shock (a)	0.431*** (0.064)	0.344*** (0.049)	0.347*** (0.046)	0.278*** (0.045)	0.318*** (0.044)	0.359*** (0.081)	0.286*** (0.050)	0.275*** (0.098)
Shock \times (b) High education	-0.153** (0.075)							
Shock \times (b) High earnings		-0.053 (0.068)						
Shock \times (b) Age>44			-0.070 (0.068)					
Shock \times (b) Female				0.091 (0.069)				
Shock \times (b) Non-cyclical industry					0.016 (0.072)			
Shock \times (b) Never unemployed						-0.048 (0.089)		
Shock \times (b) Low county unemployment							0.050 (0.070)	
Shock \times (b) High financial literacy								0.058 (0.119)
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, a dummy for Republicans and a dummy for Democrats as well as interactions of the prior with the dimension of heterogeneity and dummies for the dimension of heterogeneity. 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 A11: Learning rules: Heterogeneity by education

	Updating (high educ)			Updating (low educ)		
	(1)	(2)	(3)	(4)	(5)	(6)
Shock	0.276*** (0.040)	0.419*** (0.058)	0.453*** (0.095)	0.444*** (0.063)	0.412*** (0.087)	0.387*** (0.125)
Shock × Confident		-0.265*** (0.080)			0.058 (0.132)	
Confident		0.652 (2.773)			0.425 (3.934)	
Shock × Follow news			-0.213** (0.105)			0.061 (0.146)
Follow news			0.653 (3.221)			4.715 (4.942)
Prior	-0.255*** (0.047)	-0.243*** (0.069)	-0.171* (0.095)	-0.233*** (0.067)	-0.258*** (0.096)	-0.261* (0.145)
Observations	797	797	797	327	327	327

Notes: The table shows OLS estimates of the learning rate from the professional forecasts and how it depends on the strength of the prior separately for individuals with a college degree (columns 1 to 3) and individuals without a college degree (columns 4 to 6). 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. Specifications 2, 3, 5 and 6 also control for interactions of the prior with the dimension of heterogeneity. 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 A12: Extrapolation to personal unemployment expectations: Heterogeneity across demographic groups (IV)

	Personal unemployment (percent)			
	(1)	(2)	(3)	(4)
Posterior: Recession (a)	0.219*** (0.073)	0.168** (0.078)	0.096 (0.071)	0.154 (0.105)
Posterior: Recession \times (b) High education	-0.188 (0.129)			
Posterior: Recession \times (b) High earnings		-0.132 (0.135)		
Posterior: Recession \times (b) Age>44			0.050 (0.149)	
Posterior: Recession \times (b) Female				-0.072 (0.138)
Pr(a+b)=0	0.765	0.744	0.272	0.352
Observations	1123	1123	1123	1123
First stage F-stat (a)	54.66	48.23	50.62	28.15
First stage F-stat (b)	75.12	71.87	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 based on specification 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, a dummy for Republicans and a dummy for Democrats as well as dummies for the dimension of heterogeneity. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A13: 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** (0.086)	0.213 (0.149)	-0.101 (0.216)
Posterior: Recession \times (b) Non-cyclical industry	-0.179 (0.133)	-0.343 (0.254)	-0.072 (0.403)
Pr(a+b)=0	0.962	0.523	0.610
Observations	1087	1088	1087
Panel B: Personal unemployment history			
Posterior: Recession (a)	0.478** (0.220)	0.713** (0.355)	-0.676 (0.426)
Posterior: Recession \times (b) Never unemployed	-0.450* (0.230)	-0.767** (0.377)	0.617 (0.475)
Pr(a+b)=0	0.684	0.671	0.773
Observations	1123	1124	1123
Panel C: County unemployment			
Posterior: Recession (a)	0.233** (0.097)	0.176 (0.164)	-0.510* (0.270)
Posterior: Recession \times (b) Low county unemployment	-0.253* (0.139)	-0.214 (0.239)	0.653* (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 based on specification 4 that are underlying Figure 2. 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, a dummy for Republicans and a dummy for Democrats as well as dummies for the dimension of heterogeneity. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A14: 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 (0.028)	0.031 (0.024)	0.016 (0.026)	-0.066* (0.034)
Posterior: Recession \times (b) High education	-0.046 (0.040)			
Posterior: Recession \times (b) High earnings		-0.097** (0.043)		
Posterior: Recession \times (b) Age>44			-0.077* (0.043)	
Posterior: Recession \times (b) Female				0.098** (0.043)
Pr(a+b)=0	0.249	0.060	0.082	0.214
Observations	1118	1118	1118	1118
First stage F-stat (a)	52.66	47.32	50.07	28.02
First stage F-stat (b)	74.26	71.38	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 based on specification 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, a dummy for Republicans and a dummy for Democrats as well as dummies for the dimension of heterogeneity. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A15: Effects of recession expectations on national unemployment expectations: Heterogeneity (IV)

	National unemployment (percent)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Posterior: Recession (a)	0.671*** (0.151)	0.726*** (0.155)	0.759*** (0.147)	1.043*** (0.239)	0.977*** (0.169)	1.135*** (0.340)	0.872*** (0.186)
Posterior: Recession \times (b) High education	0.395 (0.263)						
Posterior: Recession \times (b) High earnings		0.393 (0.284)					
Posterior: Recession \times (b) Age>44			0.385 (0.312)				
Posterior: Recession \times (b) Female				-0.272 (0.282)			
Posterior: Recession \times (b) Non-cyclical industry					-0.223 (0.275)		
Posterior: Recession \times (b) Never unemployed						-0.298 (0.371)	
Posterior: Recession \times (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	48.23	50.58	29.03	49.47	14.58	37.18
First stage F-stat (b)	74.95	71.75	68.18	69.22	67.85	69.25	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 based on specification 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, a dummy for Republicans and a dummy for Democrats as well as dummies for the dimension of heterogeneity. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A16: Recession expectations and mean inflation expectations: Heterogeneity

	Inflation: Mean							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Posterior (a)	0.032 (0.028)	0.026 (0.025)	0.006 (0.023)	-0.023 (0.026)	0.006 (0.023)	0.028 (0.044)	0.043 (0.027)	0.037 (0.075)
Posterior × (b) High education	-0.035 (0.035)							
Posterior × (b) High earnings		-0.027 (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						-0.018 (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	0.969	0.474	0.111	0.325	0.635	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 based on specification 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, a dummy for Republicans and a dummy for Democrats as well as dummies for the dimension of heterogeneity. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A17: Recession expectations and inflation uncertainty: Heterogeneity

	Inflation: Uncertainty							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Posterior (a)	-0.026 (0.023)	-0.023 (0.022)	-0.016 (0.021)	0.023 (0.021)	0.027 (0.019)	-0.016 (0.032)	-0.009 (0.024)	-0.086 (0.073)
Posterior × (b) High education	0.057* (0.029)							
Posterior × (b) High earnings		0.065** (0.031)						
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						0.027 (0.036)		
Posterior × (b) Low county unemployment							0.028 (0.030)	
Posterior × (b) High financial literacy								0.120 (0.083)
Pr(a+b)=0	0.134	0.062	0.095	0.690	0.821	0.541	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 based on specification 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, a dummy for Republicans and a dummy for Democrats as well as dummies for the dimension of heterogeneity. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

B.3 Robustness

Table A18: Robustness experiment 3: Learning rates

	Updating				Posterior
	(1)	(2)	(3)	(4)	(5)
Shock	0.342*** (0.064)	0.436*** (0.087)	0.229** (0.105)	0.216** (0.110)	
Shock × Confident		-0.164* (0.095)			
Shock × T15			0.218* (0.131)		
Shock × T30			0.117 (0.121)		
Shock × TAnchor				-0.257** (0.115)	
Signal 5%					-12.513*** (3.451)
Signal 5% × No prior					-0.683 (5.005)
No prior					3.631 (3.421)
Prior	-0.135*** (0.038)	-0.159** (0.067)	-0.135*** (0.038)	-0.141*** (0.047)	
Observations	499	499	499	298	402
Sample	T5,T15 T30,TA,C	T5,T15, T30,TA,C	T5,T15, T30,TA,C	T5, TA,C	T5,T5b, C,Cb

Notes: The table shows results on the updating of recession expectations from robustness experiment 3 conducted on MTurk. The sample consists of the following groups: T5 (most optimistic forecast), T15 (mean forecast), T30 (most pessimistic forecast), TA (5 perc. num. anchor), C (control), T5b (T5 without prior) and Cb (control without prior). TA is used as an additional control group in specifications 1-3. Specifications 1-4 control for dummies for the included treatment arms as well as the respondents' prior belief and confidence in the prior. All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree and dummies for the respondent's Census region of residence. "Confident" takes value one for respondents saying that they are "very sure" or "sure" about their prior estimate of the likelihood of a recession. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A19: Robustness experiment 3: Changes in confidence

	Δ Confidence				
	(1)	(2)	(3)	(4)	(5)
Any info	0.235*** (0.062)	0.408*** (0.082)			
Any info \times Confident		-0.423*** (0.122)			
Confident		0.145 (0.132)			
T5			0.193* (0.105)		
T15			0.295*** (0.101)		
T30			0.305*** (0.096)		
TAnchor			0.059 (0.083)		
log(Updating/ Shock)				0.153*** (0.056)	
Updating/ Shock					0.364*** (0.112)
Observations	501	501	501	233	287
Sample	T5,T15 T30,TA,C	T5,T15 T30,TA,C	T5,T15 T30,TA,C	T5,T15 T30	T5,T15 T30

Notes: The table shows results on changes in confidence in recession expectations in response to the provision of information from robustness experiment 3 we conducted on MTurk. The sample in specifications 1-3 consists of the following groups: T5 (most optimistic forecast), T15 (mean forecast), T30 (most pessimistic forecast), TA (5 perc. num. anchor) and C (control). Specifications 4 and 5 only use groups T5, T15 and T30. All specifications control for the respondents' prior belief, confidence in the prior, age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree and dummies for the respondent's Census region of residence. "Confident" takes value one for respondents saying that they are "very sure" or "sure" about their prior estimate of the likelihood of a recession. The outcome variable is the change in confidence standardized by mean and standard deviation of confidence in the prior. The individual-level learning rate used in specification 5 is winsorized at the top and bottom 5 percent. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A20: Robustness experiment 3: Expectations about national unemployment and firm profits

	National unemployment (percent)	Firm profits (categorical)
	(1)	(2)
Panel A: OLS		
Posterior: Recession	0.459*** (0.071)	-0.005* (0.003)
Panel B: IV		
Posterior: Recession	0.669** (0.296)	-0.027** (0.012)
Observations	303	301
Mean dep. var.	36.79	0.06
SD dep. var.	25.58	0.95
First stage F-stat	13.98	13.98

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 national unemployment and firm profits from robustness experiment 3 we conducted on MTurk. The sample consists of the following groups: T5 (most optimistic forecast), T15 (mean forecast), T30 (most pessimistic forecast). In the IV specification the posterior is instrumented with the signal (5, 15 or 30) that the respondent received. All specifications control for age, age squared, a dummy for females, log income, a dummy for respondents with at least a bachelor degree and dummies for the respondent's Census region of residence. The outcome in column 2 is 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 A21: Robustness experiment 2: Demand and anchoring treatments

	Probability of a recession (percent)	Household financial prospects	Consumption growth (planned)
	(1)	(2)	(3)
Demand Treatment	3.662 (3.460)	-0.092 (0.147)	-0.021 (0.104)
Anchoring	-0.018 (3.526)	-0.070 (0.142)	-0.135 (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 from robustness experiment 2 we conducted on MTurk. 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.

B.4 Additional results

Table A22: Additional results: News consumption

	Follow news (follow-up)	Updating recession expectations (a)	Updating recession expectations (b)
	(1)	(2)	(3)
Panel A: Effect of recession expectations (OLS)			
Posterior: Recession	0.003 (0.002)		
Panel B: Effect of recession expectations (IV)			
Posterior: Recession	0.003 (0.007)		
Observations	732		
First stage F-stat	56.30		
Panel C: Effect of news consumption (OLS)			
Follow news (follow-up)		0.521 (1.048)	-0.980 (0.886)
Observations		736	736

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 people's self-reported news consumption. Panel C shows OLS regressions of updating on people's news consumption between the main survey and the follow-up. 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 1 is z-scored using the mean and standard deviation in our sample. The outcome in column 2 is the difference between the prior and the posterior in the follow-up. The outcome in column 3 is the difference between the posterior in the main survey and the posterior in the follow-up. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Table A23: Reduced form: Weighted versus unweighted

	Posterior: Recession (percent)	National unemployment (percent)	National unemployment (categorical)	County unemployment (percent)	Firm profits (categorical)	Inflation: mean	Household financial prospects	Earnings growth: Mean	Earnings growth: Uncertainty	Personal unemployment (percent)	Consumption growth (planned)	Stocks net purchases (scale)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A: Weighted results												
High Recession	11.805*** (1.721)	10.758*** (1.814)	0.456*** (0.085)	4.856** (1.937)	-0.190** (0.081)	0.229 (0.292)	-0.135 (0.085)	-0.336 (0.355)	0.034 (0.224)	2.039** (0.878)	-0.239** (0.097)	-0.143 (0.110)
Panel B: Unweighted Results												
High Recession	10.203*** (1.169)	9.128*** (1.390)	0.308*** (0.057)	5.467*** (1.344)	-0.133** (0.056)	0.146 (0.181)	-0.127** (0.058)	-0.130 (0.203)	0.021 (0.137)	1.150* (0.685)	-0.136** (0.059)	-0.147** (0.070)
Observations	1124	1124	1124	1124	1124	1121	1124	1118	1118	1123	1124	733

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 3, 5, 7, 11 and 12 are z-scored using the mean and standard deviation in the main sample. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

C Data appendix

C.1 Amazon Mechanical Turk

Below we describe the participant pool from Amazon Mechanical Turk (MTurk), an online labor market which is increasingly used to conduct experimental research (Cavallo et al., 2017; D’Acunto, 2018; Kuziemko et al., 2015; Roth et al., 2019). Below we discuss some advantages and disadvantages of using MTurk.

Advantages

- There is by now increasing evidence suggesting that the quality of answers on MTurk is highly similar, if not better, compared to those of laboratory samples. Furthermore, Coppock (2018) provides evidence that experiments conducted on MTurk lead to similar conclusions compared to experiments conducted on nationally representative samples. He conducts 15 replication experiments and finds a very high degree of replicability of survey experiments.
- The samples recruited from MTurk are highly diverse in terms of backgrounds which is important for studying heterogeneity of treatment effects.
- MTurk allows researchers to replicate findings quite easily.

Disadvantages

- One worry about MTurk samples is related to the fact that participants are highly experienced in taking social psychology surveys and economic experiments using experimental games to measure social preferences. We believe that this concern is mitigated in our setting as not many experiments exogenously manipulating expectations about the macroeconomy have been conducted on MTurk.
- Researchers have argued that participants on MTurk may be particularly prone to experimenter demand effects (Berinsky et al., 2014). However, recent evidence suggests no differences in response to experimenter demand among respondents from MTurk compared to respondents from representative online panels (de Quidt et al., 2018).

Sample criteria We recruit participants currently living in the United States who have completed at least 500 tasks with an overall rating of more than 95 percent.

C.2 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 co-variates have high predictive power and 80 percent of the respondents in the follow-up are classified correctly by the 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.

D Updating rule and benchmarks

D.1 Bayesian learning rule

In this subsection we derive the linear learning rule estimated in section 3.2. We are interested in individuals’ beliefs about the probability of a recession, and how they are updated in response to receiving the view of a professional forecaster on this probability. Priors about a probability are usually modeled as following a beta distribution, which is bounded to lie in the interval $[0, 1]$ and is fully described by the parameters $a > 0$ and $b > 0$. We therefore assume that our respondents’ subjective probability distributions over the probability of a recession follow beta distributions:

$$\theta_i \sim \text{Beta}(a_i, b_i) \tag{5}$$

Under quadratic loss, agents should report the mean over their individual-level probability distribution when making a forecast. We therefore assume that people’s self-reported priors are the means over their subjective probability distributions:

$$\text{prior}_i = \mathbb{E}[\theta_i] = \frac{a_i}{a_i + b_i} \tag{6}$$

The larger the sum $a_i + b_i$, the more concentrated will be the distribution. $a_i + b_i$ can therefore be viewed as a measure of respondent i ’s confidence in his or her prior. We assume that the respondents treat the professional forecasts as if they were the outcome of a Bernoulli trial with n_1 “successes” and n_0 “failures”. That is, we assume that the respondents perceive that the expert has a sample of $n = n_0 + n_1$ observations available and reports the fraction of recessions in his or her sample:

$$\text{signal} = \frac{n_1}{n_0 + n_1} \tag{7}$$

Under these circumstances, the posterior will again follow a beta distribution with the parameters c and d where $c_i = a_i + n_1$ and $d_i = b_i + n_0$. The reported posterior will be the mean over this probability distribution:

$$\text{posterior}_i = \mathbb{E}[\theta_i] = \frac{a_i + n_1}{a_i + b_i + n} \quad (8)$$

Under these assumptions the observed updating rule will be the following:

$$\text{posterior}_i - \text{prior}_i = \frac{n}{a_i + b_i + n} (\text{signal} - \text{prior}_i) \quad (9)$$

This learning rule gives five key predictions: i) the learning rate will be in the interval $[0, 1]$; ii) the larger the perceived precision of the forecast (or the “sample size” that the expert is perceived to have available), n , the larger will be the weight that is put on the forecast; iii) the higher the confidence in the prior, $a_i + b_i$, the lower will be the learning rate; iv) people’s confidence in their posterior, $c_i + d_i$, must be at least as large as their confidence in the prior; and v) the individual-level learning rate will be positively related to the change in confidence, n . It should be noted that the variance can take the highest values in case $a = b$, but it is not mechanically linked to the individual-level mean.

D.2 Benchmarks for estimated learning rate

In this subsection we provide benchmarks of the estimated learning rate that we would expect under different assumptions on i) how our respondents interpret the single forecast they receive and ii) their beliefs about the information that is contained in professional forecasts relative to the information contained in their prior. It is useful to assume that respondents hold beliefs about the information contained in the *average* professional forecast, and use the provided signal to form a belief about the average forecast.

First, if people misperceive the signal as the average professional forecast despite the wording of the experimental instructions, the learning rate should only depend on their belief about the precision of the average forecast: i) if respondents believe that the average SPF forecast is the best available forecast and is not yet fully incorporated into their priors, and that there is no useful private information in their priors, they will fully update towards the signal; ii) if they believe that the average professional forecast contains no relevant information that is not already incorporated into their priors, the estimated learning rate will be zero; iii) if respondents think that there is some relevant information in the professional forecast that is not already incorporated into their priors, and that there is some relevant private information in their priors, the learning rate will be γ with $0 < \gamma < 1$.

Second, if all respondents are able to deduce the average professional forecast from the provided biased signals, there will be no identifying variation in the signal left. The estimated learning rate will then be zero regardless of how respondents would learn from the average professional forecast.

Third, if respondents treat the forecast they receive as a (potentially biased) noisy

Table A24: Benchmarks for estimated learning rate

		Interpretation of the signal		
		Misperception as average	Full learning about the average	Perception as (biased) noisy signal about the average
Belief about information in average SPF forecast	Information not yet in prior, no private info	1	0	β_1
	Information not yet in prior, private info	γ	0	β_2
	No information not yet in prior	0	0	0

Notes: This table provides benchmarks for the estimated learning rate we would expect under different corner cases regarding i) the respondents' interpretation of the forecast (columns) and ii) the respondents' belief about the information that is contained in the average SPF forecast relative to the information in their prior (rows).

signal about the average professional forecast, they will put lower weight on it relative to the case where they misperceive it as the average forecast and $0 < \beta_2 < \beta_1 < 1$ as well as $0 < \beta_2 < \gamma < 1$.

Our estimated learning rate of 0.318 therefore implies that i) not all respondents deduce the average professional forecast from the provided signal and ii) that the respondents believe that there is at least some useful information in the average professional forecast that is not yet incorporated into their priors. In robustness experiment 3 we ran on MTurk we estimate learning rates from individual professional forecasts of 5 and 30 percent of 0.229 and 0.346, and a learning rate from explicitly providing an average forecast of 15 percent of 0.447, significantly different from the learning rate from the 5 percent forecast (Table A18). This is consistent with the idea that respondents understand that an individual forecast is a more noisy signal than the average forecast.

Our estimated learning rates from professional forecasts are within the range of estimates in related literature. For instance, Armantier et al. (2016) document that households put a weight of 0.393 on the average professional forecast about inflation when revising their inflation expectations. Coibion et al. (2018a) find a larger learning rate from inflation forecasts among firms in New Zealand of 0.691. Coibion et al. (2018a) do not measure how firms' expectations respond to the provision of professional forecasts about economic growth. However, across their information treatments they find that firms hold stronger priors about GDP growth and unemployment than about inflation. In the context of households' house price expectations, Fuster et al. (2018) estimate a

learning rate from professional forecasts of 0.328 in a setting where survey respondents are allowed to choose the type of information.

E Additional evidence

E.1 Evidence from the Survey of Consumer Expectations

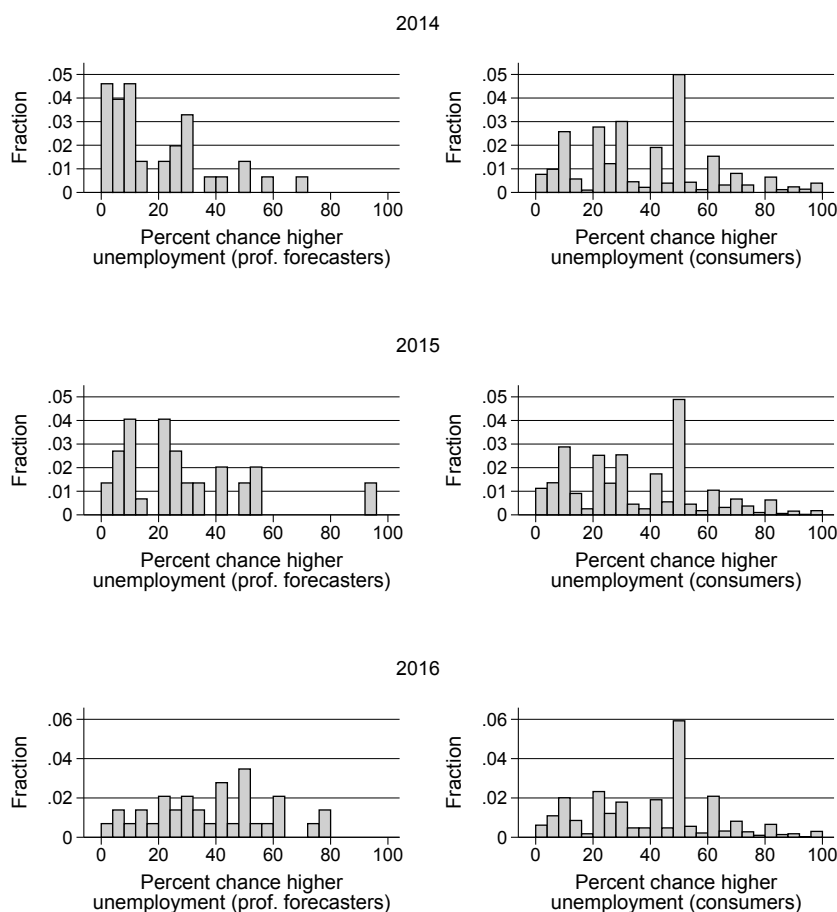
We confirm the external validity of the findings of greater pessimism and higher dispersion of beliefs among consumers than among professional forecasters using data on the probability of an increase in aggregate unemployment estimated by respondents in the Survey of Professional Forecasters (SPF) and 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.19 plots distributions of the forecasts in the SPF and the SCE in the years 2014, 2015 and 2016. Summary statistics are shown in Table A25. 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.

E.2 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 that 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. Workers believe that their employer’s firing decisions are less dependent on the state of the aggregate economy than their employer’s profits (Figure A.20). 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

Figure A.19: 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.

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. Respondents who report a lower degree of insurance through their employer extrapolate more strongly from recession expectations to personal unemployment expectations (Table A26).

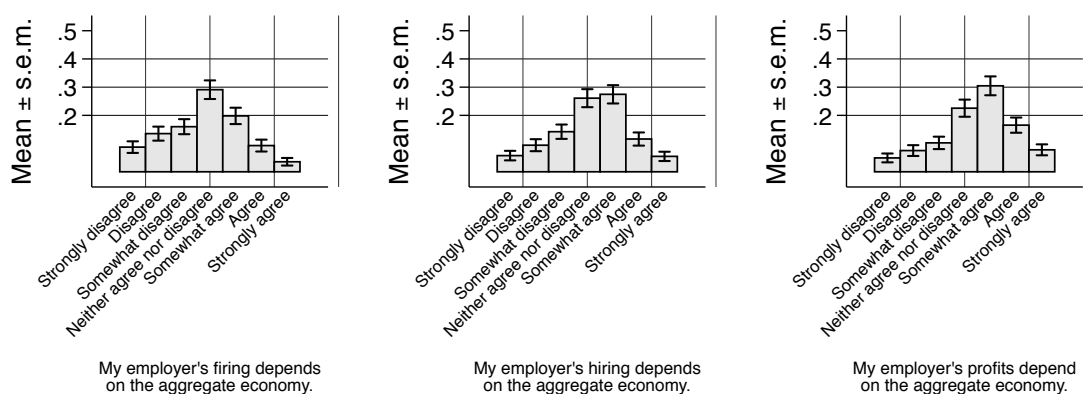
³ We neglect people working for the government in this exercise.

Table A25: 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.

Figure A.20: 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 A26: Additional results: Heterogeneity by subjective insurance within the firm (IV)

	Personal Unemployment	Job Loss	Job Finding
	(1)	(2)	(3)
Posterior: Recession (a)	0.526** (0.266)	0.900** (0.428)	0.692 (0.700)
Posterior: Recession \times (b) High firm insurance	-0.822 (0.527)	-1.443* (0.822)	-1.376 (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 based on specification 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, a dummy for Republicans and a dummy for Democrats as well as dummies for the dimension of heterogeneity. Robust standard errors are in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.