Information frictions among firms and households☆

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A R T I C L E   I N F O

A B S T R A C T

Using surveys of German firms and households, we document novel stylized facts about the extent of information frictions among the two groups. First, firms' expectations about macroeconomic variables are closer to expert forecasts and less dispersed than households', consistent with higher information frictions among households. Second, the degree of dispersion and the distance from expert forecasts varies more across groups of households than across groups of firms. Third, firms update their policy rate expectations less than households when provided with an expert forecast, consistent with firms holding stronger priors. Our results have implications for modeling choices, macroeconomic dynamics, and policies.

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1. Introduction

Information frictions are at the core of models of expectation formation in macroeconomics (Sims, 2003). They can explain various stylized facts and have important implications for the transmission of policies (Ball et al., 2005; Paciello and Wiederholt, 2014). The extent of information frictions likely varies across groups of agents in the economy, for instance, due to differences in stake size or information acquisition and processing costs (Fuster et al., 2020; Maćkowiak and Wiederholt,

2015; Mikosch et al., 2021; Reis, 2006). Given the importance of information frictions for expectation formation, it is crucial for both modeling choices and policy-making to understand how the degree of these frictions differs across and within groups of decision makers in the economy.

In this paper we examine the relative strength of information frictions among firms and households in the context of expectations about inflation, unemployment, and the central bank's policy rate. Forecasting macroeconomic developments accurately is central for firms to predict their future product demand or the cost of raising capital. Households have an interest in holding accurate expectations about changes in the cost of living, the real interest rate earned on savings or paid on loans, or the development of the labor market. Both firms and households may therefore perceive high stakes in being informed about macroeconomic developments. At the same time, managers may face lower costs of acquiring and processing macroeconomic information than households.

We use micro data from Germany to document several novel stylized facts about the extent of information frictions among firms and households. Our evidence draws on two sets of almost identical surveys of in total 4238 German firms and 4925 households broadly representative of the German population, conducted at the same points in time. A key aspect of the firm surveys is that they are answered by managers who are responsible for high-stakes decisions in these firms. Crucially, the surveys use identical framing of key questions on expectations, addressing the importance of wording choices, e.g., when asking about inflation (Bruine de Bruin et al., 2012). Hence, our setup ensures a high level of comparability of survey responses between firms and households.

Our analysis starts by comparing the level and dispersion of households' and firms' macroeconomic expectations with those of professional forecasts. All else equal, higher information frictions should be reflected in greater disagreement. In addition, expectation dispersion has direct implications for the transmission of shocks and policies (Angeletos and Lian, 2018). Using surveys conducted in September 2020, we document that firms' expectations about the ECB policy rate, inflation, and unemployment are more closely aligned with the average professional forecast than those of households. The differences between households and firms are large: mean absolute deviations from expert benchmarks among firms are 0.39 p.p. for the policy rate, 0.96 p.p for inflation, and 1.81 p.p. for unemployment, while they are much higher at 1.98 p.p., 3.30 p.p., and 6.11 p.p., respectively, for households. Moreover, firms' expectations are more dispersed than those of experts, but substantially less dispersed than those of households. These facts are consistent with stronger information frictions among households than among firms.

Next, we examine heterogeneity in the characteristics of expectations within each group of agents. Especially among households, beliefs vary systematically with observables. Most importantly, financial constraints and lower cognitive skills are associated with greater distance of beliefs to expert benchmarks. The two samples are next split into "well-informed" and "uninformed" respondents according to variables that are associated with significant differences in beliefs. The expectations of a group of "well-informed" households with higher cognitive skills, age, and financial wealth are mostly indistinguishable from those of firms. In contrast, expectations of "uninformed" firms, i.e., smaller and non-exporting firms, are mostly not statistically different from "well-informed" firms' expectations, and differ strongly from households' expectations. This suggests a larger degree of variation of information frictions across different groups of households than across different groups of firms.

When being provided with information about the current policy rate of zero percent, households' expectations about future policy rates become significantly less dispersed and shift towards expert forecasts. By contrast, information about the current policy rate has only negligible effects on firms' expectations about future rates. This indicates that differential knowledge about current economic conditions potentially explains a large part of the differences in expectations about the future between households and firms.

A higher degree of information frictions should also be reflected in agents holding weaker priors about macroeconomic variables. To study the strength of households' and firms' prior expectations about monetary policy, we conducted surveys with German firms and households in December 2019, in which respondents are randomly assigned into groups receiving differential truthful expert forecasts about the likely date of a hike in the ECB policy rate. Firms update their expectations about policy rates significantly less than households in response to the same expert forecasts, consistent with firms holding stronger priors about future monetary policy. Firms also report to have acquired more information about monetary policy than households over the weeks before the survey, and, within each sample, those respondents that have acquired more information react significantly less to the expert forecasts. Furthermore, while households adjust their expectations about interest rates they will personally face on savings accounts and loans, firms do not change their expectations about their own loan rates in response to the expert forecast. The effects on households' expectations about policy rates and own rates persist at a reduced size in a four-week follow-up survey.

Our findings have implications for macroeconomic modeling. Higher information frictions imply a higher stickiness of beliefs among households than among firms. Moreover, households will learn more slowly about changes in policies than firms, which will make policies less effective in changing their beliefs. The systematic variation of information frictions across groups of households with different levels of financial constraints or cognitive skills suggests that these frictions can be modeled as arising endogenously from a trade-off between costs and benefits of being informed, as in rational inattention models (Maćkowiak and Wiederholt, 2021). Moreover, since the optimal decisions of financially constrained households are less elastic to their expectations about the future, information frictions will have lower impact if they are concentrated among these households.

This paper contributes to a growing literature studying macroeconomic expectation formation. A set of recent papers compares the extent of expectation dispersion between households and firms. Coibion et al. (2018) document that inflation expectations of firms in New Zealand exhibit a similar degree of dispersion as households' expectations. More in line with our findings, concurrent studies highlight stronger disagreement among households than among firms in the US (Candia et al., 2021) and in France (Savignac et al., 2021). Our paper differs from those by taking a broader perspective on the extent of information frictions among firms and households. First, we study how firms and households differentially learn from information about current realizations and expert forecasts. To the best of our knowledge, ours is the first paper to compare the reactions of firms and households to identical information treatments. Second, we compare the degree of variation of information frictions across different groups of households to their variation across different groups of firms. Third, we study households' and firms' beliefs about a broader set of macroeconomic variables. Further, both the household and the firm surveys are run by ourselves, allowing us to elicit households' and firms' beliefs at identical points in time using identical survey questions.

Several other papers study households' expectations in the context of monetary policy (Andre et al., 2022b; Coibion et al., 2020b; 2022; d'Acunto et al., 2021; Roth et al., 2022). Related to our paper, Coibion et al. (2020a) show that information treatments about current and next year's policy rates have strong effects on household expectations but treatments beyond one year do not have any additional impact. Our setting differs in that the ECB policy rate had been at the zero lower bound for a long time at the time of our surveys, while Coibion et al. (2020a) study an environment of positive rates in the US.

2. Descriptive evidence on expectation dispersion

This section uses data from our September 2020 surveys to characterize the dispersion and similarity to professional forecasts of firms' and households' macroeconomic expectations. According to most prevalent models, a larger degree of information frictions will result in stronger belief disagreement, holding all else equal (Coibion and Gorodnichenko, 2012). For instance, a higher frequency of updating information sets will reduce dispersion in Calvo-style sticky information models (Mankiw and Reis, 2002), and higher signal-to-noise ratios in private signals about the economy will be reflected in lower dispersion in noisy information models (Sims, 2003).[1] Moreover, expectation dispersion has direct implications for the transmission of shocks and policies (Angeletos and Lian, 2018).

2.1. Samples of September 2020 surveys

Firm sample. We leverage the ifo Business Survey (IBS), which is conducted by the ifo Institute on a monthly basis and which aims to be representative of the German economy.[2] The survey provides the basis for the ifo Business Climate Index, the most recognized leading indicator of the German business cycle. Every month approximately 9000 survey participants from firms in manufacturing, services, construction, wholesale, and retail assess various dimensions of their activities, including their current and expected business conditions. The IBS has been used extensively in previous studies (e.g., Bachmann et al., 2019; Bachmann et al., 2013; Balleer et al., 2020; Buchheim et al., 2022; Enders et al., 2019; Link, 2022). More than 90% of respondents are in an upper management position such as owner, CEO, or department head. Hence, the survey covers individuals responsible for high-stakes decisions in these firms. Details on the IBS can be found in Sauer and Wohlrabe (2019).

The questions used in our study were part of the online portion of the September 2020 wave of the IBS covering 4563 firms in manufacturing, services, retail, and wholesale. In total, 3774 firms (83%) responded to our additional questions. Panel A of Table 1 shows summary statistics. Our sample covers a diverse set of sectors (36% in manufacturing, 38% in services, and 25% in retail and wholesale). The average (median) number of employees is 311 (41) and the average (median) firm age is 53 years (37 years). 64% of respondents from the sample hold a university degree.[3]

Household sample. In September 2020, we collected a sample of 951 German respondents in collaboration with the online panel provider Dynata, which is widely used in the social sciences (Haaland et al., 2020). Respondents in the top and bottom percent of response time, who were likely inattentive to the survey, are dropped.[4] This leaves us with 933 respondents. Panel A of Table 2 shows summary statistics of our sample as well as benchmarks from the latest available wave (2019) of

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[1] Belief disagreement can also arise from heterogeneity in agents' mental models (Andre et al., 2022a). While different degrees of heterogeneity in mental models could partially explain differences in expectation dispersion between households and firms, several additional pieces of evidence point to differential information frictions, such as differential knowledge of current realizations (Section 2.6), differential strength of priors about macroeconomic variables (Section 3.3), and different levels of news consumption (Section 3.3).

[2] Hiersemenzel et al. (2022) show that the sample of the IBS provides a very good representation of the German economy according to various criteria. In line with this, Online Appendix A.3 provides evidence that the distribution of firms across industries and size in our sample captures the distribution of firms in the German economy as measured in administrative data well.

[3] The exercises using firm samples do not apply weights, as it would be unclear which exact distribution to target. Using the unweighted population distribution would give disproportionately large weight to very small firms, while using the population distribution weighted by firm size could imply that our results are driven by a few very large firms in our samples. Appendix A.3 demonstrates the robustness of our findings from the 2020 survey to different weighting schemes.

[4] Inattention is a pervasive concern in online surveys (Haaland et al., 2020). Some respondents may want to complete the survey as quickly as possible to obtain their payment, while others may interrupt the survey to do other things, e.g., browse the internet. Very low or high response times are therefore indicative of low attention to our survey questions.

Table 1
Summary statistics and balance of firm surveys.

	Full survey sample (2020 wave)				No anchor	Anchor	*p*-value
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Mean	Median	SD	N	Mean	Mean	(5) = (6)
Panel A: 2020 wave							
Firm age	53	37	39	2739	52.48	53.73	0.40
Employees	310.99	41.00	2232.28	3761	261.50	361.85	0.17
Export share	0.18	0.09	0.22	3774	0.17	0.18	0.13
East Germany	0.12	0.00	0.33	3774	0.12	0.12	0.88
Negative impact of coronavirus	0.69	1.00	0.46	3660	0.69	0.69	0.86
Equity ratio	0.45	0.40	0.28	3008	0.45	0.46	0.77
Cash to total assets	0.22	0.15	0.21	1951	0.23	0.21	0.28
Any change in loan interest rate in last 6 months	0.08	0.00	0.27	3101	0.07	0.08	0.44
University	0.64	1.00	0.48	3063	0.65	0.63	0.18
Manufacturing Firm	0.36	0.00	0.48	3774	0.35	0.38	0.06
Services Firm	0.38	0.00	0.49	3774	0.38	0.39	0.76
Retail/Wholesale Firm	0.25	0.00	0.43	3774	0.27	0.24	0.02
	Full survey sample (2019 wave)				Increase 2020	Increase 2025	*p*-value
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Mean	Median	SD	N	Mean	Mean	(5) = (6)
Panel B: 2019 wave							
Employees (2017–2019 mean)	828.18	153.75	6122.48	464	891.41	761.60	0.82
Revenues (2017–2019 mean; in mn.)	372.81	28.88	3775.18	464	446.84	294.85	0.67
Total Investment (2017–2019 mean; in mn.)	12.37	0.87	103.44	464	13.21	11.49	0.86
East Germany	0.29	0.00	0.46	443	0.30	0.29	0.73
High influence on decisions in firm	0.87	1.00	0.33	461	0.87	0.88	0.69

Notes: This Table presents summary statistics of the German firm surveys conducted in September 2020 (Panel A) and December 2019 (Panel B). Columns 5 and 6 of Panel A display the sample means separately for respondents that did not receive information about the current rate and those that received the anchor before making their prediction, respectively. Columns 5 and 6 of Panel B display the sample means separately for respondents that obtained information from an expert forecast predicting a policy rate increase in 2020 and for respondents that received an expert forecast predicting an increase in 2025 at the earliest, respectively. Column 7 presents the *p*-values of a *t*-test on the equality of the means depicted in Columns 5 and 6. "Negative impact of coronavirus" is a dummy for firms that reported a negative impact of the Covid-19 crisis on their business activity in September 2020. The "Equity ratio", the "Cash to total assets" ratio, and "Any change in loan interest rate in last 6 months" are elicited in the September 2020 wave of the IBS. "University" is a dummy for respondents with a diploma, master, or Ph.D. degree from the February 2020 IBS wave. Firm age and export share are calculated from responses to the September 2018 IBS wave. The number of observations differs across variables as we merge information from different modules and waves of the IBS. In our regressions we deal with non-response as described in the notes of Table 4. The variables in Panel B refer to average levels of the number of employees, revenues, and total investment the firms reported in the regular ifo Investment Survey during the three years prior to the special survey in December 2019. "High influence on decisions in firm" is an indicator for respondents stating that they personally have "very much influence" or "much influence" on investment or personnel decisions.

the German Socioeconomic Panel (GSOEP), a representative household survey. Our sample is roughly representative of the population in terms of gender, age, region, and household income. The main difference is a somewhat higher share of highly educated individuals, which is common in online surveys. To address this compositional difference, we construct weights using data from the GSOEP based on cells defined by age, gender, region of residence, income, and education, and apply them to all evidence describing the distribution of households' expectations.

2.2. Design of September 2020 surveys

Firms. Due to space constraints, each participant in the IBS only responds to two additional questions on top of the regular survey. All firms respond to one question about the ECB policy rate: Two thirds report expectations about the policy rate in 2022, the remaining third about the expected rate in 2025. A random subset of respondents are told that the current policy rate is zero percent before making their prediction.[5] Columns 5 and 6 of Table 1 Panel A show that our firm sample is balanced between those who received the current rate and those who did not for most variables. In addition, respondents are asked to predict either the inflation rate in 2022 or the unemployment rate in 2022, or are asked about their trust in economic forecasts of experts. We also randomize whether the policy rate question or the other question is asked first. Online Appendix C.1 provides the wording of all questions of the IBS used in this paper.

Households. Crucially, the household survey uses identical framing of key questions on expectations as the firm survey, ruling out that wording choices are driving differences in reported expectations (Bruine de Bruin et al., 2012). Respondents' expectations about the ECB policy rate in 2022 and in 2025 are elicited in randomized order. Moreover, a random half of our respondents are informed that the current policy rate is zero percent before making their prediction about future policy

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[5] Our surveys mostly elicit point forecasts instead of subjective probability distributions due to space constraints in the firm surveys. Point forecasts have the additional advantage that they require less effort.

Table 2
Summary statistics and balance of household surveys.

	GSOEP: Full	Full survey sample (2020 wave)				No anchor	Anchor	p-value
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Mean	Mean	Median	SD	N	Mean	Mean	(6) = (7)
Panel A: 2020 wave								
Female	0.51	0.46	0.00	0.50	933	0.46	0.45	0.783
Age	51.10	45.70	50.00	13.53	933	45.25	46.14	0.315
East	0.17	0.20	0.00	0.40	933	0.19	0.22	0.207
Log(HH net income)	7.92	7.90	8.01	0.61	933	7.89	7.90	0.782
Highschool	0.16	0.32	0.00	0.47	933	0.33	0.31	0.517
University	0.25	0.27	0.00	0.44	933	0.26	0.28	0.653
Log(HH financial assets + 1)		7.56	9.17	4.16	933	7.72	7.40	0.237
Stockowner		0.34	0.00	0.47	930	0.35	0.34	0.850
Homeowner		0.44	0.00	0.50	933	0.46	0.42	0.146
Debtor		0.37	0.00	0.48	933	0.38	0.35	0.432
	GSOEP: Employed	Full survey sample (2019 wave)				Increase 2020	Increase 2025	p-value
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Mean	Mean	Median	SD	N	Mean	Mean	(6)=(7)
Panel B: 2019 wave								
Female	0.48	0.47	0.00	0.50	3992	0.47	0.47	0.746
Age	45.59	46.18	50.00	11.84	3992	46.33	46.03	0.426
East	0.20	0.19	0.00	0.39	3992	0.17	0.21	0.004
Log(HH net income)	8.16	7.96	8.01	0.58	3992	7.96	7.97	0.512
Highschool	0.18	0.26	0.00	0.44	3992	0.27	0.24	0.096
University	0.32	0.33	0.00	0.47	3992	0.32	0.34	0.198
Log(HH financial assets + 1)		7.78	9.31	4.15	3992	7.68	7.88	0.132
Stockowner		0.38	0.00	0.49	3992	0.37	0.39	0.113
Homeowner		0.49	0.00	0.50	3992	0.49	0.49	0.945
Debtor		0.42	0.00	0.49	3992	0.42	0.42	0.969
Prior policy rate 2022		0.57	0.10	0.95	3880	0.58	0.55	0.313
Prior policy rate 2025		1.14	1.00	1.22	3796	1.13	1.14	0.928
Prior year policy rate increase		2023.41	2022.00	3.07	3686	2023.31	2023.51	0.042
Prior confidence policy rates (z)		0.00	−0.13	1.00	3992	−0.01	0.01	0.666

Notes: This Table presents summary statistics of the German household surveys conducted in September 2020 (Panel A) and December 2019 (Panel B). For comparison, Column 1 depicts benchmarks from the 2019 wave of the German Socioeconomic Panel (GSOEP), a representative household survey in Germany. Columns 6 and 7 of Panel A display the sample means separately for respondents that did not receive information about the current rate and those that received the anchor before making their prediction, respectively. Columns 6 and 7 of Panel B display the sample means separately for respondents that obtained information about an expert forecast predicting a policy rate increase in 2020 and for respondents that received an expert forecast predicting an increase in 2025 at the earliest, respectively. Column 8 presents the *p*-values of a *t*-test on the equality of the means depicted in Columns 6 and 7. "East" is a dummy for respondents living in East Germany, "Highschool" refers to respondents holding an *Abitur* or comparable degree (A-levels equivalent) but do not hold a university degree, and "University" is a dummy for respondents with a university degree. "Stockowner", "Homeowner", and "Debtor" are dummies for households owning stocks, owning their main residence, and with positive gross debt, respectively.

rates. Columns 6 and 7 of Table 2 Panel A show that the sample is balanced across these two arms. Further, all respondents are asked to predict the unemployment rate and the inflation rate in 2022. The order of expectations about policy rates, inflation, and unemployment is randomized. In addition, the survey covers various individual characteristics, such as household finances, labor market behavior, numeracy, and trust in economic forecasts of experts. Online Appendix C.2 documents the survey instructions in detail.

Coding of outcome variables. Our main survey items of interest are point forecasts of economic variables. The responses to such questions contain outliers. Extreme responses could indicate typos, inattention to the survey, or respondents not taking the survey seriously. Even if extreme responses reflected true beliefs, those could drive estimation results due to the sensitivity of OLS to outliers. Following previous work on macroeconomic expectation formation (Giglio et al., 2021), predictions about interest rates, inflation, and unemployment are therefore trimmed at −1% and 25%, 0% and 35%, and 50%, respectively, commonly for the firm and household samples. This results in setting between three and four percent of responses in the household sample and less than one percent in the firm sample to missing. In our figures, these variables are mostly winsorized at lower values for expositional reasons. As demonstrated in Section A.5 in the Online Appendix, none of our findings are sensitive to the exact cutoffs used or to whether the data is trimmed or winsorized.

2.3. Descriptive results

We start by describing the macroeconomic expectations of the groups of firms and households that were not provided with information about the current policy rate.

Figure 1 displays the cumulative density functions of firms' and households' expectations about the ECB policy rate in 2022 and 2025, inflation in 2022, and the unemployment rate in 2022. For comparison, we add the distributions of forecasts
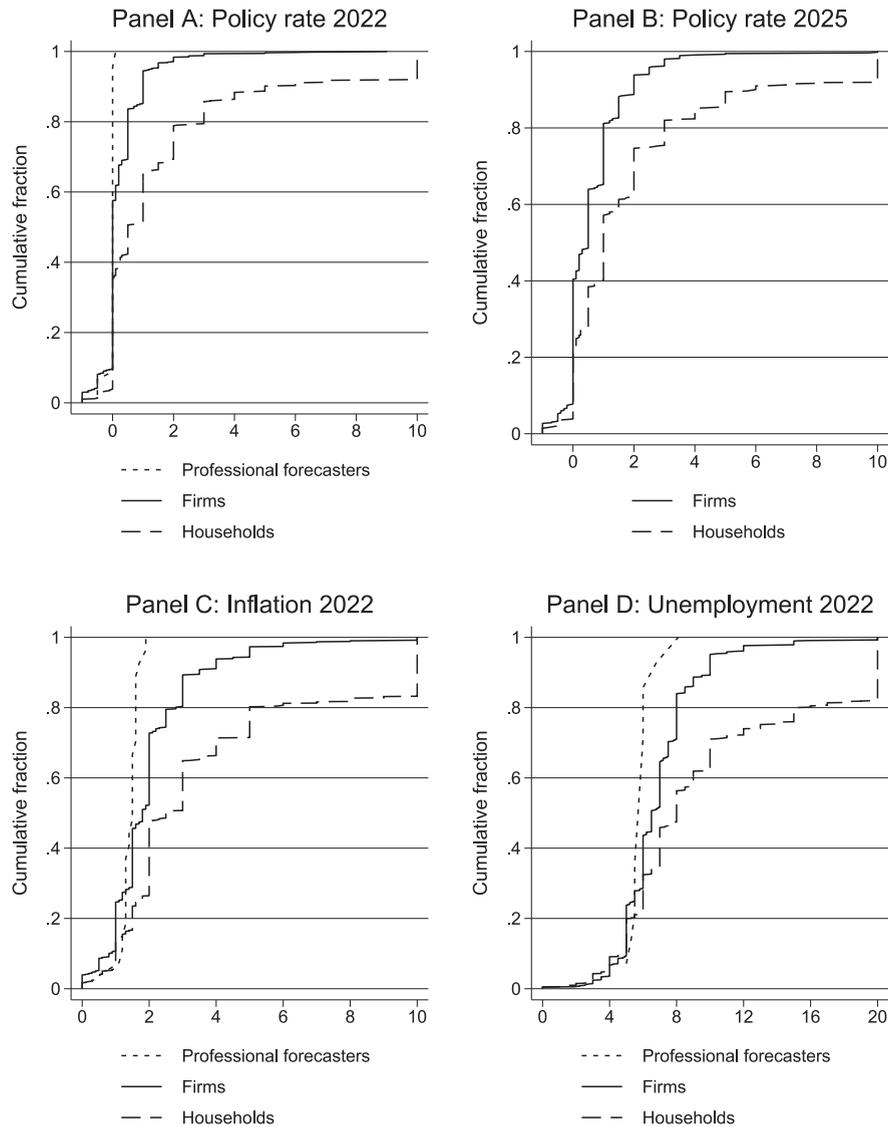
Fig. 1. Macro expectations among households and firms without anchor: 2020 survey. *Notes:* This Figure shows the cumulative distribution function of expectations from the German surveys of September 2020 among the sample of respondents that did not receive information about the current ECB policy rate. The figures show expectations about the average 2022 ECB policy rate, the average 2025 ECB policy rate, the inflation rate over the year 2022, and the average unemployment rate in 2022 separately for households and firms. Household observations are weighted based on data from the 2019 wave of the GSOEP. The dotted lines indicate the distributions of forecasts of the 2022 policy rate from the October 2020 round of the ECB SPF and of inflation and unemployment in 2022 of the professional forecasters in FocusEconomics' November 2020 survey, respectively. For the sake of readability, we winsorize expectations at −1% and 10%, 0% and 10%, and 20% for policy rates, inflation, and unemployment, respectively.

about the 2022 policy rate from the October 2020 round of the ECB SPF (median forecast 0%) and of inflation and unemployment in 2022 (median predictions 1.5% and 5.75%, respectively) from the November 2020 survey of FocusEconomics, an established survey of professional forecasters. For the sake of readability, expectations are winsorized at −1% and 10%, 0% and 10%, and 20% for policy rates, inflation, and unemployment, respectively. Table 3 displays different moments of the expectations in the three samples.

For all three variables, beliefs are the least dispersed among experts, more dispersed among firms, and by far the most dispersed among households. For instance, the cross-sectional standard deviation of the expected policy rate in 2022 is 0.1 p.p. among professional forecasters, 0.8 p.p. among firms, and 4.0 p.p. among households. For expected inflation in 2022 the standard deviations are 0.3 p.p., 1.7 p.p., and 5.7 p.p.; for the expected unemployment rate in 2022 0.8 p.p., 2.5 p.p., and 9.5 p.p. The patterns look similar for other measures of dispersion such as the interquartile range and the ranges between

Table 3

Moments of Macro expectations among households and firms: 2020 survey.

	Mean (1)	Median (2)	SD (3)	p75-p25 (4)	p90-p10 (5)	p90-mean (6)	p90-p50 (7)	Mean abs. bias (8)	N (9)
Panel A: Professional Forecasters									
Expected policy rate 2022	−0.03	0.00	0.13	0.00	0.00	0.03	0.00		45
Expected inflation 2022	1.43	1.50	0.27	0.30	0.50	0.27	0.20		27
Expected unemployment 2022	5.91	5.75	0.76	0.50	1.50	0.89	1.05		14
Panel B: Firms									
Expected policy rate 2022 (*no anchor*)	0.28	0.00	0.75	0.50	1.00	0.72	1.00	0.39	1097
Expected policy rate 2025 (*no anchor*)	0.71	0.50	1.43	1.00	2.00	1.29	1.50		543
Expected Policy rate 2022 (*anchor*)	0.26	0.00	0.86	0.20	1.00	0.74	1.00	0.31	1249
Expected Policy rate 2025 (*anchor*)	0.78	0.50	1.10	1.00	2.00	1.22	1.50		579
Expected inflation 2022	2.07	1.80	1.69	1.30	2.50	1.43	1.70	0.96	1115
Expected unemployment 2022	6.92	6.50	2.51	2.50	5.00	3.08	3.50	1.81	1236
Panel C: Households									
Expected policy rate 2022 (*no anchor*)	1.95	0.50	4.01	2.00	4.00	2.05	3.50	1.98	450
Expected policy rate 2025 (*no anchor*)	2.29	1.00	3.96	1.80	5.00	2.71	4.00		449
Expected Policy rate 2022 (*anchor*)	1.30	0.00	3.15	1.50	3.00	1.70	3.00	1.32	458
Expected Policy rate 2025 (*anchor*)	1.87	1.00	3.88	2.00	4.00	2.13	3.00		456
Expected inflation 2022	4.57	2.50	5.72	3.40	9.00	5.43	7.50	3.30	902
Expected unemployment 2022	11.20	8.00	9.54	6.00	20.00	13.80	17.00	6.11	908

Notes: This Table presents summary statistics of expected average ECB policy rates in 2022 and 2025, the expected inflation rate over the year 2022, and the expected unemployment rate in 2022. Panel A summarizes benchmark statistics for professional forecasters that are taken from the October 2020 round of the ECB SPF (expected policy rate) and from FocusEconomics' November 2020 survey (expected inflation and unemployment), respectively. Panels B and C refer to our German firm and household surveys conducted in September 2020. Here, statistics on policy rate expectations are presented separately for respondents that received information about the current rate and those who did not receive the anchor before making their prediction. Household observations are weighted based on data from the 2019 wave of the GSOEP. Columns 1 through 7 depict the mean, median, standard deviation, interquartile range, and some ranges between the 90th percentile and the 10th percentile, mean, and median for each variable in the respective survey, respectively. Column 8 displays the mean absolute deviation of firms' and households' expectations from the median expert benchmark depicted in Column 2 of Panel A. The difference between the mean absolute deviations is statistically significantly different between the firm and household samples ($p < 0.01$ for all variables). Column 9 presents the number of observations.

the 90th percentile on the one hand and the 10th percentile, the mean, and the median on the other hand, respectively.[6] Thus, while belief dispersion is significantly higher among firms than among experts, disagreement among households is several times higher than among firms. While both firms and households tend to predict higher interest rates, inflation, and unemployment than experts, firms' expectations are significantly closer to the median expert forecast than households'. For inflation the mean absolute deviation is 1.0 p.p. among firms and 3.3 p.p. among households. The first main result is as follows:

Result 1. Firm expectations about policy rates, inflation, and unemployment are more dispersed than professional forecasts but less dispersed than household expectations. Firms' beliefs deviate significantly less from the median professional forecast than households'.

Robustness. One concern is that the timing of our surveys during the coronavirus pandemic could threaten the external validity of our findings. Online Appendix A.1.1 uses surveys conducted in 2019 – before the pandemic – to show that expectations are more dispersed and more distant from expert forecasts among households than among firms. In addition, Online Appendix A.1.2 shows that the findings from our September 2020 surveys are similar across groups with different degrees of exposure to the pandemic.

Another concern could be that firms' expectations are less dispersed and more closely aligned with professional forecasts than households' because firms are more experienced in responding to questions on macroeconomic expectations (Kim and Binder, 2020). However, we were the first to elicit quantitative expectations about the ECB policy rate, inflation, and the unemployment rate in the IBS. Moreover, Online Appendix A.2 shows that firms' expectations do not vary with length of participation in the IBS.

Finally, as shown in Online Appendix A.3, the distribution of firms' macroeconomic expectations remains very similar when the sample is re-weighted to be either representative of the unweighted distribution of firms in the German economy, which puts larger weight on small firms, or comparable to the size distribution of German firms weighted by the number of employees or gross value added.

Comparison to related evidence. How do our findings compare with other recent evidence? Coibion et al. (2018) show that the expectations of firms in New Zealand are similarly dispersed and different to professional forecasts as household expectations. By contrast, Candia et al. (2021) show that US firms disagree less about future inflation than US households

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[6] The greater dispersion on the right tail among households than among firms highlights that differences in dispersion are not due to firms' beliefs about interest rates and unemployment being truncated at zero.

Table 4
Correlates of firms' beliefs: 2020 survey.

	Policy rate 2022 (1)	Policy rate 2025 (2)	Inflation rate 2022 (3)	Unempl. rate 2022 (4)
Log(Firm age)	0.003	−0.056	−0.066	−0.002
	(0.024)	(0.053)	(0.078)	(0.121)
Log(Employees)	0.000	−0.090***	−0.118***	−0.185***
	(0.014)	(0.032)	(0.034)	(0.048)
Export share	−0.004	0.175	−0.887***	−0.081
	(0.087)	(0.202)	(0.226)	(0.421)
Negative impact of coronavirus	0.014	−0.014	0.207*	0.532***
	(0.035)	(0.092)	(0.108)	(0.151)
Services Firm	0.077	0.129	−0.528***	−0.235
	(0.048)	(0.088)	(0.174)	(0.184)
Retail/Wholesale Firm	−0.009	−0.007	−0.497***	0.112
	(0.048)	(0.105)	(0.185)	(0.205)
Equity ratio	−0.062	−0.099	0.119	−0.235
	(0.082)	(0.136)	(0.194)	(0.309)
Cash to total assets	0.057	−0.234	0.354	0.594
	(0.149)	(0.185)	(0.288)	(0.569)
Any change in loan interest rate in last 6 months	−0.087*	−0.226**	0.035	−0.026
	(0.046)	(0.100)	(0.192)	(0.278)
University	−0.064	0.066	−0.181	−0.030
	(0.042)	(0.089)	(0.130)	(0.160)
Anchored on current policy rate	−0.023	0.064		
	(0.034)	(0.078)		
Observations	2338	1115	1111	1233
R^2	0.01	0.03	0.03	0.03
Mean dep. variable (no anchor)	0.28	0.71	2.06	
SD dep. variable (no anchor)	0.75	1.43	1.69	
Mean dep. variable (anchor)	0.26	0.78		6.92
SD dep. variable (anchor)	0.86	1.10		2.52

Notes: This Table displays regressions of firms' expectations on respondent characteristics based on the German firm survey of September 2020. "Firm age" and "Export share" are elicited in the September 2018 IBS wave. "Negative impact of coronavirus" is a dummy for firms that reported a negative impact of the Covid-19 crisis on their business activity in September 2020. The indicators "Services firm" and "Retail/Wholesale firm" capture the effect of firms in the respective sectors relative to manufacturing firms. "Equity ratio", "Cash to total assets", and "Any change in loan interest rate in last 6 months" are elicited in the September 2020 IBS wave, while the latter indicates firms stating to have experienced a change to loan interest rates over the previous six months. "University" indicates respondents with a diploma, master, or Ph.D. degree as elicited in February 2020. We code missing values of all covariates to zero (except for the export share, which we set to the average of the two-digit industry if missing) and include dummies indicating missings for each of the variables. "Anchored on current policy rate" is a dummy that is one if respondents received information about the current rate before making their prediction. Inflation expectations are only elicited among those respondents that did not receive information about the current policy rate, unemployment expectations only among those provided with the anchor. Robust standard errors are displayed in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

but more than experts, while firms' average beliefs tend to lie between those of households and experts. Similarly, Savignac et al. (2021) document that French firms hold less widely dispersed expectations than French households. Together with our study, these findings suggest that, in most contexts, firms' expectations lie somewhat between those of households and professional forecasts, consistent with more pronounced information frictions among households. Online Appendix A.7 presents additional evidence showing greater disagreement and stronger deviations from expert forecasts among Italian households than among Italian firms.[7]

2.4. Correlates of beliefs

We next study the correlates of respondents' expectations, focusing on the strongest predictors of forecasts. Given the patterns documented above, for both firms and households higher expectations are associated with greater differences to experts.

Firms. Table 4 displays results from multivariate regressions of expectations on respondent characteristics. Larger firms predict a lower policy rate in 2025 and lower inflation and unemployment in 2022 ($p < 0.01$, respectively). Moreover, firms with a higher subjective exposure to the coronavirus crisis expect higher inflation ($p < 0.1$) and unemployment ($p < 0.01$). Managers of firms with a higher export share and managers of services or of retail and wholesale firms predict lower inflation ($p < 0.01$, respectively). Lastly, firms reporting to have experienced a change to their loan interest rates over the previous six months expect lower policy rates in 2022 ($p < 0.1$) and 2025 ($p < 0.05$).

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[7] The different patterns in New Zealand detected by Coibion et al. (2018) may be due to its different economic structure compared to more industrial Western economies.

Table 5
Correlates of households' beliefs: 2020 survey.

	Policy rate 2022 (1)	Policy rate 2025 (2)	Inflation rate 2022 (3)	Unempl. rate 2022 (4)
Female	0.458*	0.341	0.942**	2.831***
	(0.267)	(0.281)	(0.398)	(0.627)
Age at least 50	−1.029***	−1.031***	−1.265***	−2.097***
	(0.252)	(0.282)	(0.395)	(0.604)
Highschool	−0.095	−0.180	−0.171	−1.907**
	(0.295)	(0.331)	(0.475)	(0.759)
University	−0.314	−0.647**	−0.431	−2.078***
	(0.263)	(0.259)	(0.431)	(0.674)
Covid-19 worsens economic situation	−0.051	−0.279	0.571	2.060***
	(0.262)	(0.277)	(0.415)	(0.674)
Employed	−0.126	0.030	0.811	1.155
	(0.572)	(0.679)	(0.931)	(1.460)
Unemployed	1.611	0.433	1.607	1.316
	(1.499)	(1.157)	(2.123)	(3.393)
Income > € 3,000	−0.052	0.070	−0.849**	−0.744
	(0.248)	(0.291)	(0.377)	(0.620)
Financial assets > € 11,000	−0.619***	−0.771***	−1.052**	−1.056
	(0.235)	(0.279)	(0.433)	(0.706)
Stockowner	0.004	0.145	−0.458	−0.222
	(0.262)	(0.337)	(0.417)	(0.755)
Homeowner	0.535**	0.540*	1.028**	0.428
	(0.267)	(0.294)	(0.426)	(0.606)
Debtor	−0.097	−0.188	0.280	0.572
	(0.252)	(0.261)	(0.402)	(0.613)
High numeracy	−1.384***	−1.327***	−2.247***	−3.643***
	(0.244)	(0.262)	(0.377)	(0.561)
Main earner	0.175	0.186	0.541*	0.071
	(0.184)	(0.194)	(0.278)	(0.382)
High recession exposure	−0.383	−0.056	−0.229	−1.599**
	(0.263)	(0.271)	(0.391)	(0.643)
Anchored on current policy rate	−0.804***	−0.602**	−0.753*	−0.255
	(0.237)	(0.252)	(0.384)	(0.662)
Observations	903	900	897	903
R^2	0.13	0.10	0.14	0.16
Mean dep. variable (no anchor)	2.04	2.40	4.72	11.01
SD dep. variable (no anchor)	4.24	4.20	6.10	9.38
Mean dep. variable (anchor)	1.18	1.76	3.91	11.06
SD dep. variable (anchor)	2.93	3.54	4.71	9.32

Notes: This Table displays regressions of households' expectations on respondent characteristics based on the German household survey of September 2020. "Anchored on current policy rate" is a dummy that is one if respondents received information about the current rate before making their prediction. All other covariates are coded as dummies. Robust standard errors are displayed in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

Households. Table 5 presents the corresponding analysis for households. Higher financial asset holdings are associated with lower policy rate ($p < 0.01$) and inflation expectations ($p < 0.05$). Similarly, those with higher incomes expect significantly lower inflation ($p < 0.05$). These patterns are consistent with the idea that financially constrained households have lower stakes in being informed about real interest rates, as their optimal decisions are less elastic to their expectations about the future.[8] Homeowners hold higher policy rate and inflation expectations (mostly $p < 0.05$), consistent with the idea that real estate should be protected against movements in nominal interest rates and inflation, reducing incentives to acquire information. Moreover, more numerate respondents' expectations are lower and more closely aligned with expert forecasts ($p < 0.01$), in line with lower costs of acquiring and processing information (d'Acunto et al., 2019).[9] In addition, consistent with prior evidence (e.g., d'Acunto et al., 2021), the expectations of females are higher and therefore less well-aligned with expert forecasts (mostly $p < 0.05$). Older individuals hold lower expectations ($p < 0.01$), in line with learning over the life cycle.

2.5. Within-group heterogeneity

We next examine how much the degree of expectation dispersion and deviation from the median expert forecast varies within the household and within the firm sample. For both firms and households, we define groups of "well-informed"

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[8] Accordingly, Online Appendix A.6 shows that the dispersion of expectations and their deviation from expert forecasts are particularly strong among households with low financial asset holdings or low income.

[9] Numeracy is measured using seven questions adapted from the New York Fed's Survey of Consumer Expectations (see the survey instructions in Online Appendix C.2). Respondents who respond to at least six questions correctly are defined as highly numerate (46% of our sample).
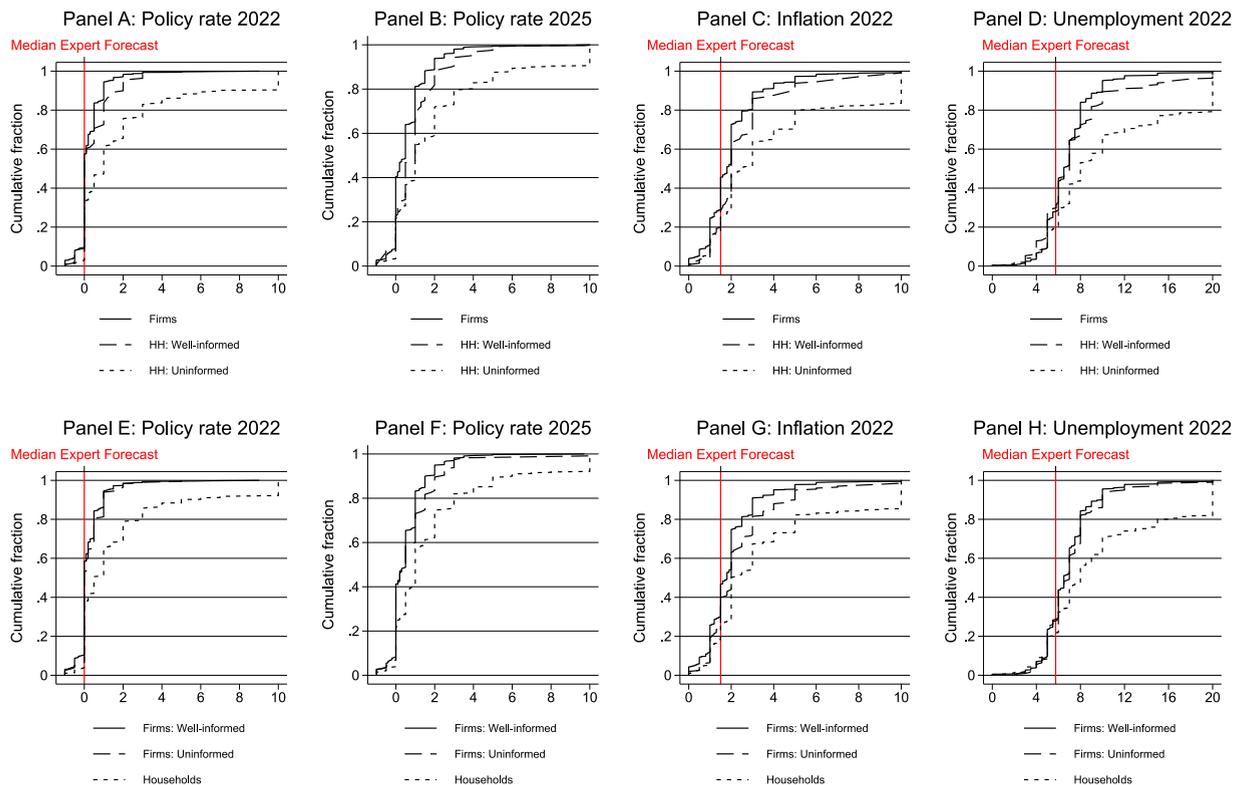
Fig. 2. Heterogeneity in expectations: "well-informed" vs. "uninformed" firms and households: 2020 survey. *Notes:* This Figure shows the cumulative distribution function of household and firm expectations about the average ECB policy rate in 2022 and 2025, the inflation rate over the year 2022, and the average unemployment rate in 2022 from the German surveys of September 2020 using only respondents in the "no anchor" condition. Panels A through D display these expectations separately for "well-informed" households (above median age, financial assets, and numeracy), which applies to 19% of households, and the remaining, "uninformed" households against the benchmark of firms. Panels E through H display these expectations separately for "uninformed" firms (non-exporting firms with below median number of employees), which applies to 18% of firms, and the remaining, "well-informed" firms against the benchmark of households. Household observations are weighted based on data from the 2019 wave of the GSOEP. The vertical red lines indicate median expert forecasts from Table 3. For readability, we winsorize expectations at −1% and 10%, 0% and 10%, and 20% for policy rates, inflation, and unemployment, respectively.

and "uninformed" respondents based on those observables that are most predictive of holding expectations that are more consistent with expert benchmarks.

For households, the "well-informed" group consists of the 19% of respondents that are at least 45 years old, have high numeracy, and hold above-median financial assets. Those respondents have had more time to learn, arguably face lower information acquisition and processing costs, and have higher stakes in being informed (at least about inflation and nominal rates). As shown in Panels A through D of Fig. 2 for the no-anchor condition, the expectations of this group are much less dispersed and more aligned with expert benchmarks compared to expectations of "uninformed" households. Indeed, mean absolute deviations from expert benchmarks in this group are 0.6 p.p., 1.3 p.p., and 2.9 p.p. for the policy rate, inflation, and unemployment in 2022, almost as low and—in the case of expected policy rate and inflation—statistically indistinguishable from firms' beliefs.

Panels E through H of Fig. 2 study a group of "uninformed" firms, whose number of employees is below the sample median and which are not exporting (18% of respondents). Even "uninformed" firms hold expectations that are substantially less dispersed and more aligned with expert benchmarks than those of households.[10] Indeed, differences in mean absolute deviations from expert benchmarks between "uninformed" and "well-informed" firms are 0.04 p.p., 0.4 p.p., and 0.2 p.p. for the policy rate, inflation, and unemployment expectations, respectively, which is only statistically different in the case of inflation. In contrast, differences between households and "uninformed" firms are much larger at 1.6 p.p., 1.8 p.p., and 4.2 p.p., and highly significant in all cases ($p < 0.01$). Thus, our second main result can be summarized as follows:

Result 2. The degree of expectation dispersion and deviation from professional forecasts varies substantially more across different groups of households than across different groups of firms.

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[10] Additional evidence presented in Online Appendix A.4 shows that these differences in dispersion of expected policy rates also hold when comparing well-informed households with uninformed firms.

2.6. The effects of the anchor on beliefs

Is differential informedness about current realizations of macroeconomic variables driving differences in expectations about the future between firms and households? To shed light on this, we compare expectations between respondents who received an anchor about the current policy rate before making their predictions and those who did not.

As can be seen in Table 3, the difference in the average expected policy rate for 2022 between firms and households shrinks from 1.7 p.p. in the no anchor condition (2.0% among households vs. 0.3% among firms) to 1.0 p.p. in the anchor condition (1.3% vs. 0.3%). The effects of the anchor are statistically significant among households (Table 5) and insignificant among firms (Table 4). Moreover, in the no-anchor condition, the difference in belief dispersion between firms and households as measured by the cross-sectional standard deviation is 3.2 p.p. (4.0 p.p. among households vs. 0.8 p.p. among firms), while it is only 2.3 p.p. (3.2 p.p. among households vs. 0.9 p.p. among firms) in the anchor condition. The fact that dispersion among firms does not respond to the information implies that the muted average response among firms is not due to respondents updating in different directions.[11] Thus, differential information frictions regarding the current policy rate account for approximately 40% of the difference in average deviations from professional forecasts and for approximately 30% of the difference in belief dispersion between households and firms.[12] Given that the current policy rate likely only partially captures the relevant information set about the state of the economy, these numbers should be viewed as a lower bound. The anchor has similar effects on expectations about the policy rate in 2025.[13] Taken together, our third main result can be summarized as follows:

Result 3. Learning about the current ECB policy rate reduces expectation dispersion among households but not among firms. Thus, differential information frictions regarding the status quo partially explain differences in expectations about the future between households and firms.

This finding is striking considering that the policy rate had been at the zero lower bound for 4.5 years at the time of the survey. It is not easily explained by sticky information models in which households update their information sets every few quarters on average, as in Carroll (2003), but points to a corner solution in which groups of households are completely inattentive to policy rates.

3. Learning from expert forecasts

Besides shaping the levels of dispersion and deviation from benchmarks in expectations, the degree of information frictions should be reflected in the strength of priors about macroeconomic variables. This section examines the strength of firms' and households' priors by studying the degree of learning from expert forecasts about future policy rates using information provision experiments conducted in December 2019.

3.1. Samples of December 2019 surveys

Firms. Given the extensive set of questions, this experiment could not be included in the monthly IBS. Instead, we conducted a special survey on the sample of firms regularly participating in the ifo Investment Survey (IIS), a semi-annual survey of the German manufacturing sector (see Sauer and Wohlrabe, 2020, for details). The sum of investment expenditures covered by firms in the IIS corresponds to roughly 40% of the total investment volume in the German manufacturing sector (Bachmann et al., 2017). As for the IBS, the IIS micro data have been used in recent research (e.g., Bachmann and Zorn, 2020).

Similar to the regular IIS, the special survey was conducted as a paper and pencil survey, which was mailed to the firms and returned by the respondents. Although this was the first time a special survey was conducted among participants of the IIS, 471 firms completed the survey, corresponding to a response rate of 20.3%—largely comparable to first waves of other firm surveys, e.g., Coibion et al. (2018). In contrast to the regular IIS, which is usually completed by executives in the controlling department, our questionnaires were sent to the firms' executive board. Accordingly, 87% of respondents

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[11] Online Appendix A.4 presents the results of formal statistical tests on the significance of these group differences in means and dispersion of policy rate expectations.

[12] The stronger average effect of information on the current rate on households' beliefs could be due to a larger size of the information shock regarding the current rate or weaker prior beliefs about future rates leading to stronger updating in response to a given information shock. Since respondents' priors about the current rate and their confidence in their priors about the future rate are unobserved, we cannot quantify the contribution of each of the two channels. That said, the fact that untreated firms' prior beliefs about the future rate are on average much more aligned with the current rate than untreated households' prior beliefs about the future rate points to an important role for a larger information shock among households. In addition, in Section 3 we present evidence from another experiment suggesting that firms hold stronger prior beliefs about future rates than households. Thus, both channels likely play some role in how differential information frictions regarding the status quo drive differences in beliefs about the future between firms and households. Moreover, given our design, we cannot disentangle ignorance regarding current monetary policy from lack of knowledge of the scale as a driver behind the effects of the information on households. However, both of these may be the result of information frictions.

[13] Having received the anchor somewhat reduces households' inflation expectations, consistent with households inferring from rates being at the zero lower bound to an environment of lower inflation (see Table 5). The anchor has no significant effect on their unemployment expectations. Due to programming constraints, the firm survey does not contain an arm in which respondents received information on the current policy rate before reporting their inflation or unemployment expectations.

indicate that they personally have "very much influence" or "much influence" on investment or personnel decisions. The pool of firms that completed our special survey does not differ significantly from the regular IIS sample with respect to total investment, number of employees, and revenues.

We merge data on average levels of investment, number of employees, and revenues reported in the regular IIS during the three years prior to the special survey. Panel B of Table A.2 shows summary statistics. The median firm employs 154 workers, has annual revenues of approximately € 29 million, and has annual investments of € 870,000.[14]

Households. We collect a sample of 4072 employed respondents (both self-employed and individuals in paid employment, both full-time and part-time) in December 2019 with the same panel provider as in the September 2020 survey. Again, respondents in the top and bottom percent of the response time are dropped, leaving us with 3992 observations. Panel B of Table 2 shows summary statistics of the sample and a comparison to benchmarks from the 2019 wave of the GSOEP. Our sample is roughly representative of the employed German population in terms of gender, age, region, and household income. As in the September 2020 wave, the average respondent is slightly more educated than the general population, as is common in online surveys.

3.2. Design of December 2019 surveys

Anchoring on current rate. While our September 2020 surveys explore how information about the current policy rate affects expectations, our December 2019 surveys examine how expert forecasts about future rates affect beliefs. Our goal is to understand whether—conditional on knowledge of current realizations—firms hold stronger priors about future realizations than households. All respondents are thus informed of the *current* policy rate of zero percent before receiving forecasts about future rates.

3.2.1. Design of firm survey

Information treatment. The firm survey starts with our information treatment on future interest rates.[15] The respondents are randomly assigned either into the "Increase 2020" arm or into the "Increase 2025" arm, which both provide the respondents with a truthful expert forecast about the point in time the ECB interest rate will increase back to a higher level. Respondents in the "Increase 2020" group are told that according to an expert who regularly participates in an expert survey of the ECB, the key interest rate of the ECB will rise to a higher level in the third quarter of 2020. This information is based on the forecast of a participant in the fourth quarter of 2019 wave of the ECB Survey of Professional Forecasters. Respondents in the "Increase 2025" group are told that according to an expert from a large German bank, the key interest rate of the ECB will rise to a higher level at the earliest in 2025.[16] Columns 5 and 6 of Table 1 Panel B in the Online Appendix show that the firm sample is balanced across these two arms according to key covariates.

Thus, respondents in the two arms receive information that differs in the timing the expert attaches to a rate hike. Our design therefore features an active control group, which has several advantages relative to designs that provide a subset of respondents with information and another subset (a passive control group) with no information (see Haaland et al., 2020, for a discussion). Most relevant in our setting, identification in alternative designs hinges on prior beliefs, which determine the expected direction and strength of the information treatment. We did not elicit priors, as the firm survey was administered in paper and pencil rather than as an online survey. While it is likely that most participants follow the natural order of the survey, respondents in principle would have been able to go back to their priors after receiving the treatment information. Hence, it would not have been possible to fully rule out that priors are confounded by the treatment.

Post-treatment beliefs. Then, respondents' expectations about inflation and aggregate unemployment are elicited at different horizons. The wording includes information about the current values of these rates, to hold constant these beliefs across firms and households. Next, the survey elicits perceptions about current and future credit access, interest rates on loans for firms similar to the respondent's firm, and firm-level outcomes such as product demand and employee wages. Respondents then report expectations about the year of a rate hike and the policy rate in 2022 and in 2025. Finally, respondents report how often they have heard news about the policy rate of the ECB over the last two weeks.

3.2.2. Design of household survey

Prior beliefs and information treatment. The household survey uses the same instructions as the firm survey whenever possible. Since the household survey was conducted as an online survey, it includes questions on priors about the timing of a rate hike and future rates before the information provision. The treatment is identical to the one in the firm survey. Columns 6 and 7 of Table 2 Panel B show that the sample is mostly balanced across arms according to key covariates.[17] Online Appendix D.2 shows exact instructions.

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[14] Panel B of Table A.2 in the Online Appendix compares the size distribution in our survey panel to the distribution of firms in administrative data.

[15] The treatment was displayed as the first item on the first page of the two-page survey, and then immediately followed by questions on macroeconomic expectations and background characteristics. Online Appendix D.1 presents the instructions of the firm survey.

[16] Source: https://www.diepresse.com/5702921.

[17] The prior expected year of a rate hike is 0.2 years higher in the "Increase 2025" arm, a statistically significant but economically small difference. To address any concerns, controls are included in all estimations.

Post-treatment beliefs. After the information provision, and after eliciting expectations about inflation and unemployment using identical questions as in the firm survey, the survey measures households' perceptions about their own credit access and borrowing rates now and in the future, separately for consumer credit and mortgages, as well as interest rates on their savings account. Then, respondents report posterior expectations about policy rates and their news acquisition about the ECB policy rate using the same questions as for firms. Finally, they report expectations about own labor market outcomes.

Follow-up. To examine the persistence of treatment effects, we conducted a follow-up survey about four weeks after the initial survey, in which no additional information is provided and in which people are not reminded of the initial information. The follow-up survey re-elicits some of the key outcome questions from the main survey. Online Appendix D.3 shows the instructions of the follow-up survey.

3.2.3. Coding of outcome variables

As in the September 2020 wave, we deal with outliers by trimming all quantitative point forecasts at thresholds that are common across firms and households. The thresholds are again chosen such that the two to four percent most extreme answers in the households sample are set to missing. This results in thresholds of 2030 for the year of a rate hike, of -1% and 5% for policy rates, of 0% and 5% for inflation, of 15% for unemployment, of 0% and 15% for own interest rates, and of -20% and 40% for income growth.[18] When point beliefs are included as controls, they are winsorized at these thresholds to keep the sample as large as possible. Online Appendix B.1 demonstrates that our findings are insensitive to alternative ways of treating outliers. Outcomes elicited on categorical scales are z-scored using the means and standard deviations in our samples.

3.3. Effects on expectations about policy rates

We examine the extent to which firms and households update their expectations about policy rates in response to the expert forecast. For this purpose, the following specification is estimated separately in the firm and in the household sample:

$$\text{posterior}_i = \alpha_0 + \alpha_1 \ \mathbb{1}(\text{Increase } 2020_i) + \Pi X_i + \varepsilon_i \tag{1}$$

where posterior_i are post-treatment beliefs on the trajectory of the ECB policy rate. The indicator $\mathbb{1}(\text{Increase } 2020_i)$ takes value one for respondents receiving the "Increase 2020" treatment and value zero for those receiving the "Increase 2025" treatment. X_i is a vector of controls included to address small imbalances and to increase statistical power for estimating treatment effects. The controls are described in detail in the table notes.

Given our active control group design, comparing respondents in the "Increase 2020" with those in the "Increase 2025" arm is informative about the average learning rate from the information. The coefficient estimate indicates the *differential* change in beliefs between those who received the 2020 and those who received the 2025 forecast. Scaling the treatment effect by the difference in signals – 4.5 years – gives the learning rate from the information. Since everyone is treated, no interaction term between the prior and the treatment dummy needs to be included to identify learning rates.

Panel A of Table 6 shows that households who receive the "Increase 2020" treatment think that a rate increase will happen 1.6 years earlier compared to those in the "Increase 2025" arm (Column 1, $p < 0.01$). The direct learning rate from the information is therefore given by $1.6/4.5 = 0.36$, which is in the range of estimates from other information provision experiments on macroeconomic expectations (Haaland et al., 2020). Moreover, households in the "Increase 2020" treatment think that the ECB policy rate will be 0.29 p.p. higher in 2022 (Column 2, $p < 0.01$) and 0.27 p.p. higher in 2025 (Column 3, $p < 0.01$). Households that are more confident in their priors respond less to the forecasts, consistent with Bayesian updating (see Panels A through C of Fig. 3). Online Appendix B.1 documents that changes in beliefs persist in the follow-up at about one third of the initial effect sizes, in line with typical estimates in the literature (Haaland et al., 2020). Online Appendix B.1 further demonstrates that updating about policy rates is reflected in changes in households' beliefs about other outcomes, such as real policy rates or the perceived probabilities of a rate hike, and that changes in beliefs are fairly uniform across different groups of households. Taken together, these findings highlight that households' expectations are quite responsive to the provision of expert forecasts, consistent with households having relatively weak priors about the ECB policy rate.

Panel B of Table 6 highlights that firms are substantially less responsive to expert forecasts. While firms change their expectations about the timing of the next rate increase by about half a year (Column 1, $p < 0.05$), they do not significantly adjust their expectations about the policy rate in 2022 and 2025 (Columns 2 and 3). This is consistent with firms having stronger priors about the ECB policy rate than households. The treatment effects on policy rate expectations differ significantly between firms and households ($p < 0.01$ for the expected year of a rate hike and policy rates in 2022 and $p < 0.05$ for 2025). Taken together, our fourth main finding can be summarized as follows:

Result 4. Firms update their policy rate expectations less in response to expert forecasts than households, in line with firms being better informed and holding stronger priors.

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[18] The thresholds for policy rates, inflation, and unemployment are lower than in the September 2020 wave because respondents were anchored on current realizations in the December 2019 survey.

Households: Heterogeneity with Respect to Confidence in Priors
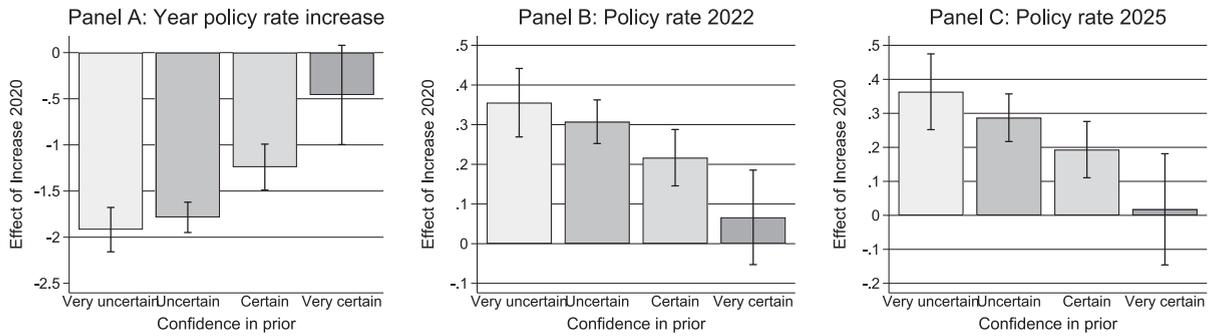
Households: Heterogeneity with Respect to News Consumption
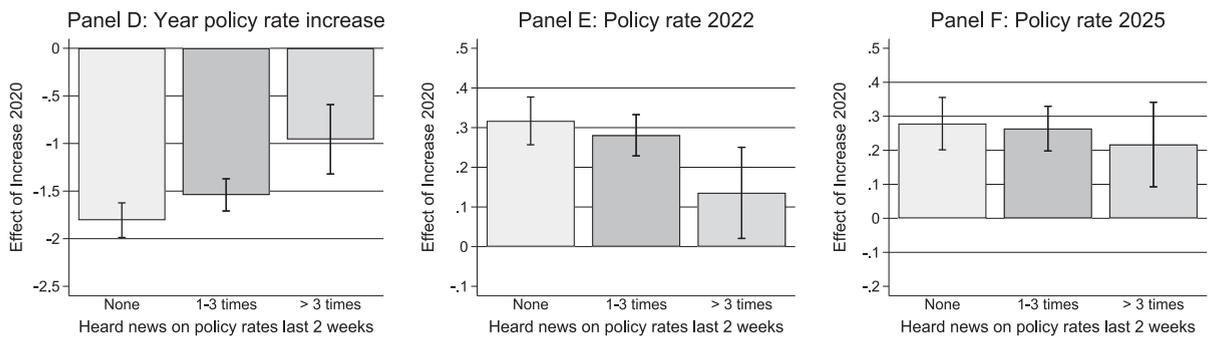
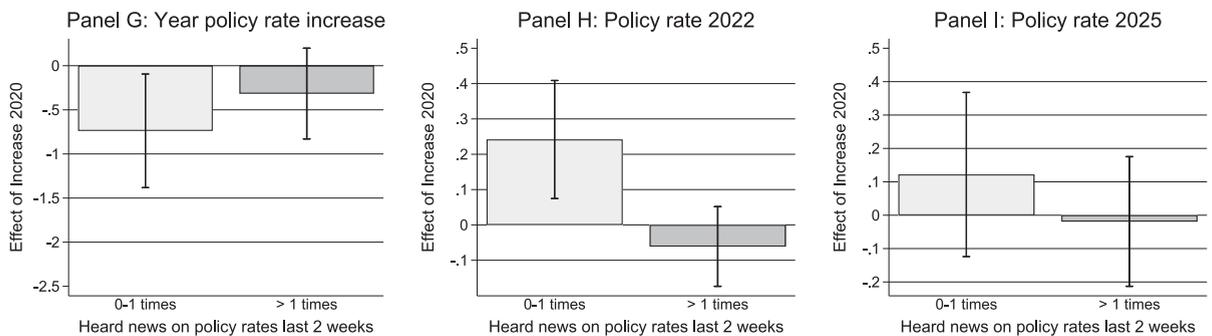## Firms: Heterogeneity with Respect to News Consumption

Fig. 3. Heterogeneity in learning from experts: 2019 survey. *Notes:* This Figure presents the estimated response of households' and firms' expectations regarding the year of the next policy rate increase (Panels A, D, and G), the policy rate in 2022 (Panels B, E, and H), and the policy rate in 2025 (Panels C, F, and I) to randomized information from an expert forecast predicting a policy rate increase in 2020 relative to respondents that received an expert forecast predicting an increase in 2025 at the earliest. The estimations are based on the German household survey (Panels A–F) and firm survey (Panels G–I) from December 2019. Panels A–C present separate estimations for respondents with different levels of confidence in their priors and Panels D–I estimate the effects separately for respondents with different levels of prior news consumption about the ECB policy rate. The regressions control for the same covariates as the regressions in Table 6. Confidence bounds are depicted at the 90% level.

Robustness. Belief updating experiments could be subject to numerical anchoring and experimenter demand effects (de Quidt et al., 2018). Our evidence is less prone to these issues for two reasons: First, policy rate expectations are elicited on a different scale than the scale on which the information is communicated (year of increase). Second, the persistence of households' belief changes suggests that at least part of the effects operate through genuine learning rather than numerical anchoring or demand effects. Moreover, Online Appendix B.1 demonstrates robustness of our main findings to alternative ways of treating extreme responses (different cutoffs, winsorizing vs. trimming, Huber regressions) and to excluding controls.

Mechanisms. In sticky information models, information frictions arise from infrequent updating of information sets by economic agents. For instance, in the epidemiological model by Carroll (2003), agents that acquire macroeconomic information more often will be more likely to have already incorporated the latest macroeconomic news into their beliefs and hold

Table 6
Learning from experts' policy rate forecasts among households and firms: 2019 survey.

	Year policy rate increase	Policy rate 2022	Policy rate 2025	Mortgage rate 2022	Consumer loan rate 2022	Savings account rate 2022	Mortgage access 2022	Consumer loan access 2022
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Households								
Increase 2020 (A)	−1.612***	0.287***	0.266***	0.180***	0.145***	0.127***	−0.043**	−0.046**
	(0.072)	(0.023)	(0.029)	(0.040)	(0.044)	(0.020)	(0.017)	(0.019)
Observations	3758	3896	3828	3859	3864	3818	3992	3992
R^2	0.46	0.40	0.46	0.83	0.80	0.65	0.70	0.63
Mean dep. variable	2023.32	0.63	1.22	4.05	4.63	0.62	−0.00	0.00
SD dep. variable	2.93	0.92	1.22	3.04	3.08	1.03	1.00	1.00

	Year policy rate increase	Policy rate 2022	Policy rate 2025	Firm loan rate 2022	Firm loan access 2022
	(1)	(2)	(3)	(4)	(5)
Panel B: Firms					
Increase 2020 (B)	−0.521**	0.040	0.025	−0.023	−0.064
	(0.251)	(0.057)	(0.094)	(0.071)	(0.058)
Observations	383	415	413	436	441
R^2	0.03	0.04	0.05	0.85	0.63
Mean dep. variable	2023.47	0.26	0.95	2.80	0.00
SD dep. variable	2.44	0.59	0.95	1.87	1.00
p-value(A = B)	0.000	0.000	0.014		

Notes: This Table examines the effect of the randomized information provision on posterior expectations of households (Panel A) and firms (Panel B) based on the German firm and household surveys of December 2019. "Increase 2020" is a dummy variable taking value one if the respondent received the forecast predicting a policy rate increase in 2020, and zero if the respondent received the forecast predicting an increase in 2025 at the earliest. The outcomes in Panel A Columns 7 and 8 and Panel B Column 5 are z-scored using the mean and the standard deviation in the corresponding sample. The regressions on the household sample control for respondents' prior beliefs about policy rates and confidence in these beliefs, perceptions of the respondents' access to and rates faced on mortgages, consumer loans, and savings accounts, gender, age, educational attainment, employment status, household income and net wealth, homeownership, stock ownership, household size, living in East Germany, numeracy, risk aversion, patience, being the financially knowledgeable person or main earner in the household, and perceptions of exposure to macroeconomic risk. The regressions on the firm sample control for firms' perceptions of access to and rates faced on loans, location in East Germany, and firms' total investment, number of employees, and revenues (all in logs) stated in the regular ifo Investment Survey. Robust standard errors are displayed in parentheses. * denotes significance at 10 pct., ** at 5 pct., and *** at 1 pct. level.

stronger priors. Accordingly, respondents with higher levels of macroeconomic news consumption should be less responsive to our information treatments. To study directly the frequency of updating, we ask respondents how often they have heard news about the ECB policy rate over the two weeks before the survey. As shown in Panel A of Fig. 4, more than 80% of firms heard news about the policy rate at least once, and more than 60% at least twice. Among households, the numbers are smaller at 56% and 33%. Moreover, households' learning rates about the year of a rate hike and policy rates in 2022 and 2025 decrease in the level of prior news consumption (Panels D through F of Fig. 3). The patterns are similar but more noisily measured in the smaller firm sample (Panels G through I). Taken together, these results i) provide direct evidence of stronger information frictions among households than among firms, and ii) suggest that differences in learning rates across groups at least partially reflect differences in how much information was acquired prior to the survey.

Another potential driver of differences in learning rates between firms and households could be differential trust in expert forecasts. Panel B of Fig. 4 shows that firms have somewhat lower levels of trust in the economic forecasts of experts than households. Thus, it is conceivable that differences in trust explain some of the differences in learning rates between firms and households.

3.4. Effects on expectations about own interest rates

Do firms and households extrapolate from expert forecasts about policy rates to expectations about own rates and credit access? Columns 4 through 6 of Table 6 Panel A show that respondents in the household sample who receive the "Increase 2020" treatment expect a 0.18 p.p. higher mortgage rate in 2022 ($p < 0.01$), a 0.15 p.p. higher rate on consumer loans ($p < 0.01$) and a 0.13 p.p. higher rate on savings accounts ($p < 0.01$) compared to individuals in the "Increase 2025" arm. Respondents who receive the "Increase 2020" treatment also report a 0.043 standard deviation more difficult expected access to mortgages (Column 7, $p < 0.05$) and a 0.046 standard deviation more difficult expected access to consumer loans (Column 8, $p < 0.05$). Online Appendix B.1 demonstrates that changes in expected own credit access and rates persist in the follow-up survey and that households significantly adjust their expectations about real own interest rates, and examine heterogeneity in updating of own credit access and rates across groups.

In contrast to the household results, Columns 4 and 5 of Table 6 Panel B show that the information treatment has no significant effects on firms' expected rates and credit access. Due to the weak updating about policy rates among firms, our estimates are not informative about firms' perceived elasticity of own credit market outcomes to changes in policy
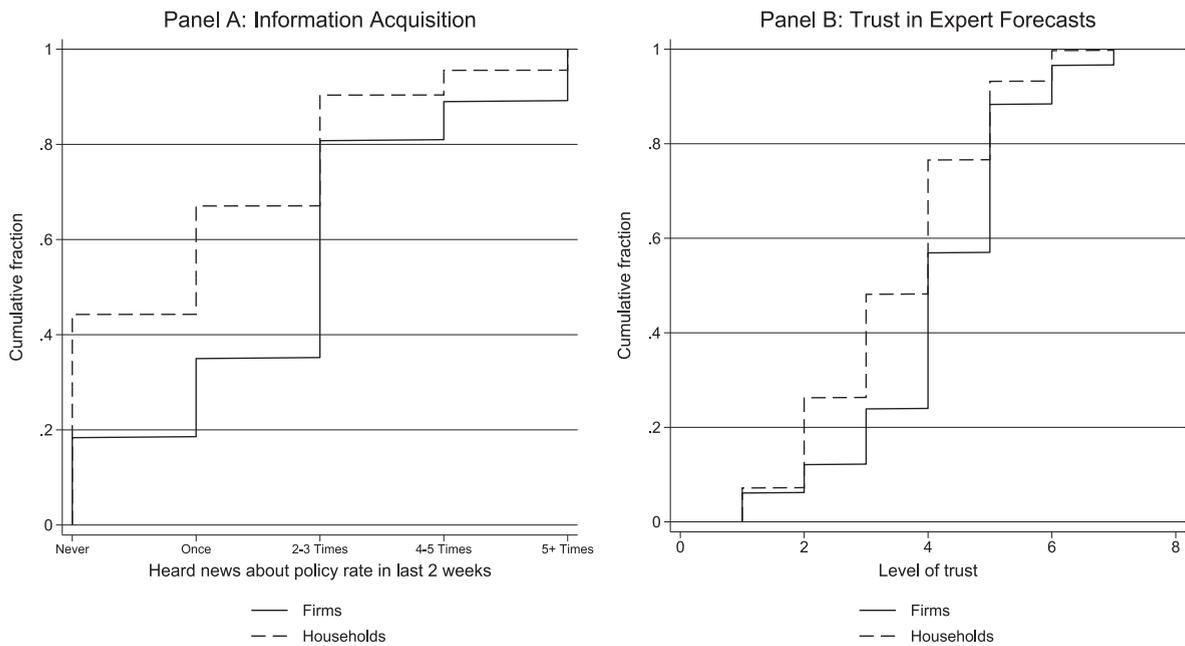
Fig. 4. Information acquisition about policy rate and trust in expert forecasts. *Notes:* Panel A shows the cumulative distribution function of information acquisition about the ECB policy rate from the German surveys of December 2019 in the firm and household samples. The figure shows the responses to the question: "How often have news about the policy rate of the European Central Bank (ECB) come to your attention in the last two weeks?". Respondents answered on the following scale: Never - Once - Between 2 and 3 times - Between 4 and 5 times - More than 5 times. Panel B shows the cumulative distribution function of trust in economic forecasts of experts as measured in the German surveys of September 2020 in the firm and household samples. The figure shows responses to the question: "How much trust do you have in the economic forecasts of experts?" Respondents answered on a scale ranging from [1] "no trust at all" to [7] "very high trust". The Figure displays these distributions separately for households and firms.

rates. However, overall the lack of an effect on firms' expectations is again in line with firms holding stronger priors than households about policy rates and potentially own credit market outcomes. Taken together, our fifth main finding is the following:

Result 5. Households extrapolate from information about the timing of a policy rate hike to future own credit market outcomes, while firms do not adjust these expectations.

Online Appendix B.2 shows that our information provision has no systematic effects on firms' or households' expectations about other own economic outcomes or other macroeconomic variables, such as inflation and the unemployment rate.

4. Conclusion and implications

Using survey data from Germany, we document five facts suggesting that information frictions are more pronounced among households than among firms. First, firms' expectations about the central bank policy rate, inflation, and aggregate unemployment are more aligned with expert forecasts and less dispersed than households'. Second, the extent of belief dispersion differs substantially less across different groups of firms than across different groups of households. Third, differences in information about current realizations of macroeconomic variables are driving a large part of the differences in expectations between firms and households. Fourth, firms update their policy rate expectations less than households when provided with an expert forecast, consistent with higher levels of news consumption before the survey and stronger prior beliefs. Fifth, while households significantly change their expectations about own credit market outcomes, firms do not adjust these expectations.

A joint explanation for many of the patterns documented in this paper is that information frictions are more pronounced among households than among firms. In Calvo-style sticky information models, a lower frequency of updating information sets will lead to a higher degree of stickiness of beliefs among households than among firms. Similarly, in rational inattention models, receiving noisier signals about the state of the economy will make households less responsive to macroeconomic news than firms (e.g., see Maćkowiak and Wiederholt, 2015; 2021). The differential responsiveness to news will also have implications for the transmission of policies (Paciello and Wiederholt, 2014). Specifically, households will learn more slowly about changes in policies than firms, which will make policy announcements less effective in changing households' beliefs. A practical implication is that ignoring information frictions in macroeconomic modeling is likely to lead to erroneous conclusions, and more so among households than among firms. Similarly, professional forecasts are a poor proxy for agents' expectations, especially for households'.

Moreover, we document that information frictions vary strongly across different types of households, and are particularly pronounced among those facing financial constraints. This is consistent with a key prediction of rational inattention models (Maćkowiak and Wiederholt, 2021): if a household's optimal decision is less responsive to a particular piece of information, this household will be less attentive to this information. Since financially constrained individuals likely exhibit hand-to-mouth consumption behavior, their optimal decisions do not depend on their expectations about future macroeconomic developments. Thus, they have less incentive to pay attention to the macroeconomy, and information frictions will be more pronounced among this group. Similarly, our finding that information frictions are stronger among those with lower cognitive skills suggests that higher costs of information acquisition and processing make households less attentive to the macroeconomy – in line with another prediction of rational inattention models.

When information frictions are concentrated among households with financial constraints, this will dampen the overall equilibrium impact of information frictions on household decisions, macroeconomic dynamics and the transmission of policies. Thus, the covariance between information frictions and the elasticity of households' optimal decisions to their expectations about the future could be a key moment for heterogeneous agent models, similar to the covariance between workers' marginal propensity to consume and their exposure to aggregate fluctuations (Patterson, 2022).

Data availability

The data that has been used is confidential.

Supplementary material

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jmoneco.2023.01.005.

References

Andre, P., Haaland, I., Roth, C., Wohlfart, J., 2022a. Narratives about the Macroeconomy. CEPR Discussion Paper 17305.
Andre, P., Pizzinelli, C., Roth, C., Wohlfart, J., 2022b. Subjective models of the macroeconomy: evidence from experts and a representative sample. Rev. Econ. Stud. 89 (6), 2958–2991.
Angeletos, G.-M., Lian, C., 2018. Forward guidance without common knowledge. Am. Econ. Rev. 108 (9), 2477–2512.
Bachmann, R., Born, B., Elstner, S., Grimme, C., 2019. Time-varying business volatility and the price setting of firms. J. Monet. Econ. 101, 82–99.
Bachmann, R., Elstner, S., Hristov, A., 2017. Surprise, surprise–measuring firm-level investment innovations. J. Econ. Dyn. Control 83, 107–148.
Bachmann, R., Elstner, S., Sims, E.R., 2013. Uncertainty and economic activity: evidence from business survey data. Am. Econ. J. 5 (2), 217–249.
Bachmann, R., Zorn, P., 2020. What drives aggregate investment? Evidence from German survey data. J. Econ. Dyn. Control 103873.
Ball, L., Mankiw, N.G., Reis, R., 2005. Monetary policy for inattentive economies. J. Monet. Econ. 52 (4), 703–725.
Balleer, A., Link, S., Menkhoff, M., Zorn, P., 2023. Demand or supply? Price adjustment heterogeneity during the COVID-19 pandemic. Int. J. Cent. Bank..
Bruine de Bruin, W., Van der Klaauw, W., Topa, J., Downs, J.S., Fischhoff, B., Armantier, O., 2012. The effect of question wording on consumers' reported inflation expectations. J. Econ. Psychol. 33 (4), 749–757.
Buchheim, L., Dovern, J., Krolage, C., Link, S., 2022. Sentiment and firm behavior during the COVID-19 pandemic. J. Econ. Behav. Organ. 195, 186–198.
Candia, B., Coibion, O., Gorodnichenko, Y., 2021. The Inflation Expectations of US Firms: Evidence from a New Survey. NBER Working Paper 28836.
Carroll, C.D., 2003. Macroeconomic expectations of households and professional forecasters. Q. J. Econ. 118 (1), 269–298.
Coibion, O., Georgarakos, D., Gorodnichenko, Y., Weber, M., 2020a. Forward Guidance and Household Expectations. NBER Working Paper No. 26778.
Coibion, O., Gorodnichenko, Y., 2012. What can survey forecasts tell us about information rigidities? J. Polit. Econ. 120 (1), 116–159.
Coibion, O., Gorodnichenko, Y., Kumar, S., 2018. How do firms form their expectations? New survey evidence. Am. Econ. Rev. 108 (9), 2671–2713.
Coibion, O., Gorodnichenko, Y., Kumar, S., Pedemonte, M., 2020. Inflation expectations as a policy tool? J. Int. Econ. 124, 103297.
Coibion, O., Gorodnichenko, Y., Weber, M., 2022. Monetary policy communications and their effects on household inflation expectations. J. Polit. Econ. 130 (6), 1537–1584.
d'Acunto, F., Hoang, D., Paloviita, M., Weber, M., 2019. IQ, Expectations, and Choice. NBER Working Paper No. 25496.
d'Acunto, F., Hoang, D., Paloviita, M., Weber, M., 2021. Human Frictions to the Transmission of Economic Policy. Working Paper.
d'Acunto, F., Malmendier, U., Weber, M., 2021. Gender roles and the gender expectations gap. Proc. Natl. Acad. Sci. 118 (21), 1–10.
Enders, Z., Hünnekes, F., Müller, G.J., 2019. Monetary policy announcements and expectations: evidence from German firms. J. Monet. Econ. 108, 45–63.
Fuster, A., Perez-Truglia, R., Wiederholt, M., Zafar, B., 2022. Expectations with endogenous information acquisition: an experimental investigation. Rev. Econ. Stat. 104 (5), 1059–1078.
Giglio, S., Maggiori, M., Stroebel, J., Utkus, S., 2021. Five facts about beliefs and portfolios. Am. Econ. Rev. 111 (5), 1481–1522.
Haaland, I., Roth, C., Wohlfart, J., 2023. Designing information provision experiments. J. Econ. Lit.. www.aeaweb.org/articles?id=10.1257/jel.20211658.
Hiersemenzel, M., Sauer, S., Wohlrabe, K., 2022. On the Representativeness of the ifo Business Survey. CESifo Working Paper No. 9863.
Kim, G., Binder, C., 2020. Learning-Through-Survey in Inflation Expectations. Available at SSRN 3790834.
Link, S., 2022. The Price and Employment Response of Firms to the Introduction of Minimum Wages. IZA Discussion Paper No. 15701.
Maćkowiak, B., Wiederholt, M., 2015. Business cycle dynamics under rational inattention. Rev. Econ. Stud. 82 (4), 1502–1532.
Maćkowiak, B., Wiederholt, M., 2021. Rational Inattention and the Business Cycle Effects of Productivity and News Shocks. CEPR Discussion Paper No. 16812.
Mankiw, N.G., Reis, R., 2002. Sticky information versus sticky prices: a proposal to replace the new keynesian phillips curve. Q. J. Econ. 117 (4), 1295–1328.
Mikosch, H., Roth, C., Sarferaz, S., Wohlfart, J., 2021. Uncertainty and Information Acquisition: Evidence from Firms and Households. Available at SSRN.
Paciello, L., Wiederholt, M., 2014. Exogenous information, endogenous information, and optimal monetary policy. Rev. Econ. Stud. 81 (1), 356–388.
Patterson, C., 2022. The Matching Multiplier and the Amplification of Recessions. Unpublished Manuscript. Northwestern University.
de Quidt, J., Haushofer, J., Roth, C., 2018. Measuring and bounding experimenter demand. Am. Econ. Rev. 108 (11), 3266–3302.
Reis, R., 2006. Inattentive consumers. J. Monet. Econ. 53 (8), 1761–1800.
Roth, C., Wiederholt, M., Wohlfart, J., 2022. The Effects of Monetary Policy: Theory with Measured Expectations. ECONtribute Discussion Paper 126/2021.
Sauer, S., Wohlrabe, K., 2019. CEO or intern-who actually answers the questionnaires in the ifo business survey? CESifo Forum 20 (2), 29–31.
Sauer, S., Wohlrabe, K., 2020. ifo Handbuch der Konjunkturumfragen, 88. ifo Beiträge zur Wirtschaftsforschung.
Savignac, F., Gautier, E., Gorodnichenko, Y., Coibion, O., 2021. Firms' Inflation Expectations: New Evidence from France. National Bureau of Economic Research Working Paper 29376.
Sims, C.A., 2003. Implications of rational inattention. J. Monet. Econ. 50 (3), 665–690.