The pass-through from inflation perceptions to inflation expectations

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PRELIMINARY DRAFT

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Abstract

After decades of stable prices, central bankers face the crucial challenge of keeping inflation and inflation expectations contained. We document a strong relationship between households' perceptions about average inflation over the past 12 months and households' short- and long-term expectations about future inflation. This relationship is strong during high-inflation environments but even stronger during low-inflation environments. The strength of the pass-through from perceptions to expectations varies across socioeconomic groups. We find two critical moderating factors for this heterogeneity: differential information sources used to form inflation perceptions and differences in individual uncertainty about future inflation. When assessing average inflation over the last 12 months, most households rely on their shopping experience (and pay particular attention to food and fuel prices) rather than the information they have heard or read. Our results suggest that in seeking to manage inflation expectations, central bankers could beneficially spend further effort in managing inflation perceptions.

Keywords: Expectations, perceptions, inflation, uncertainty, household survey, monetary policy, household finance.

JEL Classifications: D10, D84, D90, E31, E52, G40, G50.

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1   Introduction

"Perception precedes reality." (Andy Warhol)

After decades of low inflation in the developed world, inflation has been increasing significantly over the past months in many countries. Various reasons are cited for this change, including; supply shortages, the Ukraine-Russian war, and stronger demand due to exceptional high savings accumulated by households during the Covid-19 pandemic. Academics and central bankers alike emphasize the critical role of inflation expectations for actual inflation (Fiore et al., 2022).[1] Already in the time of the effective lower bound, managing inflation expectations was seen as one of the few ways to influence inflation. Nowadays, in times of high inflation rates, central banks globally aim to "anchor" and manage inflation expectations through communication. However, it is still a perennial question of whether and how households' expectations react to communication and more generally, how households form their inflation expectations.[2]

The existing research focuses primarily on expectation biases and heterogeneity based on socioeconomic characteristics (Arioli et al. (2017); Del Giovane et al. (2008)). The literature documents non-rationality, substantial forecast errors (Binder (2017); Cavallo et al. (2017)), high disagreement, and the influence of personal experiences (Angelico and Di Giacomo (2019); Malmendier et al. (2021)). This paper aims to investigate what role inflation perceptions play in the expectation formation process. If households rely heavily on their own perception of the past developments of prices, managing perceptions may be a way to influence expectations. The influence of perceptions about the development of inflation in the past on inflation expectations has attracted less attention in the literature. Only a handful of papers investigate the differences and similarities between household's perceived and expected (twelve months ahead) inflation (D'Acunto et al. (2021a) and Cavallo et al.

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[1]In 2020, current ECB-president Christine Lagarde stated that "for the actual process of setting wages and prices, it is the expectations of the public that matter most." Duca-Radu et al. (2021) exploit a large multi-country micro dataset for the euro area (EA) economies and find that European consumers increase their readiness to spend when they anticipate an increase in inflation.

[2]See for example Fed Chairwoman Janet Yellen (2016) speech: "Perhaps most importantly, we need to know more about the manner in which inflation expectations are formed and how monetary policy influences them". ECB Vice-President Vitor Constancio (2017) has expressed a similar view: "For policy-makers, this [recent research] seems to suggest that there is an important role of the central bank in shaping the expectations of the general public, not only that of financial markets. It also suggests that more research is needed to understand the different factors that shape the inflation expectations of individual households."

(2017) for the US, Arioli et al. (2017) for the EU, Bosch et al. (2015) for South Africa). Using Swedish data, Jonung (1981) and Dräger (2015) specifically look at the relationship between perceptions and expectations.

In this paper, we follow the latter two papers and investigate the relationship between perceptions and expectations. We use micro-data from the Bundesbank Online Panel Households (BOP-HH) on individuals in Germany. This survey contains rich data on inflation perceptions and various measures for short- and long-term inflation expectations. The panel dimension allows studying how the within-person variation in inflation perceptions feeds into expectations.

This paper contributes to the literature on inflation expectation formation by highlighting four results. First, we establish a strong positive and significant correlation between inflation perceptions and short-term inflation expectations (next 12 months), as well as long-term inflation expectations (5 and 10 years ahead).[3] Second, we show that the pass-through from inflation perceptions to short-term expectations is quantitatively important in periods of high inflation (after July 2021), and even stronger during periods of low inflation (before July 20221). Third, this paper finds heterogeneity in the strength of the pass-through—the strength differs across socioeconomic groups. Women, residents of East Germany, the employed, and individuals younger than 60 years old rely to a larger extent on their inflation perceptions when forming inflation expectations than other groups.

Fourth, this paper investigates the underlying reasons for this heterogeneity in the strength of the pass-through among socioeconomic groups. We discover that a large part is explained by varying usage of information sources to form inflation perceptions and by individuals' uncertainty about future inflation. We find that individual uncertainty about future inflation affects the pass-through from perceptions to short-term expectations. Households with very low and very high uncertainty rely more on inflation perceptions when forming inflation expectations—than households with intermediate levels of uncertainty. By adding unique questions to the BOP-HH survey, we are able to explore how individuals form inflation perceptions about past inflation. We find that the prices of frequently bought products (especially food and fuel) are at the forefront of respondents' minds when assessing average inflation

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[3]A one percentage point increase in inflation perceptions is associated with an approx. 0.8 pp increase in short-term inflation expectations—independent of the model specification considered. The direct effect of inflation perceptions on long-term expectations is smaller in magnitude but remains quantitatively meaningful. This result is robust to the inclusion of various controls and the use of different model specifications.

over the last 12 months. More generally, we find that while half of the respondents have heard or read about inflation over the last months, the overwhelming majority (89%) based their inflation perceptions on their shopping experience.

In summary, this paper shows that perceived inflation plays a crucial role in forming inflation expectations. Information acquisition and uncertainty are essential determinants of the strength of this relationship. Our findings are relevant for policy. They suggest that in seeking to manage and anchor inflation expectations, central bankers could beneficially spend further effort in monitoring, understanding, and managing inflation perceptions. However, our evidence suggests that a large majority of households might be hard to reach as their own shopping experience (or at least a subjective assessment of the price development in the past) is the key determinant for inflation perceptions. This leads us to conclude that the current inflation environment provides severe risks for a persistent de-anchoring of households' inflation expectations from the inflation target. Our results also have implications for the literature on expectation formation. They indicate that researchers should pay (more) attention to how certain factors influence expectations through perceptions.

The reminder of this paper is organized as follows. Section 2 discusses the related literature. Section 3 describes the data. Section 4 summarizes our main results. Section 5 investigates the mediating factors for the heterogeneity in the pass-through among different socio-economic groups. Finally, Section 6 discusses the policy implications of our findings, and concludes.

2   Literature review

Our paper contributes in particular to the small but growing literature studying the perception–expectation link. The seminal paper Jonung (1981) documents a positive correlation between perceived and expected short-term inflation. Dräger (2015) find a strong association between perceived, expected, and actual inflation. A positive shock to actual inflation increases both perceptions and short-term expectations. Moreover, expectations react more to the changes in perceptions than to the changes in actual inflation. High co-movement between actual inflation and perceptions and short-term expectations is also found by (Arioli et al., 2017). D'Acunto et al. (2021a) confirm a strong correlation between perceptions and short-term expectations. D'Acunto et al. (2021a) find that the mapping from inflation perceptions

to inflation expectations is identical for both genders. The last finding contrasts with Bosch et al. (2015), who document that differences in perceptions between women and men do not feed through to their expectations.

Our contribution to this literature is twofold. First, we provide novel evidence that perceptions do not only affect short-term but also drive long-term inflation expectations (five and ten years ahead). Second, we investigate why and how perceptions matter for inflation expectations of households. We provide evidence that the strength of the perception–expectation link is driven by two channels: individual uncertainty about future inflation and by the type of information used to form perceptions. We provide explicit evidence that households' inflation experiences (e.g., shopping) drive their perceptions. Inflation expectations are extrapolated from these inflation perceptions.

More generally, our paper contributes to the large literature investigating inflation perceptions or/and expectations of households. Numerous studies find an upward bias in both perceptions and expectations (Del Giovane et al., 2008; Jonung, 1981) and substantial heterogeneity in households' inflation perceptions and expectations (Arioli et al., 2017; Del Giovane et al., 2008; Jonung, 1981). In particular, socio-economic characteristics such as gender, employment status, education, and income are important for the size of the bias. Also, uncertainty significantly affects the bias in both inflation perceptions and expectations (Reiche and Meyler, 2022). Our paper contributes to the field by documenting novel socio-economic determinants of inflation perceptions and expectations biases.

Part of this literature digs deeper and explores potential reasons for the heterogeneity in inflation perceptions and/or expectations biases among socioeconomic groups. Personal inflation experiences, in particular frequent and salient, matter for inflation expectations (Angelico and Di Giacomo, 2019; Malmendier et al., 2021). Higher exposure to grocery prices has also been shown to increase the upward bias in inflation expectations (D'Acunto et al., 2021b). Personal inflation rates vary between households. In particular, lower-income families experience higher inflation (Kaplan and Schulhofer-Wohl, 2017). The upward bias in inflation perceptions and expectations might be partly explained by objectively higher personal inflation rates for some socio-economic groups. Besides, financial literacy influences the accuracy of inflation forecasts (Bruine de Bruin et al., 2010; Burke and Manz, 2014). Binder (2017) finds that higher uncertainty is associated with more significant errors in

inflation expectations and that uncertainty varies among socio-economic groups.

In addition, our paper contributes to the literature investigating the role of information about inflation to explain the observed heterogeneity in inflation perceptions and/or expectations. Many studies find information rigidities (Coibion and Gorodnichenko, 2012, 2015; Dovern et al., 2015). Lein and Maag (2011) estimate that less than 20% of the respondents update their perceptions within a quarter. Moreover, there is heterogeneity in the updating. Many studies focus on the effect of information provision on inflation expectations. Exposure to news has been shown to improve the quality of perceptions and expectations, increase confidence, and reduce dispersion (Lamla and Vinogradov, 2019). In contrast, Fuster et al. (2018) shows that lowering the cost of information does not reduce heterogeneity in beliefs because individuals choose to acquire different pieces of information. This paper also finds that numeracy and prior uncertainty are essential at each stage of the expectation formation process. Finally, simpler and more accessible central bank communication tends to be more effective in influencing participants' forecasts (Kryvtsov and Petersen, 2021). To our knowledge, only one paper (Conrad et al., 2021) studies the role of information on both inflation perceptions and inflation expectations. The authors find that the (indirect) effect of information about monetary policy on short-term expectations works through inflation perceptions.

3   Data

For our paper we use micro-data from the Bundesbank Online Panel Households (BOP-HH) on individuals in Germany. The survey collects monthly data on individuals' expectations regarding a large variety of economic indicators, among them inflation.[4] We use data from all 30 waves of the survey, spanning a period from April 2019 to June 2019 and April 2020 to June 2022. In total, more than 49,000 individuals participated in the survey, some of them several times, yielding around 108,000 observations. Given that not all questions we need for our analysis are asked to all respondents in all waves, our estimation sample reduces to 54,000 observations.

The goal of the paper is to study the link between inflation perceptions and inflation expectations of consumers. The BOP-HH survey is particularly suited for

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[4]The respondents are randomly selected from an online panel of individuals who are 16 years or older with internet access. Representativeness of the sample is achieved by weighting. At least 2,000 respondents participate in the survey every month. For details on the methodology see Beckmann and Schmidt (2020).

our analysis for several reasons:

First, it not only contains several measures of inflation expectations (qualitative, quantitative, probabilistic)[5], but also a measure of inflation perceptions, which appears in the survey on a quarterly basis. In particular, respondents are asked the following question about their perceptions "What do you think the rate of inflation or deflation in Germany was over the past twelve months?" and the corresponding quantitative inflation expectations question: "What do you think the rate of inflation or deflation in Germany will be over the next twelve months?".

Second, the BOP-HH has a a panel dimension, which allows us to study the relationship between inflation perceptions and expectations taking into account fixed unobserved individual characteristics. Third, the survey offers a wide variety of socio-economic characteristics of each respondent (gender, region of residence, age, employment status, income, education, etc).

We enrich the survey data with aggregate information and collect monthly CPI indices; the overall Harmonized Index of Consumer Prices, the CPI on energy, the CPI excluding food and energy, and the CPI on net rent.[6]

Construction of the key variables

The key variables of interest are the perceptions about the inflation rate in the past twelve months, the short-term inflation expectations for the next twelve months, and the long-term expectations for the next five/ten years. We take the responses from the questions listed in Appendix A, and correct the measures for outliers. To be more precise, observations with inflation expectations and perceptions greater than 30 or lower than -5 percent are excluded from the analysis.

To measure uncertainty about future inflation at the individual level, we use the probabilistic inflation expectation question. Respondents have to assign a probability to ten distinct intervals of inflation. We compute the variance. We use this uncertainty indicator to study the effect of individual inflation uncertainty on the

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[5]The survey includes several measures for inflation expectations. First, respondents report if they expect inflation or deflation in the next twelve months. Second, BOP-HH asks consumers about the development of the inflation rate over the next twelve months on a scale from "decrease significantly" to "increase significantly". Third, respondents report point inflation forecast over the next twelve months. Fourth, respondents are asked to assign probabilities to pre-determined intervals of inflation. There is also a quantitative measure of the long-term inflation expectations (5 and 10 years ahead). The exact wording of the survey questions is presented in Appendix A.

[6]These indices are taken from the Germany Federal Statistical Office, and presented in Appendix Table B1; the indicators reflect inflation relative to the same month of the previous year.

pass-through from inflation perceptions to expectations.

To study potential differences in information acquisition between individuals, we contributed three questions to wave 17 (July 2021) of the BOP-HH survey. The first question asks consumers to state how the prices for the 9 main categories of goods and services changed over the past 12 months. The scale for this question consists of 5 categories from "decreased significantly" to "increased significantly". The second question is a follow-up question that picks up the previous answer on respondents' perception of the development of prices for essential goods over the last 12 months. The question then asks households whether they based this assessment more on their own shopping experience or more on things they have heard or read (e.g., media). The last question asks if consumers obtained any information about inflation recently. The exact wording of the added information questions is provided in Section 5 and Appendix A.

To further understand how households form their perceptions of inflation over the past twelve months, we contributed a question to wave 28 (April 2022) of the BOP-HH survey. This question is a follow-up question that picks up the previous answer on respondents' perception of the inflation/deflation rate over the past twelve months. The follow-up question provides nine potential factors respondents might have used to form perceptions. The respondents are asked to rate the importance of each factor for their previously given point estimate of inflation perceptions. Lastly, we provide an open input field to allow respondents to add any additional factor they consider essential (see Appendix A for the exact wording of the survey question).

Appendix B provides descriptive and summary statistics of the variables used in this paper; see Appendix Tables B1 and B2.

4   The Perception-Expectation Link

Figure 4.1 displays the time series of inflation perceptions and short-term inflation expectations. Inflation expectations exceed perceptions in all waves. It is striking how closely perceptions and expectations move together; the time series look very similar.[7]

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[7]Appendix Table B1 reports summary statistics for these variables, as well as for long-term inflation expectations over the next 5 and 10 years. Appendix Figure B1 shows the time series of median inflation perceptions and median short-term expectations. Appendix Figure B3 displays the sample distribution for the key variables of interest: inflation perceptions over the last 12 months, short-term inflation expectations over the next 12 months, and long-term inflation expectations
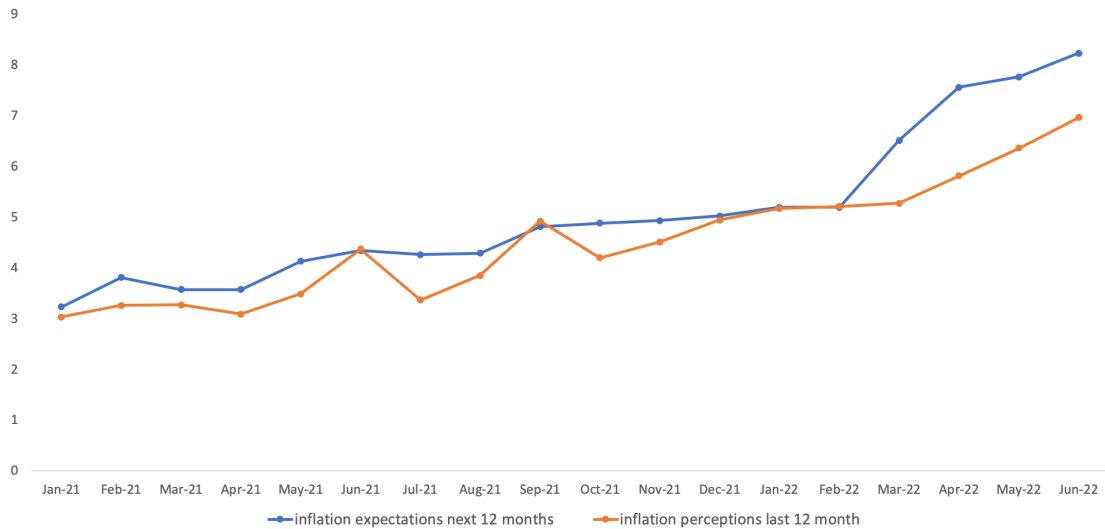
Figure 4.1: Dynamics of mean inflation expectations and perceptions

Sources: Bundesbank Online Panel households (BOP-HH). Expectations and perceptions: Weighted means, observations truncated to interval [-5;+30].

4.1 Short-term Inflation Expectations

To analyze the impact of households' inflation perceptions on households' expectations, we estimate the following baseline model by OLS (ordinary least square):

$$\mathbb{E}\left(\pi_{i,t\to t+12}\right) = \beta_0 + \beta_1' X_{i,t} + \beta_2 \tilde{P}_{i,t} + F_t + \varepsilon_{i,t} \tag{4.1}$$

where $\mathbb{E}\left(\pi_{i,t\to t+12}\right)$ denotes the inflation rate household i surveyed in wave t expects for the next 12 months; measured in percentage points. $X_{i,t}$ denotes a vector of controls for individual i, which varies with the specification considered. In the baseline specification, the individual characteristics included are gender, age, age squared, household income deciles, educational attainment, employment status, and a dummy for residence in East Germany. The East dummy absorbs unobserved time-invariant differences between East and West Germany. $\tilde{P}_{i,t}$ is our variable of interest, household's i perceived average inflation rate over the last 12 months; measured in percentage points. F_t denotes the survey-wave fixed effects to control for systematic time trends. The error term is denoted by $\varepsilon_{i,t}$. The results presented throughout the paper use the Eicker-Huber-White (EHW) method to estimate standard errors,

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over the next 5 and next 10 years. For each of these variables, Appendix Figure B4 shows the disagreement among the respondents (measured by the standard deviation) for each survey wave. Finally, Appendix Figure B5 shows the distribution of households' perception errors (i.e., the difference between inflation perceptions and actual overall CPI inflation).

but are robust to using clustered standard errors at the the individual level instead.

Columns 1-4 of Table 4.1 report the estimation results. We find a significant positive relationship ($p < 0.001$) between households' expected short-term inflation over the next 12 months and households' perceived inflation over the last 12 months. Adding sequentially our control variables does not change this result; the size and significance level of this relationship remains unchanged (Cols 1–4).[8] A one percentage point increase in households' perceptions is associated with a 0.81-pp increase in expected short-term inflation (Col. 4). This effect is quantitatively large.

In the second specification, we exploit the panel dimension of our data and estimate the model (4.1) using a fixed-effects as well a random-effects regressions. The panel dimension allows studying how the within-person variation in inflation perceptions feeds into expectations, and thus provides stronger evidence for a causal relationship. In addition, we conduct a change–on–change panel regression.[9] Column 5–7 of Table 4.1 show the estimation results. The panel regressions confirm that inflation perceptions have a positive, sizable, and statistically significant impact on short-term inflation expectations.

Result 1 (Inflation Perceptions and Short-term Expectations.). *Households' inflation perceptions $\tilde{P}_{i,t}$ over the last 12 months have a positive, large, and significant effect on households' inflation expectations over the next 12 months $\mathbb{E}\left(\pi_{i,t\to t+12}\right)$.*

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[8]Appendix Figure B6 displays the OLS regression coefficients of model (4.1) for each survey-wave individually and shows that the relationship between inflation perceptions and short-term inflation is positive and sizable in all waves.

[9]The panel specifications are advantageous as unobserved time-invariant differences across individuals are controlled for. The drawback of the the change–on–change regression (Col. 7) is the loss of 96 percent of observations compared to our baseline specification shown in Column 4.

Dependent variable: Short-term Inflation Expectations (next 12 months)							
	OLS	OLS	OLS	OLS	panel FE	panel RE	panel Δ on Δ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
perceptions	0.879***	0.825***	0.869***	0.806***	0.796***	0.867***	0.643***
(past 12 months)	(0.00893)	(0.0100)	(0.00923)	(0.0104)	(0.0146)	(0.00903)	(0.0379)
constant	1.195***	0.569***	0.440	-0.107	1.499***	1.216***	-0.0408
	0.0292)	(0.0618)	(0.252)	(0.252)	(0.0532)	(0.0292)	(0.0415)
Wave dummies	-	+	-	+	-	-	-
Controls	-	-	+	+	-	-	-
N	53393	53393	49567	49567	53393	53393	4770
R^2	0.535	0.555	0.535	0.558	0.450	0.450	0.324

Notes: Columns 1-4 report OLS estimates. The estimates from the panel fixed effect regression are shown in Column 5, the estimates from the panel random effect regression in Column 6. Column 7 reports the estimates from the panel change–on–change regression. Robust standard errors (Eicker-Huber-White) are reported in parentheses. For the panel regressions we report within R^2. Significance levels: *** p<0.001, ** p<0.01, * p<0.05. Wave controls include a dummy for each wave. Socio-demographic controls include gender, household income, education, current employment status, East residence dummy, age, age squared. The dependent variable (short-term inflation expectations) are measured by the quantitative survey question: "What do you think the rate of inflation will roughly be over the next 12 months?". Perceptions are measured by the quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?". Perceptions and expectations truncated [30;-5]. The data span waves 1-30 of the survey (April - June 2019, April 2020 - June 2022)

Table 4.1: Inflation Perceptions on Short-term Expectations (I)

4.2 The Low versus High Inflation Environment

During the time period April to June 2019 and April 2020 to July 2021, the German economy experienced a stable and low inflation rate equal to 1.1 on average and with a standard deviation of 0.83. For the time period from July 2021 to June 2022, the average inflation rate was much higher and equaled 5.6 with a standard deviation of 1.5. We split the sample into a low-inflation (before July 2021) and high-inflation environment (after July 2021) and run the estimation for both sub-samples separately. Columns 1–2 of Table 4.2 show the estimation results. We find that the relationship is in both scenarios sizable and highly significant. However, the pass-through from inflation perceptions to short-term expectations is stronger in low- versus high-inflation environments.

Instead of splitting the sample, Columns 3–5 of Table 4.2 report the estimations results using all survey waves. For convenience, Column 3 reports the baseline specification of model (4.1). To investigate the differential effect of perceptions in high- versus low-inflation environments, we include a dummy variable in Column 4 that is equal to one for the high-inflation periods, and zero otherwise. In Column 5, we add the interaction term between this dummy and perceptions. We find that households place more weight on their perceptions when forming inflation expectations in the low- versus high-inflation environment.

Result 2 (Low versus High Inflation Environment). *The pass-through from house-holds' inflation perceptions $\tilde{P}_{i,t}$ over the last 12 months to households' inflation ex-pectations over the next 12 months $\mathbb{E}\left(\pi_{i,t\rightarrow t+12}\right)$ is stronger during low– compared to a high-inflation periods.*

Dependent variable: Short-term Inflation Expectations					
	before July 2021	after July 2021	full sample		
	(1)	(2)	(3)	(4)	(5)
perceptions	0.872***	0.741***	0.806***	0.806***	0.867***
(past 12 months)	(0.0153)	(0.0144)	(0.0104)	(0.0104)	(0.0151)
high inflation				2.126***	2.718***
				(0.115)	(0.146)
perceptions $\times$ high inflation					-0.124***
					(0.0208)
constant	-0.337	0.918*	-0.107	-0.107	-0.269
	(0.299)	(0.372)	(0.252)	(0.252)	(0.251)
Wave dummies	-	-	-	-	-
controls	+	+	+	+	+
N	20702	28865	49567	49567	49567
R^2	0.578	0.486	0.558	0.558	0.560

Notes: Columns 1-5 report OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** p<0.001, ** p<0.01, * p<0.05. Socio-demographic controls include gender, household income, education, current employment status, region, age, age squared. The dependent variable (short-term inflation expectations) is measured by the quantitative survey question: "What do you think the rate of inflation will roughly be over the next 12 months?". Perceptions are measured by the quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?". High inflation is the dummy equal to 1 for periods starting from July 2021 and 0 otherwise. Perceptions and expectations truncated [30;-5]. The data span waves 1-30 of the survey (April - June 2019, April 2020 - June 2022)

Table 4.2: The Role of Perceptions in low- vs high-inflation environments

4.3 Long-term Inflation Expectations

The previous section established a strong and robust link between short-term inflation perceptions and short-term inflation expectations. Households' inflation expectations may directly affect consumption decisions and wage demands, which in turn underpin firms' price-setting (e.g., Fiore et al. (2022)). However, if households perceive high inflation rates to be a temporary phenomenon, they may be less likely to demand higher wages or adjust their consumption plans fundamentally. While the opposite is likely to be true if they expect high inflation rates to persist. Monetary policy makers, worried about second round effects and de-anchoring of expectations, are thus especially concerned about agents' long-term inflation expectations. The worry of a potential persistently high long-term inflation (expectations) has come to the forefront of policy discussions and academic research, in the wake of the surge in actual inflation following the war in Ukraine and the economic recovery after the Covid-19 pandemic.

The Bundesbank survey has two quantitative questions measuring long-term inflation expectations, and the respondents are randomly split between them:

Question 1 (inflation over the next five years)*: "What value do you think the rate of inflation or deflation will take on average over the next five years?*
Answer: […] percent

Question 2 (inflation over the next ten years)*: "What value do you think the rate of inflation or deflation will take on average over the next ten years?*
Answer: […] percent

Appendix Figure B2 shows the time series of mean (and median) long-term inflation expectations. Long-term expectations have been relatively stable and anchored until January 2022. Since then we observe significant increases in both (mean and median) long-term inflation expectations in Germany.

To analyze the impact of households' inflation perceptions on households' long-term expectations, we estimate the following model by OLS (ordinary least square):

$$\mathbb{E}\left(\pi_{i,t}^L\right) = \beta_0 + \beta_1' X_{i,t} + \beta_2 \tilde{P}_{i,t} + \beta_3 \mathbb{E}\left(\pi_{i,t \to t+12}\right) + F_t + \varepsilon_{i,t} \qquad (4.2)$$

where $\mathbb{E}\left(\pi_{i,t}^L\right)$ denotes the long-term inflation rate household i surveyed in wave t expects for the next L years with $L \in \{5, 10\}$; measured in percentage points. The remaining variables are identical to the baseline specification (4.1). We consider two time-horizons, the expected inflation rate 5 and 10 years ahead. This specification investigates whether inflation perceptions have a direct impact on long-term expectations.

Table 4.3 reports the estimation results. Column 1 and 3 show that inflation perceptions play also a crucial role for long-term inflation expectations. The size of the relationship is moderately smaller compared to the relationship between perceptions and short-term expectations. A one percentage point increase in households' perceptions is associated with a 0.63 (0.66)-pp increase in expected long-term inflation over the next 5 (10) years.[10] Unsurprisingly, the magnitude of the perception effect on long-term expectations is reduced when we control for short-term expectations (Columns 2 and 4). However, a positive, sizable, and highly significant impact remains. The households seem to use their subjective assessment of the development of inflation over the last twelve months not only to form their short-term perceptions, but also consider it when forming their long-term expectations. Long-term expectations are thus directly and indirectly, via the effect on short-term expectations, affected by households inflation perceptions. In line with the related literature, we also find a positive association between short-term and long-term inflation expectations.

Result 3 (Inflation Perceptions and Long-term Expectations)**.** *Households' inflation perceptions $\tilde{P}_{i,t}$ over the last 12 months have a direct positive, sizable, and significant effect on households' long-term inflation expectations for the next 5 (10) years $\mathbb{E}\left(\pi_{i,t}^L\right)$, with $L \in \{5, 10\}$.*

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[10]Appendix Table B4 shows that this result is robust to the various specifications and estimation methods.

Dependent variable: Long-term Inflation Expectations				
	5-Years		10-Years	
	(1)	(2)	(3)	(4)
perceptions	0.633***	0.185***	0.656***	0.294***
(past 12 months)	(0.0245)	(0.0244)	(0.0235)	(0.0308)
expectations		0.555***		0.463***
(short-term)		(0.0218)		(0.0281)
constant	3.692***	2.709***	3.524***	3.121***
	(0.845)	(0.560)	(0.783)	(0.691)
Wave dummies	+	+	+	+
Controls	+	+	+	+
N	18406	18194	16774	16567
R^2	0.250	0.339	0.214	0.264

Notes: Columns 1-4 report OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** p<0.001, ** p<0.01, * p<0.05. Wave controls include a dummy for each wave. Socio-demographic controls include gender, household income, education, employment status, region, age, age squared. The dependent variables (long-term inflation expectations) are measured by quantitative survey question: "What value do you think the rate of inflation or deflation will take on average over the next five (ten) years?". Short-term expectations are measured by quantitative survey question "What do you think the rate of inflation will roughly be over the next 12 months?". Perceptions are measured by quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?". Perceptions and expectations truncated [30;-5].The data span waves 1-30 of the survey (April - June 2019, April 2020 - June 2022).

Table 4.3: Inflation Perceptions on Long-term Expectations

4.4   What drives Inflation Perception?

The previous sections showed that households' short- and long-term inflation expectations are driven by their perceptions about inflation (over the past twelve months). Therefore, it is crucial to understand how households form their perceptions about current and past inflation.

To shed light on how households form their perceptions of inflation over the past twelve months, we added a question to wave 28 (April 2022) of the BOP-HH survey.

Question (Factors driving Perceptions): *"At the start of the survey, you estimated the inflation or deflation rate over the last twelve months to have been [...]. In your opinion, how important are the following factors for your expectations regarding the average inflation or deflation rate over the past twelve months?"*
Answers: 5-point scale, from very important to not at all important.

This question is a follow-up question that picks up the previous answer on respondents' perception of the inflation/deflation rate over the past twelve months. The follow-up question provides nine potential factors respondents might have used to form perceptions. The respondents are asked to rate the importance of each factor for their previously given point estimate of inflation perceptions (see Appendix A for the exact wording of the question and the nine factors).

For each factor, Figure 4.2 shows the share of respondents reporting "very important". The top 3 factors are the following: "The development of the geopolitical situation over the past two months, particularly the war in Ukraine", "the development of fuel prices over the past twelve months", and "the development of food prices over the past twelve months".

Hence, perceptions are highly influenced by personal shopping experiences. Frequently bought products such as fuel and food are at the forefront of households' minds when predicting the inflation rate over the past twelve months. In addition, uncertainty, such as the Ukrainian war, households consider an essential factor. In contrast, price developments of infrequently bought goods (house prices or the prices of major purchases) are rated much less often as a "very important" factor. Interestingly, less than twenty percent of the respondents considered "media reports on the inflation rate" to be a very important factor in their assessment of the inflation rate over the previous twelve months.

Result 4 (Factors driving Inflation Perceptions). *Prices of frequently bought goods (food and fuel) as well as uncertainty are the key factors households rely on when forming inflation perceptions over the previous twelve months.*
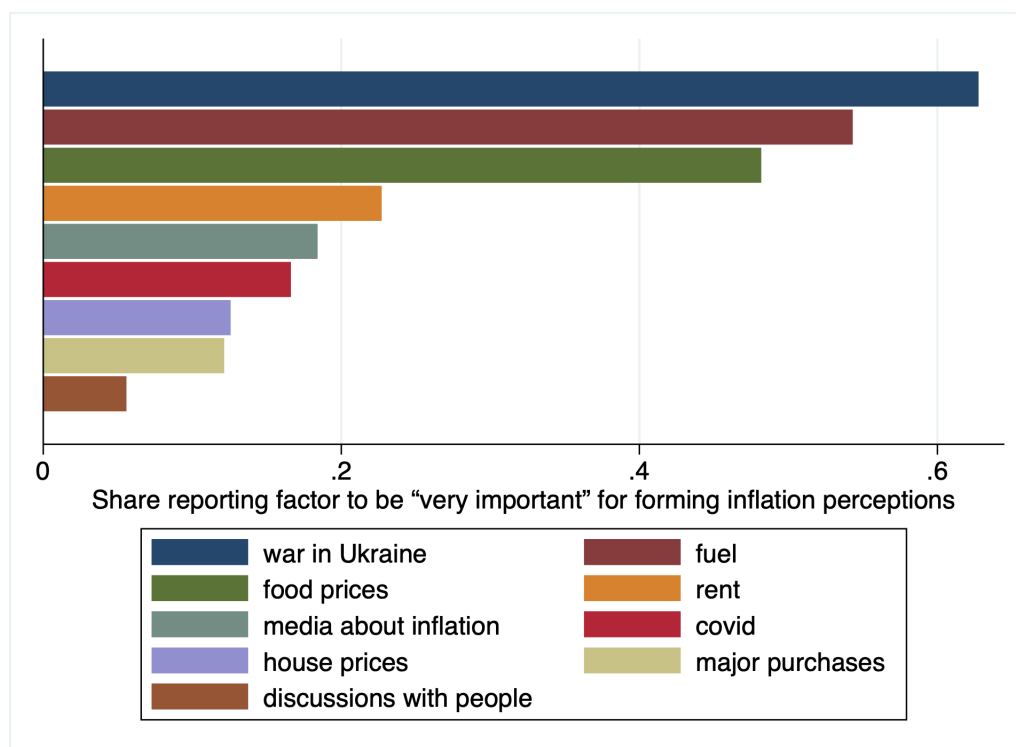

Figure 4.2: Self-reported drivers for inflation perceptions.

Sources: Bundesbank Online Panel households (BOP-HH). Survey Wave 28 (April 2022).

4.5 Heterogeneity in the Perception-Expectation Link

This and the next section explore factors, which may drive the strength of the link between perceptions and expectations. We first, analyse heterogeneity along socio-demographic characteristics, to establish whether different groups of individuals rely to a different degree on perceptions when forming expectations.[11] First, estimate the baseline specification (4.1) using sample splits. Appendix Table B6 reports the corresponding estimation results. Our results suggest that women, residents of East Germany, the employed, the low-educated, and the individuals younger than 60 years old rely to a larger extent on their inflation perceptions when forming expectations.

Second, we perform an alternative specification using the complete sample. We use the baseline model (4.1) and add as controls an interaction term between perceptions and the socio-economic characteristics:

$$\mathbb{E}\left(\pi_{i,t \to t+1}\right) = \beta_0 + \beta_1' X_{i,t} + \beta_2 \tilde{P}_{i,t} + \beta_3' \tilde{P}_{i,t} \times X_{i,t} + F_t + \varepsilon_{i,t} \tag{4.3}$$

where $\mathbb{E}\left(\pi_{i,t \to t+1}\right)$ denotes the inflation rate household i surveyed in wave t expects for the next 12 months; measured in percentage points. $X_{i,t}$ denotes a vector of controls for individual i as specified in the baseline specification (4.1). $\tilde{P}_{i,t}$ denotes household's i perceived average inflation rate over the last 12 months; measured in percentage points. $\tilde{P}_{i,t} \times X_{i,t}$ denotes the interaction term, and F_t denotes the survey-wave fixed effects. The EHW error term is denoted by $\varepsilon_{i,t}$.

Table 4.4 reports the results and provides additional evidence that women, residents of East Germany, the employed, the low-educated, and the individuals younger than 60 years old rely to a larger extent on their inflation perceptions when forming expectations.

Result 5 (Heterogeneity in Strength of Perception–Expectation Pass-through)**.**
Women, residents of East Germany, the employed, the low-educated, and the individuals younger than 60 years old place a significantly larger weight on inflation perceptions when forming short-term inflation expectations.

Understanding which socio-economic characteristics intensify the strength of the pass-through from inflation perceptions to inflation expectations helps uncover the role of inflation perceptions and potential mechanisms underlying the formation of

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[11]Appendix Table B5 reports the average inflation perceptions and expectations by socio-demographic characteristics.

inflation expectations. Combing Result 4 and Result 5, allows two conjectures. First, our results suggest that different levels of uncertainty between various socio-economic groups could be a potential explanation for the differences in the pass-through from perceptions to expectations. Second, the heterogeneity in the pass-through could be explained by different information sources used to form perceptions (e.g., media versus own shopping experience). In the next section, we investigate these two conjectures.

Dependent variable: Short-term Inflation Expectations (next 12 months)					
	(1)	(2)	(3)	(4)	(5)
Perceptions	0.759***	0.796***	0.837***	0.761***	0.768***
(past 12 months)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Female (dummy)	0.141**				
	(0.06)				
Perception × female	0.075***				
	(0.02)				
East (dummy)		0.158**			
		(0.08)			
Perception × East		0.046**			
		(0.02)			
Old (dummy)			0.234***		
			(0.07)		
Perception × Old			-0.086***		
			(0.02)		
Employed (dummy)				-0.250***	
				(0.07)	
Perception × Employed				0.079***	
				(0.02)	
Low-educated (dummy)					-0.038
					(0.06)
Perception × Low-Educated					0.054***
					(0.02)
Constant	+	+	+	+	+
Wave dummies	+	+	+	+	+
Controls	+	+	+	+	+
N	49567	49567	49567	49567	49835
R^2	0.56	0.56	0.56	0.56	0.56

Notes: OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. For the panel regressions we report within R^2. Significance levels: *** p<0.001, ** p<0.01, * p<0.05. Wave controls include a dummy for each wave. Socio-demographic controls include gender, household income, education, current employment status, East residence dummy, age, age squared. In Col.3, we include a dummy for being 60 years or older, and drop the variables age and age squared. In Col. 4, we include a dummy for being employed, and drop the drop the categorical variable (employed, unemployed, re-tired). In Col. 5, we include a dummy for being low-educated, and drop the categorical variable (low, medium, high education). The dependent variable (short-term inflation expectations) are measured by the quantitative survey question: "What do you think the rate of inflation will roughly be over the next 12 months?". Perceptions are measured by the quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?". Perceptions and expectations truncated [30;-5]. The data span waves 1-30 of the survey (April - June 2019, April 2020 - June 2022).

Table 4.4: Socio-demographic Heterogeneity in Perception-Expectation Link

5 Determinants of the Perception-Expectation Link

5.1 Information Acquisition

To analyze whether different socio-economic groups consume different inflation related information to form inflation perceptions, we add two questions to one cross-section of the survey (wave July 2021). The first question is a follow-up question, that picks up a previous answer by the respondent.

Question 1 (information source): You said you think prices for essential goods have [...] over the past twelve months. Is that based more on things you have heard or read or on your own experiences when shopping? Answers: 1 = more media; 2 = more own experience.[12]
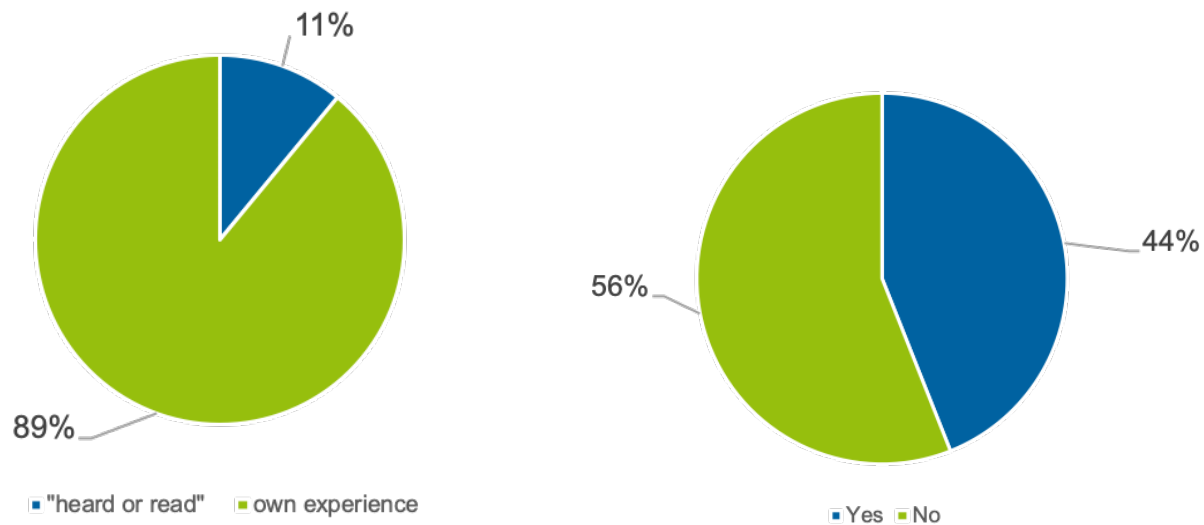
Question 2 (information extent): Aside from this survey, have you, over the past four weeks, heard or read anything about inflation in Germany? Answers: 1 = Yes; 2 = No.

Figure 5.1 shows the distribution of answers to both questions. Whilst 44% of the respondents have heard or read something about inflation over the past four weeks, almost 90% of the respondents use mainly their own shopping experience to form perceptions about past prices.

Both information acquisition aspects vary across socio-economic groups. Appendix Table B2 shows that individuals from low-income households, the low-educated, women, the young (less than 30 years old), and individuals living in East Germany, are less likely to have heard or read (i.e., be informed) about inflation. Further, we find that women, the low-educated, and individuals aged 30 years or older, are more likely to base their perceptions about past price changes on their own shopping experience. Our result that women rely more on their own shopping experience in Germany confirms findings by **?** and **?** .

These differences in information usage may be behind the heterogeneity we observe in the strength of the link between perceptions and expectations between certain socio-demographic groups. And indeed we find that the pass-through from perceptions to inflation expectations is stronger for those that rely on their own

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[12][...] denotes the placeholder for the previously given answer: decreased significantly; decreased slightly; stayed roughly the same; increased slightly; increased significantly. The corresponding survey question is described in Section 3.

(a) Answer distribution: "You said you think prices for essential goods [...] over the past twelve months. Is that based more on things you have heard or read or on your own experiences when shopping?"

(b) Answer distribution: "Aside from this survey, have you, over the past four weeks, heard or read anything about inflation in Germany?"

Figure 5.1: Information Acquisition

shopping experience than for those that didn't and for those that heard news about inflation in the past four weeks. Table 5.1 shows the estimation results using sample splits. Next, we investigate whether the information acquisition variables have only an indirect effect on short term expectations (via perceptions) or also a direct effect on their own. Table 5.2 reports the results. We find that both information acquisition variables have a direct effect on inflation perceptions (Column 2). The effect on short-term inflation expectations, however, works only through perceptions (Column 3).

Result 6 (Information Acquisition: A Determinant for the Pass-Through Strength). *Socio-economic groups differ in (i) the extent of being informed about inflation, and in (2) the choice of information source used to form perceptions about past inflation. The differential information acquisition is one determinant for the heterogeneity observed in the strength of the pass-through from inflation perceptions to inflation expectations.*

Dependent variable: Short-term Inflation Expectations				
	Information Source		Informed	
	Media	Experience	Yes	No
	(1)	(2)	(3)	(4)
Perceptions	0.648***	0.815***	0.818***	0.793***
(last 12 months)	(0.177)	(0.0483)	(0.0711)	(0.0625)
Constant	+	+	+	+
Controls	+	+	+	+
N	283	2454	1543	1198
R^2	0.300	0.463	0.398	0.504

Notes: Columns 1-4 report OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** $p<0.001$, ** $p<0.01$, * $p<0.05$. Socio-demographic controls include gender, household income, education, current employment status, region, age, age squared. The dependent variable (short-term inflation expectations) is measured by the quantitative survey question: "What do you think the rate of inflation will roughly be over the next 12 months?". The independent variable (short-term inflation perceptions) are measured by the quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?". Perceptions and expectations truncated [30;-5]. The data span wave 19 (July 2021).

Table 5.1: Information Acquisition, a Driver for Heterogeneity (I)

	Expectations	Perceptions	Expectations
	(1)	(2)	(3)
inflation info	0.149	0.465***	-0.165
(dummy)	(0.162)	(0.140)	(0.120)
base perceptions	0.506*	0.450**	0.193
on shopping experience	(0.204)	(0.146)	(0.161)
Perceptions			0.808***
(last 12 months)			(0.0471)
Constant	+	+	+
Controls	+	+	+
N	2779	2772	2735
R^2	0.045	0.053	0.452

Notes: Columns 1-2 report OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** $p<0.001$, ** $p<0.01$, * $p<0.05$. Socio-demographic controls include gender, household income, education, current employment status, region, age, age squared. The first dependent variable (short-term inflation expectations) is measured by the quantitative survey question: "What do you think the rate of inflation will roughly be over the next 12 months?". The second dependent variable (short-term inflation perceptions) are measured by the quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?". Perceptions and expectations truncated [30;-5].The data span wave 19 (July 2021).

Table 5.2: Information Acquisition, a Driver for Heterogeneity (II)

5.2 Individual Uncertainty about Inflation Dynamics

This section investigates the impact of uncertainty on the pass-through from inflation perceptions to expectations. We use the probabilistic inflation expectation question to measure the uncertainty about inflation for each respondent.[13] Figure 5.2 shows the time series of the average level of individual uncertainty (as well as the median).
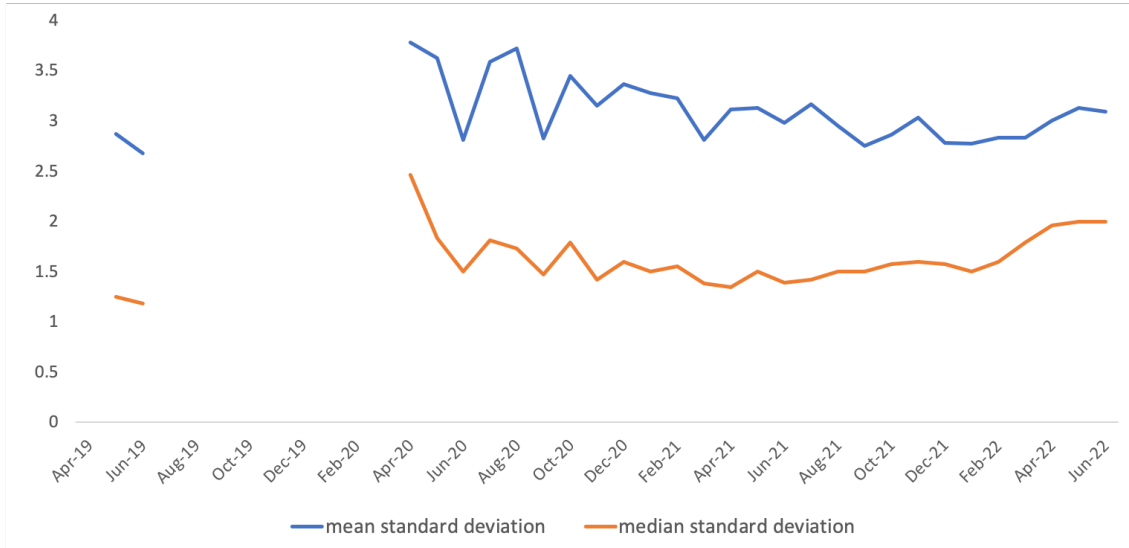

Figure 5.2: Uncertainty about Inflation (next 12 months)

Sources: Bundesbank Online Panel households (BOP-HH). Uncertainty is measured by the standard deviation of the subjective probability distribution of the probabilistic question regarding inflation expectations. Question: In your opinion, how likely is it that the rate of inflation will change as follows over the next twelve months? Participants are asked to distribute a probability of 100% over ten categories between a deflation rate $\geq 12\%$ and an inflation rate $\leq 12\%$.

We find that the level of individual uncertainty varies significantly across socio-economic groups. Women, the young, individuals from low-income households, the low-educated, and respondents living in East Germany show higher levels of uncertainty.[14] Figure 5.3 illustrates this finding for the income dimension using three household income bins (low, medium, and high) over time. Respondents from low-income households have the highest level of uncertainty in each survey wave.

Next, we investigate whether the heterogeneity in inflation uncertainty explains the discovered heterogeneity in the strength of the pass-through from inflation perceptions to expectations. We split the sample into three groups—households revealing inflation expectations with low uncertainty (lower quartile), medium uncertainty

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[13]Appendix A documents the exact wording of the survey question and answer categories.

[14]Appendix Table B3 documents the uncertainty level for socio-economic groups separately. Appendix Table B8 reports corresponding regression results. These socio-economic characteristics are highly significant factors for the individual level of inflation uncertainty.
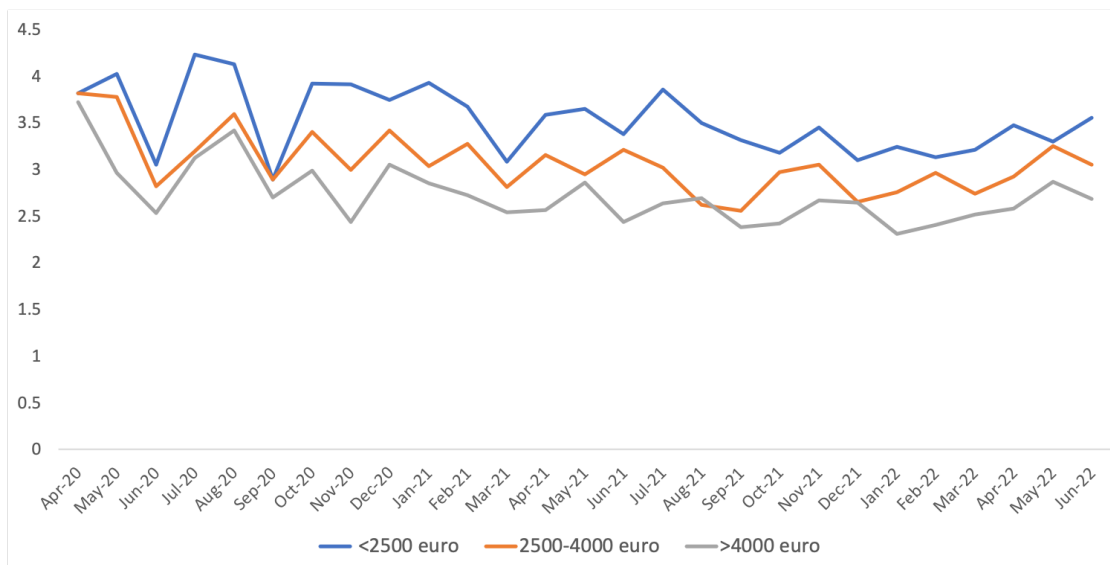
Figure 5.3: Inflation Uncertainty by Household Income

Sources: Bundesbank Online Panel households (BOP-HH). Uncertainty is measured by the standard deviation of the subjective probability distribution of the probabilistic question regarding inflation expectations. Question: In your opinion, how likely is it that the rate of inflation will change as follows over the next twelve months? Participants are asked to distribute a probability of 100% over ten categories between a deflation rate $\geq 12\%$ and an inflation rate $\leq 12\%$.

(second and third quartile), and high uncertainty (upper quartile). We estimate the baseline model (4.1) for each group separately, Table 5.3 shows the results. We observe a U-shape pattern for the relationship between perceptions and expectations depending on the uncertainty level. Consumers with low and high uncertainty rely more on inflation perceptions when forming inflation expectations, but this relationship weakens for the intermediate uncertainty range.[15]

Result 7 (Uncertainty: A Determinant for the Pass-Through Strength). *Reported uncertainty about future inflation varies significantly across households. The differential perceived uncertainty is one determinant for the heterogeneity observed in the strength of the pass-through from inflation perceptions to inflation expectations.*

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[15]As a robustness check, we perform an alternative specification using the complete sample. We use the baseline model (4.1) and add as controls the uncertainty measure and an interaction term between perceptions and uncertainty. Column 2 of Appendix Table ?? reports the result. In Column 3, we add squared uncertainty. The coefficients on uncertainty and its square have opposite signs; we conclude that uncertainty has a non-linear effect. In column 4, we add an interaction term between the squared uncertainty and perceptions. The interaction terms are significant; uncertainty has a non-linear effect on the perceptions–expectations pass-through.

Dependent variable: Short-term Inflation Expectations (next 12 months)		
	Low uncertainty (bottom quartile)	Medium uncertainty (2 medium quartiles)	High uncertainty (top quartile)
	(1)	(2)	(3)
Perceptions	0.793***	0.722***	0.850***
(past 12 months)	(0.0141)	(0.0213)	(0.0231)
Constant	-0.201	-0.302	0.232
	(0.503)	(0.263)	(0.550)
Wave dummies	+	+	+
Controls	+	+	+
N	17124	21498	10945
R^2	0.537	0.505	0.603

Notes: Columns 1-3 report OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** p<0.001, ** p<0.01, * p<0.05. Socio-demographic controls include gender, household income, education, current employment status, region, age, age squared. The dependent variable (short-term inflation expectations) is measured by the quantitative survey question: "What do you think the rate of inflation will roughly be over the next 12 months?". Perceptions are measured by the quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?". Individual uncertainty equals the variance in short-term inflation expectations; calculated from probabilistic inflation expectations question (Appendix A). Perceptions and expectations truncated [30;-5]. The data span waves 1-30 of the survey (April-June 2019, April 2020 - June 2022).

Table 5.3: Individual Uncertainty, a Driver for Heterogeneity

6 Conclusion and Policy Implications

This paper studies how and why households' perceptions about past inflation (last 12 months) and expectations about future inflation (next 12 months) are related and what factors influence the strength of their relationship. We use the Bundesbank Online Panel for Households survey, which is representative of the online population of Germany and provides rich data on short-term and long-term inflation expectations and inflation perceptions.

Households' inflation perceptions are the crucial determinant for their short-term inflation expectations. The magnitude of the perception effect on short-term expectations is quantitatively large. A one percentage point (pp.) increase in households' perceptions is associated with a 0.81-pp increase in expected short-term inflation. The relationship between perceptions and expectations is robust to various estimation specifications and controls.

The substantial increase in the inflation rate in Germany starting in the summer of 2021 allows us to investigate how the link between inflation perceptions and inflation expectations changes in a high-inflation environment. While the pass-through remains sizable, consumers rely less on their perception in the high-inflation environment.

Especially relevant for central bankers, we show that inflation perceptions do

not only influence short-term inflation expectations. Perceptions have a direct, significant, and sizable impact on long-term inflation expectations over the next five years and on long-term inflation expectations over the next ten years. Moreover, the effect of perception on long-term expectations survives when controlling for short-term expectations. That is to say that inflation perceptions, directly and indirectly (through short-term expectations), affect long-term inflation expectations.

Given the large impact of perceptions on expectations, it is crucial to understand how households form their inflation perceptions over the previous twelve months. We generate novel data on this question by asking respondents a follow-up question on which factors they considered essential for their assessment of inflation over the past twelve months. We find that perceptions are highly influenced by personal shopping experiences. Frequently bought products such as fuel and food are on households' minds when predicting the inflation rate over the past twelve months. In addition, households consider macroeconomic uncertainty to be an essential factor. Interestingly, less than twenty percent of the respondents considered "media reports on the inflation rate" to be an essential factor in their assessment of the inflation rate over the previous twelve months.

While perceptions play a crucial role when forming inflation expectations for all socio-economic groups, we document heterogeneity in the strength of the link between inflation perceptions and inflation expectations. For example, women, residents of East Germany, the low-educated, the employed, and individuals younger than 60 years old put a significantly larger weight on inflation perceptions when forming short-term inflation expectations.

This paper tests the hypothesis that information and uncertainty moderate the pass-through from perceptions to inflation expectations. In other words, we investigate whether differential usage of information to form perceptions and differing levels of uncertainty can explain the observed heterogeneity in the strength of the link between inflation perceptions and inflation expectations across socio-economic groups.

We find that individual uncertainty about future inflation affects the pass-through from perceptions to short-term expectations (in a non-linear way). Households with very low and very high uncertainty rely more on inflation perceptions when forming inflation expectations—than households with intermediate levels of uncertainty.

We add three novel questions to the Bundesbank survey to study the moderating

factor of information. The first question elicits households' inflation perceptions over the past 12 months on nine main categories of goods and services. The follow-up question elicits the information source used to form perceptions (own shopping experience or media). The last question elicits whether the households have recently heard or read any information about inflation. We find that half of the respondents have heard or read something about inflation over the last months. Nevertheless, the overwhelming majority (89%) based their inflation perceptions on their shopping experience. This paper shows that the strength of the perception–expectation link is quantitatively largest for those that are non-informed and for those that base their assessment of past inflation on their own shopping experience.

In summary, inflation perceptions are one of the most important determinants of short-term and long-term inflation expectations (5 and 10 years ahead). Our paper helps identify what type of inflation matters for consumers' inflation perceptions and why this matters for inflation expectations. Our findings suggest that monitoring inflation perceptions of households would be valuable. Central banks might profit from creating a new communication tool by which they address households to "correct" households' perceptions of past and current inflation (and, by that, influence inflation expectations). Our finding that households' shopping experience and prices of frequently bought products (food and fuel) are the critical determinants for households' inflation perceptions suggests that households' perception could increase further—as current inflation is predominantly driven by food and energy prices. As households' inflation expectations are extrapolated from inflation perceptions, we conclude that the current inflation environment provides severe risks for a further (and potentially persistent) de-anchoring of households' short-term and long-term expectations from the inflation target.

For future work, we conducted an RCT experiment in the August 2022 survey wave to strengthen the evidence of a causal relationship between inflation perceptions and expectations. We will have access to the data in October 2022. We are also interested in understanding whether providing objective information leads individuals to update their perceptions about past inflation.

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Appendix A: Survey Questions

1. **Inflation perceptions:** *What do you think the rate of inflation or deflation in Germany was over the past twelve months?*
   Note: If you assume there was deflation, please enter a negative value. Values may have one decimal place.
   Please enter a value here: [...] percent

2. **Qualitative inflation expectations:** *What developments do you expect in the inflation rate over the next twelve months? Will the inflation rate:*
   1 - decrease significantly
   2 - decrease slightly
   3 - stay roughly the same
   4 - increase slightly
   5 - increase significantly

3. **Inflation/deflation:** *Do you think inflation or deflation is more likely over the next twelve months?*
   Note: Inflation is the percentage increase in the general price level. It is mostly measured using the consumer price index. A decrease in the price level is generally described as "deflation".
   Please select one answer.
   1 - Inflation more likely
   2 - Deflation more likely

4. **Quantitative inflation expectations:** *What do you think the rate of inflation/deflation will roughly be over the next twelve months?*
   Note: Inflation is the percentage increase in the general price level. It is mostly measured using the consumer price index. A decrease in the price level is generally described as "deflation".
   Please enter a value in the input field (values may have one decimal place).
   [...] percent

5. **Probabilistic inflation expectations:** *In your opinion, how likely is it that the rate of inflation will change as follows over the next twelve months?*
   Note: The aim of this question is to determine how likely you think it is that something specific will happen in the future. You can rate the likelihood on

a scale from 0 to 100, with 0 meaning that an event is completely unlikely and 100 meaning that you are absolutely certain it will happen. Use values between the two extremes to moderate the strength of your opinion. Please note that your answers to the categories have to add up to 100.

- The rate of deflation (opposite of inflation) will be 12% or higher.
- The rate of deflation (opposite of inflation) will be between 8% and less than 12%.
- The rate of deflation (opposite of inflation) will be between 4% and less than 8%.
- The rate of deflation (opposite of inflation) will be between 2% and less than 4%.
- The rate of deflation (opposite of inflation) will be between 0% and less than 2%.
- The rate of inflation will be between 0% and less than 2%.
- The rate of inflation will be between 2% and less than 4%.
- The rate of inflation will be between 4% and less than 8%.
- The rate of inflation will be between 8% and less than 12%.
- The rate of inflation will be 12% or higher.

6. **Detailed qualitative inflation perceptions:** *How do you think prices for the following items have changed over the past twelve months?*

- Major purchases (e.g. car, furniture, electrical appliances, etc.)
- Essential goods (e.g. food and beverages, non-food items such as cleaning products or similar)
- Clothing and footwear
- Entertainment/recreation (e.g. restaurant visits, cultural events, gym)
- Mobility (e.g. fuel, car loans and running costs, bus and train tickets)
- Services (e.g. hairdresser, childcare, medical costs)
- Travel, holidays
- Housing costs (e.g. rent, mortgage, ancillary costs)

○ Financial reserves

Please select one answer for each row.

1 - decreased significantly

2 - decreased slightly

3 - stayed roughly the same

4 - increased slightly

5 - increased significantly

7. **Source of information for inflation perceptions:** *You said you think prices for essential goods have "[...]" over the past twelve months. Is that based more on things you have heard or read or on your own experiences when shopping?*

   1 - It is more something that I have read or heard in the media.

   2 - It is more something that I myself or a member of my household have/has experienced in my/their own shopping.

   [...] denotes placeholder for previously given answer: decreased significantly; decreased slightly; stayed roughly the same; increased slightly; increased significantly.

8. **Obtaining information about inflation:** *Aside from this survey, have you, over the past four weeks, heard or read anything about inflation in Germany?*

   1 - Yes

   2 - No

9. **Perception Factors:** *At the start of the survey, you estimated the inflation or deflation rate over the last twelve months to have been [...]. In your opinion, how important are the following factors for your expectations regarding the average inflation or deflation rate over the past twelve months?*

   1 - Very important

   2 - Fairly important

   3 - Neither important nor unimportant

   4 - Fairly unimportant

   5 - Not at all important

- Development of **food prices** over the past 12 months

- Development of **fuel prices** over the past 12 months

- Development of **house prices** in your region over past 12 months

- Development of **rent** and ancillary costs in your region over the past 12 months

- Development of **prices of major purchases** over past 12 months

- **Media** reports on the inflation rate

- **Discussions** about inflation with colleagues, friends or relatives

- Development of the **COVID-19 pandemic** over past 12 months

- Development of the geopolitical situation over past 2 months, particularly the **war in Ukraine**

[...] denotes placeholder for previously given point estimate (Q1: Inflation Perception).

Appendix B: Descriptive Statistics & Results

Descriptive Statistics

	N obs	Mean	St. Dev	25th	Median	75th
	(1)	(2)	(3)	(4)	(5)	(6)
Socio-economic characteristics						
Gender	108531	0.41	.49	0	0	1
Income	108540	7.01	2.10	5	8	9
Education	105879	1.68	0.85	1	1	3
East	108540	0.18	0.38	0	0	0
Age	108540	56.06	15.38	45	58	70
Household size	108252	2.21	1.06	2	2	3
Have children	83433	0.32	0.47	0	0	1
Inflation expectations						
1-year	101601	4.52	3.94	2	4	6
5-year	20717	4.65	4.27	2.3	3.5	5
10-year	20478	4.90	4.80	2	3	5
Inflation perceptions						
1-year	54222	3.74	3.53	2	3	4.9
CPI inflation						
food	108540	4.21	3.26	1.44	4.40	5.31
energy	108540	13.28	15.36	0.29	11.65	22.11
excluding food and energy	108540	2.26	1.11	1.42	2.71	3.2
overall	108540	3.52	2.65	1.33	3.77	5.24

Notes: Gender dummy is equal to 0 for men and 1 for women. Income is a categorical variable with the following categories: 1 - Less than €500; 2 - €500 to €999; 3 - €1,000 to €1,499; 4 - €1,500 to €1,999; 5 - €2,000 to €2,499; 6 - €2,500 to €2,999; 7 - €3,000 to €3,499; 8 - €3,500 to €3,999; 9 - more than €4,000. Education is a categorical variable with the following categories: 1 - High school or less; 2 - Bachelor or equivalent; 3 - Higher than bachelor. East is a dummy equal to 1 if a household lives in East Germany and 0 otherwise. Have children is a dummy equal to 1 if a household has children and 0 otherwise. The data span waves 1-30 of the survey (April 2019 - June 2019, April 2020 - June 2022).

Table B1: Summary statistics

	Obtained information about inflation recently	Base inflation perceptions on own shopping experiences
	(1)	(2)
Females	44.8%	91.5%
Males	62.7%	88.4%
Low income	45.3%	88.0%
Medium income	53.6%	90.6%
High income	57.2%	88.7%
Education high school or lower	51.3%	92.0%
Education bachelor certificate	58.8%	89.5%
Education high than bachelor	60.3%	85.3%
East	51.5%	90.3%
West	55.2%	89.6%
North	54.5%	90.1%
South	56.3%	89.5%
Young	34.5%	81.5%
Middle age	46.3%	90.1%
Old	67.1%	90.3%
Have children	43.8%	89.6%
Have no children	60.0%	90.1%
Employed	47.2%	89.3%
Unemployed	48.7%	89.7%
Retired	68.0%	90.5%
Not in labor force	34.7%	89.7%

Notes: Low income refers to the monthly income less that 1000 euro. Medium income refers to the monthly income level from 1000 euro to 3999 euro. High income refers to the monthly income level higher than 4000 euro. East (West/North/South) is a dummy equal to 1 if a household lives in Eastern (Western/Northern/Southern) Germany and 0 otherwise. Young is a dummy variable equal to 1 if a consumer is 30 years old or less and 0 otherwise. Middle age is the dummy variable equal to 1 if the age of the consumer is greater than 30 but less 61 and 0 otherwise. Old is the dummy variable equal to 1 if the age of the consumer is greater than 60 and 0 otherwise. Have children is a dummy equal to 1 if a household has children and 0 otherwise. The data span wave 19 of the survey (July 2021).

Table B2: Summary statistics for information acquisition

	Uncertainty about future inflation
	(1)
Females	8.56
Males	5.98
Low income	10.81
Medium income	8.03
High income	5.36
Education high school or lower	7.99
Education bachelor certificate	6.64
Education high than bachelor	5.04
East	7.90
West	7.02
North	7.02
South	6.60
Young	10.54
Middle age	6.83
Old	6.64
Have children	6.85
Have no children	6.69
Employed	6.89
Unemployed	7.55
Retired	6.66
Not in labor force	10.65

Notes: Uncertainty is measured as the variance of the subjective probability distribution from the probabilistic inflation expectations question. Low income refers to the monthly income less that 1000 euro. Medium income refers to the monthly income level from 1000 euro to 3999 euro. High income refers to the monthly income level higher than 4000 euro. East (West/North/South) is a dummy equal to 1 if a household lives in Eastern (Western/Northern/Southern) Germany and 0 otherwise. Young is a dummy variable equal to 1 if a consumer is 30 years old or less and 0 otherwise. Middle age is the dummy variable equal to 1 if the age of the consumer is greater than 30 but less 61 and 0 otherwise. Old is the dummy variable equal to 1 if the age of the consumer is greater than 60 and 0 otherwise. Have children is a dummy equal to 1 if a household has children and 0 otherwise. The data span waves 1-30 of the survey (April 2019 - June 2019, April 2020 - June 2022).

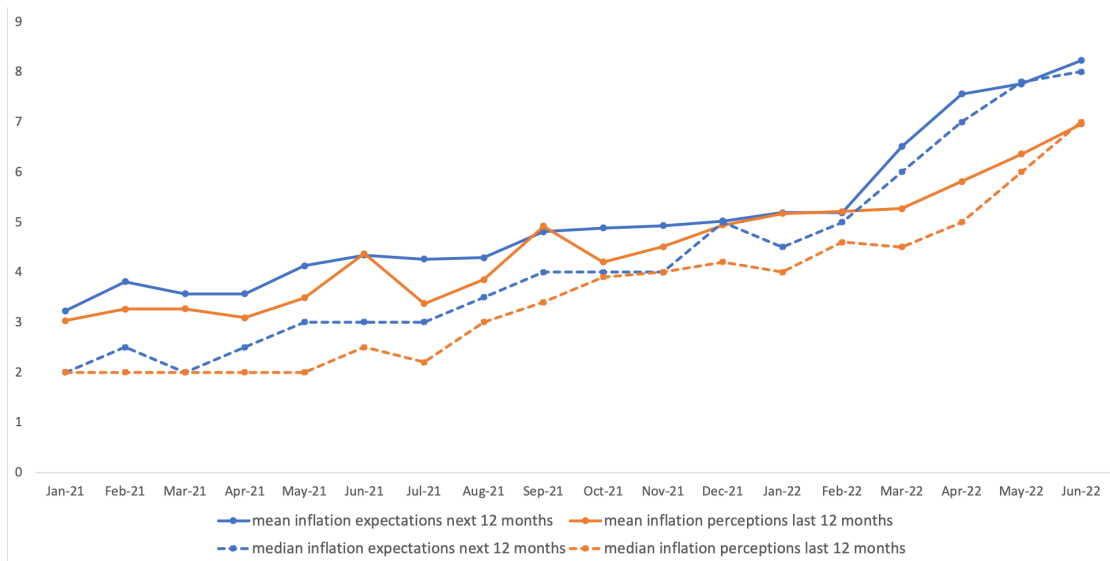Table B3: Summary statistics for uncertainty

Figure B1: Short-term Expectations and Perceptions over time

Sources: Bundesbank Online Panel households (BOP-HH). Short-term inflation expectations and perceptions: Weighted means/medians, observations truncated to interval [-5;+30].

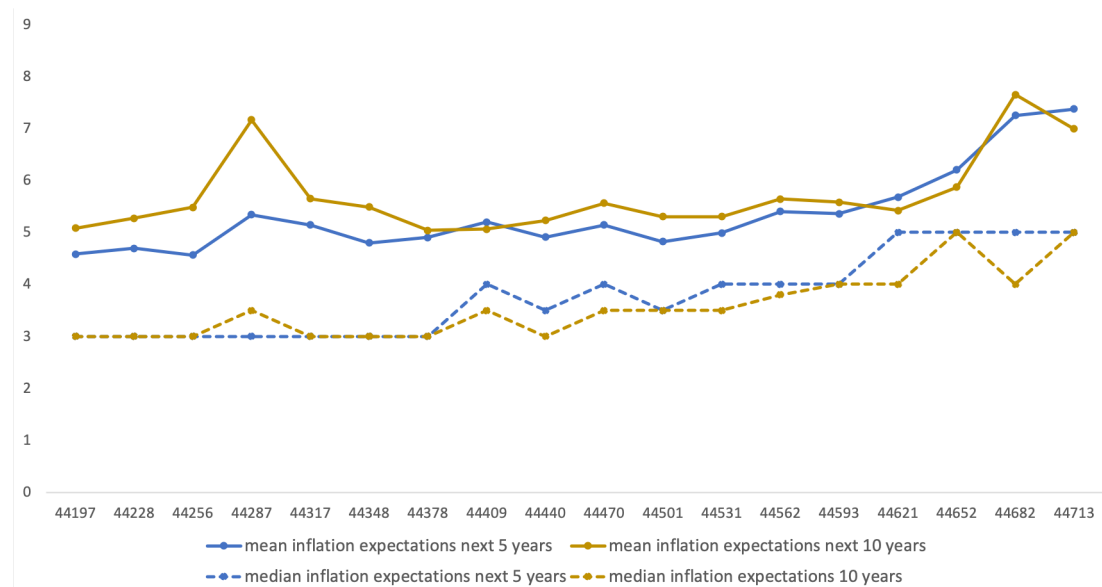Figure B2: Long-term expectations over time (mean and median)

Sources: Bundesbank Online Panel households (BOP-HH). Long-term inflation expectations (5 years and 10 years ahead): Weighted means/medians, observations truncated to interval [-5;+30].
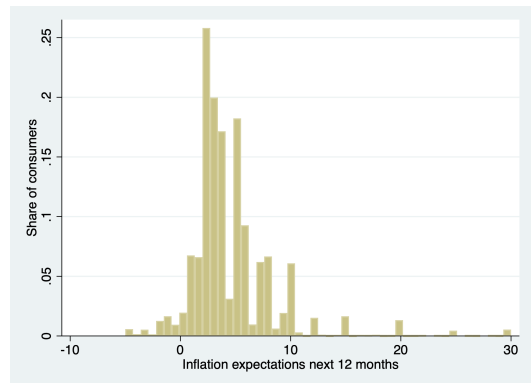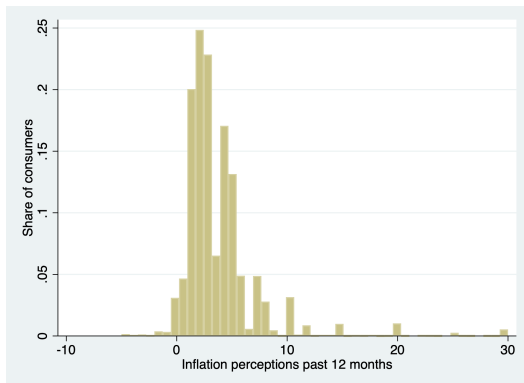
(a) Inflation perceptions, next 12 months

(b) Inflation expectations, next 12 months
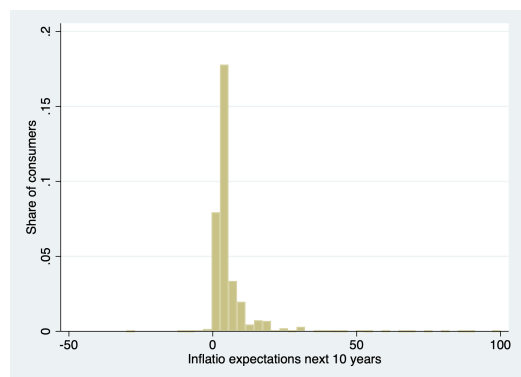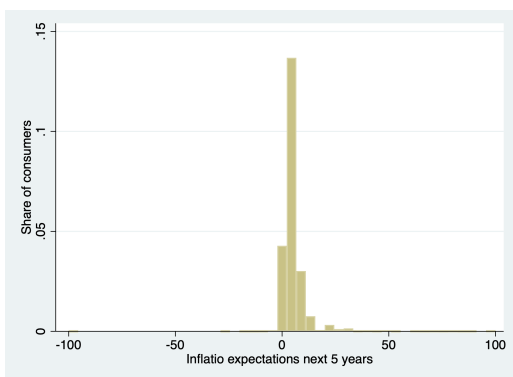
(c) Inflation expectations, next 5 years

(d) Inflation expectations, next 10 years

Figure B3: The distribution of inflation perceptions and expectations

Figure B4: Inflation Expectation and Perception Disagreement over survey waves

Figure B5: Inflation Perception Error Distribution

Additional Estimation Results

Figure B6: Correlation of short-term expectations and perceptions (by wave)

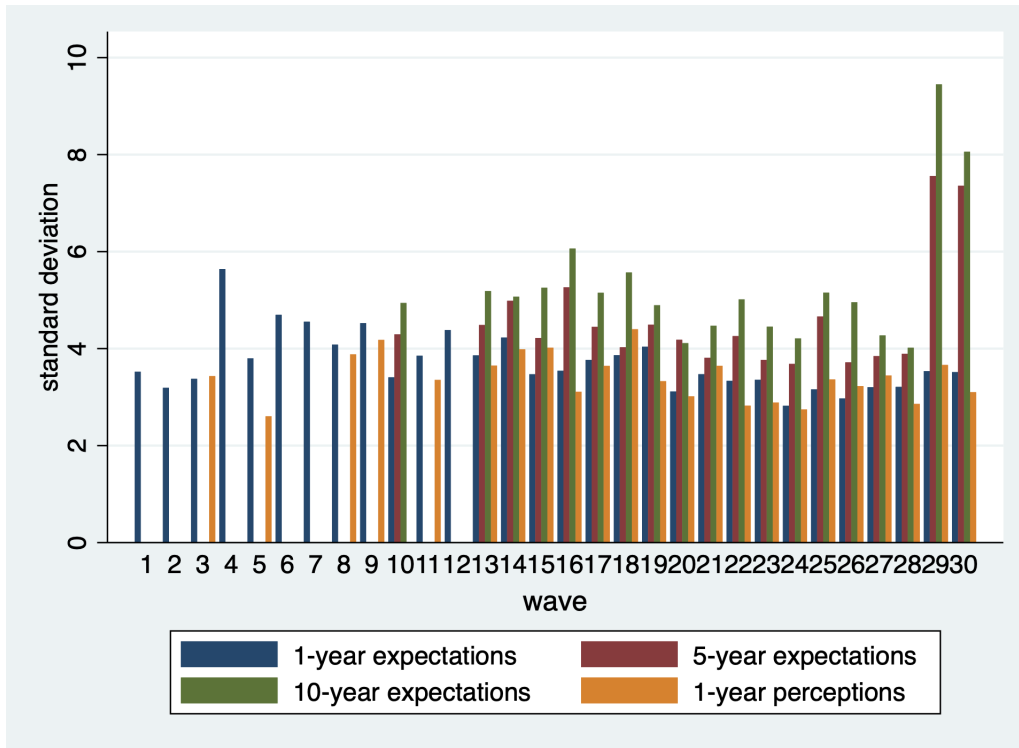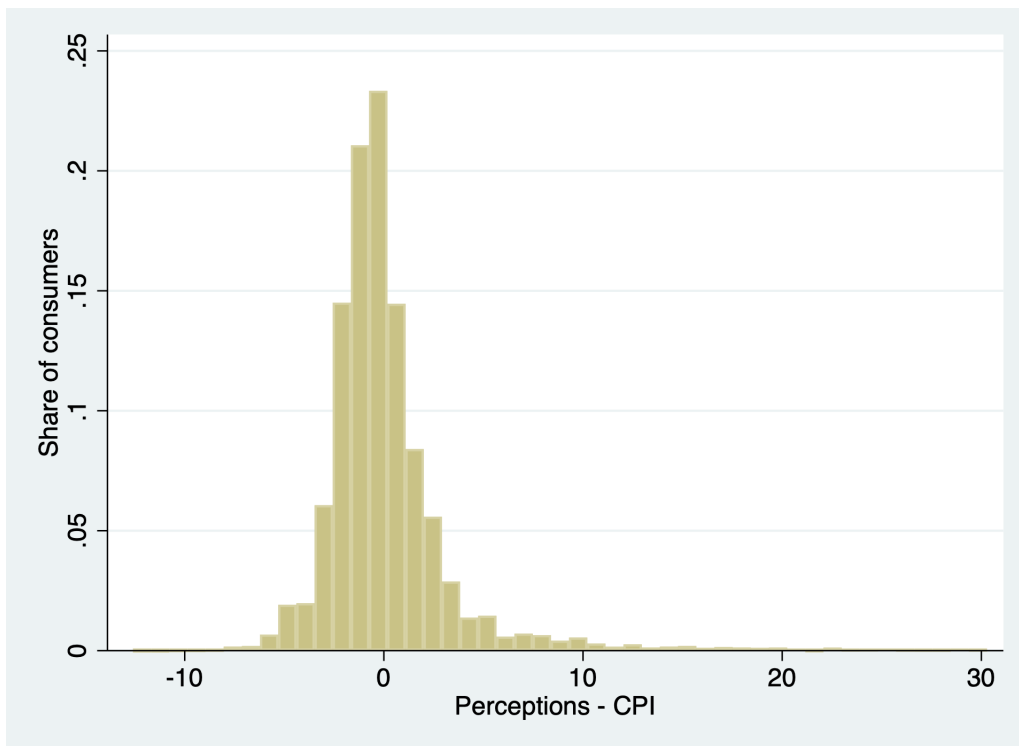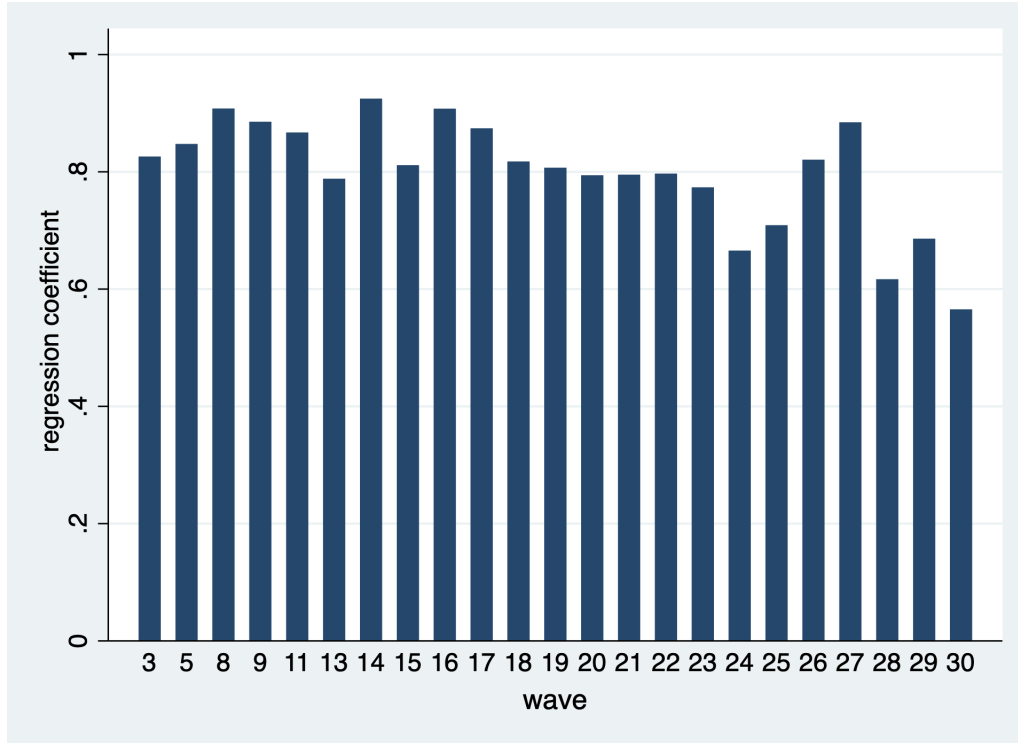| Dependent variable: Long-term Inflation Expectations (10Y)							
	OLS	OLS	OLS	OLS	panel FE	panel RE	panel Δ on Δ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
perceptions last 12 months	0.637***	0.694***	0.602***	0.656***	0.320***	0.613***	0.429**
	(0.0195)	(0.0220)	(0.0206)	(0.0235)	(0.0354)	(0.0192)	(0.142)
constant	2.419***	2.940***	3.229***	3.524***	3.670***	2.549***	-0.600*
	(0.0712)	(0.165)	(0.780)	(0.783)	(0.140)	(0.0700)	(0.272)
Wave dummies	-	+	-	+	-	-	-
Controls	-	-	+	+	-	-	-
N	18599	18599	16774	16774	18599	18599	350
R^2	0.184	0.196	0.203	0.214	0.056	0.06	0.049

Notes: Columns 1-4 report OLS estimates. The estimates from the panel fixed effect regression are shown in Column 5, the estimates from the panel random effect regression in Column 6. Column 7 reports the estimates from the panel change–on–change regression. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** $p<0.001$, ** $p<0.01$, * $p<0.05$. Socio-demographic controls include gender, household income, education, current employment status, East residence dummy, age, age squared. The dependent variable (long-term inflation expectations) is measured by the quantitative survey question: "And what value do you think the rate of inflation or deflation will take on average over the next ten years?". The independent variable (short-term inflation perceptions) are measured by the quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?". Perceptions and expectations truncated [30;-5]. The data span waves 1-30 (April 2020 - June 2020, April 2021 - June 2022).

Table B4: Inflation Perceptions and Long-term Inflation Expectations

Heterogeneity in inflation perceptions and expectations

This section documents households' average inflation perceptions, expectations, perception errors, and individual uncertainty about future inflation—along socio-economic characteristics (Table B5).

We confirm findings of considerable heterogeneity in inflation perceptions and expectations among individuals (Table B5). In Germany, women have on average higher inflation perceptions and expectations than men (i.e., consistent with findings by Jonung (1981) and ? for the US; Takahashi and Tamanyu (2022) for Japan; Arioli et al. (2017) for the European Union). As documented by Goldfayn-Frank and Wohlfart (2020), we find that respondents who (i) lived in East Germany during 1989 and (ii) those who live in East Germany nowadays, have on average higher inflation perceptions and expectations than their Western counterparts. In addition, we find that individuals have higher inflation perceptions, perception errors and expectations when living in larger German cities compared to smaller cities. In line with Christelis et al. (2020), we find that consumers with lower trust in the ECB tend to have higher inflation expectations and perceptions, perception errors, and uncertainty about future inflation.

We contribute to this related literature by documenting that besides the standard sociodemographic characteristics, additional characteristics are relevant to explaining inflation perception and expectation heterogeneity among households. The differences discussed in this section are statistically significant (p<0.001) using non-parametric MWU-tests. First, the homeownership status matters. Renters report higher perceptions, expectations, perception errors, and uncertainty about future inflation than homeowners.[16] Second, households intending to buy a real estate property over the next ten years have higher perceptions, expectations, perception errors, and uncertainty about future inflation—than households that are not planning on embarking on this endeavor. Third, information matters. Households reporting to have heart or read information about inflation in the past four weeks have lower inflation perceptions, perception errors, and uncertainty about future inflation. Fourth, the information source matters. Households that form inflation perceptions more on their shopping experiences than media reports reveal higher inflation expectations, perception, and perception error. Fifth, individuals who expect difficulties paying their current expenditures over the following months have higher

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[16]This finding is especially important for the ECB, as the currency union consists of countries that differ significantly in aggregate homeownership rates (Huber and Schmidt, 2022).

inflation expectations, perceptions, perception errors, and uncertainty. Finally, we find that households reporting to generally have a pessimistic outlook for the next 12 months have higher inflation expectations, perceptions, perception errors, and uncertainty about future inflation.

A: gender, location of residence (East/West), income, unemployment status

	Gender			Current residence			Income			Unemployed		
	M	F	Δ	West	East	Δ	Low	Medium/High	Δ	No	Yes	Δ
Expectations	4.10	5.14	-1.04***	4.40	5.08	-0.67***	4.50	5.28	-0.78***	4.59	3.80	0.79***
Perceptions	3.39	4.24	-0.85***	3.66	4.10	-0.44***	3.72	4.43	0.70***	3.79	3.85	-0.07***
Perc error	-0.16	0.66	-0.83***	0.09	0.54	-0.44***	0.15	0.99	-0.84***	0.12	1.26	-1.14***
Uncertainty	5.98	8.56	-2.58 ***	6.82	7.90	-1.07 ***	10.81	6.92	3.90***	6.96	7.55	-0.59***

B: education, city size, age, trust in ECB

	Education			City Size			Age			Trust inflation		
	Medium/High	Low	Δ	Small	Medium/Big	Δ	≤ 60	> 60	Δ	No	Yes	Δ
Expectations	4.18	4.80	-0.62***	4.68	4.49	0.19***	4.55	4.48	0.06***	4.17	2.53	1.64***
Perceptions	3.44	3.98	-0.54***	3.82	3.73	0.09***	3.77	3.69	0.09***	3.79	2.55	1.25***
Perc error	-0.17	0.45	-0.62***	0.28	0.21	0.07***	0.27	0.03	0.24***	3.98	2.73	1.25***
Uncertainty	5.77	7.99	-2.22 ***	6.87	7.07	-0.20**	7.27	6.64	0.63***	7.11	5.93	1.18**

C: rent/own; liquidity constraint; outstanding loans; intention to buy property

	Renters			Liquidity constrained			Outstanding loans			Intention to buy		
	Yes	No	Δ	Yes	No	Δ	Yes	No	Δ	Yes	No	Δ
Expectations	4.53	4.08	0.45***	5.12	3.25	1.88***	3.59	3.15	0.44***	2.76	2.98	-0.22***
Perceptions	3.88	3.42	0.46***	3.45	2.39	1.06***	3.37	3.03	0.34	2.73	3.06	-0.33**
Perc error	0.91	0.45	0.46***	2.88	1.82	1.06***	3.56	3.22	0.34	1.09	1.42	-0.33**
Uncertainty	8.95	6.81	2.14 ***	17.65	10.53	7.12 ***	8.48	7.53	0.95	6.81	6.04	0.77**

D: inflation information; source of inflation information; pessimism; income loss due to Covid-19

	Informed about inflation			Information source			Pessimistic			Covid-19 Income loss		
	Yes	No	Δ	Media	Shopping	Δ	Yes	No	Δ	Yes	No	Δ
Expectations	3.70	4.19	-0.62	3.36	3.98	-0.48***	5.42	4.00	1.43***	3.25	3.37	0.12
Perceptions	2.88	3.49	-0.58***	2.63	3.21	-0.61***	4.48	3.81	0.67***	2.55	2.38	0.17*
Perc error	-0.89	-0.28	-0.58***	-1.14	-0.56	-0.61***	0.42	-0.26	0.67***	1.99	1.81	0.17*
Uncertainty	5.19	9.51	-4.32 ***	8.83	6.91	1.92	5.77	5.18	0.58	10.94	12.36	-1.42*

Notes: This table reports averages (means). Gender is the dummy variable equal to 1 if the respondent is a woman and 0 otherwise. Low income refers to the monthly income level lower than 1000 euro, medium/high income - higher than 1000 euro. Unemployed is a dummy variable equal to 1 if an individual is currently unemployed and 0 otherwise. Low education is a dummy variable equal to 1 if the highest education level a respondent is high-school diploma and 0 otherwise. Medium/high level of education refers to bachelor certificate and higher. Small city is a dummy variable equal to 1 for the city with population less than 5000 people. Trust inflation is a dummy equal to 1 if a consumer chose "Yes, the rate of inflation experienced by my household is roughly in line with the official rate of inflation" as an answer to the survey question " According to the official statistics of the Federal Statistical Office, the rate of inflation averaged ... between May 2019 and June 2020. What are your thoughts? Is this rate of inflation roughly in line with the rate of inflation your household has experienced over the past twelve months?" Renters is a dummy variable equal to 1 if an individual rents a house/flat and 0 otherwise. Liquidity constrained variable if equal to 1 if a consumer expects difficulties with covering current expenditures in the next month and 0 otherwise. Outstanding loans is a dummy variable equal to 1 is an individual has not yet fully repaid loans and 0 otherwise. Intention to buy equals to 1 for consumers who plan to buy property in the next 10 years and 0 otherwise. Informed about inflation is a dummy equal to 1 if an individual answered "yes" to the survey question: "Aside from this survey, have you, over the past four weeks, heard or read anything about inflation in Germany?" and 2 if "no" was chosen. Inflation source variable is equal to 1 if "more media" is the answer to the survey question: "You said you think prices for essential goods have [...] over the past twelve months. Is that based more on things you have heard or read or on your own experiences when shopping?" and 2 if "more own shopping experience" is chosen. Pessimistic is a dummy variable equal to 1 if a respondent chose "rather pessimistic" or "very pessimistic" answer to the survey question: "Thinking for a moment about your current circumstances, do you generally have an optimistic or pessimistic outlook for the next twelve months?" and 0 otherwise. Covid-19 income loss is a variable equal to 1 if an individual suffered income loss due to the covid-19 pandemic and 0 otherwise. Δ denotes the differences between the left and the right columns. The statistical significance of the differences in means is based on Mann-Whitney U tests. The significance level for the differences is denoted by * p<0.1, ** p<0.05, *** p<0.01. The data span waves 1-27 of the survey (April - June 2019, April 2020 - March 2022).

Table B5: Heterogeneity along socio-demographic characteristics

Dependent variable: Short-term Inflation Expectations (next 12 months)

	female	male	east	non-east	young	middle age	old	education low	education medium	education high	income low	income medium	income high	employed	unemployed	retired
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Perceptions (past 12 months)	0.831***	0.762***	0.842***	0.796***	0.868***	0.834***	0.746***	0.822***	0.790***	0.751***	0.756***	0.810***	0.803***	0.841***	0.777***	0.748***
	(0.0134)	(0.0167)	(0.0222)	(0.0118)	(0.0362)	(0.0143)	(0.0167)	(0.0125)	(0.0257)	(0.0275)	(0.0566)	(0.0128)	(0.0189)	(0.0138)	(0.0566)	(0.0177)
Constant	-0.327	0.367	-0.461	0.0668	-0.322	0.842**	0.769	-0.253	-0.0726	-0.161	-1.222	0.409**	0.510**	0.435	0.526	2.299
	(0.481)	(0.270)	(0.496)	(0.289)	(0.432)	(0.298)	(0.463)	(0.303)	(0.620)	(0.637)	(0.893)	(0.137)	(0.169)	(0.395)	(0.893)	(1.239)
Wave dummies	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Controls	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
N	20020	29547	8684	40883	3226	25222	21119	27708	8919	12940	1096	28578	19893	28073	1175	18552
R^2	0.568	0.532	0.557	0.557	0.572	0.564	0.552	0.563	0.559	0.527	0.526	0.565	0.544	0.564	0.608	0.548

Notes: Columns 1-15 report OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** p<0.001, ** p<0.01, * p<0.05. Socio-demographic controls include gender, household income, education, current employment status, region, age, age squared. The dependent variable (short-term inflation expectations) is measured by the quantitative survey question: "What do you think the rate of inflation will roughly be over the next 12 months?". Perceptions are measured by the quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?" Individual uncertainty equals the variance in short-term inflation expectations; calculated from probabilistic inflation expectations question (Appendix A). Perceptions and expectations truncated [30,-5]. The data span waves 1-30 of the survey (April-June 2019, April 2020 - June 2022).

Table B6: Heterogeneity in the Pass-through

Dependent variables:		
	informed about inflation	base perceptions on own shopping experience
	(1)	(2)
female	0.161***	0.0304**
	(0.0180)	(0.0112)
medium level of income	-0.0102	0.0225
	(0.0617)	(0.0362)
high income	-0.0643	0.0220
	(0.0625)	(0.0370)
medium level of education	-0.0685**	-0.0218
	(0.0235)	(0.0149)
high level of education	-0.103***	-0.0643***
	(0.0212)	(0.0150)
employed	-0.0319	-0.0124
	(0.0466)	(0.0293)
unemployed	-0.0662	-0.0135
	(0.0902)	(0.0553)
retired	-0.0876	-0.0289
	(0.0517)	(0.0322)
east	0.0460*	0.00997
	(0.0227)	(0.0143)
age	-0.00358	0.00626*
	(0.00420)	(0.00290)
age^2	-0.0000337	-0.0000439
	(0.0000411)	(0.0000271)
constant	1.816***	1.695***
	(0.116)	(0.0831)
N	2917	2910
R^2	0.106	0.016

Notes: Columns 1-2 report OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** $p<0.001$, ** $p<0.01$, * $p<0.05$. The dependent variable ("informed about inflation") is measured by the survey question: "Aside from this survey, have you, over the past four weeks, heard or read anything about inflation in Germany?". The dependent variable ("base perceptions on own shopping experience") are measured by the survey question: "You said you think prices for essential goods have "[...]" over the past twelve months. Is that based more on things you have heard or read or on your own experiences when shopping?". Low income refers to the monthly income less that 1000 euro. Medium income refers to the monthly income level from 1000 euro to 3999 euro. High income refers to the monthly income level higher than 4000 euro. Low level of education refers to high school education or less. Medium level of education refers to Bachelor degree. High level of education denotes education level higher than Bachelor degree. East (West/North/South) is a dummy equal to 1 if a household lives in Eastern (Western/Northern/Southern) Germany and 0 otherwise. The data span wave 19 (July 2021).

Table B7: Socio-economic Heterogeneity in Information Acquisition

Dependent variable: Uncertainty about future inflation	
female	2.231***
	(0.116)
high income	-3.750***
	(0.515)
medium level of income	-1.709***
	(0.515)
low level of education	2.111***
	(0.108)
medium level of education	1.202***
	(0.137)
employed	-0.924*
	(0.365)
unemployed	-0.571
	(0.541)
retired	-1.665***
	(0.397)
east	1.003***
	(0.157)
age	-0.398***
	(0.0288)
age^2	0.00351***
	(0.000289)
constant	17.14***
	(0.851)
N	84786
R^2	0.029

Notes: The table reports OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** $p<0.001$, ** $p<0.01$, * $p<0.05$. Survey wave dummies are included. The dependent variable (uncertainty about future inflation) uncertainty is measured as the standard deviation of the subjective probability distribution from the probabilistic question regarding inflation expectations (Appendix A). Low income refers to the monthly income less that 1000 euro. Medium income refers to the monthly income level from 1000 euro to 3999 euro. High income refers to the monthly income level higher than 4000 euro. Low level of education refers to high school education or less. Medium level of education refers to Bachelor degree. High level of education denotes education level higher than Bachelor degree. East (West/North/South) is a dummy equal to 1 if a household lives in Eastern (Western/Northern/Southern) Germany and 0 otherwise. The data span waves 1-30 (April 2020 - June 2020, April 2021 - June 2022).

Table B8: Socio-economic Heterogeneity in Inflation Uncertainty

Dependent variables:	Short-term Inflation Expectations 1-Year	Long-term Inflation Expectations	
		5-Years	10-Years
	(1)	(2)	(3)
perceptions last 12 months	0.614*** (0.0149)	0.193*** (0.0253)	0.271*** (0.0348)
expectations last 12 months		0.431*** (0.0254)	0.394*** (0.0335)
uncertainty	0.0185*** (0.00214)	0.0464*** (0.00433)	0.0560*** (0.00547)
perceptions *×uncertainty*	0.00165*** (0.000412)	-0.000670 (0.000686)	-0.00161* (0.000716)
constant	-0.125 (0.222)	1.722** (0.528)	2.190** (0.701)
N	44305	16013	14939
R^2	0.643	0.371	0.284

Notes: Columns 1-3 report OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** $p<0.001$, ** $p<0.01$, * $p<0.05$. Socio-demographic controls include gender, household income, education, current employment status, region, age, age squared. We also control for the mean inflation expectations derived from the subjective probability distribution from the probabilistic question regarding inflation expectations (Appendix A). The variable uncertainty is measured as the variance of the subjective probability distribution from the probabilistic question. The dependent variable (short-term inflation expectations) is measured by the quantitative survey question: "What do you think the rate of inflation will roughly be over the next 12 months?". The independent variable (short-term inflation perceptions) are measured by the quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?". Perceptions and expectations truncated [30;-5]. The data span waves 1-30 (April 2020 - June 2020, April 2021 - June 2022).

Table B9: Inflation Uncertainty and Inflation Expectations

Dependent variable: Short-term Inflation Expectations		
	(1)	(2)
perceptions	0.647***	0.614***
last 12 months	((0.0130)	(0.0149)
uncertainty	0.0277***	0.0185***
	(0.00146)	(0.00214)
perceptions × uncertainty		0.00165***
		(0.000412)
constant	-0.228	-0.125
	(0.220)	(0.222)
Controls	+	+
Wave dummies	+	+
N	44305	44305
R^2	0.642	0.643

Notes: Columns 1-2 report OLS estimates. Robust standard errors (Eicker-Huber-White) are reported in parentheses. Significance levels: *** $p<0.001$, ** $p<0.01$, * $p<0.05$. Socio-demographic controls include gender, household income, education, current employment status, region, age, age squared. The variable uncertainty is measured as the variance of the subjective probability distribution from the probabilistic question regarding inflation expectations (Appendix A). We also control for the mean inflation expectations derived from the subjective probability distribution from the probabilistic question. The dependent variable (short-term inflation expectations) is measured by the quantitative survey question: "What do you think the rate of inflation will roughly be over the next 12 months?". The independent variable (short-term inflation perceptions) are measured by the quantitative survey question: "What do you think the rate of inflation or deflation in Germany was over the past 12 months?". Perceptions and expectations truncated [30;-5]. The data span waves 1-30 (April 2020 - June 2020, April 2021 - June 2022).

Table B10: Inflation Uncertainty and Short-term Inflation Expectations