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The role of information and experience for households' inflation expectations

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The role of information and experience for households' inflation expectations*

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August 18, 2020

Abstract

Based on a new survey of German households, we investigate the role of information channels and lifetime experience for households' inflation expectations. We show that the types of information channels that households use to inform themselves about monetary policy are closely related to their socio-economic characteristics. These information channels, in turn, have an important influence on the *level* of perceived past and expected future inflation, as well as uncertainty thereof. The expected future *change* of inflation and the unemployment rate, however, is strongly influenced by individual experience of these variables. Similarly, the expected response of inflation to a change in the interest rate is also shaped by experience. We propose the interpretation that households obtain inflation numbers from the media, but their 'economic model' is shaped by experience.

JEL-Codes: E31, D84, E71

Keywords: Household expectations, inflation expectations, information channels, experience, Bundesbank household survey

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1 Introduction

What determines households' inflation expectations? Considering that the answer is of high importance to monetary policy, relatively few studies have empirically taken up this question until recently. Moreover, most studies on this topic – see below for an overview – employ US data only. Presumably, data limitations are to blame for this research gap. In this paper, we take an explorative look at a new and large survey of German households, conducted in 2019 by the German central bank, with a focus on the role of information channels (e.g., traditional media or social media) and experiences for shaping households' inflation expectations.¹ We find that both play a role, but for different aspects of how expectations are formed.

Expectations of economic variables can vary across households because of different information sets, or due to alternative views on the workings of the economy, i.e., the 'economic model' entertained by households. We find that socio-economic characteristics are related to the information channel used primarily by households to inform themselves about monetary policy. This channel, in turn, plays an important role for what households expect about the *level* of past and future inflation, controlling for other household characteristics. Specifically, consumers of traditional media such as newspapers or television have lower and, thereby, more accurate views of inflation over the last year, as well as lower inflation expectations for the coming year. They are also less uncertain about future inflation than households who do not inform themselves about monetary policy. These results can be rationalized by a high information content and a comprehensible presentation in traditional media. Lifetime experience does not play an important role, arguably because this experience is not remembered in the form of numerical values. In contrast, households that inform themselves about monetary policy via social media display higher uncertainty regarding future inflation. As discussed in Bundesbank (2019), this latter finding suggests that central banks should increase their social media presence to facilitate the spread of accurate information via this channel.

For expectations regarding the *direction* of future of inflation, instead, lifetime experience of inflation turns out to be highly relevant. The higher the inflation experience of an individual, the more likely is the individual to expect inflation to increase over the next twelve months. This finding is consistent with the hypothesis that experiences, rather than information channels, influence individuals' economic model, i.e., the way how agents think about the basic mechanics of the economy. This is confirmed by our observations regarding the expected direction of the unemployment rate, and the answers to a thought experiment, in which the European Central Bank unexpectedly raises inter-

¹Lagarde (2020) outlines the importance of both economic expectations of the public and communication about monetary policy for the ECB. Given that direct central bank communication has difficulties to change households' inflation expectations (Lamla and Vinogradov, 2019), other communication channels might be crucial to fill this gap (Lamla and Lein, 2014). Binder (2017) also finds that expectations of more informed individuals react more strongly to monetary policy announcements.

est rates. When asked for the effects of such a change in interest rates, consumption of traditional media loses its importance. Experience has again a much stronger influence on expected linkages of economic variables. Specifically, individuals who have experienced higher inflation over their lifetime expect inflation to rise after an increase in the interest rate.

The remainder of this paper is organized as follows. Section 2 discusses the related literature. Section 3 presents the data set. Section 4 investigates the determinants of households' information channels, while Section 5 investigates the role of information channels and experience on inflation expectations. Section 6 analyzes the effect of a hypothetical change in the policy rate on inflation expectations. Section 7 concludes.

2 Related Literature

Our paper relates to the literature on the determinants of households' inflation expectations. In particular, we contribute to the evidence on the role of information channels and experience on individual expectations.² Using a survey of Dutch households, van der Crujsen et al. (2015) find that knowledge about the ECB's objectives is quite limited. Similarly, Lamla and Vinogradov (2019) observe no general effect of FOMC meetings on household expectations in the US. Andre et al. (2019) present households with hypothetical exogenous shocks and find strong deviations of adjustments of households' expectations from those of economic experts. Household behavior follows a pattern in which variables co-move that households consider as 'bad' or 'good'. Rather than using information about central bank actions, households seem to form inflation expectations based on their observations during grocery shopping, according to D'Acunto et al. (2019). This also creates a significant gender gap in inflation perceptions (D'Acunto et al., 2020). However, if confronted with alternative information treatments about current and next year's interest rates (but not if treated with longer horizons), households significantly adjust their inflation expectations (Coibion et al., 2020).

An early study that, among other things, investigates the channels that US households use to inform themselves about economic issues is Krueger and Blinder (2004). Television and newspapers are the two most frequent and most important sources of information. In one part of their analysis, Kumar et al. (2015) relate the employed information channels of firm managers in New Zealand to their perceived and expected inflation, as well as their estimate of the central bank's inflation target. They find that those managers that have the most accurate view on the inflation target primarily use television and newspapers to inform themselves and users of media have the lowest error for actual inflation. Coibion et al. (2019b) go one step further and test the reaction of households' inflation expectations

²Early studies have often focused on the socio-economic determinants of inflation expectations, see, e.g., Jonung (1981) and Bruine de Bruin et al. (2010).

to different forms of information about inflation. Reading the FOMC statement has approximately the same effect on households' forecast revisions as just providing the FED's inflation target. Compared to these information channels, the reaction to reading news articles is about half.

Regarding the role of experience, Malmendier and Nagel (2011) have triggered a growing literature on the effects of individuals' economic experience on their behavior by showing that people who have witnessed lower stock market returns in their lifetime have more pessimistic return expectations and participate less in the stock market. In Malmendier and Nagel (2016), the authors find that individuals overweigh inflation that occurred during their lifetimes. Young individuals hence update their expectations more strongly, which is also documented by Mertens et al. (2020) for the impact of surprise changes in the Federal Funds target rate on household confidence. For Germany, Goldfayn-Frank and Wohlfart (2020) show that East Germans expect higher inflation, most likely due to higher experienced inflation rates after re-unification.

Evidence on how households form inflation expectations is economically important, given new evidence that these expectations have a bearing on actual household decisions. While Bachmann et al. (2015) found a small correlation between expected inflation and readiness to spend, Coibion et al. (2019a) use randomized information treatments about expected inflation and observe large negative effects of higher inflation expectations on durable spending. This effect seems to be driven by a more pessimistic view about real income in case of higher inflation expectations. Vellekoop and Wiederholt (2019) find that households with higher inflation expectations save less.

3 Data

Our analysis is based on data from the Bundesbank Online Pilot Survey on Consumer Expectations which was conducted in April, May and June 2019 and covers a representative sample of the German population.³ In each wave, individuals were asked about their quantitative expectations on inflation, their qualitative expectations on inflation and the unemployment rate, and other macroeconomic figures. The data also contain detailed information about the respondents' socio-economic characteristics. In our analysis, we focus on the subset of individuals who participated in the third wave (June 2019). To this wave, we contributed a question on the information channels through which individuals take notice of the ECB's monetary policy.

³For details on the process of how the respondents were selected, see Bundesbank (2019).

3.1 Socio-economic characteristics

We use information about the socio-economic characteristics of individuals who participated in the third wave as control variables. The survey targeted individuals of age 16 and older. The average age is 53. We consider indicator variables for individuals living in East Germany shortly before the reunification (*east1989*), gender (*female*), full employment (*fullemploy*), whether the individuals intend to buy a house in the next 10 years (*homebuy*) and whether individuals do not own real-estate (*no_property*). In addition, we use information about household size (*hhsiz*), income (*income*) and years of education (*yo*). Further details on the construction of the variables are provided in Tables A.1-A.2 of the Appendix. Descriptive statistics are presented in Table A.3.

3.2 Information channels

We contributed the following question on the information channels about the ECB's monetary policy.

Q:314: Via which of the following channels do you most often receive information about the European Central Bank's (ECB) monetary policy? Please select all answers that apply.

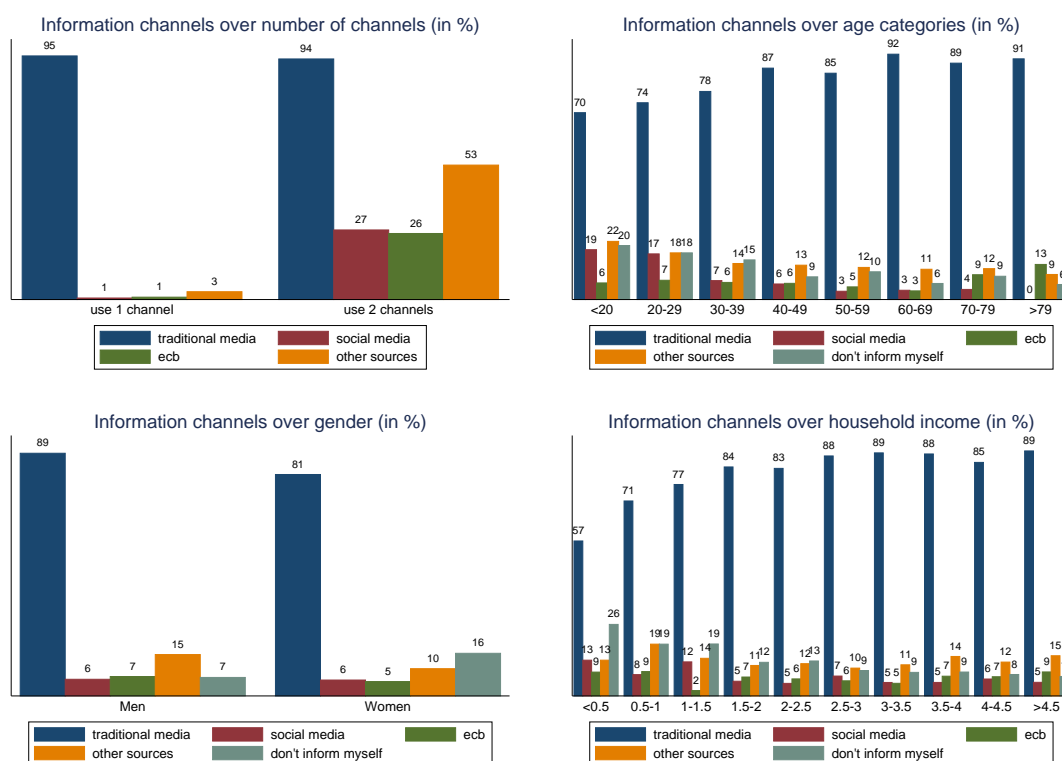
- Traditional media such as newspapers, radio, television or the websites of such providers
- Social media such as Facebook or Twitter
- ECB communication channels (e.g., ECB's website, ECB's Economic Bulletin, ECB's monthly press conference)
- Other sources
- I do not follow the ECB's monetary policy

Among the 2,591 households in Wave 3, 2,585 answered Question Q:314. 85% of the respondents state that traditional media is among the most important information channels through which they they receive information about the ECB's monetary policy. 6% of households use social media, 6.3% rely on direct communication channels of the ECB and 12.9% use other information sources. Only 10.4% of households do not inform themselves about monetary policy. The majority of respondents (70.8%) state that they receive information about monetary policy through a single information channel. 16.8% of respondents use two information channels. Hardly any respondent uses three or four information channels (1.9% and 0.1%).

The upper left panel in Figure 1 provides information about the information channels that respondents rely on when conditioning on the overall number of channels that are

used. The panel shows that among those individuals who state that they use a single information channel, 95% rely on traditional media. Respondents who use two information channels still predominantly rely on traditional media (94%), followed by other sources (53%). For those individuals who use two information channels, the frequency of social media and direct ECB communication channels is more than 25%. The upper right panel shows that the usage of traditional media increases with age, while social media is most popular among those younger than 30 years. The lower left panel indicates that men are more likely than women to use traditional media and that 16% of women (vs. 7% of men) do not inform themselves about monetary policy. The lower right panel shows that the likelihood of using traditional media increases with income and that the percentage of individuals who do not receive information about monetary policy is the highest among low-income households (26%).

Figure 1: Conditional distribution of information channels



Notes: The panels depict the share of German households relying on distinct information channels of monetary policy conditional on the number of information channels (upper left), age (upper right), gender (lower left) and income (lower right). Household income is expressed in 1,000 Euros.

3.3 Survey-based expectations data

The Bundesbank survey elicits different types of inflation expectations. First, the survey asks for a point prediction of the rate of inflation over the past twelve months.⁴ We consider those point predictions as the perceived inflation, $\pi_{i,t-12:t|t}$, of each household. Second, each individual is asked for a point prediction of the rate of the inflation over the next twelve months, $\pi_{i,t:t+12|t}$. We refer to $\pi_{i,t:t+12|t}$ as expected future inflation. Summary statistics for $\pi_{i,t-12:t|t}$ and $\pi_{i,t:t+12|t}$ can be found in Table A.4 in the Appendix. Following Bundesbank (2019), we focus on individuals with expectations in the range of -12% to 12%. For those individuals, the mean of perceived inflation is 2.53%. This contrasts with an actual inflation rate over the May 2018 to May 2019 period of only 1.4%.⁵ That is, on average households overestimated the actual inflation rate. In the following, we denote the individual perception errors by $e_{i,t-12:t|t}$. The expected inflation over the next twelve months is 2.50% on average.

Besides the point predictions, the Bundesbank survey also asks for histogram forecasts for the rate of inflation over the next twelve months. For each individual, we compute the standard deviation, $\sigma_{i,t:t+12|t}$, of the histogram forecast and use it as a measure of inflation uncertainty.

Finally, the survey asks questions in qualitative form. We employ questions about expected changes in inflation and the unemployment rate to better understand the economic model that individuals have in mind when forming expectations. Individuals are asked whether they believe that the inflation/unemployment rate will decrease significantly, decrease slightly, stay roughly the same, increase slightly or increase significantly. We reclassify the answers as -1, 0, 1 whereby -1 stands for a slight/significant decrease, 0 for no change and 1 for a slight/significant increase. We denote the qualitative inflation and unemployment expectations by *infl_exp* and *unemp_exp*. For summary statistics see Panel B of Table A.4. The qualitative inflation expectations are well aligned with the quantitative expectations: for individuals with $-12 \leq \pi_{i,t:t+12|t} \leq 12$, the conditional means of expected inflation are 1.65%, 2.16% and 2.74% when the qualitative expectations are -1, 0 and 1.

3.4 Time-series data

In order to compute lifetime experiences of inflation and unemployment rates, we make use of annualized aggregate time series for West-Germany from 1950 until 2019. The data on inflation is provided by the Deutsche Bundesbank and refers to the German CPI, seasonally and working-day adjusted. Unemployment data is taken from the Federal Employment Agency of Germany and refers to the official unemployment rate based on

⁴This question was only asked to participants of Wave 3 of the Bundesbank survey who did not already participate in Wave 2.

⁵We compute the inflation rate based on the German CPI (“Verbraucherpreisindex, VPI”).

civilian dependent employment. There have been several distinct phases in the historical evolution of inflation and the unemployment rate in Germany since 1950. After WWII, unemployment came down from high levels, while inflation was slowly increasing. It remained high and volatile in the 70's, fell in the 80's, and has remained low and relatively stable since the mid-1990s. Unemployment rose in the 70's, peaked in the late 1990s, and has fallen since. Given these developments, it is conceivable that households with different lifetime experiences of inflation and unemployment have different views of the future development of both variables. Malmendier and Nagel (2011, 2016) have formally shown that individual experiences matter for the formation of expectations. We follow the methodological approach in Malmendier and Nagel (2011) and model inflation experience as a weighted average of the inflation rates that materialized during an individuals' lifetime. Specifically, the inflation experience of individual i is given by

$$\tilde{\pi}_{i,2019}^{lt}(\lambda) = \sum_{k=1}^{age_i-1} w_i(k, \lambda) \tilde{\pi}_{2019-k}, \quad (1)$$

where $\tilde{\pi}_{2019-k}$ is the annual inflation rate in (West) Germany in year $2019 - k$ and

$$w_i(k, \lambda) = \frac{(age_i - k)^\lambda}{\sum_{k=1}^{age_i-1} (age_i - k)^\lambda}. \quad (2)$$

We restrict λ to be non-negative. For $\lambda > 0$ the weights are declining from lag one onwards. This is in line with the empirical observation that individuals are usually influenced most strongly by recent inflation experience (Malmendier and Nagel, 2016). Nevertheless, for a sufficiently small λ individuals can attach considerable weight even to observations that lie in the distant past. In the extreme case when $\lambda = 0$, all lags receive the same weight and, hence, $\tilde{\pi}_{i,2019}^{lt}(0)$ is the simple average of the inflation rates during the lifetime of an individual. Additionally, we compute the lifetime experience of the unemployment rate, $\tilde{u}_{i,2019}^{lt}$, in the same way as described above for inflation.

In the empirical analysis, we estimate either linear regression models or Probit models. We estimate those models for a fixed value of λ and then search over a grid of λ values for the one that either minimizes the sum of the squared residuals (linear regression models) or maximizes the log-likelihood (Probit models).

4 Determinants of Information Channels

In a first step, we study in detail the determinants of each household's most important information channels regarding monetary policy. For each information channel, we estimate a Probit model that relates the choice of the information channel to the households' socio-economic characteristics. Motivated by the upper and lower right panels in Figure 1, we include age and age^2 as regressors as well as the log of income. The average marginal

effects (multiplied by 100) are presented in Table 1. The first column shows that the probability that an individual uses traditional media increases with age, household income and years of education. For example, the predicted probability for the usage of traditional media is 66.52% for a 20-year-old individual but 93.30% for an 80-year-old individual. Thus, switching from a ‘young’ to an ‘old’ individual increases the likelihood of using traditional media by 26.78 percentage points (denoted by $\Delta P(y = 1|\mathbf{X})$ in Table 1). Increasing household income by one percent raises the probability of using traditional media by 5.52 percentage points. In addition, women are less and individuals with more years of education are more likely to rely on traditional media. As expected, younger individuals are more likely to rely on social media. In contrast, the probability that an individual uses direct communication channels of the ECB increases with age. Interestingly, individuals who intend to buy a house are more likely to inform themselves through direct channels of the ECB. This suggests that households that might take a mortgage loan monitor the ECB’s interest-rate decisions more carefully than other households. Younger individuals, individuals with lower education, lower household income, females and those who do not intend to buy a house are more likely to not inform themselves about monetary policy.

5 Inflation Expectations

Next, we investigate whether information channels and/or individual experience can explain inflation expectations. In all regressions, we include dummies for the four information channels *traditional*, *social*, *ecb* and *other*. Those individuals who state that they do not inform themselves about monetary policy serve as the reference group. For all individuals, the inflation experience in Equation (1) is based on West-German historical inflation rates. That is, we assign West-German inflation rates also to individuals who lived in East Germany before 1989. Nevertheless, in order to control for their specific experience we include the *east1989* dummy in all regressions.

5.1 Quantitative expectations

5.1.1 Point predictions

The first three columns of Table 2 show the results of linear regressions of the point predictions for perceived inflation ($\pi_{i,t-12:t|t}$), the absolute perception errors ($|e_{i,t-12:t|t}|$), and the future expected inflation ($\pi_{i,t+12:t|t}$) on the information channels and individual inflation experience while controlling for socio-economic characteristics.⁶ Columns (1)-(3) show that the only information channel which has a significant effect is traditional media.

⁶Due to the cross-sectional nature of our data set, we cannot include age dummies as done in Malmendier and Nagel (2011). If we did, these dummies would capture the effect of lifetime experience of inflation. Instead, we leave out age controls in the baseline and resort to cohort dummies in a robustness check, as suggested by Malmendier and Nagel (2011) for cases of multicollinearity. As we discuss below, including cohort dummies does not affect our results.

Table 1: Information channels and socio-economic characteristics

	(1)	(2)	(3)	(4)	(5)
	<i>traditional</i>	<i>social</i>	<i>ecb</i>	<i>other</i>	<i>noinform</i>
<i>age</i>	0.39*** (0.06)	-0.17*** (0.04)	0.15*** (0.06)	-0.09 (0.06)	-0.27*** (0.05)
<i>east1989</i>	-3.06 (2.19)	0.24 (1.41)	-2.40* (1.31)	2.26 (2.10)	1.73 (1.88)
<i>female</i>	-6.61*** (1.54)	-0.51 (0.96)	-0.92 (1.04)	-5.56*** (1.40)	7.91*** (1.38)
<i>fullemploy</i>	-1.08 (1.84)	-0.10 (1.20)	2.94** (1.45)	-1.88 (1.83)	0.59 (1.59)
<i>hhsiz</i>	-0.66 (0.79)	0.60 (0.48)	-0.79 (0.67)	-0.28 (0.81)	0.55 (0.68)
<i>homebuy</i>	2.10 (1.70)	-0.48 (1.16)	6.41*** (1.82)	3.88** (1.97)	-3.20** (1.34)
$\ln(\textit{income})$	5.52*** (1.63)	-1.24 (0.95)	1.12 (1.45)	-1.87 (1.68)	-3.86*** (1.36)
<i>no_property</i>	-0.17 (1.61)	1.55 (1.11)	-0.70 (1.25)	-3.67** (1.57)	1.36 (1.40)
<i>yoe</i>	0.73*** (0.23)	-0.09 (0.15)	0.00 (0.15)	0.49** (0.20)	-0.52*** (0.20)
Observations	2,307	2,307	2,307	2,307	2,307
% correctly predicted	65.76	74.99	59.90	59.73	65.06
$\Delta P(y = 1 \mathbf{X})$	26.78	-12.38	8.81	-5.35	-18.87

Notes: This table presents average marginal effects from Probit regressions of households' information channels on their socio-economic characteristics. The underlying regression model includes age and age squared. Heteroskedasticity-consistent standard errors are reported in parentheses. The reported average marginal effects and standard errors are the estimated ones times 100. Asterisks '*', '**', and '***' indicate significance at the 10%, 5% and 1% critical level, respectively. The estimation sample includes individuals with $-12 \leq \pi_{i,t:t+12|t} \leq 12$. In the second-to-last row, we report the fraction of correct predictions for each information channel. In the last row, we report the difference in the predicted probability of using a particular information channel for a 20- and an 80-year-old individual.

For individuals who use this information channel, perceived inflation is on average 0.55 percentage points lower than for those individuals who do not inform themselves. Further, as shown by Columns (2) and (3), users of traditional media have significantly lower absolute prediction errors and expect significantly lower rates of inflation for the future. Both results remain significant if perceived inflation is included as a control variable, see Columns (1) and (2) in Table A.5 in the Appendix. Hence, utilizing traditional media does not only lower perceived inflation, but also makes it more accurate. Additionally, usage of traditional media reduces inflation expectations even more than what is implied by the effect of lower perceived inflation on expected inflation. It should be noted that the insignificant estimates for the other information channels may be partly driven by

the fact that the number of households that rely exclusively on these information sources is relatively small. Lifetime inflation experience does neither affect perceived inflation, perception errors nor future expected inflation.⁷

Table 2: Regressions of expectations on information channels and lifetime experience

	(1)	(2)	(3)	(4)	(5)	(6)
	$\pi_{i,t-12:t t}$	$ e_{i,t-12:t t} $	$\pi_{i,t:t+12 t}$	$\sigma_{i,t:t+12 t}$	<i>infl_exp</i>	<i>unemp_exp</i>
<i>traditional</i>	-0.55*** (0.18)	-0.57*** (0.17)	-0.51*** (0.18)	-0.34** (0.13)	-0.03 (0.03)	-0.02 (0.03)
<i>social</i>	0.16 (0.27)	0.15 (0.25)	0.27 (0.22)	0.54*** (0.20)	0.01 (0.04)	0.05 (0.04)
<i>ecb</i>	0.04 (0.24)	0.17 (0.21)	0.01 (0.19)	0.07 (0.17)	-0.06 (0.04)	0.05 (0.04)
<i>other</i>	-0.03 (0.14)	-0.10 (0.13)	0.06 (0.14)	-0.09 (0.11)	-0.02 (0.03)	0.07** (0.03)
$\tilde{\pi}_{i,2019}^{lt}$	0.30 (0.31)	0.28 (0.28)	0.91 (0.73)	-0.70*** (0.12)	0.45*** (0.13)	
$\tilde{u}_{i,2019}^{lt}$						0.11*** (0.02)
Constant	3.96*** (1.11)	3.97*** (1.00)	3.66*** (1.23)	5.06*** (0.75)		
Observations	1,309	1,309	2,307	2,317	2,305	2,306
Controls	Yes	Yes	Yes	Yes	Yes	Yes
λ	1.70	1.60	5.10	0.20	4.40	2.70
\bar{R}^2	0.07	0.09	0.03	0.04	–	–
% correctly predicted	–	–	–	–	61.95	49.96
$\Delta P(y = 1 \mathbf{X})$	–	–	–	–	12.59	9.72

Notes: Columns (1)-(4) present OLS estimates from regressions of households’ quantitative expectations on their sources of information about monetary policy, lifetime inflation and socio-economic characteristics. Columns (5)-(6) present average marginal effects for an increase (=1) in the respective dependent variable from ordered Probit regressions of households’ qualitative expectations on information channels, lifetime experience and socio-economic controls. Heteroskedasticity-consistent standard errors are reported in parentheses. Asterisks ‘*’, ‘**’ and ‘***’ indicate significance at the 10%, 5% and 1% critical level, respectively. The estimation sample in Columns (1) and (2) includes individuals with $-12 \leq \pi_{i,t-12:t|t} \leq 12$. Columns (3), (5) and (6) include those with $-12 \leq \pi_{i,t:t+12|t} \leq 12$. Column (4) includes all individuals. In the second-to-last row, we report the fraction of correct predictions for each qualitative expectation. In the last row, we report the difference in the predicted probability of stating a one when comparing an individual with experience at the 90th percentile with an individual with experience at the 10th percentile.

⁷The finding that lifetime inflation experience does not matter for the quantitative inflation expectations is robust to several alternative specifications. For example, we assigned East-German inflation rates (which were officially always close to zero) to individuals who lived in East Germany before the reunification or, alternatively, imposed that their inflation experience “begins” with the reunification. Contrary to our results, Malmendier and Nagel (2016) find that lifetime experience matters for inflation expectations. This contrast might be due to either the different countries under investigation or the imposition of an AR(1) process for perceived inflation dynamics in Malmendier and Nagel (2016).

Note that we control for each household’s socio-economic characteristics. For brevity, detailed results are omitted from Table 2 (the detailed estimates can be found in Table A.6 in the Appendix). In line with the previous literature, we find that females have higher perceived inflation, larger perception errors and higher expected future inflation. In contrast, years of education have a significantly negative effect on all three variables (see, for example, Bruine de Bruin et al., 2010). The *no_property* dummy is significantly positive in Columns (1) and (2), while higher income tends to go along with lower future expected inflation, see D’Acunto et al. (2019). We also find that the *east1989* dummy is significantly positive in Column (3), which is in line with the findings in Goldfayn-Frank and Wohlfart (2020).

5.1.2 Inflation uncertainty

In Column (4), we explore the effects on inflation uncertainty. We find that individuals who rely on traditional media are significantly less uncertain than those who do not inform themselves. Interestingly, we also find that individuals who use social media are more uncertain. According to Bundesbank (2019), the data from all three waves of the survey suggest that individuals with higher inflation uncertainty have less stable and potentially de-anchored inflation expectations. Hence, as discussed in Bundesbank (2019), our finding that users of social media are more uncertain about future inflation suggests that central banks should disseminate accurate information through channels other than traditional media. Moreover, higher lifetime inflation experience significantly reduces inflation uncertainty. This finding could be explained by the empirical observation that higher levels of inflation typically go along with higher inflation variability (see, for example, Conrad and Hartmann, 2019). Individuals who have experienced phases of high inflation might therefore be more certain about the inflation outlook in the current low-inflation environment. The estimate of 0.2 for λ implies that individuals take into account inflation experiences from large parts of their life when asked for the possible range of future inflation.⁸

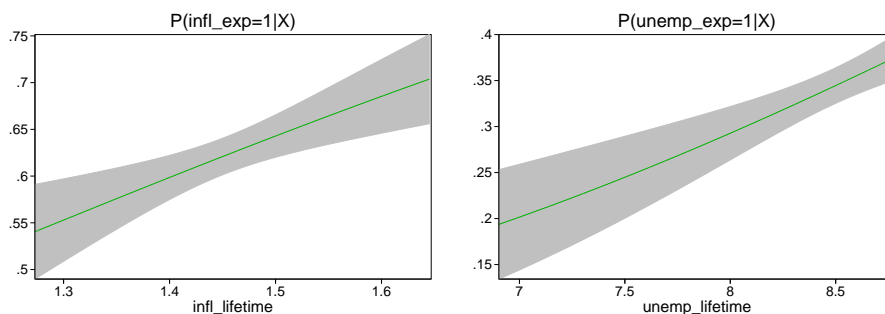
In addition, we find that men are significantly less uncertain than women and that individual uncertainty decreases with income and years of education. The fact that individuals with higher income are less uncertain complements the finding in D’Acunto et al. (2019) that household income explains the expected inflation rate.

⁸As a robustness check, we also re-estimated Column (4) with an alternative measure of inflation uncertainty as the dependent variable (see Column (3) in Table A.5). Krüger and Pavlova (2020) propose a new uncertainty measure for histogram forecasts, which they call ‘expected ranked probability score’ (ERPS). The ERPS is solely based on the probabilities that an individual assigns to each bin and does not require further assumptions (such as mass-at-midpoint). When using this new uncertainty measure, however, all results remained unchanged.

5.2 Qualitative expectations: directions of change

Column (5) of Table 2 presents the average marginal effects from an ordered Probit regression of the qualitative inflation expectations on information channels, lifetime inflation experience as well as control variables. We report marginal effects on the probability that individuals expect a slight or significant increase in the inflation rate. It turns out that information channels are no longer relevant when explaining directional changes in inflation expectations. Instead, lifetime inflation experience plays a crucial role. The optimal λ is estimated to be 4.4. This estimate implies that the weights in Equation (2) decline quickly for a 20-year-old individual while an 80-year-old individual will attach non-negative weights to inflation rates over the last 40 years. The left panel in Figure 2 shows how inflation experience affects the predicted probability for expecting a slight or significant increase in the inflation rate. For example, for an individual with an inflation experience of 1.31% (which corresponds to the 10th percentile) the probability is 55.66% and for an individual with an experience of 1.59% (which corresponds to the 90th percentile) the probability is 68.25%. Hence, the difference in the predicted probabilities when moving from the 10th to the 90th percentile is 12.59 percentage points. That is, individuals who have experienced higher inflation rates are more likely to expect an increase in the inflation rate.⁹ Concerning the control variables, we again find that individuals who lived in East Germany before the reunification are more likely to expect an increase in the inflation rate.

Figure 2: Predicted probabilities as a function of experience



Notes: The figure shows the predicted probabilities (green line) and corresponding 95% confidence intervals (grey shaded) for increases in the inflation rate (left panel) and the unemployment rate (right panel) as a function of lifetime experience. The predictions are based on the estimates in Columns (5) and (6) of Table 2.

⁹The results in Column (5) of Table 2 are robust to including cohort dummies, constructed as in Figure 1. Specifically, Column (4) in Table A.5 shows that lifetime inflation experience remains significant. In addition, when including cohort dummies, we find that usage of traditional media is still significant in the regressions for perceived and expected inflation while inflation experience remains insignificant (results available upon request).

5.3 Summary and interpretation

Our findings are so far consistent with the following interpretation. Households learn about the level of current and future inflation rates mainly from traditional media, but individual inflation experience is key for explaining the expected change in inflation. In order to understand whether this finding applies more generally, we also investigate the determinants of the expected changes in the unemployment rate. As Column (6) shows, the lifetime unemployment experience plays a crucial role for explaining the expected change in the unemployment rate. The right panel in Figure 2 shows that the predicted probability of expecting an increase in the unemployment rate increases with the lifetime unemployment experience. Additionally, individuals who rely on other information channels (e.g., personal interactions) have higher unemployment expectations. Thus, our analysis of the unemployment rate reveals a similar picture as for the expected change in the inflation rate.

Our interpretation of these findings is that traditional media channels are important for gaining an accurate picture of the current state of the economy, i.e., for obtaining the correct figures. However, information channels either do not convey an economic model of the workings of the economy or households do not absorb this information. Instead, the economic model which is used by households to forecast future developments appears to be shaped to a large degree by their own experiences.

6 Response to Changes in the Policy Rate

In order to learn more about the ‘economic model’ that households implicitly use when thinking about the economy, we investigate how individuals respond to a monetary policy shock. Specifically, we contributed a question to the survey that asked households how they would update their inflation expectations in response to an unexpected increase in the policy rate by the ECB. There were two randomly assigned versions of this question:

Q:311A/B: Imagine that you have just found out that the Governing Council of the European Central Bank has unexpectedly announced that it is putting up the policy rate by...

- weak treatment (WT): ...0.25 percentage points.
- strong treatment (ST): ...1.00 percentage point.

What impact does this information have on your expectations regarding the rate of inflation over the next twelve months?

- I expect inflation to be lower
- It has no impact on my expectations
- I expect inflation to be higher

The upper panel of Table 3 summarizes the answers. While Column (1) presents the results for the combined treatments, Columns (2) and (3) report results for the weak and strong treatments separately. Roughly 50% of individuals do not update their inflation expectations in response to an unexpected increase in the policy rate. The fraction of individuals who do not update expectations is somewhat lower in the treatment with a stronger increase in the policy rate but still higher than the fraction of individuals who change their inflation expectations upwards or downwards. Interestingly, in both treatments the fraction of individuals who increase their inflation expectations is higher than the fraction of those who decrease inflation expectations. Although this behaviour is at odds with standard theory, it has been previously observed for households and is in line with an information effect of the increase in the interest rate, i.e., households infer from the policy rate change that the central bank has a more positive view on the current state of the economy than the household previously thought, see Eminidou et al. (2020) or Enders et al. (2019) in the context of a firm survey.

The lower panel of Table 3 shows the results of ordered Probit regressions of the change in the inflation expectation (*adj_infl_exp*) on the information channels and inflation experience while controlling for socio-economic characteristics. In all three columns, we report marginal effects for the probability that a household increases its inflation expectation in response to an unanticipated increase in the interest rate, i.e., for the response which stands in contrast to standard theory. For the strong and the combined treatment, we find that the direct ECB communication channel has a significant effect. Individuals who rely on this channel are less likely to increase their inflation expectations in response to an unexpected increase of the policy rate. This suggests that those who rely on direct ECB communication channels entertain an economic model of the economy that is in line with standard theory. In the weak treatment, using *other channels* increases the likelihood of revising the inflation expectation upwards. Interestingly, neither the traditional nor social media channel are important for the expectation updating.

Experience, however, is highly relevant for the updating behavior. Specifically, individuals with higher inflation experience are more likely to revise their inflation expectations upwards in response to an unexpected increase in the interest rate. A potential interpretation could be that these households have experienced rising interest rates during times of high inflation and hence mentally connect these two phenomena. Alternatively, there could be a negative effect of high experienced inflation rates on the perception of the ability of monetary policy to reduce inflation. In both cases, the inflation experience has shaped the economic model which is entertained by individuals. Note that the estimate of λ is now much smaller than in Column (5) of Table 2. This suggests that the lifetime inflation experience which essentially applies equal weights to all experienced inflation rates is most informative for understanding an individual's updating behavior.

In the strong treatment, the *east1989* dummy is significantly positive (see Table A.7 in the Appendix). That is, individuals who lived in East Germany before the reunification are

Table 3: Regressions of inflation updating on information channels and lifetime inflation

	(1) WT+ST	(2) WT	(3) ST
Panel A: Summary of Outcomes			
lower expected inflation	586 (24.10%)	274 (22.50%)	312 (25.70%)
same expected inflation	1131 (46.50%)	613 (50.33%)	518 (42.67%)
higher expected inflation	715 (29.40%)	331 (27.18%)	384 (31.63%)
	2432	1218	1214
Panel B: Ordered Probit Regression <i>adj_infl_exp</i>			
<i>traditional</i>	-0.65 (2.38)	-2.90 (3.31)	1.44 (3.43)
<i>social</i>	-0.86 (3.73)	2.07 (5.45)	-2.15 (5.28)
<i>ecb</i>	-6.12* (3.13)	-4.85 (4.34)	-7.55* (4.46)
<i>other</i>	3.62 (2.43)	6.16* (3.64)	1.02 (3.28)
$\tilde{\pi}_{i,2019}^{lt}$	8.27*** (2.80)	8.19** (3.57)	9.55** (4.66)
Observations	2,295	1,150	1,145
Controls	Yes	Yes	Yes
λ	0.10	0.00	0.40
% correctly predicted	46.14	50.26	42.79
$\Delta P(y = 1 \mathbf{X})$	7.50	7.66	8.15

Notes: Upper panel: Absolute frequencies of the reactions to the ECB announcements for the full sample, the ‘weak treatment group’ (WT) and the ‘strong treatment group’ (ST). Relative frequencies conditional on treatment status are reported in parentheses. Lower panel: Average marginal effects for an increase (=1) in *adj_infl_exp* from ordered Probit regressions of households’ inflation updating on their sources of information about monetary policy, lifetime inflation and socio-economic characteristics. Heteroskedasticity-consistent standard errors are reported in parentheses. The reported average marginal effects and standard errors are the estimated ones times 100. Asterisks ‘*’, ‘**’ and ‘***’ indicate significance at the 10%, 5% and 1% critical level, respectively. The estimation sample includes individuals with $-12 \leq \pi_{i,t:t+12|t} \leq 12$. In the second-to-last row, we report the fraction of correct predictions. In the last row, we report the difference in the predicted probability of stating a one when comparing an individual with inflation experience at the 90th percentile with an individual with experience at the 10th percentile.

more likely to expect the inflation rate to increase in response to a contractionary policy shock. In contrast, individuals who plan to buy real estate are less likely to increase their inflation expectations. This finding is in line with our previous result that those individuals are more likely to follow direct communication channels of the ECB and, hence, might have a better understanding of the effect of tighter monetary policy (see Table 1).

7 Conclusion

We interpret our findings as follows. Information channels provide households with information about the *level* of inflation, where traditional media seems to be more accurate in this respect. Perceived inflation and quantitative forecasts, which typically do not move too far away from perceived inflation rates, are hence very dependent on the information channel used. Lifetime inflation experience does not play an important role, arguably because this experience is not remembered in the form of numerical values. When forming expectations about the *direction* of future inflation, however, experience plays a much larger role, while information channels are less important. This finding is consistent with the hypothesis that experiences, rather than information channels, influence individuals' economic model, i.e., the way how agents think about the basic mechanics of the economy. This is confirmed by our observations regarding the expected direction of the unemployment rate, and the answers to a thought experiment in which the European Central Bank unexpectedly raises interest rates.

References

- Andre, Peter, Carlo Pizzinelli, Christopher Roth, and Johannes Wohlfart (2019). Subjective models of the macroeconomy: Evidence from experts and a representative sample. CESifo Working Paper 7850.
- Bachmann, Rüdiger, Tim O. Berg, and Eric R. Sims (2015). Inflation expectations and readiness to spend: Cross-sectional evidence. *American Economic Journal: Economic Policy*, 7(1):1–35.
- Binder, Carola (2017). Fed speak on main street: Central bank communication and household expectations. *Journal of Macroeconomics*, 52:238–251.
- Bruine de Bruin, Wändi, Wilbert Vanderklaauw, Julie S. Downs, Baruch Fischhoff, Giorgio Topa, and Olivier Amantier (2010). Expectations of inflation: The role of demographic variables, expectation formation, and financial literacy. *The Journal of Consumer Affairs*, 44(2):381–402.
- Bundesbank (2019). The relevance of surveys of expectations for the Deutsche Bundesbank. Monthly Report 12/19.
- Coibion, Olivier, Dimitris Georgarakos, Yuriy Gorodnichenko, and Maarten van Rooij (2019a). How does consumption respond to news about inflation? Field evidence from a randomized control trial. Mimeo.
- Coibion, Olivier, Dimitris Georgarakos, Yuriy Gorodnichenko, and Michael Weber (2020). Forward guidance and household expectations. Mimeo.

- Coibion, Olivier, Yuriy Gorodnichenko, and Michael Weber (2019b). Monetary policy communications and their effects on household inflation expectations. Mimeo.
- Conrad, Christian and Matthias Hartmann (2019). On the determinants of long-run inflation uncertainty: Evidence from a panel of 17 developed economies. *European Journal of Political Economy*, 56:233–250.
- D’Acunto, Francesco, Ulrike Malmendier, Juan Ospina, and Michael Weber (2019). Exposure to daily price changes and inflation expectations. Mimeo.
- D’Acunto, Francesco, Ulrike Malmendier, and Michael Weber (2020). Gender roles and the gender expectations gap. Mimeo.
- Eminidou, Snezana, Marios Zachariadis, and Elena Andreou (2020). Inflation expectations and monetary policy surprises. *Scandinavian Journal of Economics*, 122(1):306–339.
- Enders, Zeno, Franziska Hünnekes, and Gernot J. Müller (2019). Monetary policy announcements and expectations: Evidence from German firms. *Journal of Monetary Economics*, 108:45–63.
- Goldfayn-Frank, Olga and Johannes Wohlfart (2020). Expectation formation in a new environment: Evidence from the German reunification. *Journal of Monetary Economics*. forthcoming.
- Jonung, Lars (1981). Perceived and expected rates of inflation in Sweden. *The American Economic Review*, 71(5):961–968.
- Krueger, Alan B. and Alan Blinder (2004). What does the public know about economic policy, and how does it know it? *Brookings Papers on Economic Activity*, pages 327–397.
- Krüger, Fabian and Lora Pavlova (2020). Quantifying subjective uncertainty in survey expectations. *Working Papers of the Priority Programme 1859 “Experience and Expectation. Historical Foundations of Economic Behaviour”, No 14 (March), Berlin.*
- Kumar, Saten, Hassan Afrouzi, Olivier Coibion, and Yuriy Gorodnichenko (2015). Inflation targeting does not anchor inflation expectations: Evidence from firms in New Zealand. *Brookings Papers on Economic Activity*.
- Lagarde, Christine (2020). Hearing at the Committee on Economic and Monetary Affairs of the European Parliament.
- Lamla, Michael J. and Sarah M. Lein (2014). The role of media for consumers’ inflation expectation formation. *Journal of Economic Behavior and Organization*, 106:62–77.

- Lamla, Michael J. and Dmitri V. Vinogradov (2019). Central bank announcements: Big news for little people? *Journal of Monetary Economics*, 108:21–38.
- Malmendier, Ulrike and Stefan Nagel (2011). Depression babies: Do macroeconomic experiences affect risk taking? *The Quarterly Journal of Economics*, 126(1):373–416.
- Malmendier, Ulrike and Stefan Nagel (2016). Learning from inflation experiences. *The Quarterly Journal of Economics*, 131(1):53–87.
- Mertens, Karel, Daniel J. Lewis, and Christos Makridis (2020). Do monetary policy announcements shift household expectations? CEPR Discussion Paper 14360.
- SOEP-IS Group (2017). SOEP-IS 2015.1—PGEN: Person-related Status and Generated Variables. SOEP Survey Papers 462: Series D – Variable Descriptions and Coding. Berlin: DIW Berlin/SOEP.
- van der Cruijssen, Carin, David-Jan Jansen, Jakob de Haan, et al. (2015). How much does the public know about the ECB’s monetary policy? Evidence from a survey of Dutch households. *International Journal of Central Banking*, 11(4):169–218.
- Vellekoop, Nathanael and Mirko Wiederholt (2019). Inflation expectations and choices of households. Mimeo.

Appendix

Table A.1: Variable construction

Variable	Questionnaire	Description
Socio-economic characteristics		
<i>age</i>	<i>age</i>	Age of individual. Set to 80 if <i>age</i> equals '80 years or older'.
<i>east1989</i>	<i>eastwest1989</i>	Equals unity if <i>eastwest1989</i> equals 'East Germany', and zero else.
<i>female</i>	<i>gender</i>	Equals unity if <i>gender</i> equals 'female', and zero else.
<i>fullemploy</i>	<i>employ</i>	Equals unity if <i>employ</i> equals 'Employed, full-time', and zero else.
<i>hhsiz</i>	<i>hhsiz</i>	Household size. Set to 6 if <i>hhsiz</i> equals '6 or more'.
<i>homebuy</i>	<i>intbuyprop_renter</i> (Q:003A) and <i>intbuyprop_owner</i> (Q:003B)	Equals unity if either <i>intbuyprop_renter</i> or <i>intbuyprop_owner</i> equal 'yes', and zero else.
<i>income</i>	<i>hhinc</i>	Monthly household income in 1.000 EUR based on interval mid-points: $\left\{ \begin{array}{l} = 0.25 \text{ if } hhinc \text{ equals } '< 500 \text{ EUR}', \\ = 0.75 \text{ if } hhinc \text{ equals } '500 - < 1.000 \text{ EUR}', \\ = 1.25 \text{ if } hhinc \text{ equals } '1.000 - < 1.500 \text{ EUR}', \\ = 1.75 \text{ if } hhinc \text{ equals } '1.500 - < 2.000 \text{ EUR}', \\ = 2.25 \text{ if } hhinc \text{ equals } '2.000 - < 2.500 \text{ EUR}', \\ = 2.75 \text{ if } hhinc \text{ equals } '2.500 - < 3.000 \text{ EUR}', \\ = 3.25 \text{ if } hhinc \text{ equals } '3.000 - < 3.500 \text{ EUR}', \\ = 3.75 \text{ if } hhinc \text{ equals } '3.500 - < 4.000 \text{ EUR}', \\ = 4.25 \text{ if } hhinc \text{ equals } '4.000 - < 4.500 \text{ EUR}', \\ = 4.75 \text{ if } hhinc \text{ equals } '> 4.499 \text{ EUR}'. \end{array} \right.$
<i>no_property</i>	<i>homeown</i>	Equals unity if <i>homeown</i> equals 'rent and do not own any other home(s)', and zero else.
<i>yoe</i>	<i>eduschool</i>	Years of education of individual following SOEP-IS Group (2017): $\left\{ \begin{array}{l} = 7 \text{ if } eduschool \text{ equals } 'No school-leaving certificate', \\ = 9 \text{ if } eduschool \text{ equals } 'Secondary school-leaving certificate', \\ = 10 \text{ if } eduschool \text{ equals } 'Other school-leaving certificate', \\ = 10 \text{ if } eduschool \text{ equals } 'Intermediate secondary school certificate', \\ = 10 \text{ if } eduschool \text{ equals } 'Polytechnical secondary school certificate (8th/10th grade)', \\ = 13 \text{ if } eduschool \text{ equals } 'University of applied sciences entrance diploma / completed technical school', \\ = 13 \text{ if } eduschool \text{ equals } 'Senior school-leaving certificate/ general or subject-specific university entrance diploma', \\ = 18 \text{ if } eduschool \text{ equals } 'College / university degree'. \end{array} \right.$
Information channels		
<i>traditional</i>	<i>source_mpecb_a</i> (Q:314)	Equals unity if individual selects 'Traditional media such as newspapers, radio, television or the websites of such providers' as one of the channels through which he / she most often receives information about the ECB's monetary policy, and zero else.
<i>social</i>	<i>source_mpecb_b</i> (Q:314)	Equals unity if individual selects 'Social media such as Facebook or Twitter', and zero else.

Notes: This table describes the construction of the variables used in the empirical analysis. In the middle column, we refer to the names of the original variables as listed in the questionnaire for Wave 3 of the Bundesbank Online Pilot Survey on Consumer Expectations.

Table A.2: Variable construction (cont.)

Variable	Questionnaire	Description
<i>ecb</i>	<i>source_mpecb_c</i> (Q:314)	Equals unity if individual selects ‘ECB communication channels (e.g., ECB’s website, ECB’s Economic Bulletin, ECB’s monthly press conference)’, and zero else.
<i>other</i>	<i>source_mpecb_d</i> (Q:314)	Equals unity if individual selects ‘Other sources’, and zero else.
<i>noinform</i>	<i>source_mpecb_e</i> (Q:314)	Equals unity if individual selects ‘I do not follow the ECB’s monetary policy’, and zero else.
Quantitative expectations		
$\pi_{i,t-12:t t}$	<i>devinfpoin</i> t (Q:307)	Perceived German inflation rate over the previous twelve months in percent. This question was only asked to participants of Wave 3 of the Bundesbank survey who did not already participate in Wave 2.
$ e_{i,t-12:t t} $	<i>devinfpoin</i> t (Q:307)	Perception error. Defined as $ \pi_{i,t-12:t t} - 1.4 $, where 1.4 is the German CPI inflation rate in May 2019.
$\pi_{i,t:t+12 t}$	<i>infdef</i> (Q:005A) and <i>inflexppoin</i> t (Q:005B)	Expected German inflation rate over the next twelve months in percent. Equals <i>infexppoin</i> t if <i>infdef</i> equals ‘Inflation’ and $(-1) \cdot$ <i>infexppoin</i> t if <i>infdef</i> equals ‘Deflation’.
$\sigma_{i,t:t+12 t}$	<i>infexprob_a</i> – <i>infexprob_j</i> (Q:308)	Standard deviation derived from the probabilities assigned to the distinct outcome intervals (‘bins’) for the German inflation rate over the next twelve months. We assume i) that the exterior bins have a width of four percentage points and ii) that the probability mass in each bin is located at the midpoint.
Qualitative expectations		
<i>infl_exp</i>	<i>expmacroquali_e</i> (Q:004)	Expected development of the German inflation rate over the next twelve months: $\begin{cases} = -1 \text{ if } \textit{expmacroquali_e} \text{ equals ‘decrease significantly’ or ‘decrease slightly’,} \\ = 0 \text{ if } \textit{expmacroquali_e} \text{ equals ‘stay roughly the same’,} \\ = 1 \text{ if } \textit{expmacroquali_e} \text{ equals ‘increase slightly’ or ‘increase significantly’.} \end{cases}$
<i>unemp_exp</i>	<i>expmacroquali_a</i> (Q:004)	Expected development of the German unemployment rate over the next twelve months: $\begin{cases} = -1 \text{ if } \textit{expmacroquali_a} \text{ equals ‘decrease significantly’ or ‘decrease slightly’,} \\ = 0 \text{ if } \textit{expmacroquali_a} \text{ equals ‘stay roughly the same’,} \\ = 1 \text{ if } \textit{expmacroquali_a} \text{ equals ‘increase slightly’ or ‘increase significantly’.} \end{cases}$
Inflation updating		
<i>adj_infl_exp</i>	<i>infexchange1</i> (Q:311A / Q:311B)	Adjustment in inflation expectations over the next twelve months in reaction to unexpected announcement that the Governing Council of the ECB is putting up the policy rate by 0.25 (Q:311A) / 1.0 (Q:311B) percentage points: $\begin{cases} = -1 \text{ if } \textit{infexchange1} \text{ equals ‘lower expected inflation’,} \\ = 0 \text{ if } \textit{infexchange1} \text{ equals ‘same expected inflation’,} \\ = 1 \text{ if } \textit{infexchange1} \text{ equals ‘higher expected inflation’.} \end{cases}$

Notes: This table describes the construction of the variables used in the empirical analysis. In the middle column, we refer to the names of the original variables as listed in the questionnaire for Wave 3 of the Bundesbank Online Pilot Survey on Consumer Expectations. Question Q:307 is only assigned to individuals who did not also participate in Wave 2.

Table A.3: Summary statistics for socio-economic characteristics

	Obs.	Mean	Std. dev.	Min.	Max.
<i>age</i>	2585	53.01	16.85	16	80
<i>east1989</i>	2583	0.14	0.35	0	1
<i>female</i>	2585	0.42	0.49	0	1
<i>fullemploy</i>	2585	0.43	0.50	0	1
<i>hhsiz</i>	2580	2.24	1.08	1	6
<i>homebuy</i>	2584	0.22	0.41	0	1
<i>income</i>	2434	3.06	1.21	0.25	4.75
<i>no_property</i>	2584	0.36	0.48	0	1

Notes: This table provides summary statistics for the socio-economic characteristics of the participants in Wave 3 of the Bundesbank Online Pilot Survey on Consumer Expectations. Household income is expressed in 1,000 Euros. We consider only responses from households who revealed their information channels of monetary policy.

Table A.4: Summary statistics for inflation expectations / uncertainty

Panel A: Quantitative expectations					
	Obs.	Mean	Std. dev.	Min.	Max.
$\pi_{i,t-12:t t}$	1389	2.53	1.95	-10.00	12.00
$ e_{i,t-12:t t} $	1389	1.31	1.84	0.00	11.40
$\pi_{i,t:t+12 t}$	2445	2.50	2.20	-12.00	12.00
$\sigma_{i,t:t+12 t}$	2443	1.60	1.82	0.00	12.07
Panel B: Qualitative expectations					
	Obs.	-1 (decrease)	0 (same)	1 (increase)	
<i>infl_exp</i>	2443	80 (3.27%)	856 (35.04%)	1507 (61.69%)	
<i>unemp_exp</i>	2444	401 (16.41%)	1198 (49.02%)	845 (34.57%)	

Notes: This table provides summary statistics for the macroeconomic expectations of the participants in Wave 3 of the Bundesbank Online Pilot Survey on Consumer Expectations. For $\pi_{i,t-12:t|t}$ and $|e_{i,t-12:t|t}|$, we only consider households with $-12 \leq \pi_{i,t-12:t|t} \leq 12$. For $\pi_{i,t:t+12|t}$, *infl_exp* and *unemp_exp*, we only consider households with $-12 \leq \pi_{i,t:t+12|t} \leq 12$.

Table A.5: Regressions of expectations on information channels and lifetime experience: robustness checks

	(1)	(2)	(3)	(4)
	$ e_{i,t-12:t t} $	$\pi_{i,t:t+12 t}$	$ERPS_{i,t:t+12 t}$	$infl_exp$
<i>traditional</i>	-0.13** (0.06)	-0.54** (0.23)	-0.05** (0.03)	-0.03 (0.03)
<i>social</i>	0.03 (0.09)	0.41 (0.25)	0.10** (0.04)	0.01 (0.04)
<i>ecb</i>	0.14 (0.16)	-0.36 (0.23)	0.00 (0.03)	-0.06 (0.04)
<i>other</i>	-0.08** (0.04)	-0.10 (0.17)	-0.01 (0.02)	-0.02 (0.03)
$\tilde{\pi}_{i,2019}^{lt}$	0.04 (0.08)	0.29 (0.25)	-0.15*** (0.02)	1.44*** (0.56)
$\pi_{i,t-12:t t}$	0.80*** (0.06)	0.06* (0.04)		
Constant	0.80 (0.72)	3.92*** (1.16)	1.01*** (0.14)	
Observations	1,309	1,309	2,317	2,305
Controls	Yes	Yes	Yes	Yes
Cohort dummies	No	No	No	Yes
λ	0.50	0.90	0.20	4.50
\bar{R}^2	0.77	0.06	0.04	–
% correctly predicted	–	–	–	61.87
$\Delta P(y = 1 \mathbf{X})$	–	–	–	36.30

Notes: Columns (1)-(3) present OLS estimates from regressions of households' quantitative expectations on their sources of information about monetary policy, lifetime inflation and socio-economic characteristics. Columns (1) and (2) include perceived inflation as an additional covariate. In Column (3), we use the 'expected ranked probability score' of Krüger and Pavlova (2020) as an alternative measure of inflation uncertainty. Column (4) presents average marginal effects for an increase (=1) in expected inflation from ordered Probit regressions of households' qualitative expectations on information channels, lifetime experience, socio-economic controls and dummy variables for age cohorts. Heteroskedasticity-consistent standard errors are reported in parentheses. Asterisks '*', '**' and '***' indicate significance at the 10%, 5% and 1% critical level, respectively. The estimation sample in Column (1) includes individuals with $-12 \leq \pi_{i,t-12:t|t} \leq 12$. Columns (2) and (4) include those with $-12 \leq \pi_{i,t:t+12|t} \leq 12$. Column (3) includes all individuals.

Table A.6: Regressions of expectations on information channels and lifetime experience: control variables

	(1)	(2)	(3)	(4)	(5)	(6)
	$\pi_{i,t-12:t t}$	$ e_{i,t-12:t t} $	$\pi_{i,t:t+12 t}$	$\sigma_{i,t:t+12 t}$	<i>infl_exp</i>	<i>unemp_exp</i>
<i>traditional</i>	-0.55*** (0.18)	-0.57*** (0.17)	-0.51*** (0.18)	-0.34** (0.13)	-0.03 (0.03)	-0.02 (0.03)
<i>social</i>	0.16 (0.27)	0.15 (0.25)	0.27 (0.22)	0.54*** (0.20)	0.01 (0.04)	0.05 (0.04)
<i>ecb</i>	0.04 (0.24)	0.17 (0.21)	0.01 (0.19)	0.07 (0.17)	-0.06 (0.04)	0.05 (0.04)
<i>other</i>	-0.03 (0.14)	-0.10 (0.13)	0.06 (0.14)	-0.09 (0.11)	-0.02 (0.03)	0.07** (0.03)
$\tilde{\pi}_{i,2019}^{lt}$	0.30 (0.31)	0.28 (0.28)	0.91 (0.73)	-0.70*** (0.12)	0.45*** (0.13)	
$\tilde{u}_{i,2019}^{lt}$						0.11*** (0.02)
<i>east1989</i>	0.24 (0.16)	0.20 (0.15)	0.32** (0.14)	0.09 (0.11)	0.07*** (0.03)	-0.06** (0.02)
<i>female</i>	0.53*** (0.12)	0.64*** (0.11)	0.36*** (0.10)	0.21*** (0.08)	0.05** (0.02)	-0.04** (0.02)
<i>fullemploy</i>	-0.16 (0.13)	-0.07 (0.12)	-0.05 (0.12)	-0.02 (0.08)	0.08*** (0.02)	0.03 (0.02)
<i>hhsiz</i>	0.12* (0.06)	0.12** (0.06)	0.14*** (0.05)	0.05 (0.04)	0.03*** (0.01)	-0.00 (0.01)
<i>homebuy</i>	-0.05 (0.12)	-0.07 (0.11)	0.04 (0.11)	0.01 (0.10)	0.05* (0.02)	-0.01 (0.02)
$\ln(\text{income})$	-0.22 (0.15)	-0.37*** (0.13)	-0.28** (0.12)	-0.18** (0.09)	-0.09*** (0.02)	-0.01 (0.02)
<i>no_property</i>	0.57*** (0.14)	0.52*** (0.13)	0.17 (0.11)	0.07 (0.09)	-0.01 (0.02)	0.01 (0.02)
<i>yoe</i>	-0.03** (0.01)	-0.04*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.00 (0.00)	-0.00 (0.00)
Constant	3.96*** (1.11)	3.97*** (1.00)	3.66*** (1.23)	5.06*** (0.75)		
Observations	1,309	1,309	2,307	2,317	2,305	2,306
λ	1.70	1.60	5.10	0.20	4.40	2.70
\bar{R}^2	0.07	0.09	0.03	0.04	–	–
% correctly predicted	–	–	–	–	61.95	49.96
$\Delta P(y = 1 \mathbf{X})$	–	–	–	–	12.59	9.72

Notes: Columns (1)-(4) present OLS estimates from regressions of households' quantitative expectations on their sources of information about monetary policy, lifetime inflation and socio-economic characteristics. Columns (5)-(6) present average marginal effects for an increase (=1) in the respective dependent variable from ordered Probit regressions of households' qualitative expectations on information channels, lifetime experience and socio-economic controls. Heteroskedasticity-consistent standard errors are reported in parentheses. Asterisks '*', '**' and '***' indicate significance at the 10%, 5% and 1% critical level, respectively. The estimation sample in Columns (1) and (2) includes individuals with $-12 \leq \pi_{i,t-12:t|t} \leq 12$. Columns (3), (5) and (6) include those with $-12 \leq \pi_{i,t:t+12|t} \leq 12$. Column (4) includes all individuals. In the second-to-last row, we report the fraction of correct predictions for each qualitative expectation. In the last row, we report the difference in the predicted probability of stating a one when comparing an individual with experience at the 90th percentile with an individual with experience at the 10th percentile.

Table A.7: Regressions of inflation updating on information channels and lifetime inflation: control variables

	<i>adj_infl_exp</i>		
	(1)	(2)	(3)
	WT+ST	WT	ST
<i>traditional</i>	-0.65 (2.38)	-2.90 (3.31)	1.44 (3.43)
<i>social</i>	-0.86 (3.73)	2.07 (5.45)	-2.15 (5.28)
<i>ecb</i>	-6.12* (3.13)	-4.85 (4.34)	-7.55* (4.46)
<i>other</i>	3.62 (2.43)	6.16* (3.64)	1.02 (3.28)
$\tilde{\pi}_{i,2019}^{lt}$	8.27*** (2.80)	8.19** (3.57)	9.55** (4.66)
<i>east1989</i>	3.66 (2.41)	-2.15 (2.99)	10.29*** (3.76)
<i>female</i>	0.07 (1.67)	0.10 (2.28)	0.22 (2.45)
<i>fullemploy</i>	0.84 (1.79)	1.05 (2.40)	1.57 (2.71)
<i>hhsiz</i>	-0.27 (0.93)	0.42 (1.24)	-0.97 (1.41)
<i>homebuy</i>	-2.32 (2.15)	0.70 (2.93)	-5.31* (3.13)
$\ln(\text{income})$	-1.10 (2.02)	-2.67 (2.63)	0.33 (2.99)
<i>no_property</i>	-2.29 (1.87)	-0.38 (2.47)	-4.18 (2.86)
<i>yo</i>	0.43* (0.24)	0.35 (0.33)	0.52 (0.35)
Observations	2,295	1,150	1,145
λ	0.10	0.00	0.40
% correctly predicted	46.14	50.26	42.79
$\Delta P(y = 1 \mathbf{X})$	7.50	7.66	8.15

Notes: This table presents average marginal effects for an increase (=1) in *adj_infl_exp* from ordered Probit regressions of households' inflation updating on their sources of information about monetary policy, lifetime inflation and socio-economic characteristics. Heteroskedasticity-consistent standard errors are reported in parentheses. The reported average marginal effects and standard errors are the estimated ones times 100. Asterisks '*', '**' and '***' indicate significance at the 10%, 5% and 1% critical level, respectively. The estimation sample includes individuals with $-12 \leq \pi_{i,t:t+12|t} \leq 12$. In the second-to-last row, we report the fraction of correct predictions. In the last row, we report the difference in the predicted probability of stating a one when comparing an individual with inflation experience at the 90th percentile with an individual with experience at the 10th percentile.