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Abstract

The legitimacy of central banks is on the decline in many countries yet support for central banks is thought to be essential for the successful conduct of monetary policy. Embedding survey vignette experiments into three panel survey waves of German citizens, we examine how support for the European Central Bank (ECB) and the central bank's communication style affects a respondent's inflation expectations. Our experiments show that while information effects existwhat, such effects are heterogeneous across different societal groups. We find that information effects are strongest among those who already support the European project and the ECB. Our findings have important implications for the public outreach strategies of central banks. Further, in the aggregate, our results also suggest that Euroskepticism likely has inflationary effects.

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1 Introduction

Over the last two decades, central banks have increasingly targeted citizens with their policy communications. Whereas before, central bank communications focused primarily on investors and industry experts, central banks today now direct a significant share of their policy communications towards the mass public or "Main Street" (Binder 2017). Because the European Central Bank (ECB) is a supra-national central bank rather than a national central bank, the ECB's communication strategy is especially complex. Recent rises in Eurozone inflation beyond the ECB's target of two percent per annum and a loss of support among residents, especially in Germany, adds additional complexity to the already complicated policy environment (Moschella, Pinto, and Martocchia Diodati 2020).

Given the public's relatively new exposure to central bank communications, and given many central banks often fail at achieving their targets, it remains unclear how and which citizens uptake information about the economy when supplied with central bank messages (Bottan and Perez-Truglia 2017; Cavallo, Cruces, and Perez-Truglia 2017; Coibion, Gorodnichenko, and Weber 2022; Coibion et al. 2020). The public shows little knowledge or interest in central banking, even though collectively, macroeconomic outcomes depend on citizens' beliefs, expectations, and behaviors (Bachmann, Berg, and Sims 2015; Bernanke 2007; Bodea and Hicks 2015). Further, despite evidence that central bank communications can improve the effectiveness of monetary policy (Mokhtarzadeh and Petersen 2020), central banks and central bankers are increasingly unpopular. So prevalent are such concerns that researchers now refer to these issues as the "twin deficit" in monetary policy, reflecting a combined lack of public understanding and a decline in public support of central banks (Haldane and McMahon 2018; Lamla and Vinogradov 2019).

Of course, how central banks communicate has been shown to affect citizens' beliefs and especially their inflation beliefs (Baerg 2020). In understanding how citizens form their inflation expectations, much of the previous literature focuses on the role of citizens' demographic, social, and economic characteristics (D'Acunto, Malmendier, and Weber 2023). Recent literature also focuses on the institutional environment, including trust in the central bank (Blinder et al. 2022; Christelis et al. 2020; Cruijsen, Jansen, and De Haan 2018), and tests for effects of different communication strategies (Brouwer and Haan 2022; Coibion, Gorodnichenko, and Weber 2022; Coibion et al. 2020). To our knowledge, no research to date evaluates the combined effects of central bank communication style, which is a supply side effect, and the perceived success of

central bank policy, which is a demand side effect. Additionally, while the political science literature has long showed how political partisanship structures agents' economic outlook (Anderson, Mendes, and Tverdova 2004; Conover and Feldman 1986; Gerber and Huber 2010; Wlezien, Franklin, and Twiggs 1997), less explored is how attitudes towards supra-national institutions, such as the ECB and the European project more generally, influences citizens' expectations of *national-level* inflation. The main characteristic that we focus on in this paper is how much a respondent supports the ECB and the European project. We interact this variable with different central bank communication styles: clarity, brevity, and repetition; we examine how these variables combined affect households' inflation expectations.

We collected original panel survey data in order to empirically test our hypotheses. We implemented survey vignette experiments embedded in three waves of the German Internet Panel (GIP), a representative panel dataset of the German population, fielded between 2014 and 2016.[1] Trust in the ECB amongst Germans was at its lowest in 20 years throughout this time period (Jonung and Roth 2020). Our survey results show that respondents vary significantly in how well they think the ECB is performing. As our research design is experimental and a panel of the same respondents, we manipulate directly the ECB's message style that a respondent receives across time, testing for the effects of clarity, length and repetition.

Confirming previous research, we find that message simplicity matters: shorter and clearer central bank statements move panel respondents closer to the central bank's announced inflation target (Bholat et al. 2019). Second, we also find that panel respondents' approval of the ECB matters. We show that a more positive attitude towards the ECB is associated with more information uptake of the ECB's message, which is important as it suggests that individuals' economic evaluations are entangled with their attitudes towards the central bank. In fact, as we also demonstrate, it is not just attitudes towards the ECB but attitudes towards EU integration generally that matters. Our results show that the ECB is preaching most (least) effectively to those already in support (opposition) of the European project.

Our findings contribute a new understanding of the way that central bank communications and attitudes interact in shaping citizens' inflation expectations. We show that while central bank communication works in a technical sense in moving inflation expectations closer to the central bank's target, communications work best for those that perceive the central bank as legit-

[1]While the survey experiment was not pre-registered, all data, including all potential variables not used in the analysis presented here, are available on the website of the German Internet Panel. An earlier pre-test survey was fielded between July and August 2014, using a quota-sample of German households. All questions used in the analysis are also contained in the pre-test (Reference blinded for peer review).

imate in the first place. Such a finding is important because it implies that a reduction in central bank legitimacy makes central bank communication strategies more difficult to implement. Further, our findings also have important implications for inflation. This is because how citizens learn about monetary policy as well as how they perceive central banks and central banking has implications for the delivery of successful monetary policy in the aggregate. For example, if only those citizens supportive of the central bank uptake central bank messages, the ability to tackle inflation with communication likely varies across countries. We might therefore see a viscous cycle of persistent inflation and loss of central bank legitimacy in some countries more than others despite having the same supra-national monetary authority. Our paper, therefore, brings together literature that examines the origins of households' inflation expectations using survey experiments (Armantier et al. 2016; Cavallo, Cruces, and Perez-Truglia 2017; Roos and Schmidt 2012); the literature on Euroskepticism and European politics (De Vries 2018; Hobolt and Wratil 2015; Sorace and Hobolt 2021); and the literature that links political behavior and political economy (Tverdova 2012).

Our study also makes a number of methodological contributions. First, by exploring central bank communications in a panel over time rather than a one shot experiment, we account for some important life events that may or may not change people's sensitivity to central bank messaging. In life, inflation rates as well as price changes matter. While it is true that people can be inattentive to inflation while being aware of price changes, it is also true that the same person can become more attentive when inflation is high(er) and when they are required to be attentive such as when they are fixing a mortgage rate, negotiating a salary increase, or purchasing an (index-linked) financial product.[2] Another contribution is that we develop an intuitive way to measure respondents' inflation expectations, one which anchors respondents to a specific price basket. This new question has already been used by other researchers (Brouwer and Haan 2022) and we argue that it is an improvement on standard questions used to elicit inflation expectations.

[2]For an excellent review on inflation opinions in a comparative perspective see Scheve (2001) as well as expectations formation during COVID-19 see Armantier et al. (2021)

2 Literature Review and Hypotheses

2.1 Central Bank Communications and Inflation Expectations

Financial knowledge – or the ability to understand how money works – is important for undertaking many daily activities such as following news about the economy, managing debt, and buying a home. A basic understanding of financial concepts and the ability to apply numeracy skills can ensure that citizens manage their own financial affairs and react to news and events unfolding in the economy in ways that benefit them. Previous studies find that those with higher levels of financial knowledge make better investment and retirement decisions and are also less likely to accumulate debt (Clark, Lusardi, and Mitchell 2017; Hastings, Madrian, and Skimmyhorn 2013).[3]

Central banks have recently tried to capitalize on links between central bank communications and financial literacy by paying closer attention to how they provide information to the general public. As demonstrated in Woodford (2005), the more the central bank is willing to share its information, the more predictable is the policy. The management of expectations is crucial because uncertainty – about the state of the economy, the economy's structure, and the inferences that the public will draw from policy actions or economic developments – is a pervasive feature of monetary policy making. Informing the public about the central bank's future course of action has been shown to affect the public's behavior as well as macroeconomic outcomes (Bernanke 2004; Orphanides and Williams 2005). An increase in predictability, especially predictability about future monetary policy, is therefore associated with an increase in economic stability.[4] According to Cavallo, "All these efforts may help central banks increase the speed at which individuals react to monetary policy" (Cavallo, Cruces, and Perez-Truglia 2017, p.4). This is in direct opposition to older arguments of how monetary policy works (Blinder et al. 2008). Older theories by contrast suggest in order to be effective, monetary policy must be surprising; rather than be surprising, modern central banking aims to be predictable, informative, and clear.

The ECB itself also notes that "transparency means more than simply releasing information, as this does not by itself translate into a better understanding of monetary policy... [Clarity] becomes even more important when information is to be communicated to different audiences

[3]For an excellent review on inflation opinions in a comparative perspective and crises see (Armantier et al. 2021; Scheve 2001).

[4]Economic theory predicts that inflation expectations influence both inflation dynamics and real activity. In particular, according to the New Keynesian Phillips curve, inflation π_t depends on labor market slack X_t, expected inflation $E_t(\pi_{t+1})$, and a supply shock ζ_t. For a given nominal interest rate, a rise in expected inflation implies a lower real interest rate, which should in turn imply higher consumption.

across different environments" (European Central Bank, 2002, p. 60).[5] Empirically, researchers have measured central bank clarity by examining the readability of central bank communications (Bulíř, Čihák, and Jansen 2013; Jansen 2011; Montes et al. 2016) or the expressed level of uncertainty in central bank statements (Baerg 2020). When there is a possibility of information overload or "cacophony," central banks also face a trade-off between providing more information meanwhile ensuring common understanding (Chahrour 2014; Eppler and Mengis 2008), particularly because only those better informed are able to anchor their expectations at communicated central bank targets (Binder 2017) and the regular audience of central bank communications – consumers, investors, wage-setters, etc. – show great heterogeneity in expectations (Kumar et al. 2015).

Recent experimental research has causally demonstrated that when central banks give information about policy objectives, such as inflation targets, information influences inflation expectations (Coibion, Gorodnichenko, and Weber 2022). Research has shown that information is stronger if messages are simple, repeated, and targeted (Coibion et al. 2020). In fact, experimentally induced information about inflation can even have long-lasting effects (Bottan and Perez-Truglia 2017; Cavallo, Cruces, and Perez-Truglia 2017).

Importantly, previous research shows that people update their beliefs about the economy on the basis of new information despite any cognitive problems they may face in acquiring and processing the information (Armantier et al. 2016; Malmendier and Nagel 2016). Beyond affecting inflation expectation, central bank communication also affects trust in the institution (Brouwer and Haan 2022). Such effects are relevant because trust increases legitimacy in the central bank (Bordo and Jonung 2003) through increased transparency (Cruijsen, Eijffinger, and Hoogduin 2010) improving the accuracy of citizens' ability to forecast inflation.

While all the above shows that information can matter, citizens must be exposed to information – i.e. central banks must be able to reach the mass public in order to have an effect. Previous research shows that central bank messages can reach the broader public via the media, including television, newspapers, and social media (Blinder and Krueger 2004; Ter Ellen, Larsen, and Thorsrud 2022). In the case of the U.S. and U.K., for example, Lamla and Vinogradov (2019) find that the mass public is frequently exposed to news from central banks, especially about official monetary policy. Similarly in Europe, Ehrmann and Wabitsch (2022) show that former ECB president Mario Draghi's "Whatever it takes" speech led to substantial

[5]European Central Bank (2002). The Accountability of the ECB. Monthly Bulletin, November, 45-57.

reactions by the masses on Twitter. The ability for social media networks to expose citizens to central bank news is corroborated by Masciandaro, Peia, and Romelli (2024). These authors find that on Twitter, news about coins and banknotes as well as monetary policy decisions and official operations have higher public engagement as measured by likes and re-tweets. Berger, Ehrmann, and Fratzscher (2011) find that decisions that have large informational content and statement repetition gain the most favorable news coverage. Finally, recent research by Munday and Brookes (2021) provide evidence for how central banks ought to engage persuasively with the media in order to be reported on. Similar to our findings, these authors show that among other things, keeping communications simple as well as using shorter sentences and reporting facts and figures increases the likelihood that newspapers will cover central bank news.

2.2 Political Beliefs and Economic Forecasts

The economic voting literature has long argued that voters evaluate the economy and punish incumbents for bad economic outcomes (for an overview see Lewis-Beck and Stegmaier 2000). As far back as Campbell et al. (1960), party identification, or which party a voter identifies with, is argued to affect individuals' political choice as well as their final vote. Partisan attachment also means that voters stay with the same party over time and resist contrary influence. Much of the literature argues that partisan attachment is formed early in life and is more or less stable over one's lifetime.

Just like party identification links voters to opinions about policies, partisanship can also influence voters *evaluation* of economic circumstances as well as their *expectations* of the future economy. Voters' expectations not only matter for economic forecasts but also their consumption behavior and the macro-economy (Gerber and Huber 2009, 2010; Ladner and Wlezien 2007). When partisans anticipate their favored party will win the next election, they tend to form more optimistic perceptions of the future economy. Moreover, partisans also adjust their economic behaviors based on whether or not their preferred party holds power; this has a powerful effect showing how political variables can influence both perceptions and outcomes (Evans and Andersen 2006; Gillitzer, Prasad, and Robinson 2021). One example of the effects of political beliefs on economic expectations comes from researching individuals living in countries transitioning to democracy in Eastern Europe. Tverdova (2012) finds that citizens' political dispositions matter for their economic forecasts, with those favorable to democratic transition having more optimistic perceptions of the future economy. This effect is particularly strong despite contemporaneous

high inflation and unemployment levels. In other words, despite living in unfavorable economic conditions, those individuals supportive of democratic transition are also those individuals that think the economy will improve.

Political divisions based on other political beliefs or biases may be equally forceful in shaping individuals' economic expectations. Hobolt and Sorace (2020), for example, demonstrate differences in the economic perceptions of British citizens contingent on support for Brexit. Beyond the United Kingdom, support or opposition towards the European Union (EU) more generally, as well as opinions citizens may hold about the performance of EU institutions, may reflect political divides that can shape economic expectations of the future.

The ECB is a particularly important institution in EU economic governance and increasingly scholars have shown how the ECB operates in a highly politicized environment (Moschella, Pinto, and Martocchia Diodati 2020). The ECB was a key actor during the Euro crisis and its prominence in managing the Euro crisis resulted in controversies and heterogeneous support amongst member states. While the Eurozone stabilised without any member state defaulting or leaving the Eurozone, the adoption of so-called "unconventional" monetary policies increased opposition to the ECB's expanded powers, generating frustrations that were frequently criticized, especially in the German media and by German political and economic elites (Högenauer 2019). Also important for our research, this was associated with a gradual decline in support for the ECB among individuals living in Germany, which bottomed out in 2014, coinciding with the first wave of our survey (Jonung and Roth 2020).

For a supra-national organization like the ECB, with a mandate that encompasses 20 member states, euroskepticism rather than partisan attachment is therefore the most likely political cleavage to condition the transmission of central bank communications to everyday citizens. The term euroskepticism means criticism of the EU and the European integration project. De Vries (2018) argues that euroskepticism is fundamentally about attributing success and blame to different levels of government relative to one's own expectations: "When national conditions are good, in economic and political terms, or at least when people perceive them as such, euroskepticism is mostly likely to develop. When national conditions are bad, however, EU support is the most likely outcome with no viable alternative to membership is present" (De Vries 2018, p.6). As suggested above, the ECB, therefore, has a "twin-deficit" problem when it comes to policy communications: firstly, the ECB must communicate its policy decisions clearly to citizens who have limited interest and understanding of its policies. The severity

of this knowledge gap about what the ECB does cannot be overstated. One recent study surveying Dutch households about their degree of knowledge about the ECB find that, on average, respondents incorrectly guessed more than half of the eleven questions about what the ECB does (Cruijsen, Jansen, and De Haan 2015). Secondly, the ECB must also communicate in an increasingly hostile environment in terms of public support, though this hostility varies across countries and over time. Communications might be easily ignored by citizens that are euroskeptic. If individuals are not supportive of the ECB, even clear communications may have little sway on their expectations.

2.3 Hypotheses

Summarizing the review of related literature leads us to a number of testable hypotheses about the relationship between central bank communication styles and attitudes towards central banks in general and the ECB in particular, and their combined effect on households' inflation expectations. First, following from the previous literature, we test how message clarity affects respondents' inflation expectations. We propose two dimensions of clarity: more precise targets and message brevity. Our expectations are that:

H1a: ECB statements that are clear have a greater effect on an individual's inflation expectations compared to vague statements.

H1b: ECB statements that are short have a greater influence on an individual's inflation expectations than long statements.

Furthermore, we also expect that exposure as well as style matters:

H1c: ECB statements that are repeated have a greater influence on an individual's inflation expectations than statements that are only received once.

In addition to being a recipient of information, individuals must also be willing to incorporate central bank communications into their beliefs. In other words, respondents must be receptive to the information that they are given in the first place. As outlined above, we expect that individuals incorporate economic information conditional on their attitudes towards the ECB and the European project. Rather than inflation expectations being based on computed inputs from economic data alone, inflation expectations likely depend on whether a respondent supports the central bank or not. Inflation expectations, therefore, likely incorporate respondents'

political opinions, making them similar to other kinds of political attitude they hold. Indeed, if the public believes that the central bank is doing a bad job, individuals may discount what the central bank says. Our last hypothesis therefore is that:

H2: Central bank communications are most effective for those individuals who hold more favorable attitudes towards the central bank

To examine whether we observe the causal relationships outlined above, we implemented three waves of survey experiments where we directly manipulate how information is delivered to respondents. We do this by varying the central bank's use of clear (vague) and short (long) language in their policy statements. Respondents also vary in how consistently the content they receive is presented over time. Importantly, our experimental manipulations allow us to make causal claims about between-group average treatment effects, while the panel set-up controls for individual-level determinants that may matter for political opinions and that can change over time, such as job loss or retirement, which may make a respondent particularly sensitive (or not) to central bank messages.

3 Research design

3.1 Case selection

We evaluate the effects of central bank statements on inflation expectations using 3-waves of survey experiments on a panel of respondents in Germany between 2014 and 2016. As mentioned above, this time period in Germany offers an interesting study environment for a number of reasons, and many of these features are helpful for understanding Germany today. First, inflation rates during the experimental period were very low – well below the ECB's target inflation rate of 2%. This means that the ECB is missing its official inflation target rate, which can be interpreted as poor performance. However, Germany is also notoriously a inflation-adverse country and so lower than target inflation may be understood as "good performance" by German respondents. Also important is that Germany's inflation is so low during the study period that the country is experiencing disinflation and deflation. Deflation and disinflation can cause individuals to postpone consumption decisions, for example deciding to buy big purchase items like cars and household appliances in the future, because they expect that future prices will be lower than they are today. This is important as it means that during this period, it is somewhat costly

for citizens to ignore important economic information and individuals may have incentives to search for information (Morris and Shin 1998), thus motivating demand.

Second, at first glace, Germany may seem like an unlikely case for opposition to the ECB. Germany was traditionally attached to creating a highly independent ECB modeled after West Germany's central bank, the *Deutsche Bundesbank*. Germany also has little history of opposition to the national central bank and had, until the emergence of the Alternative für Deutschland, no major eurosceptic domestic right-wing party. However, during the time under study, the ECB's policies became politicized and a subject of scrutiny and dissatisfaction, especially from many of Germany's political and economic elites. A critical view of the ECB was taken publicly by the Bundesbank's President, Jens Weidman where he criticized ECB policies in a number of popular news outlets. Indeed, throughout our study period, the German and European news-media engaged in a lively and sometimes attacking debate about whether the ECB should engage in asset purchases of euro-area government bonds in order to help re-inflate struggling European economies. Opinions in Germany on euro-bond purchases varied enormously, with some pundits arguing that by purchasing assets, the ECB was over-extending its legal reach, yet others arguing in support of more activist policies aimed at re-inflating Europe. Important for us, ECB and inflation-related news was noteworthy, contentious, and talked about widely, making it a good opportunity to ask survey respondents about monetary policy. We especially exploit the timing of this political debate in wave 2 of our study where we encourage citizens to think about the asset purchase program directly and link the ECB's policy to the possibility of future changes in inflation.

Furthermore, recent studies show that firstly, media reporting (whether by news-wires or other media entities) on the ECB is positively associated with the amount of news distributed by the ECB Governing Council during this time. What this means is that the more statements that the ECB publishes, the more ECB news is reported in the media. Furthermore, the authors show that during our sample period, reporting on the ECB governing council and its statements went up. These authors therefore show evidence of a direct link between the amount of information by the ECB and coverage of the ECB (Hwang, Lustenberger, and Rossi 2023). For the particular case of Germany, Schmidt et al. (2023) construct a measure that they call the inflation perceptions index (IPI); this metric is based on media coverage in Germany and is replicated below. In support of our paper, these authors find that the public is over-exposed to ECB and that inflation news is the dominant topic. They show that between 2012 and 2015,

inflation coverage in Germany is very high when compared to the average level of media about the ECB and inflation over time.

3.2 Panel

We ran our experimental vignettes on German households participating in three waves of an ongoing panel dataset called the German Internet Panel (GIP). GIP respondents are German residents in private households between 16 and 75 years-old. Sampling is based on multistage proportionate stratified random sampling, including equipping a number of previously offline individuals with computers and internet and making them online. Our survey experiments were fielded in November 2014 (Wave 14), November 2015 (Wave 20), and May 2016 (Wave 23). In this paper, we refer to these three surveys as wave 1, wave 2, and wave 3. The total number of respondents for wave 1 was 3,575; wave 2, 3,159; and wave 3, 2,941. In total, we have 2,457 respondents that are present across all three waves. Of the respondents in the sample, 97% were given either of the two conditions of our information treatment in wave 1 and 97% either of the four conditions of our information treatment in wave 2. Non-response answers for our questions was very low, ranging from 2 to 70 respondents. The highest non-response rate in our set of questions appears on the question asking respondents to report their general news consumption levels (70 people or 2% of the survey).[6]

3.3 Experimental design

We incorporate two sets of information treatments, one in wave 1 and one in wave 2, and use comparisons between groups to identify the causal effects of style in central bank communications on respondents' inflation expectations.[7] In wave 3, we also ask respondents about their inflation beliefs, trust in inflation statistics, and level of uncertainty about their answer. In the first two waves, we implement *two information manipulations* that vary the level of inflation-target clarity (wave 1 and wave 2) by including (or not) vague or precise textual language as well as vary the length of the example policy statement given to respondents (wave 2). In this study, we do not compare our information treatments to a control group that receives no central bank message. This is because our research question asks whether respondents' expectations change given changes in the style of communications not whether communications affect respondents'

[6]More details on the panel are given in Section A.1. Attrition and non-response information are shown in Table A.1 in the appendix.

[7]All survey questionnaire items introduced in this section are given verbatim (in German) in Section A.5 in the appendix.

inflation expectations. There is a large and robust literature that shows elite cues matter for citizens' economic beliefs (Boydstun, Highton, and Linn 2018; Haller and Norpoth 1997; Shen, Ahern, and Baker 2014) and so in this experiment, we focus on manipulating the style of central bank messages. Our hypothesis H1c speaks directly to the effects of exposure to central bank messages. Here we test whether more consistent messaging matters.

Wave 1, first information treatment: In wave 1, we first elicit respondents' prior inflation expectations. We develop a novel way to ask respondents about their inflation expectations by leveraging the fact that it is difficult for individuals to translate annual changes in prices for a given basket of goods and services to changes in annual inflation rates. We do this to make sure that we measure the effect of our information treatment rather than just estimating who has good recall of inflation statistics, which might be due to other factors such as financial sophistication, news consumption, or an interest in economics or politics. In the first screen, respondents are asked to give an estimate of expected price changes for a particular basket of goods and services over the next 12 months, which we denote as $\pi^0_{i,t}$. Respondents are given a hypothetical scenario in which a person is said to have spent 1500 Euros per month on typical purchases for food, goods, and services such as groceries, clothes and a hair-cut. Another benefit of asking the question this way is that we prompt respondents into thinking about a specific price basket therefore mitigating issues where respondents vary in terms of items they imagine in the basket. Respondents are then asked how much they think the same person would spend on the same items 12 months from now. As response options, individuals are given a list of different Euro amounts ranging from "less than 1500 Euros" to "1650 Euros or more." Each response option is measured in increments of 1 percent annual inflation, forcing respondents to consider the same scale, but respondents are not told the intervals in annual inflation rates at the time of answering the question about changes in the price basket.

On the next screen, respondents are then asked to consider inflation in Germany. Respondents are given a short explanation about inflation, including a definition of inflation and about the role of the ECB in managing inflation in the Eurozone. All respondents get this information. Then, respondents are randomized into two groups and receive either a vignette with a text snippet that gives information about inflation and also the ECB's policy goals (*Clear Information*) or a similar text that says the same thing but uses vaguer language (*Vague Information*).

The (English translation) of the vignettes read as follows:

Clear Information: The European Central Bank expects the important interest rates to remain at the current level or below for a longer period of time. This assessment rests on the general expectation of low inflation of 1 percent per year. The expected inflation for the Eurozone is in line with the objective of the Central Bank to keep inflation at 2 percent.

Vague Information: The European Central Bank expects the important interest rates to remain at the current level or below for a longer period of time. This assessment rests on the general expectation of low inflation. The expected inflation for the Eurozone is in line with the objective of the Central Bank to keep inflation at an appropriate level.

Respondents are then asked a number of questions, including a manipulation check, to make sure that they understood the question and were treated with the information. The manipulation check question asks respondents how detailed the information they received was and a larger number of people in the clear information treatment group said the information was detailed compared to those in the vague group.

Finally, before measuring our main outcome variable, respondents are shown their answer to the first question and are told how their response translates into an annual inflation rate. This translation makes their initial beliefs about the cost of a basket of goods and services directly comparable to an annual inflation rate presented in the ECB message for those in the clear treatment group. We then measure the main outcome variable, 12-month ahead inflation expectations, to assess the effect of the information treatment on respondents' expected annual inflation rate. In order to cue the respondents to think about the information treatments explicitly when answering this question, we add the prompt, "considering the expectations by the ECB [...]". We denote a respondent's answer to this question as, $\pi^1_{i,1}$, and we call this measure their posterior (posterior to information) inflation expectations.

Wave 2, second information treatment: Wave 2 occurs exactly one-year (12 months) later and, because the panel is a longitudinal survey, wave 2 has the same respondents, with the exception of a loss of some respondents discussed above and as shown in the appendix. We again use a similar treatment vignette only now we vary the information using a 2 by 2 experimental design: here we vary the use of a clear (vague) language and the length, either short or long. As mentioned above, we also tap into the ECB asset purchase program controversy, which was highly salient in the German media during this time period. German politicians and right-wing political elites legally challenged the ECB's emergency bond-buying scheme in a number of prominent court-cases. While Germany's constitutional court ruled that the bond-program

was legal, Jens Weidmann as well as others frequently criticized the program publicly.[8]

The four (English translations) of the wave 2 treatment conditions read as follows:

> *Clear information, long text*: The ECB extends its purchase of bonds to those issued by Eurozone governments, issuers with development objects, and issued by European institutions. Overall, monthly purchases of a total value of 60 million Euros are planned. These purchases will continue until September 2016 at a minimum. The program serves to fulfill the ECB mandate to ensure price stability and reach a medium-term inflation rate close to 2%.
>
> *Vague information, long text*: The ECB extends its purchase of bonds to those issued by Eurozone governments, issuers with development objects, and issued by European institutions. Overall, monthly purchases of high total value are planned. These purchases will continue until the middle of next year at a minimum. The program serves to fulfill the ECB mandate to ensure price stability and reach a medium-term inflation rate close to an appropriate level.
>
> *Clear information, short text*: The ECB extends its purchase of bonds. Purchases of a total value of 60 million Euros will continue until September 2016 and serve to fulfill the ECB mandate to ensure price stability and reach a medium-term inflation rate close to 2%.
>
> *Vague information, short text*: The ECB extends its purchase of bonds. Purchases of high total value will continue until the middle of next year and serve to fulfill the ECB mandate to ensure price stability and reach a medium-term inflation rate close to an appropriate level.

As in wave 1, we again ask respondents for their posterior inflation expectations using the same question text, and we denote wave 2, one-year ahead inflation expectations as $\pi^1_{i,2}$.

Wave 3, final inflation expectations: Finally, wave 3 occurs 6 months later in May 2016 and is again fielded on the same panel of respondents. As before, we ask respondents for their inflation expectation, using the same text as in wave 1 and 2 and we denote wave 3, one-year ahead inflation expectations as $\pi_{i,3}$. We also ask respondents about how uncertain they are about their answer to their own inflation forecast and how much they trust inflation statistics.

3.4 Measures

The main variable that we are interested are: the respondent's initial beliefs about price changes over the next 12 months, $\pi^0_{i,1}$, which we call their *prior (to treatment) inflation belief*. We are also interested in how their *posterior (after treatment inflation expectations* $\pi^1_{i,1}, \pi^1_{i,2}$) relate to

[8] See for e.g. Bundesbank president Jens Weidmann steps up criticism of QE: Comments highlight scale of opposition to asset purchases in Germany

their prior beliefs under different information treatments.[9] Additionally, we are also interested in respondents' attitudes towards the ECB, which we call *ECB approval*. More specifically, we record respondents' opinions on whether they approve of the ECB's performance with respect to the ECB achieving its inflation mandate of 2%. We also ask respondents to self report how much general news they consume (*News consumption*) as well as business/financial news (*Business news consumption*). This includes news that they watch, listen to, or read. We also ask individuals for their personally preferred inflation rate then calculate the distance between their stated preferences and the ECB's 2% target rate (more on this below). Finally, we ask respondents for their medium (5-year) and long term (10-year) ahead inflation expectations, $\pi^5_{i,1}, \pi^{10}_{i,1}$.

As a second measure of support for the ECB, we also use a metric of how much support a respondent has for *EU integration*. For other political variables, we also measure their self-placement on the left-right scale (*ideology*), and their trust in inflation statistics (*trust in statistics*).

Finally, at the personal level, we also indicate whether a respondent reports a change in their occupation status from wave to wave, *Changed occupation status*. This includes going from employed to unemployed or to retired.

The variables *EU integration*, *ideology*, and *changed occupation* are questions that are asked of GIP panelists in 2015 but come from a different set of questions asked by other researchers and are not asked in the context of the ECB nor central bank communications. Answers to these questions are therefore not elicited in the context of our survey despite being recorded during the same time period.

Table 1 summarizes the time-line of our study across the three waves.

Table 1: Time-line of treatments and outcome measures within and across the three waves of the German Internet Panel (GIP)

	⟶ **Time** ⟶								
	Wave 1, November 2014					**Wave 2, November 2015**			**Wave 3, May 2016**
Treatments		✓				✓			
Outcome measures	$\pi^0_{i,1}$		$\pi^1_{i,1}$				$\pi^1_{i,2}$		$\pi^1_{i,3}$
Manipulation checks				✓					
Additional measures					$\pi^5_{i,1}$,$\pi^{10}_{i,1}$, ECB approval, News consumption, Business News consumption			Policy Congruence	Uncertainty Trust in statistics

[9] We use the term "posterior" as meaning "after receiving new information" and not necessarily that agents update their expectations using Bayes' rule.

As shown in Table 1, ECB approval, news consumption, and business news consumption questions are asked after treatment but before the outcome measures. In wave 2, the policy congruence question is asked before the treatment and the outcome measure. In wave 3, questions about uncertainty in their inflation estimate and trust in inflation statistics are asked after the inflation expectations question.

3.5 Empirical strategy

To test H1a, we examine whether respondents in the clear treatment group are more likely to adjust their posterior inflation expectation towards the communicated central bank target given where they started. We employ five different methods to evaluate whether we find support for H1a.

1. We compare the central tendency and spread of prior inflation expectation $\pi^0_{i,t}$ and posterior inflation expectation $\pi^1_{i,t}$ in the clear and vague treatment conditions. We see evidence for H1a if the central tendency of $\pi^1_{i,t}$ is closer to the central bank communicated inflation target and also shows a lower spread in $\pi^1_{i,t}$ in the clear treatment than in vague treatment and there is no such difference in $\pi^0_{i,t}$.
2. We repeat the same analysis for the posterior inflation expectation elicited in wave 2, $\pi^2_{i,t}$, and wave 3, $\pi^3_{i,t}$
3. We repeat the same analysis for the clear vs vague treatment conditions administered in wave 2 and assess its effect on $\pi^2_{i,t}$ and $\pi^3_{i,t}$.
4. We regress the posterior inflation expectation $\pi^1_{i,t}$ on an indicator of the clear vs vague information treatment conditions administered in wave 1, prior inflation expectations $\pi^0_{i,t}$, and the interaction of the two variables.
5. We repeat the regression-based analysis for the clear vs vague information treatment conditions administered in wave 2, now with $\pi^2_{i,t}$ as outcome measure while including $\pi^1_{i,t}$ as additional control. If respondents pick up better on the inflation information in the clear than the vague treatment, the marginal effect of the prior inflation expectation $\pi^0_{i,t}$ on $\pi^1_{i,t}$ should be lower in the clear treatment group.

H1b is assessed by comparing the effect of the short vs long information treatment conditions administered in wave 2 on the posterior inflation expectation $\pi^2_{i,t}$ and $\pi^3_{i,t}$ elicited in wave 2 and wave 3, respectively. Similar to the analysis above, we look at shifts in central tendency and distribution of the posterior inflation expectations as well as run a regression with $\pi^2_{i,t}$ and $\pi^3_{i,t}$ as dependent variables.

Hypothesis H1c is tested by comparing central tendency and spread of $\pi^2_{i,t}$ and $\pi^3_{i,t}$ as well as the marginal effect of the prior $\pi^0_{i,t}$ on $\pi^2_{i,t}$ and $\pi^3_{i,t}$ in the following combinations of treat-

ment conditions administered in wave 1 and wave 2: clear/clear, clear/vague or vague/clear, and vague/vague. Whichever of the single wave treatments exerts the strongest effects on the posterior inflation expectation, this effect should continue to be strong if it is repeated. In other words, we find evidence of H1c if the clear/clear treatment condition affects the central tendency and spread more than the clear/vague or vague/clear treatment condition. Similarly, the marginal effect of the prior $\pi^0_{i,t}$ on the posterior inflation expectation $\pi^2_{i,t}$ and $\pi^3_{i,t}$ should be smallest for the clear/clear than the clear/vague or vague/clear treatment conditions.[10]

Finally, we test H2 by evaluating the interaction between treatment effects, identified in a way similar to the assessment of H1, and ECB approval. We find evidence for H2 if that interaction is significant and positive, implying that the treatment effects are stronger when ECB approval is higher.[11]

3.6 Inflation in Germany

Before we present our main results, we provide some descriptive information about inflation in Germany during our sample period. In the lead up to wave 1, inflation in Germany is going down and is below the ECB's 2% target rate. In November 2014, which is when our first wave is fielded, Germany starts to experience significant disinflation and deflation (negative inflation rates) and these conditions continue throughout the sample period. Consequently, changes in inflation are variable across the three waves of our experiments, moving between negative inflation to one-percent inflation.

As shown in Figure 1, respondents are tracking real changes in inflation in the economy, though with a long delay.

Despite inflation going down throughout the period, the average inflation expectations of a respondent in our sample (1-year ahead) is 3.30%, with a standard deviation 2.72.[12] After our first information treatment in wave 1, however, inflation expectations are substantially lower, averaging 2.61%, with standard deviation 2.26.

Additionally, as we have a longitudinal panel of respondents, we can also examine over-time

[10] A similar expectation could be formulated for the vague/vague vs the clear/vague or vague/clear treatment conditions. Since we expect the single wave clear information treatment to have the strongest effect on the posterior inflation expectations, we omit this test here.

[11] We are able to elicit ECB approval post-treatment and still say something about group heterogeneity, when the ECB evaluate is balanced across first wave information treatment conditions as well as when the relationship between prior inflation expectation and ECB evaluate is not different across first wave information treatment conditions. These assumptions hold. See Figures B.6 and B.7 in the appendix.

[12] This is not unusual as inflation expectations tend to be skewed, with respondents thinking that inflation is much higher then it actually is.

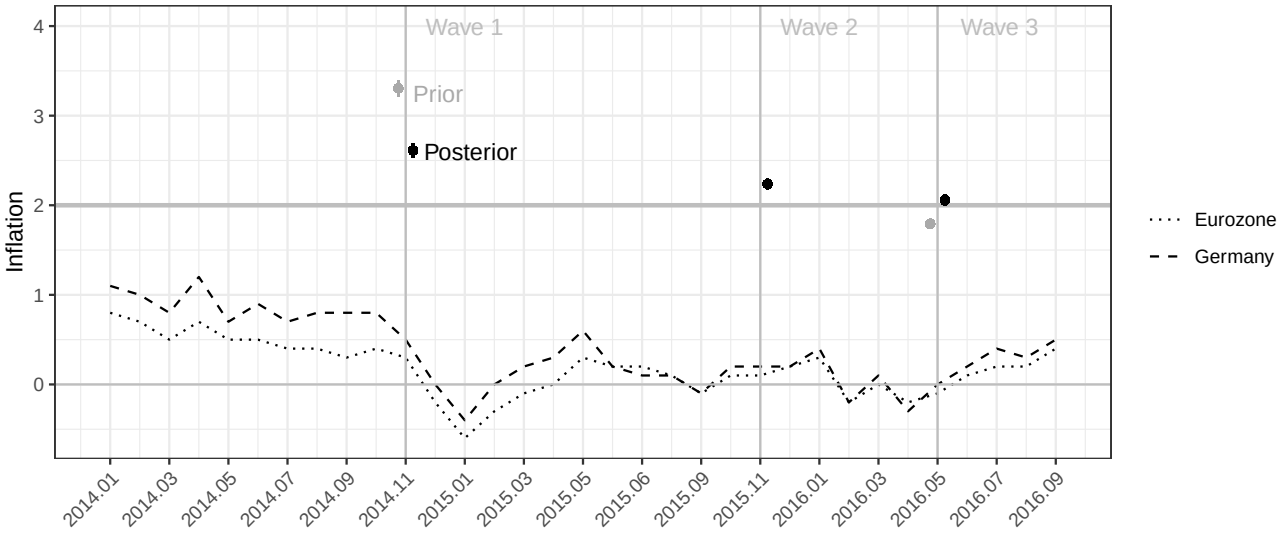

Figure 1: Prior and posterior expectation inflation in our sample (mean and full distribution) and real inflation in Germany and the Eurozone. The gray horizontal line indicates the ECB's 2% target.

changes in the panel's inflation expectations. Average after treatment inflation expectations across the sample period go down from 3.30% to 2.24% between 2014 and 2015, with a standard deviation of 1.82. They decline even further in 2016 from 2.24% to 2.07%, with a standard deviation of 1.72. Pre-treatment inflation expectations in wave 3, average 1.79%, with a standard deviation of 1.58, just slightly above the post-treatment posterior of that wave.

4 Results

4.1 Information effects

Clear vs vague information We start by evaluating the effect of clear vs vague information on the posterior inflation expectation elicited across all waves. This is a test of the information effect stipulated in Hypothesis H1a. Recall the two different messages in wave 1: half of our respondents receive clear information about the value of inflation, the ECB's target, and the ECB's policy objective (clear information) whereas the other half of our respondents receive vague information about inflation, the ECB's target, and the ECB's policy objective (vague information). The top left pane of Figure 2 shows that respondents allocated into the different treatment groups in wave 1 start off with similar prior expectations of future inflation. The mean of the prior is 3.35 in the clear information treatment (black) and 3.26 in the vague

information treatment (gray). Difference-in-means and difference-in-distribution tests suggest that the differences are not statistically significant ($p = 0.36$ and $p = 0.45$).

Next we examine posterior inflation expectations across treatment groups, which we measure after respondents receive the information manipulation in wave 1 as well as differences in wave 2 and 3. Figure 2 (top right panel) illustrates the effects: clearer information given to respondents in wave 1 significantly reduces respondents' average posterior inflation expectations in wave 1. While the difference in means and distributions of the posterior in wave 1 across the treatment groups is not significant, the reduction in inflation expectation from prior to posterior is in the clear information but not the vague information treatment ($p < .05$).[13] Similarly, clearer information in wave 1 significantly lowers the variance in expectations for those in the clear group but not for those in the vague group. The variance of respondents' prior inflation expectations is 7.54 in the clear group and 7.27 in the vague group. In both groups, the variance in inflation expectations significantly reduces from the prior to posterior responses ($p < .01$). Additionally, the variance reduces more in the clear group, to 4.61, and only 5.60 in the vague group, which is a significant difference ($p < .01$).

Recall that our respondents have to translate changes in prices of consumer goods and services into changes in annual inflation rates. All respondents likely update as they correct mistaken calculations between price changes and annual inflation. Individuals in the clear group update their expectations more than those in the vague group even when we account for this. The posterior inflation expectation in the group that receives clear information is 2.58 (wave 1) while posterior inflation expectation in the vague group is 2.65. Finally, while all respondents move closer to the inflation target after being asked about annual inflation rather than price changes, those in the clear group adjust to the announced target inflation rate more. The reduction in deviation from the target is, on average, 0.22 in the clear group whereas in the vague group, average deviation from target actually increases by 0.09. Difference-in-means and difference-in-distributions tests of the reductions between groups both return $p < 0.01$.

[13]Evidence for this claim is taken from the significant coefficient on the interaction in the regression shown in Table B.1 in the appendix.

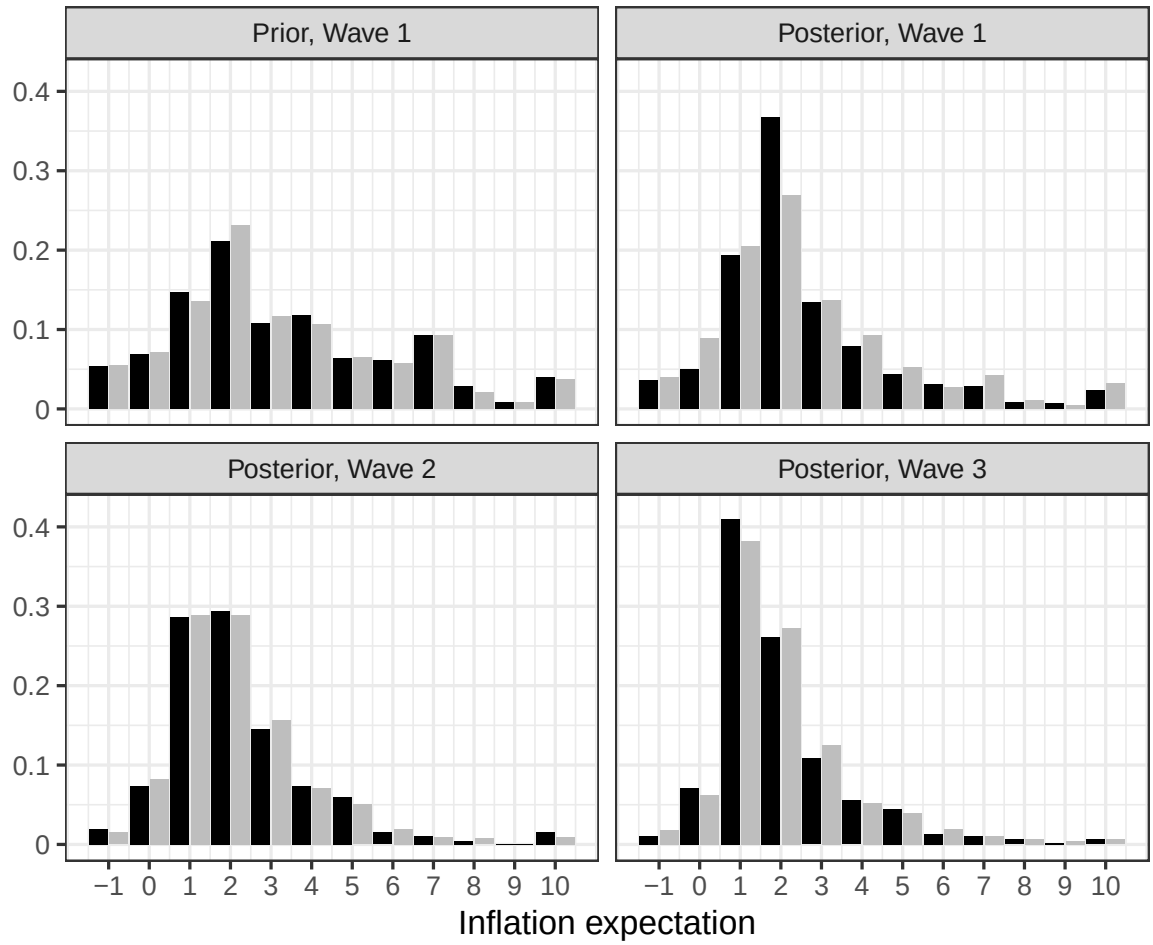

Figure 2: Distribution of Respondents' Reported Prior and Posterior Inflation Expectations by First Information Treatment and Waves

When comparing prior inflation expectations from wave 1 to posterior inflation expectations in wave 2 and 3 (one year and one-and-a-half-years later), we see a further reduction in the variance of expectations overall but no differences across groups; the test of a difference in variance returns $p = .05$ for the comparison prior and posterior in wave 2 and $p = .25$ for the comparison prior and posterior in wave 3. Any effect of the treatments in wave 1 therefore seems short-lived, not lasting into subsequent waves.[14]

For a more detailed statistical test of the relationship between prior and posterior, we turn to regression analysis. Table 2 shows three different sets of models: (A) regressions of the posterior in waves 1-3 on an indicator of the first information treatment; (B) regressions of the posterior in waves 1-3 on an indicator of the first information treatment, the first wave prior, and the interaction of those two variables; and, (C) Model B with covariates. Comparing (A)

[14]Another way to assess the information treatment effects, is to investigate respondent-level updating. Results examining this are shown in Section B.1 in the appendix.

and (B) demonstrates a significant effect of the first information treatment, the prior, and their interaction on the first wave posterior.

	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3	Wave 1	Wave 2	Wave 3
Clear information	−0.071	0.053	−0.063	0.278***	0.158	0.036	0.150	0.459	0.068
	(0.077)	(0.070)	(0.066)	(0.084)	(0.114)	(0.108)	(0.380)	(0.474)	(0.459)
Prior				0.619***	0.128***	0.151***	0.592***	0.110***	0.125***
				(0.022)	(0.020)	(0.022)	(0.023)	(0.021)	(0.021)
Clear information x				−0.120***	−0.036	−0.034	−0.115***	−0.045	−0.028
Prior				(0.030)	(0.030)	(0.030)	(0.032)	(0.031)	(0.030)
Business news consumption							0.003	−0.076**	−0.167***
							(0.032)	(0.035)	(0.037)
News consumption							−0.033	−0.022	0.016
							(0.047)	(0.052)	(0.055)
Positive evaluation of ECB							0.345***	0.188***	0.246***
							(0.060)	(0.066)	(0.061)
Clear information x							−0.020	−0.031	0.125**
Business news consumption							(0.044)	(0.053)	(0.051)
Clear information x							0.070	−0.060	−0.103
News consumption							(0.064)	(0.078)	(0.074)
Clear information x							−0.070	0.081	−0.009
Positive evaluation of ECB							(0.083)	(0.099)	(0.098)
Constant	2.648***	2.197***	2.039***	0.628***	1.784***	1.550***	−0.111	1.786***	1.618***
	(0.057)	(0.048)	(0.048)	(0.061)	(0.076)	(0.077)	(0.276)	(0.307)	(0.326)
R^2	0.000	0.000	0.000	0.457	0.028	0.046	0.466	0.052	0.077
Adj. R^2	−0.000	−0.000	−0.000	0.457	0.027	0.045	0.465	0.049	0.074
Num. obs.	3464	2660	2567	3464	2660	2567	3432	2645	2553
RMSE	2.258	1.794	1.680	1.664	1.769	1.642	1.642	1.742	1.617

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table 2: OLS Regression of Posterior Inflation Expectation in Wave 1, 2, and 3 on First Information Treatment Indicator, Prior Inflation Expectation, Covariates, and their Interactions.

Most importantly, as a test of Hypothesis H1a, we examine how much the marginal effect of prior inflation expectations (as elicited in wave 1) on posterior inflation expectation (as elicited in waves 1, 2, and 3) differs by the clarity of information received by the respondent and based on regression model C which includes covariates. We find that on average, respondents in the clear group place significantly lower weight on their initial inflation beliefs (and therefore a higher weight on ECB information) than respondents in the vague group. These results are consistent with previous evidence, which finds clarity in central bank communications matters.

As indicated earlier alredy the effects of message clarity are not long-lasting. We do not find any residual effect of treatment on respondents' posterior inflation expectations gathered one year or one-and-a-half years later (waves 2 and 3). Clear information, however, alters posterior inflation expectations consistently no matter respondents' prior inflation expectation; in other words, the first wave information treatment effects are robust to heterogeneity in prior inflation expectation.[15]

[15]See Figure B.5 in the appendix.

Short vs long information We next evaluate the effect of shorter vs longer information on the posterior inflation expectations elicited across all waves. This is a direct test Hypothesis H1b and the expectation is that shorter information is more effective than longer information. We start by observing that central tendency and spread of prior and posterior inflation expectations are the same for respondents across groups as expected.[16]

While we know from the previous analysis that the variance reduces from wave 1 to 3, we find no treatment effect of short vs long information on the spread of posterior inflation expectation. The marginal effect of the prior on the wave 2 posterior is 0.06, ($t = 1.89$, $p = 0.06$) smaller and wave 3 is 0.06, ($t = 1.93$, $p = 0.05$) smaller in the short group compared to the long group.

We do however find that the stickiness of prior inflation beliefs is smaller for respondents that receive short messages. Furthermore, we also find that this is especially true for respondents that receive texts that are both clear and short when compared with the other treatment types (See Figure 3).

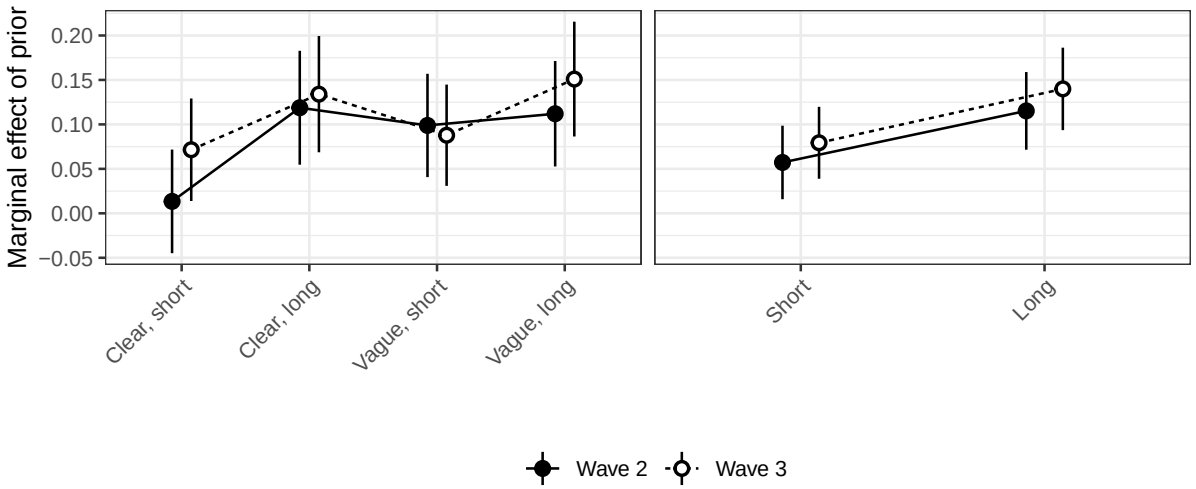

Figure 3: Marginal Effect of Respondents' Reported Prior Inflation Expectations (Wave 1) on Reported Posterior Inflation Expectations (Wave 2 and 3) by second wave information treatment.

In particular, we see a significantly lower marginal effect of the prior in the combined clear and short information treatment compared to all other groupings. The differences of the effects of this group to the clear and long group ($d = 0.11$, $t = 2.38$, $p = 0.02$); the vague and short group($d = 0.09$, $t = 2.03$, $p = 0.04$); and the vague and long group ($d = 0.10$, $t = 2.32$, $p = 0.02$).[17]

[16]See Figure B.2 in the appendix.

[17]Estimates of the marginal effect based on the regression are shown in Table B.2 in the appendix.

Finally, the estimated difference in the marginal effects across treatment groups is the coefficient on the interaction between treatment indicator and prior. These results confirm that central bank communications that are simultaneously short and clear are most effective in altering respondents' post-treatment inflation expectations.

Repeated vs single exposure to information Since our experimental manipulations are implemented within a panel of respondents over time and we have treatment conditions in two waves, we are able to evaluate the effect of information exposure and message consistency. For those respondents that are exposed to treatments in both waves, they either receive the same treatments (clear/clear, vague/vague) or mixed treatments (clear/vague). In our sample, approximately 20% of respondents fall into each of the four possible groupings.[18]

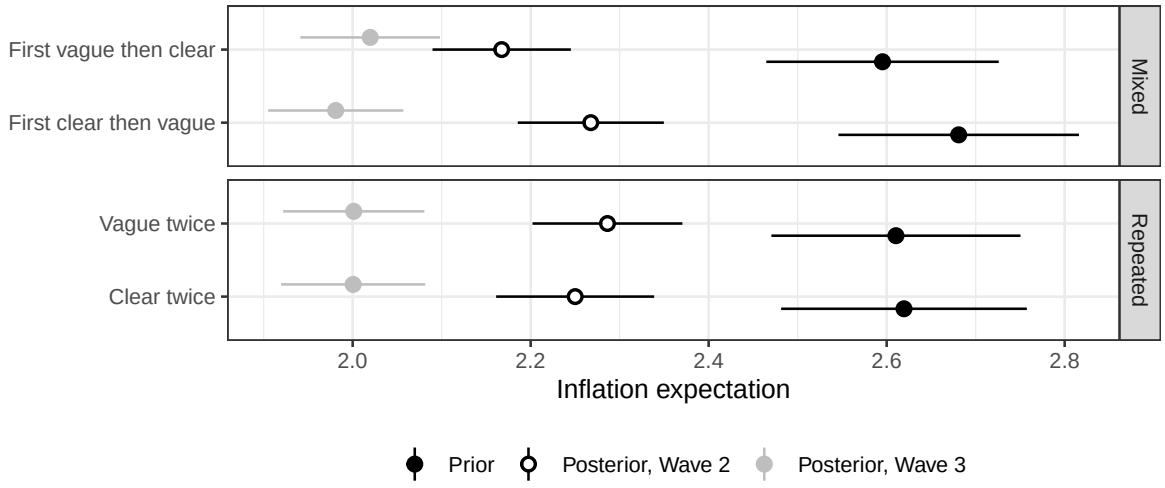

Figure 4: Respondents' Reported Prior Inflation Expectations (Wave 1) on Reported Posterior Inflation Expectations (Wave 2 and 3) by treatment exposure

Figure 4 shows the marginal effects of the prior across the three waves according to whether participants are exposed to the same messages or a mix of messages. We see an overall reduction in inflation expectation as already reported above but no difference in the mean and spread of inflation expectation across repeated or mixed groupings. Whether participants are exposed to the same or a different type of information does not affect the marginal effect of the prior on the posterior in a statistically significant way.[19]

Consequently, we find no evidence that repeated exposure at this level of frequency has an

[18]The remaining 20% of the respondents who are not exposed twice to treatments are because either these people drop out of the panel after the first wave or are newly recruited into wave 2 and 3. These respondents are omitted from the following analysis. The distribution of subjects across repeated treatments is given in Table A.3 in the appendix.

[19]Figure B.3 in the appendix gives the marginal effect estimates.

effect on inflation expectations. We think that this result is interesting as it means that respondents treat central bank communications as if it is news (short term) rather than information (long term). In order to check that this is a robust finding, future research might increase the frequency of exposure, especially if respondents are exposed at a monthly-rate rather than annual or bi-annual rate.

4.2 Information effects by approval of the ECB

Lastly, we examine the influence of an individuals' support for the ECB by treatment group, conditional on the respondent's prior inflation expectations (H2). Respondents' opinions on the performance of the ECB is measured using a Likert-scale, where (1) is very bad and (5) is very good. If attitudes towards the ECB have an effect on the receptivity of central bank communications, then we should expect that respondents with more favorable opinions of the ECB (higher values) are also those most likely to up-weight information given by the ECB (have lower marginal effect of the prior). Furthermore, we expect that the treatment effect is stronger the clearer the treatment text. In order to test this, we again examine the marginal effect of prior expectations on posterior inflation expectation at each interval in the Likert-scale. Figure 5 provides evidence that respondents who view the ECB more favorably are also those more likely to down-weight their priors (incorporate provided information) and conversely, those who view the ECB less favorably are those with stronger priors. In terms of the substantive effects, going from a rating of the ECB is doing a bad job (2) to the ECB is doing a good job (4) reduces the weight of the prior to around 0.18.

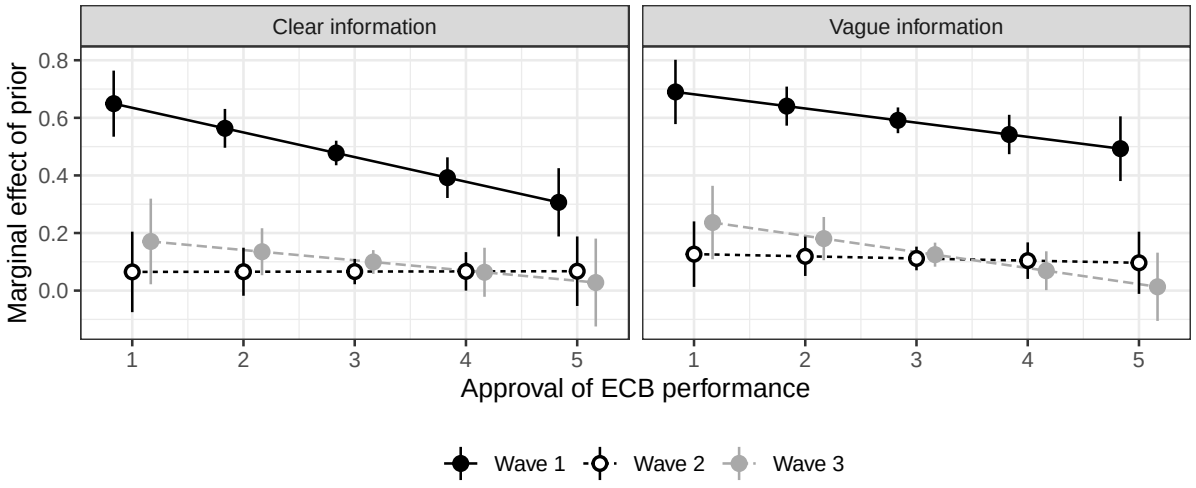

Figure 5: Marginal Effect of Priors on Posterior Inflation Expectation by Approval of ECB performance, first wave information treatment, and waves.

Our measure of ECB approval specifically targets respondents' attitudes towards the ECB with respect to the ECB's core mandate: controlling inflation. We can think of two possible concerns with this measure: one that question ordering may invalidate the causal effect of the treatment and second, that partisanship rather than euroskepticism is the underlying driver of the relationships that we find. We examine both of these concerns in detail.

Because we ask the question about whether a respondent thinks the ECB is doing a good job or not right after respondents are treated, respondents might answer the question in a way that is conditioned by either the treatment variable or the fact that they are getting information about the ECB from the survey. In order to check that this is not the case, we use an alternative measure that asks the respondent about their views on European Union (EU) integration. This question was asked in an independent wave of the GIP in 2015, in which none of our questions were included. Attitudes towards the EU are measured by asking respondents whether they think EU integration has "moved ahead too far" with those answering (0) as yes too far and those answering needs to continue further as (10). The correlation between our ECB approval measure and attitudes towards EU integration is positive and statistically significant ($\rho = .22, t = 11.5, p < .01$). When we replace our measure with the EU integration measure, we find similar results as before. The more a respondent wants EU integration to continue, the more open he/she is to ECB information and the less sticky their prior inflation beliefs. These results are shown in Figure 6.

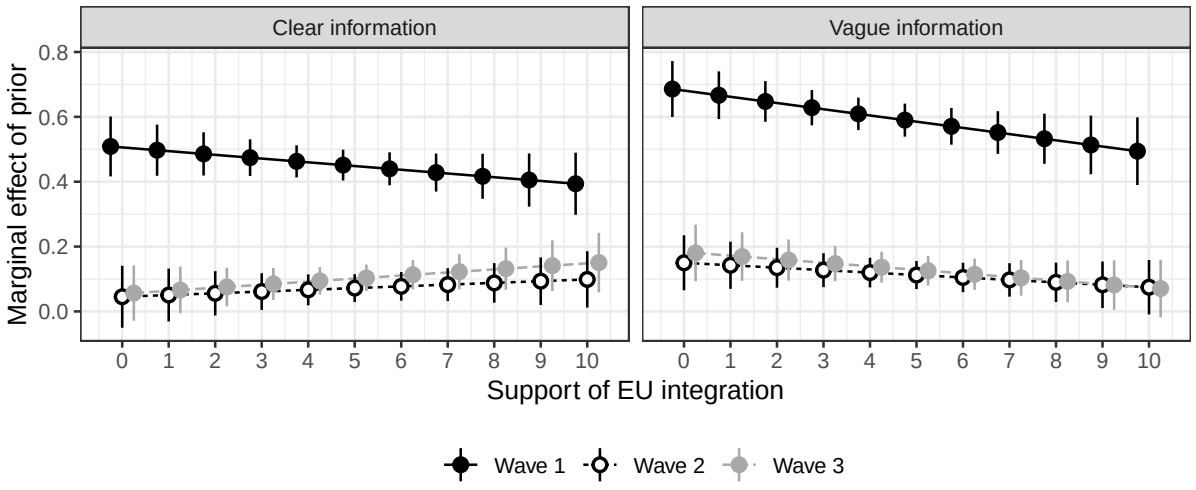

Figure 6: Marginal Effect of Priors on Posterior Inflation Expectation by Attitudes towards EU Integration, first wave information treatment, and waves.

Secondly, another concern is that attitudes towards the ECB and EU might be proxying

other political opinions or biases, such as an individual's political ideology or partisanship. To check for this, we use another GIP survey question from another wave, which asks respondents to place themselves on a left-right scale. Computing the marginal effects of respondents' prior inflation expectations on their posterior inflation expectations conditioned by self-placement on the political left-right scale does not show any effects. As shown in Figure 7, we find no evidence that right-left self placement affects inflation expectations and that the stronger effect is indeed support for the ECB and EU integration.[20] German respondents accurately condition their inflation expectations on their attitudes towards the ECB and the EU, with respondents who are more skeptical of the central bank (ECB) and more skeptical of EU integration less likely to incorporate central bank communications into their inflation expectations.

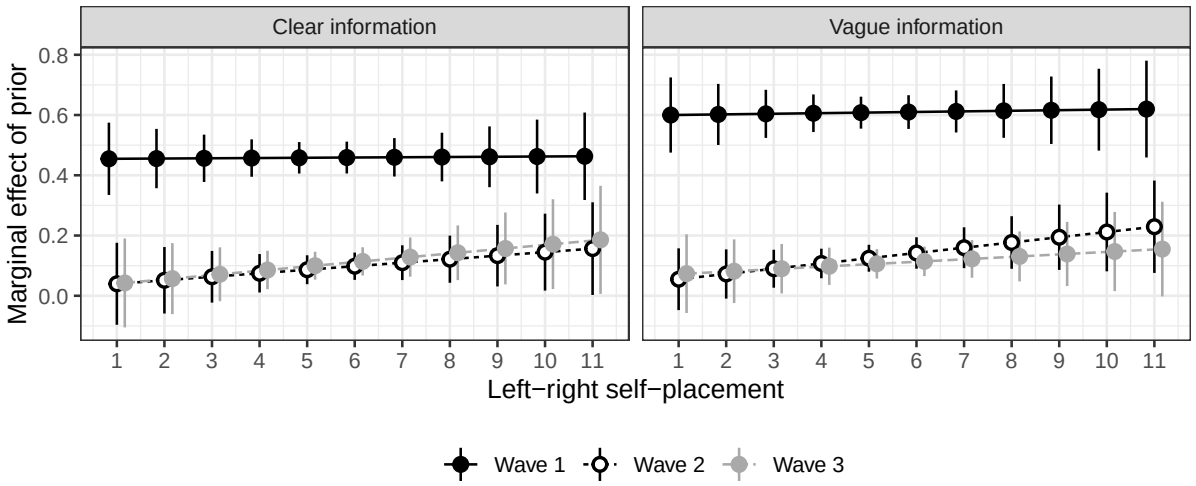

Figure 7: Marginal Effect of Priors on Posterior Inflation Expectation by Left-Right Self-Placement, first wave information treatment, and waves.

5 Alternative Mechanisms

Our experimental findings thus far corroborate observational and laboratory studies that show that central banks can alter the public's inflation expectations in ways that they intend with public communications (Ehrmann and Fratzscher 2009; Mokhtarzadeh and Petersen 2020). We find that central bank messages that are clear are a particularly useful communication style. Another contribution is that we find that brevity matters as well. Our most important finding is that clarity and brevity are most effective if the respondent is supportive of the European project. For respondents that think that the ECB is doing a bad job or that European integration

[20]This is particularly interesting as recent research shows that ideology matters for inflation expectations in the U.S. context (Gillitzer, Prasad, and Robinson 2021).

has gone too far, central bank communication is less effective.

In this section, we consider a number of possible alternative mechanisms. We consider the role of (self-reported) financial sophistication, financial life-event changes, and personal inflation preferences as possible channels that may be affecting inflation expectations in ways that previous models do not account for.

First, we are interested in whether a respondent's level of financial sophistication matters for how they respond to ECB messaging. We measure financial sophistication by asking respondents to self-report their media consumption, asking them how much they read/watch/or listen to general news as well as read/watch/or listen to business news. News consumption is measured on a scale ranging from not at all (1) to several times a day (7).

As shown in Table 2, the general consumption of news media does not matter for respondents' posterior inflation expectations. General news media also does not interact with prior inflation expectation in determining the respondent's posterior beliefs in any wave. On the other hand, respondents who self-report consuming more *business news* hold lower wave 1 - posterior inflation expectations than those who have less exposure to business news. This can be seen in the left pane of Figure 8, although the interaction between business news consumption and prior is not significant in its effect on the posterior.

Respondents who report that they consume a greater amount of business news are also those more likely to have inflation priors closer to the ECB's 2% inflation target. They are also more certain in their expectations. Both their accuracy and certainty imply that respondents are likely learning about the economy and inflation from the media. The fact that outside media information reduces the influence of official information by a favored elites (those that say the ECB is doing a good job) is unlike findings in the literature on elite cues and political sophistication. For example, the American politics literature finds that when people are told factual information about the economy, they interpret it through their own partisan lens irrespective of the actual reported information and that more strong partisans do this more rather than less (Lodge and Taber 2013). By contrast, in our experiment, people with more exposure to ECB information are less (rather than more) likely to be influenced by the experimental treatment and they are also more likely to hold accurate beliefs and know that they do.

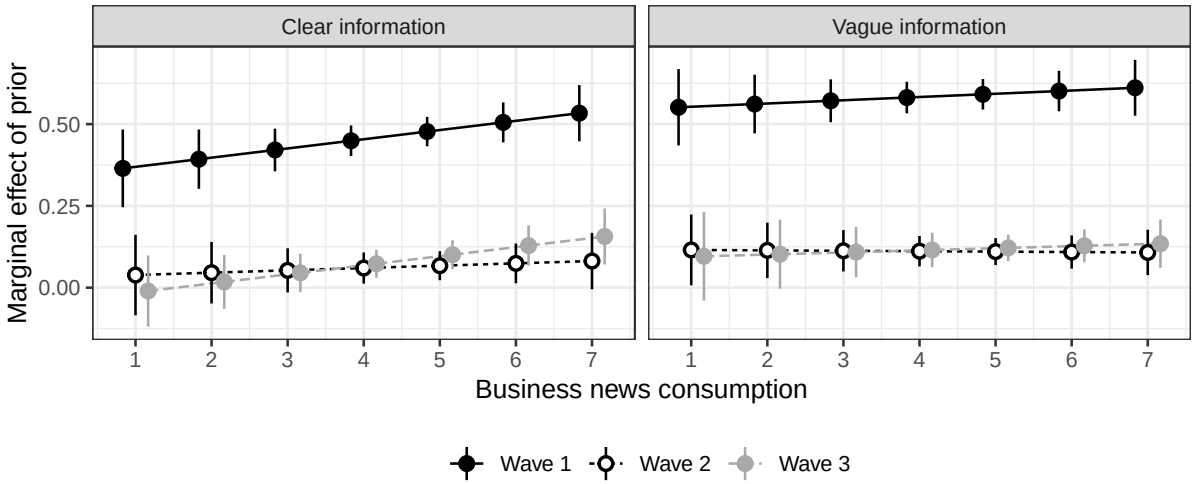

Figure 8: Marginal Effect of Priors on Posterior Inflation Expectation by Business News Consumption, First Wave Information Treatment, and Waves.

Since we only depend on self-reported news and financial news consumption, one concern may be that respondents misreport their level of sophistication. To check for this, we examine whether a respondent has a change in occupation status (e.g. from employed to retired or full time to part time) across the three panel waves under study. The intuition here is that significant changes in one's financial situation are important life events and these life events likely correspond to higher demands for financial information. Interestingly, we find that those respondents who changed their occupation status also hold lower wave 1 - posterior inflation expectation, suggesting that they are likely to have more accurate inflation expectations than those that do not. When we put this measure in our model, we observe a higher marginal effect of the prior (a stickier prior) than those whose occupation status was constant. Furthermore, we also find a significantly lower influence of clear information for those that changed occupation.[21]

Our final consideration is whether an individual's *preferred inflation rate* matters for their *inflation forecast*. To explore this, we examine deviations in individuals' personal inflation preferences from the ECB's target rate of two-percent. In wave 2, we ask respondents about their own preferred inflation rate so as to measure policy congruence in three different ways.[22]

Interestingly, we find little individual-level variation across the number of ways we try to get at preferred policy rates. Individuals seem to hold relatively consistent preferences over inflation across the three tasks we give them. Furthermore, we also find that the preferred level of inflation is stable despite presenting different geographical regions with different conditions

[21]Both of these results are shown graphically in Figure B.8 in the appendix.
[22]For more details, see the appendix.

including: inflation in the Eurozone as a whole, Germany, and their own personally preferred situation, tailored to their own financial conditions.

When we substitute respondent's preferences rather than respondent's opinions about the ECB and the EU into the model, we get very different results. There is a little evidence in Figure 9 of a relationship between the policy distance from the ECB's inflation target and the marginal effect of the prior. The fact that a respondent's inflation preferences do not matter, either substantively or statistically, makes our findings that attitudes towards the ECB and the EU matters even more interesting. The effectiveness of central bank communication is conditioned by whether or not someone positively (or negatively) evaluates the central bank and is independent from an individuals' own preferred level of inflation.

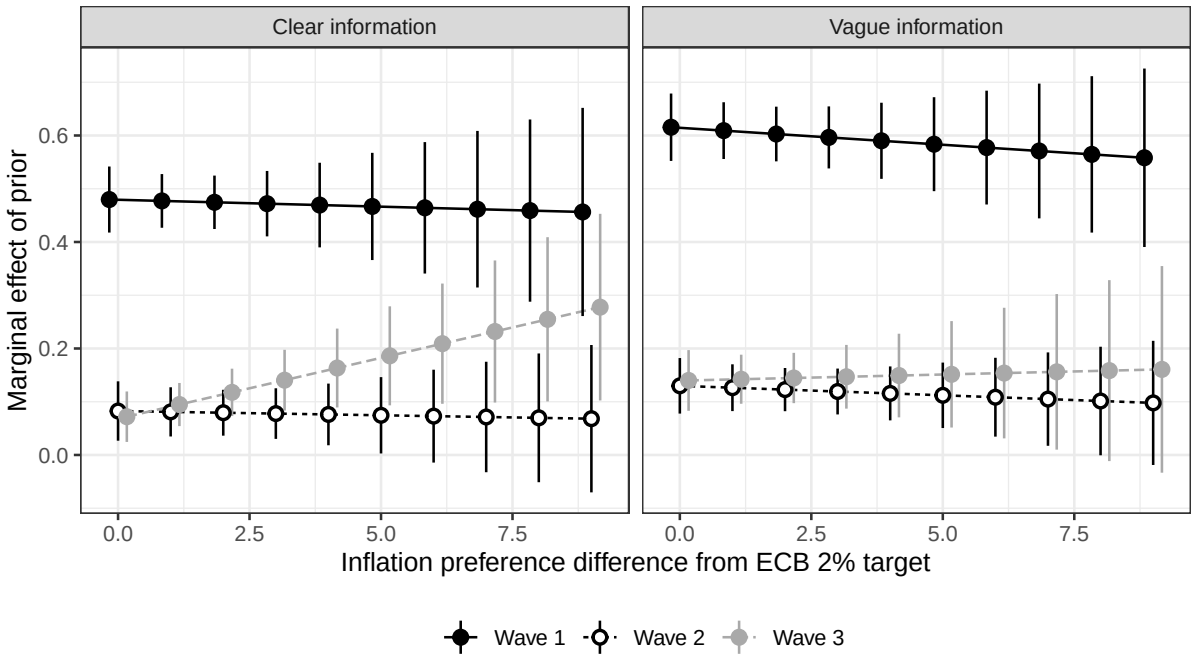

Figure 9: Marginal Effect of Priors on Posterior Inflation Expectation by Policy Congruence (Vague – dashed line, Clear – solid line)

Finally, coming back to findings in the literature about differences in inflation expectations by region (East vs West Germany) and gender, we find that respondents residing in East Germany as well as women have higher inflation expectations (in contrast to West Germans and men, respectively); the treatment effects reported in the result section, however, are robust to regional and gender variation.[23]

[23]See Figures B.9-B.12 in the appendix.

6 Conclusion

In this paper, we provide evidence that citizens are sensitive to (short) textual information communicated by the European Central Bank (ECB). We find that this is true even during a time period where inflation is low, below the ECB's 2% target rate, and the ECB's monetary policy, especially the asset purchase program, is hotly contested and politicized in the German media and by German central bankers. Furthermore, independently conducted research examining the ECB, central bank trust, and inflation expectations in the Dutch context finds results similar to ours (Christelis et al. 2020). Taken together, these results show that political support for the ECB is important for euro-area inflation expectations and consequently domestic level inflation.

We motivated our experiments as a way to uncover how citizens update their beliefs given variations in information content. Our main finding is that citizens who hold more negative assessments of the ECB and those with greater exposure to financial news are also those less likely to uptake ECB communications. We also find that holding personal preferences close to the ECB target rate is not associated with more uptake of information. And we find that when interacting message clarity and message length, messages that are both short and clear are those that have the most influence.

We also think that a study of inflation beliefs in Germany is important. As mentioned previously, the ECB was modeled after the purported success of the German Bundesbank. Germany and by extension Germans have grown up with particular narratives about inflation, some of which are factually inaccurate, as a consequence of hyperinflation in the Wiemar Republic (Haffert, Redeker, and Rommel 2019). German reunification also acted as a significant inflation shock for over 15 million people. While we do not want to overstate the particulars of Germany and inflation, the population is notoriously inflation adverse and as shown by our survey, makes little distinction between optimal inflation rates for the country, the Eurozone as as whole, or themselves as an individual. Since our study was fielded, our insights have only gained in relevance. First, the German public have become even more critical of the ECB.[24] According to our results, elite signals in the German media toting the ineffectiveness of ECB policy may undermine the communication tools the ECB has in its arsenal for stabilizing inflation in Germany (but not in the EU as a whole). This corroborates research that shows how euroskepticism can both reduce the legitimacy of European institutions and also reduce their effectiveness (Baerg and Hallerberg 2016).

[24]For example, see the Financial times: German scepticism of the ECB reveals a eurozone paradox

In addition to euroskepticism, many countries have recently seen an surge in far-right and populists parties making electoral gains and even displacing traditional right parties including the U.S., Romania, France, the Netherlands, and the U.K.. It is possible that one reason why people support populists lies in trust – or lack of it. This coupled with high inflation over the last few years might have led to further discontent. However, our research finds that central bank can combat declining trust by changing its communication style. By communicating with more clarity and using shorter policy communications, we show that citizens are more likely to integrate central bank communications into their inflation forecasts. Future research should examine whether, despite such a wide rise in populism, countries where central banks with more simplistic and clearer communication styles were able to recover from inflation shocks faster than those that communicated less clearly.

Supplemental to these empirical insights, our study provides a number of new important findings. While previous studies suggest that political sophisticates may be more likely to adopt information by their favored elites, in the case of central banks, we find little evidence that public information crowds out private information. We also find surprising stability in respondents' personal preferences over inflation and we find that respondents are likely to report consistent preferences and make little distinction between personal inflation preferences, Eurozone inflation, and German inflation. Furthermore, while many studies have examined how non-elected political elites change citizens' opinion (Broockman and Butler 2017; Iyengar and Kinder 1987), new to this study is testing whether central banks can change citizens' understanding of the economy. Our results suggest that we should be skeptical that central bank communication transmits information. Instead, central bank messages act more like short term news items and less like information.

References

Anderson, Christopher J, Silvia M Mendes, and Yuliya V Tverdova (2004). "Endogenous economic voting: evidence from the 1997 British election". In: *Electoral Studies* 23.4, pp. 683–708.

Armantier, Olivier et al. (2016). "The price is right: Updating inflation expectations in a randomized price information experiment". In: *Review of Economics and Statistics* 98.3, pp. 503–523.

Armantier, Olivier et al. (2021). "How economic crises affect inflation beliefs: Evidence from the Covid-19 pandemic". In: *Journal of Economic Behavior & Organization* 189, pp. 443–469.

Bachmann, Rüdiger, Tim O Berg, and Eric R Sims (2015). "Inflation expectations and readiness to spend: Cross-sectional evidence". In: *American Economic Journal: Economic Policy* 7.1, pp. 1–35.

Baerg, Nicole (2020). *Crafting consensus: Why central bankers change their speech and how speech changes the economy*. Oxford University Press, USA.

Baerg, Nicole Rae and Mark Hallerberg (2016). "Explaining instability in the stability and growth pact: The contribution of member state power and euroskepticism to the euro crisis". In: *Comparative Political Studies* 49.7, pp. 968–1009.

Berger, Helge, Michael Ehrmann, and Marcel Fratzscher (2011). "Monetary policy in the media". In: *Journal of Money, Credit and Banking* 43.4, pp. 689–709.

Bernanke, Ben (2004). *Fedspeak. Remarks at the Meetings of the American Economic Association, San Diego, California, January 3, 2004*.

— (2007). *Inflation expectations and inflation forecasting*. Tech. rep. Board of Governors of the Federal Reserve System (US).

Bholat, David et al. (2019). "Enhancing central bank communications using simple and relatable information". In: *Journal of Monetary Economics* 108, pp. 1–15. ISSN: 0304-3932. DOI: https://doi.org/10.1016/j.jmoneco.2019.08.007. URL: https://www.sciencedirect.com/science/article/pii/S0304393219301394.

Binder, Carola (2017). "Fed speak on main street: Central bank communication and household expectations". In: *Journal of Macroeconomics* 52, pp. 238–251.

Blinder, Alan S and Alan B Krueger (2004). *What does the public know about economic policy, and how does it know it?*

Blinder, Alan S et al. (2008). "Central bank communication and monetary policy: A survey of theory and evidence". In: *Journal of economic literature* 46.4, pp. 910–45.

Blinder, Alan S et al. (2022). "Central bank communication with the general public: Promise or false hope?" In:

Bodea, Cristina and Raymond Hicks (2015). "Price stability and central bank independence: Discipline, credibility, and democratic institutions". In: *International Organization* 69.1, pp. 35–61.

Bordo, Michael D and Lars Jonung (2003). "The future of EMU: what does the history of monetary unions tell us?" In: *Monetary Unions*. Routledge, pp. 52–79.

Bottan, Nicolas L and Ricardo Perez-Truglia (2017). *Choosing your pond: location choices and relative income*. Tech. rep. National Bureau of Economic Research.

Boydstun, Amber E, Benjamin Highton, and Suzanna Linn (2018). "Assessing the relationship between economic news coverage and mass economic attitudes". In: *Political Research Quarterly* 71.4, pp. 989–1000.

Broockman, David E and Daniel M Butler (2017). "The Causal Effects of Elite Position-Taking on Voter Attitudes: Field Experiments with Elite Communication". In: *American Journal of Political Science* 61.1, pp. 208–221.

Brouwer, Nils and Jakob de Haan (2022). "Trust in the ECB: Drivers and consequences". In: *European Journal of Political Economy* 74, p. 102262.

Bulíř, Aleš, Martin Čihák, and David-Jan Jansen (2013). "What drives clarity of central bank communication about inflation?" In: *Open Economies Review* 24.1, pp. 125–145.

Campbell, Angus et al. (1960). *The American Voter*. New York: Wiley.

Cavallo, Alberto, Guillermo Cruces, and Ricardo Perez-Truglia (2017). "Inflation expectations, learning, and supermarket prices: Evidence from survey experiments". In: *American Economic Journal: Macroeconomics* 9.3, pp. 1–35.

Chahrour, Ryan (2014). "Public communication and information acquisition". In: *American Economic Journal: Macroeconomics* 6.3, pp. 73–101.

Christelis, Dimitris et al. (2020). "Trust in the central bank and inflation expectation". In: *Available at SSRN 3540974*.

Clark, Robert, Annamaria Lusardi, and Olivia S Mitchell (2017). "Financial knowledge and 401 (k) investment performance: a case study". In: *Journal of Pension Economics & Finance* 16.3, pp. 324–347.

Coibion, Olivier, Yuriy Gorodnichenko, and Michael Weber (2022). "Monetary policy communications and their effects on household inflation expectations". In: *Journal of Political Economy* 130.6, pp. 1537–1584.

Coibion, Olivier et al. (2020). "Inflation expectations as a policy tool?" In: *Journal of International Economics* 124, p. 103297.

Conover, Pamela and Stanley Feldman (1986). "The Role of Inference in the Perception of Political Candidates". In: *Political Cognition*. Ed. by R. Lau and D. Sears. Hillsdale: Lawrence Erlbaum, pp. 79–102.

Cruijsen, Carin Van der, David-Jan Jansen, and Jakob De Haan (2018). "How much does the public know about the ECB's monetary policy? Evidence from a survey of Dutch households". In: *42th issue (December 2015) of the International Journal of Central Banking*.

Cruijsen, Carin Van der, 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". In: *International Journal of Central Banking* 11.4, pp. 169–218.

Cruijsen, Carin AB Van der, Sylvester CW Eijffinger, and Lex H Hoogduin (2010). "Optimal central bank transparency". In: *Journal of International Money and Finance* 29.8, pp. 1482–1507.

D'Acunto, Francesco, Ulrike Malmendier, and Michael Weber (2023). "What do the data tell us about inflation expectations?" In: *Handbook of economic expectations*. Elsevier, pp. 133–161.

De Vries, Catherine E (2018). *Euroscepticism and the future of European integration*. Oxford University Press.

Ehrmann, Michael and Marcel Fratzscher (2009). "Explaining Monetary Policy in Press Conferences". In: *International Journal of Central Banking* 5.2, pp. 42–84.

Ehrmann, Michael and Alena Wabitsch (2022). "Central bank communication with non-experts–A road to nowhere?" In: *Journal of Monetary Economics* 127, pp. 69–85.

Eppler, Martin J and Jeanne Mengis (2008). "The concept of information overload-a review of literature from organization science, accounting, marketing, mis, and related disciplines (2004)". In: *Kommunikationsmanagement im Wandel*. Springer, pp. 271–305.

Evans, Geoffrey and Robert Andersen (2006). "The political conditioning of economic perceptions". In: *The Journal of Politics* 68.1, pp. 194–207.

Gerber, Alan S and Gregory A Huber (2009). "Partisanship and economic behavior: Do partisan differences in economic forecasts predict real economic behavior?" In: *American Political Science Review*, pp. 407–426.

— (2010). "Partisanship, political control, and economic assessments". In: *American Journal of Political Science* 54.1, pp. 153–173.

Gillitzer, Christian, Nalini Prasad, and Tim Robinson (2021). "Political Attitudes and Inflation Expectations: Evidence and Implications". In: *Journal of Money, Credit and Banking* 53.4, pp. 605–634.

Haffert, Lukas, Nils Redeker, and Tobias Rommel (2019). "Misremembering Weimar: Hyperinflation, the Great Depression, and German collective economic memory". In: *Economics & Politics*.

Haldane, Andrew and Michael McMahon (2018). "Central bank communications and the general public". In: *AEA Papers and Proceedings*. Vol. 108, pp. 578–83.

Haller, H Brandon and Helmut Norpoth (1997). "Reality bites: News exposure and economic opinion". In: *Public Opinion Quarterly*, pp. 555–575.

Hastings, Justine S, Brigitte C Madrian, and William L Skimmyhorn (2013). "Financial literacy, financial education, and economic outcomes". In: *Annu. Rev. Econ.* 5.1, pp. 347–373.

Hobolt, Sara and Miriam Sorace (2020). "A tale of two peoples: motivated reasoning in the aftermath of the Brexit vote". In: *Political Science Research and Methods*.

Hobolt, Sara B and Christopher Wratil (2015). "Public opinion and the crisis: the dynamics of support for the euro". In: *Journal of European Public Policy* 22.2, pp. 238–256.

Högenauer, Anna-Lena (2019). "The politicisation of the European Central Bank and the Bundestag". In: *Politics and governance* 7.3, pp. 291–302.

Hwang, In Do, Thomas Lustenberger, and Enzo Rossi (2023). "Central bank communication and public trust: The case of ECB speeches". In: *Journal of International Money and Finance* 137, p. 102916. ISSN: 0261-5606. DOI: https://doi.org/10.1016/j.jimonfin.2023.102916. URL: https://www.sciencedirect.com/science/article/pii/S0261560623001171.

Iyengar, S. and Donald Kinder (1987). *News that Matters: Television and American Opinion*. Chicago: Chicago University Press.

Jansen, David-Jan (2011). "Does the Clarity of Central Bank Communication Affect Volatility in Financial Markets? Evidence from Humphrey-Hawkins Testimonies". In: *Contemporary Economic Policy* 29.4, pp. 494–509.

Jonung, Lars and Felix Roth (2020). "Public Support for the Euro and Trust in the ECB: the first two decades of the common currency". In: *The Economics of Monetary Unions. Past experience and the Eurozone*. Routledge, pp. 141–158.

Kumar, Saten et al. (2015). *Inflation targeting does not anchor inflation expectations: Evidence from firms in New Zealand*. Tech. rep. National Bureau of Economic Research.

Ladner, Matthew and Christopher Wlezien (2007). "Partisan preferences, electoral prospects, and economic expectations". In: *Comparative Political Studies* 40.5, pp. 571–596.

Lamla, Michael J and Dmitri V Vinogradov (2019). "Central bank announcements: Big news for little people?" In: *Journal of Monetary Economics* 108, pp. 21–38.

Lewis-Beck, Michael S and Mary Stegmaier (2000). "Economic determinants of electoral outcomes". In: *Annual review of political science* 3.1, pp. 183–219.

Lodge, Milton and Charles S Taber (2013). *The rationalizing voter*. Cambridge University Press.

Malmendier, Ulrike and Stefan Nagel (2016). "Learning from inflation experiences". In: *The Quarterly Journal of Economics* 131.1, pp. 53–87.

Masciandaro, Donato, Oana Peia, and Davide Romelli (2024). "Central bank communication and social media: From silence to Twitter". In: *Journal of Economic Surveys* 38.2, pp. 365–388.

Mokhtarzadeh, Fatemeh and Luba Petersen (2020). "Coordinating expectations through central bank projections". In: *Experimental Economics*, pp. 1–36.

Montes, GC et al. (2016). "Effects of transparency, monetary policy signalling and clarity of central bank communication on disagreement about inflation expectations". In: *Applied Economics* 48.7, pp. 590–607.

Morris, Stephen and Hyun Song Shin (1998). "Unique equilibrium in a model of self-fulfilling currency attacks". In: *American Economic Review*, pp. 587–597.

Moschella, Manuela, Luca Pinto, and Nicola Martocchia Diodati (2020). "Let's speak more? How the ECB responds to public contestation". In: *Journal of European public policy* 27.3, pp. 400–418.

Munday, Tim and James Brookes (2021). *Mark my words: the transmission of central bank communication to the general public via the print media*. Bank of England working papers 944. Bank of England. URL: https://ideas.repec.org/p/boe/boeewp/0944.html.

Orphanides, Athanasios and John C Williams (2005). "Inflation scares and forecast-based monetary policy". In: *Review of Economic Dynamics* 8.2, pp. 498–527.

Roos, Michael WM and Ulrich Schmidt (2012). "The Importance of Time-Series Extrapolation for Macroeconomic Expectations". In: *German Economic Review* 13.2, pp. 196–210.

Scheve, Kenneth (2001). "Public attitudes about inflation: a comparative analysis". In: *Bank of England Quarterly Bulletin, Autumn*.

Schmidt, Torsten et al. (2023). *Inflation perception and the formation of inflation expectations*. 1025. Ruhr Economic Papers.

Shen, Fuyuan, Lee Ahern, and Michelle Baker (2014). "Stories that count: Influence of news narratives on issue attitudes". In: *Journalism & Mass Communication Quarterly* 91.1, pp. 98–117.

Sorace, Miriam and Sara Binzer Hobolt (2021). "A tale of two peoples: motivated reasoning in the aftermath of the Brexit Vote". In: *Political Science Research and Methods* 9.4, 675–692. DOI: 10.1017/psrm.2020.50.

Ter Ellen, Saskia, Vegard H Larsen, and Leif Anders Thorsrud (2022). "Narrative monetary policy surprises and the media". In: *Journal of Money, Credit and Banking* 54.5, pp. 1525–1549.

Tverdova, Yuliya V (2012). "The formation of economic perceptions in post-communist countries of east central Europe". In: *Political Behavior* 34.1, pp. 137–158.

Wlezien, Christopher, Mark Franklin, and Daniel Twiggs (1997). "Economic perceptions and vote choice: Disentangling the endogeneity". In: *Political Behavior* 19.1, pp. 7–17.

Woodford, Michael (2005). *Central bank communication and policy effectiveness*.

Appendix

A Experimental design appendix

A.1 Panel Information and Ethics

The German Internet Panel is based on a random probability sample of the general population in Germany aged 16 to 75. The study started in 2012, and was supplemented with additional participants in 2014. The panel participants were recruited offline using strict statistical procedures. Every other month, panel participants are invited to take part in a voluntary online survey.

The online panel methodology in combination with the random probability sample of the general population enables the GIP to conduct research on both cross-sectional and longitudinal issues, to run randomized experiments, and to react quickly to current events in politics, the economy, and society.

In 2012 and 2014, the GIP sampled with a so-called ADM design. In a first stage, 250 and 299 regions were randomly selected from a database of 52,947 regions, with approximately the same number of households. The regions were stratified in advance according to federal state and urbanity to ensure a proportionate distribution across the whole of Germany. A random starting address was then drawn in each region. Following a strict random route procedure, the first 200 households (identified via names on mailboxes or doorbells) along the pre-defined random route were listed in a database. At the head office, this household list was cleaned for non-existent households. Subsequently, we randomly drew households with a fixed spatial distance of exactly 5 households. Finally, selected households received an advance letter announcing the visit of an interviewer. The final gross sample consisted of 4,878 households in 2012 and 9,316 in 2014.

Interviewers conducted 15-minute face-to-face interviews in the households to establish contact, to introduce the study, to determine which household members were part of the eligible sample (target population: persons aged 16-75), and to identify households in need for computer and internet equipment to enable their participation in the study.

Eligible household members who agreed to be contacted were subsequently invited by postal mail to participate in the online study. Households that did not have the necessary computer and internet equipment were provided with user-friendly devices, internet and the appropriate technical support.

In 2012, the recruitment process yielded 1,603 registered online panelists with a cumulative AAPOR response rate of 18.5%; in 2014, this were 3,401 registered online panelists with a cumulative response rate of 21.0%. All samples are regularly surveyed to collect individual data on socio-economic characteristics, behaviors, and attitudes with bi-monthly 20–25 minutes questionnaires. For each survey, an email-invitation is sent out to all panelists on the 1st day of the odd months. The survey remains open for one month. At the beginning of each questionnaire, the identity of the respondents is verified through self-assessment. The participants receive a conditional incentive of 4 Euros and plus a yearly bonus: 10 Euros for all who took part in all surveys of year, or 5 Euros for all who took part in all but one surveys of year. Study participants may choose whether the incentive is transferred into their bank account, paid out as an Amazon voucher, or donated to charity.

The GIP survey data are made available to researchers as Scientific Use Files in the GIP data archive at the GESIS-Leibniz Institute for the Social Sciences six months after the completion of fieldwork and after data preparation and pseudonymization. As part of the Open Science movement, the GIP makes all survey data available to the scientific community. Researchers worldwide can apply for data access free of charge (except for a processing fee).

The GIP collects a wealth of detailed information as well as paradata that cannot be provided in Scientific Use Files for reasons of data protection. In order to enable scientists to work on these data, the GIP offers On-Site Data Access (ODA) in our Data Center in Mannheim. On request,

we can provide sensitive data such as small-area information, the year of birth, verbatim data, ECSP collected paradata, as well as detailed response categories that were aggregated in the Scientific Use Files. This sensitive information may be used in the controlled environment of the ODA.

A.2 Attrition details

	2012 sample	**2014 sample**	**Completion rate**	**Cumulative response**
Wave 14 (November 2014)	948	2627	72.4%	14.8%
Wave 20 (November 2015)	859	2300	63.8%	13.0%

Table A.1: Attrition statistics for the German Internet Panel

A.3 Wave and treatment statistics

		Frequency	**Proportion**
Wave 1			
Clear information		1729	.499
Vague information		1735	.501
		3464	
Wave 2			
Clear information	short	769	.25
	long	767	.25
Vague information	short	768	.25
	long	768	.25
		3072	

Table A.2: Wave and treatment statistics

	N	Rel.freq
Clear twice	1812	0.2
Vague twice	1791	0.2
First clear then vague	1946	0.22
First vague then clear	1951	0.22
Clear only first	457	0.05
Clear only second	276	0.03
Vague only first	464	0.05
Vague only second	288	0.03
	8985	1

Table A.3: Number of observations and relative frequency of the sequence of treatments over subjects in all three waves.

A.4 Sample characteristics and treatment balance

Table A.4: Means and standard deviation of pre-treatment variables by treatment condition.

Variable	**Clear information** Mean (SD)	**Vague information** Mean (SD)	**Clear, short information** Mean (SD)	**Clear, long information** Mean (SD)	**Vague, short information** Mean (SD)	**Vague, long information** Mean (SD)
Age	7.00 (3.08)	7.18 (3.12)	7.13 (3.11)	7.31 (3.09)	7.02 (3.08)	7.06 (3.07)
Share female	0.48 (0.50)	0.50 (0.50)	0.48 (0.50)	0.48 (0.50)	0.46 (0.50)	0.51 (0.50)
Share Hauptschule	0.17 (0.38)	0.17 (0.38)	0.17 (0.38)	0.17 (0.38)	0.17 (0.38)	0.17 (0.38)
Share Abitur	0.36 (0.48)	0.37 (0.48)	0.36 (0.48)	0.34 (0.47)	0.39 (0.49)	0.35 (0.48)
Share married	0.56 (0.50)	0.56 (0.50)	0.58 (0.49)	0.59 (0.49)	0.54 (0.50)	0.56 (0.50)
Share retired	0.17 (0.37)	0.19 (0.39)	0.18 (0.38)	0.20 (0.40)	0.18 (0.38)	0.17 (0.37)
Share unemployed	0.03 (0.17)	0.03 (0.16)	0.03 (0.17)	0.03 (0.18)	0.03 (0.16)	0.02 (0.14)
Share working full time	0.47 (0.50)	0.44 (0.50)	0.46 (0.50)	0.44 (0.50)	0.47 (0.50)	0.47 (0.50)
ECB approval	3.10 (0.77)	3.08 (0.77)	3.06 (0.80)	3.13 (0.74)	3.07 (0.75)	3.11 (0.76)
Support for EU integration	4.73 (3.04)	4.83 (3.05)	4.75 (2.99)	4.72 (3.12)	4.88 (2.98)	4.77 (3.12)
Left-right self-placement	5.50 (2.00)	5.47 (1.94)	5.48 (2.00)	5.53 (1.96)	5.42 (1.96)	5.54 (2.02)
News consumption	5.89 (1.35)	5.91 (1.30)	5.98 (1.24)	5.95 (1.29)	5.86 (1.36)	5.91 (1.33)
Business news consumption	4.78 (1.78)	4.74 (1.79)	4.80 (1.76)	4.91 (1.70)	4.79 (1.79)	4.70 (1.81)

Table A.5: Difference-in-means tests of pre-treatment variables for *Clear information* vs *vague information* treatment, *Clear, short information* vs *Clear, long information*, *Vague, short information*, and *Vague, long information* treatment.

Variable	**Clear vs Vague** Diff (p)	**Clear, short vs Clear, long** Diff (p)	**Clear, short vs Vague, short** Diff (p)	**Clear, short vs Vague, long** Diff (p)
Age	0.20 (0.06)	0.17 (0.32)	-0.18 (0.28)	-0.13 (0.45)
Share female	0.03 (0.07)	0.01 (0.73)	-0.01 (0.62)	0.04 (0.17)
Share Hauptschule	-0.01 (0.62)	0.01 (0.71)	-0.01 (0.77)	-0.01 (0.69)
Share Abitur	0.00 (0.80)	-0.00 (0.97)	0.04 (0.14)	0.02 (0.56)
Share married	0.00 (0.97)	0.02 (0.39)	-0.03 (0.21)	-0.03 (0.32)
Share retired	0.03 (0.04)	0.03 (0.21)	0.00 (0.95)	-0.00 (0.86)
Share unemployed	-0.00 (0.61)	0.00 (0.70)	0.00 (0.84)	0.00 (0.58)
Share working full time	**-0.04 (0.03)**	-0.02 (0.50)	0.01 (0.62)	0.03 (0.31)
ECB approval	-0.03 (0.28)	0.06 (0.15)	0.00 (0.94)	0.04 (0.32)
Support for EU integration	0.07 (0.55)	0.12 (0.50)	0.20 (0.24)	0.08 (0.67)
Left-Right self-placement	-0.04 (0.64)	0.02 (0.87)	-0.10 (0.40)	0.01 (0.94)
News consumption	0.01 (0.83)	-0.04 (0.52)	-0.11 (0.12)	-0.08 (0.28)
Business news consumption	-0.05 (0.46)	0.11 (0.24)	-0.01 (0.94)	-0.10 (0.31)

A.5 Questionnaire items

A.5.1 Wave 1 (November 2014)

1. Assessing inflation

   German original:
   Bei den folgenden Fragen besteht Ihre Aufgabe darin, Preisentwicklungen einzuschätzen. Eine Person gibt aktuell 1500 Euro für Lebensmittel und Kleidung sowie für Friseurbesuche pro Monat aus. Wie werden sich diese Ausgaben in 12 Monaten verändern? Geben Sie bitte an, wie viel diese Person für Lebensmittel und Kleidung sowie für Friseurbesuche in 12 Monaten ausgeben wird. Gehen Sie bitte davon aus, dass sich weder die Lebensumstände noch das Konsumverhalten der Person verändern wird, d.h. sie wird in 12 Monaten ähnliche Produkte und Dienstleistungen im gleichen Umfang wie derzeit nutzen. Bei dieser Frage können Sie nur eine Antwort geben.

Ausgaben in 12 Monaten [Answer key:] *weniger als 1500 EUR, 1500 EUR, 1515 EUR, 1530 EUR, 1545 EUR, 1560 EUR, 1575 EUR, 1590 EUR, 1605 EUR, 1620 EUR, 1635 EUR, 1650 EUR oder mehr.*

2. Inflation expectation, vague/ clear treatment condition

   German original:
   Bei den folgenden Fragen besteht Ihre Aufgabe darin, Preisentwicklungen einzuschätzen. Eine Person gibt aktuell 1500 Euro für Lebensmittel und Kleidung sowie für Friseurbesuche pro Monat aus. Wie werden sich diese Ausgaben in 12 Monaten verändern? Geben Sie bitte an, wie viel diese Person für Lebensmittel und Kleidung sowie für Friseurbesuche in 12 Monaten ausgeben wird. [Anchoring treatment 1 (AT1):]

   AT1.1 Vague information:
   Die europäische Zentralbank erwartet, dass die wichtigen Zinssätze für eine längere Zeit auf dem gegenwärtigen Level oder darunter liegen werden. Diese Einschätzung beruht auf den insgesamt gedämpften Inflationsaussichten. Die Inflationserwartung für die Eurozone deckt sich mit dem Ziel der Zentralbank die Preissteigerung auf angemessenem Niveau zu halten.

   AT1.2 Clear information:
   Die europäische Zentralbank erwartet, dass die wichtigen Zinsssätze in den nächsten 6 bis 12 Monaten auf dem gegenwärtigen Level oder darunter liegen werden. Diese Einschätzung beruht auf den insgesamt gedämpften Inflationsaussichten von derzeit 1 Prozent pro Jahr. Die Inflationserwartung für die Eurozone deckt sich mit dem Ziel der Zentralbank die Preissteigerung nahe 2 Prozent zu halten.

   Bei der vorherigen Frage haben Sie angegeben, dass eine Person im [Date, year from now][Answer from question 1] *für Lebensmittel und Kleidung ausgeben wird. Dieser Betrag entspricht einer jährlichen Inflationsrate von* [Answer from question 1 expressed as inflation rate]. *Wenn Sie nun die Erwartungen der EZB berücksichtigen, was schätzen Sie: Wie viel Euro wird diese Person für die gleichen Lebensmittel und die gleiche Kleidung im* [Date, year from now] *bezahlen? Gehen Sie bitte davon aus, dass sich weder die Lebensumstände noch das Konsumverhalten der Person verändern wird, d.h. sie wird in 12 Monaten ähnliche Produkte und Dienstleistungen im gleichen Umfang wie derzeit nutzen. Bei dieser Frage können Sie nur eine Antwort geben.*

   Ausgaben in 12 Monaten [Answer key:] *weniger als 1500 EUR, 1500 EUR, 1515 EUR, 1530 EUR, 1545 EUR, 1560 EUR, 1575 EUR, 1590 EUR, 1605 EUR, 1620 EUR, 1635 EUR, 1650 EUR oder mehr.*

3. Medium-term inflation expectation

   German original:
   Mit welcher jährlichen Inflationsrate rechnen Sie in 5 Jahren? Bei dieser Frage können Sie nur eine Antwort geben. [Answer key:] *-1,0,1,2,3,4,5,6,7,8,9,10 %*

4. Long-term inflation expectation

   German original:
   Mit welcher jährlichen Inflationsrate rechnen Sie in 10 Jahren? Bei dieser Frage können Sie nur eine Antwort geben. [Answer key:] *-1,0,1,2,3,4,5,6,7,8,9,10 %*

5. Manipulation check

   German original:

Vague information treatment condition:
In einer der vorherigen Fragen haben Sie folgende Informationen gelesen: Die Inflationserwartung für die Eurozone deckt sich mit dem Ziel der Europmäischen Zentralbank, die Preissteigerung auf angemessenem Niveau zu halten.

Clear information treatment:
In einer der vorherigen Fragen haben Sie folgende Informationen gelesen: Die Inflationserwartung für die Eurozone deckt sich mit dem Ziel der Europäischen Zentralbank, die Preissteigerung nahe 2% zu halten.

Für wie detailliert halten Sie diese Information?
Answer key: *überhaupt nicht detailliert, wenig detailliert, mäßig detaillier, ziemlich detaillier, sehr detailliert*

6. Approval of ECB

German original:
Die Hauptaufgabe der Europäischen Zentralbank (EZB) ist es, dafür zu sorgen, dass die Preise in der gesamten Eurozone stabil bleiben. Das bedeutet, dass die EZB dafür verantwortlich ist, dass sich die Preise über die Zeit nur wenig verändern. Wie erfüllt die EZB Ihrer Meinung nach die Aufgabe, die Preise stabil zu halten?
Answer key: *sehr gut, gut, weder gut noch schlecht, schlecht, sehr schlecht*

7. News consumption

German original:
Wie oft schauen oder lesen Sie Nachrichten?
Answer key: *gar nicht, seltener als einmal pro Woche, einmal pro Woche, alle 4-6 Tage, alle 2-3 Tage, einmal am Tag, mehrmals am Tag*

8. Business news consumption

German original:
Wie oft schauen oder lesen Sie Nachrichten zu wirtschaftlichen Themen?
Answer key: *gar nicht, seltener als einmal pro Woche, einmal pro Woche, alle 4-6 Tage, alle 2-3 Tage, einmal am Tag, mehrmals am Tag*

A.5.2 Wave 2 (November 2015)

1. Preference inflation vs unemployment Germany (*CD20100 pref_inflation_unemployment_de*)

German original:
Bei den folgenden Fragen geht es um Inflation. Wenn alles teurer wird spricht man von Inflation und meint damit, dass Sie sich für denselben Geldbetrag weniger kaufen können. Die Stärke der Inflation wird als Inflationsrate bezeichnet. Die Inflation wirkt sich auf die Arbeitslosenrate aus. Üblicherweise sind entweder die Inflationsrate oder die Arbeitslosenrate niedrig, nicht aber beide zum selben Zeitpunkt. Stellen Sie sich vor, dass Sie für Deutschland zwischen zwei extremen Szenarien wählen müssten. Für welches dieser beiden Szenarien würden Sie sich entscheiden? [Answer key:] *Deutschland hätte in den nächsten 2 Jahren eine Inflationsrate von nur 2% pro Jahr, bei einer gleichzeitigen Arbeitslosenrate von 15%. Deutschland hätte in den nächsten 2 Jahren eine Inflationsrate von 15% pro Jahr, bei einer gleichzeitigen Arbeitslosenrate von nur 2%.*

2. Comprehension inflation vs unemployment trade-off Germany
(*CD20101 pref_inflation_unemployment_de_s2* or *CD20102 pref_inflation_unemployment_de_s3*

German original:
Sie haben sich bei der vorherigen Frage für das [erste/zweite] Szenario entschieden: Deutschland hätte in den nächsten 2 Jahren eine Inflationsrate von nur [2/15]% pro Jahr, bei einer gleichzeitigen Arbeitslosenrate von [15/2]%. Das [zweite/erste] Szenario lautete: Deutschland hätte in den nächsten 2 Jahren eine Inflationsrate von [15/2]% pro Jahr, bei einer gleichzeitigen Arbeitslosenrate von nur [2/15]%. Wie hoch müsste die prozentuale Arbeitslosenrate im ersten Szenario mindestens sein, damit Sie sich für das zweite Szenario entscheiden würden? Bitte tragen Sie eine Zahl [zwischen 16 und 100/größer als 15] ein. [Answer key:] Integer [16-100/>15]

3. Preference inflation vs unemployment Eurozone (*CD20103 pref_inflation_unemployment_eu*)

   German original:
   Stellen Sie sich vor, dass Sie für den Euroraum zwischen zwei extremen Szenarien wählen müssten. Für welches dieser beiden Szenarien würden Sie sich entscheiden ? [Answer key:] *Der Euroraum hätte in den nächsten 2 Jahren eine Inflationsrate von nur 2% pro Jahr, bei einer gleichzeitigen Arbeitslosenrate von 15%. Der Euroraum hätte in den nächsten 2 Jahren eine Inflationsrate von 15% pro Jahr, bei einer gleichzeitigen Arbeitslosenrate von nur 2%.*

4. Comprehension inflation vs unemployment trade-off Eurozone
   (*CD20104 pref_inflation_unemployment_de_s2* or
   CD20105 pref_inflation_unemployment_de_s1

   German original:
   Sie haben sich bei der vorherigen Frage für das [erste/zweite] Szenario entschieden: Der Euroraum hätte in den nächsten 2 Jahren eine Inflationsrate von nur [2/15]% pro Jahr, bei einer gleichzeitigen Arbeitslosenrate von [15/2]%. Das [zweite/erste] Szenario lautete: Der Euroraum hätte in den nächsten 2 Jahren eine Inflationsrate von [15/2]% pro Jahr, bei einer gleichzeitigen Arbeitslosenrate von nur [2/15]%. Wie hoch müsste die prozentuale Arbeitslosenrate im ersten Szenario mindestens sein, damit Sie sich für das zweite Szenario entscheiden würden? Bitte tragen Sie eine Zahl [zwischen 16 und 100/größer als 15] ein. [Answer key:] Integer [16-100/>15]

5. Inflation/interest rate/unemployement rate/growth rate preference Eurozone/Germany (*CD20106 pref_inflation_eu* or *CD20107 pref_inflation_de*)

   German original:
   Die Europäische Zentralbank (EZB) und die Euroländer, wie beispielsweise die Deutsche Bundesbank, legen die wichtigsten Zinssätze für den Euroraum fest. Dieser Zins wird als Leitzins bezeichnet, da er die gesamte Volkswirtschaft beeinflusst. Durch die Erhöhung des Leitzinses macht die Zentralbank das Geld "teurer," das heißt Bürger und Unternehmen nehmen weniger Kredite auf. Damit ist das Geld der Banken weniger gefragt und die Inflation sinkt. In den folgenden zwei Fragen werden Sie gebeten, einmal die Rolle der EZB einzunehmen und den Leitzins für den Euroraum festzulegen und einmal die Rolle der deutschen Bundesbank einzunehmen und entsprechend den Leitzins für Deutschland festzulegen. In der dritten Frage bittet man Sie, einen Leitzins festzulegen, der für Ihre eigene finanzielle Situation am besten ist. Der Leitzins hat einen Einfluss auf die Höhe der Inflation, der Arbeitslosigkeit und des Wirtschaftswachstums im Euroraum und auch in Deutschland.
   Stellen Sie sich vor, dass Sie die Rolle der [EZB/Bundesbank] übernehmen und den Leitzins für [den Euroraum/Deutschland] festlegen. Der Leitzins hat einen Einfluss auf die Höhe der Inflation, der Arbeitslosigkeit und des Wirtschaftswachstums im Euroraum.

Die vier unten stehenden Linien sind so miteinander verbunden, dass ein höherer Zinssatz zu einer niedrigeren Inflation, einer höheren Arbeitslosenrate und einem niedrigeren Wirtschaftswachstum führt. Ein niedrigerer Zinssatz hat die gegenteiligen Auswirkungen. Bitte klicken Sie auf die [erste/zweite/dritte/vierte] Linie, um Ihren bevorzugten Zinssatz auszuwählen. Anschließend können Sie die Werte verändern, indem Sie eines der Vierecke verschieben [order of sliders is randomized]. [Answer key:]

Figure A.1: Example of screen as displayed to respondents to answer question item *CD20106* and *CD20107*

6. Preferences personal inflation (*CD20108 pref_inflation_personal*)

   German original:
   Stellen Sie sich vor, dass man Sie persönlich beauftragt hat, einen Leitzins festzulegen, der für ihre eigene finanzielle Situation am besten ist. Der Leitzins hat einen Einfluss auf die Höhe der Inflation, der Arbeitslosigkeit und des Wirtschaftswachstums in Deutschland. Die vier unten stehenden Linien sind so miteinander verbunden, dass ein höherer Zinssatz zu einer niedrigeren Inflation, einer höheren Arbeitslosenrate und einem niedrigeren Wirtschaftswachstum führt. Ein niedrigerer Zinssatz hat die gegenteiligen Auswirkungen. Bitte klicken Sie auf die [erste/zweite/dritte/vierte] Linie, um Ihren bevorzugten Zinssatz auszuwählen. Anschließend können Sie die Werte verändern, indem Sie eines der Vierecke verschieben [order of sliders is randomized]. [Answer key:] See previous question item.

7. Weighting inflation/unemployment rate (*CD20109 weight_unemployment_EZB*, *CD20110 weight_inflation_EZB*, *CD201011 weight_unemployment_EZB*, and *CD201102 weight_inflation_EZB*)

   German original:
   Die Politik der [EZB/deutschen Bundesregierung] beeinflusst die Inflation und die Arbeitslosenrate. Auf einer Skala von 0 bis 10: Wie stark sollte Ihrer Meinung nach die Verringerung der Inflation und wie stark die Reduzierung der Arbeitslosenrate

gewichtet werden?
Die Summe der Antworten muss 10 ergeben. [Answer key:]

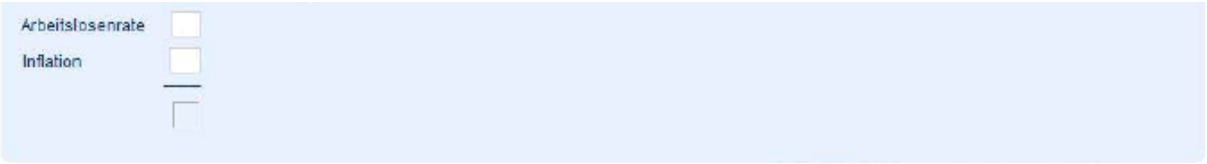

Figure A.2: Example of screen as displayed to respondents to answer question item *CD20106* and *CD20107*

8. Inflation expectation (next 12 month, (*CD20113 change_inflation_ecb*)

   German original:
   Der folgende Bericht beschreibt und erklärt die Handlungen der EZB für die Öffentlichkeit. Bitte beachten Sie diese Informationen bei der Beantwortung der anschließenden Frage. [Anchoring treatment 2 (AT2):]

   AT2.1 Clear information, long:
   Die EZB dehnt ihre Ankäufe auf Anleihen aus, die von im Euroraum ansässigen Zentralstaaten, Emittenten mit Förderauftrag und europäischen Institutionen begeben werden. Insgesamt sind monatliche Ankäufe von Vermögenswerten in Höhe von 60 Milliarden Euro geplant. Die Ankäufe sollen mindestens bis September 2016 erfolgen. Das Programm dient der Erfüllung des Mandats der EZB, die Preisstabilität zu gewährleisten und mittelfristige Inflationsraten nahe 2% zu erreichen.

   AT2.2 Vague information, long:
   Die EZB dehnt ihre Ankäufe auf Anleihen aus, die von im Euroraum ansässigen Zentralstaaten und anderen Emittenten und Institutionen begeben werden. Insgesamt sind monatliche Ankäufe von Vermögenswerten in großer Höhe geplant. Die Ankäufe sollen mindestens bis Mitte nächsten Jahres erfolgen. Das Programm dient der Erfüllung des Mandats der EZB, die Preisstabiliät zu geährleisten und mittelfristige Inflationsraten nahe einem angemessenen Level zu erreichen.

   AT2.3 Clear information, short:
   Die EZB dehnt ihre Ankäufe auf Anleihen aus. Die Ankäufe in Höhe von 60 Milliarden Euro sollen bis September 2016 erfolgen und dienen der Erfüllung des Mandats der EZB zur Gewährleistung von Preisstabilität und einer Inflationsrate nahe 2%.

   AT2.4 Vague information, short:
   Die EZB dehnt ihre Ankäufe auf Anleihen aus. Die Ankäufe in großer Höhe sollen bis Mitte nächsten Jahres erfolgen und dienen der Erfüllung des Mandats der EZB zur Gewährleistung von Preisstabilität und einer angemessenen Inflationsrate.

   Wie sehr wird Ihrer Meinung nach die Inflationsrate in den nächsten 12 Monaten steigen oder sinken (in Prozent)? [Answer key]: *-1 oder mehr sinken, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10% oder mehr steigen.*

A.6 Investigating inflation preferences

We elicit individuals' inflation preferences in various ways. First, we ask them directly about their preferences. Second, respondents also indicate their inflation preferences by completing a number of small interactive tasks, which we list below. In all of these tasks, we include additional comprehension checks:

Task A: Respondents decide between either an economic scenario of high unemployment and low inflation in Germany and the Eurozone with an additional comprehension questions. A scenario where both indicators are stable is not given as an option.

Task B: Respondents move interconnected sliders for interest rate, inflation, unemployment rate, and growth rate (order of sliders is randomized), for Germany, the Eurozone, or for their individual situation. These sliders cue respondents that these indicators involve trade-offs. For example, when inflation rates increase, so do interest rates. Respondents are then asked to choose their preferred outcome.

Task C: Respondents report their preferred weighting that the ECB (or the German federal government) should apply to lowering inflation vs reducing unemployment on a scale of 0 to 10.

Using answers from these interactive tasks, we then measure *policy Congruence* as the (quadratic) distance between the respondent's preferred inflation rate and the ECB's 2% target rate.In the main results, the policy rate we use comes from the task where respondents use sliders to specify their preferred inflation rate, however, we also run the results using the alternative measures as shown in Figure A.5.2

On average, respondents do not vary much in their answers despite these different hypothetical scenarios, with a median response that is very stable across the three types of questions (2.8, 2.8, 2.7). This implies that in the case of inflation preferences at least in this low inflation environment, respondents show little difference in "pocketbook" versus "socio-tropic" preferences. Despite this stability, however, when we move to examining between-respondent preferences, we observe significant variation. For example, while two-thirds of respondents prefer a world in which there is low inflation and high-unemployment, despite the fact that inflation is well below the ECB's target if made to choose, a remaining one-third of respondents prefer a world with higher inflation and higher unemployment.

We also probe respondents to consider monetary policy as if it involves trade-offs consistent with inflation "games" made available at most central bank museums or online.[25] In our games, we show respondents' randomized sliders and ask them to move the slider to their preferred inflation rate. When they move one indicator, such as inflation, they observe the effect of their preferred rate on other variables in the economy: interest rates, unemployment, and growth. The purpose of this task is to make respondents realize that different economic variables are inter-related. After interacting with our tasks, respondents' preferred inflation rate emerges at a very similar rate of 2.5 percent.

[25]For example, the ECB provides inflation education through the game Inflation Island. For an overview of the types of educational games see Inflation Island and Economia: Educational Games

B Statistical appendix

B.1 Information effects

Another way to assess the information treatment effects, is to investigate respondent-level updating. Figure B.1 plots, for each wave and by first information treatment, the share of respondents with a particular prior-posterior pair. On the x-axis, we show the share of respondents with a given level of deviation of the prior inflation expectation from the actually observed inflation of 1%. On the y-axis, we show that share for the deviation of the posterior from 1%. Clearly, prior and first wave posterior are more closely aligned, that is, a larger share of respondents does not update that is, they show no different deviation of prior and posterior; the darkest colors indicating the highest share of respondents sits along the 45-degree line in the top pane.

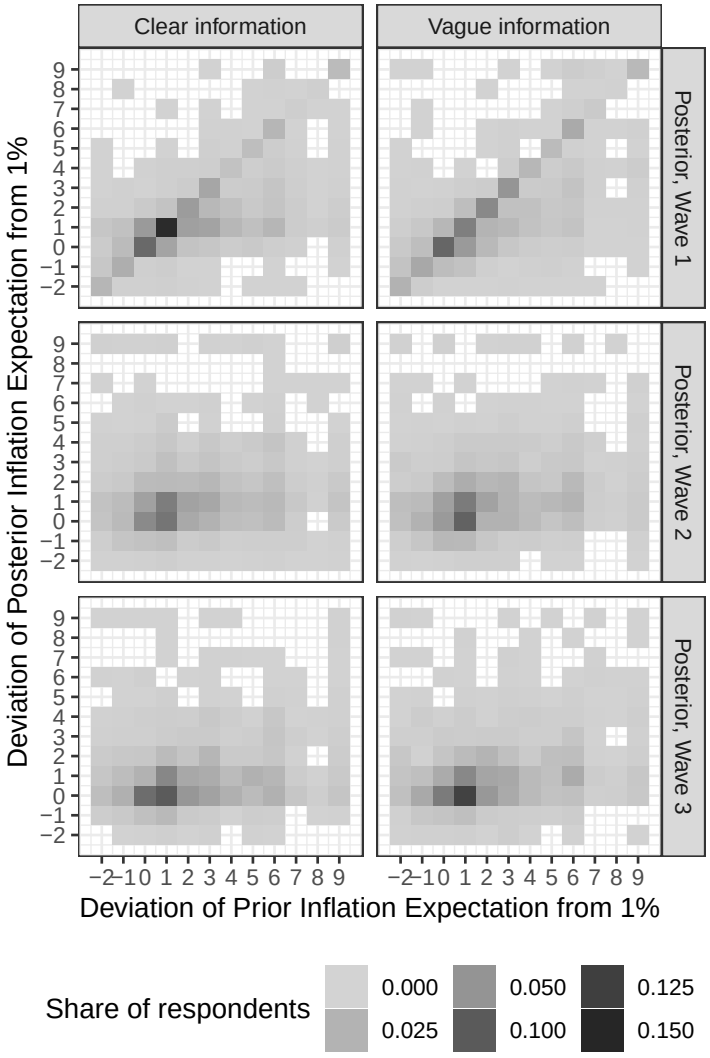

Figure B.1: Share of Respondent with Pairs of Reported Prior and Posterior Inflation Expectations by First Information Treatment and Waves

We observe the effect of the first information treatment in two ways: (1) the share of respondents who is off in prior and posterior by 1%, i.e. deviates from 1% actual inflation upwards by 1%, is larger in the clear than the vague treatment (darker tiles). We already know that share of respondents who hold inflation expectation of 2% is higher for the posterior than the prior and higher still for the clear than the vague treatment. (2) We can also see that the spread of

deviations is larger for the prior, in both first wave treatments, than the posterior in wave 2, i.e., the horizontal spread of colored tiles is larger than the vertical spread; this reduction in spread of deviations, however, is smaller in the middle panes (wave 2) and bottom panes (wave 3).

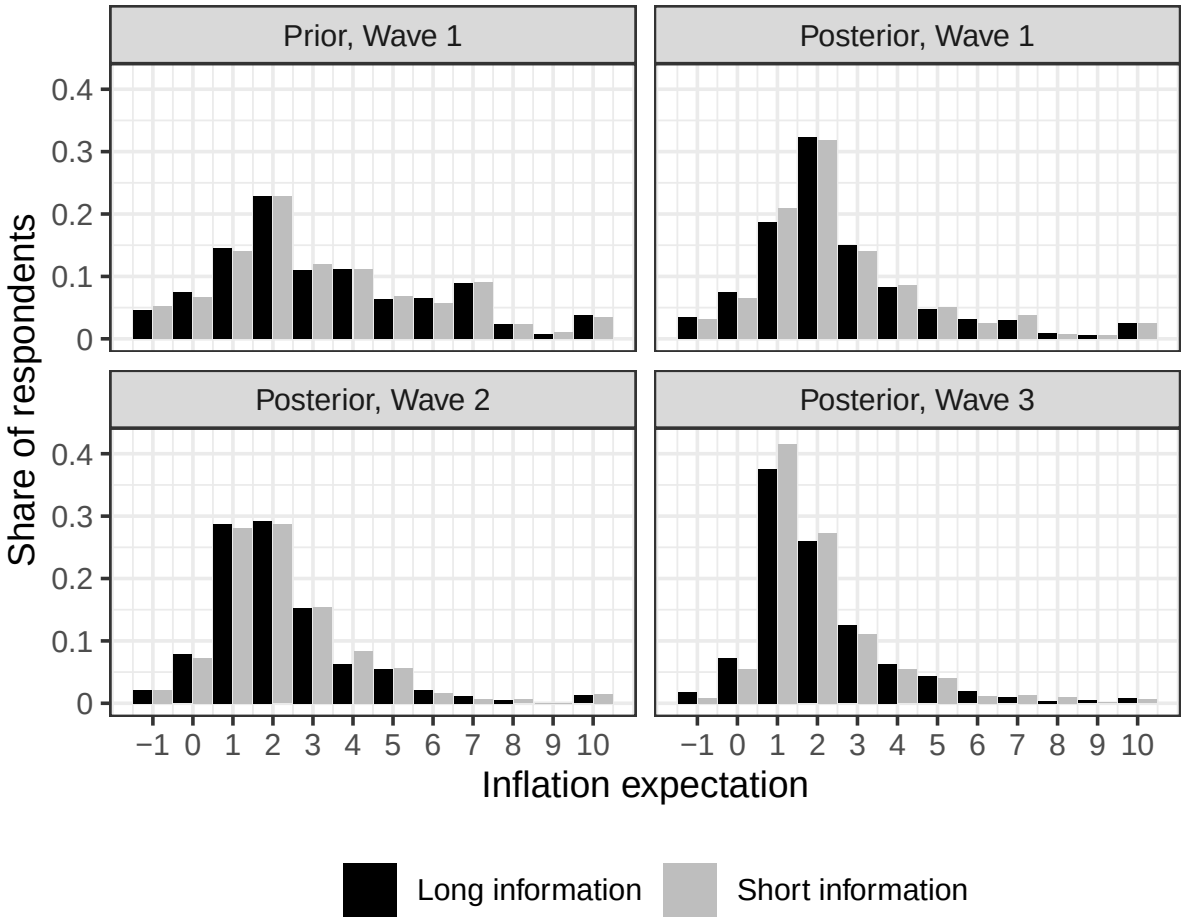

Figure B.2: Distribution of Respondents' Reported Prior and Posterior Inflation Expectations by Second Information Treatment and Waves

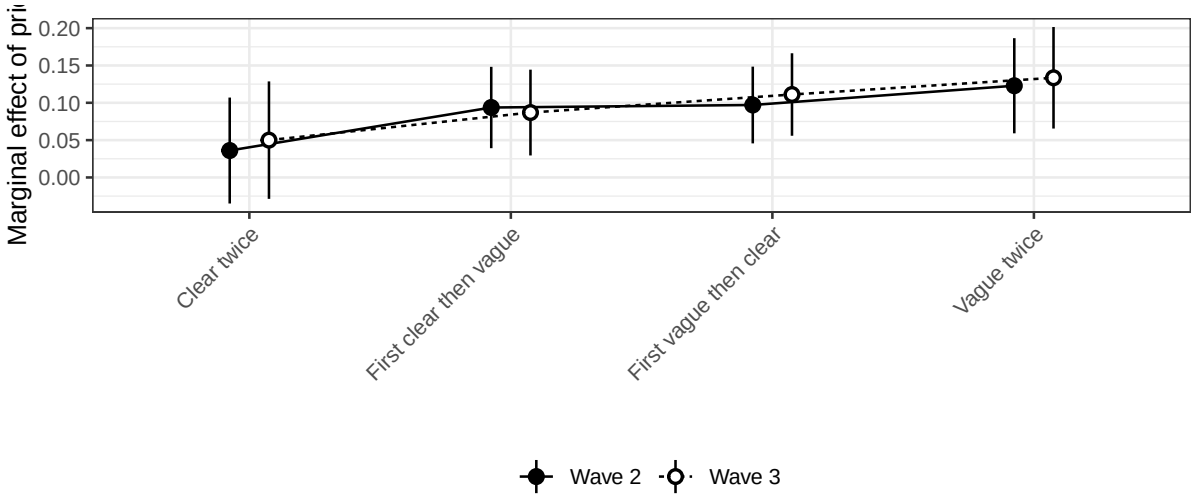

Figure B.3: Marginal Effect of Respondents' Reported Prior Inflation Expectations (Wave 1) on Reported Posterior Inflation Expectations (Wave 2 and 3) by whether second and third wave information treatment is repeated or mixed. Participants who are treated only once (because they dropped out of the panel or were recruited in wave 2 only) are omitted from the analysis.

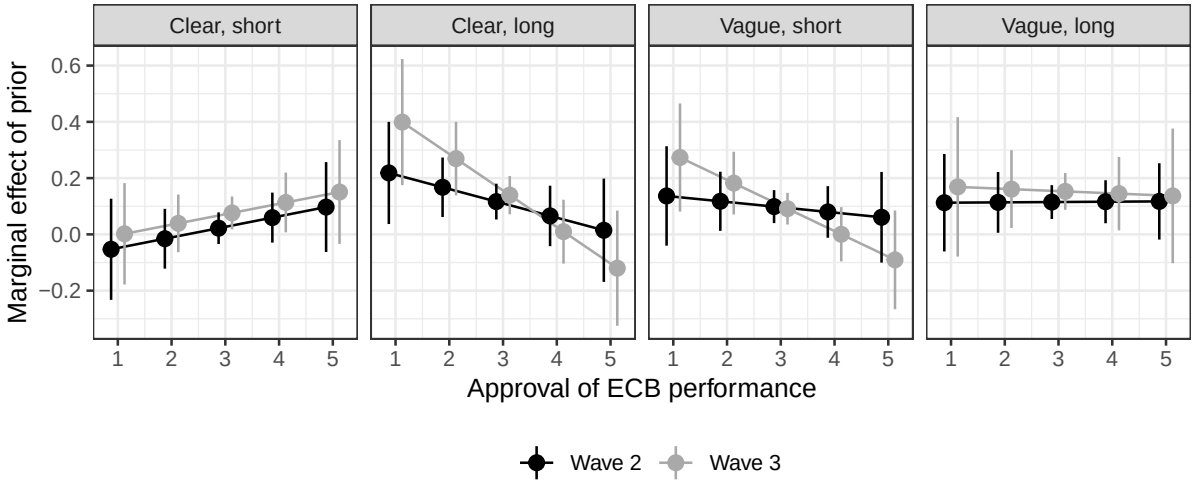

Figure B.4: Marginal Effect of Priors on Posterior Inflation Expectation by Approval of ECB performance, second wave information treatment, and waves.

	Wave 1
Clear information	-0.615^{***}
	(0.047)
Indicator for posterior	0.084
	(0.092)
Clear information x Indicator for posterior	-0.155^{**}
	(0.070)
Constant	3.263^{***}
	(0.065)
R^2	0.019
Adj. R^2	0.019
Num. obs.	6928
RMSE	2.501
N Clusters	3464

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table B.1: OLS Regression of Inflation Expectation on an Indicator of Clear Information Treatment, an Indicator of whether the Inflation Expectation is a Prior or Posterior, and the Interaction of the Two Variables.

	Wave 2	Wave 3	Wave 2	Wave 3	Wave 2	Wave 3
Clear, long information	−0.078	0.031	−0.366**	−0.209	0.041	−0.506
	(0.094)	(0.094)	(0.157)	(0.157)	(0.629)	(0.674)
Vague, short information	0.050	−0.032	−0.123	−0.090	0.588	0.229
	(0.095)	(0.091)	(0.163)	(0.153)	(0.647)	(0.642)
Vague, long information	0.030	−0.023	−0.251	−0.322**	0.221	0.233
	(0.098)	(0.093)	(0.167)	(0.150)	(0.685)	(0.671)
Prior			0.046	0.087***	0.013	0.072**
			(0.028)	(0.028)	(0.030)	(0.029)
Clear, long information x prior			0.105**	0.072	0.105**	0.062
			(0.044)	(0.044)	(0.044)	(0.044)
Vague, short information x prior			0.058	0.019	0.085**	0.016
			(0.041)	(0.041)	(0.042)	(0.041)
Vague, long information x prior			0.092**	0.089**	0.099**	0.079*
			(0.041)	(0.042)	(0.042)	(0.044)
Business news consumption					−0.102*	−0.074
					(0.054)	(0.053)
News consumption					−0.024	0.008
					(0.074)	(0.077)
Positive evaluation of ECB					0.334***	0.199*
					(0.101)	(0.102)
Clear, long information x Business news consumption					−0.019	−0.101
					(0.076)	(0.076)
Vague, short information x Business news consumption					0.072	−0.034
					(0.074)	(0.078)
Vague, long information x Business news consumption					−0.006	0.019
					(0.075)	(0.072)
Clear, long information x News consumption					0.009	0.105
					(0.109)	(0.110)
Vague, short information x News consumption					−0.078	−0.048
					(0.104)	(0.111)
Vague, long information x News consumption					−0.048	−0.150
					(0.111)	(0.104)
Clear, long information x Positive evaluation of ECB					−0.122	0.072
					(0.143)	(0.142)
Vague, short information x Positive evaluation of ECB					−0.234*	0.045
					(0.137)	(0.132)
Vague, long information x Positive evaluation of ECB					−0.065	0.093
					(0.141)	(0.154)
Constant	2.237***	2.037***	2.048***	1.712***	1.807***	1.491***
	(0.069)	(0.065)	(0.117)	(0.104)	(0.445)	(0.471)
R^2	0.001	0.000	0.031	0.048	0.056	0.079
Adj. R^2	−0.000	−0.001	0.029	0.046	0.049	0.071
Num. obs.	2967	2629	2660	2397	2645	2386
RMSE	1.816	1.690	1.768	1.619	1.741	1.596

$^{***}p < 0.01$; $^{**}p < 0.05$; $^{*}p < 0.1$

Table B.2: OLS Regression of Posterior Inflation Expectation in 2 and 3 on Second Information Treatment Indicator, Prior Inflation Expectation, Covariates, and Their Interactions.

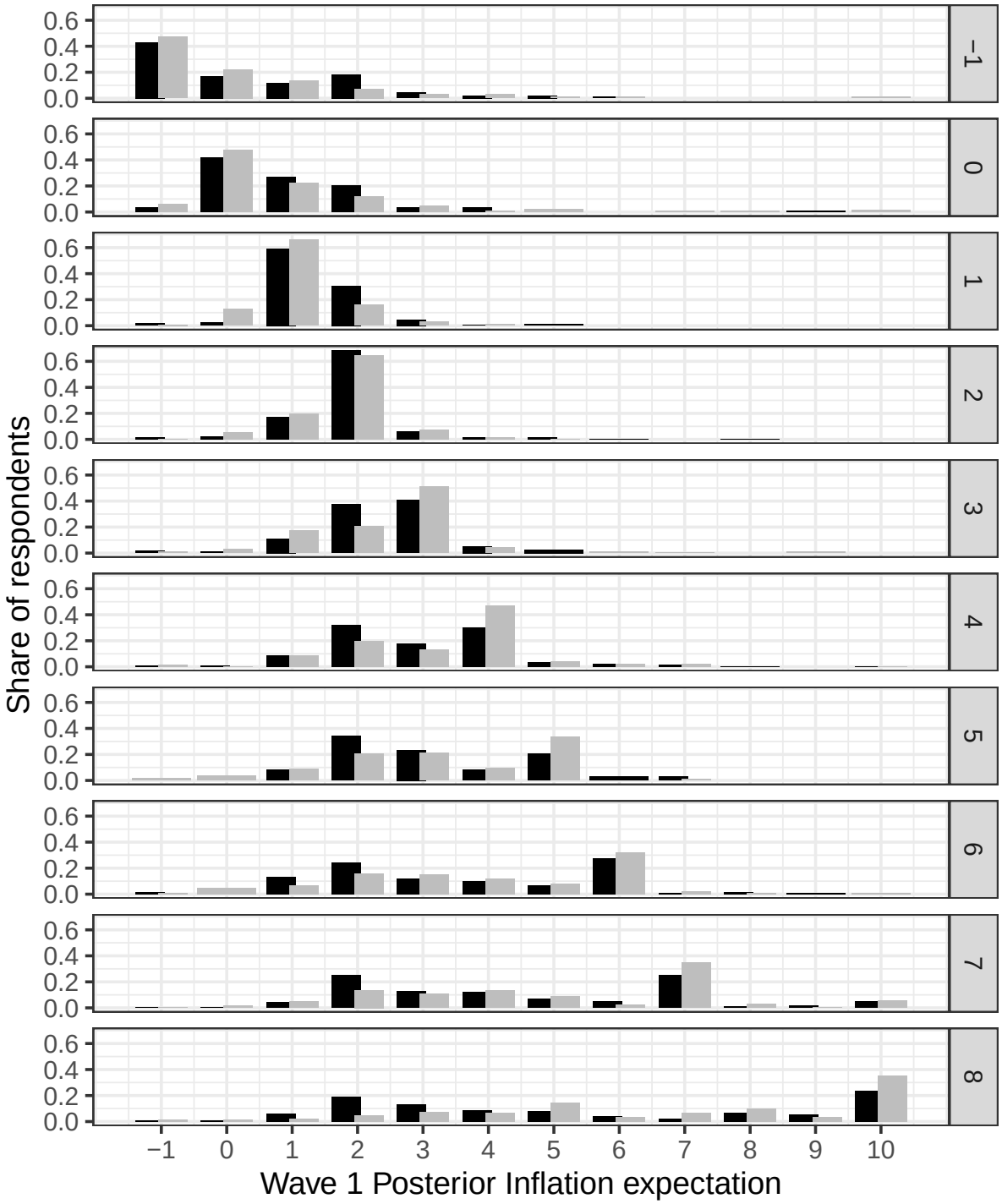

Figure B.5: Distribution of Respondents' Reported Wave 1 Posterior Inflation Expectations by First Information Treatment

B.2 Information effects by ECB approval

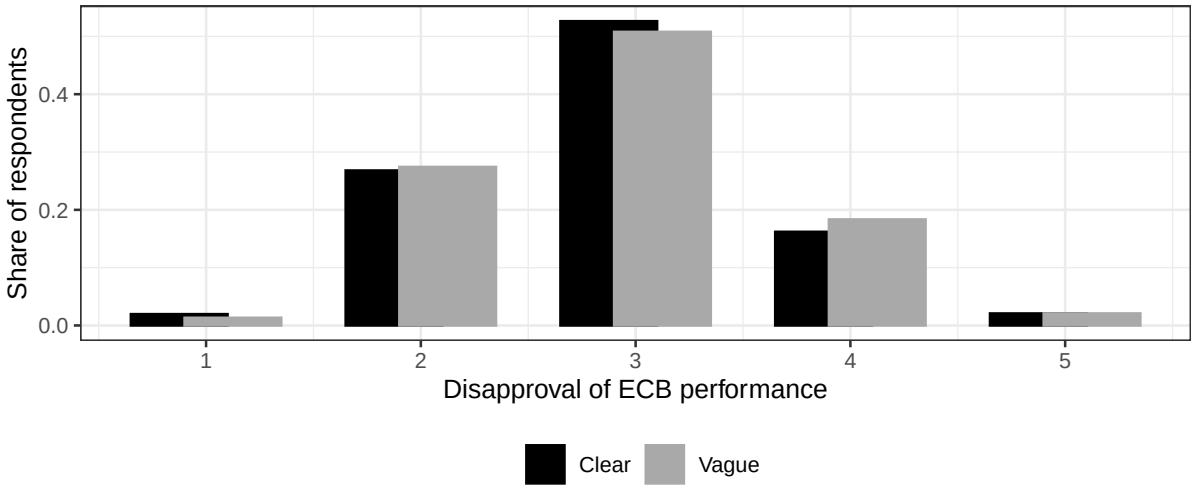

Figure B.6: Distribution of Respondents' Approval with the Performance of the ECB by First Wave Information Treatment.

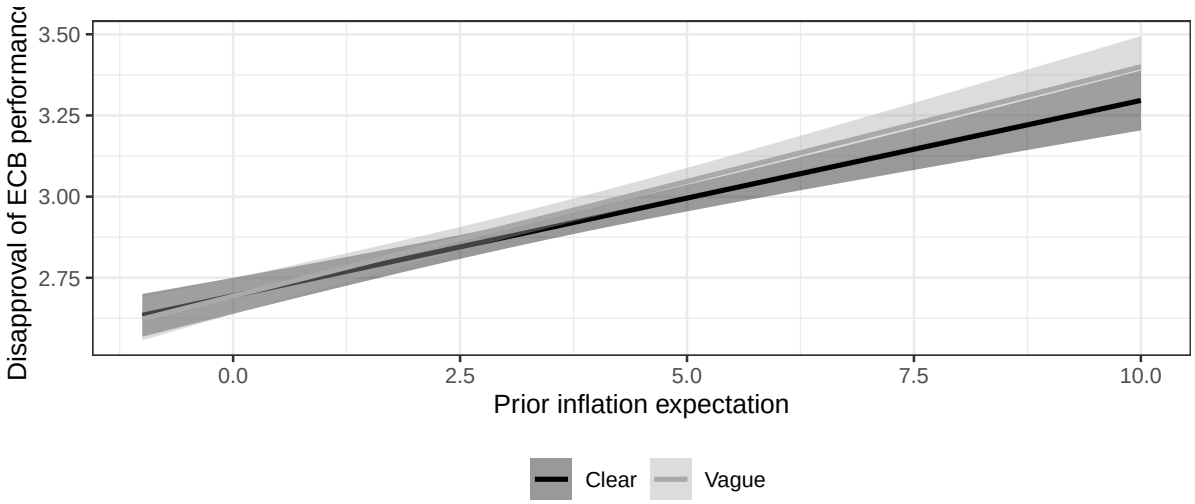

Figure B.7: Relationship of Respondents' Approval with the Performance of the ECB an their Prior Inflation Expectation by First Wave Information Treatment.

B.3 Information effects by occupation status

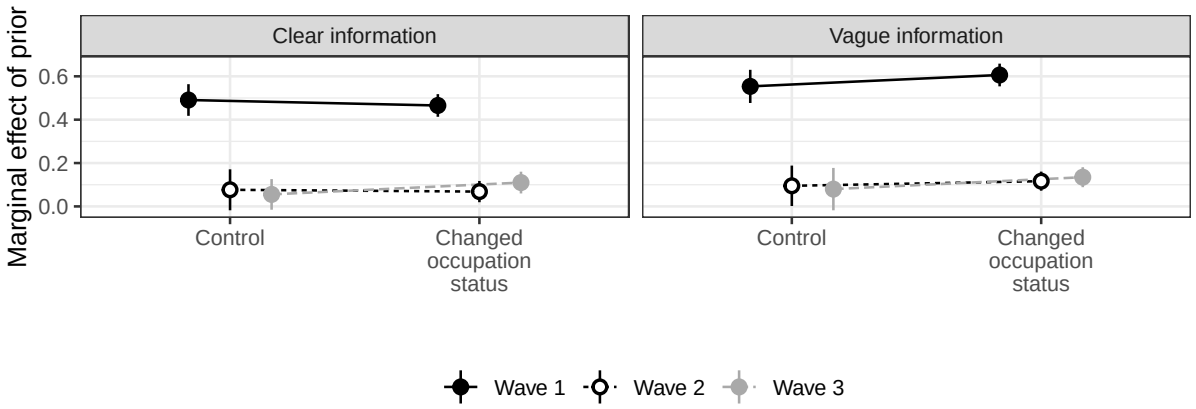

Figure B.8: Marginal Effect of Priors on Posterior Inflation Expectation by Change in Occupation Status, First Wave Information Treatment, and Waves.

B.4 Information effects by region and gender

Living in East Germany in contrast to West Germany is associated with higher inflation expectations. Specifically, the prior inflation expectation is by 0.367 ($t = 3.07$, $p < 0.01$) higher in East than West Germany. The numbers for poster inflation expectation are 0.349 ($t = 3.48$, $p < 0.01$) in wave 1, 0.148 ($t = 1.66$, $p < 0.1$) in wave 2, and 0.432 ($t = 4.62$, $p < 0.01$) in wave 3. Similarly, the prior inflation expectation is by 0.621 ($t = 6.76$, $p < 0.01$) higher for women than for men. The numbers for poster inflation expectation are 0.328 ($t = 4.28$, $p < 0.01$) in wave 1, 0.326 ($t = 4.89$, $p < 0.01$) in wave 2, and 0.391 ($t = 6.08$, $p < 0.01$) in wave 3. We also observe that the treatment effects characterized in the main text are similar by region and gender (see Figures B.9-B.12).

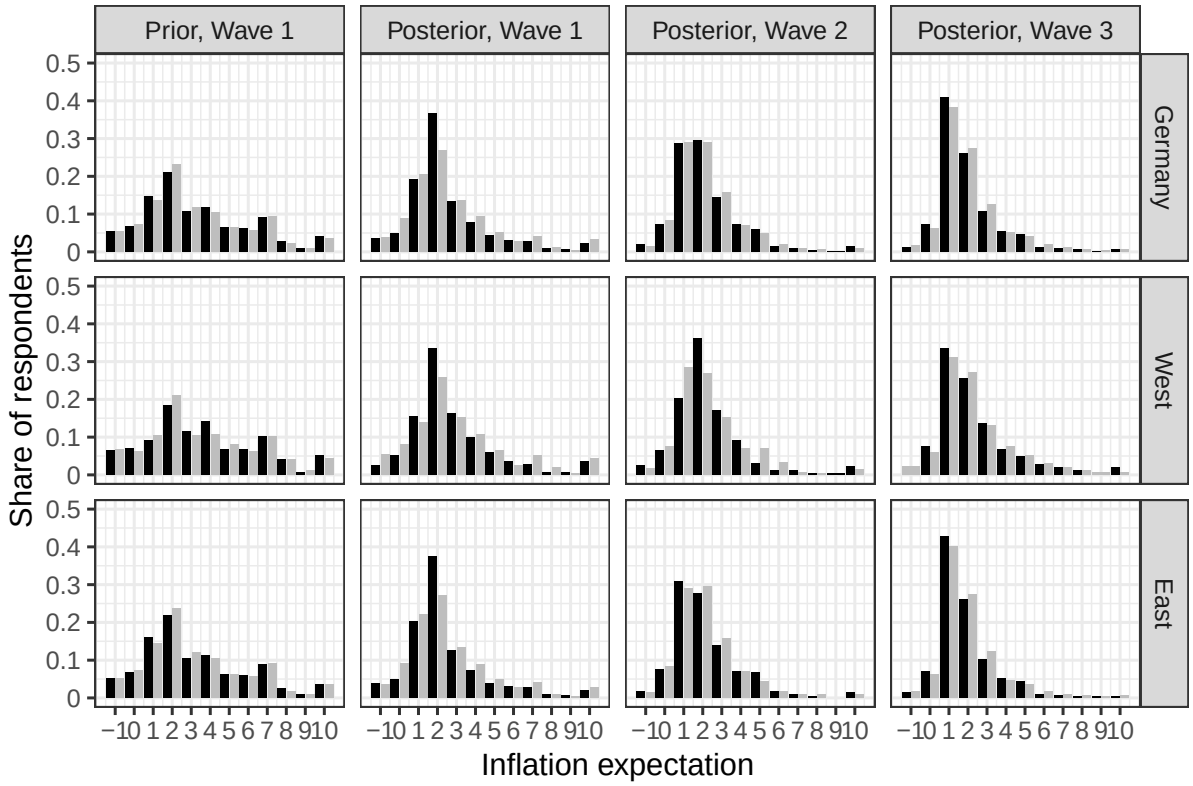

Figure B.9: Distribution of Respondents' Reported Prior and Posterior Inflation Expectations by First Information Treatment, Waves, and whether they currently reside in East or West Germany

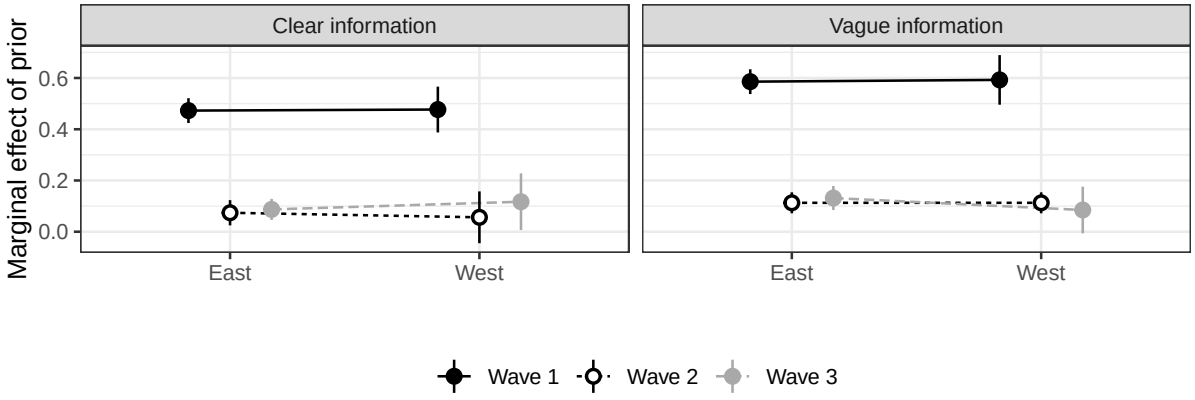

Figure B.10: Marginal Effect of Priors on Posterior Inflation Expectation by First Wave Information Treatment, Waves, and whether they currently reside in East or West Germany.

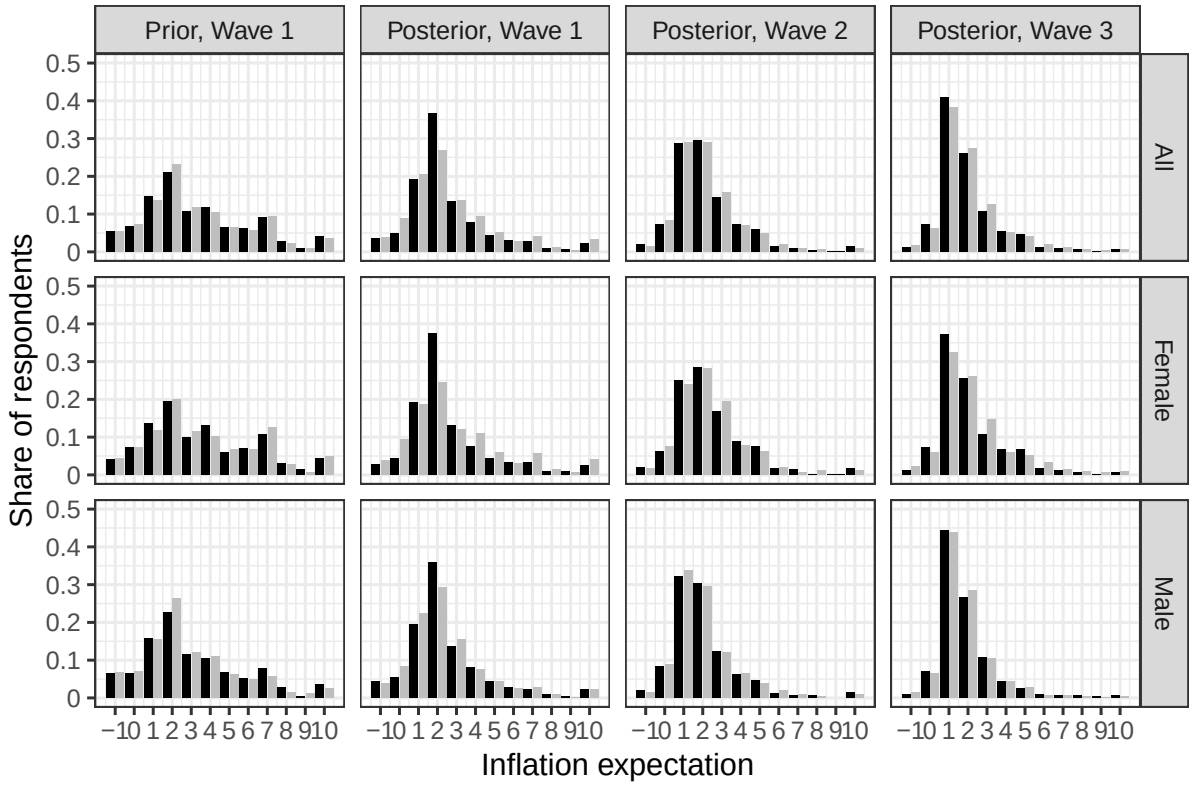

Figure B.11: Distribution of Respondents' Reported Prior and Posterior Inflation Expectations by First Information Treatment, Waves, and Gender.

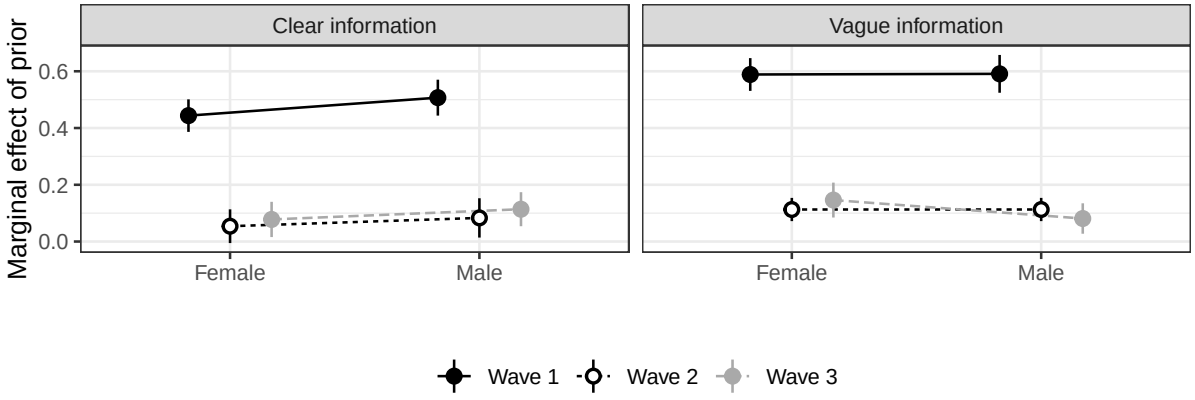

Figure B.12: Marginal Effect of Priors on Posterior Inflation Expectation by First Wave Information Treatment, Waves, and Gender.