

CENTRAL BANK COMMUNICATION WITH NON-EXPERTS: RESULTS FROM AN EXPERIMENT*

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Abstract

This study examines the impact of direct central bank communication, akin to ECB press conferences, on monetary literacy and expectations among non-experts. Using randomized controlled trials (RCT) involving [3,373] visitors to the ECB Visitor Centre, we explore whether central banks can influence non-experts through direct communication and whether citizens' monetary literacy or trust play a role in this respect. Our findings indicate that direct central bank communication significantly increases non-experts' monetary literacy scores. It also improves policy effectiveness in aligning non-experts' medium-term inflation expectations with the ECB's inflation target, facilitated by an enhanced understanding of the objective or increased trust in the ECB's monetary policy. Tests with German speakers suggest that communication in the native language can strengthen the effects on anchoring of private inflation expectations. By shedding light on the effectiveness of communication strategies with diverse audiences, this research provides valuable insights for central banks aiming to optimize their outreach activities with the public.

JEL codes: C83, C93, D83, E52, E58.

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1. Introduction

Clear and transparent communication is essential for central banks to guide public expectations about future inflation (Blinder, 2004; Issing, 2005; Yellen, 2012). Traditional communication strategies often assume a uniform level of understanding among the public, overlooking individuals' diverse financial and monetary literacy levels and educational backgrounds. However, a heterogeneous audience may require a different approach to central bank communication. Consumer surveys have documented that households' financial literacy and their inflation perceptions and expectations are heterogeneous, making the monetary policy transmission to the real economy uneven.¹ Non-experts typically possess limited knowledge about monetary policy transmission and economic developments and generally pay less attention to economic news than firms or professional watchers. Their understanding of the central bank's approach to achieving price stability varies, depending on individual literacy, trust in the central bank, and demographic factors.

Central bank communication directly reaches only a small fraction of households, as most citizens rely on indirect communication through the media (see Figure 1) for monetary policy information (d'Acunto et al., 2024). Extreme circumstances can amplify the impact of direct communication, as evidenced by former ECB President Mario Draghi's "*whatever it takes*" speech in the summer of 2012, which had a profound effect on public expectations (Ehrmann and Wabitsch, 2022). Despite broad agreement on the critical role of clear communication in maintaining trust and guiding private inflation expectations, a knowledge gap exists on how households form their expectations about inflation and how they process economic and financial news. Evidence on the causal impact of central bank communication strategies on non-expert audiences with varying literacy levels is scant. Some studies suggest that targeted central bank communication can significantly influence households' inflation expectations (Coibion et al., 2022; Dalloul et al., 2023; Ehrmann et al., 2023; Mochhoury, 2023). Conversely, other studies indicate that when households understand how policy decisions affect their finances, they are more likely to align their expectations with the central bank's goals (Burke and Manz, 2014; van der Cruijsen et al., 2015; Rumler and Valderrama, 2020).

***** Insert Figure 1 here *****

This experimental study aims to explore whether central banks can influence non-experts' literacy and expectations through direct communication. Randomized controlled trials (RCT) involving many participants can be helpful because they provide insights into how individuals select and process information when making economic decisions and forming expectations. Our RCT with non-experts aims to address this knowledge gap in two ways: (1) by examining whether central bank communication influences non-experts' knowledge about monetary policy and (2) by exploring whether communication

¹ In the euro area, heterogeneity may also reflect diverse individual experiences by country and before the monetary union.

contributes to anchoring non-experts' expectations about inflation and economic growth. We investigate whether direct communication, akin to press conferences, is influential and whether citizens' diverse knowledge about monetary policy matters in this respect. Our central hypothesis is that effective communication enhances monetary literacy, which helps stabilize private inflation expectations around the ECB's 2% inflation target over the medium term.

This study reports on the first RCT experiment with ECB visitors. As part of its external activities, the ECB provides on-site expert lectures on "*specific topics [which] are aimed at groups with a good understanding of the ECB's mandate*".² These sessions are ideal for experimenting with non-experts. ECB visitors reportedly are financially literate and had some prior exposure to monetary policy issues beforehand, allowing them to understand the implications of economic news for inflation and economic growth. The diverse levels of their prior knowledge, learning skills, and personal demographics enabled us to explore the extent to which communication influences monetary literacy and non-experts' expectations and identify the main drivers of heterogeneity.

The experiment included [87] sessions with a total of [3,373] individuals visiting the ECB premises between December 2022 and [October 2024]. Each interactive session, lasting around 90 minutes, involved ECB visitors briefing participants on recent ECB monetary policy decisions. Participants were randomly assigned by session to receive either no treatment, placebo treatment, or treatment in the form of relevant information about the ECB's monetary policy. The placebo treatment comprised a briefing on other topics such as the euro, climate change, or banking supervision, which did not improve their knowledge about the ECB's monetary policy and recent decisions.³ Monetary literacy surveys (see Online Appendix B) collected information about participants' socio-demographic characteristics, prior knowledge, and perceptions on euro area inflation and growth. Our outcome variables included visitors' monetary literacy scores and their (medium-term) expectations for inflation and economic growth in the euro area. We concentrated on medium-term expectations since these are the targets central bank communication aims to anchor (Williams, 2022).

By exploring the effectiveness of communication strategies with diverse audiences, this research provides valuable insights for central banks aiming to enhance their public outreach. Compared to previous studies, we make several significant contributions. First, our study examines the causal effects of ECB communication on private expectations across different monetary literacy levels. We developed a monetary literacy survey for the euro area that extends the concept of financial literacy and provides insights into monetary policy knowledge. Our findings robustly suggest that direct communication, akin

² For details see <https://www.ecb.europa.eu/ecb/visits/html/index.en.html#onsiteexp>. Visitor sessions are free but travel costs are not reimbursed. Note that the ECB Visitor Centre also offers other events to less experienced groups that were not exploited in this experiment (virtual presentations, virtual expert lectures, a guided tour of its premises, and virtual tours).

³ Participants were unaware that they received placebo treatments. Placebo treatment allowed us to disentangle genuine learning from anchoring effects and spurious learning, which could arise if visitors had paid special attention to ECB monetary policy messages before their visit.

to ECB press conferences, significantly increases the monetary literacy scores of non-experts.

Second, we challenge the growing literature that doubts the influence of central bank communication on households' inflation expectations (e.g., Carroll, 2003; Lamla and Vinogradov, 2019; De Fiore et al., 2021). This skepticism is based on the premise that households' attention to economic and financial news is generally low and more related to media news (Sims, 2003; Maćkowiak et al., 2023; Eusepi and Preston, 2010; Lusardi and Mitchell, 2014; Lamla and Lein, 2014; Conrad et al., 2022; Coibion et al., 2020).⁴ In our experiment, we demonstrate that direct communication increases the effectiveness of aligning medium-term inflation expectations with the ECB's inflation target, reflecting participants' enhanced understanding of the mandate or trust in the ECB's monetary policy.

Third, the results of this study add to the growing empirical evidence supporting the notion that targeted central bank communication is more influential on private expectations. This study demonstrates that direct communication, akin to ECB press conferences, not only contributes to anchoring non-experts' medium-term inflation expectations, but that communication in the native language can further improve its effectiveness.

This paper is structured as follows. Section 2 provides a brief summary on central bank communication with the general public. Section 3 introduces a new monetary literacy survey, and Section 4 outlines the experimental design. Section 5 reports results from the monetary literacy survey, and Section 6 discusses the findings on the impact of communication on monetary literacy and private expectations. Section 7 concludes.

2. Central Bank Communication with Citizens: A Literature Survey

This literature review examines central bank communication with the general public, particularly focusing on household expectations and insights from experimental studies. Prior research (Gürkaynak et al., 2005; Blinder et al., 2008 and 2024; Hayo et al., 2022) demonstrated that central bank communication on decision-making days significantly influences private expectations, primarily applied for professional forecasters or firms. Unlike financial markets, which efficiently incorporate monetary policy signals, households often fail to do so. This gap, attributable to factors such as rational inattention (Sims, 2003; Maćkowiak et al., 2023), lack of trust, and limited knowledge about monetary policy among citizens, poses a significant challenge for the effective transmission of monetary policy.

There is a growing consensus that households' information processing differs from that of professionals. Households' inflation expectations are specifically influenced by their perceptions of inflation, whereas professionals look into the broader economic picture and assess varying risks and uncertainties (Adam, 2007; Georgarakos et al., 2023). Some studies have shown that the formation of households' inflation expectations may be strongly influenced by other factors such as lifetime

⁴ However, recent event studies find that individuals incorporate monetary news when forming their inflation expectations (Lewis et al., 2020; Jung and Kühl, 2022).

experience (Malmendier and Nagel, 2011 and 2016), gasoline prices (Binder, 2018), and observed price-setting during everyday shopping experiences (D’Acunto et al., 2021; Huber et al., 2023). Burke and Manz (2014) find that monetary literacy, independently of financial literacy, exerts an influence on the public’s ability to forecast inflation. When individuals process news on monetary policy to forecast future interest rates, their higher level of literacy may help them to select more relevant information and make better use of it, aligning closer with the medium-term projections of the central bank.

The way central banks communicate about their inflation target and inflation projections is crucial for effectively managing private expectations. A lack of understanding of the central bank’s inflation target can unanchor the public's expectations (Binder, 2017). Moreover, the central bank’s inflation target must be credible to effectively anchor inflation expectations, as expectations are formed through perpetual learning (Hofmann et al., 2021). A study by Cobion et al. (2022) finds that direct communication using simple messages about the level of inflation and the central bank’s inflation target influenced households’ inflation expectations, while indirect communication through the media was less effective in this respect. The study by Rholes and Petersen (2021) suggests that the effectiveness of managing inflation expectations decreases, if the central bank communicates inflation uncertainty through density forecasts rather than through precise point forecasts. A recent survey experiment by McCowage and Rickards (2024) with Australian households showed that the public’s knowledge of the Reserve Bank’s inflation target played a pivotal role in the formation of their inflation expectations. The study suggests that individuals with more precise knowledge about the inflation target question tend to have more anchored inflation expectations.

Central bank communication may not effectively inform substantial segments of the population, if there is heterogeneity in the ability to process economic and financial news. Financial literacy, i.e. an individual’s ability to “*process economic information and make informed decisions about household finances*” (Lusardi and Mitchell, 2014) of households is typically found to be low (Batsaikhan and Demertzis, 2018; OECD, 2020; European Commission, 2023) and varies across demographics. Lower levels of financial literacy is observed among women, older individuals, and those with lower income and education (Klapper et al., 2014; Bruine de Bruin et al., 2010; Di Nino et al., 2022; d’Acunto et al., 2024; McCowage and Rickards, 2024).⁵ For this reason, a growing number of studies suggests that more investment in financial education is needed to improve the financial knowledge of citizens (Lusardi and Mitchell, 2014; Kaiser and Menkhoff, 2017; Sutter et al., 2023).

A key takeaway from earlier experiments is that central bank communications based on simple messages can be more effective for managing private expectations (Blinder et al., 2024; Haldane and

⁵ The literature distinguishes between financial literacy (the numeracy of the non-experts) and monetary literacy (the public’s understanding of central bank actions and inflation dynamics). According to the OECD International Network on Financial Education (OECD/INFE), financial literacy is a combination of several factors necessary “*to make sound financial decisions and ultimately achieve individual financial well-being*” (OECD, 2022, p. 6). It is a broader concept that captures an individual’s understanding of the “*broader economic context and thereby the situation of others*” (McCowage and Dwyer, 2022).

McMahon, 2018; Kryvtsov and Petersen, 2021). Understanding central bank messages on monetary policy often requires years of financial education (Coenen et al., 2017; De Haan and Hoogduin, 2024), while households' literacy levels vary widely. Enhancing knowledge about monetary policy can help households to accurately interpret and respond to direct central bank communication.

Less complex messages also have the benefit that they increase citizen's trust in the central bank (Haldane, 2021). Survey experiments exposing participants to new information about the central bank's monetary policy showed that this form of communication improved monetary literacy and raised trust in the central bank (Haldane and MacMahon, 2018; Bholat et al. (2019); Dräger and Nghiem, 2023). However, as shown by Eickmeier and Petersen (2024), other factors may influence citizens' trust in the central bank, notably their personal values and trust in political institutions more generally.

However, the complexity of explaining monetary policy to the public has increased in an environment of larger than ever economic and political uncertainties. Central banks are addressing the challenge of explaining the interplay of standard and non-standard monetary policy measures by refining their communication strategies (Masciandaro et al., 2023). For example, the ECB simplified the language used in its monetary policy statements and clarified its inflation target following the strategy review in 2021 (Blinder et al., 2024; Gardt et al., 2021).

In summary, existing studies suggest that citizens' knowledge about monetary policy are key constraints for effective central bank communication strategies.

3. Assessment of Visitors' Monetary Literacy

This section introduces a new monetary literacy survey designed to compare the responses of treated individuals with those of the control group and to assess participants' prior knowledge about the ECB's monetary policy.

3.1 The Monetary Literacy Questionnaire

This study measures visitors' monetary literacy based on questions testing their knowledge about the ECB's monetary policy. Our survey closely relates to those of Burke and Manz (2014) and McCowage and Dwyer (2022), which measure the literacy of households in the United States and Australia, respectively. Unlike those studies, we did not test the numeracy of participants, as our experiment focused on individuals with high levels of financial literacy.

All ECB visitors were asked to complete a three-part questionnaire (see Online Appendix B for the questionnaire).⁶ In part one, we collected data on the personal demographics of visitors, including age, gender, education, and origin. Part two included questions requiring institutional knowledge about the ECB's mandate, monetary policy instruments, decision-making bodies, and their perceptions of inflation and growth, as well as the main driving forces behind euro area inflation. In part three, we

⁶ The English version of the questionnaire was translated into German and is available from Online Appendix B.

asked questions requiring quantitative knowledge about the ECB's mandate, monetary policy instruments, and decision-making bodies. Participants were also asked to provide their medium-term expectations about inflation and economic growth and to identify the main future driver of euro area inflation. They were asked to mark the single answer they deemed correct, choosing from six to nine answer choices depending on the question.

3.2 Computation of Monetary Literacy Scores

The dataset used in this study was collected via questionnaires from individual participants of [87] visitor group sessions, totaling [3,373] visitors. The literacy score is a quantitative measure derived from a scoring model that counts the correct answers for each respondent, allowing for comparisons across visitors.⁷ In line with OECD (2016), the scoring model assigns equal weights for each of the ten questions considered, ensuring that scores are not biased by the weighting scheme. Total literacy scores and subscores for institutional (or ex ante) and quantitative (or ex post) literacy have been normalized to a scale of 0 to 100 for ease of interpretation.⁸ The two questions on the main current and future drivers of inflation were excluded from the score because it turned out that more than one answer could be correct.

Measuring literacy from surveys is common practice in the field but may give rise to biases that need to be addressed in the survey design (Stantcheva, 2023). For example, we avoided asking the exact same question twice to respondents, thereby ensuring that revisions in their expectations owing to treatment could be accurately measured relative to the control group. Cronbach's alpha for the questionnaire, a standard measure of internal consistency based on the average intercorrelation of questions, is 0.70, which aligns with the widely used threshold of acceptable reliability.

In some sessions, participants did not respond the way they were randomly assigned to treatment, i.e., they returned the questionnaire at the beginning instead of at the end of the meeting and vice versa. This implied that some individuals who were allocated to the experimental group had received no treatment and vice versa. However, based on a timestamp that recorded the submission of the questionnaire for each participant, we were able to identify those individuals (about 50 participants) with wrong allocations. We corrected the treatment variable accordingly to address the potential bias.

Other potential issues relate to the guessing behavior of survey participants when they do not know the answer to a question. Since we did not penalize for a wrong answer, the literacy scores slightly overstate their knowledge, though this point similarly applies to treated and non-treated groups. Moreover, survey demand effects could be present if participants infer the purpose of an experiment

⁷ In the literature, scoring models have been successfully applied to create consumer credit ratings and assess financial literacy (OECD, 2022).

⁸ The institutional literacy score counts the correct answers to five questions in Section II (excluding the drivers of current inflation). The quantitative literacy score counts the correct responses to five questions in section III (excluding the drivers of future inflation). For details on the computation see Online Appendix C2.

and respond to help confirm a researcher’s hypothesis (Mummolo and Peterson, 2019). However, in our experiment, participants had no prior information about the experiment, and there was competition among them to perform well in the survey.

We also checked for the presence of a non-response bias, which could bias the results from the experiment if the demographics or opinions of abstainers are systematically different from those who participate (attrition). The average response rate was 64.6%, and per session, the range varied between 24% and 96% (see Table A6 in the Online Appendix A). Although, in principle, at these relatively high rates, a non-response bias could still be present, we do not see it as a major issue in our RCT, given that abstaining from the survey was in many cases due to the absence of a mobile phone, which was needed to fill out the questionnaire. Moreover, our experiment's response rates are similar to those reported for well-established household surveys. For comparison, the CES household survey for the euro area documents a slightly higher rate for selected participants of 66.7% (see Bańkowska et al., 2021).

4. Experimental Design

This section outlines the design of the RCT experiment and the methods used to estimate average treatment effects. Through the RCT, we examine the influence of direct central bank communication on the monetary literacy and the inflation (and growth) expectations of non-experts, considering their varying pre-existing knowledge about monetary policy.

4.1 The RCT Experiment

As part of its outreach activities, the ECB offers on-site expert lectures to visitor groups (with a minimum group size of 15 persons), which interested parties with some prior knowledge about monetary policy can sign up for. These lectures cover specific topics in more detail, namely on monetary policy, institutional framework (“*role and tasks of the ECB*”), banking supervision, climate change, and the (digital) euro. Visitor groups choose the topics of their training session from those principal options and the ECB visitor centre selects and invites eligible groups. Groups are randomly assigned to ECB speakers based on their chosen topics and the availability of the speaker.

This RCT experiment uses those ECB’s in-person briefing sessions with visitors at the ECB premises in Frankfurt, Germany, conducted in either English or German (see Table A6).⁹ Between December 2022 and [October 2024], we conducted [87] experimental sessions with [3,373] visitors and [2,157] respondents. Most participants were high-school students or university students from international universities majoring in business or economics from the euro area.¹⁰ As shown in Table

⁹ One initial session was held at the Goethe University of Frankfurt.

¹⁰ These sessions are free but travel costs are not reimbursed. Note that, the ECB Visitor Centre also offers a guided tour of its premises to less experienced groups (mostly school groups), which we are not using for the experiment. However, it is noteworthy in terms of self-selection that requests from visitor groups allow to sign up for both kinds of sections, and this has implied that groups with more knowledge and an interest in discussing monetary policy issues signed up for the on-site expert lectures.

A6 of the Online Appendix A, visitor groups ranged from medium-sized to large-scale, with sizes between 20 and 100 people.

We use a monetary literacy survey to compare the responses of the treated individuals with those of the control group and to assess participants' prior knowledge about monetary policy. The answers to the literacy questionnaire were collected via a mobile phone app, which allowed us to record the exact submission time for each participant.¹¹ Participants received oral instructions on how to use the app and when to fill out which part of the questionnaire. It took participants normally less than five minutes to respond, and the information was kept confidential to protect their data.

In each session, participants were assessed on their monetary literacy and asked about their perceptions and (medium-term) expectations regarding euro area inflation and economic growth. Additionally, demographic information was collected for each participant. Unlike studies using online surveys, the physical presence of participants and the time constraints for completing the questionnaire ensured that the scores reflected individual knowledge, minimizing the likelihood of participants searching for correct answers in the internet.

The information treatment consisted of an intense briefing on the ECB's monetary policy decisions and the institutional framework. This was delivered through an intensive 90-minute lecture by a senior monetary policy expert from the ECB, featuring interactive elements akin to the Q&A session at press conferences.¹² Participants were encouraged to ask questions on monetary policy topics during the session.

Our key outcome variables are participants' monetary literacy scores and their medium-term inflation and economic growth expectations. A treatment effect should manifest in differences regarding outcome variables between the experimental and control groups, and there should be no significant differences between placebo and control groups. Since it is conceivable that individuals attending visitor sessions are incentivized to pay more attention to economic and financial news ahead of the meetings, potentially biasing the results, some sessions with an identical format covering topics unrelated to monetary policy were used for placebo treatment. These briefing sessions had similar format but different contents, notably banking supervision, climate change, and the (digital) euro. Hence, no information on recent monetary policy decisions and the ECB's institutional framework was provided.

Each session proceeded as follows. At the start of a session, individuals were informed that they were participating in an experiment and were asked to complete a monetary literacy questionnaire. Participation was voluntary, and no rewards were given. Allocation to the treatment, placebo treatment

¹¹ In the first two rounds, we collected the responses in the form of printed questionnaires.

¹² The monetary policy lectures covered the ECB's assessment of the current economic situation, future outlook (including staff projections), risk assessment, the mandate and institutional setting of the ECB (including the price stability objective, central bank independence, prohibition of monetary financing and voting at the Governing Council), the ECB's monetary policy strategy, the outcome of the ECB's 2020/21 strategy review, the monetary policy tools including conventional and non-conventional monetary policy instruments, channels of monetary policy transmission (for details on the presentations see Online Appendix C.1).

and control groups was randomized by session rather than individually, facilitating the survey process while keeping the group engaged and active in the discussion (see Figure 2). Participants were unaware of whether they belonged to the experimental group or the control group.

***** Insert Figure 2 here *****

The control group answered all questions from the literacy questionnaire (parts I – III) before receiving any additional information during a briefing session by the ECB expert. The experimental group responded to questions about their demographics, institutional literacy, and perceptions about euro area inflation and growth at the start of the session (parts I and II of the questionnaire). After the briefing from the ECB expert, they answered the questions on quantitative literacy and medium-term euro area inflation (growth) expectations (part III).

Overall, the treatment was homogeneous in terms of the length, the structure, and the main communication messages of the monetary policy sessions with ECB experts (see the description in the Online Appendix C3). However, different presenters and group dynamics in the Q&A parts of the sessions and shifts in the session language between English and German may explain group-related effects beyond what can be attributed to differences in prior knowledge. In the econometric analysis of treatment effects, we therefore assess the impact of communicating in English relative to the German language, a main aspect of heterogeneity across sessions. Additionally, because the experimental sessions were conducted at various points from 2022 to 2024, there were variations in terms of policy rate levels and the economic situation in the euro area. Since we collect information about participants' prior inflation and growth perceptions, we report results controlling for these variables, thereby taking into account differences in the inflation and economic growth outlook throughout the experimental sessions.

4.2 Econometric Analysis of Treatment Effects

We analyze average treatment effects to gauge the impact of ECB monetary policy communication on visitors' monetary literacy and their inflation and growth expectations. To measure the effect of treatment on the dependent variable, we focus on the difference in outcomes with and without treatment. There are two population parameters of primary interest (Wooldridge, 2010): the average treatment effect (ATE) and the average treatment effect on the treated (ATET), defined as follows:

$$\text{ATE} = E(y_1 - y_0) \tag{1}$$

$$\text{ATET} = E(y_1 - y_0 \mid w=1) \tag{2}$$

where w is the treatment indicator, a binary variable that equals 1 if the individual is treated.¹³ ATE

¹³ Imbens and Angrist (1994) define another measure of the treatment effect, namely the local average treatment effect (LATE). LATE can be estimated using instrumental variables under very weak conditions. However, this would be needed if the randomized treatment would not guarantee that a difference-in-means estimator from basic

represents the mean effect for a randomly drawn person from a population, defined as the difference between the outcome for an individual if they are treated (y_1) and the outcome for the same individual if they are not treated (y_0). While ATE captures the mean effect for all participants in the experiment, ATET reports the mean effect for those who were treated, excluding the non-treated from the measurement. When estimating treatment effects, we control for various factors.

Under two standard assumptions in program evaluation literature, namely “*unconfoundedness*” and “*ignorability*”, no (unobserved) characteristics of the individual are associated with both the potential outcomes and the treatment beyond the observed covariates (Imbens and Wooldridge, 2009).¹⁴ These assumptions are satisfied since individuals were randomly assigned to treatment in our experiments (i.e., the selection was exogenous to visitors), and covariates for demographics and prior knowledge have been included.¹⁵

To estimate treatment effects, we regress an outcome variable for each visitor (y_i) on an indicator variable for their treatment, include individual-specific controls (demographics and prior knowledge or of respondents), and compute the average effect for all three groups based on:¹⁶

$$y_i = \alpha + \sum_{j=0}^1 \beta_j \times Treat_{ij} + \sum_{j=0}^1 \gamma_j \times X_{ij} + \varepsilon_{ij} \quad (3)$$

where j denotes the different sessions since the experiment is for visitor groups, $Treat_{ij}$ are indicator variables indicating which treatment was received by respondent i (equal to zero for the control group, one for the treated group and two for the placebo group), X_{ij} is a vector of individual-specific controls including demographics (gender, age, education, origin), inflation and growth perceptions, and prior knowledge, as obtained from the survey, and ε_i is an error term.

In these regressions, the dependent variables are visitors' literacy scores, and the number of correct answers concerning medium-term inflation or growth expectations for the euro area. The coefficient of interest is β , which measures ATE (or ATET). We estimate treatment effects by applying regression adjustment, which offers the advantage of a fully interacted parametric model, while applying generalized methods of moments estimation.¹⁷ To address a potential bias due to pre-treatment differences among visitors from different sessions, we apply matching methods and estimate (3) using propensity score-matching (Rosenbaum and Rubin, 1983; Imbens, 2004).

statistics is unbiased, consistent, and asymptotically normal. In our experiment, the administration of the visitor centre randomly chooses whether a group that attends a monetary policy session will be an experimental or a control group.

¹⁴ Under ignorability it is possible to apply approaches to matching such as propensity scores, while in the absence of ignorability, we would have to resort to instrumental variable approaches.

¹⁵ Note also that the design of the experiment is such that the stable unit treatment assumption (SUTVA) holds meaning that treatment of one individual only affects the outcome variable of that individual.

¹⁶ Specifically, we use the STATA command “*teffects RA*” to estimate average treatment effects.

¹⁷ Other studies have also used robust regressions using the Huber estimator. That approach should provide identical results when estimating ATE (or ATET) if account is taken for treatment heterogeneity. As shown in Table A2 in the Online Appendix A, the results for ATE using that approach are similar.

5. Results from the Monetary Literacy Survey

This section provides evidence about the performance of the visitors in the monetary literacy surveys and compares them with the CES household survey, which represents the broader European public.¹⁸

5.1 Results on Visitors' Monetary Literacy and Demographics

Table 1 reports the descriptive statistics of ECB visitors who participated in our experiments. The majority of visitors came from the euro area (70.2% of total respondents) and was below 30 years old (78.3%). About half of the visitors had a university degree (50.4%) and 54.4% of them were male. Overall, our sample is well balanced across treated and untreated groups (Table 1, column 2 and 3). However, as confirmed by tests for the equality of means, a few imbalances occur, such as for origin and education. To address those imbalances, we include control variables in the regressions and apply matching techniques when estimating treatment effects.

The average monetary literacy score of 42.9% indicates that visitors answered four out of 10 questions correctly. Participants found it harder to answer questions requiring quantitative knowledge about the ECB's monetary policy compared to questions reproducing institutional facts. The average subscore for institutional literacy, measuring prior knowledge, was with 47.0%, higher than the quantitative literacy score (37.6%), which partly reflects treatment.

***** Insert Table 1 here *****

The empirical distribution of prior knowledge, which closely resembles a normal distribution, is similar for the treated and control groups (Figure 3a, LHS). As can be expected if the treatment is effective, the monetary literacy scores reflecting treatment show a clear improvement relative to the control group. This is evidenced by a rightward shift of the overall distribution (see Figure 3a, RHS).

Consistent with patterns observed in financial literacy surveys conducted by the OECD and the CES Household Survey (see Figure A2 in the Online Appendix), prior knowledge about monetary policy varies according to the respondents' demographic factors (Figure 3b). On average, men had higher scores than women and scores tended to increase with age.¹⁹ Visitors with a university education had higher scores than those with no university education (e.g., middle or high school diploma or professional qualification). Furthermore, visitors from the euro area generally had higher literacy scores than those from other regions.

***** Insert Figure 3 here *****

Table 2 illustrates the influence of personal demographics on monetary literacy scores based on

¹⁸ Note that in line with the official reporting by the ECB in real time, CES household survey data are based on six-euro area country aggregates until January 2024 (including Belgium, Germany, Spain, France, Italy, and the Netherlands) and thereafter on 11-euro area country aggregates (including the above six countries and, Ireland, Greece, Austria, Portugal and Finland).

¹⁹ There appears to be a discontinuity around the age of 19, above which literacy jumps upwards.

a panel regression analysis. To facilitate the economic interpretation of our main characteristics, we create binary dummy variables to represent the four individual visitor demographics (education, age, origin, and gender) in a binary format ([0,1]). The variable Higheredu is 1 for visitors with a university degree, Young is 1 for visitors below 30 years, Female is 1 for women, and Euroarea is 1 for visitors who stated that their currency is the euro. Using a Huber panel estimator to estimate robust regression coefficients that control for outliers (columns 1 to 3),²⁰ we confirm the results from the descriptive analysis. However, that analysis indicates that younger participants only have lower scores when it comes to prior knowledge and that differences disappear following the treatment.

In summary, the above results suggest that visitors who received treatment had higher literacy scores compared to those who received no treatment, while the main cross-sectional stylized facts concerning demographic heterogeneity known from financial literacy surveys regarding gender, age and education are also observed in our experiment, albeit this time for monetary literacy.

***** Insert Table 2 here *****

5.2 Results on Visitors' Monetary Literacy by Subject

Figure 4 illustrates selected answers from all visitors to the literacy questionnaire, showing the dispersion of their knowledge by subject. Regarding the ECB's mandate, a large majority of participants (78.2%) was aware that the ECB's primary objective is price stability and more than half (58.5%) knew that the ECB's symmetric inflation target is set at an annual rate of 2% (Figure 4a). Interestingly, around one-fifth of the respondents chose the 0 to 2% range underlying the ECB's definition of price stability that applied before the 2020/21 strategy review, during which the ECB adopted a symmetric, medium-term inflation target of 2%. This change, as noted by Ehrmann et al. (2023), was initially widely unnoticed by European citizens. However, this outstanding result was owing to the treatment, as more than 80% of the experimental group and only 45.7% of the control group participants knew the precise inflation target, indicating learning from the ECB expert presentations.

Many visitors demonstrated a good understanding of the ECB's conventional monetary policy tools (see Figure 4b). Only 6.3% mistakenly thought the interest rate was not a monetary instrument, while 25.7% correctly identified that the exchange rate is not part of the ECB's monetary policy toolkit. However, the survey revealed knowledge gaps concerning unconventional measures, despite the extensive media coverage of the ECB's large-scale asset purchases over the last decade. Around 45% of the respondents incorrectly believed that either the ECB's Asset Purchase Programme (APP) or the Pandemic Emergency Purchase Programme (PEPP) were not monetary policy instruments of the ECB.

Regarding decision-making, almost half of the visitors knew that the Governing Council is

²⁰ In comparison with panel OLS, this methodology is more efficient than panel OLS since potential outliers and influential observations are removed, which makes estimates less sensitive to extreme observations in the data and leads to significant improvements in the R^2 . The results for panel OLS are shown in Table A2 in the Online Appendix A.

responsible for monetary policy decisions in the euro area (Figure 4c). Only a minority of visitors (14.1%) wrongly indicated that the European Commission or the Heads of State would take monetary policy decisions.²¹ However, only few visitors (16.6%) knew that the Governing Council meets eight times a year to take monetary policy decisions.

We also asked visitors about the drivers of euro area inflation. Since euro area inflation is always driven by several factors whose influence varies over time, this question created unforeseen complexities. Therefore, we did not include the scores from the two questions about past and future inflation drivers in the monetary literacy score.

Overall, the results confirm the self-assessment of the visitors that they possess advanced knowledge about the ECB's monetary policy, amid substantial heterogeneity across groups and individuals.

***** Insert Figure 4 here *****

5.3 Results on Visitors' Perceptions and Expectations

The results show that participants systematically underestimated the actual policy rate (Figure 5, panel a). However, this observation is in part related to the tightening cycle of the ECB, which aimed to address the exceptional high inflation rates in 2023.

Participants' inflation perceptions and inflation expectations were in general more accurate than those of the CES (Figure 5, panels b and c). The mean respondent from our survey better anticipated current inflation and deviations of medium-term inflation expectations from the ECB's target were smaller than those of the average respondent in the ECB's CES household survey. However, for the median medium-term inflation expectations from the CES household survey was more accurate (see Figures A4a and A4b in the Online Appendix).

Additionally, respondents exhibited very optimistic medium-term growth expectations (see Figure A3a of the Online Appendix), while growth expectations of CES respondents better aligned with longer-run estimates of potential output growth in the euro area (see Figure A3b of the Online Appendix).

***** Insert Figure 5 here *****

6. Result from the RCT experiment

This section presents the results from the RCT experiment conducted with ECB visitors. The experiment examines whether direct communication influences monetary literacy and expectations of non-experts and examines how knowledge about the ECB's monetary policy and the economic situation

²¹ In reality, the Governing Council takes monetary policy decisions as a committee by forming a consensus based on the members' preferences and interpretation of the data, the Executive Board prepares them, and the ECB President together with the Vice-President communicates monetary policy decisions to the public.

contributes to the formation of inflation and growth expectations of households.

6.1 Treatment Effects on Monetary Literacy

Table 3 presents the results of the intervention by ECB experts on monetary literacy and the subscore for quantitative literacy. The average treatment effects, estimated using regression adjustment, are significant and substantial when compared to the control group. In our baseline, we include all demographic controls and inflation and economic growth perceptions, but not prior knowledge.

The baseline results for monetary literacy (column 1) indicate gains of 10.1 points (out of 100) relative to the control group, while for quantitative literacy (column 5) gains of 13.4 points are estimated (column 7). The respective results applying propensity score-matching (column 2 and 6) show similar, albeit slightly lower gains. Separate post-estimation tests show that imbalances in demographics across subjects are absent when applying propensity-score matching.²²

To capture systematic differences among participants related to prior knowledge we add individual institutional literacy scores as an additional control in the regressions. Column 3 shows that monetary literacy decline to 6.2 points and quantitative literacy scores (column 7) show a more modest decline to 12.1 points relative to the baseline, with similar results from propensity score-matching.

Additionally, an insignificant placebo treatment effect for monetary and quantitative literacy scores (Table 3, second row) confirms that the results are due to genuine learning during the experimental session. Placebo treatment effects measure differences between the group that received placebo treatment - i.e., treatment with no relevant information - and the control group, receiving latest information about the ECB's monetary policy decisions.

***** Insert Table 3 here *****

To check for the potential presence of a selection bias, we estimate average treatment effects of the treated population (ATET). Table 4 (columns 1 and 5) shows that the results are broadly similar to those from ATE (reported in Table 3), as to be expected under randomization, and indicating the likely absence of a selection bias.²³ The baseline results indicate gains of 10.1 points for visitors' monetary literacy and of 12.1 points for quantitative literacy, while propensity-score matching leads to similar gains, confirming the robustness of the findings. Accounting for prior knowledge (column 3 and 7) gives similar treatment effects of 5.4 points for monetary literacy and 10.2 points for quantitative literacy.

***** Insert Table 4 here *****

²² For robustness, we also applied inverse propensity score matching, and obtained similar results, which are not reported here but are available from the authors.

²³ Re-randomisation can address imbalances in the demographics between treated and non-treated groups. Additional regressions with randomization inferences and permutation tests, as in Hess (2017), confirm the validity of the above inference. For brevity of the analysis these results are not reported here but are available from the authors upon request.

We also find that average treatment effects display heterogeneity across personal demographics. Compared with the sample average and controlling for other demographics, inflation and economic perceptions and prior knowledge, treatment effects related to monetary literacy are slightly larger for participants above 30 years, larger for visitors from countries outside the euro area, and significantly larger for visitors with no university education, while gender differences are not statistically significant (see Figure 6a). These results on treatment heterogeneity are confirmed when looking at quantitative literacy, which better reflects the genuine treatment effects (see Figure 6b).

***** Insert Figure 6 here *****

Next, we estimate treatment effects on literacy by distinguishing different levels of prior knowledge, as proxied by the institutional literacy score, while controlling for individual demographics, inflation and economic perceptions, and prior knowledge. These results (see Figure 7) confirm that the detected gains in monetary (quantitative) literacy relative to the control group were higher for participants who were less literate before the experiment.

***** Insert Figure 7 here *****

Overall, these findings suggest that direct communication leads to significant improvements in literacy, even when controlled for heterogeneity in prior knowledge among participants. We observe treatment heterogeneity indicating larger treatment effects for less knowledgeable participants, while gender and age-related effects are largely absent.

6.2 Treatment Effects on Expectations

Table 5 presents the results of the information treatment on the (medium-term) euro area inflation and growth expectations of ECB visitors. The average treatment effects, estimated using regression adjustment, are significant for medium-term inflation expectations but not for economic growth expectations. Additionally, the results (row: “Pomean”) show that around 30 percent of the visitors had medium-term inflation expectations in line with the ECB’s symmetric inflation target of 2% and around half of the visitors had growth expectations consistent with the euro area’s longer-run (real) economic growth potential of between 1 and 2%. In our baseline, we include all demographic controls and inflation and economic growth perceptions, but not prior knowledge.

The baseline results for medium-term inflation expectations (column 1) shows that, on average, there was an increase in the number of correct answers of 10% relative to the control group, indicating that those participants aligned their expectations fully with the ECB’s medium-term inflation target of 2% following treatment. However, a similar alignment is not observed for growth expectations (column 5), where the estimated effect is not significantly different from zero. The respective results applying

propensity score-matching (column 2 and 6) are similar. The results are confirmed by placebo tests (second row) and remain robust when controlling for participants' prior knowledge (column 4 and 8).

***** Insert Table 5 here *****

Next, we look into heterogeneity of treatment effects on medium-term inflation expectations distinguishing between demographics and different levels of prior knowledge, while controlling for individual demographics, inflation and economic perceptions, and prior knowledge. The treatment effects are larger for older visitors, participants from the euro area, and those without university education (see Figure 8a). Moreover, they also depend on prior knowledge with less knowledgeable participants benefiting more from the treatment (see Figure 8b).

***** Insert Figure 8 here *****

Overall, these findings suggest direct communication helps to better anchor visitors' medium-term expectations for euro area inflation. However, this result does not extend to economic growth expectations.

6.3 Knowledge about the Inflation Target and Anchoring of Inflation Expectations

We explore whether participants' prior knowledge about the ECB's symmetric 2% medium-term inflation target is a key factor leading them to revise their medium-term inflation expectations. To this end, we split the population into three subgroups based on their prior knowledge about the mandate: a) Full literacy: participants know both the mandate and the inflation target; b) Partial literacy: participants know the mandate but not the precise inflation target; c) No literacy: participants have no prior knowledge about the mandate and the inflation target. In our baseline, we include all demographic controls and also provide results controlling for economic growth perceptions of participants.

The results in Table 6 (first line) suggest a positive impact for the group with no literacy, no impact for the group with partial literacy, and a positive impact for the group with full literacy. It implies that two separate channels are at work: (a) a "trust"-related response from participants with no knowledge, and (b) a response based on precise knowledge of participants about the ECB's medium-term inflation target, both leading to an improvement in anchoring inflation expectations. However, participants who understand that the ECB has a price-stability mandate but do not recall the precise target do not behave differently from the control group.

In summary, by increasing non-experts' literacy about the symmetric 2% inflation target or by increasing trust, the ECB could strengthen its impact on medium-term inflation expectations, thereby contributing to price stability.

***** Insert Table 6 here *****

6.4 The Role of the Communication Language

So far, this study has ignored that language barriers may reduce visitors's ability to listen to direct central bank communication, if their native language is not English but the session is held in English. This point extends to the ability to correctly fill out the literacy questionnaire. To explore this issue, we conducted further checks and re-estimated the treatment effects, focusing on a subgroup of German native visitors who attended the experimental sessions on monetary policy in German and filled out the questionnaire in German.²⁴

Table 7 suggests that literacy gains are broadly similar to what we obtained for the entire experimental population (see Table 3), while the results using propensity score-matching methods indicate that the treatment effects could be somewhat stronger.

Table 8 (column 1) shows a significant impact on participants' medium-term inflation expectations, while again there is no significant impact on economic growth expectations. The average gain of 18% in the number of correct answers relative to the control group for inflation expectations shows that the effects are almost double as strong, when compared to the total experimental population (Table 5).

Next, we explore whether channels for German-speakers are similar. Figure 9 indicates the presence of two channels in the transmission from communication to inflation expectations for both populations: (a) the "trust"-related response of participants with no knowledge, and (b) the response based on precise knowledge of participants about the ECB's medium-term inflation target, both leading to an improvement in anchoring inflation expectations. Both effects are more substantial than in the baseline for the total experimental population. However, a relative larger share of German participants with full knowledge about the mandate revised their medium-term inflation expectations relative to their initial beliefs. This suggests that the channel based on precise knowledge of the inflation target was more important for the German-speaking audience, whereas the "trust-related" channel was relatively more important for the total experimental population.

***** Insert Figure 9 here *****

Overall, the subsample results of the German-speakers show that the average treatment effects on inflation expectations are stronger if the central bank reaches out to the visitors in the native language.

6.5 The Role of the Information Treatment

Next, we consider that the treatment between groups attending the monetary policy and the institutional framework sessions did not have the same information content.²⁵ While they overlapped widely,

²⁴ Table A1 in the Online Appendix shows descriptive statistics of the German-speaking group.

²⁵ As a further robustness check, we consider that unobservables influence literacy scores and treatment simultaneously, leading to endogeneity. To uncover such effects, we explain literacy as a function of prior

briefings on recent monetary policy decisions were more detailed in the monetary policy sessions and included a discussion of the economic outlook and the ECB staff projections for inflation and economic growth in the euro area.

The results show that the average treatment effects on monetary literacy are larger for the groups that attended a session on monetary policy compared to those that attended sessions on the institutional framework (10.7% versus 5.4%; see Table A4 in the Online Appendix). However, when examining the effect on anchoring medium-term inflation expectations, the gain is significantly larger for the groups attending institutional framework sessions than for those attending monetary policy sessions (12% versus 6%; see Table A5 in the Online Appendix).

A further analysis of the channels shows that participants from the monetary policy sessions aligned their inflation expectations based on enhanced knowledge about the ECB's inflation target, whereas those from the institutional framework sessions aligned their inflation expectations based on both channels, enhanced trust and new information about the ECB's inflation target. The larger gains were obtained for participants improving their understanding of the ECB's inflation target, highlighting the importance of that channel.

In summary, this robustness check suggests that communication that gives orientation about the precise inflation target helps participants to better anchor their inflation expectations.

6.6 Limitations of the Experimental Study

The findings of this study provide new insights into the effects of direct central bank communication on non-experts' monetary literacy and their inflation and growth expectations. However, it is important to acknowledge some limitations of this experiment to address them in future research.

First, most of our participants were young students (below 30 years), thereby limiting the generalizability of our findings to the European population. Secondly, other confounding factors such as income and employment may also be relevant for a comprehensive understanding of the influence of central bank communication on different demographic groups (see Coibion et al., 2022; Blinder et al., 2024).²⁶ However, in our experiment, this was less of an issue, given the focus on students with little or no income and not yet employed, and the inclusion of the age factor that is correlated with income. Thirdly, treatment effects on monetary literacy and inflation expectations likely decline over time. To assess this point, one would need to repeat the experiments with the same individuals after some time. Addressing this point was not straightforward in our experiment, as visitor groups that come to the ECB

knowledge while conjecturing that treatment was influenced by the individual demographics characterizing the different visitor groups. We use the STATA procedure *eteffects* to estimate average treatment effects accounting for treatment endogeneity. The results reported in Table A3 in the Online Appendix show that the treatment effects of ECB communication on monetary and quantitative literacy, accounting for endogeneity, are robust but larger than those in the baseline (shown in Table 3).

²⁶ Based on the CES household survey, the main factors influencing financial literacy are gender, age, education, and income (see Figure A3 of the Online Appendix A and the results by D'Acunto et al., 2024).

repeatedly usually consist of different individuals each time.

In summary, while this study offers valuable insights, the limitations outlined above should be considered in future research to enhance the robustness and external validity of the findings.

7. Conclusion

Central banks are tasked with maintaining price stability, and effective communication strategies are essential in achieving this objective. This experimental study investigated the impact of direct central bank communication, akin to ECB press conferences, on the monetary literacy and expectations of non-experts through [87] sessions conducted over two years with visitor groups at the ECB headquarters. A newly developed monetary literacy survey enabled us to assess participants' prior and posterior knowledge about monetary policy and to compare the expectations of groups that received treatment with those that did not.

Our findings indicate that direct communication significantly increases non-experts' monetary literacy scores. It also improves policy effectiveness by aligning non-experts' medium-term inflation expectations with the ECB's inflation target. The alignment is facilitated by an enhanced understanding of the objective or on trust in the ECB's monetary policy. Additionally, tests with German speakers suggest that communication in the native language can further strengthen the anchoring of private inflation expectations.

These results highlight the effectiveness of direct communication strategies with diverse audiences and offer valuable insights for central banks aiming to optimize their public outreach activities. The study underscores the importance of understanding the relationship between central bank communication, monetary literacy, and private expectations. Our key policy implication is that direct central bank communication can exert a powerful impact on households' medium-term inflation expectations. Relying on indirect communication through the media may be suboptimal for anchoring private expectations across heterogeneous groups. Instead, central banks should consider strengthening their direct communication with non-experts with the aim to increase trust in monetary policy and enhance monetary literacy. Central banks should also integrate additional activities, such as targeted educational programs on monetary policy, particularly those aimed at improving the understanding of the inflation target, and measures to enhance citizens' trust. The ECB should continue to tailor its communication strategies to address the specific needs of audiences with varying literacy levels and diverse native languages. Such an approach is crucial for managing and anchoring public expectations effectively.

Future research could explore whether the improved effectiveness of direct communication observed with German speakers also applies to other official Community languages.

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Figures and Tables

Figure 1: Direct and indirect central bank communication

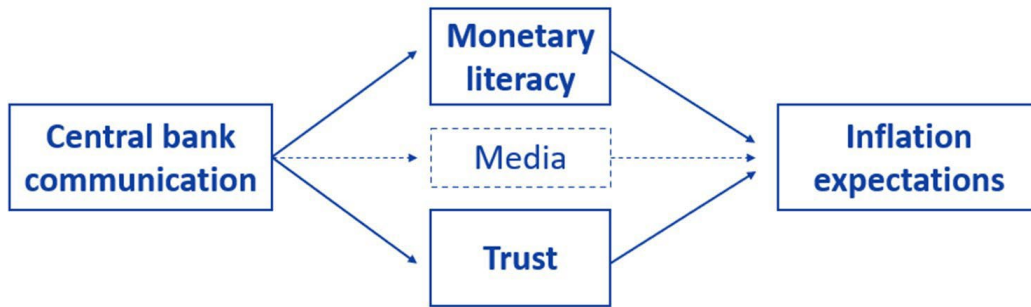


Figure 2: The RCT study design

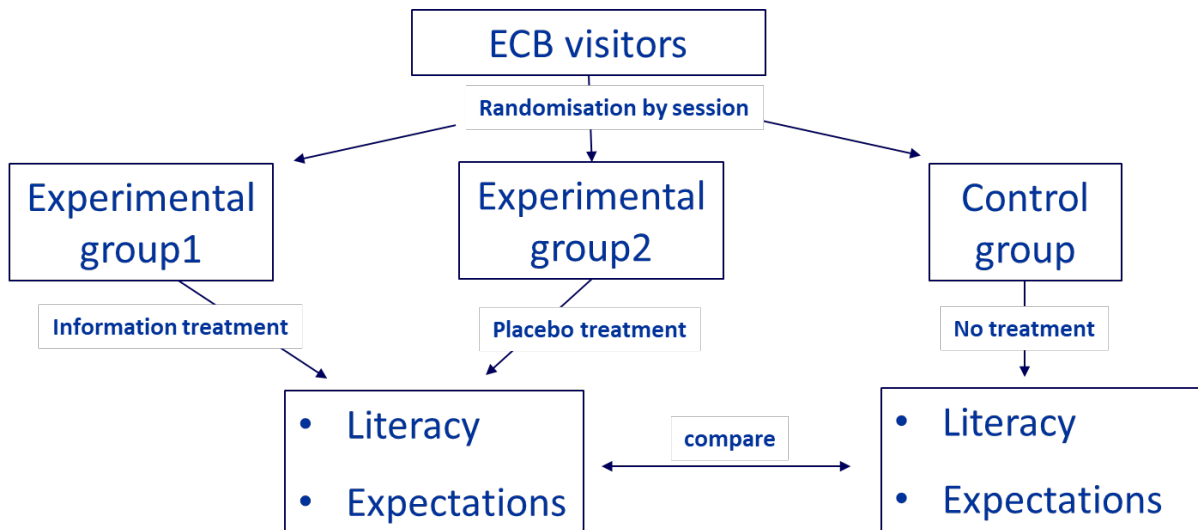
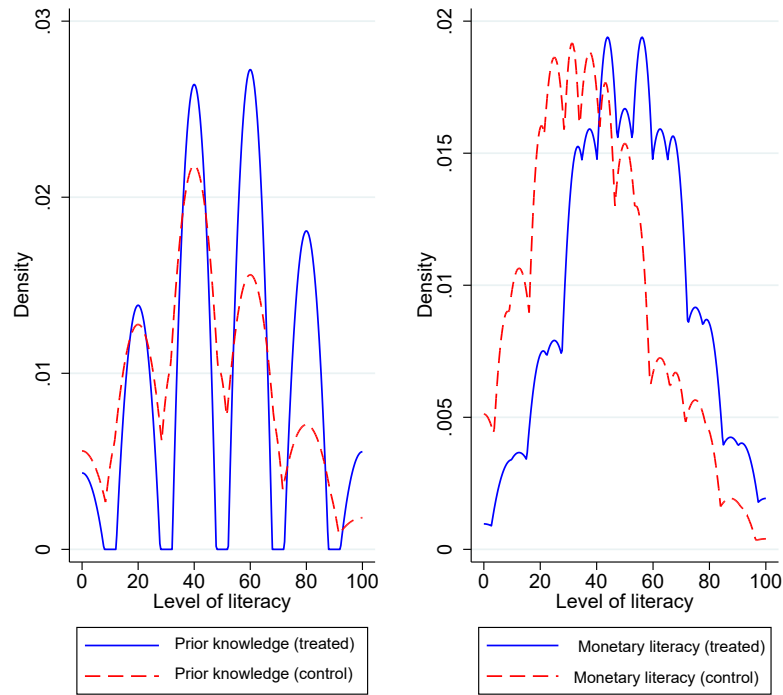
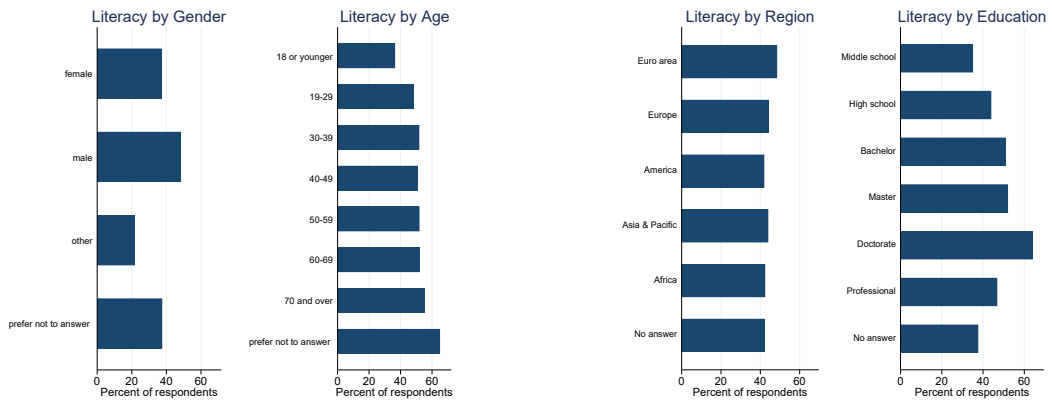


Figure 3: Monetary literacy of ECB visitors

a) Distribution of monetary knowledge



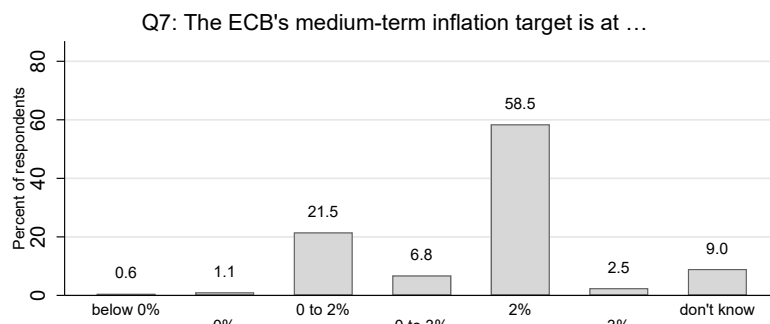
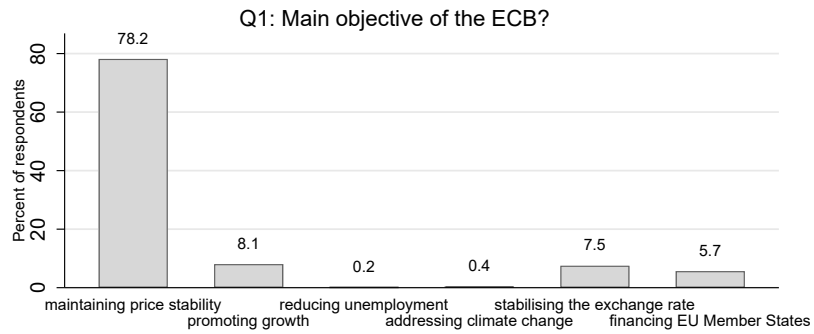
b) Prior knowledge by demographics



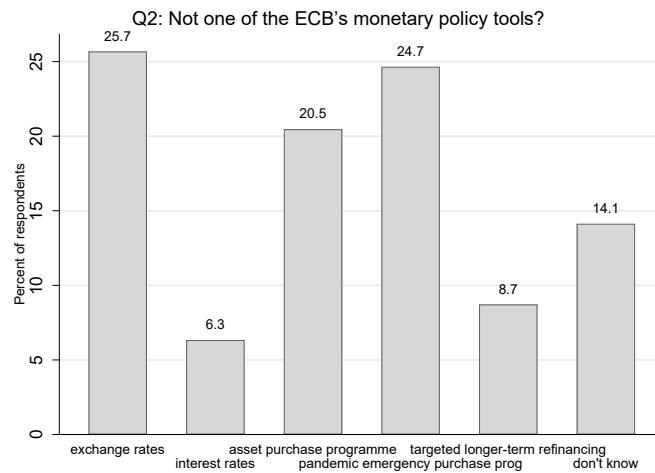
Notes: Panel (a) shows the distribution of literacy scores for the treated and the control group. Panel (b) shows the distribution of institutional literacy scores for all participating ECB visitors and by demographics.

Figure 4: Selected answers to the monetary literacy questionnaire

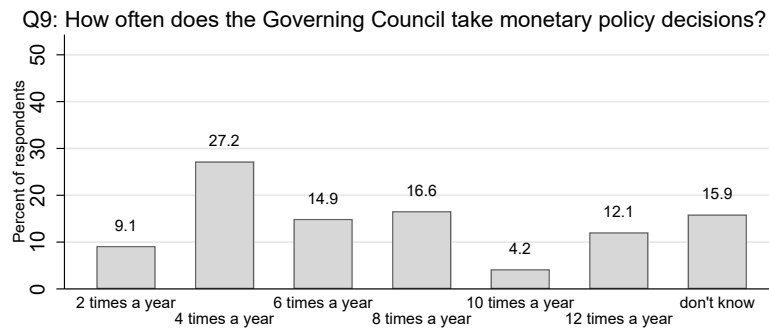
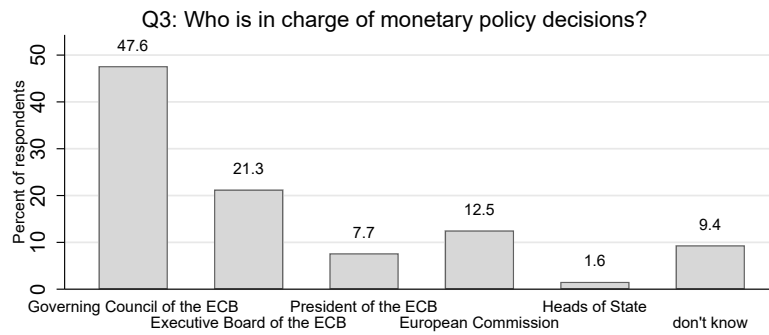
a) The ECB's mandate



b) The ECB's instruments



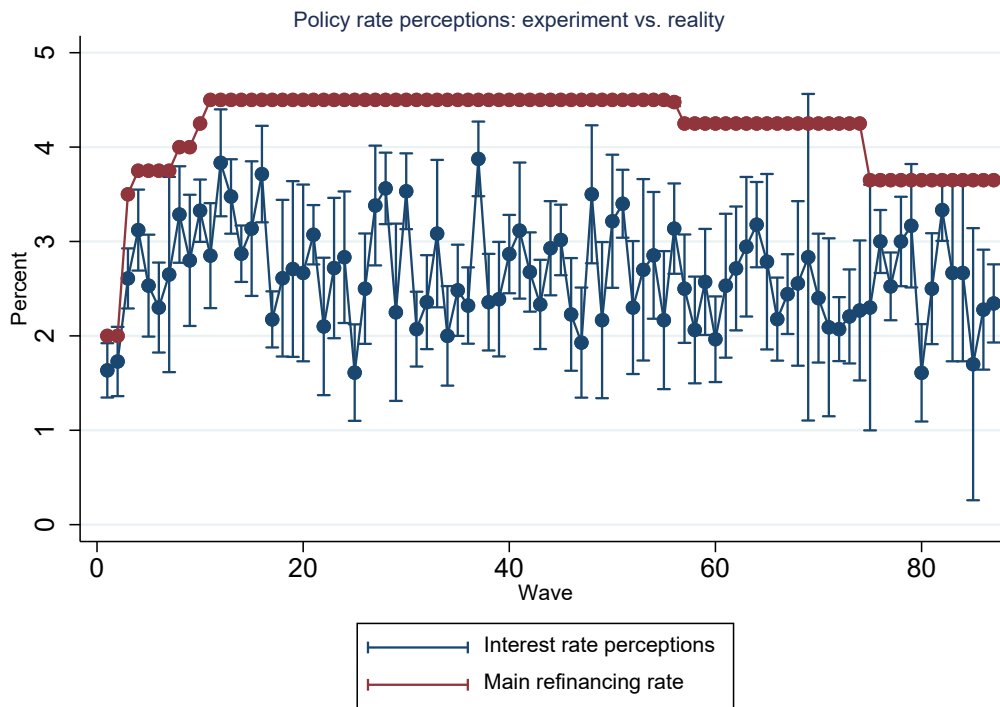
c) *The ECB's decision-making bodies*



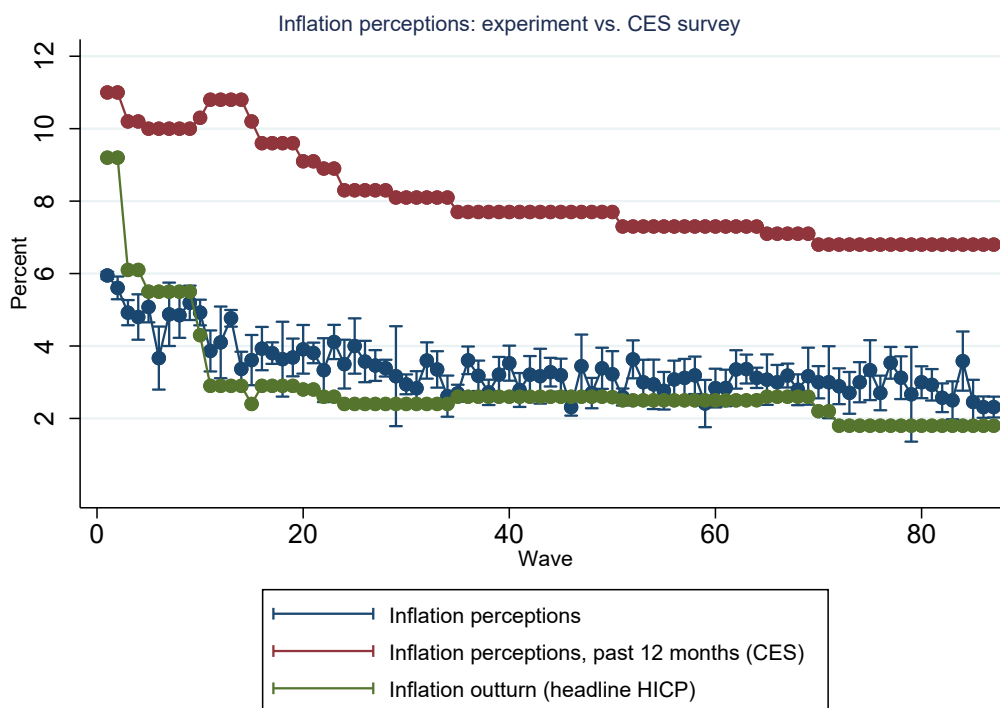
Notes: The figures show the distribution of answers to selected monetary literacy questions for all participating ECB visitors.

Figure 5: Visitors' perceptions and expectations about policy rates and headline inflation

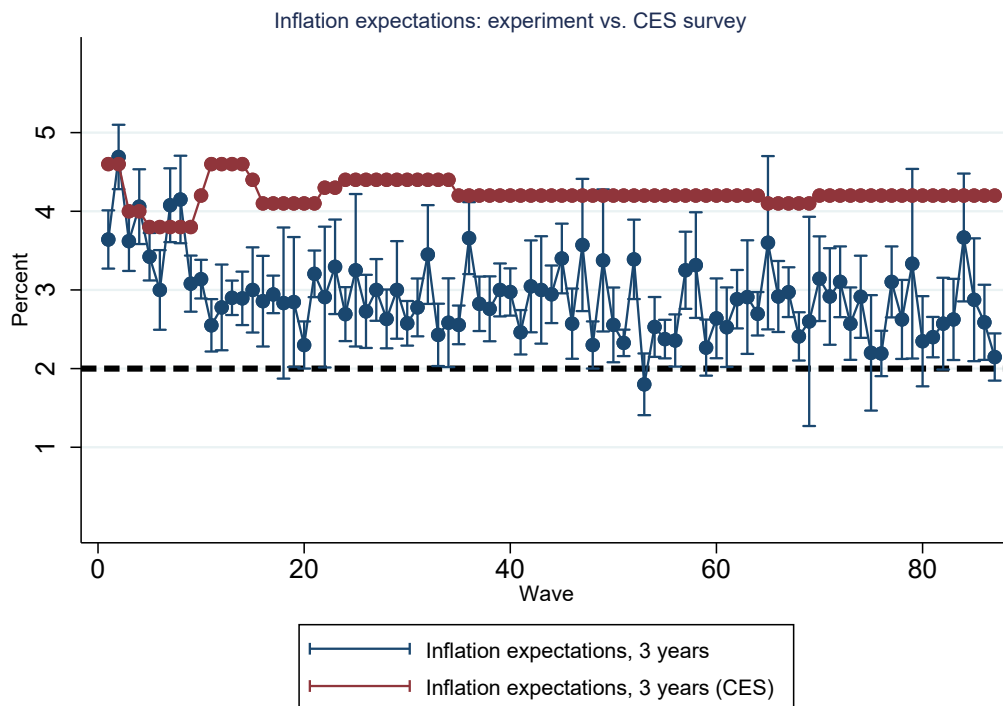
a) *Policy rate perceptions*



b) *Inflation perceptions*



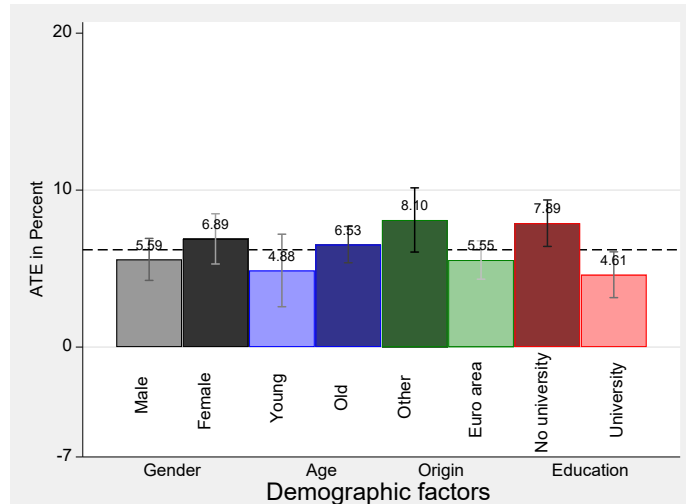
c) *Medium-term inflation expectations*



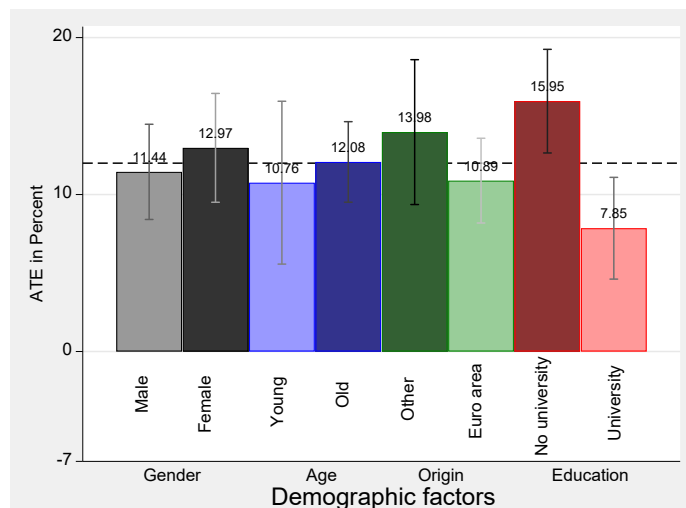
Notes: The figures show the distribution of (mean) perceptions and expectations for all participating ECB visitors and the wider public from the CES household survey. The vertical lines show the distribution (95% confidence interval around the mean). The x-axis shows the session number ordered by date of the experiment. The black (dashed) line shows the ECB's symmetric, medium-term inflation target of 2%.

Figure 6: Treatment heterogeneity by demographics

a) *Monetary literacy*



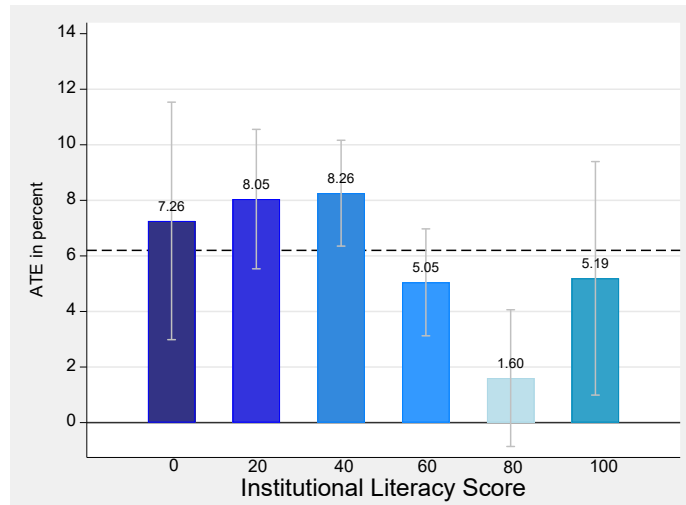
b) *Quantitative literacy*



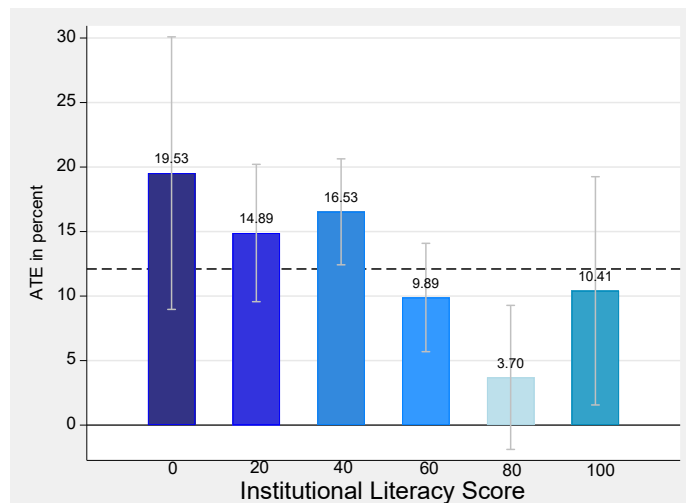
Notes: The figures show a breakdown of average treatment effects for the experimental group relative to the control group by demographics with regression adjustment. ATE estimates include controls for individual demographics: i.e. the binary variables Young, Female, Euroarea, and Higheredu, inflation and economic perceptions, and prior knowledge. The dashed horizontal lines show the respective total effect. The x-axis shows the results for the four demographics, gender (male vs. female), age (younger vs. older), origin (euro area vs. outside euro area), and education (no university education vs. university education).

Figure 7: Treatment effects on literacy by prior knowledge

a) Monetary literacy



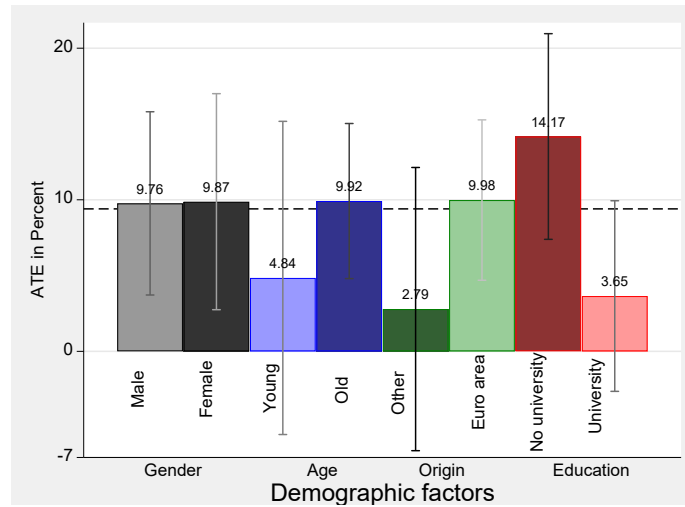
b) Quantitative literacy



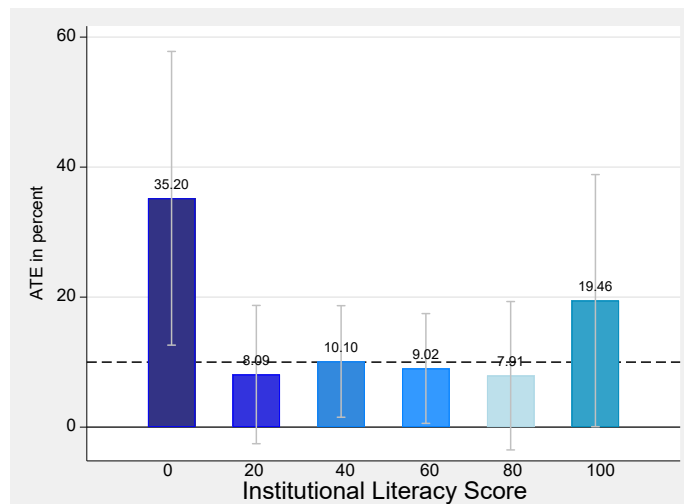
Notes: The figures show a breakdown of average treatment effects for the experimental group relative to the control group by prior knowledge with regression adjustment. ATE estimates include controls for individual demographics: i.e. the binary variables Young, Female, Euroarea, and Higheredu, and inflation and economic perceptions, and prior knowledge.

Figure 8: Treatment heterogeneity and inflation expectations

a) Demographics



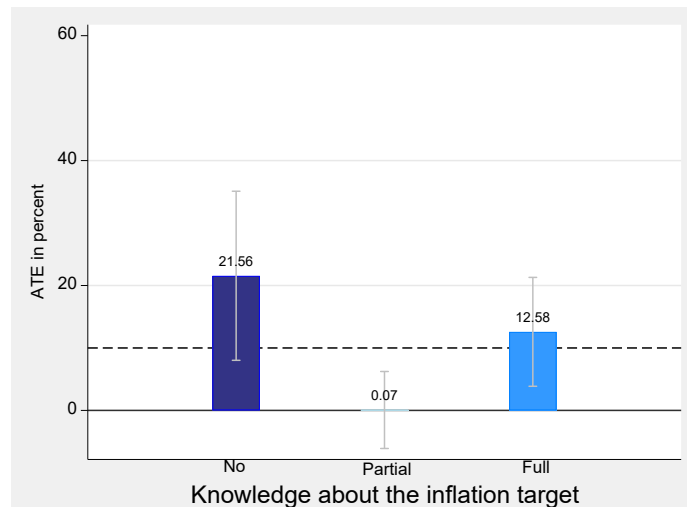
b) Prior knowledge



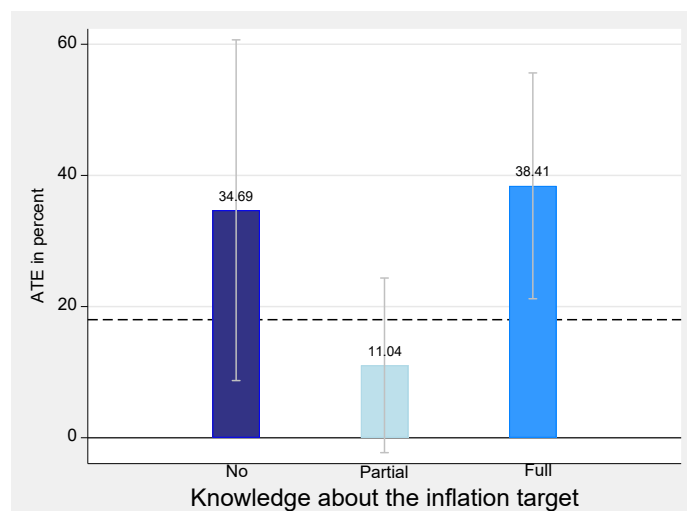
Notes: The figures show a breakdown of average treatment effects for the experimental group relative to the control group by demographics and prior knowledge with regression adjustment. ATE estimates include controls for individual demographics: i.e. the binary variables Young, Female, Euroarea, and Higheredu, inflation and economic perceptions, and prior knowledge. The dashed horizontal lines show the respective total effect. In the upper chart, the x-axis shows the results for the four demographics, gender (male vs. female), age (younger vs. older), origin (euro area vs. outside euro area), and education (no university education vs. university education). In the lower chart, the x-axis shows different levels of the institutional literacy score, as proxy for prior knowledge.

Figure 9: Treatment effects on literacy by knowledge about the ECB's inflation target

a) *All participants*



b) *German speakers*



Notes: The figures show a breakdown of average treatment effects for the experimental group relative to the control group by knowledge about the ECB's inflation target with regression adjustment. ATE estimates include controls for individual demographics: i.e. the binary variables Young, Female, Euroarea, and Higheredu, and for individual economic growth perceptions.

Table 1: Descriptive statistics by group

Variables	(1) Total population	(2) Experimental group	(3) Control group	(4) Placebo group
Observations	2,157	792	1,260	100
<i>Individual demographics (%)</i>				
Female	43.7	42.1	45.3	36.0
Male	54.4	56.9	52.4	61.0
Euro area	70.2	71.9	68.5	74.5
European (other)	10.7	15.7	9.3	5.5
America	8.6	3.9	11.0	9.0
Africa	1.2	1.1	1.0	2.0
Asia & Pacific	8.9	6.9	9.8	9.0
Age (below 30 years)	78.3	78.9	79.6	55.0
Age (30 to 59 years)	18.5	16.4	17.9	43.0
Age (60 years and above)	2.9	4.4	2.1	1.0
Bachelor	22.4	25.9	19.6	30.0
Master	25.2	29.0	22.1	34.0
Doctorate	2.8	3.4	2.1	5.0
Middle school	13.0	7.7	17.2	2.0
High school	33.4	31.9	34.9	27.0
Professional	2.0	1.9	2.3	0
<i>Binary demographics (%)</i>				
Female	44.9	42.8	46.6	39.0
Euroarea	70.2	76.1	68.5	45.0
Young	78.3	78.9	79.6	56.0
Higheredu	50.4	58.3	43.8	69.0
<i>Expectations and perceptions (mean in %)</i>				
Inflation perceptions	3.6	3.9	3.4	2.9
Growth perceptions	2.2	2.1	2.3	2.2
Inflation expectations, 3 years	3.0	3.0	3.0	2.6
Growth expectations, 3 years	2.3	2.2	2.4	2.1
Inflation wedge	0.6	0.9	0.5	0.3
<i>Literacy scores (mean in %)</i>				
Monetary literacy	42.9	51.3	37.7	41.8
Institutional literacy	47.0	52.0	43.5	49.8
Quantitative literacy	37.6	48.0	31.2	36.4

Notes: This table reports selected summary statistics for participating ECB visitors.

Table 2: The influence of demographics on literacy

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Monetary literacy	Institutional literacy	Quantitative literacy	Monetary literacy	Institutional literacy	Quantitative literacy
Young	-0.08 (1.22)	-2.81** (1.39)	-2.31 (1.46)	-5.61*** (1.53)	-7.42*** (1.80)	-5.16*** (1.89)
Female	-9.55*** (0.93)	-7.77*** (1.06)	-11.65*** (1.12)	-6.59*** (0.95)	-5.24*** (1.15)	-7.84*** (1.14)
Higheredu	11.61*** (1.02)	11.26*** (1.16)	8.70*** (1.22)	5.36*** (1.76)	5.99*** (1.90)	3.34 (2.09)
Euroarea	8.04*** (1.05)	8.17*** (1.20)	5.37*** (1.26)	6.86*** (1.37)	5.78*** (1.32)	5.25*** (1.87)
Constant	35.52*** (1.56)	41.15*** (1.78)	35.91*** (1.88)	42.76*** (1.81)	48.03*** (1.97)	39.81*** (2.35)
R-squared	0.13	0.09	0.09	0.06	0.04	0.04
Observations	2,157	2,157	2,157	2,157	2,157	2,157

Notes: Results (1) to (3) are from Huber robust regressions to control for outliers and influential observations. Results (4) to (6) are from panel OLS and include group-fixed effects for each session. Robust standard errors are below the estimates. ***, **, and * refer to the 1%, 5%, and 10% significance levels, respectively.

Table 3: Results on average treatment effects of the whole population (ATE)

Variables	(1) Monetary literacy	(2) Monetary literacy	(3) Monetary literacy	(4) Monetary literacy	(5) Quantitative literacy	(6) Quantitative literacy	(7) Quantitative literacy	(8) Quantitative literacy
Treatment	10.06*** (0.96)	9.36*** (1.02)	6.23*** (0.53)	6.98*** (0.80)	13.36*** (1.19)	13.56*** (1.43)	12.06*** (1.17)	11.82*** (1.41)
Placebo	-3.48 (2.57)		-1.71 (1.22)		-0.90 (2.96)		-0.79 (2.66)	
Pomean	42.01*** (0.64)		43.81*** (0.55)		35.71*** (0.76)		36.44*** (0.75)	
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Perceptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prior knowledge	No	No	Yes	Yes	No	No	Yes	Yes
Matching	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1,802	1,712	1,802	1,712	1,802	1,712	1,802	1,712

Notes: With regression adjustment. Matching refers to propensity score matching. Robust standard errors are below the estimates. ***, **, and * refer to the 1%, 5%, and 10% significance levels, respectively. Demographics include the binary variables Young, Female, Euroarea, and Higheredu.

Table 4: Results on average treatment effects of the treated (ATET)

Variables	(1) Monetary literacy	(2) Monetary literacy	(3) Monetary literacy	(4) Monetary literacy	(5) Quantitative literacy	(6) Quantitative literacy	(7) Quantitative literacy	(8) Quantitative literacy
Treatment	10.09*** (0.99)	9.61*** (1.22)	5.43*** (0.55)	6.40*** (0.97)	12.10*** (1.23)	12.83*** (1.54)	10.21*** (1.21)	9.93*** (1.69)
Placebo	-5.18* (3.00)		-2.28 (1.47)		-1.14 (3.52)		-1.26 (3.08)	
Pomean	43.24*** (0.76)		47.90*** (0.83)		37.06*** (0.88)		38.95*** (0.91)	
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Perceptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prior knowledge	No	No	Yes	Yes	No	No	Yes	Yes
Matching	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1,802	1,712	1,802	1,712	1,802	1,712	1,802	1,712

Notes: With regression adjustment. Matching refers to propensity score matching. Robust standard errors are below the estimates. ***, **, and * refer to the 1%, 5%, and 10% significance levels, respectively. Demographics include the binary variables Young, Female, Euroarea, and Higheredu.

Table 5: Results on average treatment effects: visitors' expectations

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	Inflation	Inflation	Inflation	Inflation	Economic growth	Economic growth	Economic growth	Economic growth
Treatment	0.10*** (0.02)	0.10*** (0.03)	0.09*** (0.02)	0.08*** (0.03)	0.01 (0.02)	0.02 (0.03)	0.01 (0.02)	0.01 (0.03)
Placebo	0.09 (0.07)		0.09 (0.07)		0.00 (0.07)		0.00 (0.07)	
Pomean	0.29*** (0.01)		0.29*** (0.01)		0.52*** (0.02)		0.53*** (0.02)	
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Perceptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prior knowledge	No	No	Yes	Yes	No	No	Yes	Yes
Matching	No	Yes	No	Yes	No	Yes	No	Yes
Observations	1,802	1,712	1,802	1,712	1,802	1,712	1,802	1,712

Notes: With regression adjustment. Matching refers to propensity score matching. Robust standard errors are below the estimates. ***, **, and * refer to the 1%, 5%, and 10% significance levels, respectively. Demographics include the binary variables Young, Female, Euroarea, and Higheredu.

Table 6: Results on average treatment effects with respect to literacy about the ECB's mandate

Variables	(1) Full knowledge	(2) Full knowledge	(3) Partial knowledge	(4) Partial knowledge	(5) No knowledge	(6) No knowledge
Inflation expectations of all participants						
Treatment	0.13*** (0.04)	0.13*** (0.04)	0.04 (0.03)	-0.00 (0.03)	0.24*** (0.06)	0.20*** (0.07)
Placebo	-0.00 (0.12)	0.14 (0.25)	0.17** (0.08)	0.11 (0.09)	0.21* (0.13)	0.15 (0.14)
Pomean	0.33*** (0.03)	0.34*** (0.03)	0.28*** (0.02)	0.29*** (0.02)	0.20*** (0.02)	0.25*** (0.03)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Growth perceptions	No	Yes	No	Yes	No	Yes
Observations	539	506	1,114	939	392	276
Inflation expectations of German speakers						
Treatment	0.38*** (0.09)	0.38*** (0.09)	0.14** (0.06)	0.11 (0.07)	0.30*** (0.11)	0.35*** (0.13)
Pomean	0.28*** (0.05)	0.28*** (0.05)	0.24*** (0.03)	0.28*** (0.03)	0.16*** (0.03)	0.19*** (0.04)
Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Growth perceptions	No	Yes	No	Yes	No	Yes
Observations	137	128	314	263	139	92

Notes: With regression adjustment. Robust standard errors are below the estimates. ***, **, and * refer to the 1%, 5%, and 10% significance levels, respectively. Demographics include the binary variables Young, Female, Euroarea, and Higheredu.

Table 7: Results on average treatment effects (ATE), German speakers

Variables	(1) Monetary literacy	(2) Monetary literacy	(3) Monetary literacy	(4) Monetary literacy	(5) Quantitative literacy	(6) Quantitative literacy	(7) Quantitative literacy	(8) Quantitative literacy
Treatment	6.93*** (1.81)	8.24*** (1.80)	5.34*** (1.05)	8.33*** (1.96)	12.62*** (2.56)	13.30*** (2.70)	12.19*** (2.52)	15.01*** (2.84)
Pomean	41.76*** (1.06)		42.37*** (0.96)		32.79*** (1.21)		32.98*** (1.20)	
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Perceptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prior knowledge	No	No	Yes	Yes	No	No	Yes	Yes
Matching	No	Yes	No	Yes	No	Yes	No	Yes
Observations	501	501	501	501	501	501	501	501

Notes: With regression adjustment. Matching refers to propensity score matching. Robust standard errors are below the estimates. ***, **, and * refer to the 1%, 5%, and 10% significance levels, respectively. Demographics include the binary variables Young, Female, and Higheredu.

Table 8: Results on average treatment effects: visitors' expectations, German speakers

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Variables	Inflation	Inflation	Inflation	Inflation	Economic growth	Economic growth	Economic growth	Economic growth
Treatment	0.18*** (0.05)	0.18*** (0.06)	0.18*** (0.05)	0.22*** (0.06)	0.01 (0.05)	0.02 (0.07)	-0.00 (0.05)	0.02 (0.07)
Pomean	0.26*** (0.02)		0.26*** (0.02)		0.50*** (0.03)		0.51*** (0.03)	
Demographics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Perceptions	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prior knowledge	No	No	Yes	Yes	No	No	Yes	Yes
Matching	No	Yes	No	Yes	No	Yes	No	Yes
Observations	501	501	501	501	501	501	501	501

Notes: With regression adjustment. Matching refers to propensity score matching. Robust standard errors are below the estimates. ***, **, and * refer to the 1%, 5%, and 10% significance levels, respectively. Demographics include the binary variables Young, Female, and Higheredu.