FORWARD GUIDANCE AND HOUSEHOLD EXPECTATIONS

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Abstract: We compare the causal effects of forward guidance communication about future interest rates on households' expectations of inflation, mortgage rates, and unemployment to the effects of communication about future inflation in a randomized controlled trial using more than 25,000 U.S. individuals. We elicit individuals' expectations in the Nielsen Homescan panel and then provide 22 different forms of information regarding past, current and/or future inflation and interest rates. Information treatments about current and next year's interest rates have a strong effect on household expectations but treatments beyond one year do not have any additional impact on forecasts. Exogenous variation in inflation expectations transmits into other expectations. The richness of our survey allows us to better understand how individuals form expectations about macroeconomic variables jointly and the non-response to long-run forward guidance is consistent with models in which agents have constrained capacity to collect and process information.

JEL: E31, C83, D84,

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"In particular, low interest rates encourage households to bring forward durable consumption, and firms' investment, through credit."

Mario Draghi, October 25, 2016.[1]

"In particular, easier borrowing conditions for firms and households are underpinning consumer spending and business investment."

Christine Lagarde, December 12, 2019.[2]

1 Introduction

As monetary policy-makers in many advanced economies pushed short term interest rates to zero during the financial crisis, attention quickly turned to other tools that could be used to further stimulate economic activity. Along with quantitative easing, forward guidance about the path of future interest rates became one of the main tools that central banks developed to address the exceptional circumstances they were facing. Since the zero-bound period remains likely to return even in those economies that were fortunate enough to eventually exit it, understanding how forward guidance affects economic outcomes remains a central question in policy-making. But because the mechanism of forward guidance is through expectations and these are not readily observable, it has been difficult to establish how policy announcements about the future actually affect individual economic actors.

In this paper, we implement a large-scale randomized control trial (RCT) on a representative sample of about 25,000 U.S. consumers to whom we provide, in a randomized fashion, different pieces of information about the evolution of future interest rates as well as about past and current rates and inflation. This RCT approach provides a transparent way to assess whether the exogenous provision of information about future interest rates changes households' economic expectations. The large scale of the experiment allows us to characterize in unprecedented detail how the magnitude of the treatment as well as the time horizon of the announcement affect the size of individuals' revisions as well as how they change their views about different economic variables (e.g. long-term interest rates vs. inflation vs. unemployment). We can also compare how the provision of different types of information (such as about interest rates vs. inflation) translates into changes in households' expectations.

We document a number of new results from this large-scale experiment. First, prior to any information treatment, we find that households' knowledge about interest rates is limited: the cross-sectional dispersion in their beliefs about the levels of interest rates is as high as previously documented for their beliefs about inflation (e.g., Coibion, Gorodnichenko and Weber 2019). Second, the provision

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of information about the current level of interest rates leads to large revisions in households' expectations about interest rates over short horizons, but much less so over longer horizons. Third, providing information about interest rates at longer horizons (such as two to three years) has relatively small effects on households' expectations over future interest rates. Fourth, households tend to revise their inflation expectations along with their interest rate expectations when provided with information about interest rates, but not in a one-for-one fashion, so that their perceived real interest rates still adjust. Fifth, treatments about recent or future inflation have even larger effects on real interest rates than do most treatments about nominal interest rates. Sixth, we detect little sensitivity in households' expectations about unemployment to treatments. Finally, these exogenous changes in beliefs about future interest rates and inflation are associated with revisions in whether households perceive that now is a good or bad time to purchase durable goods, although these effects are less precise.

To measure how households' expectations change in response to information treatments, we first elicit households' expectations on a host of variables including inflation, mortgage rates, and the unemployment rate. We then provide information treatments to households and finally, elicit household expectations again, both immediately after the treatment as well as after three and six months. The latter allows us to characterize how persistent the effects of different information treatments are on households' expectations. Consistent with earlier work, we find that treatments about inflation have relatively short-lived effects (strongly mitigated within three months and completely dissipated within six months) while treatments about interest rates have much more long-lived effects. These results imply that policy makers could choose different strategies for forward guidance depending on how persistent they would like the effects to be (e.g. guidance about the instrument for persistent effects and guidance about an inflation objective to have more transient effects).

Because our survey has such a large cross-section, we are able to consider an exceptionally large number of different treatments relative to previous work. Specifically, we vary (i) the variable on which we provide information: policy rates, inflation, mortgage market rates; (ii) the horizon over which we provide information: current, past, future periods up to three years into the future and for the longer run; and (iii) the interest rate trajectories: central tendency, upper range, lower range. This variety in treatments is the source of our ability to identify in such detail what types of information affect households' beliefs most and which dimensions are less important. For example, we find no meaningful differences across treatments depending on the specific path of interest rates provided. Informing households about the upper range of FOMC members' projections about the future path of interest rates leads to very similar results as providing them with the lower contour of those same projections. But as

noted earlier, some dimensions are quite important, especially the time horizon about which the information is provided. The effects of information treatments about interest rates far in the future are significantly smaller than those found for near-term interest rates.

The fact that households do not adjust their expectations to a larger extent to information beyond one year provides empirical support to theories that model decision makers with limited capacity to collect and process information: e.g., limited planning horizons (Woodford 2018), bounded rationality (Gabaix 2019), level-k thinking (Farhi and Werning 2019), lack of common information (Angeletos and Lian 2018). While the exact micro foundations differ across studies, they share the feature that agents with limited abilities react less to information in the far future relative to information about the current and immediate future and hence possibly resolve the forward-guidance puzzle.

Randomized controlled trials have recently become more common in macroeconomics (e.g., Armona et al. 2019, Coibion et al. 2019a,b, Binder and Rodrigue 2018, Roth and Wohlfart 2018). Following the design of research in applied micro and development, these papers typically study how randomized treatments affect individuals' expectations and decisions in domains that are directly affected by the treatments. Yet, in macroeconomic contexts, feedback effects, general equilibrium effects, and the expectations on how other aggregate variables move in response to the treatment are important for the overall response of individuals. A central innovation in our survey design is the fact that we can jointly study the response of several economic expectations to our different treatments to better predict how individuals form expectations jointly and how they might react to actual announcements by central banks on how the future path of policy rates or inflation might evolve. Furthermore, we study how information about past, current, and future policy rates influences expectations of households and contrast these responses with the responses when households are informed about inflation, a powerful force for moving households expectations about macroeconomic variables (e.g., Coibion, Gorodnichenko and Weber 2019) as well as a strong determinant of households' consumption (e.g., Coibion et al. 2019 and D'Acunto et al. 2016).

Our paper is closely related to an extensive body of work on the effect of forward guidance (Del Negro et al. 2015, Campbell et al. 2012, Andrade and Ferroni 2018). However, we differ from this work along a number of dimensions. First, much of this work (e.g., Chodorow-Reich 2014) has concentrated on how forward guidance affects financial markets and nominal interest rates of different term structures. This focus reflects the common viewpoint among policymakers that the main channel through which forward guidance operates is precisely via financial markets: changing expectations of future short-term interest rates affects current long-term interest rates which, if inflation expectations are

anchored, then leads to changes in the real interest rates faced by households and firms, which in turn affects their behavior. However, this approach is incomplete. We show, for example, that providing information about future interest rates changes not just the perceived path of nominal rates but also inflation expectations, so that the pass-through to households' real interest rates is much less than one-for-one and many households do not adjust their propensities to take out loans to changes in interest rates (D'Acunto et al. 2018b). If households draw inference from forward guidance about the future state of the economy, this can also affect their expectations of their future income and therefore their spending decisions. In addition, households may be sensitive not just to the level of long-term interest rates but also to their expected path: the timing of durable goods purchases is likely to depend on whether households expect interest rates to rise or fall in the future because purchases of durable goods (capital) have a very high intertemporal elasticity of substitution (e.g., House and Shapiro 2008). Understanding how households revise their views about the path of future interest rates is therefore of interest independently of how financial markets revise their views. We regard our results on the response of households' expectations as complementary to earlier work focusing on financial markets by helping to identify additional changes through which forward guidance shapes economic outcomes.

Another strand of literature focuses on the aggregate effects of forward guidance, primarily using time series analysis (e.g., Swanson 2018; see Bhattarai and Neely (2018) for a survey). This work is of direct use in measuring how the economy responds to forward guidance, but it does not speak directly to the underlying mechanisms at work. Our approach is more targeted: we are able to identify how households' expectations respond to information about current and future interests but are unable to speak directly to the general equilibrium effects that would obtain were all households to respond in a similar fashion. However, by more precisely identifying the mechanisms, we hope that our work can be used to differentiate between and quantify models of forward guidance, which in turn can then be used for policy analysis and counterfactuals.

Finally, our paper relates to a much broader literature on central bank communication and how this communication shapes household expectations and decision-making. This literature has emphasized two general stylized facts. One is that households (and firms) are often inattentive to policy and relatively uninformed about macroeconomic aggregates. A second is that, despite this inattention, households' expectations about future aggregate conditions affect their decisions (see Coibion et al. 2018c for a survey of this literature). The results in this paper corroborate these two stylized facts but do so in the specific context of forward guidance. This growing body of evidence supports the recent interest among policy-makers in rethinking their communication strategies with

the broader public and suggests a need for more research to better understand the interplay between policy announcements and the decision-making process of economic agents.

The paper is organized as follows. Section 2 describes the survey and information treatments. Section 3 lays out our empirical methodology for characterizing how treatments affect expectations. Section 4 presents the empirical results while section 5 discusses them in the context of theory and broader policy discussions. Section 6 concludes.

2.   Data and Survey Design

This section describes our survey design to elicit inflation expectations, the various treatments, and provides descriptive statistics for a range of expectations and perceptions. We first detail the Nielsen Homescan panel on which we run the survey and then provide more information on the structure of the survey.

2.1 Nielsen Panel

In March, June, and September of 2019, we fielded three waves of the *Chicago Booth Expectations and Communications Survey* inviting participation by all household members in the Kilts-Nielsen Consumer Panel (KNCP). The KNCP represents a panel of approximately 80,000 households that report to Nielsen (i) their static demographic characteristics, such as household size, income, ZIP code of residence, and marital status, and (ii) the dynamic characteristics of their purchases, that is, which products they purchase, at which outlets, and at which prices. Panelists update their demographic information at an annual frequency to reflect changes in household composition or marital status.

Nielsen attempts to balance the panel on nine dimensions: household size, income, age of household head, education of female household head, education of male household head, presence of children, race/ethnicity, and occupation of the household head. Panelists are recruited online, but the panel is balanced using Nielsen's traditional mailing methodology. Nielsen checks the sample characteristics on a weekly basis and performs adjustments when necessary.

Nielsen provides households with various incentives to guarantee the accuracy and completeness of the information they report. These incentives include monthly prize drawings, providing points for each instance of data submission, and engaging in ongoing communication with households. Panelists can use points to purchase gifts from a Nielsen-specific award catalog. Nielsen structures the incentives to not bias the shopping behavior of their panelists. The KNCP has a

retention rate of more than 80% at the annual frequency. Nielsen validates the reported consumer spending with the scanner data of retailers on a quarterly frequency to ensure high data quality and filters households that do not report a minimum amount of spending over the previous 12 months.

2.2 Chicago Booth Expectations and Communication Survey

Nielsen runs surveys on a monthly frequency on a subset of panelists in the KNCP, the online panel, but also offers customized solutions for longer surveys. Retailers and fast-moving consumer-good producers purchase this information and other services from Nielsen for product design and target-group marketing. At no point of the survey did Nielen tell their panelists that the survey we fielded was a part of academic research which minimizes the concerns of survey demand effects.

In summer 2019, we designed a customized survey consisting of 34 questions in total in cooperation with Nielsen, the *Chicago Booth Expectations and Communication Survey*. The survey also contains 22 different information treatments, one placebo treatment as well as one control group. Our survey design builds on the Michigan Survey of Consumers, the New York Fed Survey of Consumer Expectations (SCE), the Dutch National Bank's Household Survey as well as D'Acunto et al. (2018), Coibion, Gorodnichenko and Weber (2019), and Coibion et al. (2018c).

Nielsen fielded the first wave of the survey in March of 2019. The survey sample was 92,982 households. 26,929 individuals (from 24,886 households) responded for a response rate of 26.80% and an average response time of 19 minutes and 35 seconds. The second and third waves were slightly shorter, consisting mostly of follow-up questions, with median response times of about 19 minutes and 28,580 unique respondents for the second wave (June 2019; 16,726 participated in the initial wave) and 15,912 unique respondents for the third wave (September 2019; 8,152 participated in the initial wave). Nielsen provides weights to ensure representativeness of the households participating in the survey.

The initial wave of the survey covers a wide range of questions. First, respondents are presented with a series of questions about their demographic characteristics, which are more detailed relative to the basic demographic information the KNCP provides. We collect information on employment status, current occupation, financial constraints, savings and portfolio choice, homeownership status, past spending behavior in various categories including expenses that are not covered in the KNCP, and we identify the primary shopper of the household among all the responding members (D'Acunto et al. 2019). Participants are then asked a sequence of questions about their perceptions and expectations of inflation. We follow the design in the recent New York Fed Survey of Consumer Expectations (SCE)

and ask specifically about inflation, because asking about prices might induce individuals to think about specific items whose prices they recall rather than about overall inflation (see Crump et al. (2015) for a recent paper using the SCE data). We first ask individuals about their perception of past inflation, that is, inflation over the previous 12 months. We then ask them about their expectations for 12-month-ahead inflation. We elicit a full probability distribution of expectations by asking participants to assign probabilities to different possible levels of the inflation rate. In addition, we also ask about the perception of the current unemployment rate and the expected unemployment rate in twelve months. Finally, we also ask survey participants on their expectations regarding interest rates on a 30-years fixed rate mortgage at the end of 2019, 2020, 2021, and in the next 5-10 years.

Subsequent waves largely follow the same structure but in a much shorter form. Hence, the follow-up surveys are primarily used to measure individuals' perceptions and expectations of inflation, mortgage rates, and the unemployment rate over time.

2.3 Treatments

After respondents answered the initial set of questions in the first wave, they were assigned to one of 24 groups: a control group, one placebo treatment group, and 22 treatment groups. We designed the treatments to disentangle the effects of different possible types of forward guidance. We vary the target that is communicated: we not only communicate inflation forecasts or expected future policy rates but we also vary the length of the forecast horizon, the exact information of the forecast, central tendency, upper range, or lower range, or all jointly, as well as different combinations. Moreover, some survey participants only received information about current/past rates. The latter treatments allow us to study the extent to which individuals might have differential responses to backward-looking vs. forward-looking information. We also fielded a placebo treatment to differentiate true learning from spurious anchoring effects. Each group consists of approximately 1/24th of the total sample that received the survey and the treatments are randomly assigned. Appendix Table 3 confirms that assignment of treatment was not predictable by respondents' observable household and individual characteristics.

Our choice of treatments is motivated by a number of practical and theoretical considerations. Central banks often give forward guidance directly about the future path of their policy instrument, the fed funds rate (FFR) in the US, with the goal to influence contemporaneous long-term interest rates via the expectations hypothesis for interest rates, i.e. changing financial market participants' expectations of future short-term interest rates should be reflected in current

long term interest rates. The transmission to the real economy then occurs because these long-term rates affect households' and firms' borrowing decisions and the purchase of durable goods and investment goods as the introductory quotes by former and current ECB President Draghi and Lagarde indicate. Theoretically, forward guidance typically operates through affecting household expectations of inflation and the consumer Euler equation (Eggertson and Woodford 2003). Promises to keep interest rates low until after the end of the liquidity trap will be inflationary in the future and hence, households should already update upwards their inflation expectations today which during the liquidity trap period will translate into lower real rates and stimulate consumption. Therefore, we directly provide treatments about the future path of interest rates and inflation to study whether forecasts for inflation or the path of interest rates are more effective in moving individuals' expectations. Moreover, given that central banks mainly focus on a transmission mechanism through financial markets and household borrowing, we also directly study the reaction of individuals' expectations regarding future mortgage rates and contrast the effects with the reaction of inflation expectations that are the focus in the academic literature and in virtually all models used in leading central banks.

Empirically, forward guidance appears to be less powerful than standard theory predicts, a phenomenon commonly referred to as the forward guidance puzzle (Del Negro et al. 2015, D'Acunto et al. 2019a). Recent theoretical attempts (e.g., Woodford 2018, Gabaix 2019, Farhi and Werning 2019) at resolving this puzzle that emerges in a representative agent New Keynesian model propose deviations from rational expectations as a possible resolution of the puzzle. While the exact microfoundations differ, they all attribute an important role to some form of limited cognition on the part of the decision maker. These models attribute lower effectiveness of communication in the future on current day expectations to the fact that the agents in the model either do not plan that far into the future or they discount the information heavily. While we do not aim to disentangle the exact mechanism at play, the treatments with different horizons for the provided information can help assess whether these models are broadly consistent with the data.

In the data, inflation expectations of households are widely dispersed suggesting some form of information friction. Given the evidence that many individuals are not well informed about the prevailing inflation rate and the possibility that agents form expectations adaptively, we also provided treatments that only informed households about the current inflation rate and policy rate. We then compare the reaction in forecasts to treatments about past, future or both pieces of information to better understand whether forward- or backward-looking expectations are a better description of

expectations on average. The large cross-sectional component of our sample also allows us study which type of individuals might have either forward- or backward-looking expectations.

Mortgage rates play a key role in the practice of monetary policy, yet central bankers typically do not directly communicate about future mortgage rates or inflation. D'Acunto et al. (2018b) find many households do not change their borrowing behavior to in response to changes in policy rates, possibly because they do not understand the implications of changes in policy rates on their borrowing rates. We also directly provided some households with information about future mortgage rates to see whether direct communication about interest rates that are of direct interest to households might be more effective in guiding households' expectations and decision making.

Randomized-controlled trials have gained interest in recent empirical macro studies yet it is not clear how the provision of information of one macro variable jointly affects agents' forecast for other variables that also affect economic behavior. Andre et al. (2019) find many households differ in their reaction to fundamental shocks compared to the reaction of experts and models because they follow a 'good-bad' heuristic in the sense that households consider several macroeconomic variables jointly. Empirically, Coibion et al. (2019) find in an information provision experiment that households with exogenously higher inflation expectations lowered their overall consumption after the treatment because their overall economic outlook became more negative. Our setting allows up to study whether treatments about inflation or interest rates might be a more promising communication tools for central bank to stimulate household spending because we can directly compare their effects on expectations but crucially also study in a systematic fashion how these treatments affects individual expectations about inflation, mortgage rates, household income and other variables jointly.

Table 1 summarizes treatments. Specifically, the treatments are: (T3) the current fed funds rate (FFR); (T4) the current FFR and the *high* path forecast by the FOMC for 2019, 2020, 2021, and the long run; (T5) the current FFR and the *low* path forecast by the FOMC for 2019, 2020, 2021, and the long run; (T6) the current FFR and the *central* path forecast by the FOMC for 2019, 2020, 2021, and the long run; (T7) the current FFR and the 2019 *central* projection; (T8) the current FFR and the 2019 *high* projection; (T9) the current FFR and the 2019 *low* projection; (T10) the current FFR and the 2019 and 2020 *central* projections; (T11) the current FFR, the 2019 *central* projection, and the 2020 *high* projection; (T12) the current FFR, the 2019 *central* projection, and the 2020 *low* projection; (T13) the current FFR and the 2019, 2020, and 2021 *central* projections; (T14) the current FFR and the 2019 and 2020 *central* projections, and the 2021 *high* projection; (T15) the

current FFR and the 2019 and 2020 *central* projections, and the 2021 *low* projection; (T16) the current FFR, the 2019, 2020, and 2021 *central* projections, and the *high* long-run forecast; (T17) the current FFR, the 2019, 2020, and 2021 *central* projections, and the *low* long-run forecast; (T18) the current FFR, average rates in 2015, 2016, and 2017, and the *central* path forecast by the FOMC for 2019, 2020, 2021, and the long run; (T19) the current FFR and the average rates in 2015, 2016, and 2017; (T20) the current CPI inflation rate (1.8%); (T21) the average annual CPI inflation rate over the years 2016 to 2018 (1.6%); (T22) the current CPI inflation rate and the expected inflation rate by the FOMC for 2019, 2020, 2021, and the longer run (1.8%, 1.9%, 2.1%, 2.1%, and 2.0%); (T23) the current CPI inflation rate and the FOMC inflation target (1.8% and 2.0%); (T24) the average current 30-years fixed rate mortgage rate (4.6%). Importantly, when we provided the different paths, we only mentioned that these reflected one forecast by the Federal Reserve and never mentioned whether it corresponded to the high, central, or low path. Also note that we use only Fed forecasts to avoid potential heterogeneity in the responses due to differences in the credibility of sources (see Coibion, Gorodnichenko and Weber 2019). As placebo treatment we provided the actual fact that the U.S. population grew by 2.2% between 2015 and 2017. We report the treatments as part of the overall survey in the Online Appendix.

Following each treatment (as well as for the control group), respondents were again asked about their inflation forecasts and perceptions, but this time in the form of a point estimate to avoid them having to answer the exact same question twice. This allows us to measure the instantaneous revision in expectations (if any) after the information treatments compared to the control group. The treatments were only applied in the first wave of the survey. In subsequent waves, respondents were again asked for their inflation expectations and perceptions, but questionnaires were identical across all respondents in the two follow-up waves. The first follow-up was three months after the initial wave and the second follow-up was after six months.

2.4 Preliminary Facts and External Validity

Table 2 shows descriptive statistics on consumer perceptions and expectations, both from the raw data and Huber-robust moments that filter out outliers, with reference to inflation, unemployment, and nominal mortgage interest rates. The first panel (Pre-treatment data) displays unconditional statistics before any information treatment is provided. For completeness, the second panel (Post-treatment data) shows statistics collected after the information experiment. However, these are not directly comparable to pre-treatment statistics as they are aggregated over various groups receiving different treatments and

the control group. To provide further insights into the heterogeneity of responses across consumers, we plot the distributions of (pre-treatment) perceptions and expectations about inflation and unemployment rates (Figure 1) and the distribution of expectations about interest rates (Figure 2).

The (robust) mean of perceived inflation over the 12 months preceding the survey is 2.88% (i.e. almost 1 percentage point higher than the official inflation rate). This is in line with evidence from various consumer surveys according to which consumers tend to over-estimate actual inflation (see, e.g., D'Acunto et al. 2019). As can be seen by the distribution of perceived inflation (Panel A, Figure 1), a non-trivial fraction of respondents reports focal values in excess of 10% also in line with previous work (D'acunto et al. 2018a, 2019b).

To measure expected inflation we use the probabilistic type of question asked by the NY FED SCE in which respondents are invited to assign probabilities over a range of inflation/ deflation bins.[3] The expected inflation (12 months ahead) implied from the reported probability distribution is 1.64%. Comparable moments from the NY Fed's SCE and Michigan Survey of Consumers were 2.8% and 2.9% respectively while professional forecasters were predicting CPI inflation of 2.3%. This figure is not immediately comparable to the one regarding past inflation due to the different way that the two questions are asked (point estimates vs. probability bins). This difference is also evident in the distribution of implied means of expected inflation (Panel B, Figure 1) that is smoother than the corresponding one for perceived inflation. When we use post-treatment point predictions for the control group in the initial wave, we find that the Huber-robust average expected inflation is 2.24% and the (raw) average expected inflation is 4.8%, which brings our survey closer to other surveys.

We also ask about the perception of the current unemployment rate in the U.S. and the expected unemployment rate twelve months ahead. The mean perceived and expected unemployment rates are 4.76% and 5.32%, respectively, above the national unemployment average (3.8%). The distribution of answers (Figure 1, panels C and D) show these averages mask a significant amount of cross-sectional heterogeneity.

Moreover, the survey asks consumers about current and expected nominal interest rates with reference to a fixed rate 30-year mortgage. Mortgages with a 30-year fixation period represent the most popular mortgage product in the U.S., accounting for more than 70% of mortgages originated over the period 2013-2016.[4] In our survey, respondents are asked to provide an estimate of the

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[3] Probabilistic-type questions allow deducing, apart from the implied mean expectation, the implied variance that denotes, in this context, consumer-specific inflation uncertainty.

[4] According to data from the National Mortgage Database program, jointly managed by the Federal Housing Finance Agency (FHFA) and the Consumer Financial Protection Bureau (CFPB).

nominal interest rate for such a mortgage both at the time of the interview and over different time horizons (i.e. one year ahead; two years ahead; three years ahead; and in the next five to ten years).[5] The robust mean of the (perceived) current mortgage rate is 4.55% and the median is 4.80%. These moments are comparable to those derived from a similar question asked in the SCE (median: 4.3%; mean: 5.2%).[6] Moreover, they are in line with Freddie Mac Primary Mortgage Market Survey, according to which the interest rate for a 30-year fixed rate mortgage was on average between 4.06% and 4.41% in March 2019.[7]

The expected mortgage rate one year ahead is 4.90% (i.e. 35 basis points higher, on average, than the perceived one at the time of the interview). As regards longer horizons, expected interest rates rise, on average, to 5.28%, 5.53% and 5.93% with reference to two years ahead, three years ahead and next five to ten years, respectively. This implies that consumers expect somewhat higher mortgage rates in future periods. These trends are well aligned with the respective ones recorded in the SCE. More specifically, in the SCE the expected rate changes for one year ahead and three years ahead, compared to the current ones, are on average, 37 and 130 basis points, respectively (the counterpart figures in our survey are 35 and 98 basis points).

In Appendix Figure 1 and Appendix Table 1, we show various correlations between inflation expectations (one year ahead) and other expectations asked in our survey. The raw data suggest a positive association between expected inflation and expected mortgage interest rate one year ahead, yet considerable heterogeneity exists in this pattern. To this end, we examine not only how consumers respond to (exogenously) elevated inflation and nominal interest rate expectations but also to updates in the real rate expectations. The raw data also suggest some positive association with the national unemployment rate, both expected and perceived at the time of the survey.

In short, our survey results of Nielsen panelists are broadly consistent with those of other surveys of households. Average levels of perceived and expected inflation, interest rates and unemployment are somewhat higher than actual levels and, most strikingly, display large amounts of cross-sectional heterogeneity. Unlike other surveys however, our results are based on a much larger

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[5] Prior to our information treatments we ask respondents to give their estimates of the current and future (over different horizons) "interest rates on a fixed-rate 30-year mortgage for someone like you". To avoid repeating the same wording post-treatment, we ask this question with reference to "someone with excellent credit score". Not surprisingly, reported interest rates to the latter question are somewhat lower to the pre-treatment ones, however they are not statistically different if one compares them for the control group.

[6] In February 2019, the SCE asked the following question: 'Assume that you applied for a 30-year fixed-rate mortgage today. What mortgage rate do you think you would qualify for?'; source: https://www.newyorkfed.org/medialibrary/interactives/sce/sce/downloads/data/frbny_sce_housing_chartpacket2019.pdf

[7] The survey is conducted over mortgage lenders originating loans in the U.S. See FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/MORTGAGE30US

cross-section of households (approximately 25,000 vs 1,500 in the SCE and 500 in the MSC) and allow for randomized information treatments that generate *exogenous* variation in beliefs.

3. Econometric framework

We now consider how randomized information treatments affect the beliefs of households. Because the pre-treatment expectations are on average close to actual values of mortgage, unemployment, and inflation rates, providing households with information about actual values should have little effect on *average* beliefs. As a result, simply regressing forecast revisions on treatment indicator variables is not a fruitful avenue to estimate the effect of information provision on households' beliefs. Instead, we follow Coibion, Gorodnichenko and Weber (2019) and Coibion et al. (2019) and use the following specification:

$$X_j^{post} = \alpha X_j^{pre} + \sum_{k=2}^{24} \beta_k \, Treatment_j^{(k)} + \sum_{k=2}^{24} \gamma_k \, Treatment_j^{(k)} \times X_j^{pre} + W_j \psi + error_j, (1)$$

where j indexes respondents, X is a measure of expectations, pre denotes expectations measured before treatment, $post$ denotes expectations measured after treatment, $Treatment_j^{(k)}$ is an indicator variable equal to one if individual j is provided with treatment k, W is a vector of household/ individual characteristics.[8] Intuitively, this specification assesses whether households put more or less weight on their prior beliefs in forming their posteriors depending on whether they are provided with new information or not. As discussed in Coibion, Gorodnichenko and Kumar (2018), Bayesian updating of information implies that γ_k should be negative because respondents' posterior beliefs are a weighted average of their prior beliefs and a signal. Furthermore, γ_k should be more negative for more informative/ credible treatments, i.e., the weight on the prior is smaller. Coefficients β_k (the "level" effects) may be positive or negative depending on where a signal is relative to the initial belief.

While estimating specification (1), we use sampling weights to correct for possible imbalances in the sample. Because expectations can take extreme values, we use Huber-robust regressions to minimize the adverse effects of influential observations and outliers. Whether we include controls in specification (1) affects only the precision of the estimates because the assignment of treatment is random. To conserve space, we report results with controls in the Online Appendix. To maximize

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[8] Individual characteristics are gender, age, age squared, employed indicator, unemployment indicator, and race. Household characteristics are household income (binned; indicator variable for each bin), household size (indicator variable for each size), census region (indicator variable for each region), male head education (indicator variable for each group), female head education (indicator variable for each group).

statistical power and improve readability of our results, we estimate specification (1) with some treatments aggregated to coarser groups.

Note that coefficient α measures the persistence of expectations for the control group. Although one may naturally expect $\alpha = 1$ for post-treatment beliefs measured shortly after pre-treatment beliefs are elicited (the control group receives no information), the design of the survey as well as the nature of survey responses can result in estimates of α different from one. First, pre- and post-treatment responses even in the control group can differ because respondents may have noise in their responses and one may expect some mean-reversion in responses. Second, because households participating in surveys do not like responding to the same question twice, we formulate pre- and post-treatment questions differently. For example, to elicit inflation expectations before treatments, we ask respondents to assign probabilities to a range of bins for possible inflation outcomes. We use the reported probability distributions to compute the implied mean for expected inflation. In contrast, we gather the post-treatment inflation expectations as point predictions. Because responses may vary with the design of the survey questions (e.g., Bruine de Bruin et al. 2017), one may obtain $\alpha \neq 1$.

Because survey responses can take implausible values, we drop few extreme observations. Specifically, for inflation forecasts we drop responses of 100% or -100% for point predictions and responses that put 100% probability on a large deflation (more than 12% deflation). With these filters we drop 1% of the sample. We drop observations with perceived/ expected mortgage rates that are greater than 50% (drop less than 0.1% of the sample) and we censor mortgage rates at 30% if the responses are between 30% and 99% (applies to approximately 2% of the sample). We recode unemployment responses as missing when perceive/ expected unemployment rate is greater than 30% (drop 11% of the sample).

4. Treatment Effects of Different Communication Tools

In this section, we present and discuss how different treatments affect the inflation expectations of individuals. To preserve space, we focus on the reaction of expectations immediately after the treatment and relegate results for beliefs in follow-up waves to the Online Appendix.

4.1 Mortgage rate expectations

Given that mortgages are the most important form of credit for U.S. households, we study how forward guidance changes consumers' expectations about this key rate. We report results of estimating specification (1) on perceived/ expected nominal mortgage rates in Table 3. Survey

questions about mortgage rate expectations are similar both pre- and post-treatment and, consequently, the slope linking pre-treatment expectations to post-treatment expectations for the control group is close to one ($\hat{\alpha} = 0.996$), indicating that measurement error in these expectations is quite small (as this would bias estimated α below one). The placebo treatment (T2)—apprising respondents of the population growth over the last few years (approximately 2 percent)—has an "anchoring" effect on mortgage rate expectations, but this effect is generally small.

Providing households with information on the current average mortgage rate (T24) has a large effect on how households perceive the current mortgage rate. Effectively, the post-treatment belief is reset to the provided statistic (the slope is -1 and the intercept is equal to the provided magnitude). However, as we increase the forecast horizon, the slope gradually increases (i.e., becomes less negative) and the level effect (measured with β) decreases. This pattern suggests that the treatment is strongly informative about current conditions in the mortgage market but—in agreement with results in Coibion, Gorodnichenko and Weber (2019) and Coibion, Gorodnichenko and Ropele (2020)—its informativeness declines with the forecast horizon: the estimated slope γ moves from -1 for the nowcast (column 2 of Table 3) to -0.565 for the longer-run horizon (column 10 of Table 3).

To appreciate the significance of these magnitudes, it is instructive to compare the strength of the response to the treatment with information about the current policy rate (T3). The slope of the revision (γ) for the nowcast is only -0.374 which is roughly a third of the revision one gets when households are treated with information about actual mortgage rates. For the longer run, the corresponding figures are -0.183 for T3 vs. -0.565 for T24. Similar to results for T24, the absolute size of the revision relative to the control group ($|\gamma|$) decreases with the forecast horizon. We conclude that informing households about current mortgage rates rather than current policy rate is much more powerful for influencing households' expectations and perceptions about current and future mortgage rates.

Treating households with information about future policy rates has stronger effects on perceived mortgage rates (Panel A of Figure 3) than treating households only with information about the current policy rate. Although we observe variation in the size of revisions ($\hat{\gamma}$) across treatments within a horizon, there is little difference between short (e.g., 1-year-ahead) and long (e.g., 3-year-ahead) forward guidance for households' nowcast of mortgage rates. As we increase the forecast horizon to year 2020 (Panel B, Figure 3), 2021 (Panel C, Figure 3) and longer run (Panel D, Figure 3), the differences in estimated slopes between treatments with current policy rates

only vs. future policy rates generally shrink (Appendix Table 6). In fact, we find that providing households with information about current or future policy rates results in similar revisions of longer-run forecasts for mortgage rates.

Note that varying the magnitude of FFR at the end of the provided forward guidance horizon does not generate a systematic pattern for the response of mortgage rate expectations in terms of slope (γ) or level (β) effects. In other words, going from a central-high path (e.g., T7) to a central path (T8) to a central-low path (T9) does not yield a monotonic change in estimated γ and β. This finding is important because this kind of variation can tell us about the credibility/ informativeness of various policy paths (more negative values of γ mean higher credibility/precision of provided information) as well as the magnitude of the signal relative to initial beliefs (larger values of β suggest that a signal is above initial beliefs) holding the horizon of forward guidance constant.

Informing households about current, past and future inflation rates also has an effect on perceptions and expectations of mortgage rates. For example, the size of $\hat{\gamma}$ for T20 (treatment with information about the current inflation rate) is similar to the size of $\hat{\gamma}$ for forward-guidance treatments. However, there is heterogeneity in the size of the response across inflation treatments. For example, informing households about the current and projected path of the inflation rate over the next three years (T22) generates $\hat{\gamma}$ nearly 50 percent smaller than $\hat{\gamma}$ for T20. As we increase the forecast horizon for mortgage rates, the estimated γ's for inflation treatments become more uniform across treatments. Furthermore, the effect of inflation treatment becomes increasingly similar to the effect of forward-guidance treatment as we increase the forecast horizon for mortgage rates (Figure 4). Specifically, the effects of pooled treatments at the longer horizon (5 years after 2019) are nearly identical for treatments with forward-guidance, inflation, or current rates (Panel D, Figure 4).

We conclude that while supplying consumers with information about the future path of policy rates is helpful in managing perceptions and expectations about mortgage rates, one can move perceptions/expectations about this key consumer loan rate even more by other means. Specifically, information about current mortgage rates is most powerful at short horizons. Alternatively, one can apprise households of inflation which is as effective as providing households with information about current or future FFR. We also observe a small (if any) marginal effect of supplying consumers with information about the policy rate beyond the one-year-horizon. Finally, consistently positive values of estimated β suggest that provided information contains signals greater in magnitude than what households expect to observe in these signals.

4.2 Inflation expectations

Perceived/ expected inflation and interest rates are positively correlated in our data and so treatments about interest rates may affect inflation expectations as well as nominal interest rate expectations, making the effect on real interest rates a priori ambiguous. To explore how/ whether households' inflation expectations respond to different treatments, we estimate specification (1) on inflation expectations and report estimated coefficients in columns (1) and (2) of Table 4. The first row of column (2) in Table 4 shows that the coefficient on the pre-treatment beliefs of the control group is 0.215. This low magnitude likely reflects mean-reversion in the responses as well as differences in the design of survey questions eliciting post-treatment (point predictions, which are much more variable) and pre-treatment (based on probability distributions over a fixed set of bins with possible outcomes for inflation) expectations. Nonetheless, the coefficient is highly statistically significant and points to a strong correlation between post- and pre-treatment inflation expectations for the control group. Panel A of Appendix Figure 2 contrasts the revision of inflation expectations for the control and T2 groups. We find no significant difference for the estimated slope (γ) for the placebo group (T3), but there is an anchoring effect as the coefficient on the indicator variable for this treatment (β) is positive and statistically significant.

Consistent with Coibion, Gorodnichenko and Weber (2019), we find that treatment with information about past inflation (T20 and T21) yields a strong downward revision in inflation expectations: the estimated level and slope effects are negative (see Panel B of Appendix Figure 2). Informing people about the average inflation rate over the last three years rather than the last year makes no material difference for the estimated effects: both lead to strong revisions in expectations toward the provided signal. In a similar spirit, providing respondents with past inflation and inflation projected by the Fed (T22: path of projected inflation; T23: average value of inflation over the next three years) is no different from providing respondents only with past inflation. Thus, the marginal value of treating households with information about inflation in earlier years or with inflation forecasts appears to be small in terms of moving inflation expectations.

Treatment T3 (which informs respondents about the current policy rate) has an estimated effect similar to what we observe for treatments providing information about inflation. These effects are consistent with the view that respondents make inferences about the current inflation rate from the level of the current policy rate. Specifically, a low policy rate appears to signal that inflation is low. Interestingly, informing households about the current mortgage rate (treatment T24) does *not* move inflation expectations.

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Adding a year of forward guidance on future policy rates (treatments T7, T8, T9) leads to estimates similar to those for treatment T3 (current FFR rate), i.e. significant revisions in inflation expectations in the same direction as the provided treatment. Moreover, providing households with a low path of future policy rate (i.e., 2.4% in treatment T9 instead of 2.8% in the central path in T7 or 3.1% in the high path in T8) results in a weaker weight on the prior beliefs (coefficient γ becomes more negative), although we can we cannot reject equality of the estimates across T7, T8, and T9. Adding yet another year of forward guidance (treatments T10, T11, T12) appears to induce respondents to put an even lower weight on their priors, which suggests that households treat this information as more precise. Again, this effect is the strongest for the trajectory that provides the low value (2.4%) of FFR in 2020, while the effect is the weakest for the trajectory that provides the high value (3.1%) of FFR in 2020. Hence, a one-year-ahead forecast for policy rates seems to help to reduce variation in inflation expectations relative to the case when only the current policy rate is provided.

Providing information about policy rates projected for 2021 (three years ahead; T13, T14, T15) or longer run (T16, T17) does not result in material improvements in the precision of signals as perceived by households: the estimated slopes (weight on the priors) tend to be similar to the estimated slopes for treatments that provide only the current rate or forward guidance up to two years. We also observe that low-path treatments do not generate lower weights on priors (i.e., estimated γ is more negative) relative to high-path treatments. Note that treatments T16 and T17 use central path for years up to "longer run" and vary only the policy rate forecast at the "longer-run" horizon. To assess how the whole path of low- vs. high-trajectory policy rate forecasts influence inflation expectations, we use treatments T4, T5, and T6 that give respondents a consistently high, low, or central tendency of the Fed forecast. We find that the results for these treatments are similar to the results for treatments T16 and T17. Hence, within the range of more-than-three-year trajectories we consider, the specifics of a trajectory do not appear to have a tangible difference for how households revise their inflation expectations. Furthermore, we find that treatment T19 (policy rates for the current period, previous three years, next three years and longer run) is perceived as the most informative (γ is the most negative) among the treatments that provide households with information about policy rates (Panel D of Appendix Figure 2). These revisions are larger than for the treatment that only provides current and future rates (treatment T18). This result suggests that providing households with some historical background on policy decisions is potentially effective in moving inflation expectations. We also note that the estimated level effects β are generally negative suggesting that signals are below what households expect to see.

To maximize statistical power, we aggregate treatments into coarser groups. Panel A of Figure 5 illustrates that informing households about the policy rate influences inflation expectations: the fitted line for this aggregated group is flatter than the line fitted for the control group. However, informing households about inflation (future/past values) tends to be more powerful (the slope of the fitted line is the smallest). Panel B of Figure 5 also demonstrates that there is relatively little variation in the effect of treatments across the horizons and there is little value in providing households with information about policy rates more than two years out.

4.3 Real interest rate expectations

The revision of interest rate expectations in response to inflation treatments—a key result in Section 4.1—suggests that households recognize a positive correlation between nominal interest rates and inflation. Given that households also revise their inflation expectations in response to forward-guidance treatments (previous section), we have evidence of causality flowing both ways: from inflation expectations to expectations about nominal interest rates and vice versa. A key question is therefore how the real interest rate—a central variable for consumer choices—responds to the treatments.

We measure the real interest rate as the expected/perceived nominal mortgage rate at a given horizon minus the one-year-ahead inflation forecast. Because we have pre- and post-treatment expectations for nominal mortgage rates and the inflation rate, we can estimate specification (1) for real interest rates. We report estimated coefficients in Table 5 and visualize the effects for aggregated treatments in Figure 6 and Figure 7.

Similar to the responses for inflation and forward-guidance treatments on inflation and nominal interest rate expectations, our treatments dampen the variation in post-treatment beliefs about real interest rates relative to the corresponding pre-treatment variation, i.e., estimated γ's are generally negative ($\hat{\gamma}$ for the placebo group is generally small and does not exhibit any particular pattern across forecast horizons). We also find that providing information about future policy rates beyond the one-year horizon leads to no material differences relative to the case where only current rates or one-year-ahead forecast for policy rates are provided (Figure 6).

However, there are some important differences. First, the magnitude of this effect is smaller relative to the magnitudes of this effect for inflation and nominal rate expectations, i.e., $|\hat{\gamma}|$'s are larger in the latter cases. This reflects the fact that when households revise their nominal interest

rate expectations downwards, they also tend to revise their inflation expectations downward albeit by less (and vice versa), so that their real interest rate expectations are less sensitive to news. This could reflect an "information effect" in forward guidance: lower future interest rates do not signal that monetary policy will be more accommodative (since this would be associated with higher expectations of inflation) but rather than the low interest rates will be a response to weaker inflationary pressures (hence the simultaneous reduction in inflation expectations). This type of information effect for professional forecasters has similarly been documented in Nakamura and Steinsson (2018).

Second, the size of the effect for real rates does not decline with the horizon as strongly as it does for inflation and nominal rate expectations. Thus, the treatments appear to shift the whole "yield curve" for expected real rates. Finally, estimated γ's are similar across forward-guidance, inflation, and current/ past rate treatments but we observe that the level effects (measured with β's) are consistently positive with the largest level effects observed for inflation treatments. This likely reflects the fact that information treatments with respect to inflation generally lead to larger revisions in beliefs than those with respect to interest rates. This suggests that, to the extent that policy-makers are ultimately trying to shape real interest rates via forward guidance announcements, providing information about the future desired outcome (inflation) may be more powerful than providing information about the future instrument (interest rates), as suggested in Angeletos and Sastry (2019) in the case when general equilibrium feedbacks are important.

4.4 Unemployment rate expectations

The fact that forward guidance about interest rates moves not just expectations about interest rates but also about inflation is of course illustrative of a broader point, which is that agents form their expectations about macroeconomic conditions jointly. Information treatments should not necessarily be expected to only alter the expectations regarding the treated but could affect households' broader economic outlook. How they respond to forward guidance could therefore reflect not just real interest rates but also income effects. For example, Kamdar (2018) and Coibion et al. (2019) provide evidence of this type of effect.

To assess whether this is an important consideration in this setting, we estimate specification (1) for expectations about the unemployment rate. Columns (3) and (4) in Table 4 report estimated β's and γ's for the treatments. Note that because the structure of the questions eliciting

unemployment expectations before treatments (expected unemployment rate at the end of 2019) and after treatments (expected unemployment rate in 12 months) is much closer than the counterparts for inflation expectations, we observe that the link between post- and pre-treatment expectations for the control group is tight: $\hat{\alpha} = 0.984$ in specification (1) is close to one. The placebo treatment (T2) has no statistically significant estimate for slope γ. While some treatments have a statistically significant effect on unemployment rate expectations (see also Appendix Figure 3), the quantitative importance of these effects is relatively small and there is no consistent pattern in the revisions. Generally, there is little difference between treatment and control groups even for cases with differential treatment effects. For example, treatment T6 (current fed fund rate and central-tendency forecast for the fed fund rate over the next 3 years and beyond) has a modest effect on the revisions of expectations for unemployment rate. Indeed, when we pool treatments by type of information (forward guidance; inflation; current/past interest rates; see Panel A, Figure 8) or by the horizon of forward guidance (Panel B, Figure 8), we see no difference between a treatment group and the control group. In short, these results suggest that for the specific information treatments considered here, the main interaction in the expectations formation process is between nominal interest rates and inflation, with little feedthrough from these expectations into households' views about unemployment.

4.5 Persistence of treatment effects

Previous research (e.g., Coibion, Gorodnichenko and Weber 2019, Cavallo, Cruces, and Perez-Truglia 2017) documents that information treatments have short-lived effects on households' expectations. We generally find a similar pattern in our results although the comparison across waves is complicated by many treatments (i.e., we estimate many coefficients and some variation can be attributed to sampling errors in the estimates) and differences in the design of survey questions (e.g., inflation expectations are elicited as point prediction immediately after the treatment while in the follow-up waves inflation expectations are based on reported probability distributions).[9] Specifically, for inflation and unemployment, the weight on the prior belief (α for the control group and γ's for other groups) decreases as time passes after the initial wave (see Appendix Table 9 and Appendix Table 12). On the other hand, treatment effects have longer-lasting effects on nominal mortgage rate expectations: we do not observe clear declines in α and γ between the first and second follow-up and estimated γ's are broadly similar for expectations measured immediately after

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[9] We find no systematic evidence of attrition being related to treatments (Appendix Table 4).

the treatment and those measured in the second follow-up six months later. The response of perceptions/expectations on real interest rate largely inherit the properties of nominal mortgage rates. These results suggest that while households may forget information about unemployment and inflation, information about mortgage rates has much longer lasting effects on expectations. One interpretation of this result is that depending on the desired persistence of the effect of forward guidance, policy-makers may want to target different variables in their announcements: inflation for larger but short-lived effects and interest rates for more persistent effects.

4.6 Heterogeneity in treatment effects

Jonung (1981), D'Acunto, Malmendier and Weber (2019) and others document that households have highly heterogeneous expectations with some of this variation linked to demographics (e.g., Bryan and Venkatu 2001; see also Appendix Table 5), cognitive capacity (D'Acunto et al. 2018a, 2019b), shopping experience (e.g. D'Acunto et al. 2018), and other characteristics. One may conjecture that the reaction to information treatments should be heterogeneous as well. Indeed, theories of rational inattention emphasize costs and benefits of collecting and interpreting signals and these costs/ benefits could vary across households. As a result, one may anticipate that, for example, a consumer who plans to buy an expensive durable good should have stronger incentives to be well-informed and thus potentially exhibit a different (likely smaller) response in their expectations to an information treatment.[10]

We generally find little variation in the means of pre-treatment beliefs across demographic groups but there are statistically significant (yet relatively small in economic terms) differences in high-order moments (disagreement, uncertainty). For example, we find that households who plan to buy a durable good in the next 12 months have similar means for expectations and perceptions relative to households without such a plan, but their disagreement is smaller (Appendix Table 2). When we estimate the response of expectations to information treatments across different groups (Appendix Table 8), we fail to find any systematic or economically significant differences across groups. "Planning" households do not respond systematically more or less to treatments relative to

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[10] The strength of the reaction could be ambiguous, however. For example, if a high-incentive consumer is already informed, he may respond little to the provided information because he has a strong prior. This weak reaction could be similar to a weak response of a consumer who is poorly informed and not interested in receiving/interpreting information. On the other hand, if information is new and valuable to an informed consumer, he should immediately incorporate it into his beliefs. In contrast, a disinterested consumer will continue to exhibit a weak reaction.

"non-planning" households.[11] This pattern is consistent with the results in Coibion, Gorodnichenko and Weber (2019) who also do not find systematic variation in responses to information treatments across demographic groups.

4.6. Effects on consumer sentiment

Our results suggest that information treatments have a strong effect on expectations of both nominal interest rates and inflation and therefore on perceived real interest rates. Economic theory predicts that changes in the latter should affect households' consumption and saving decisions, thereby giving policymakers a powerful lever over the economy. Specifically, by varying the real interest rate, policymakers can influence consumption choices of households: an increase in the real interest rate should depress consumer spending contemporaneously. To establish whether this prediction is borne out by the data, we follow Coibion et al. (2019) and estimate the following regression:

$$Y_j^{post} = \phi_1\left(E_j^{post}i - E_j^{post}\pi\right) + \phi_2\left(E_j^{pre}i - E_j^{pre}\pi\right) + W_j\kappa + error_j, \tag{2}$$

where j indexes respondents, pre and $post$ indicate the timing of measurement for decisions/expectations, Y is a dummy variable to one if a respondent says that now is a good time to buy a durable good,[12] Ei is the expected mortgage rate in the end of 2020, $E\pi$ is the one-year-ahead inflation forecast, W is a vector of household/ individual characteristics. As discussed in Coibion et al. (2019), estimating specification (2) with OLS is problematic because of mean-reversion in responses and other forms of endogeneity. To address this issue, we estimate specification (2) with instrumental variables (IV) approach where the first stage is given by specification (1). In this case, coefficient ϕ_1 yields a causal effect of changing expectations about real interest rates on consumer sentiment. That is, the IV approach helps us isolate exogenous variation in beliefs due to the randomized provision of information so that we can rule out endogenous co-movement in expectations and sentiment.[13]

In contrast to earlier work studying the effects of expectations on consumption, we have different types of treatments which can induce differential responses to changes in expectations. For example, Coibion, Gorodnichenko and Weber (2019) and Coibion, Gorodnichenko, and Ropele

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[11] Because the number of treatments is large, we cannot decompose effects by group within each type of treatment due to limited number of observations. Instead, we provide results for sub-groups using pooled treatment effects (e.g. those receiving any type of information treatment about interest rates or any type of information treatment about inflation).

[12] We choose consumer sentiment as the outcome variable because it maximizes the sample size and consumer sentiment predicts actual consumer spending (Carroll, Fuhrer, and Wilcox 1994.)

[13] To deal with outliers and influential observations in IV estimation of specification (2), we adopt the jackknife procedure described in Appendix C of Coibion et al. (2019).

(2020) document that economic agents can interpret provided information as signaling demand-side or supply-side forces and therefore, depending on the interpretation, associate changes in inflation with either a contracting or expanding level of economic activity. To control for this possibility, we estimate specification (2) separately for each type of treatment (that is, we aggregate treatments to coarser categories) and report results for each type of information treatment in Table 6. In addition, we report results (column 4) for the case when we estimate specification (2) on the full sample, i.e., we put together all treatment indicator variables (aggregated to coarser categories) and their interactions in specification (1) and allow coefficients β and γ in the first stage to vary across aggregated treatments but we restrict coefficients in specification (2) to be the same across treatments.

We find that, as we exogenously raise real interest rate expectations via information treatments, households are more likely to report that now is *not* a good time to buy a house, car, or appliance, as one might expect from theory. The economic magnitude of the effect is relatively large. A one-standard-deviation increase in the expected real interest rate (2.15) reduced the probability of reporting that now is a good time to buy any durable (column 4, Panel D) by $-0.05 \times 2.15 \approx 0.11$ which is tangible given that the mean and standard deviation for outcome variable are 0.61 and 0.49 respectively. We also observe that the effect depends on the source of variation in expectations. For example, relative to the inflation treatment, the forward-guidance treatment generates variation in real interest rate expectations that more strongly affects the "good time to buy" outcome for houses (Panel A) and cars (Panel B) and less strongly for appliances/electronics (Panel C), although the differences are not statistically significant. Hence, consistent with theory and reduced form evidence in D'Acunto et al (2018c), exogenous increases in expectations about real interest rates inhibit consumer spending on durable goods and policy tools relying on management of expectations have an effect on both expectations and actions of households.

5   Discussion

Our results speak directly to an extensive literature on the effects of forward guidance. One implication of our results is that, contrary to the common wisdom that financial markets are the main mechanism through which forward guidance affects the economy, forward guidance can also have strong effects directly via households' expectations. In our experiments, market interest rates are largely the same across all treatment groups, yet the provision of information about either inflation or interest rates leads to a change in households' expectations and ultimately a change in whether they believe that now is a good time to buy durable goods. In other words, even in the

absence of a financial transmission mechanism, communications about interest rates or inflation that reach households can affect economic outcomes. Furthermore, the magnitude of this channel can be important: the revision in households' expectations about interest rates and inflation in our treatments are quite large.

Another interesting result for policy-makers is that the horizon of the guidance matters: for households, information about distant interest rates has little effect on beliefs compared to information about current or near-term interest rates. This is the opposite of the usual intuition for financial markets. Market participants are generally confident in their very short-run predictions of future interest rates but much less so in their longer-run forecasts. In the face of news, they should therefore place higher weights on their prior beliefs about the short-run than about the long-run, implying that signals about the long-run should move beliefs and financial assets more than signals about the short-run. We find instead that households respond much more to guidance about near-term interest rates than those in the distant horizon.

Underlying this characteristic is that, unlike financial markets, households are quite uninformed about the current level of interest rates, as documented in Table 1. Our forward guidance treatments therefore affect expectations in two ways. First, they provide information about the current level of interest rates. Second, they provide information about future changes in interest rates. The high elasticity of beliefs with respect to treatments about current or near-term interest rates relative to what we find for guidance about more distant interest rates suggests that the former is a much more powerful force when it comes to households' expectations.

Finally, we also document that nominal interest rate expectations and inflation expectations on the part of households are positively correlated, both unconditionally in the cross-section but also conditionally on information treatments. When households receive news that interest rates are or will be higher than they expected a priori, they revise both their expectations of future interest rates as well as their expectations of underlying inflation. The latter changes less than one-for-one with the former, however, meaning that households tend to revise their nominal and real interest rate expectations in the same direction.

One important caveat to these results, however, is that they speak to households' expectations revisions *conditional* on being directly provided with the information. Because many households may be unaware of policy announcements in real-time, ours are likely upper bounds on the potential direct effects of forward guidance treatments on households' expectations. Coibion et al. (2018) and D'Acunto, Hoang, and Weber (2019a) find little evidence of households' inflation

expectations responding to monetary policy announcements in the U.S. or abroad. Lamla and Vinogradov (2019) similarly argue that households' expectation appear to be invariant to policy decisions and announcements. In contrast, Lewis, Mertens, and Makridis (2019) use Gallup polling data and find some response of households' economic expectations to monetary policy decisions. While the degree to which households track monetary policy announcements therefore remains unestablished, the evidence strongly suggests that their degree of attention to macroeconomic news and policy is relatively limited. Achieving effects of the orders we estimate here would therefore likely require communications strategies on the part of central banks that pierce through households' veil of inattention more successfully than current ones.

6   Conclusion

Forward guidance is often thought to be a powerful tool to stimulate aggregate demand especially when policy rates are constrained by the effective lower bound on nominal interest rates and large central bank balance sheets constrain further asset purchase programs (e.g., Eggertsson and Woodford 2003). However, evidence on the mechanisms through which forward guidance affect economic outcomes remains limited, particularly looking beyond the direct financial market channel. In particular, evidence on how households' expectations respond to forward guidance announcements, which is the key mechanism in standard New Keynesian models, has been sorely lacking. This paper contributes to this area by providing clear causal evidence of how information about current and future interest rates affects households' expectations.

We implement a large-scale randomized trial on a representative sample of roughly 25,000 US households and find that communication about current and next period policy rates moves expectations as much as communicating about current inflation or mortgage rates. Communications beyond one or two years into the future, especially about policy rates, do not move expectations much at all, which suggests a much more limited effect for forward guidance than standard New Keynesian theory predicts but is consistent with historical evidence (Del Negro et al. 2015) as well as recent work emphasizing cognitive constraints of economic agents. Thus, our results support a growing body of evidence that limits on the information processing capacities of individuals can have pronounced economic effects.

We also study how exogenous variation in the expectations of one variable affects individuals' expectations about other macroeconomic variables. Consistent with information effects, we find that households revise their views about nominal interest rates and inflation in the same

direction, thereby dampening the response of real interest rates to new information. This can provide an additional rationale for the forward guidance puzzle.

Finally, our results have implications for the design of forward guidance, such as the optimal horizon to provide guidance over or whether policy-makers should provide guidance about future instruments or targets. With respect to the former, our results indicate that information about shorter horizons are much more effective in altering the expectations of households since they also impart information about the current levels of variables, which households are otherwise quite uninformed about. With respect to the latter, we find that the persistence of treatment effects on expectations differs significantly depending on which variable households are being informed about. Above and beyond the strength of general equilibrium effects emphasized in Angeletos and Sastry (2019), whether forward guidance policy should be done in terms of interest rate announcements or inflation targets may therefore also depend on how persistent or transient policy-makers would like the policy intervention to be.

The literature on the forward guidance puzzle has exclusively focused on trying to reduce the implied effects of forward guidance in theoretical models to conform to the empirical evidence of its effects. However, perhaps part of the puzzle comes instead from its implementation by policy-makers: alternative designs and strategies for forward guidance could yield much larger effects. With a better understanding of how to design forward guidance in a way that maximizes its effect on expectations, one might resolve the forward guidance puzzle in the opposite direction: by making its empirical effects rise to the levels predicted by standard theory.

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Table 1. Description of treatments.

| Treatment | Horizon of provided information | | | | | | | | |
| | Current | Future years | | | | Past years | | |
		'19	'20	'21	LR	'15	'16	'17
T2 (Population growth)	2.2%							
T3 (Current FFR)	2.5%							
T4 (FG: LR high)	2.5%	3.1%	3.6%	3.6%	3.5%			
T5 (FG: LR low)	2.5%	2.4%	2.4%	2.4%	2.5%			
T6 (FG: LR central)	2.5%	2.8%	3.1%	3.0%	2.8%			
T7 (FG: 1yr central)	2.5%	2.8%						
T8 (FG: 1yr high)	2.5%	3.1%						
T9 (FG: 1yr low)	2.5%	2.4%						
T10 (FG: 2yr central)	2.5%	2.8%	3.1%					
T11 (FG: 2yr central-high)	2.5%	2.8%	3.6%					
T12 (FG: 2yr central-low)	2.5%	2.8%	2.4%					
T13 (FG: 3yr central)	2.5%	2.8%	3.1%	3.0%				
T14 (FG: 3yr central-high)	2.5%	2.8%	3.1%	3.6%				
T15 (FG: 3yr central-low)	2.5%	2.8%	3.1%	2.4%				
T16 (FG: LR central-high)	2.5%	2.8%	3.1%	3.0%	3.5%			
T17 (FG: LR central-low)	2.5%	2.8%	3.1%	3.0%	2.5%			
T18 (FG: LR central + past FFR)	2.5%	2.8%	3.1%	3.0%	2.8%	0.1%	0.4%	1.0%
T19 (Current FFR + past FFR)	2.5%					0.1%	0.4%	1.0%
T20 (Inflation last year)	1.8%							
T21 (Average inflation over last 3 years)							1.6%	
T22 (Inflation last year + 3yr ahead inflation path forecast)	1.8%	1.9%	2.1%	2.1%	2.0%			
T23 (Inflation last year + 3yr ahead inflation average forecast)	1.8%		2.0%					
T24 (Current mortgage rate)	4.6%							

Notes: the table shows information provided in each treatment. FFR is fed funds rate. FG is forward guidance.

Table 2. Descriptive statistics.

	Robust moments		Moments		
	Mean	St. Dev	Mean	Median	St. Dev
	(1)	(2)	(3)	(4)	(5)
Pre-treatment data					
Perceived inflation, previous 12 months	2.88	2.41	7.41	3.00	13.23
Expected inflation, 12-month ahead	1.64	2.56	1.75	1.36	5.13
Perceived unemployment rate, current	4.76	2.16	13.26	5.00	17.09
Expected unemployment rate, 12-month ahead	5.32	2.79	13.57	6.00	16.95
Perceived interest rate on a saving account in a bank, current	1.29	0.99	3.91	1.50	9.25
Perceived and expected mortgage rate					
Current	4.55	1.19	7.13	4.80	8.63
End of 2019	4.90	1.44	7.59	5.00	8.74
End of 2020	5.28	1.65	8.20	5.50	9.26
End of 2021	5.53	1.92	8.74	6.00	10.07
Next 5-10 years	5.95	2.35	9.78	6.00	11.71
Post-treatment data					
Expected inflation, 12-month ahead	1.89	1.54	4.06	2.00	9.63
Expected inflation, next 3-5 years	2.42	1.79	4.65	3.00	9.47
Expected unemployment rate, end of 2019	4.57	2.16	10.59	5.00	13.70
Expected unemployment rate, next 3-5 years	5.29	2.70	11.83	6.00	14.97
Perceived and expected mortgage rate					
Current	4.13	1.07	5.72	4.00	7.33
End of 2019	4.39	1.09	6.02	4.50	6.96
End of 2020	4.73	1.37	6.52	5.00	7.40
End of 2021	4.97	1.57	6.88	5.00	7.83
Next 5-10 years	5.36	1.90	7.70	5.50	9.24

Notes: pre-treatment expected inflation (12 months ahead) is computed as mean implied from the reported probability distribution over a range of bins. All other measures of inflation are reported as point predictions. Perceived and expected mortgage rates are elicited for "a person line you" at the pre-treatment stage and for " someone with excellent credit" at the post-treatment stage. Moments in columns (1) and (2) are computed using the Huber-robust method. The number of observations is 26,891.

Table 3. Posterior beliefs (nominal mortgage rates) by treatment.

Treatment	Current		one-year [2019]		two-year [2020]		Three-year [2021]		Longer run	
	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control	-0.193***	0.996***	-0.121***	0.968***	0.803***	0.767***	0.465***	0.843***	0.106*	0.921***
	(0.024)	(0.004)	(0.045)	(0.009)	(0.045)	(0.007)	(0.054)	(0.009)	(0.054)	(0.009)
Relative to control										
T2 (Population growth)	0.009	-0.008	0.447***	-0.115***	-0.318***	0.064***	0.293***	-0.057***	0.310***	-0.053***
	(0.041)	(0.007)	(0.058)	(0.010)	(0.064)	(0.010)	(0.074)	(0.012)	(0.078)	(0.012)
T3 (Current FFR)	1.540***	-0.374***	1.533***	-0.344***	1.442***	-0.300***	0.576***	-0.123***	0.886***	-0.183***
	(0.050)	(0.009)	(0.062)	(0.011)	(0.072)	(0.011)	(0.069)	(0.010)	(0.083)	(0.012)
T4 (FG: LR high)	2.287***	-0.542***	2.167***	-0.475***	1.343***	-0.271***	1.152***	-0.228***	1.708***	-0.326***
	(0.056)	(0.010)	(0.076)	(0.014)	(0.074)	(0.012)	(0.087)	(0.014)	(0.084)	(0.012)
T5 (FG: LR low)	0.917***	-0.230***	1.510***	-0.353***	0.825***	-0.190***	0.390***	-0.087***	1.356***	-0.277***
	(0.056)	(0.011)	(0.069)	(0.012)	(0.089)	(0.015)	(0.081)	(0.013)	(0.086)	(0.012)
T6 (FG: LR central)	2.343***	-0.562***	2.402***	-0.536***	1.965***	-0.419***	1.376***	-0.307***	0.737***	-0.167***
	(0.052)	(0.009)	(0.070)	(0.013)	(0.075)	(0.012)	(0.092)	(0.015)	(0.094)	(0.014)
T7 (FG: 1yr central)	0.141***	-0.026***	1.247***	-0.280***	1.259***	-0.256***	0.933***	-0.173***	1.610***	-0.291***
	(0.051)	(0.010)	(0.066)	(0.012)	(0.072)	(0.011)	(0.090)	(0.015)	(0.091)	(0.013)
T8 (FG: 1yr high)	1.754***	-0.415***	2.225***	-0.494***	0.972***	-0.207***	0.149*	-0.040***	0.930***	-0.171***
	(0.060)	(0.011)	(0.067)	(0.012)	(0.066)	(0.010)	(0.090)	(0.015)	(0.083)	(0.012)
T9 (FG: 1yr low)	1.445***	-0.353***	1.171***	-0.280***	1.020***	-0.219***	1.794***	-0.370***	0.546***	-0.112***
	(0.043)	(0.007)	(0.060)	(0.010)	(0.076)	(0.012)	(0.075)	(0.011)	(0.076)	(0.011)
T10 (FG: 2yr central)	0.816***	-0.210***	0.982***	-0.239***	-0.134**	0.015*	0.871***	-0.191***	1.214***	-0.234***
	(0.052)	(0.010)	(0.063)	(0.011)	(0.057)	(0.008)	(0.075)	(0.011)	(0.070)	(0.009)
T11 (FG: 2yr central-high)	0.737***	-0.189***	0.725***	-0.173***	-0.094	0.013	0.226***	-0.047***	0.610***	-0.116***
	(0.046)	(0.008)	(0.058)	(0.010)	(0.070)	(0.011)	(0.072)	(0.011)	(0.081)	(0.012)
T12 (FG: 2yr central-low)	0.973***	-0.244***	0.414***	-0.112***	-0.561***	0.110***	0.168**	-0.049***	0.984***	-0.215***
	(0.059)	(0.012)	(0.071)	(0.014)	(0.065)	(0.011)	(0.072)	(0.012)	(0.089)	(0.013)
T13 (FG: 3yr central)	1.622***	-0.389***	2.204***	-0.491***	1.090***	-0.233***	2.068***	-0.412***	1.675***	-0.328***
	(0.046)	(0.007)	(0.067)	(0.012)	(0.083)	(0.013)	(0.080)	(0.012)	(0.084)	(0.012)
T14 (FG: 3yr central-high)	2.622***	-0.626***	1.995***	-0.450***	1.599***	-0.331***	1.270***	-0.255***	2.507***	-0.471***
	(0.060)	(0.011)	(0.064)	(0.011)	(0.079)	(0.013)	(0.083)	(0.013)	(0.089)	(0.013)
T15 (FG: 3yr central-low)	1.361***	-0.341***	1.371***	-0.329***	1.189***	-0.268***	0.562***	-0.139***	1.034***	-0.219***
	(0.052)	(0.009)	(0.063)	(0.011)	(0.069)	(0.010)	(0.083)	(0.013)	(0.078)	(0.011)
T16 (FG: LR central-high)	0.580***	-0.155***	1.717***	-0.404***	0.597***	-0.134***	0.918***	-0.194***	1.704***	-0.330***
	(0.038)	(0.006)	(0.062)	(0.011)	(0.068)	(0.010)	(0.076)	(0.012)	(0.085)	(0.012)
T17 (FG: LR central-low)	2.943***	-0.694***	0.350***	-0.097***	1.962***	-0.406***	0.593***	-0.141***	0.697***	-0.162***
	(0.054)	(0.010)	(0.075)	(0.015)	(0.083)	(0.013)	(0.089)	(0.014)	(0.093)	(0.014)
T18 (FG: LR central + past FFR)	2.377***	-0.562***	0.903***	-0.213***	-0.024	-0.011	0.864***	-0.183***	0.755***	-0.164***
	(0.048)	(0.008)	(0.078)	(0.015)	(0.070)	(0.011)	(0.081)	(0.013)	(0.092)	(0.014)
T19 (Current FFR + past FFR)	2.101***	-0.513***	2.243***	-0.505***	1.025***	-0.225***	1.284***	-0.275***	1.956***	-0.374***
	(0.037)	(0.005)	(0.076)	(0.014)	(0.067)	(0.010)	(0.075)	(0.011)	(0.089)	(0.013)
T20 (Inflation last year)	1.768***	-0.413***	0.643***	-0.124***	0.111	-0.011	0.612***	-0.099***	0.761***	-0.143***
	(0.053)	(0.010)	(0.068)	(0.013)	(0.079)	(0.014)	(0.081)	(0.013)	(0.097)	(0.015)
T21 (Inflation last 3 years)	-0.001	-0.005	1.093***	-0.248***	0.245***	-0.046***	0.532***	-0.107***	0.780***	-0.138***
	(0.042)	(0.007)	(0.065)	(0.012)	(0.077)	(0.013)	(0.084)	(0.014)	(0.074)	(0.011)
T22 (Inflation last year + 3yr ahead inflation path forecast)	0.991***	-0.238***	1.128***	-0.248***	-0.013	-0.001	1.116***	-0.224***	1.053***	-0.203***
	(0.047)	(0.008)	(0.069)	(0.012)	(0.073)	(0.012)	(0.093)	(0.015)	(0.084)	(0.012)
T23 (Inflation last year + 3yr ahead inflation average forecast)	0.034	-0.002	0.470***	-0.110***	0.493***	-0.105***	-0.082	0.023*	0.707***	-0.140***
	(0.038)	(0.006)	(0.058)	(0.011)	(0.082)	(0.013)	(0.077)	(0.013)	(0.075)	(0.011)
T24 (current mortgage rate)	4.503***	-0.994***	4.657***	-0.969***	3.791***	-0.728***	3.443***	-0.646***	3.162***	-0.565***
	(0.042)	(0.006)	(0.057)	(0.010)	(0.069)	(0.011)	(0.082)	(0.013)	(0.078)	(0.011)
Observations	22,519		22,822		23,108		23,066		22,960	
R-squared	0.937		0.908		0.895		0.896		0.912	

Notes: The table reports estimates of coefficients in specification (1) for nominal mortgage rates for various horizons. All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

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Treatment	Inflation expectations		Unempl. rate expectations	
	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)
	(1)	(2)	(3)	(4)
Control	1.814***	0.216***	-0.066*	0.984***
	(0.050)	(0.014)	(0.035)	(0.005)
Relative to control				
T2 (Population growth)	0.158**	-0.022	-0.000	-0.002
	(0.076)	(0.021)	(0.055)	(0.008)
T3 (Current FFR)	-0.163**	-0.135***	-0.009	-0.002
	(0.078)	(0.020)	(0.055)	(0.008)
T4 (FG: LR high)	0.158**	-0.110***	1.026***	-0.234***
	(0.077)	(0.021)	(0.058)	(0.009)
T5 (FG: LR low)	-0.206***	-0.136***	0.864***	-0.222***
	(0.073)	(0.019)	(0.056)	(0.008)
T6 (FG: LR central)	-0.061	-0.108***	0.402***	-0.103***
	(0.074)	(0.019)	(0.062)	(0.010)
T7 (FG: 1yr central)	-0.144*	-0.097***	0.018	0.008
	(0.075)	(0.020)	(0.050)	(0.006)
T8 (FG: 1yr high)	-0.091	-0.100***	-0.031	0.007
	(0.075)	(0.019)	(0.050)	(0.006)
T9 (FG: 1yr low)	-0.180**	-0.123***	0.024	0.000
	(0.079)	(0.020)	(0.054)	(0.007)
T10 (FG: 2yr central)	-0.103	-0.177***	0.082	-0.010
	(0.075)	(0.020)	(0.056)	(0.008)
T11 (FG: 2yr central-high)	-0.052	-0.148***	-0.038	0.018***
	(0.076)	(0.019)	(0.050)	(0.006)
T12 (FG: 2yr central-low)	-0.041	-0.184***	-0.065	0.008
	(0.075)	(0.019)	(0.051)	(0.007)
T13 (FG: 3yr central)	-0.025	-0.139***	-0.021	-0.002
	(0.075)	(0.019)	(0.055)	(0.008)
T14 (FG: 3yr central-high)	0.004	-0.142***	0.033	0.003
	(0.076)	(0.020)	(0.052)	(0.007)
T15 (FG: 3yr central-low)	-0.032	-0.138***	-0.062	0.002
	(0.076)	(0.020)	(0.054)	(0.008)
T16 (FG: LR central-high)	-0.049	-0.155***	-0.033	0.004
	(0.077)	(0.020)	(0.055)	(0.007)
T17 (FG: LR central-low)	-0.086	-0.095***	-0.105**	0.013**
	(0.078)	(0.019)	(0.051)	(0.006)
T18 (FG: LR central + past FFR)	0.006	-0.151***	-0.042	0.013**
	(0.074)	(0.019)	(0.048)	(0.006)
T19 (Current FFR + past FFR)	0.117	-0.210***	-0.003	0.011*
	(0.078)	(0.019)	(0.052)	(0.006)
T20 (Inflation last year)	-0.153**	-0.174***	-0.044	0.009
	(0.067)	(0.017)	(0.050)	(0.006)
T21 (Inflation last 3 years)	-0.173**	-0.153***	-0.068	0.004
	(0.068)	(0.018)	(0.054)	(0.007)
T22 (Inflation last year + 3yr ahead inflation path forecast)	-0.080	-0.205***	0.707***	-0.164***
	(0.069)	(0.018)	(0.065)	(0.011)
T23 (Inflation last year + 3yr ahead inflation average forecast)	-0.165**	-0.149***	-0.087*	0.016***
	(0.071)	(0.018)	(0.048)	(0.006)
T24 (current mortgage rate)	-0.025	0.007	0.056	-0.003
	(0.079)	(0.020)	(0.055)	(0.007)
Observations	24,323		20,517	
R-squared	0.081		0.975	

Notes: The table reports estimates of coefficients in specification (1) for one-year-ahead inflation expectations (columns 1 and 2) and for one-year-ahead unemployment rate expectations (columns 3 and 4). Posterior unemployment rate expectations (point predictions) are for one-year ahead. Prior unemployment rate expectations (point predictions) are for "the end of 2019". Posterior inflation expectations are point predictions. Prior inflation expectations are measured as implied means from the reported probability distributions. All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Table 5. Posterior beliefs (real mortgage rates) by treatment.

Treatment	Current Intercept (b) (1)	Current Slope (γ) (2)	one-year [2019] Intercept (b) (3)	one-year [2019] Slope (γ) (4)	two-year [2020] Intercept (b) (5)	two-year [2020] Slope (γ) (6)	Three-year [2021] Intercept (b) (7)	Three-year [2021] Slope (γ) (8)	Longer run Intercept (b) (9)	Longer run Slope (γ) (10)
Control	1.280*** (0.057)	0.147*** (0.009)	1.531*** (0.058)	0.143*** (0.008)	1.705*** (0.063)	0.189*** (0.009)	1.897*** (0.064)	0.182*** (0.008)	2.199*** (0.073)	0.188*** (0.010)
Relative to control										
T2 (Population growth)	0.062 (0.090)	-0.029** (0.015)	-0.181* (0.092)	0.092*** (0.012)	-0.084 (0.101)	0.048*** (0.014)	-0.054 (0.102)	0.032** (0.013)	-0.080 (0.114)	0.004 (0.015)
T3 (Current FFR)	0.518*** (0.089)	-0.064*** (0.014)	0.544*** (0.090)	-0.041*** (0.013)	0.529*** (0.099)	-0.054*** (0.016)	0.494*** (0.103)	-0.035** (0.015)	0.798*** (0.118)	-0.097*** (0.015)
T4 (FG: LR high)	0.175** (0.088)	-0.050*** (0.014)	0.193** (0.091)	-0.037*** (0.013)	0.275*** (0.097)	-0.068*** (0.014)	0.293*** (0.098)	-0.075*** (0.012)	0.016 (0.113)	-0.011 (0.015)
T5 (FG: LR low)	0.581*** (0.091)	-0.097*** (0.015)	0.629*** (0.092)	-0.129*** (0.012)	0.683*** (0.098)	-0.155*** (0.013)	0.602*** (0.101)	-0.128*** (0.012)	0.554*** (0.115)	-0.129*** (0.014)
T6 (FG: LR central)	0.302*** (0.086)	-0.009 (0.014)	0.411*** (0.089)	-0.068*** (0.013)	0.284*** (0.093)	-0.043*** (0.014)	0.235** (0.097)	-0.033** (0.013)	0.141 (0.106)	-0.032** (0.014)
T7 (FG: 1yr central)	0.331*** (0.086)	-0.027** (0.012)	0.287*** (0.087)	-0.026** (0.012)	0.456*** (0.092)	-0.085*** (0.012)	0.551*** (0.097)	-0.075*** (0.013)	0.550*** (0.110)	-0.075*** (0.013)
T8 (FG: 1yr high)	0.337*** (0.093)	-0.066*** (0.016)	0.316*** (0.095)	-0.056*** (0.015)	0.377*** (0.099)	-0.079*** (0.015)	0.360*** (0.100)	-0.059*** (0.013)	0.312*** (0.109)	-0.057*** (0.012)
T9 (FG: 1yr low)	0.499*** (0.091)	-0.016 (0.013)	0.469*** (0.092)	-0.039*** (0.013)	0.474*** (0.099)	-0.049*** (0.014)	0.441*** (0.105)	-0.043*** (0.015)	0.183 (0.114)	0.030** (0.015)
T10 (FG: 2yr central)	0.483*** (0.088)	-0.047*** (0.013)	0.343*** (0.090)	0.001 (0.013)	0.510*** (0.098)	-0.070*** (0.014)	0.503*** (0.097)	-0.038*** (0.012)	0.209* (0.117)	0.029* (0.015)
T11 (FG: 2yr central-high)	0.445*** (0.091)	-0.103*** (0.013)	0.518*** (0.094)	-0.132*** (0.013)	0.618*** (0.099)	-0.162*** (0.013)	0.542*** (0.103)	-0.127*** (0.013)	0.457*** (0.114)	-0.090*** (0.014)
T12 (FG: 2yr central-low)	0.354*** (0.086)	-0.068*** (0.013)	0.315*** (0.089)	-0.084*** (0.013)	0.462*** (0.095)	-0.132*** (0.013)	0.388*** (0.099)	-0.107*** (0.014)	0.354*** (0.111)	-0.087*** (0.015)
T13 (FG: 3yr central)	0.605*** (0.089)	-0.122*** (0.013)	0.428*** (0.089)	-0.061*** (0.013)	0.505*** (0.095)	-0.088*** (0.013)	0.428*** (0.100)	-0.065*** (0.013)	0.426*** (0.113)	-0.070*** (0.015)
T14 (FG: 3yr central-high)	0.281*** (0.087)	-0.010 (0.015)	0.319*** (0.089)	-0.056*** (0.011)	0.403*** (0.092)	-0.076*** (0.012)	0.627*** (0.099)	-0.126*** (0.012)	0.343*** (0.111)	-0.033** (0.014)
T15 (FG: 3yr central-low)	0.440*** (0.090)	-0.087*** (0.014)	0.321*** (0.093)	-0.058*** (0.014)	0.482*** (0.098)	-0.129*** (0.013)	0.330*** (0.102)	-0.115*** (0.013)	0.268** (0.111)	-0.091*** (0.014)
T16 (FG: LR central-high)	0.426*** (0.089)	-0.080*** (0.013)	0.396*** (0.093)	-0.060*** (0.013)	0.447*** (0.097)	-0.089*** (0.012)	0.396*** (0.102)	-0.069*** (0.013)	0.330*** (0.115)	-0.051*** (0.015)
T17 (FG: LR central-low)	0.242*** (0.090)	-0.071*** (0.014)	0.340*** (0.093)	-0.119*** (0.012)	0.453*** (0.101)	-0.146*** (0.014)	0.491*** (0.103)	-0.149*** (0.013)	0.326*** (0.118)	-0.128*** (0.015)
T18 (FG: LR central + past FFR)	0.333*** (0.086)	-0.035*** (0.013)	0.221** (0.089)	-0.009 (0.013)	0.379*** (0.093)	-0.071*** (0.012)	0.321*** (0.098)	-0.050*** (0.012)	0.215* (0.111)	-0.031** (0.014)
T19 (Current FFR + past FFR)	0.514*** (0.091)	-0.131*** (0.014)	0.550*** (0.096)	-0.134*** (0.014)	0.562*** (0.101)	-0.136*** (0.015)	0.587*** (0.100)	-0.148*** (0.012)	0.630*** (0.115)	-0.151*** (0.014)
T20 (Inflation last year)	0.681*** (0.085)	-0.036** (0.015)	0.697*** (0.083)	-0.036*** (0.011)	0.762*** (0.091)	-0.062*** (0.014)	0.786*** (0.095)	-0.069*** (0.014)	0.713*** (0.113)	-0.056*** (0.016)
T21 (Inflation last 3 years)	0.688*** (0.080)	-0.046*** (0.014)	0.650*** (0.081)	-0.002 (0.012)	0.813*** (0.087)	-0.066*** (0.014)	0.769*** (0.094)	-0.037** (0.014)	0.848*** (0.106)	-0.049*** (0.014)
T22 (Inflation last year + 3yr ahead inflation path forecast)	0.758*** (0.082)	-0.082*** (0.013)	0.743*** (0.086)	-0.071*** (0.014)	0.758*** (0.090)	-0.064*** (0.014)	0.754*** (0.093)	-0.051*** (0.014)	0.719*** (0.105)	-0.043*** (0.014)
T23 (Inflation last year + 3yr ahead inflation average forecast)	0.707*** (0.084)	-0.076*** (0.013)	0.688*** (0.087)	-0.078*** (0.013)	0.721*** (0.092)	-0.083*** (0.013)	0.773*** (0.095)	-0.115*** (0.012)	0.648*** (0.109)	-0.085*** (0.013)
T24 (current mortgage rate)	0.175* (0.092)	-0.091*** (0.013)	0.162* (0.094)	-0.077*** (0.013)	0.224** (0.098)	-0.128*** (0.013)	0.209** (0.102)	-0.108*** (0.013)	0.097 (0.114)	-0.065*** (0.015)
Observations	24,202		24,170		24,184		24,234		24,227	
R-squared	0.107		0.135		0.157		0.159		0.202	

Notes: The table reports estimates of coefficients in specification (1) for real mortgage rates (nominal mortgage rate minus one-year-ahead inflation forecast) for various horizons.

All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses.

***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Table 6. Consumer sentiment as a function of real interest rate

	Type of treatment			
	Forward guidance	Inflation	Current/past interest rates	Pooled
	(1)	(2)	(3)	(4)
Panel A: Good time to buy a house				
Post-treatment $Ei - E\pi$	-0.071**	-0.020	-0.015	-0.026
	(0.031)	(0.030)	(0.026)	(0.019)
Pre-treatment $Ei - E\pi$	0.010**	0.002	-0.002	0.003
	(0.004)	(0.005)	(0.004)	(0.002)
Observations	17,071	5,378	3,384	23,114
R-squared	-0.044	0.045	0.065	0.029
1st stage F-statistic	16.87	48.94	36.12	38.51
Panel B: Good time to buy a car				
Post-treatment $Ei - E\pi$	-0.065**	-0.029	-0.045*	-0.047**
	(0.032)	(0.030)	(0.026)	(0.019)
Pre-treatment $Ei - E\pi$	0.012***	0.006	0.005	0.009***
	(0.004)	(0.005)	(0.004)	(0.003)
Observations	17,065	5,376	3,382	23,107
R-squared	-0.032	0.024	0.011	-0.000
1st stage F-statistic	15.62	49.34	36.12	37.56
Panel C: Good time to buy a large home appliance or electronics				
Post-treatment $Ei - E\pi$	-0.015	-0.058*	-0.016	-0.064***
	(0.032)	(0.030)	(0.026)	(0.019)
Pre-treatment $Ei - E\pi$	0.005	0.010**	0.002	0.011***
	(0.004)	(0.005)	(0.004)	(0.002)
Observations	17,087	5,375	3,385	23,099
R-squared	0.029	-0.008	0.055	-0.031
1st stage F-statistic	16.70	49.02	39.23	38.48
Panel D: Good time to buy a durable good				
Post-treatment $Ei - E\pi$	-0.093***	-0.072**	-0.005	-0.050***
	(0.030)	(0.030)	(0.028)	(0.019)
Pre-treatment $Ei - E\pi$	0.015***	0.011**	-0.001	0.010***
	(0.004)	(0.005)	(0.004)	(0.002)
Observations	17,071	5,370	3,387	23,081
R-squared	-0.107	-0.023	0.061	-0.001
1st stage F-statistic	18.39	48.19	37.52	37.21

Notes: The table reports instrumental variable (IV) estimates of coefficients ϕ_1 and ϕ_2 in specification (2). The first stage is given by specification (1). The dependent variable is equal to one if a respondent says that it is a good time to buy a particular durable good and zero otherwise. In Panel D, the dependent variable is equal to one if a respondent says that it is a good time to buy either house, car, or appliance/electronics. The treatment of outliers and influential observations is described in Appendix C of Coibion et al. (2019). The sample in column (1) includes only the treatment group and treatments classified as forward guidance treatments (T4-T19). The sample in column (2) includes only the treatment group and treatments classified as inflation treatments (T20-T23). The sample in column (3) includes only the treatment group and treatments classified as current/past interest rate treatments (T3, T19, T24). The sample in column (4) covers all treatment groups. In this column, coefficients ϕ_1 and ϕ_2 are restricted to be the same across treatment groups but coefficients β and γ in the first stage are allowed to vary across treatment groups. All regressions use sampling weights. Household/respondent controls are included but not reported. Robust standard errors are in parentheses. "1st stage F-statistic" reports the Cragg-Donald Wald F statistic for the first stage. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Figure 1. Distribution of pre-treatment perceptions and expectations of inflation and unemployment rates.
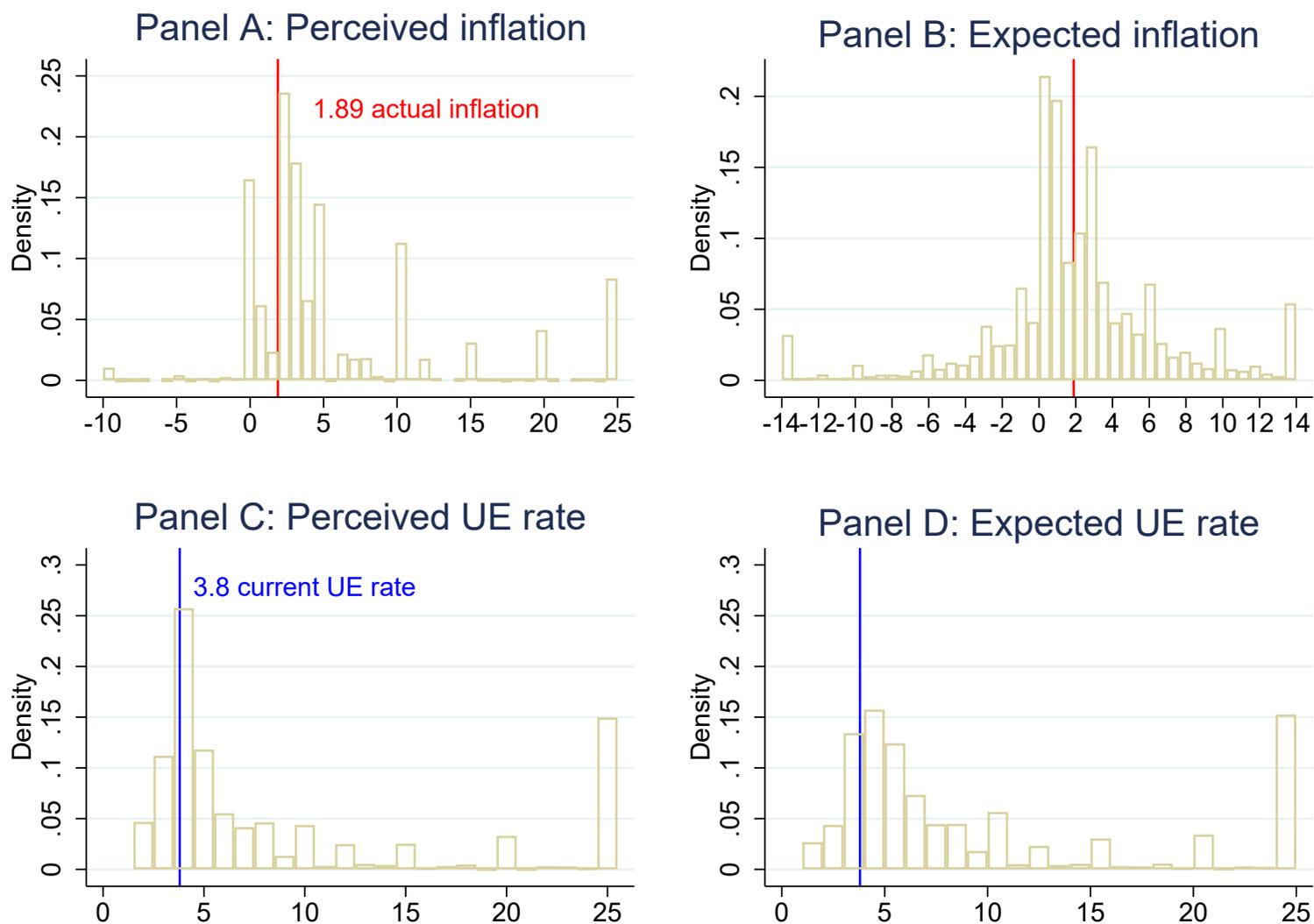
Notes: Unemployment (UE) rate expectations (point prediction) and perceptions (point prediction) are censored at 25 percent. Perceived inflation rate (point prediction) is censored at -10 percent and 25 percent. The blue vertical line shows actual unemployment rate at the time of the survey. The red vertical line shows actual inflation rate (over the previous 12 months) at the time of the survey. Expected inflation rate is based on the mean implied by the reported probability distribution for the one-year ahead inflation forecast. Expected unemployment rate is for the end of 2019.

Figure 2. Distribution of pre-treatment perceptions and expectations of interest rates.
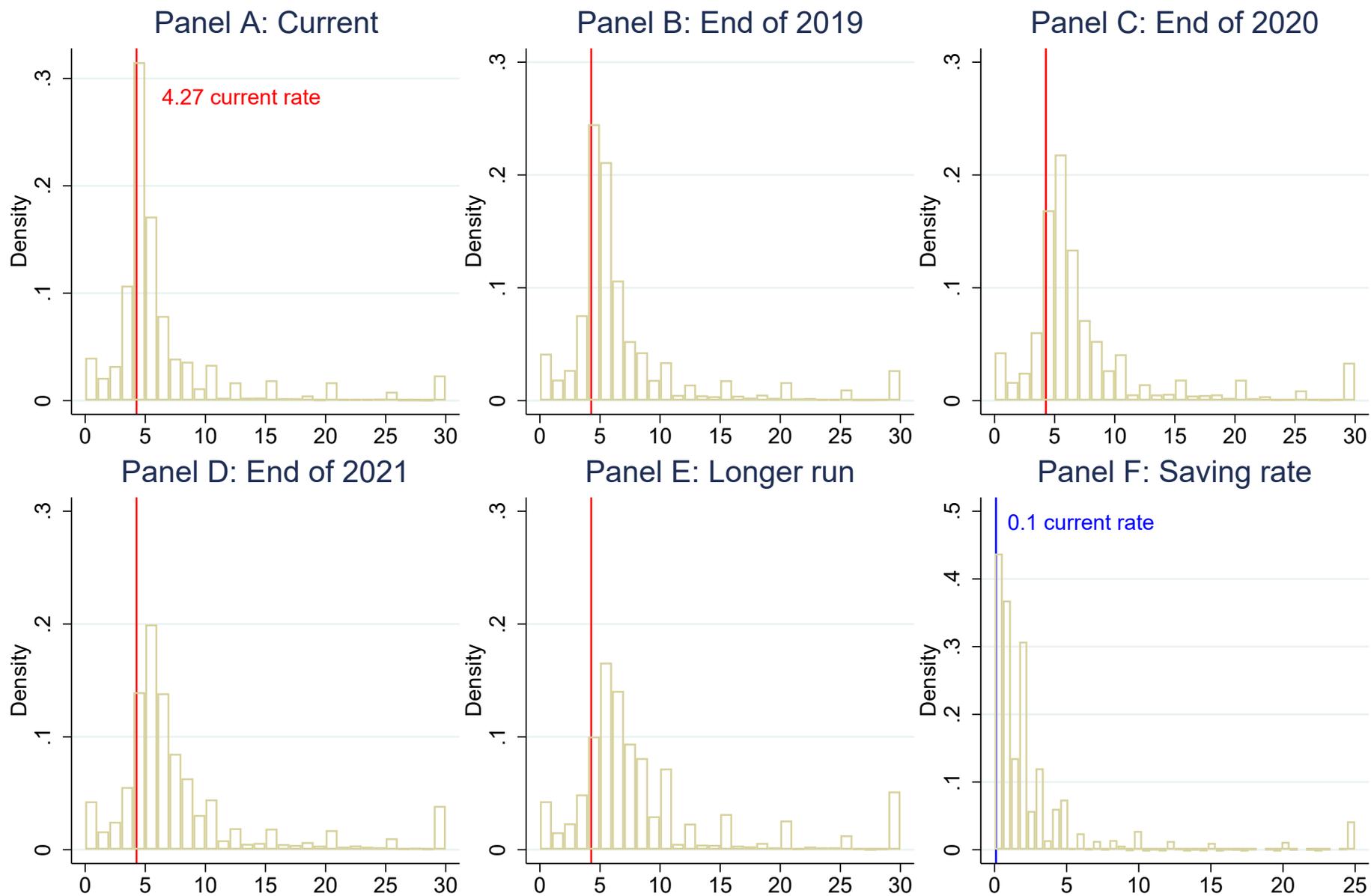
Notes: Panels A-E report perceptions and expectations for mortgage rates. Panel F reports perceptions for the rate on a saving account in a bank. Mortgage rates are censored at 30 percent. Saving rates are censored d at 25 percent.

Figure 3. Response of nominal mortgage rate expectations by the forecast horizon and the horizon of forward guidance (FG).
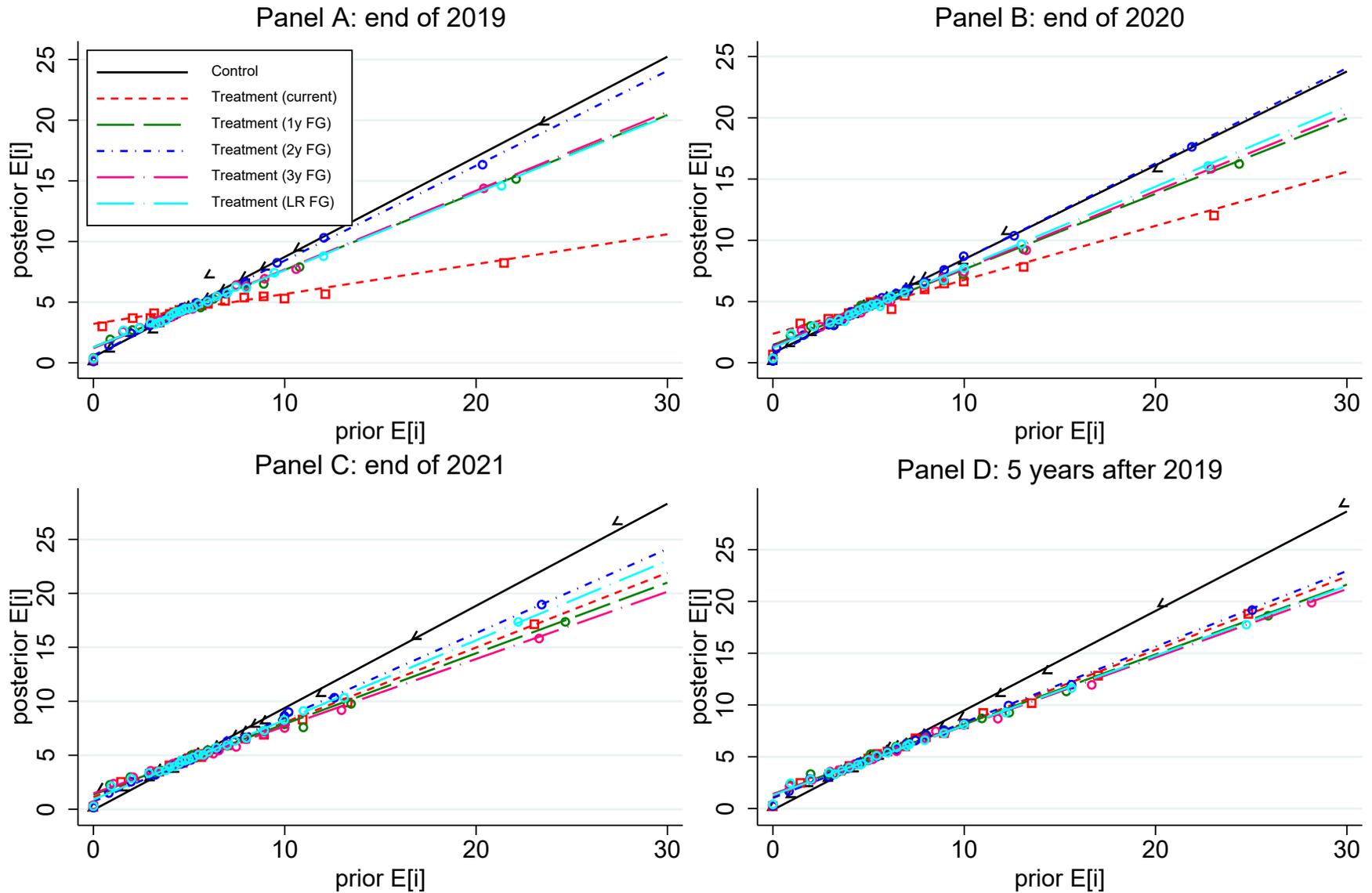
Notes: each panel shows binscatter plots for revisions in nominal mortgage rates when treatments are combined into information provision about current rates ("current": T3, T19, T24), 1-year forward guidance ("1y FG": T7, T8, T9), 2-year forward guidance ("2y FG": T10, T11, T12), 3-year forward guidance ("3y FG": T13, T14, T15), longer-run forward guidance ("LR FG": T4, T5, T6, T16, T17, T18). The title of each panel indicates the horizon of the forecasts for mortgage rates. Estimated regression coefficients are reported in Appendix Table 7.

Figure 4. Response of nominal mortgage rate expectations by treatment and horizon.
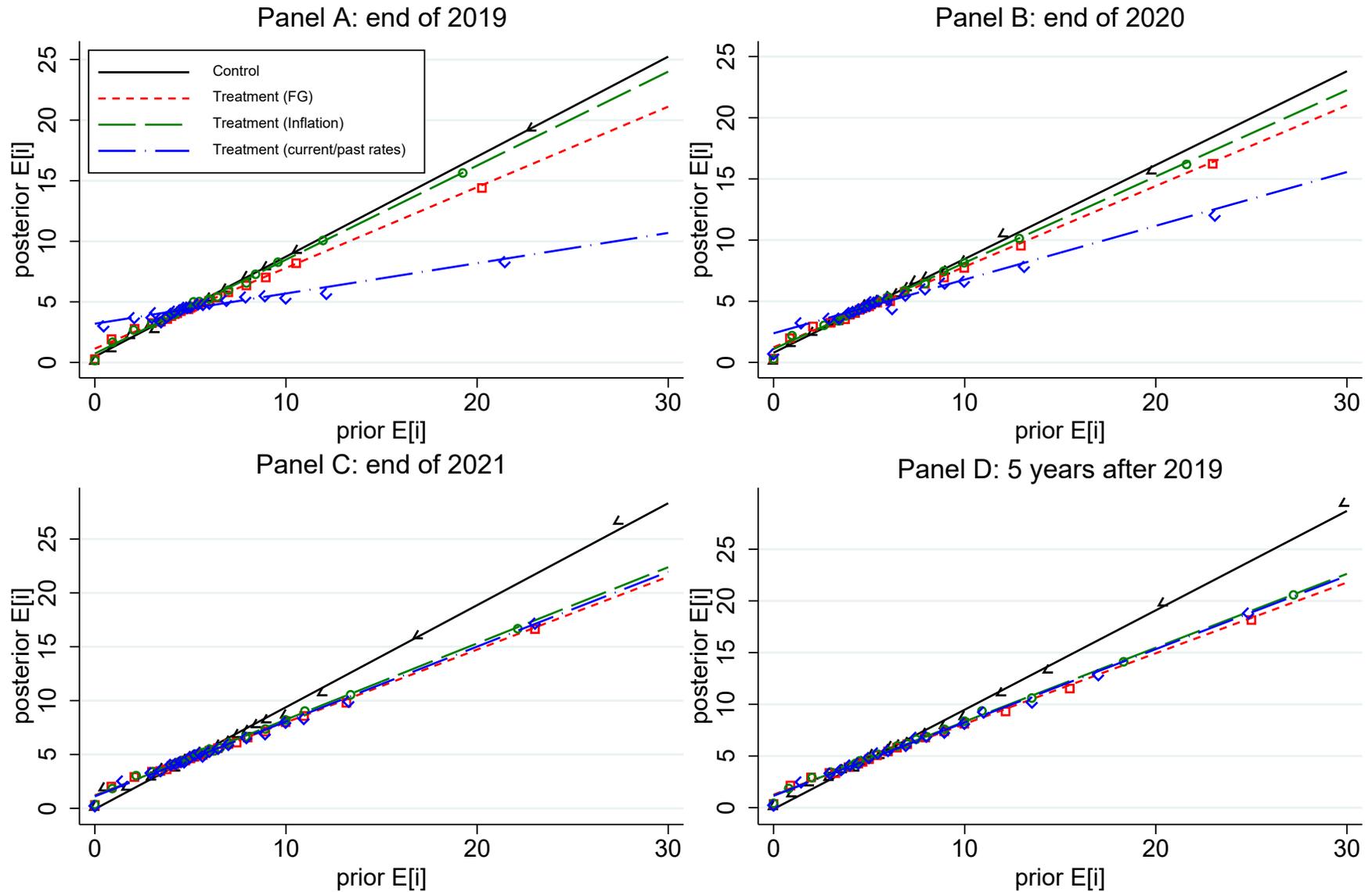
Notes: each panel shows binscatter plots for revisions in nominal mortgage rates when treatments are combined into information provision about current rates ("Current/past rates": T3, T19, T24), forward guidance ("FG": T4-T19), inflation ("Inflation": T20-T23). The title of each panel indicates the horizon of the forecasts for mortgage rates. Estimated regression coefficients are reported in Appendix Table 6.

Figure 5. Response of inflation expectations by treatment type and by the horizon of forward guidance.

Panel A: By treatment type

Panel B: By the horizon of forward guidance

Notes: Panel A shows binscatter plots for revisions in inflation forecasts when treatments are combined into forward guidance (T4-T19), inflation (T20-T23), and current/past interest rates (T3, T19, T24). Panel B shows binscatter plots for revisions in inflation forecasts when treatments are combined into information provision about current rates ("current": T3, T19, T24), 1-year forward guidance ("1y FG": T7, T8, T9), 2-year forward guidance ("2y FG": T10, T11, T12), 3-year forward guidance ("3y FG": T13, T14, T15), longer-run forward guidance ("LR FG": T4, T5, T6, T16, T17, T18). Estimated regression coefficients are reported in Appendix Table 6 and Appendix Table 7.

Figure 6. Response of real mortgage rate expectations by the forecast horizon and the horizon of forward guidance (FG).
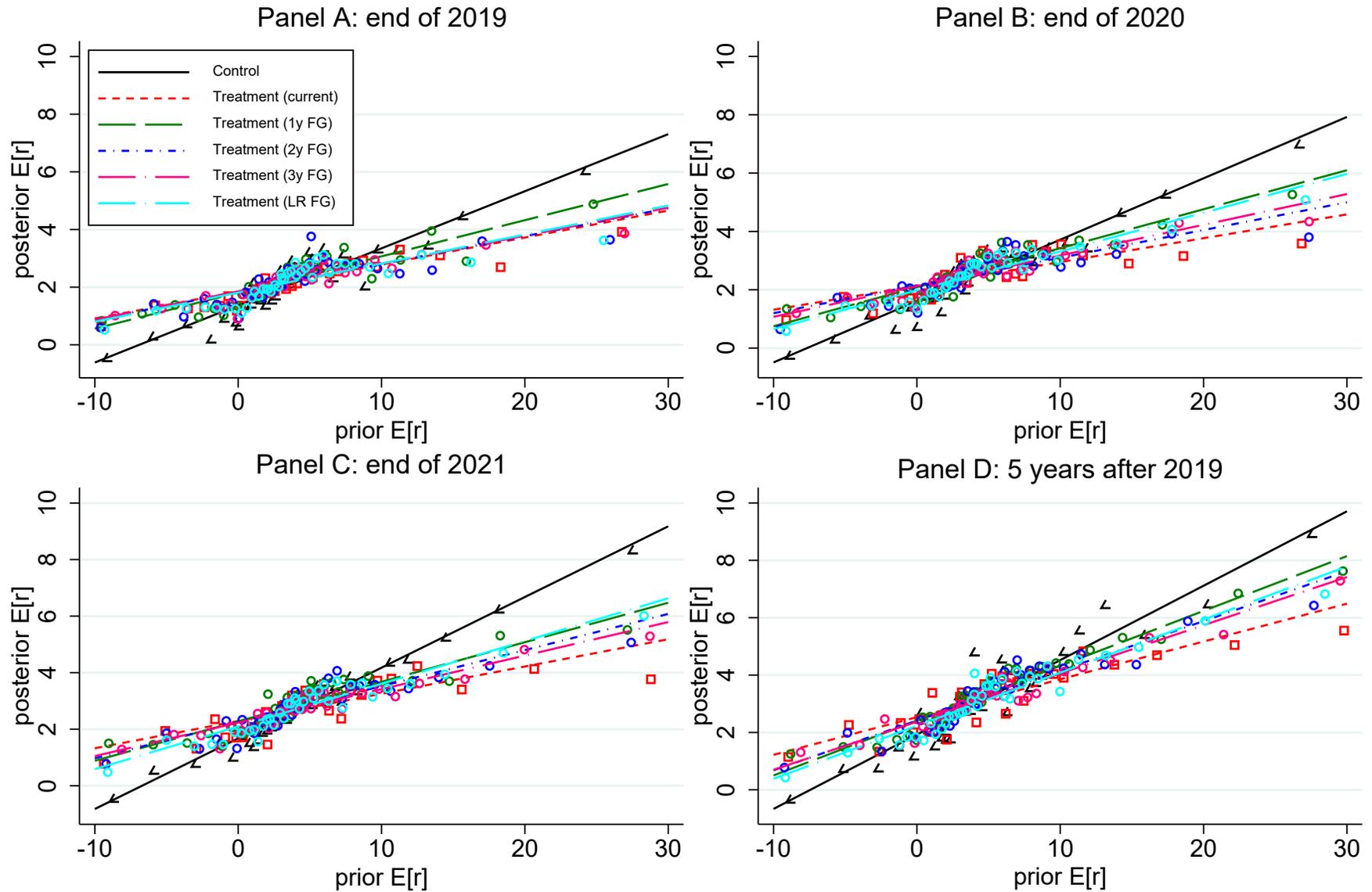
Notes: each panel shows binscatter plots for revisions in real mortgage rates (nominal mortgage rate minus one-year ahead inflation forecast) when treatments are combined into information provision about current rates ("current": T3, T19, T24), 1-year forward guidance ("1y FG": T7-T9), 2-year forward guidance ("2y FG": T10-T12), 3-year forward guidance ("3y FG": T13- T15), longer-run forward guidance ("LR FG": T4-T6, T16-T18). The title of each panel indicates the horizon of the forecasts for mortgage rates. Estimated regression coefficients are reported in Appendix Table 7.

Figure 7. Response of real mortgage rate expectations by treatment and horizon.
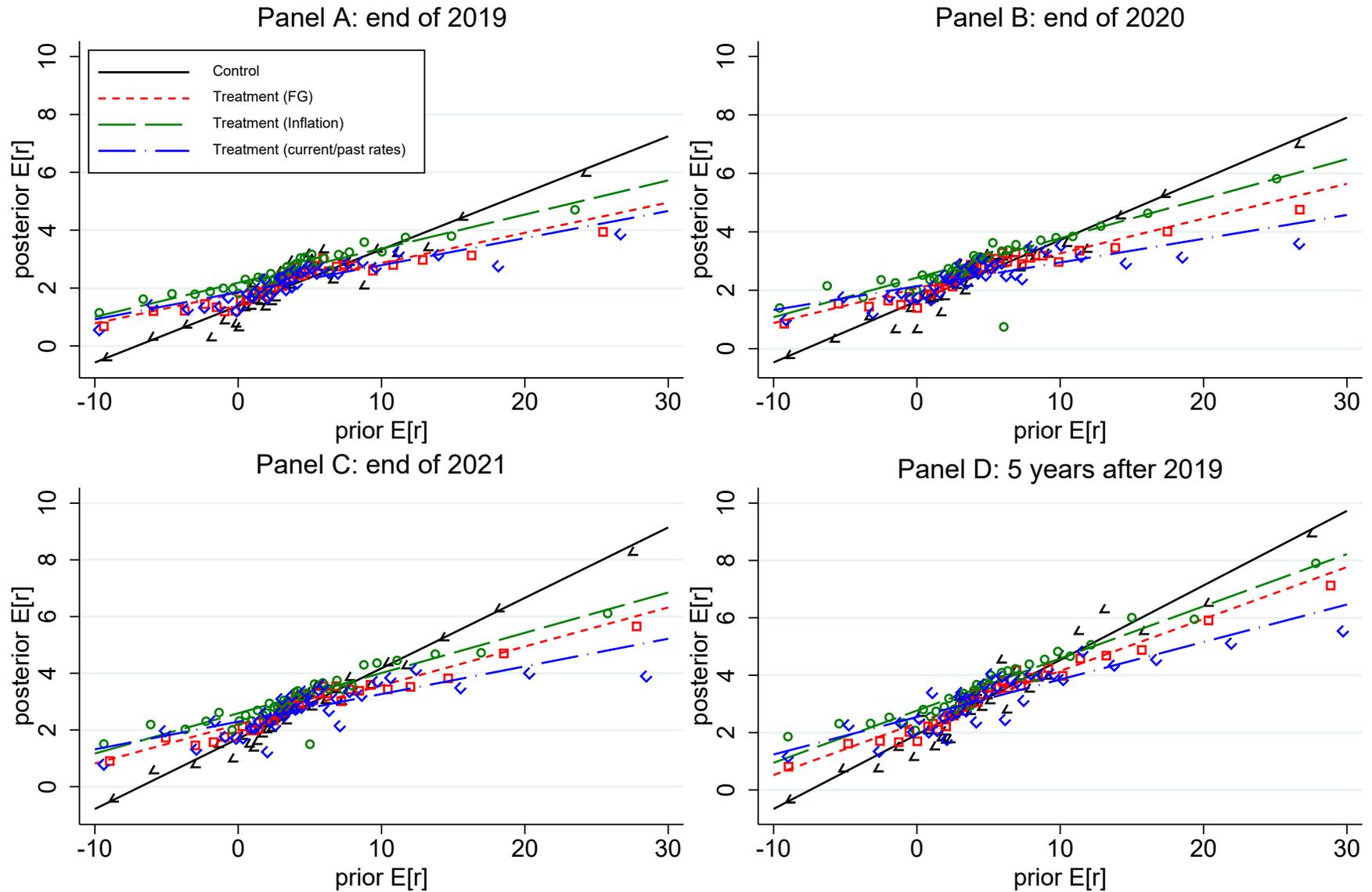
Notes: each panel shows binscatter plots for revisions in real mortgage rates (nominal mortgage rate minus one-year ahead inflation forecast) when treatments are combined into information provision about current rates ("Current/past rates": T3, T19, T24), forward guidance ("FG": T4-T19), inflation ("Inflation": T20-T-23). The title of each panel indicates the horizon of the forecasts for mortgage rates. Estimated regression coefficients are reported in Appendix Table 6.

Figure 8. Response of unemployment rate expectations by treatment type and by the horizon of forward guidance.

Panel A: By treatment type

Panel B: By the horizon of forward guidance

Notes: Panel A shows binscatter plots for revisions in unemployment rate forecasts when treatments are combined into forward guidance (T4-T19), inflation (T20-T23), and current/past interest rates (T3, T19, T24). Panel B shows binscatter plots for revisions in unemployment rate forecasts when treatments are combined into information provision about current rates ("current": T3, T19, T24), 1-year forward guidance ("1y FG": T7, T8, T9), 2-year forward guidance ("2y FG": T10, T11, T12), 3-year forward guidance ("3y FG": T13, T14, T15), longer-run forward guidance ("LR FG": T4, T5, T6, T16, T17, T18). Estimated regression coefficients are reported in Appendix Table 6 and Appendix Table 7.

ONLINE APPENDIX

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Perceived inflation, previous 12 months	(1)	1.00									
Expected inflation, 12-month ahead	(2)	0.13	1.00								
Perceived unemployment rate, current	(3)	0.33	-0.02	1.00							
Expected unemployment rate, 12-month ahead	(4)	0.35	0.01	0.80	1.00						
Perceived interest rate on a saving account in a bank, current	(5)	0.22	-0.07	0.36	0.34	1.00					
Perceived and expected mortgage rate for "a person like you"											
Current	(6)	0.21	-0.00	0.33	0.33	0.43	1.00				
End of 2019	(7)	0.23	0.01	0.34	0.35	0.41	0.91	1.00			
End of 2020	(8)	0.25	0.03	0.33	0.35	0.40	0.86	0.93	1.00		
End of 2021	(9)	0.26	0.04	0.34	0.36	0.39	0.82	0.89	0.94	1.00	
Next 5-10 years	(10)	0.26	0.06	0.33	0.36	0.36	0.74	0.81	0.87	0.91	1.00

Notes: the table reports the coefficient matrix for pre-treatment expectations and perceptions. Sampling weights are applied. Extreme observations are removed for all variables (e.g., recode inflation perceptions as missing if perceived inflation is reported at 100% or -100%) and then all variables are winsorized at bottom and top 0.5%.

Appendix Table 2. Descriptive statistics by plan to buy a durable vs. no plans to buy a durable.

	Plan (# obs = 4,927)		No plan (# obs = 21,964)	
	Mean	St. Dev	Mean	St. Dev
	(1)	(2)	(3)	(4)
Pre-treatment data				
Perceived inflation, previous 12 months	2.89	2.35	2.87	2.42
Expected inflation, 12-month ahead	1.58	2.47	1.65	2.58
Perceived unemployment rate, current	4.79	2.10	4.76	2.17
Expected unemployment rate, 12-month ahead	5.35	2.76	5.31	2.79
Perceived interest rate on a saving account in a bank, current	1.32	0.99	1.29	0.99
Perceived and expected mortgage rate for "a person like you"				
Current	4.54	1.10	4.55	1.21
End of 2019	4.88	1.33	4.90	1.46
End of 2020	5.26	1.54	5.29	1.67
End of 2021	5.50	1.80	5.54	1.95
Next 5-10 years	5.88	2.20	5.97	2.38
Post-treatment data				
Expected inflation, 12-month ahead	1.93	1.51	1.89	1.55
Expected inflation, next 3-5 years	2.46	1.76	2.41	1.80
Expected unemployment rate, end of 2019	4.56	2.08	4.57	2.17
Expected unemployment rate, next 3-5 years	5.30	2.64	5.28	2.72
Perceived and expected mortgage rate for "someone with excellent credit"				
Current	4.09	1.00	4.13	1.08
End of 2019	4.35	1.02	4.39	1.10
End of 2020	4.67	1.29	4.75	1.38
End of 2021	4.91	1.50	4.99	1.59
Next 5-10 years	5.29	1.82	5.38	1.92

Notes: pre-treatment expected inflation (12 months ahead) is computed as mean implied from the reported probability distribution over a range of bins. All other measures of inflation are reported as point predictions.

Treatment	F-statistic	p-value
T1 (control)	0.98	0.50
T2 (Population growth)	1.01	0.45
T3 (FG)	1.28	0.10
T4 (FG)	1.16	0.22
T5 (FG)	1.08	0.34
T6 (FG)	1.07	0.34
T7 (FG)	0.83	0.78
T8 (FG)	1.13	0.25
T9 (FG)	1.14	0.25
T10 (FG)	1.00	0.48
T11 (FG)	0.63	0.97
T12 (FG)	0.78	0.85
T13 (FG)	0.88	0.69
T14 (FG)	1.09	0.31
T15 (FG)	1.16	0.22
T16 (FG)	0.96	0.55
T17 (FG)	0.97	0.52
T18 (FG)	0.94	0.58
T19 (FG)	1.01	0.46
T20 (Past inflation last year)	1.24	0.14
T21 (Past inflation last 3 years)	1.19	0.18
T22 (Past inflation last year + 3yr ahead inflation path forecast)	0.94	0.58
T23 (Past inflation last year + 3yr ahead inflation average forecast)	0.64	0.96
T24 (current mortgage rate)	0.68	0.95

Notes: The table reports results for estimating the following linear-probability regression for each treatment k separately: $Treatment_i^{(k)} = X_i b^{(k)} + error$ where i indexes respondents, $Treatment_i^{(k)}$ is a dummy variable equal to one if household i is provided with treatment k and zero otherwise, X is a vector of household/individual characteristics. Individual characteristics are gender, age, age squared, employed indicator, unemployment indicator, and race. Household characteristics are household income (binned; indicator variable for each bin), household size (indicator variable for each size), census region (indicator variable for each region), male head education (indicator variable for each group), female head education (indicator variable for each group). The table reports F-statistic for the joint statistical significance of b.

	Missing in:		
	1st follow-up wave	2nd follow-up wave	1st or 2nd follow-up wave
	(1)	(2)	(3)
T2 (Population growth)	0.013	-0.028	-0.002
	(0.025)	(0.023)	(0.022)
T3 (Current FFR)	0.012	-0.011	0.007
	(0.025)	(0.023)	(0.022)
T4 (FG: LR high)	0.006	0.023	0.030
	(0.025)	(0.022)	(0.021)
T5 (FG: LR low)	-0.014	-0.009	-0.000
	(0.025)	(0.023)	(0.022)
T6 (FG: LR central)	-0.068***	-0.032	-0.035
	(0.025)	(0.023)	(0.023)
T7 (FG: 1yr central)	-0.001	0.015	0.018
	(0.025)	(0.022)	(0.022)
T8 (FG: 1yr high)	-0.053**	-0.028	-0.026
	(0.025)	(0.024)	(0.023)
T9 (FG: 1yr low)	0.000	0.014	0.041**
	(0.025)	(0.022)	(0.021)
T10 (FG: 2yr central)	0.012	0.010	0.021
	(0.025)	(0.022)	(0.021)
T11 (FG: 2yr central-high)	-0.008	0.010	0.015
	(0.025)	(0.022)	(0.022)
T12 (FG: 2yr central-low)	0.000	-0.017	-0.005
	(0.025)	(0.023)	(0.022)
T13 (FG: 3yr central)	-0.033	-0.029	-0.012
	(0.025)	(0.023)	(0.022)
T14 (FG: 3yr central-high)	-0.004	-0.003	0.012
	(0.025)	(0.022)	(0.021)
T15 (FG: 3yr central-low)	-0.047*	-0.022	-0.019
	(0.025)	(0.023)	(0.022)
T16 (FG: LR central-high)	-0.003	-0.020	0.004
	(0.025)	(0.023)	(0.022)
T17 (FG: LR central-low)	-0.024	0.011	0.017
	(0.025)	(0.022)	(0.022)
T18 (FG: LR central + past FFR)	-0.043*	-0.052**	-0.042*
	(0.025)	(0.023)	(0.023)
T19 (Current FFR + past FFR)	0.017	-0.007	0.001
	(0.026)	(0.023)	(0.022)
T20 (Inflation last year)	-0.030	-0.012	0.007
	(0.025)	(0.023)	(0.022)
T21 (Inflation last 3 years)	0.013	0.007	0.027
	(0.025)	(0.023)	(0.022)
T22 (Inflation last year + 3yr ahead inflation path forecast)	0.003	-0.028	-0.003
	(0.025)	(0.023)	(0.022)
T23 (Inflation last year + 3yr ahead inflation average forecast)	-0.021	-0.012	0.007
	(0.025)	(0.023)	(0.022)
T24 (current mortgage rate)	0.008	-0.032	-0.010
	(0.025)	(0.023)	(0.022)
Constant	0.403***	0.717***	0.745***
	(0.016)	(0.014)	(0.014)
Observations	26,891	26,891	26,891
R-squared	0.002	0.002	0.002

Notes: the table reports estimates of a linear probability model where the regressand is a dummy variable equal to one if a respondent is missing in a follow-up wave and zero otherwise. All regressors are dummy variables for various treatments. Robust standard errors are in parentheses. Sampling weights are applied. ***, **, * indicate statistical significance at 1, 5, and 10 percent.

	Dependent variable:					
	Perceived current inflation rate	Expected inflation rate, 12-month ahead	Perceived current unempl. rate	Expected unempl. Rate, 12-month ahead	Perceived current mortgage rate	Expected mortgage rate, end of 2019
	(1)	(2)	(3)	(4)	(5)	(6)
male	-0.314***	-0.018	-0.519***	-0.650***	-0.127***	-0.171***
	(0.045)	(0.045)	(0.040)	(0.050)	(0.022)	(0.026)
age	0.081***	0.056***	-0.006	0.002	0.011***	0.021***
	(0.007)	(0.007)	(0.007)	(0.008)	(0.004)	(0.004)
age^2	-0.061***	-0.035***	-0.005	-0.015**	-0.008**	-0.015***
	(0.006)	(0.006)	(0.006)	(0.007)	(0.003)	(0.004)
employed	0.174***	-0.157***	0.115***	0.138***	0.043**	0.077***
	(0.039)	(0.038)	(0.036)	(0.045)	(0.019)	(0.022)
unemployed	0.450***	-0.256***	0.303***	0.471***	0.075	0.048
	(0.098)	(0.085)	(0.092)	(0.114)	(0.049)	(0.059)
Household income (less than $12,000 is the omitted category)						
$12,000-$14,999	0.627***	0.038	0.408***	0.720***	0.455***	0.509***
	(0.149)	(0.127)	(0.140)	(0.182)	(0.086)	(0.104)
$15,000-$19,999	0.637***	0.398***	0.596***	0.593***	0.109	0.204**
	(0.124)	(0.109)	(0.118)	(0.151)	(0.067)	(0.081)
$20,000-$24,999	0.531***	0.360***	0.266**	0.330**	0.069	0.104
	(0.109)	(0.096)	(0.107)	(0.137)	(0.059)	(0.072)
$25,000-$29,999	0.731***	0.371***	0.341***	0.161	0.083	0.117
	(0.113)	(0.101)	(0.112)	(0.143)	(0.063)	(0.075)
$30,000-$34,999	0.850***	0.342***	0.352***	0.271*	0.154**	0.215***
	(0.113)	(0.099)	(0.110)	(0.141)	(0.061)	(0.073)
$35,000-$39,999	0.388***	0.273***	0.480***	0.475***	-0.105*	-0.069
	(0.113)	(0.098)	(0.115)	(0.143)	(0.061)	(0.073)
$40,000-$44,999	0.638***	0.409***	0.329***	0.260*	-0.065	0.000
	(0.112)	(0.101)	(0.112)	(0.140)	(0.060)	(0.072)
$45,000-$49,999	0.671***	0.097	0.030	-0.075	-0.032	-0.011
	(0.112)	(0.102)	(0.107)	(0.136)	(0.059)	(0.071)
$50,000-$59,999	0.735***	0.254***	0.086	-0.065	-0.064	-0.025
	(0.097)	(0.089)	(0.099)	(0.125)	(0.054)	(0.065)
$60,000-$69,999	0.508***	0.189**	-0.185*	-0.346***	-0.142***	-0.096
	(0.099)	(0.091)	(0.100)	(0.127)	(0.055)	(0.065)
$70,000-$99,999	0.376***	0.209***	-0.076	-0.241**	-0.174***	-0.172***
	(0.090)	(0.081)	(0.092)	(0.117)	(0.051)	(0.061)
$100,000 or more	-0.162*	0.095	-0.710***	-0.975***	-0.276***	-0.291***
	(0.090)	(0.081)	(0.092)	(0.117)	(0.051)	(0.061)
Household size						
2	-0.056	-0.152***	0.062	0.090	0.015	0.020
	(0.050)	(0.051)	(0.045)	(0.057)	(0.024)	(0.029)
3	-0.166***	-0.273***	-0.021	-0.102	0.025	0.043
	(0.063)	(0.061)	(0.056)	(0.072)	(0.030)	(0.036)
4	-0.201***	-0.320***	0.140**	-0.073	0.037	0.003
	(0.070)	(0.069)	(0.065)	(0.081)	(0.033)	(0.040)
5 or more	-0.134*	-0.608***	0.018	0.001	-0.018	-0.017
	(0.078)	(0.073)	(0.073)	(0.091)	(0.036)	(0.043)
Race (white is the omitted category)						

Black	-0.144**	-0.391***	0.285***	0.670***	-0.061**	0.006
	(0.059)	(0.054)	(0.054)	(0.068)	(0.028)	(0.034)
Asian	0.324***	-0.077	-0.025	0.039	-0.088***	-0.188***
	(0.071)	(0.071)	(0.064)	(0.083)	(0.033)	(0.039)
Other	0.038	-0.343***	-0.009	0.090	-0.067**	-0.046
	(0.074)	(0.065)	(0.064)	(0.086)	(0.033)	(0.040)
Census region [New England is omitted category]						
Mid-Atlantic	-0.222***	-0.007	0.079	-0.007	-0.005	0.037
	(0.085)	(0.082)	(0.075)	(0.097)	(0.040)	(0.048)
East North Central	0.011	-0.014	0.233***	0.175*	-0.026	0.081*
	(0.083)	(0.080)	(0.074)	(0.096)	(0.039)	(0.046)
West North Central	0.129	0.065	-0.057	-0.190*	0.027	0.168***
	(0.093)	(0.091)	(0.082)	(0.104)	(0.044)	(0.052)
South Atlantic	-0.155*	-0.123	-0.045	-0.249***	-0.011	0.064
	(0.082)	(0.079)	(0.071)	(0.092)	(0.038)	(0.045)
East South Central	-0.366***	-0.327***	-0.105	-0.361***	-0.036	0.048
	(0.097)	(0.094)	(0.088)	(0.112)	(0.046)	(0.055)
West South Central	-0.203**	-0.288***	-0.093	-0.314***	0.004	0.084*
	(0.091)	(0.085)	(0.078)	(0.101)	(0.042)	(0.050)
Mountain	-0.200**	-0.030	-0.102	-0.356***	-0.061	-0.006
	(0.094)	(0.090)	(0.081)	(0.105)	(0.043)	(0.051)
Pacific	-0.189**	0.086	0.076	0.049	-0.114***	-0.046
	(0.085)	(0.082)	(0.075)	(0.098)	(0.039)	(0.047)
Education of male head (more than college is the omitted category)						
No male head (or missing)	-0.428***	-0.196***	-0.263***	-0.260***	-0.098***	-0.102***
	(0.066)	(0.068)	(0.061)	(0.077)	(0.032)	(0.039)
Less than high school	-0.206*	-0.335***	0.045	-0.105	-0.140***	-0.157**
	(0.112)	(0.099)	(0.109)	(0.136)	(0.054)	(0.063)
High school	-0.237***	-0.268***	-0.070	-0.177**	-0.114***	-0.104***
	(0.059)	(0.063)	(0.055)	(0.069)	(0.030)	(0.036)
Some college	-0.096*	-0.102*	-0.085*	-0.150**	-0.131***	-0.135***
	(0.054)	(0.059)	(0.049)	(0.062)	(0.027)	(0.033)
College	0.015	-0.196***	0.000	-0.022	-0.102***	-0.148***
	(0.050)	(0.058)	(0.047)	(0.060)	(0.026)	(0.031)
Education of male head (more than college is the omitted category)						
No female head (or missing)	-0.688***	-0.361***	-0.578***	-0.756***	-0.134***	-0.213***
	(0.071)	(0.075)	(0.065)	(0.081)	(0.035)	(0.042)
Less than high school	-1.266***	-0.781***	-0.551***	-0.798***	-0.222***	-0.402***
	(0.130)	(0.115)	(0.145)	(0.181)	(0.071)	(0.083)
High school	-0.685***	-0.396***	-0.273***	-0.522***	-0.077***	-0.140***
	(0.060)	(0.060)	(0.056)	(0.070)	(0.028)	(0.034)
Some college	-0.077	-0.061	-0.130**	-0.198***	-0.045*	-0.105***
	(0.055)	(0.057)	(0.053)	(0.065)	(0.026)	(0.031)
College	0.160***	0.013	0.120**	0.054	0.000	-0.026
	(0.052)	(0.055)	(0.052)	(0.064)	(0.025)	(0.030)
Constant	-0.243	-0.238	4.970***	5.593***	4.294***	4.232***
	(0.201)	(0.192)	(0.209)	(0.264)	(0.108)	(0.130)
Observations	23,706	25,249	21,901	22,487	23,308	23,737
R-squared	0.049	0.043	0.073	0.074	0.023	0.027

Notes: Huber robust regression. ***, **, * denote statistical significance at 1, 5, and 10 percent levels.

Appendix Table 6. Response of expectations by aggregated by treatment horizons.

	Inflation	Unempl. rate	Nominal mortgage rate					Real mortgage rate				
			Current	One-year [2019]	Two-year [2020]	Three-year [2021]	Longer run	Current	One-year [2019]	Two-year [2020]	Three-year [2021]	Longer run
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Intercept												
Control	1.859***	0.327***	-0.197***	0.486***	0.798***	-0.065	-0.127**	1.117***	1.369***	1.615***	1.680***	1.931***
	(0.053)	(0.046)	(0.025)	(0.042)	(0.062)	(0.054)	(0.054)	(0.064)	(0.066)	(0.068)	(0.072)	(0.080)
Current Rate	-0.030	-0.458***	2.980***	2.729***	1.569***	1.188***	1.282***	0.502***	0.482***	0.518***	0.614***	0.610***
	(0.064)	(0.051)	(0.044)	(0.059)	(0.078)	(0.073)	(0.073)	(0.078)	(0.080)	(0.084)	(0.088)	(0.098)
1-year FG	-0.161**	-0.473***	0.743***	0.808***	0.659***	1.417***	1.518***	0.476***	0.446***	0.473***	0.604***	0.484***
	(0.063)	(0.050)	(0.038)	(0.056)	(0.074)	(0.069)	(0.076)	(0.078)	(0.080)	(0.083)	(0.088)	(0.097)
2-year FG	-0.087	-0.474***	0.733***	0.126**	-0.121*	0.759***	1.144***	0.498***	0.468***	0.534***	0.569***	0.488***
	(0.062)	(0.050)	(0.041)	(0.056)	(0.072)	(0.069)	(0.072)	(0.077)	(0.080)	(0.083)	(0.088)	(0.097)
3-year FG	-0.044	-0.516***	0.762***	0.720***	0.551***	1.537***	1.508***	0.572***	0.479***	0.510***	0.555***	0.448***
	(0.063)	(0.050)	(0.039)	(0.059)	(0.075)	(0.072)	(0.073)	(0.078)	(0.080)	(0.084)	(0.088)	(0.097)
Longer-run FG	-0.064	-0.523***	0.656***	0.794***	0.430***	0.958***	1.416***	0.450***	0.441***	0.368***	0.419***	0.305***
	(0.058)	(0.048)	(0.033)	(0.050)	(0.069)	(0.063)	(0.065)	(0.071)	(0.074)	(0.076)	(0.081)	(0.089)
Slope												
Control	0.202***	0.899***	0.993***	0.825***	0.767***	0.946***	0.961***	0.207***	0.198***	0.210***	0.250***	0.259***
	(0.015)	(0.007)	(0.004)	(0.008)	(0.011)	(0.009)	(0.008)	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)
Current Rate	-0.126***	0.097***	-0.689***	-0.579***	-0.325***	-0.253***	-0.252***	-0.130***	-0.104***	-0.129***	-0.154***	-0.128***
	(0.017)	(0.007)	(0.008)	(0.011)	(0.014)	(0.012)	(0.011)	(0.014)	(0.014)	(0.013)	(0.013)	(0.014)
1-year FG	-0.095***	0.098***	-0.183***	-0.187***	-0.149***	-0.291***	-0.286***	-0.070***	-0.073***	-0.077***	-0.110***	-0.068***
	(0.017)	(0.007)	(0.007)	(0.010)	(0.013)	(0.011)	(0.011)	(0.014)	(0.014)	(0.013)	(0.014)	(0.014)
2-year FG	-0.157***	0.100***	-0.188***	-0.043***	0.013	-0.165***	-0.230***	-0.104***	-0.101***	-0.115***	-0.122***	-0.086***
	(0.017)	(0.007)	(0.008)	(0.010)	(0.013)	(0.011)	(0.011)	(0.014)	(0.014)	(0.013)	(0.014)	(0.014)
3-year FG	-0.129***	0.099***	-0.197***	-0.176***	-0.133***	-0.323***	-0.300***	-0.125***	-0.101***	-0.105***	-0.131***	-0.091***
	(0.017)	(0.007)	(0.007)	(0.011)	(0.013)	(0.012)	(0.011)	(0.014)	(0.014)	(0.013)	(0.014)	(0.014)
Longer-run FG	-0.116***	0.098***	-0.170***	-0.189***	-0.109***	-0.208***	-0.287***	-0.101***	-0.097***	-0.077***	-0.099***	-0.074***
	(0.016)	(0.007)	(0.006)	(0.009)	(0.012)	(0.010)	(0.010)	(0.013)	(0.013)	(0.012)	(0.012)	(0.013)
Observations	19,437	17,582	18,584	19,029	19,134	19,045	19,095	19,391	19,356	19,364	19,398	19,417
R-squared	0.056	0.989	0.907	0.838	0.822	0.856	0.855	0.096	0.094	0.114	0.143	0.199

Notes: The table reports estimates of coefficients in specification (1) for various expectations when treatments are aggregated by horizon of forward guidance (FG). Coefficients for groups other than the control group are relative to the coefficient for the control group. All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.
Aggregation treatments:
    Current rate: T3, T19, T24
    1-year forward guidance: T7, T8, T9
    2-year forward guidance: T10, T11, T12
    3-year forward guidance: T13, T14, T15
    Longer-run forward guidance: T4, T5, T6, T16, T17, T18

Appendix Table 7. Response of expectations by treatment types.

	Inflation	Unempl. rate	Nominal mortgage rate					Real mortgage rate				
			Current	One-year [2019]	Two-year [2020]	Three-year [2021]	Longer run	Current	One-year [2019]	Two-year [2020]	Three-year [2021]	Longer run
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Intercept												
Control	1.815***	0.332***	-0.192***	0.486***	0.795***	-0.068	-0.128**	1.132***	1.383***	1.626***	1.695***	1.936***
	(0.050)	(0.046)	(0.024)	(0.042)	(0.062)	(0.053)	(0.054)	(0.063)	(0.065)	(0.067)	(0.071)	(0.079)
Forward guidance	-0.061	-0.509***	0.679***	0.658***	0.439***	1.281***	1.395***	0.477***	0.443***	0.445***	0.500***	0.399***
	(0.052)	(0.047)	(0.027)	(0.046)	(0.065)	(0.057)	(0.059)	(0.066)	(0.068)	(0.070)	(0.074)	(0.083)
Inflation	-0.144***	-0.550***	0.036	0.250***	0.305***	1.233***	1.313***	0.830***	0.800***	0.804***	0.895***	0.832***
	(0.055)	(0.049)	(0.030)	(0.053)	(0.073)	(0.067)	(0.069)	(0.070)	(0.073)	(0.076)	(0.081)	(0.091)
Current/past rates	-0.018	-0.464***	3.006***	2.714***	1.585***	1.181***	1.281***	0.490***	0.472***	0.512***	0.598***	0.609***
	(0.061)	(0.051)	(0.043)	(0.059)	(0.078)	(0.072)	(0.073)	(0.076)	(0.079)	(0.082)	(0.086)	(0.097)
Slope												
Control	0.216***	0.897***	0.994***	0.825***	0.767***	0.947***	0.961***	0.205***	0.195***	0.209***	0.248***	0.260***
	(0.014)	(0.007)	(0.003)	(0.008)	(0.011)	(0.009)	(0.008)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
Forward guidance	-0.135***	0.100***	-0.174***	-0.160***	-0.108***	-0.270***	-0.277***	-0.098***	-0.091***	-0.090***	-0.111***	-0.079***
	(0.014)	(0.007)	(0.004)	(0.008)	(0.011)	(0.009)	(0.009)	(0.012)	(0.012)	(0.011)	(0.011)	(0.012)
Inflation	-0.172***	0.102***	-0.007	-0.050***	-0.062***	-0.239***	-0.247***	-0.097***	-0.077***	-0.074***	-0.106***	-0.078***
	(0.015)	(0.007)	(0.005)	(0.010)	(0.013)	(0.011)	(0.010)	(0.013)	(0.013)	(0.012)	(0.013)	(0.013)
Current/past rates	-0.137***	0.099***	-0.695***	-0.576***	-0.328***	-0.252***	-0.252***	-0.128***	-0.102***	-0.128***	-0.151***	-0.129***
	(0.016)	(0.007)	(0.008)	(0.010)	(0.013)	(0.012)	(0.011)	(0.013)	(0.013)	(0.013)	(0.013)	(0.014)
Observations	23,388	21,244	22,202	22,930	23,071	23,033	23,053	23,304	23,269	23,282	23,313	23,369
R-squared	0.057	0.989	0.935	0.841	0.823	0.846	0.855	0.101	0.103	0.124	0.150	0.206

Notes: The table reports estimates of coefficients in specification (1) for various expectations when treatments are aggregated by type of treatment. Coefficients for groups other than the control group are relative to the coefficient for the control group. Treatments are combined into information provision about current rates ("Current/past rates": T3, T19, T24), forward guidance ("FG": T4-T19), inflation ("Inflation": T20-T-23). All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

| | Inflation expectations | | Unemployment expectations | | Mortgage rate expectations, end of 2020 | |
| | Plan | No plan | Plan | No plan | Plan | No plan |
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept						
Control	2.407***	1.717***	0.280***	-0.077**	1.385***	0.685***
	(0.133)	(0.054)	(0.089)	(0.035)	(0.101)	(0.067)
Forward guidance	-0.636***	0.033	-0.372***	-0.017	-0.161	0.525***
	(0.137)	(0.056)	(0.092)	(0.036)	(0.109)	(0.071)
Inflation	-0.666***	-0.064	-0.371***	-0.068*	0.039	0.016
	(0.143)	(0.060)	(0.098)	(0.040)	(0.123)	(0.077)
Current/past rates	-0.542***	0.063	-0.380***	0.019	1.201***	1.636***
	(0.155)	(0.066)	(0.100)	(0.043)	(0.140)	(0.085)
Slope						
Control	-0.018	0.255***	0.908***	0.988***	0.635***	0.792***
	(0.035)	(0.015)	(0.015)	(0.005)	(0.016)	(0.012)
Forward guidance	0.110***	-0.176***	0.083***	0.003	0.021	-0.126***
	(0.036)	(0.015)	(0.015)	(0.005)	(0.017)	(0.013)
Inflation	0.067*	-0.212***	0.085***	0.007	-0.000	-0.004
	(0.037)	(0.016)	(0.015)	(0.005)	(0.019)	(0.014)
Current/past rates	0.056	-0.168***	0.091***	-0.001	-0.219***	-0.345***
	(0.041)	(0.018)	(0.015)	(0.006)	(0.023)	(0.015)
Observations	4,219	19,167	3,524	15,885	4,167	18,880
R-squared	0.052	0.062	0.980	0.980	0.850	0.829

Notes: the table reports estimated coefficients of specification (1) for responses of expectations immediately after treatments by whether a household plans to buy a durable good (house, car, electronics) in the next 12 months or not. Treatments are aggregated by type as in Appendix Table 7. All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Appendix Table 9. Posterior beliefs (inflation and unemployment rate) in the 1st follow-up wave by treatment.

Treatment	Inflation expectations		Unempl. rate expectations	
	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)
	(1)	(2)	(3)	(4)
Control	0.842***	0.468***	1.363***	0.649***
	(0.073)	(0.018)	(0.092)	(0.015)
Relative to control				
T2 (Population growth)	0.337***	-0.186***	-0.164	0.055**
	(0.121)	(0.034)	(0.147)	(0.025)
T3 (Current FFR)	0.191	-0.249***	0.603***	-0.137***
	(0.117)	(0.029)	(0.165)	(0.028)
T4 (FG: LR high)	0.046	-0.046	0.243	-0.093***
	(0.117)	(0.032)	(0.160)	(0.028)
T5 (FG: LR low)	0.371***	-0.207***	0.931***	-0.238***
	(0.111)	(0.030)	(0.151)	(0.024)
T6 (FG: LR central)	0.102	-0.148***	0.785***	-0.172***
	(0.115)	(0.031)	(0.140)	(0.024)
T7 (FG: 1yr central)	0.057	-0.169***	0.630***	-0.159***
	(0.114)	(0.032)	(0.163)	(0.029)
T8 (FG: 1yr high)	0.232**	-0.338***	1.452***	-0.331***
	(0.118)	(0.032)	(0.155)	(0.025)
T9 (FG: 1yr low)	0.414***	-0.288***	0.901***	-0.207***
	(0.118)	(0.030)	(0.146)	(0.024)
T10 (FG: 2yr central)	-0.030	-0.165***	0.759***	-0.192***
	(0.113)	(0.033)	(0.150)	(0.025)
T11 (FG: 2yr central-high)	-0.189	-0.050	0.287**	-0.047**
	(0.118)	(0.034)	(0.145)	(0.023)
T12 (FG: 2yr central-low)	0.199*	-0.271***	0.293**	-0.081***
	(0.116)	(0.030)	(0.148)	(0.025)
T13 (FG: 3yr central)	0.359***	-0.223***	1.242***	-0.315***
	(0.108)	(0.029)	(0.155)	(0.026)
T14 (FG: 3yr central-high)	0.168	-0.149***	0.683***	-0.173***
	(0.118)	(0.031)	(0.141)	(0.023)
T15 (FG: 3yr central-low)	-0.075	-0.175***	-0.232	0.055**
	(0.116)	(0.030)	(0.147)	(0.026)
T16 (FG: LR central-high)	0.175	-0.217***	1.133***	-0.267***
	(0.113)	(0.031)	(0.143)	(0.022)
T17 (FG: LR central-low)	0.130	-0.229***	0.543***	-0.104***
	(0.115)	(0.030)	(0.141)	(0.022)
T18 (FG: LR central + past FFR)	0.028	-0.170***	0.911***	-0.210***
	(0.112)	(0.032)	(0.156)	(0.026)
T19 (Current FFR + past FFR)	0.091	-0.179***	0.053	-0.023
	(0.116)	(0.031)	(0.141)	(0.021)
T20 (Inflation last year)	0.306***	-0.343***	0.114	-0.036
	(0.108)	(0.027)	(0.139)	(0.023)
T21 (Inflation last 3 years)	0.276**	-0.223***	1.198***	-0.296***
	(0.116)	(0.028)	(0.156)	(0.025)
T22 (Inflation last year + 3yr ahead inflation path forecast)	0.337***	-0.224***	1.286***	-0.276***
	(0.117)	(0.032)	(0.166)	(0.026)
T23 (Inflation last year + 3yr ahead inflation average forecast)	0.182*	-0.282***	1.703***	-0.411***
	(0.107)	(0.028)	(0.133)	(0.020)
T24 (current mortgage rate)	0.251**	-0.212***	0.563***	-0.148***
	(0.118)	(0.034)	(0.151)	(0.025)
Observations	15,397		13,212	
R-squared	0.232		0.665	

Notes: The table reports estimates of coefficients in specification (1) for one-year-ahead inflation expectations (columns 1 and 2) and for one-year-ahead unemployment rate expectations (columns 3 and 4). Posterior unemployment rate expectations (point predictions) are for one-year ahead. Prior unemployment rate expectations (point predictions) are for "the end of 2019". Posterior inflation expectations are point predictions. Prior inflation expectations are measured as implied means from the reported probability distributions. All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Appendix Table 10. Posterior beliefs (nominal mortgage rates) in the 1st follow-up wave by treatment.

Treatment	Current		one-year [2019]		two-year [2020]		Three-year [2021]		Longer run	
	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control	3.114***	0.317***	2.008***	0.548***	2.899***	0.409***	2.093***	0.587***	1.600***	0.691***
	(0.079)	(0.014)	(0.105)	(0.019)	(0.091)	(0.012)	(0.112)	(0.016)	(0.137)	(0.018)
Relative to control										
T2 (Population growth)	0.581***	-0.162***	1.451***	-0.299***	0.365**	-0.058**	0.587***	-0.096***	0.630***	-0.077***
	(0.108)	(0.019)	(0.143)	(0.025)	(0.153)	(0.023)	(0.192)	(0.028)	(0.216)	(0.029)
T3 (Current FFR)	-0.765***	0.148***	1.680***	-0.344***	0.865***	-0.162***	1.915***	-0.351***	2.139***	-0.360***
	(0.117)	(0.021)	(0.161)	(0.028)	(0.167)	(0.025)	(0.172)	(0.024)	(0.228)	(0.031)
T4 (FG: LR high)	-0.141	-0.007	1.142***	-0.272***	0.384***	-0.096***	0.995***	-0.207***	1.973***	-0.373***
	(0.117)	(0.021)	(0.147)	(0.025)	(0.143)	(0.020)	(0.170)	(0.023)	(0.197)	(0.027)
T5 (FG: LR low)	-0.452***	0.069***	0.821***	-0.178***	-0.670***	0.126***	0.581***	-0.103***	2.514***	-0.428***
	(0.116)	(0.021)	(0.149)	(0.025)	(0.162)	(0.024)	(0.189)	(0.027)	(0.207)	(0.027)
T6 (FG: LR central)	-0.313**	0.039*	1.196***	-0.267***	0.870***	-0.185***	2.191***	-0.426***	2.173***	-0.358***
	(0.124)	(0.024)	(0.148)	(0.026)	(0.152)	(0.023)	(0.163)	(0.024)	(0.199)	(0.027)
T7 (FG: 1yr central)	-0.044	-0.029	1.381***	-0.296***	0.126	-0.038*	0.580***	-0.110***	0.773***	-0.140***
	(0.119)	(0.022)	(0.147)	(0.025)	(0.145)	(0.020)	(0.180)	(0.026)	(0.204)	(0.028)
T8 (FG: 1yr high)	-0.638***	0.086***	1.167***	-0.266***	0.583***	-0.135***	1.160***	-0.237***	0.272	-0.048*
	(0.112)	(0.020)	(0.146)	(0.026)	(0.147)	(0.022)	(0.188)	(0.028)	(0.204)	(0.028)
T9 (FG: 1yr low)	-0.573***	0.095***	1.196***	-0.255***	-0.581***	0.104***	0.467***	-0.097***	0.900***	-0.178***
	(0.116)	(0.021)	(0.141)	(0.024)	(0.154)	(0.023)	(0.175)	(0.026)	(0.199)	(0.027)
T10 (FG: 2yr central)	0.122	-0.078***	1.351***	-0.312***	0.235	-0.085***	0.148	-0.069**	0.557***	-0.109***
	(0.111)	(0.020)	(0.144)	(0.025)	(0.161)	(0.024)	(0.190)	(0.029)	(0.207)	(0.028)
T11 (FG: 2yr central-high)	-0.945***	0.174***	0.303*	-0.080**	-0.492***	0.088***	1.456***	-0.279***	0.908***	-0.176***
	(0.126)	(0.023)	(0.174)	(0.031)	(0.150)	(0.021)	(0.186)	(0.026)	(0.219)	(0.030)
T12 (FG: 2yr central-low)	-0.612***	0.080***	0.442***	-0.132***	-0.803***	0.112***	0.144	-0.079***	0.692***	-0.153***
	(0.124)	(0.024)	(0.145)	(0.026)	(0.155)	(0.024)	(0.185)	(0.029)	(0.211)	(0.030)
T13 (FG: 3yr central)	-0.027	-0.026	1.661***	-0.371***	0.271	-0.071***	1.386***	-0.269***	0.653***	-0.093***
	(0.133)	(0.025)	(0.139)	(0.024)	(0.166)	(0.026)	(0.177)	(0.026)	(0.205)	(0.028)
T14 (FG: 3yr central-high)	-0.266**	0.013	1.062***	-0.253***	0.128	-0.046**	0.406**	-0.104***	1.716***	-0.314***
	(0.127)	(0.025)	(0.135)	(0.023)	(0.149)	(0.022)	(0.181)	(0.027)	(0.196)	(0.026)
T15 (FG: 3yr central-low)	-1.425***	0.289***	0.730***	-0.154***	-0.357**	0.050**	0.260	-0.080***	2.196***	-0.416***
	(0.106)	(0.018)	(0.153)	(0.027)	(0.153)	(0.022)	(0.180)	(0.027)	(0.212)	(0.029)
T16 (FG: LR central-high)	-1.029***	0.188***	0.868***	-0.199***	-0.858***	0.132***	0.507***	-0.127***	1.014***	-0.191***
	(0.128)	(0.025)	(0.142)	(0.025)	(0.143)	(0.021)	(0.167)	(0.024)	(0.202)	(0.029)
T17 (FG: LR central-low)	0.858***	-0.230***	1.732***	-0.365***	1.428***	-0.298***	0.988***	-0.226***	1.943***	-0.376***
	(0.115)	(0.021)	(0.145)	(0.025)	(0.151)	(0.022)	(0.191)	(0.028)	(0.204)	(0.027)
T18 (FG: LR central + past FFR)	-1.430***	0.277***	0.892***	-0.193***	-0.039	0.007	1.048***	-0.199***	1.024***	-0.191***
	(0.106)	(0.019)	(0.159)	(0.029)	(0.147)	(0.021)	(0.179)	(0.026)	(0.228)	(0.032)
T19 (Current FFR + past FFR)	0.263**	-0.070***	1.383***	-0.291***	0.233	-0.033	1.536***	-0.274***	2.564***	-0.408***
	(0.114)	(0.020)	(0.143)	(0.025)	(0.145)	(0.021)	(0.168)	(0.024)	(0.203)	(0.027)
T20 (Inflation last year)	-0.530***	0.089***	0.843***	-0.180***	0.892***	-0.175***	0.845***	-0.148***	2.209***	-0.389***
	(0.125)	(0.023)	(0.142)	(0.024)	(0.146)	(0.021)	(0.166)	(0.023)	(0.201)	(0.027)
T21 (Inflation last 3 years)	-0.829***	0.150***	-0.018	0.008	0.017	-0.013	0.859***	-0.181***	0.851***	-0.153***
	(0.135)	(0.026)	(0.189)	(0.036)	(0.142)	(0.021)	(0.170)	(0.024)	(0.202)	(0.027)
T22 (Inflation last year + 3yr ahead inflation path forecast)	-1.121***	0.215***	0.451***	-0.124***	-0.065	-0.017	0.045	-0.031	0.925***	-0.172***
	(0.114)	(0.020)	(0.149)	(0.026)	(0.183)	(0.029)	(0.187)	(0.028)	(0.219)	(0.030)
T23 (Inflation last year + 3yr ahead inflation average forecast)	1.025***	-0.267***	1.820***	-0.412***	0.650***	-0.168***	1.700***	-0.363***	2.037***	-0.385***
	(0.103)	(0.017)	(0.139)	(0.023)	(0.150)	(0.022)	(0.163)	(0.023)	(0.218)	(0.030)
T24 (current mortgage rate)	0.958***	-0.251***	2.150***	-0.460***	0.046	-0.034	1.982***	-0.399***	0.845***	-0.197***
	(0.114)	(0.019)	(0.137)	(0.023)	(0.149)	(0.022)	(0.166)	(0.023)	(0.203)	(0.027)
Observations	14,758		14,875		14,998		15,074		15,097	
R-squared	0.608		0.472		0.535		0.528		0.572	

Notes: The table reports estimates of coefficients in specification (1) for nominal mortgage rates for various horizons. All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Treatment	Current Intercept (b)	Current Slope (γ)	one-year [2019] Intercept (b)	one-year [2019] Slope (γ)	two-year [2020] Intercept (b)	two-year [2020] Slope (γ)	Three-year [2021] Intercept (b)	Three-year [2021] Slope (γ)	Longer run Intercept (b)	Longer run Slope (γ)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control	1.912***	0.301***	1.801***	0.365***	2.184***	0.348***	2.357***	0.353***	2.825***	0.348***
	(0.115)	(0.017)	(0.114)	(0.017)	(0.121)	(0.018)	(0.130)	(0.019)	(0.147)	(0.019)
Relative to control										
T2 (Population growth)	0.057	-0.033	0.378**	-0.146***	0.301	-0.116***	0.371*	-0.105***	0.127	-0.080**
	(0.186)	(0.031)	(0.185)	(0.027)	(0.191)	(0.026)	(0.208)	(0.029)	(0.232)	(0.032)
T3 (Current FFR)	-0.162	0.073***	0.119	-0.020	0.066	-0.026	0.150	-0.051*	-0.026	-0.006
	(0.174)	(0.025)	(0.180)	(0.027)	(0.191)	(0.028)	(0.201)	(0.028)	(0.225)	(0.032)
T4 (FG: LR high)	-0.103	0.037	0.369**	-0.103***	0.331	-0.113***	0.189	-0.084**	0.529**	-0.209***
	(0.179)	(0.030)	(0.185)	(0.030)	(0.203)	(0.034)	(0.211)	(0.034)	(0.232)	(0.032)
T5 (FG: LR low)	0.277	-0.077***	0.330*	-0.091***	0.216	-0.058**	0.073	-0.037	0.189	-0.081***
	(0.175)	(0.029)	(0.177)	(0.026)	(0.191)	(0.027)	(0.209)	(0.030)	(0.229)	(0.030)
T6 (FG: LR central)	0.265	-0.055*	0.429**	-0.105***	0.283	-0.062**	0.200	-0.065**	0.223	-0.068**
	(0.174)	(0.029)	(0.175)	(0.027)	(0.186)	(0.027)	(0.198)	(0.028)	(0.221)	(0.029)
T7 (FG: 1yr central)	0.240	-0.031	0.327*	-0.059**	0.438**	-0.091***	0.277	-0.041	0.609**	-0.181***
	(0.185)	(0.033)	(0.182)	(0.028)	(0.206)	(0.033)	(0.214)	(0.032)	(0.239)	(0.034)
T8 (FG: 1yr high)	0.796***	-0.169***	1.077***	-0.250***	0.978***	-0.205***	1.088***	-0.225***	0.677***	-0.154***
	(0.175)	(0.029)	(0.176)	(0.028)	(0.188)	(0.029)	(0.199)	(0.028)	(0.226)	(0.029)
T9 (FG: 1yr low)	0.089	-0.027	0.635***	-0.152***	0.411**	-0.114***	0.231	-0.100***	0.240	-0.128***
	(0.182)	(0.029)	(0.184)	(0.028)	(0.192)	(0.028)	(0.197)	(0.028)	(0.223)	(0.030)
T10 (FG: 2yr central)	0.412**	-0.063**	0.661***	-0.125***	0.385**	-0.065**	0.247	-0.045	0.301	-0.080**
	(0.178)	(0.029)	(0.180)	(0.027)	(0.196)	(0.030)	(0.210)	(0.032)	(0.234)	(0.034)
T11 (FG: 2yr central-high)	0.070	0.079**	0.428**	-0.026	0.199	0.041	0.482**	-0.040	-0.275	0.083**
	(0.183)	(0.032)	(0.181)	(0.029)	(0.193)	(0.031)	(0.201)	(0.030)	(0.237)	(0.034)
T12 (FG: 2yr central-low)	0.093	-0.063**	0.286	-0.104***	0.512***	-0.181***	0.486**	-0.169***	0.381*	-0.152***
	(0.169)	(0.030)	(0.174)	(0.031)	(0.178)	(0.030)	(0.193)	(0.032)	(0.218)	(0.032)
T13 (FG: 3yr central)	0.319*	-0.076***	0.549***	-0.171***	0.498***	-0.144***	0.318	-0.086***	0.020	-0.012
	(0.176)	(0.029)	(0.173)	(0.026)	(0.189)	(0.028)	(0.198)	(0.029)	(0.221)	(0.031)
T14 (FG: 3yr central-high)	-0.279	0.027	0.090	-0.047*	-0.102	0.008	-0.086	0.023	-0.051	-0.059*
	(0.172)	(0.028)	(0.175)	(0.025)	(0.189)	(0.028)	(0.200)	(0.031)	(0.229)	(0.032)
T15 (FG: 3yr central-low)	0.311*	-0.017	0.551***	-0.080***	0.398**	-0.057**	0.535***	-0.105***	0.150	-0.055*
	(0.176)	(0.027)	(0.179)	(0.028)	(0.191)	(0.028)	(0.198)	(0.027)	(0.219)	(0.028)
T16 (FG: LR central-high)	0.179	-0.049	0.439**	-0.120***	0.391**	-0.146***	0.117	-0.092***	-0.297	-0.005
	(0.181)	(0.031)	(0.187)	(0.032)	(0.198)	(0.031)	(0.213)	(0.033)	(0.232)	(0.034)
T17 (FG: LR central-low)	0.143	0.084***	0.404**	0.030	0.687***	-0.147***	0.656***	-0.161***	0.404*	-0.130***
	(0.178)	(0.030)	(0.180)	(0.029)	(0.190)	(0.030)	(0.201)	(0.030)	(0.223)	(0.029)
T18 (FG: LR central + past FFR)	0.466***	-0.055*	1.019***	-0.224***	0.872***	-0.170***	0.929***	-0.167***	0.912***	-0.222***
	(0.167)	(0.030)	(0.174)	(0.030)	(0.185)	(0.030)	(0.198)	(0.030)	(0.226)	(0.031)
T19 (Current FFR + past FFR)	0.332*	-0.014	0.597***	-0.118***	0.370*	-0.044	0.544***	-0.092***	0.726***	-0.131***
	(0.180)	(0.027)	(0.182)	(0.026)	(0.193)	(0.027)	(0.204)	(0.029)	(0.230)	(0.030)
T20 (Inflation last year)	0.557***	-0.103***	0.945***	-0.216***	0.866***	-0.173***	1.018***	-0.184***	0.584***	-0.093***
	(0.169)	(0.029)	(0.174)	(0.029)	(0.186)	(0.028)	(0.199)	(0.031)	(0.225)	(0.030)
T21 (Inflation last 3 years)	0.259	0.004	0.442**	-0.045	0.449**	-0.064**	0.480**	-0.065**	0.355	-0.055*
	(0.178)	(0.029)	(0.184)	(0.030)	(0.192)	(0.030)	(0.206)	(0.029)	(0.224)	(0.030)
T22 (Inflation last year + 3yr ahead inflation path forecast)	0.034	0.036	-0.002	-0.010	0.062	-0.044	0.367*	-0.084**	0.114	-0.024
	(0.171)	(0.033)	(0.171)	(0.029)	(0.188)	(0.036)	(0.208)	(0.034)	(0.235)	(0.036)
T23 (Inflation last year + 3yr ahead inflation average forecast)	0.576***	-0.084***	0.811***	-0.145***	0.912***	-0.221***	0.829***	-0.210***	0.514**	-0.145***
	(0.173)	(0.028)	(0.178)	(0.029)	(0.186)	(0.026)	(0.198)	(0.027)	(0.226)	(0.031)
T24 (current mortgage rate)	-0.146	0.088***	0.177	-0.038	0.123	-0.035	-0.079	0.006	-0.493**	0.076**
	(0.186)	(0.027)	(0.193)	(0.027)	(0.204)	(0.029)	(0.212)	(0.030)	(0.239)	(0.033)
Observations	15,226		15,146		15,125		15,130		15,105	
R-squared	0.272		0.268		0.250		0.250		0.243	

Notes: The table reports estimates of coefficients in specification (1) for real mortgage rates (nominal mortgage rate minus one-year-ahead inflation forecast) for various horizons. All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses.
***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Treatment	Inflation expectations		Unempl. rate expectations	
	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)
	(1)	(2)	(3)	(4)
Control	1.250***	0.205***	2.304***	0.428***
	(0.115)	(0.031)	(0.110)	(0.013)
Relative to control				
T2 (Population growth)	-0.120	0.084*	-0.811***	0.207***
	(0.179)	(0.046)	(0.196)	(0.033)
T3 (Current FFR)	-0.348**	0.169***	0.861***	-0.160***
	(0.171)	(0.050)	(0.193)	(0.027)
T4 (FG: LR high)	-0.030	0.014	0.533**	-0.108***
	(0.176)	(0.047)	(0.214)	(0.035)
T5 (FG: LR low)	0.040	0.039	0.064	-0.017
	(0.170)	(0.048)	(0.176)	(0.024)
T6 (FG: LR central)	-0.168	0.060	0.360**	-0.084***
	(0.158)	(0.048)	(0.169)	(0.023)
T7 (FG: 1yr central)	0.223	0.037	1.328***	-0.286***
	(0.170)	(0.044)	(0.198)	(0.030)
T8 (FG: 1yr high)	-0.465***	0.113*	-1.251***	0.301***
	(0.179)	(0.058)	(0.188)	(0.026)
T9 (FG: 1yr low)	0.089	-0.116**	0.923***	-0.204***
	(0.176)	(0.045)	(0.200)	(0.028)
T10 (FG: 2yr central)	-0.361**	0.041	-0.259	0.087***
	(0.158)	(0.047)	(0.186)	(0.029)
T11 (FG: 2yr central-high)	-0.133	-0.101**	-0.660***	0.188***
	(0.174)	(0.051)	(0.199)	(0.032)
T12 (FG: 2yr central-low)	-0.075	-0.010	0.934***	-0.202***
	(0.161)	(0.043)	(0.181)	(0.025)
T13 (FG: 3yr central)	-0.355**	-0.011	-0.426**	0.098***
	(0.166)	(0.044)	(0.197)	(0.032)
T14 (FG: 3yr central-high)	-0.249	0.203***	0.549***	-0.121***
	(0.167)	(0.044)	(0.189)	(0.027)
T15 (FG: 3yr central-low)	-0.078	-0.079	-1.398***	0.314***
	(0.172)	(0.049)	(0.187)	(0.030)
T16 (FG: LR central-high)	-0.218	0.111**	0.407**	-0.081***
	(0.176)	(0.046)	(0.176)	(0.025)
T17 (FG: LR central-low)	-0.094	-0.001	0.929***	-0.191***
	(0.173)	(0.048)	(0.175)	(0.022)
T18 (FG: LR central + past FFR)	-0.047	0.063	-0.225	0.042*
	(0.166)	(0.044)	(0.170)	(0.025)
T19 (Current FFR + past FFR)	-0.265	-0.025	0.812***	-0.166***
	(0.163)	(0.045)	(0.190)	(0.025)
T20 (Inflation last year)	-0.394**	0.224***	0.282	-0.081**
	(0.173)	(0.051)	(0.210)	(0.032)
T21 (Inflation last 3 years)	-0.076	-0.004	1.559***	-0.345***
	(0.166)	(0.047)	(0.184)	(0.024)
T22 (Inflation last year + 3yr ahead inflation path forecast)	-0.299*	0.106**	-0.155	0.046
	(0.159)	(0.042)	(0.190)	(0.028)
T23 (Inflation last year + 3yr ahead inflation average forecast)	-0.191	-0.047	1.137***	-0.226***
	(0.158)	(0.046)	(0.173)	(0.025)
T24 (current mortgage rate)	-0.455***	0.248***	0.378**	-0.100***
	(0.168)	(0.046)	(0.177)	(0.024)
Observations	7,580		6,492	
R-squared	0.206		0.612	

Notes: The table reports estimates of coefficients in specification (1) for one-year-ahead inflation expectations (columns 1 and 2) and for one-year-ahead unemployment rate expectations (columns 3 and 4). Posterior unemployment rate expectations (point predictions) are for one-year ahead. Prior unemployment rate expectations (point predictions) are for "the end of 2019". Posterior inflation expectations are point predictions. Prior inflation expectations are measured as implied means from the reported probability distributions. All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Appendix Table 13. Posterior beliefs (nominal mortgage rates) in the 2nd follow-up wave by treatment.

Treatment	Current		one-year [2019]		two-year [2020]		Three-year [2021]		Longer run	
	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)	Intercept (b)	Slope (γ)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control	2.638***	0.328***	2.536***	0.357***	2.533***	0.395***	2.283***	0.468***	2.032***	0.563***
	(0.102)	(0.019)	(0.120)	(0.021)	(0.136)	(0.021)	(0.169)	(0.025)	(0.179)	(0.023)
Relative to control										
T2 (Population growth)	1.228***	-0.290***	1.356***	-0.313***	1.420***	-0.287***	1.254***	-0.255***	1.818***	-0.335***
	(0.147)	(0.027)	(0.150)	(0.024)	(0.198)	(0.030)	(0.219)	(0.032)	(0.244)	(0.031)
T3 (Current FFR)	-0.014	-0.004	0.228	-0.062**	0.771***	-0.149***	-0.721***	0.148***	1.009***	-0.157***
	(0.179)	(0.034)	(0.179)	(0.029)	(0.205)	(0.029)	(0.275)	(0.043)	(0.269)	(0.034)
T4 (FG: LR high)	0.317**	-0.074***	0.252	-0.062**	0.265	-0.043*	0.521**	-0.090***	1.220***	-0.213***
	(0.146)	(0.026)	(0.166)	(0.029)	(0.176)	(0.025)	(0.215)	(0.030)	(0.246)	(0.031)
T5 (FG: LR low)	0.349*	-0.074**	0.646***	-0.148***	0.932***	-0.187***	-0.227	0.051	1.469***	-0.261***
	(0.185)	(0.035)	(0.159)	(0.025)	(0.181)	(0.025)	(0.269)	(0.041)	(0.278)	(0.038)
T6 (FG: LR central)	0.659***	-0.134***	0.933***	-0.187***	1.001***	-0.172***	1.338***	-0.225***	1.842***	-0.312***
	(0.167)	(0.031)	(0.181)	(0.031)	(0.189)	(0.028)	(0.220)	(0.032)	(0.249)	(0.031)
T7 (FG: 1yr central)	-0.844***	0.203***	-0.658***	0.152***	-0.499**	0.096***	0.092	0.004	1.607***	-0.282***
	(0.161)	(0.030)	(0.188)	(0.033)	(0.202)	(0.030)	(0.252)	(0.038)	(0.268)	(0.037)
T8 (FG: 1yr high)	0.806***	-0.185***	-1.494***	0.298***	-0.589**	0.104**	-0.309	0.054	0.638**	-0.103***
	(0.152)	(0.028)	(0.172)	(0.030)	(0.250)	(0.042)	(0.267)	(0.041)	(0.262)	(0.035)
T9 (FG: 1yr low)	-1.228***	0.289***	-0.458***	0.105***	-0.934***	0.210***	-0.465*	0.118***	-0.184	0.033
	(0.137)	(0.023)	(0.172)	(0.028)	(0.195)	(0.028)	(0.240)	(0.035)	(0.243)	(0.030)
T10 (FG: 2yr central)	0.761***	-0.157***	0.522***	-0.113***	1.280***	-0.239***	1.547***	-0.305***	2.015***	-0.375***
	(0.155)	(0.029)	(0.177)	(0.028)	(0.180)	(0.026)	(0.216)	(0.030)	(0.237)	(0.028)
T11 (FG: 2yr central-high)	-0.607***	0.126***	0.285*	-0.052**	0.036	-0.008	0.611***	-0.111***	0.442	-0.070**
	(0.159)	(0.029)	(0.163)	(0.027)	(0.204)	(0.030)	(0.229)	(0.033)	(0.273)	(0.035)
T12 (FG: 2yr central-low)	-0.368**	0.069**	0.581***	-0.164***	-0.896***	0.146***	1.322***	-0.241***	1.941***	-0.346***
	(0.157)	(0.029)	(0.172)	(0.029)	(0.221)	(0.033)	(0.212)	(0.029)	(0.263)	(0.033)
T13 (FG: 3yr central)	0.388***	-0.106***	1.166***	-0.261***	0.324	-0.079**	-0.798***	0.110***	0.779***	-0.167***
	(0.150)	(0.028)	(0.167)	(0.028)	(0.217)	(0.035)	(0.248)	(0.037)	(0.272)	(0.036)
T14 (FG: 3yr central-high)	-0.074	0.020	0.035	-0.024	0.493**	-0.100***	0.906***	-0.173***	1.262***	-0.204***
	(0.134)	(0.024)	(0.170)	(0.029)	(0.206)	(0.032)	(0.227)	(0.033)	(0.254)	(0.033)
T15 (FG: 3yr central-low)	-0.432***	0.093***	0.081	-0.040	-0.356*	0.052	-0.682***	0.117***	-0.289	0.064**
	(0.144)	(0.027)	(0.195)	(0.036)	(0.206)	(0.033)	(0.222)	(0.032)	(0.231)	(0.028)
T16 (FG: LR central-high)	-0.171	0.028	-0.340*	0.051	-0.499***	0.092***	-0.663***	0.137***	0.073	-0.022
	(0.158)	(0.030)	(0.186)	(0.034)	(0.189)	(0.027)	(0.228)	(0.034)	(0.267)	(0.036)
T17 (FG: LR central-low)	-0.271*	0.068**	0.749***	-0.138***	1.506***	-0.267***	2.468***	-0.422***	0.356	-0.055
	(0.156)	(0.027)	(0.165)	(0.026)	(0.229)	(0.035)	(0.252)	(0.037)	(0.287)	(0.037)
T18 (FG: LR central + past FFR)	1.308***	-0.303***	1.442***	-0.327***	1.418***	-0.292***	1.928***	-0.347***	2.013***	-0.360***
	(0.148)	(0.028)	(0.173)	(0.031)	(0.205)	(0.032)	(0.242)	(0.036)	(0.248)	(0.032)
T19 (Current FFR + past FFR)	0.368**	-0.069**	0.757***	-0.158***	-0.005	-0.005	0.108	-0.031	-0.009	-0.002
	(0.151)	(0.028)	(0.177)	(0.031)	(0.198)	(0.028)	(0.253)	(0.036)	(0.249)	(0.031)
T20 (Inflation last year)	0.518***	-0.129***	1.238***	-0.272***	1.460***	-0.282***	1.407***	-0.293***	1.898***	-0.374***
	(0.146)	(0.027)	(0.171)	(0.029)	(0.188)	(0.027)	(0.244)	(0.036)	(0.239)	(0.029)
T21 (Inflation last 3 years)	0.730***	-0.170***	0.645***	-0.153***	0.625***	-0.128***	1.028***	-0.189***	0.705***	-0.142***
	(0.180)	(0.035)	(0.223)	(0.042)	(0.223)	(0.034)	(0.249)	(0.036)	(0.272)	(0.035)
T22 (Inflation last year + 3yr ahead inflation path forecast)	-0.398**	0.095***	-0.739***	0.145***	0.801***	-0.146***	0.320	-0.047	1.105***	-0.179***
	(0.172)	(0.035)	(0.196)	(0.036)	(0.207)	(0.032)	(0.260)	(0.040)	(0.269)	(0.036)
T23 (Inflation last year + 3yr ahead inflation average forecast)	-0.435***	0.077***	0.133	-0.041	-0.318	0.031	-0.642**	0.104***	0.463*	-0.114***
	(0.153)	(0.027)	(0.206)	(0.036)	(0.257)	(0.041)	(0.255)	(0.038)	(0.255)	(0.033)
T24 (current mortgage rate)	-0.966***	0.226***	-0.225	0.053**	0.289	-0.052*	-1.252***	0.235***	0.955***	-0.189***
	(0.151)	(0.027)	(0.160)	(0.026)	(0.196)	(0.030)	(0.219)	(0.031)	(0.254)	(0.032)
Observations	7,135		7,178		7,248		7,285		7,340	
R-squared	0.589		0.517		0.543		0.626		0.589	

Notes: The table reports estimates of coefficients in specification (1) for nominal mortgage rates for various horizons. All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.

Appendix Table 14. Posterior beliefs (nominal mortgage rates) in the 2nd follow-up wave by treatment.

| Treatment	Current Intercept (b)	Current Slope (γ)	one-year [2019] Intercept (b)	one-year [2019] Slope (γ)	two-year [2020] Intercept (b)	two-year [2020] Slope (γ)	Three-year [2021] Intercept (b)	Three-year [2021] Slope (γ)	Longer run Intercept (b)	Longer run Slope (γ)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control	1.956***	0.210***	2.031***	0.216***	2.334***	0.235***	2.588***	0.238***	2.599***	0.365***
	(0.156)	(0.027)	(0.163)	(0.027)	(0.176)	(0.027)	(0.181)	(0.024)	(0.203)	(0.027)
Relative to control										
T2 (Population growth)	0.061	-0.163***	-0.060	-0.116***	0.243	-0.135***	0.243	-0.118***	0.623**	-0.206***
	(0.245)	(0.043)	(0.252)	(0.040)	(0.274)	(0.041)	(0.277)	(0.039)	(0.312)	(0.042)
T3 (Current FFR)	-0.790***	0.320***	-0.820***	0.298***	-0.377	0.141***	-0.192	0.117**	0.412	-0.069
	(0.248)	(0.047)	(0.253)	(0.039)	(0.294)	(0.048)	(0.295)	(0.046)	(0.305)	(0.044)
T4 (FG: LR high)	0.502**	-0.107***	0.113	-0.018	0.274	-0.058	0.030	-0.038	0.656**	-0.219***
	(0.241)	(0.040)	(0.251)	(0.038)	(0.268)	(0.039)	(0.276)	(0.034)	(0.309)	(0.040)
T5 (FG: LR low)	0.052	-0.024	-0.037	-0.013	0.075	-0.043	-0.048	-0.001	0.117	-0.100**
	(0.247)	(0.043)	(0.253)	(0.039)	(0.265)	(0.036)	(0.284)	(0.039)	(0.324)	(0.045)
T6 (FG: LR central)	0.102	-0.008	0.050	0.010	-0.006	-0.022	0.056	-0.045	0.451	-0.208***
	(0.235)	(0.038)	(0.241)	(0.038)	(0.258)	(0.039)	(0.265)	(0.038)	(0.297)	(0.038)
T7 (FG: 1yr central)	-0.348	0.028	-0.528**	0.059	-0.612**	0.046	-0.468*	0.013	0.350	-0.192***
	(0.237)	(0.040)	(0.247)	(0.038)	(0.263)	(0.039)	(0.278)	(0.039)	(0.307)	(0.041)
T8 (FG: 1yr high)	-1.061***	0.427***	-1.460***	0.496***	-1.397***	0.365***	-1.384***	0.322***	-0.375	0.010
	(0.246)	(0.047)	(0.253)	(0.048)	(0.279)	(0.049)	(0.293)	(0.049)	(0.321)	(0.046)
T9 (FG: 1yr low)	-0.446*	0.160***	0.096	-0.033	0.377	-0.075**	0.303	-0.094***	0.488	-0.179***
	(0.238)	(0.041)	(0.257)	(0.040)	(0.276)	(0.038)	(0.288)	(0.034)	(0.332)	(0.039)
T10 (FG: 2yr central)	0.189	0.071	0.182	0.028	0.034	0.056	-0.011	0.007	0.493*	-0.121***
	(0.245)	(0.047)	(0.257)	(0.046)	(0.276)	(0.047)	(0.287)	(0.043)	(0.297)	(0.040)
T11 (FG: 2yr central-high)	-0.922***	0.407***	-0.545**	0.261***	-0.609**	0.240***	-0.460	0.185***	0.216	-0.028
	(0.261)	(0.040)	(0.276)	(0.046)	(0.286)	(0.041)	(0.292)	(0.041)	(0.354)	(0.051)
T12 (FG: 2yr central-low)	-0.142	0.014	-0.435*	0.051	-0.358	0.049	-0.031	-0.028	0.276	-0.178***
	(0.229)	(0.038)	(0.247)	(0.038)	(0.260)	(0.039)	(0.265)	(0.034)	(0.292)	(0.039)
T13 (FG: 3yr central)	0.462**	-0.065*	0.562**	-0.110***	0.332	-0.097**	0.042	-0.053	0.355	-0.138***
	(0.235)	(0.037)	(0.252)	(0.039)	(0.272)	(0.042)	(0.284)	(0.042)	(0.305)	(0.045)
T14 (FG: 3yr central-high)	-0.415*	0.098**	-0.157	0.016	-0.343	0.034	-0.487*	0.045	0.037	-0.079*
	(0.229)	(0.041)	(0.245)	(0.041)	(0.256)	(0.038)	(0.267)	(0.038)	(0.318)	(0.046)
T15 (FG: 3yr central-low)	0.153	0.166***	-0.114	0.172***	-0.255	0.148***	-0.330	0.143***	0.317	-0.038
	(0.244)	(0.041)	(0.254)	(0.039)	(0.264)	(0.037)	(0.273)	(0.038)	(0.296)	(0.040)
T16 (FG: LR central-high)	0.137	0.009	0.224	-0.028	-0.182	0.079*	-0.228	0.081**	-0.503*	0.143***
	(0.244)	(0.045)	(0.253)	(0.041)	(0.269)	(0.044)	(0.267)	(0.039)	(0.293)	(0.043)
T17 (FG: LR central-low)	-0.567**	0.211***	-0.097	0.060	-0.462*	0.162***	-0.651**	0.184***	0.193	-0.078*
	(0.235)	(0.039)	(0.260)	(0.040)	(0.272)	(0.039)	(0.278)	(0.038)	(0.323)	(0.044)
T18 (FG: LR central + past FFR)	0.045	-0.030	-0.362	0.111***	-0.085	-0.078**	-0.040	-0.061*	0.768**	-0.276***
	(0.225)	(0.037)	(0.237)	(0.040)	(0.255)	(0.039)	(0.268)	(0.037)	(0.307)	(0.041)
T19 (Current FFR + past FFR)	0.027	0.032	0.101	-0.030	0.073	0.025	0.212	-0.094***	0.538*	-0.150***
	(0.240)	(0.041)	(0.250)	(0.040)	(0.271)	(0.043)	(0.267)	(0.036)	(0.317)	(0.044)
T20 (Inflation last year)	-0.359	0.135***	0.110	-0.008	0.004	0.051	-0.662**	0.179***	0.100	-0.045
	(0.249)	(0.050)	(0.249)	(0.044)	(0.263)	(0.043)	(0.300)	(0.050)	(0.332)	(0.047)
T21 (Inflation last 3 years)	-0.259	0.034	-0.527*	0.109**	-0.288	0.018	-0.305	-0.008	0.095	-0.099*
	(0.271)	(0.053)	(0.277)	(0.050)	(0.284)	(0.043)	(0.294)	(0.040)	(0.350)	(0.052)
T22 (Inflation last year + 3yr ahead inflation path forecast)	-0.296	0.162***	-0.264	0.117**	-0.391	0.167***	-0.397	0.145***	0.827***	-0.240***
	(0.250)	(0.050)	(0.261)	(0.050)	(0.287)	(0.048)	(0.303)	(0.048)	(0.314)	(0.047)
T23 (Inflation last year + 3yr ahead inflation av. forecast)	0.435*	-0.050	0.431*	-0.060	0.304	-0.067*	0.366	-0.095**	0.335	-0.104**
	(0.229)	(0.036)	(0.249)	(0.041)	(0.265)	(0.040)	(0.273)	(0.038)	(0.307)	(0.043)
T24 (current mortgage rate)	-0.940***	0.207***	-1.288***	0.289***	-1.179***	0.177***	-1.196***	0.183***	-0.833***	0.037
	(0.235)	(0.042)	(0.241)	(0.041)	(0.267)	(0.044)	(0.276)	(0.043)	(0.303)	(0.039)
Observations	7,400		7,431		7,410		7,398		7,413	
R-squared	0.334		0.315		0.300		0.287		0.259	

Notes: The table reports estimates of coefficients in specification (1) for real mortgage rates (nominal mortgage rate minus one-year-ahead inflation forecast) for various horizons. All estimates are based on Huber robust regressions. Regressions use sampling weights. No household/respondent controls are included. Robust standard errors are in parentheses. ***, **, * denote statistical significance at 1, 5 and 10 percent levels.
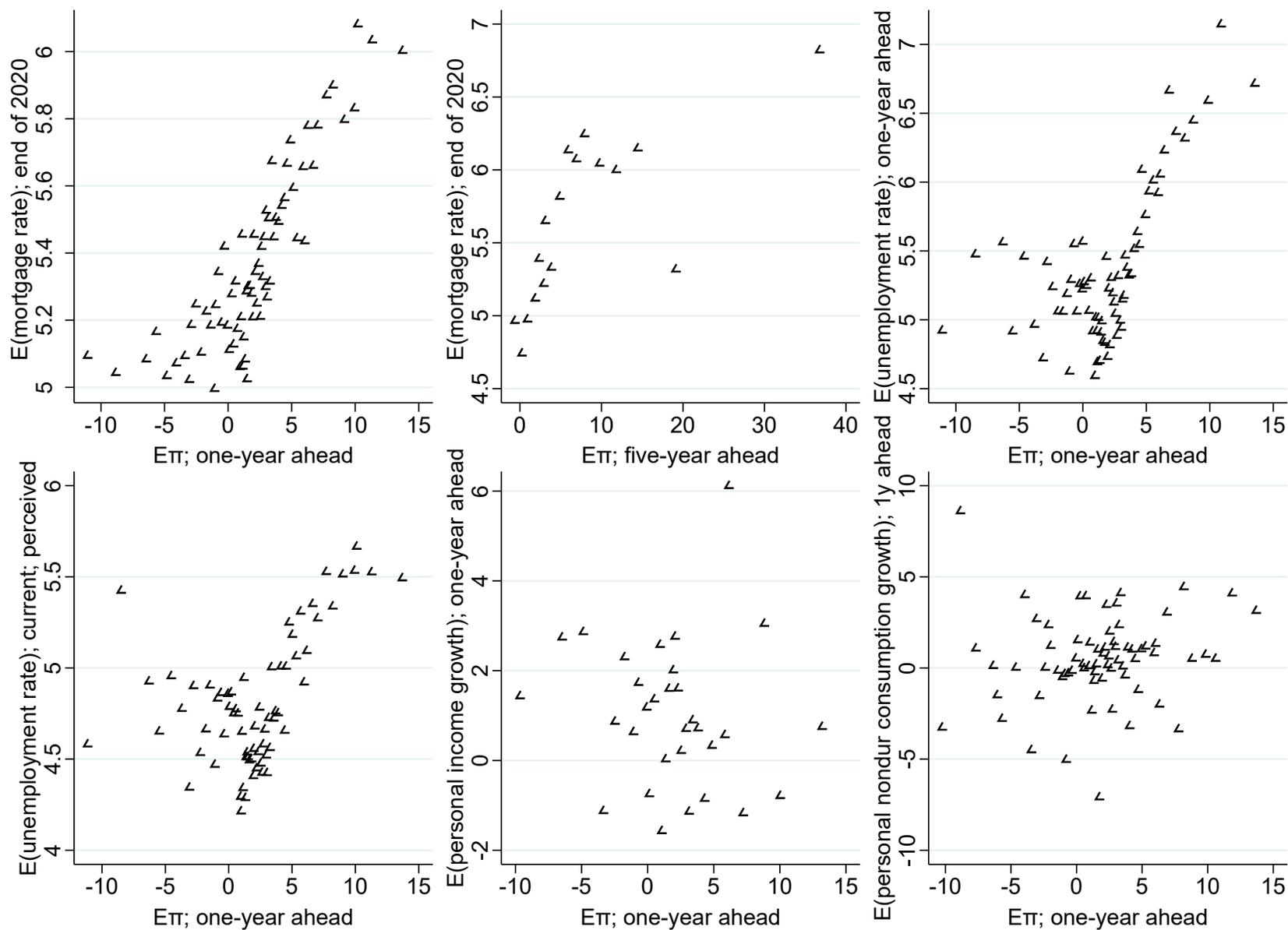
Appendix Figure 2. Revision of inflation expectations by select treatments.
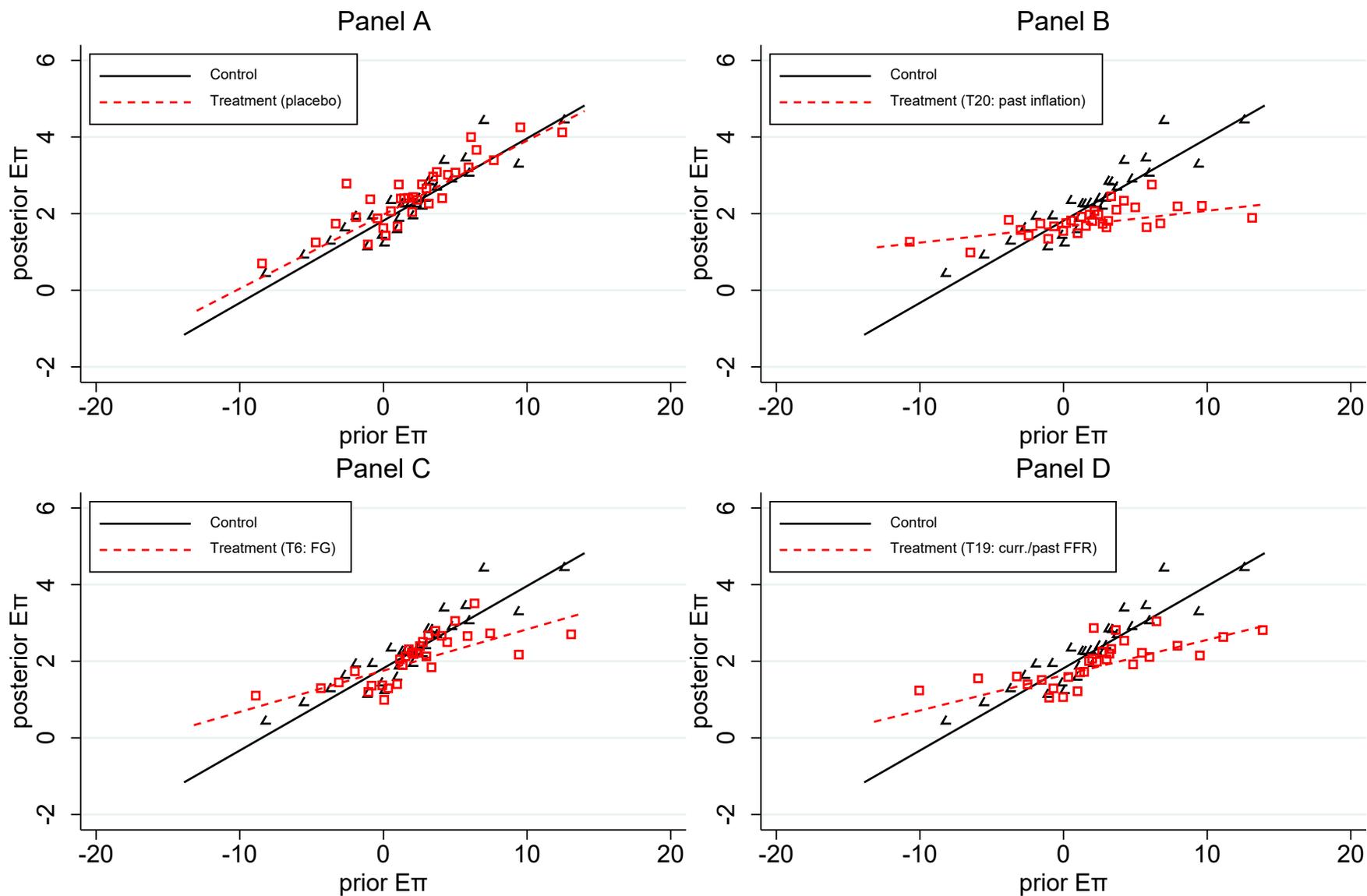
Notes: Each panel shows binscatter plot for post- vs. pre-treatment inflation expectations. Each square and triangle aggregate approximately 30 observations. Lines show fitted linear regressions.

Appendix Figure 3. Revision of unemployment rate expectations by select treatments.
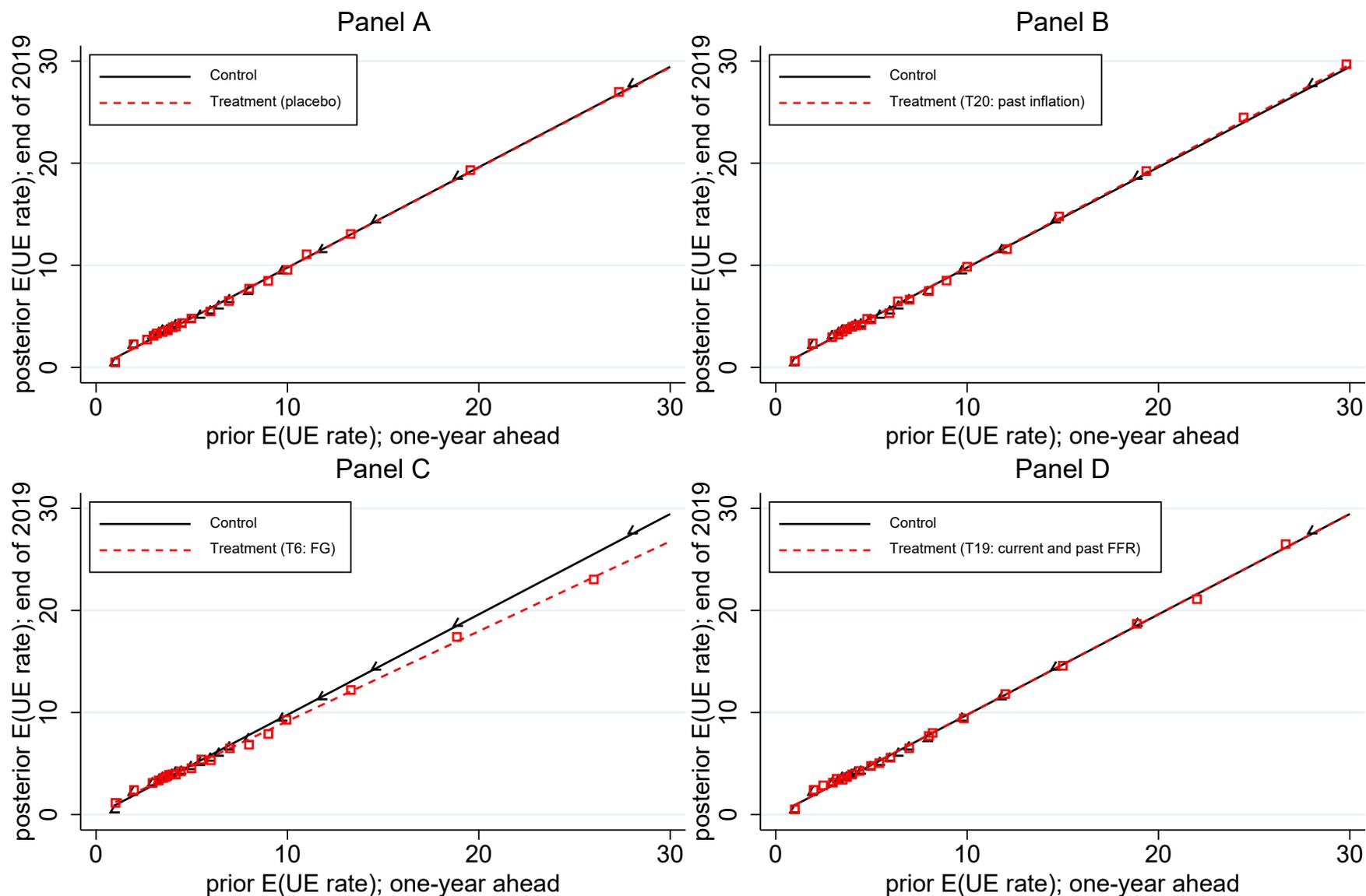
Notes: Each panel shows binscatter plot for post- vs. pre-treatment unemployment rate expectations. Each square and triangle aggregate approximately 30 observations. Lines show fitted linear regressions. The sample is restricted to 0-30 percent unemployment rate.

Appendix Figure 4. Revision of nominal mortgage rate expectations (end of 2020) by select treatments.
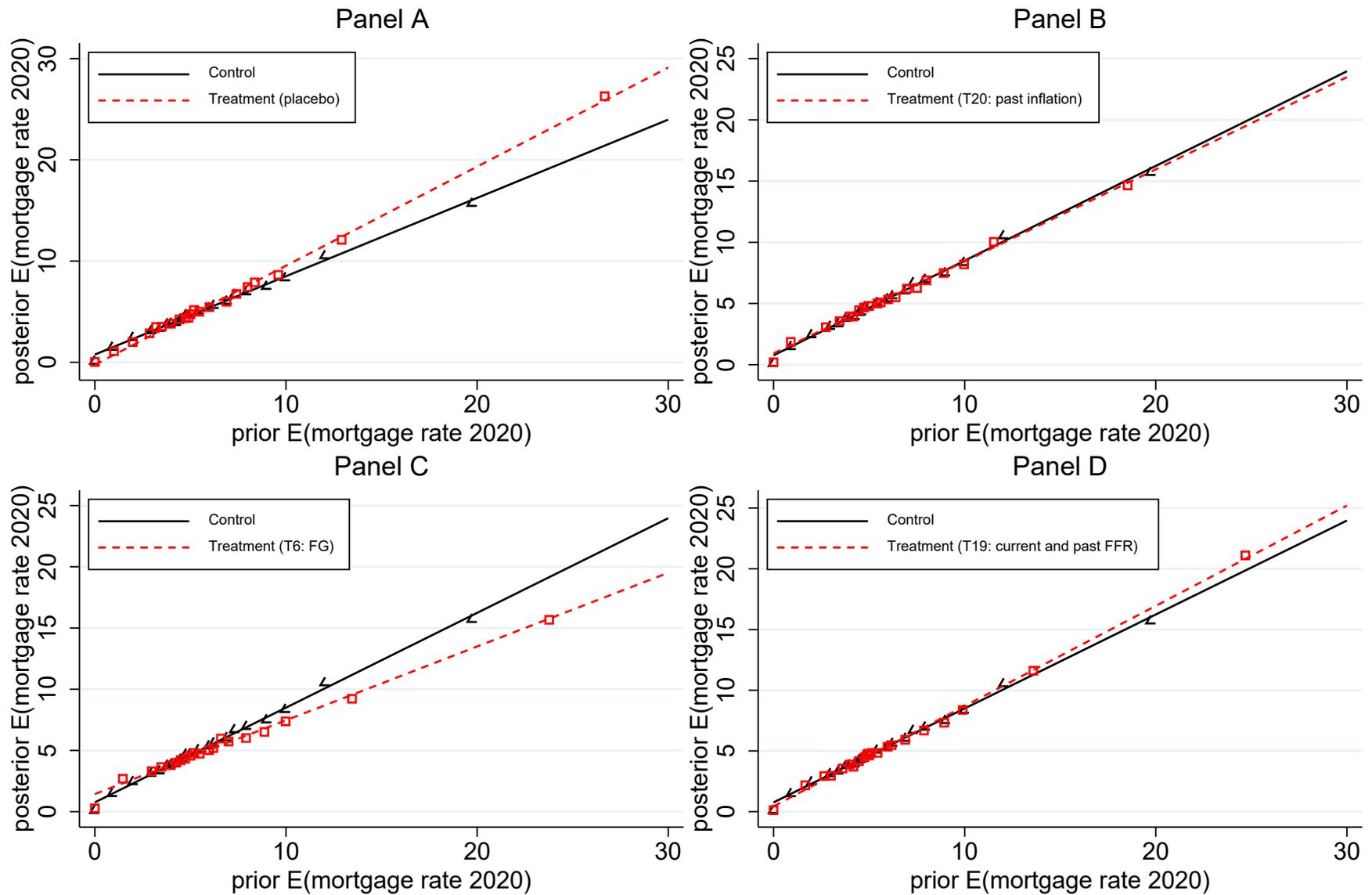
Notes: Each panel shows binscatter plot for post- vs. pre-treatment nominal mortgage expectations at the end of 2020. Each square and triangle aggregate approximately 30 observations. Lines show fitted linear regressions.

Appendix Figure 5. Revision of real mortgage rate expectations (end of 2020) by select treatments.
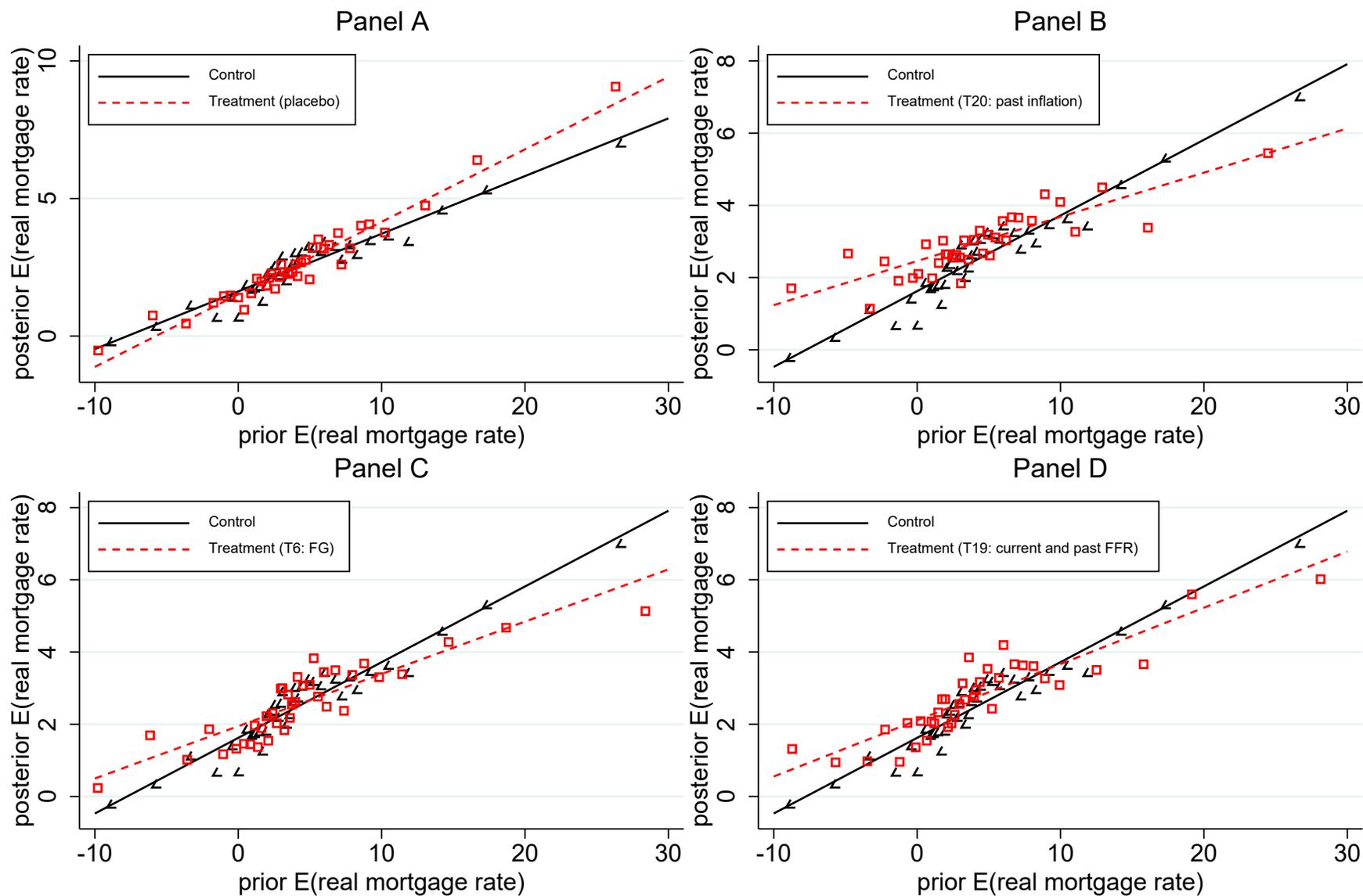
Notes: Each panel shows binscatter plot for post- vs. pre-treatment real mortgage expectations (nominal mortgage rates at the end of 2020 minus one-year-ahead inflation forecast). Each square and triangle aggregate approximately 30 observations. Lines show fitted linear regressions.