

# FORWARD GUIDANCE AND HOUSEHOLD EXPECTATIONS

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*Abstract:* We compare causal effects of forward guidance about future interest rates on households' expectations of inflation and nominal mortgage rates to the effects of communication about inflation in a randomized control trial using more than 25,000 U.S. individuals in the Nielsen Homescan Panel. We elicit households' expectations, then provide 22 different forms of information regarding past, current and/or future interest rates and inflation. Information treatments about current or future interest rates all have similar and offsetting effects on interest rate and inflation expectations, yielding limited pass-through into perceived real rates. Information about mortgage rates has much more powerful effects on interest rate perceptions, with no offsetting effects on inflation expectations, thereby delivering much larger changes in perceived real rates. Revisions in perceived real rates are shown to lead to changes in the ex-post purchases of durable goods by households.

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*“Under the empirically reasonable assumption that what matters for aggregate spending is the entire expected path of short-term rates rather than just the current level, [forward guidance] enables the Fed to provide substantial additional accommodation during zero lower bound episodes. The strategy also potentially supports aggregate demand by raising inflation expectations, thereby lowering real long-term rates relative to a Taylor Rule type baseline.”*  
Janet Yellen, September 2018.<sup>1</sup>

*“After all, it is the everyday economic decisions of people and companies that we seek to influence with our policy and communication. If our language is not accessible, our policy will be less effective.”*  
Christine Lagarde, February 2020.<sup>2</sup>

*“The limits to forward guidance depend on what the public understands, and what it believes. In normal times, the general public does not pay much attention to central bank statements, so robust policies should be designed to be effective even if they are followed closely only by financial market participants. ... policymakers must communicate consistently and intelligibly.”*  
Ben Bernanke, January 2020.<sup>3</sup>

## **1 Introduction**

As monetary policymakers in many advanced economies pushed short-term interest rates to zero both during the financial crisis and the recent COVID-19 pandemic, 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 have been facing. Understanding how forward guidance affects economic outcomes is therefore a central question. But because the mechanism of forward guidance is via expectations and these are not readily observable, it has been difficult to establish how 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 interest rates and inflation 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’ forecast revisions and how they change their views about different economic variables (e.g., long-term interest rates vs. inflation). We can also assess whether the resulting variation in perceived real interest rates of households changes their actual spending decisions on both durables and non-durables.

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<sup>1</sup> <https://www.brookings.edu/blog/up-front/2018/09/14/comments-on-monetary-policy-at-the-effective-lower-bound/>

<sup>2</sup> <https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200206~edb83d06a3.en.html>

<sup>3</sup> [https://www.brookings.edu/wp-content/uploads/2019/12/Bernanke\\_ASSA\\_lecture.pdf](https://www.brookings.edu/wp-content/uploads/2019/12/Bernanke_ASSA_lecture.pdf)

Households' expectations play a central role in the transmission of forward guidance into economic outcomes through several channels. While forward guidance is commonly viewed as operating primarily via financial markets to affect long-term nominal interest rates, it is the pass-through of these interest rates into consumption and saving decisions that partly determines how big the overall effect of forward guidance is. It is well documented that households exhibit considerable inertia in their borrowing decisions (e.g., in refinancing their fixed rate mortgages in a period of declining interest rates, see Campbell, 2006 and Andersen et al. 2020). Recently, D'Acunto et al. (2018b) find that many households do not adjust their mortgage choices to changes in interest rates. We provide new evidence on households' perceptions of market interest rates and how they respond to different types of information that speaks directly to the potential strength of this channel.

Another channel through which forward guidance should stimulate spending is via the inflation expectations of households: if households anticipate larger price increases in the future, they have an incentive to spend more today. We show that in standard New Keynesian models this is often the most powerful transmission channel of forward guidance. However, prior work should give one pause before placing much faith in this channel. D'Acunto, Hoang and Weber (2019), for example, show that European households did not adjust their inflation expectations in the months bracketing the initial forward guidance announcement by the ECB. Our results speak to the potential strength of this channel by characterizing how inflation expectations respond to different types of information about current and future interest rates.

We document a number of new results from this large-scale experiment. First, prior to any information treatment, we find that households' knowledge about market interest rates is limited: the cross-sectional dispersion in their beliefs about the level of the 30-year mortgage rate is as high as previously documented for their beliefs about inflation (e.g., Coibion, Gorodnichenko and Weber 2019). This lack of knowledge on the part of many consumers about one key interest rate is suggestive that pass-through of forward guidance from financial markets to households may be limited. Second, we find that the provision of information to households about current, past and future policy rates of the Federal Reserve has some, albeit limited, effects on households' perceptions of both current or future market interest rates even though they result in large actual changes in mortgage rates (Eichenbaum, Rebelo, and Wong 2020). This again suggests that communication about policy rates is unlikely to lead to large changes in household spending. Third, providing information about current, past and future policy rates also leads households to revise their inflation expectations in offsetting directions, consistent with them inferring that future policy rates will be an endogenous response to future economic conditions. This "information effect" is consistent with prior evidence for professional forecasters in Nakamura and Steinsson (2018). Jointly, this implies that communications about policy rates should have only limited effects on the perceived *real* interest rates of

households, since the pass-through into households' perceived nominal interest rates is limited and there is an offsetting effect on their inflation expectations, and it is precisely these perceived real interest rates that should determine the strength of the consumption response to forward guidance. We confirm that exogenous variation in perceived real interest rates of households affects their subsequent durable goods purchases.

This joint evolution of beliefs about nominal interest rates and inflation is not limited to information treatments about policy rates. We find very similar results for information treatments that involve current and future levels of inflation. While these induce a strong reaction in households' inflation expectations, they also lead households to significantly revise their beliefs about both current and future nominal mortgage interest rates. Households' perceived real interest rates therefore do not change nearly as much as would be expected solely from considering the revision in their inflation expectations.

In contrast, we find much more promising results for communication strategies focusing on long-term market interest rates themselves. One of our information treatments consists of informing households about the current 30-year mortgage rate. This treatment leads to a very strong response in households' perceptions of the mortgage rate (an almost complete convergence in beliefs to the provided information) which extends into households' expectations about future long-term rates as well. In addition, and unlike what was found with either policy rate or inflation rate treatments, providing information to households about the mortgage rate leads to almost no offsetting revision in their inflation expectations. The effect on their perceived real interest rate is therefore much larger than what we observe with other treatments. Consistent with Angeletos and Sastry (2019), this result implies that communication about the target (in this case, the mortgage interest rate) may be a more effective form of forward guidance than communication about the policy rate. And since we also show below that exogenously generated changes in households' perceived real interest rates affect households' ex-post purchases of durable goods, communication about market interest rates could potentially provide a much more powerful way of stimulating consumption than forward guidance about future policy rates.

To measure how households' expectations change in response to information treatments, we first elicit households' expectations on a host of variables including inflation and nominal mortgage rates. Subsequently, we provide information treatments to households and finally, elicit household expectations again, both shortly 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. We document that treatments about policy rates and inflation have somewhat persistent effects, present after three months but significantly dampened after six months. In contrast, the treatment involving mortgage rates dissipates much more rapidly. This is consistent with the fact that households place little

weight on their priors when it comes to information about this market rate: new signals lead to large revisions in beliefs so our provided signal has been replaced by new information within months.

Because our survey has such a large cross-section, we can consider an exceptionally large number of different treatments relative to previous work and perform multiple comparisons. Specifically, we vary (i) the variable on which we provide information: policy rates, inflation, mortgage 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 very little effect stemming from the time horizon of information about policy rates: whether the information is only about current rates or extends to several years out seems to have little marginal effect on beliefs. 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 2020), level- $k$  thinking (Farhi and Werning 2019), or 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 are not necessarily more responsive to information in the far future relative to information about the current and immediate future.

The recent focus of policymakers on forward guidance originates in part from the fact that conventional monetary policy is no longer feasible once policy rates hit the effective lower bound. One potential caveat of our survey could therefore be that we implemented it during a period in which the US has already normalized interest rates to positive levels. We believe our findings still provide important insights for several reasons. First, many households have expectations and perceptions of current interest rates that deviate significantly from the actual rates so their reaction in the survey is informative about how individuals would actually react to a forward guidance announcement. Second, the use of forward guidance long predates the Great Recession and the extent to which forward guidance affects financial markets has been studied not only during the zero bound but also outside of it (Gurkaynak et al. 2005). Third, central bankers anticipate that forward guidance and other communications-based policies can become a more conventional tool in the future (Blinder et al. 2017). Fourth, to the extent we exploit cross-sectional variation, we keep constant the level of interest rates and exploit differences in the reaction of individuals to different information treatments. This cross-sectional variation, because it identifies the weight households place on their priors, nonetheless also speaks to the weight that households place on new information and therefore to the first-round effects of communication strategies.

Randomized controlled trials have recently become more common in macroeconomics (e.g., Armona et al. 2019, Coibion et al. 2018, 2020a, Binder and Rodrigue 2018, Roth and Wohlfart 2020, D’Acunto et al. 2020). 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 influence expectations of households and contrast these responses with those of households who are informed about inflation, a powerful force for moving households expectations about macroeconomic variables (e.g., Coibion, Gorodnichenko and Weber 2019) as well as strong determinant of households’ consumption (e.g., Coibion et al. 2019, D’Acunto et al. 2016) in the U.S.<sup>4</sup>

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 maturities. 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, to reiterate and emphasize the statement of former Fed Chairman Ben Bernanke, this viewpoint 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. Moreover, many households do not adjust their propensities to take out loans to changes in interest rates (D’Acunto et al. 2018b). 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

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<sup>4</sup> This line of work is not limited to the U.S. For example, Galashin et al. (2020) combine an RCT and credit card data for approximately 3,000 respondents in Malaysia. Apart from having a much larger sample, our study is different from Galashin et al. (2020) along other dimensions. For example, our study has a control group, applies different treatments (interest rates at different horizons rather than inflation and/or exchange rate), and has potentially more comprehensive measures of consumer spending (we use survey responses and scanner data).

is likely to depend on whether households expect interest rates to rise or fall in the future because purchases of durable goods 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 channels 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 2021; see Bhattarai and Neely 2018 for a survey). This research 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 complementary: we are able to identify how households' expectations and spending respond to information about current and future interest rates 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, the horizon over which forward guidance operates, and the variable which central banks give guidance about, 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.

A recent strand of the theoretical literature develops models that limit the power of forward guidance either through deviations from full information rational expectations (Woodford 2018, Gabaix 2020, Farhi and Werning 2019, Angeletos and Lian 2018) or via introducing market incompleteness and constraints (McKay, Nakamura, and Steinsson 2016, Werning 2015, Kaplan, Moll, and Violante 2018, Hagedorn et al. 2019). We empirically add to this literature and study how individuals adjust their expectations to news about interest rates and inflation, how they adjust their consumption choices, and heterogeneity in the responses.

Our paper also 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 for advanced economies. First, households (and firms) are often inattentive to policy and relatively uninformed about macroeconomic aggregates. Second, despite this inattention, households' expectations about future aggregate conditions affect their decisions (see Coibion et al. 2020b 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 policymakers in rethinking their communication strategies with the public and suggests a need for more research to better understand the link between policy announcements and the decision-making process of economic agents.

Finally, some features of our approach are worth clarifying. First, most households do not actively follow central bank announcements (Lamla and Vinogradov 2019), even when major policy changes are made (Coibion et al. 2020a). In our survey experiment, we focus on an intensive margin of central bank communication, that is, we provide different information to agents and study which message is most effective in moving expectations but we cannot speak to the extensive margin of information acquisition. Hence, our results on the effect of communication on expectations inform policy makers on the potential power of forward guidance to the extent they are able to reach consumers with their communication. Second, actual forward guidance announcements often provide additional context on the state of the economy, the economic outlook, and potential state-dependence in the guidance such as a level of unemployment rate that has to be reached before considering interest rate changes. Previous work (Coibion, Gorodnichenko, and Weber 2019) finds that households revise their expectations similarly regardless of whether they only receive summary statistics for inflation or policy rates (as we provide here) or whether they are provided with substantially more details from actual policy statements. Third, forward guidance in practice is often about the future path of policy rates. We provide information not just about future rates but also about current and past interest rates, as well as on inflation and mortgage rates, because no systematic evidence exists so far on which form of guidance is most powerful in shaping individuals' expectations. Policy rates are not directly relevant for most consumer decisions. Mortgage rates, on the other hand, are an important transmission channel of monetary policy (Wong 2020). Given that most mortgages in the U.S. are fixed rate mortgages, households have an incentive to be informed about the evolution of these rates to determine refinancing decisions (Eichenbaum et al. 2020; Berger, Milbradt, Tourre, and Vavra 2020). Last, inflation expectations are a key determinant of individuals' saving and consumption decisions and, in New Keynesian models, forward guidance often operates primarily through inflation expectations.

## 2. Expectations and Consumption

To anchor ideas, it is helpful to recall how consumption by households relates to expectations. The consumption Euler equation determines the desired evolution of consumption over time given nominal interest rates and the expected change in prices:

$$c_t = E_t^{hh} c_{t+1} - \sigma(i_t - E_t^{hh} \pi_{t+1}) = -\sigma \sum_{j=0}^{\infty} E_t^{hh} i_{t+j} + \sigma \sum_{j=0}^{\infty} E_t^{hh} \pi_{t+j+1},$$

where  $E_t^{hh} x_{t+j}$  denotes the household's expectation at time  $t$  for variable  $x$  at time  $t + j$ . Iterated forward, the consumption Euler equation relates current consumption to the expected path of future nominal interest rates and prices.



Assume that the long-term market interest rate is determined by the term structure of expectations of the market/marginal investor:  $i_t^m = \sum_{j=0}^{\infty} E_t^m i_{t+j}$ , where  $E_t^m$  denotes the expectations of the marginal investor in financial markets. The household's belief about the long-term rate is similarly defined as  $i_t^{hh} = \sum_{j=0}^{\infty} E_t^{hh} i_{t+j}$ . The consumption Euler equation can then be written as:

$$c_t = -\sigma i_t^m - \sigma(i_t^{hh} - i_t^m) + \sigma \sum_{j=0}^{\infty} E_t^{hh} \pi_{t+j+1}.$$

This expression illustrates the three channels via which forward guidance can affect the consumption decisions of households. The first component is the financial market channel ( $i_t^m$ ). Forward guidance by the central bank about future short-term interest rates should be reflected in contemporaneous long-term nominal interest rates via financial markets. The second component ( $i_t^{hh} - i_t^m$ ) can be interpreted as the pass-through of market rates into household interest-rate expectations. If households fully observe market rates, then this term will be zero and there will be full pass-through of market rates into household consumption decisions. But if there is a difference between the perceived interest rates of households and those determined in financial markets, then this difference will alter how changes in market interest rates feed into household spending decisions. The third component reflects households' expectations about future prices ( $\sum_{j=0}^{\infty} E_t^{hh} \pi_{t+j+1}$ ). When households expect prices to go up a lot in the future, this induces them to move their consumption forward and vice-versa if prices are expected to go down.

A common narrative used by policymakers to describe how forward guidance affects household consumption is as follows: forward guidance about future short-term rates will lower long-term rates, households will then reduce their saving and increase their spending while their inflation expectations remain well-anchored. We will refer to this as the “policy narrative.” In the context of the equation above, this narrative is built on the idea that forward guidance leads to a change in the long-term rate ( $di_t^m$ ), that households observe and respond to market rates ( $di_t^{hh} = di_t^m$ ), and that “well-anchored” inflation expectations are stable, i.e.,  $d(\sum_{j=0}^{\infty} E_t^{hh} \pi_{t+j+1}) \approx 0$ . In short, the change in consumption from the policy narrative is  $dc_t^{pol} = -\sigma di_t^m$ . In this narrative, all that is needed to evaluate the effect of forward guidance on consumption is the degree to which financial markets responded to the announcement, which is summarized by the response of the long-term nominal interest rate.

In standard New Keynesian models, the effect of forward guidance is generally quite large and certainly larger than what is implied by the policy narrative. With full-information rational expectations, household expectations of the long-rate are identical to the market rate, so  $i_t^m - i_t^{hh} = 0$  and pass-through of changes in market interest rates into spending is complete. In addition, to the extent that forward guidance should induce higher inflation in subsequent periods and households anticipate this

( $d(\sum_{j=0}^{\infty} E_t^{hh} \pi_{t+j+1}) > 0$ ), the expected inflation channel will also be present. Thus,  $dc_t^{NK} = -\sigma di_t^m + \sigma d(\sum_{j=0}^{\infty} E_t^{hh} \pi_{t+j+1})$ . Importantly, it is the inflation expectations of households, not of financial markets, which magnifies the effect of forward guidance on consumption decisions in standard macroeconomic models. Understanding how these household inflation expectations respond in practice therefore can help explain how much forward guidance affects economic outcomes.

To illustrate how either channel can dominate in driving the response of consumption, we plot responses to different types of monetary shocks in the benchmark Smets and Wouters (2007) model in Figure 1. The first such shock is a standard contemporaneous expansionary 25 basis points monetary policy shock. The associated persistent decline in the policy rate implies that the contemporaneous long-term (10-year) interest rate falls on impact (by 0.04 percentage points) while expected inflation rises (by 0.03 percentage points per year over ten years), so that the real long-term interest rate falls sharply due to both channels, leading to a rise in consumption. With forward guidance shocks, however, the expected inflation channel becomes more important. For example, Figure 1 plots the effects of pre-announced expansionary monetary shocks 5 and 9 quarters later, assuming the policy rate is unconstrained prior to then. The expected decline in future short-term rates leads to a rise in expected inflation and a boom in current activity. These announcements also induce a sharp rise in short-term interest rates before the monetary shocks are realized. In these cases, the contemporaneous long-term interest rate *rises* following the forward guidance announcement. The contemporaneous increase in consumption is therefore driven by the persistent rise in households' expectations of future inflation. In this case, focusing on how long-term nominal interest rates set in financial markets responded to this shock would yield a very misleading interpretation of the effect on consumption.

Even if we assume that policy rates are fixed prior to the pre-announced shock (also shown in Figure 1) so that the long-term interest rate must fall on impact, the expected inflation effect quantitatively drives the behavior of consumption. For example, when the shock is pre-announced by one year, the long-term (10-year) nominal interest rate falls by only 1 basis point while the change in expected inflation is six times larger. The effect of forward guidance on consumption in a standard macroeconomic model therefore hinges on households' expectations of future inflation, not just the response of long-term nominal interest rates set in financial markets.

Moving beyond full-information models, one can also allow for the possibility that changes in market interest rates are not fully incorporated into households' perceptions of these rates (i.e.,  $di_t^{hh} \neq di_t^m$ ). In that case, changes in consumption depend on how households' *perceptions* of market rates change with forward guidance, as well as their inflation expectations:  $dc_t^{gen} = -\sigma di_t^{hh} +$

$\sigma d(\sum_{j=0}^{\infty} E_t^{hh} \pi_{t+j+1})$ . Ignoring general equilibrium effects, forward guidance can have larger effects than in the standard model if household expectations over-react relative to markets (as in e.g., Bordo et al. 2020). If instead households are very inattentive and do not change their perceptions of interest rates and their inflation expectations at all, then forward guidance can be impotent in affecting consumption ( $dc_t^{gen} = 0$ ) regardless of what happens in financial markets.

This dampened reaction of households could reflect two channels. One is in the spirit of sticky information as in Mankiw and Reis (2002): a fraction of agents is likely to not receive any news about the announcement, implying no effect on expectations. Coibion, Gorodnichenko, Knotek and Schoenle (2020) show that the degree of inattention by households can be very high even for very consequential monetary policy announcements such as the adoption of average inflation targeting by the Federal Reserve. The other channel follows noisy information models (e.g., Woodford 2001): households may receive some news about the announcement but treat it as a noisy signal ( $s_t$ ), such that their beliefs about interest rates follow Bayesian updating:

$$i_{t|t}^{hh} = G s_t + (1 - G) i_{t|t-1}^{hh},$$

where  $G$  is the Kalman gain and reflects the perceived noisiness of the news. Fully-informed financial markets would adjust their expectations fully, so the discrepancy between market and household expectations after an announcement would be given by  $di_t^m - di_t^{hh} = (1 - G)s_t$ . The absence of a long time series of forward guidance announcements means that one cannot estimate  $1 - G$  from the time series. Our approach in this paper will instead consist of using RCT's to estimate  $1 - G$  from the cross-section of households. Given the fact that many households would not adjust their expectations to policy announcements at all because they do not hear news about forward guidance announcements, our approach should therefore provide an upper bound on the potential effectiveness of forward guidance through household expectations.

### 3. Data and Survey Design

This section describes our survey design to elicit 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 provide more information on the structure of the survey.

#### 3.1 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 method. Nielsen checks the sample characteristics on a weekly basis and performs adjustments when necessary.

Nielsen provides households with various incentives to ensure 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.

### **3.2 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-goods producers purchase this information and other services from Nielsen for product design and target-group marketing. At no point of the survey did Nielsen tell their panelists that the survey we fielded was a part of academic research which minimizes the concerns of survey demand effects (de Quidt et al., 2018).

In early 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. (2020b).

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 response rate compares favorably with other ad-hoc surveys and is similar to other studies running surveys on Nielsen, such as D’Acunto et al (2018). For example, Qualtrics estimates an average response rate between 5 and 10% across their surveys.

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, Malmendier and Weber 2019). Participants are then asked a sequence of questions about their perceptions and expectations of inflation. We follow the design in the 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. 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. Hence, the follow-up surveys are primarily used to measure individuals’ perceptions and expectations of inflation and nominal mortgage rates.

### **3.3 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 1/24<sup>th</sup> 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. Although the number of treatments is large and thus one may be concerned about inflated p-values due to multiple hypothesis testing, our sample size is so large and our estimates are so precise that p-values adjusted for multiple hypothesis testing are nearly identical to the conventional p-values.<sup>5</sup>

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 of influencing 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 quote by former Fed Chair Janet Yellen indicates.

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 also 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 by 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. 2019). Recent theoretical attempts (e.g., Woodford 2018, Gabaix 2020, Farhi and Werning 2019, Angeletos

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<sup>5</sup> For example, Appendix Table 6 reports estimates underlying Figures 4-6, which visualize key results of the paper. Appendix Table 19 reports the corresponding p-values and q-values (p-values adjusted for multiple hypothesis testing), where the latter are computed using the method developed in Anderson (2008). Both p-values and q-values are less than 0.1 percent for nearly all coefficients.

and Lian 2018) at resolving this puzzle that emerges in a representative agent New Keynesian model propose deviations from rational expectations as a possible resolution. While the exact microfoundations differ, they all attribute an important role to some form of limited cognition on the part of the consumer. 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.

Empirically, 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 to 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 mortgage rates or inflation (Wong, 2020). D'Acunto et al. (2018b) find many households do not change their borrowing behavior 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 therefore also directly provided some households with information about current mortgage rates with reference to a 30-year fixed rate mortgage (the most prevalent mortgage product in the U.S.). Thus, we examine whether communication about interest rates that are of direct interest to households might be more effective in guiding households' expectations and decision making.

Randomized control trials have gained interest in recent empirical macro studies but it is not yet clear how the provision of information on one macro variable jointly affects agents' forecast for other variables that also affect economic behavior. Andre et al. (2019) find that 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 spending on durables after the treatment because their overall economic outlook became more negative. Our setting allows us to study whether treatments about inflation or interest rates over different horizons might be a more promising communication tool for central banks to stimulate household spending because we can directly compare their effects on

expectations but crucially also study in a systematic fashion how these treatments affect individual expectations about inflation and mortgage rates jointly.

Finally, we also vary the trajectory for the future path of interest rates, that is, the high, central, and low forecasts for future interest rates. By varying the trajectory of future interest rates across treatment arms, we aim to understand whether these nuanced differences affect individuals' expectations. Importantly, when we provided the different trajectories, we made clear that these were only one of the forecasts 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). Our placebo treatment 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 Appendix and provide a summary in Table 1.

Following each treatment (as well as for the control group), respondents were again asked about their inflation forecasts, 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. We elicited inflation expectations via a full distribution in the follow up wave and use the mean of the distribution and the inflation perception via point estimates. The first follow-up was three months after the initial wave and the second follow-up was after six months.

### **3.4 Preliminary Facts and External Validity**

Table 2 shows descriptive statistics on consumer perceptions and expectations, both from the raw data and Huber (1964) robust moments that filter out outliers, with reference to inflation 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 mortgage 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), in line with evidence from various consumer surveys according to which consumers tend to over-estimate recent inflation (see, e.g., D'Acunto et al. 2019).



The distribution of perceived inflation (Panel A, Figure 2) shows a non-trivial fraction of respondents reporting focal values in excess of 10%, as in previous work (D’Acunto et al. 2018a, 2019b, Binder 2017).

To measure expected inflation, we use the probabilistic type of question asked in the SCE in which respondents are invited to assign probabilities over a range of inflation/deflation bins. However, the ordering of the inflation ranges presented in the survey began with deflation options before offering inflation ranges. This appears to have confused some respondents, who assigned all their weight to deflation outcomes but later provided positive answers to point forecast questions about inflation (even in the control group). To address this confounding factor, we drop expectations of inflation that have a negative implied mean from the distributional question ( $\approx 20\%$  of answers).<sup>6</sup> The resulting expected inflation (12 months ahead) implied from the reported probability distribution is 2.3%. 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%.

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.<sup>7</sup> In our survey, respondents are asked to provide an estimate of the 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).<sup>8</sup> 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%).<sup>9</sup> 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.<sup>10</sup> However, this masks significant heterogeneity in beliefs about interest rates. The robust standard deviation is 1.19%.<sup>11</sup> Hence, for many

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<sup>6</sup> We find no evidence that treatments can predict which respondents are dropped at this stage (Appendix Table 20) and hence our estimated treatment effects are not affected.

<sup>7</sup> 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).

<sup>8</sup> 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.

<sup>9</sup> 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](https://www.newyorkfed.org/medialibrary/interactives/sce/sce/downloads/data/frbny_sce_housing_chartpacket2019.pdf)

<sup>10</sup> 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>

<sup>11</sup> For comparison, Bhutta et al. (2020) report that the standard deviation of mortgage rates paid by U.S. households is approximately 0.5%

households in the U.S., perceived market interest rates are quite far from actual interest rates. In the context of the Euler equation in section 2, this means that  $i_t^m \neq i_t^{hh}$  for many households.

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 5.95% 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 ones recorded in the SCE. 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 (their counterparts 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 weak 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.

In short, our survey results for Nielsen panelists are consistent with those of other surveys of households. Average levels of perceived and expected inflation and interest rates are somewhat higher than actual levels and, strikingly, display large amounts of cross-sectional heterogeneity. Unlike other surveys, our results are based on a much larger cross-section of households (approximately 25,000 vs. 1,500 in the SCE and 500 in the MSC) and allow for randomized treatments that generate *exogenous* variation in beliefs within the same survey population and time period.

#### 4. Econometric framework

We now consider how randomized information treatments affect the beliefs of households. Because the average pre-treatment expectations are relatively close to actual values of mortgage 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:

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

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  $k$ ,  $\mathbf{W}$  is a vector of household/individual characteristics.<sup>12</sup> 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  $\gamma_k$  should be negative because respondents' posterior beliefs are a weighted average of their prior beliefs and a signal. Furthermore,  $\gamma_k$  should be more negative for more informative/credible treatments, i.e., the weight on the prior is smaller. Coefficients  $\beta_k$  (the "level" effects) may be positive (a signal is above initial beliefs) or negative (a signal is below initial beliefs).<sup>13</sup>

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(1964)-robust regressions to minimize the adverse effects of influential observations and outliers. Huber-robust regressions differ from using winsorized data in standard regressions because they also take correlations across variables into account. Whether we include controls in specification (1) affects only the precision of the estimates because the assignment of treatment is random. To maximize statistical power and improve readability of our results, we estimate specification (1) with some treatments aggregated to coarser groups. We report detailed treatment effects in the Appendix.

Coefficient  $\alpha$  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  $\alpha$  different from one. First, pre- and post-treatment responses even in the control group can differ because respondents may have noise in their responses, leading to mean-reversion in answers. Second, as households participating in surveys do not like responding to the same question twice, we often formulate pre- and post-treatment questions differently. For example, we elicit inflation expectations before treatments by asking respondents to assign probabilities to a range of bins for possible inflation outcomes and use the reported probability distributions to compute the implied mean for expected inflation, whereas we gather the post-treatment inflation expectations as point predictions. Because

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<sup>12</sup> Individual characteristics are gender, age, age squared, employed/unemployed/out-of-labor-force 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).

<sup>13</sup> Intuitively, the posterior belief is a weighted average of the prior belief and the signal where the weight on the signal is equal to the gain of the Kalman filter and the weight on the prior is equal to one minus the Kalman gain. If the signal is not informative (or not available), then the weight on the prior is equal to one (hence,  $\alpha = 1$  in specification (1)). If the signal is informative, then  $\gamma$  in specification (1) is equal to the minus Kalman gain. Coefficient  $\beta$  estimate the product of the signal and one minus the Kalman gain. See Coibion, Gorodnichenko and Kumar (2018) for further discussion.

responses often vary with the design of the survey questions (e.g., Bruine de Bruin et al. 2017), one may obtain  $\alpha \neq 1$ .<sup>14</sup>

Because survey responses can take implausible values, we drop some extreme observations. Specifically, for inflation forecasts we drop responses of 100% or -100% for point predictions (drop 0.2% of the sample). We also 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 50% (applies to approximately 2% of the sample).

## **5. Effects of Different Information Treatments**

In this section, we present and discuss how different treatments affect the 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. In addition, we focus on estimates that pool across some different treatments to ease presentation but present full set of results for each treatment separately in Appendix Tables 6-11.

### **5.1 The Effect of Forward Guidance Treatments on Interest Rate Beliefs**

We begin by focusing on treatments regarding the future path of the federal funds rate relative to treatments focusing only on current and recent levels of the policy rate. Figure 4 (panel A) presents how contemporaneous mortgage rate expectations of respondents change when presented with information about different paths of the Federal Funds rate. For the control group that gets no information, the slope linking pre-treatment expectations to post-treatment expectations is close to one ( $\hat{\alpha} = 0.996$ , see Appendix Table 9), indicating that measurement error in these expectations is quite small (as this would bias the estimated  $\alpha$  to values smaller than one).<sup>15</sup> Figure 3 then presents the equivalent cross-sectional relationship between prior and posterior beliefs for those receiving information about the Federal Funds rate at different horizons. For each horizon, we present estimates pooled across treatments of the same horizon.

For those receiving information about only current and recent FFR (i.e., treatments 3 and 19), the slope of the relationship between priors and posteriors is flatter than the control group (approximately 0.8), as illustrated in Panel A of Figure 3. This indicates that telling households about current and recent levels of the policy rate has nontrivial effects on their beliefs about the current mortgage rate relative to their

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<sup>14</sup> Another approach is to impose  $\alpha = 1$  as was done in Galashin et al. (2020) who did not have a control group. Excluding the control group however presents a number of other challenges for estimating treatment effects (especially at the stage where we study the response of consumption to exogenous changes in expectations) and thus we do not take this route.

<sup>15</sup> 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.

priors. Treatments that provide *additional* information about the path of the future Federal Funds rate lead to indistinguishable effects on the perceived level of the current mortgage rate: treatments at the 1 year horizon (T7-T9), 2 year horizon (T10-T12), 3 year horizon (T13-T15), and longer horizon (T4-T6 and T16-T18) all lead to very similar slope relationships ( $\approx 0.8$ ). Similar results hold for households' beliefs about future mortgage rates (Panels B-D). Providing future estimates of the FFR leads to only small revisions in current perceptions of the mortgage rate, despite the fact that current information about the FFR is still included in the treatments. Similar results obtain for expected future mortgage rates, with few differences across treatments at longer horizons. A slope of 0.8 in the cross-sectional relationship between posteriors and priors implies that the average weight assigned to signals is only 0.2. We should therefore expect the response of households' expectations of interest rates to be 20% of that of fully informed financial markets.

While the horizon of the guidance does not seem to have any effect on the degree to which households' expectations respond, the level of interest rates in the guidance does. To see this, Table 3 reports the average revision in expectations about the nominal rate for treatments involving a high trajectory of interest rates (T4, T8, T11, T14, T16), a medium trajectory (T6, T10, T13, T18), or a low trajectory (T5, T9, T12, T15, T17). Differences in the level of the signal should not affect the slope between posteriors and priors but only the intercept, which are captured by the average revisions in Table 3. We find that average revisions in beliefs about nominal interest rates, especially future ones, are generally smaller (more negative) for low trajectory treatments than high trajectory treatments, consistent with the level of the treatment affecting the average level of beliefs.

Because the signal is in terms of the policy rate while the expectations are in terms of the 30-year mortgage rate, the mapping between the two is not immediate. To get a sense of orders of magnitude involved, note that the average difference between the high and low interest rates in the treatments is approximately 70 basis points. From Figure 3, we see that treatments involving only the current rate affect future expected long-term interest rates almost as much as treatments involving future policy rates, suggesting that households view interest rates as quite persistent. Suppose this persistence is well-approximated by an AR(1) with decay rate of  $\delta$ . Then the implied signal for the long-term rate that is equivalent to a 70 basis points persistent change in the FFR would be approximately  $70/(30 \times (1 - \delta))$  basis points. Typical Taylor rule estimates find a degree of interest smoothing of approximately 0.95 at the quarterly frequency, so  $\delta \approx 0.8$  at the annual frequency. Hence, this implies a comparable value of the signal in terms of the long-term rate of around 12 basis points. In other words, 12 basis points would be the expected change in the long-term rate in well-informed financial markets. But since households only put a weight of 20% on signals in updating their beliefs, we would expect the average revision in household beliefs arising from the different trajectories in interest rates to be around 2-3 basis points.

Estimates in Table 3 are in this range, somewhat smaller for current nominal rates and slightly higher for future nominal rates, consistent with significant downweighting of the received signal on the part of households. While the specific path of the announced policy interest rate therefore does shape households' long-term nominal interest expectations, the effect is significantly smaller than for financial markets due to the strong weight households place on their prior beliefs.

## **5.2 Interest Rate Expectations after Other Treatments**

How do households' interest rate expectations respond to other types of treatments? Our experiment included two other types of information treatments that did not involve the policy rate. One alternative involved providing households with information about current or future inflation. Another involved providing households with direct information about the contemporaneous mortgage rate.

We illustrate how these different treatments affected households' perceptions of nominal interest rates in Figure 4. For comparison, Panel A of Figure 4 plots the relationship between priors and posteriors over mortgage rates for information treatments involving current/past policy rates as well as information treatments involving forward guidance about policy rates. The effect of providing information about inflation (T20-T23) on perceived nominal rates is small. Posteriors for the current mortgage rate line up with priors in much the same way as for the control group. This result obtains whether we just include information about past inflation (T20-T21) or also include FOMC forecasts about future inflation (T22-T23). The latter in particular establishes that the FOMC predicts inflation to be very close to 2% in subsequent years, its longer-term inflation objective. The effects of inflation treatments have more impact on expectations of future interest rates (Panels B-D). For example, the effect on households' expectations of mortgage rates at the end on 2021 is indistinguishable from when information about the policy rate is provided. This shows that information about inflation affects expectations of future interest rates, much as information treatments about interest rates also affect inflation expectations.

In contrast, the other information treatment involving the current mortgage rate (T24) has an immediate and very powerful effect on households' perceptions of the current rate as well as their expectations of future mortgage rates. Panel A shows that posterior beliefs of households line up almost perfectly with the provided signal, regardless of respondents' prior beliefs. The estimated slope of the relationship between posteriors and priors is 0.02. This effect holds not just for the contemporaneous mortgage rate (Panel A) but also for expectations over future levels of the mortgage rate (Panels B-D). Even for mortgage rates two years ahead, respondents place almost full weight on the signal about the current weight and effectively zero weight on their prior beliefs.

By the standards of information treatments in macroeconomic RCTs, this level of convergence in reported beliefs toward the signal is, to the best of our knowledge, unprecedented. While it is not uncommon to find strong responses to information about variables that respondents are generally uncertain about, the full pass-through of the provided signal into reported beliefs, not just for the current mortgage rate but also for predicted mortgage rates years into the future, is very unusual. It suggests that providing information about the actual market interest rates that households face may be one of the more effective communication strategies available to central banks. The notion that communicating about targets, rather than instruments, can be most effective is consistent with the logic of Angeletos and Sastry (2019).

### **5.3 The Effects of Information Treatments on Inflation Expectations**

As emphasized in section 2, the effect of monetary policy communication on household consumption depends not only on how this communication affects the long-term nominal interest rates that households perceive but also their expectations about inflation. Indeed, some of the evidence from workhorse macroeconomic models described in section 2 suggests that inflation expectations are the most important channel quantitatively. Because our survey includes questions about both nominal interest rate and inflation expectations, we are therefore able to assess the way that information treatments affect both sets of expectations, and therefore the real interest rates that households perceive.

Panel A of Figure 5 presents the effects of information treatments about different variables on inflation expectations, while panel B of Figure 5 shows how the nominal interest rate information treatments affect expectations of inflation depending on the horizon of the information in the treatments. Several striking results arise, with treatment-specific effects reported in Appendix Table 10. First, information treatments involving recent and past inflation have very large effects on households' inflation expectations, consistent with prior evidence in Coibion, Gorodnichenko and Weber (2019). Second, information treatments involving current, past and future levels of the policy rate have an effect on inflation expectations that is about *as strong as treatments focusing directly on inflation*. Importantly, this is not driven by a simple anchoring effect reflecting low numbers reported in the treatments: the placebo treatment of 2% population growth has only a small effect on expectations relative to the control group. The fact that information about policy rates affects inflation expectations 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 that the low interest rates will be a response to weaker inflationary pressures (hence the simultaneous reduction in inflation expectations). This type of information effect has similarly been documented for professional forecasters in Nakamura and Steinsson (2018).

The final result emanating from Figure 5 is that the information treatment involving the current mortgage interest rate has very little effect on inflation expectations relative to the control group. This is strikingly different from the fact that information about the current policy rate has very large effects on inflation expectations. The latter result suggests the presence of powerful information effects when it comes to the Federal Funds rate, whereas no such effects appear to be present with the mortgage rate. Households therefore distinguish between the information content associated with different types of interest rates. This also suggests that policy communications may have very different effects on consumption depending on the type of interest rate discussed due to their differential effects on both inflation expectations and perceived nominal rates.

#### **5.4 The Effects of Information Treatments on Perceived Real Interest Rates**

Economic theory predicts that, ultimately, the way in which information treatments affect consumption depends on the joint response of long-term interest rate perceptions and inflation expectations, i.e., the response of households' perceived *real* interest rates. This is not, in general, a simple combination of the responses of nominal interest rate expectations from Figures 3 and 4 with those of inflation expectations from Figure 5. To see this, consider the stylized effect of the inflation treatment: it leads to almost zero revision in nominal interest rate perceptions but almost complete revision of inflation expectations toward the signal. One might think this would imply real interest rates would also necessarily converge as inflation expectations converge. However, if prior beliefs about nominal interest rates and inflation expectations are sufficiently positively correlated, the reverse could be true. In that case, someone with initially high inflation expectations (and who would therefore revise those expectations down sharply with the inflation treatment) would also be someone with high nominal interest rate expectations and therefore high real interest rate expectations (if the covariance between the two is sufficiently high). As that individual revises her inflation expectations downward, her real interest rate beliefs would rise and therefore deviate even more from the average. The inflation treatment could simultaneously lead to convergence in inflation expectations but divergence in real interest rate expectations depending on the joint distribution of beliefs about interest rates and inflation. This implies that it is important to consider the revision of beliefs *jointly* over nominal interest rates and inflation, i.e., the revision in perceived real interest rates.

To do so, we define households' perceived real interest rate as their belief about the 30-year mortgage rate in the end of 2019 (it takes time to utilize interest rates) minus their expected rate of inflation over the next twelve months. Figure 6 then plots the posterior real interest rates perceived by households against their prior perceptions of the real rate, broken down by treatment type (Panel A) and treatment horizon (Panel B). Several results stand out. First, there is little difference in how households



revise their views about the real interest rate across forward guidance treatments, current FFR treatments or inflation treatments. The slopes are approximately equal across treatments. This reflects the fact that these treatments all affect perceptions of nominal interest rates and inflation in broadly similar ways, as well as the fact that prior beliefs about nominal interest rates and inflation are only weakly positively correlated in the pre-treatment data. Second, there are also few differences across treatment horizons, i.e., whether information about rates is restricted to current and recent policy rates or whether they also provide information about the future path of interest rates. Third, we find that the mortgage rate treatment leads to large revisions in perceptions of real interest rates: the slope of the relationship between priors and posteriors is about half as steep as for the other treatments. This reflects the fact that mortgage rate treatments have large and immediate effects on perceptions of nominal interest rates, but unlike other treatments these have little offsetting effects on inflation expectations.

As described in section 2, the slope of the cross-sectional relationship between priors and posteriors speaks directly to how much weight agents place on new signals: a flat slope indicates a low weight on priors and therefore a large weight placed on new information. Successful communication by policymakers should target areas that households are most responsive to. Our results speak directly to this and suggest that providing information about the specific market interest rates faced by households is likely to be more powerful than communication strategies involving policy rates. Households not only revise their views about the rates they face much more strongly when provided with information about these rates, they also do not seem to revise their inflation views in offsetting ways as strongly as they do with policy rates. The ultimate effects on their perceived real interest rates are therefore much more powerful.

## **5.5 Persistence of Information Treatments**

Previous research (e.g., Coibion, Gorodnichenko and Weber 2019, Cavallo, Cruces, and Perez-Truglia 2017) documents that information treatments often have short-lived effects on households' expectations. To assess the persistence of treatment effects in our survey, we compare posterior beliefs in two subsequent waves, performed three and six months after the initial treatment, to the prior beliefs of respondents.<sup>16</sup> Results for perceived real interest rates are plotted in Figure 7. Consistent with prior work, we find that information treatments generally have transitory effects on beliefs. Most of the effects have dissipated six months after the treatment. The results are similar across treatments involving policy rates or inflation rates. However, the results with the mortgage rate treatment are again quite different. We find that effects on perceived real interest rates from the mortgage treatment are much more transitory than those from other treatments. Despite the very large contemporaneous effect of this treatment on

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<sup>16</sup> We find no systematic evidence of attrition across waves being related to the treatments (Appendix Table 4).

households' perceived real rates, the effects three months later are much smaller than those of the other treatments and have completely dissipated by six months. This suggests that communication about market interest rates, while potentially quite powerful in altering agents' perceptions of real interest rates, are unlikely to have long-lived effects on those expectations.

The fact that the most powerful treatment is also the least persistent is consistent with Bayesian updating by households and likely extends beyond this specific setting. A powerful information treatment is one in which households place little weight on their prior beliefs and instead respond strongly to the provided information. But the small weight on the individual's prior belief also implies that the information treatment will not have a persistent effect on household beliefs: the next piece of news respondents receive will again strongly move their beliefs, eliminating the effect of the information treatment. The transitory nature of the mortgage treatment on households' perceived real rates is therefore the natural flip side of its very large contemporaneous effect on their beliefs. Any communication which strongly affects households' contemporaneous beliefs will tend to be very transitory in its effects, quickly replaced by the next piece of news received by agents.

## **5.6 The Effect of Real Interest Rates on Household Spending**

Our results suggest that information treatments can 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, as illustrated in section 2, 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 construct measures of ex-post spending by households in the months following the information treatment. First, in the second follow-up wave six months after the treatment, households were asked whether they purchased a car, a house, or other large durable goods over the previous six months. This provides us with a self-reported measure of the extensive margin of durable goods purchases by households. Second, we can measure household spending on food and other available categories of goods tracked in the Nielsen Homescan panel over the six months following the survey. This provides an external source of information on the purchases of select categories of non-durable goods by households. Third, both follow-up surveys asked households to report their spending over the previous months on a wide range of categories, allowing us to measure spending on food items (comparable to the Nielsen measure), all non-durable goods, and the sum of non-durable goods purchases and debt payments.

Following Coibion et al. (2019), we use the following regression to quantify the effect of (perceived) real interest rates on ex-post purchases:

$$Y_j^{post} = \beta E_j^{pre} Y_j + \phi_1 (E_j^{post} i - E_j^{post} \pi) + \phi_2 (E_j^{pre} i - E_j^{pre} \pi) + \mathbf{W}_j \boldsymbol{\kappa} + error_j, \quad (2)$$

where  $j$  indexes respondents,  $pre$  and  $post$  indicate the timing of measurement for decisions/expectations,  $Ei$  is the expected mortgage rate in the end of 2020,  $E\pi$  is the one-year-ahead inflation forecast,  $\mathbf{W}$  is a vector of household/individual characteristics (income, age, education, presence of children, etc.). In the case of durable goods purchases,  $Y_j^{post}$  is an indicator variable  $\times 100$  if household  $j$  ex-post purchased a durable good over the six months following the information experiment and  $E_j^{pre} Y_j$  is that household's prior plans (measured before the information treatment) of whether to purchase that type of durable good over the next six months. In the case of non-durable goods purchases,  $Y_j^{post}$  is  $100 \times \log(\text{monthly spending})$  measured either three months or six months after the treatment using either Nielsen or survey data. Since ex-ante expectations of future non-durable goods spending were not collected, we use the household's pre-treatment monthly spending (measured in the initial wave) for  $E_j^{pre} Y_j$ .<sup>17</sup> This empirical specification therefore involves regressing ex-post measures of households' consumption decisions on their perceived real interest rates ( $E_j^{post} i - E_j^{post} \pi$ ) after conditioning on their earlier beliefs and plans as well as a wide range of household controls. We use posterior beliefs measured immediately after the treatments.

Estimating specification (2) with OLS is problematic because of mean-reversion in responses and other forms of endogeneity. Instead, we estimate specification (2) with an instrumental variables (IV) approach where the first stage is given by specification (1).<sup>18</sup> Effectively, this means that the revision in real interest rates is being instrumented by the information treatments, which are randomly assigned to some households and not to others. Coefficient  $\phi_1$  then yields a causal effect of changing expectations about real interest rates on ex-post household spending. The randomized provision of information helps us isolate exogenous variation in beliefs so that we can rule out endogenous co-movement in expectations and spending.<sup>19</sup> As shown in Tables 4 and 5, our information treatments provide sufficient variation in perceived real rates for identification purposes.

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<sup>17</sup> To attenuate noise, we apply several filters to consumer spending on nondurables reported in the surveys and in the scanner data. For example, we exclude households who have inconsistent reporting in the scanner data. In a similar spirit, we exclude households who report unrealistically low or high consumer spending in the surveys.

<sup>18</sup> To maximize statistical power, we group treatments into i) future policy rates; ii) past and current policy rates; iii) inflation; iv) current mortgage rate; v) control.

<sup>19</sup> To deal with outliers and influential observations, we adopt the jackknife procedure described in Coibion et al. (2019).

We report results for durable goods spending in Table 4 for each type of durable good separately and using all types of durable goods. For cars (column 2) and big-ticket items (column 3), we find that higher perceived real interest rates by households are followed by lower likelihoods of durable goods being purchased over the next six months. In the case of houses (column 1), the coefficient is also negative but is not significantly different from zero, which likely reflects the fact that we have very few observations of house purchases over that six-month period. When we combine all purchases of durables goods into one (column 4), we again estimate a negative coefficient on real interest rates. Specifically, a one percentage point decrease in the perceived real interest rate raises the probability of a large durable goods purchase in the next six months by around 1.1-1.3 percentage points, an economically strong response given that 7.1 percent of households reported buying a durable good over the last 6 months. Hence, exogenous changes in perceived real rates arising from our information treatments have a clear causal effect on subsequent household purchases of durable goods.<sup>20</sup> This indicates that forward guidance, conditional on reaching households and changing their perceived real interest rates, can be expected to affect durable goods purchases of households within a relatively short time frame.

Results for non-durable goods purchases, three and six months after the information treatments, are reported in Table 5. We find little evidence of a robust response of non-durable goods spending to changes in perceived real interest rates. Regardless of whether we use narrow (food) or broad (all available spending) measures of spending from the survey or Nielsen, we find no statistically significant response of spending six months after the information treatments. Only with the Nielsen broad measure of spending over three months do we find a statistically significant effect, but it dissipates completely after another three months. Given that none of the other measures yield a similar result, we are inclined to treat it more as a noisy finding than clear evidence of a transitory change in non-durable goods spending. In all cases, the standard errors are quite large, which reflects the noisiness of non-durable goods spending data, whether it comes from scanners or self-reports in surveys. In short, we view the results for non-durable goods spending as inconclusive: in contrast to interest-rate sensitive purchases of durable goods, we do not find evidence that changes in perceived real interest rates have discernible effects on ex-post household spending on non-durables, but the large standard errors also do not allow us to say that the effects are necessarily small.

## 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

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<sup>20</sup> In Appendix Table 19, we find equivalent results using as dependent variable whether households think that now is a good time to buy a durable good.

balance sheets constrain further asset purchase programs. In typical theoretical models, forward guidance about future policy rates tends to lower the long-term interest rate perceived by households, which reduces the incentive to save and makes them want to consume more, while raising their expectations about future price increases, which further encourages them to move their spending up. In more general settings, one would expect the effect on long-term nominal interest rates to happen via financial markets, so that consumers' responses would ultimately depend on the extent to which they perceive those changes in market interest rates as well as the extent to which their inflation expectations respond to the announcement. This last channel is often the most quantitatively important in typical models. We contribute to this area by providing clear causal evidence of how information about current and future interest rates and inflation affects households' expectations of both nominal mortgage rates and inflation.

Using a large-scale randomized control trial on a representative sample of roughly 25,000 U.S. households, we find that communication about current and future policy rates moves both interest rate and inflation expectations by about as much as communicating about current or future inflation. In all of these cases, communication has partially offsetting effects on nominal interest rate and inflation expectations, so that real interest rates move significantly less than would be expected from looking at either expectation independently. In contrast, communication about the mortgage rate has immediate and dramatic effects on household perceptions of these market interest rates, both current and those expected for years thereafter, while generating almost no offsetting changes in inflation expectations. The result is that real interest rate expectations end up being significantly more sensitive to the mortgage rate treatment than any other information treatment. We also document that lowering perceived real interest rates can stimulate spending on durable goods but it has no clear effect on spending on nondurables.

These results have a number of practical implications. First, they provide evidence for some mechanisms why forward guidance may not be as strong in practice as in theory: effects of forward guidance communication tend to have offsetting effects on inflation expectations and interest rates, mitigating the change in households' perceived real interest rates. Second, communication strategies could have much larger effects on household expectations and actions if they focused on objectives for long-term market interest rates, rather than policy rates, as emphasized in Angeletos and Sastry (2019). Third, the most effective communications strategies in terms of changing households' expectations will also naturally tend to be the most transitory in their effects. Generating long-lived effects on expectations will require persistent communication campaigns.

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 policymakers:

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)
<b>Pre-treatment data</b>					
Perceived inflation, previous 12 months	2.88	2.41	7.41	3.00	13.23
Expected inflation, 12-month ahead	2.32	2.02	3.62	2.60	3.69
Perceived and expected mortgage rate for a “person like you”					
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
<b>Post-treatment data</b>					
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
Perceived and expected mortgage rate for a “person with excellent credit”					
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. Pre-treatment expected inflation excludes responses reporting deflation. Perceived and expected mortgage rates are elicited for “a person like 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. Response of expectations revisions by aggregated trajectory.

Dependent variable: revisions in perceptions or expectations of mortgage rate	Nominal mortgage rate				
	Current	One-year [2019]	Two-year [2020]	Three-year [2021]	Longer run
	(1)	(2)	(3)	(4)	(5)
Control	-0.191*** (0.014)	-0.263*** (0.019)	-0.330*** (0.022)	-0.362*** (0.025)	-0.358*** (0.026)
FG: High trajectory	-0.030* (0.016)	-0.038* (0.022)	-0.032 (0.026)	-0.038 (0.029)	0.025 (0.030)
FG: Central trajectory	-0.036** (0.017)	-0.034 (0.022)	-0.046* (0.027)	-0.004 (0.029)	-0.010 (0.031)
FG: Low trajectory	-0.032** (0.016)	-0.077*** (0.022)	-0.072*** (0.026)	-0.041 (0.028)	-0.063** (0.030)
Current FFR rate	-0.042* (0.024)	-0.051 (0.031)	-0.099*** (0.038)	-0.026 (0.040)	-0.043 (0.044)
Current mort. rate	0.058** (0.025)	0.037 (0.031)	0.032 (0.038)	-0.022 (0.041)	0.035 (0.044)
Inflation	-0.001 (0.016)	-0.002 (0.022)	-0.001 (0.026)	0.044 (0.029)	0.004 (0.030)
Observations	19,425	19,909	20,313	20,370	20,247
R-squared	0.001	0.002	0.001	0.001	0.001

Notes: The table reports estimates of coefficients on treatment indicator variables when treatments are aggregated by the trajectory of forward guidance (FG). The estimated specification is  $X_j^{post} - X_j^{pre} = \alpha + \sum_{k=2}^{24} \beta_k Treatment_j^{(k)} + error_j$ . 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 FFR rate: T3

High trajectory: T4, T8, T10, T13, T16

Central trajectory: T6, T7, T11, T14

Low trajectory: T5, T9, T12, T15, T17

Current mortgage rate: T24

Inflation rate: T20-T-23

Table 4. The Effect of Real Interest Rates on the Purchase of Durable Goods.

	Home	Car	Big item	Any
	(1)	(2)	(3)	(4)
Posterior $i - E\pi$	-0.04 (0.10) [-0.217, 0.127]	-1.06** (0.41) [-1.746, -0.382]	-1.32*** (0.41) [-1.995, -0.645]	-1.33* (0.72) [-2.525, -0.141]
Plan to buy (pre-treatment)	3.73*** (1.18)	7.39*** (1.61)	3.73*** (1.40)	8.64*** (1.48)
Prior $i - E\pi$	-0.01 (0.02)	0.23*** (0.08)	0.22*** (0.07)	0.20 (0.13)
female	0.46*** (0.10)	0.58 (0.53)	0.58 (0.54)	0.91 (0.81)
age	-0.06 (0.05)	-0.28* (0.15)	-0.13 (0.14)	-0.37* (0.20)
age <sup>2</sup>	0.00 (0.00)	0.00* (0.00)	0.00 (0.00)	0.00* (0.00)
Have child	-0.05 (0.33)	1.18 (1.05)	-0.81 (0.95)	-0.11 (1.54)
HH head education: high school	-0.05 (0.15)	0.45 (0.90)	-1.24 (0.89)	-2.17 (1.40)
HH head education: some college	0.06 (0.15)	-0.83 (0.76)	-1.03 (0.82)	-2.95** (1.27)
HH head education: college or more	0.54** (0.23)	0.13 (0.87)	-0.77 (0.81)	-1.56 (1.35)
ln(household income)	-0.00 (0.00)	0.01* (0.00)	0.00 (0.00)	0.01** (0.00)
Household size	0.01 (0.07)	-0.02 (0.27)	0.49* (0.30)	0.42 (0.48)
N obs	5,784	5,779	5,780	5,738
1 <sup>st</sup> -stage F-stat	9.99	10.41	9.14	10.17

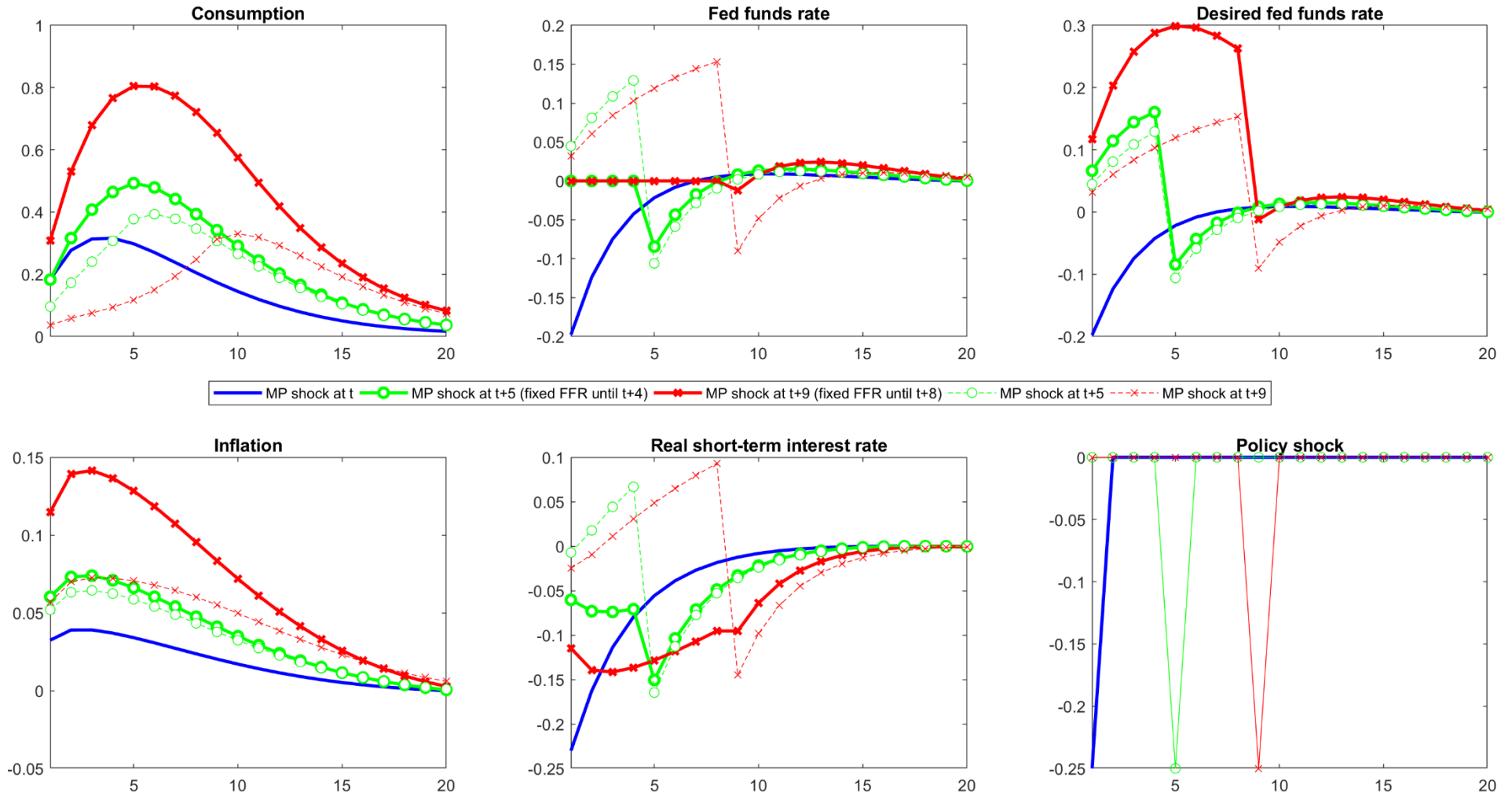
Note: The table reports instrumental variable (IV) estimates of specification (2). The first stage is given by specification (1). The dependent variable is equal to 100 if a respondent purchased a durable good of the type defined by each column (house in column 1, car in column 2, other big-ticket item in column 3, any of these in column 4) in the six months following the information treatment and zero otherwise. All regressions use sampling weights. Robust standard errors are in parentheses. 90 percent confidence intervals robust to weak IV are reported in square parentheses. “1<sup>st</sup> stage F-statistic” reports the F statistic for the first stage regression. The treatment of outliers and influential observations is described in Appendix C of Coibion et al. (2019). \*\*\*, \*\*, \* denote statistical significance at 1, 5 and 10 percent levels. 90 percent confidence interval robust to weak IV is reported in square parentheses.

Table 5. The Effect of Real Interest Rates on Non-Durable Goods Spending.

	Wave		
	First follow-up	Second follow-up	Combined follow-ups
<b>Panel A. Nielsen food</b>			
Posterior $i - E\pi$	1.37 (1.17) [-0.91, 3.66]	0.20 (1.29) [-2.33, 2.72]	0.95 (1.02) [-1.03, 2.93]
N obs	11,699	11,642	11,576
F-stat	22.22	22.63	23.90
<b>Panel B. Nielsen total</b>			
Posterior $i - E\pi$	2.93*** (1.10) [0.78, 5.07]	-0.40 (1.27) [-2.88, 2.09]	1.37 (1.00) [-0.59, 3.33]
N obs	11,653	11,574	11,527
F-stat	22.50	22.72	23.21
<b>Panel C. Survey food</b>			
Posterior $i - E\pi$	-0.14 (2.27) [-4.59, 4.32]	0.30 (3.12) [-5.80, 6.41]	0.88 (2.14) [-3.31, 5.07]
N obs	10,752	5,416	4,588
F-stat	14.64	6.775	7.059
<b>Panel D. Survey nondurable</b>			
Posterior $i - E\pi$	2.00 (1.95) [-1.81, 5.81]	-3.94 (2.51) [-8.84, 0.97]	-2.30 (2.18) [-6.57, 1.97]
N obs	10,798	5,373	4,555
F-stat	17.72	7.320	6.056
<b>Panel E. Survey nondurable + debt payments</b>			
Posterior $i - E\pi$	2.22 (1.88) [-1.46, 5.90]	-0.98 (2.29) [-5.48, 3.51]	1.13 (2.20) [-3.18, 5.43]
N obs	10,813	5,366	4,528
F-stat	17.90	8.363	7.466

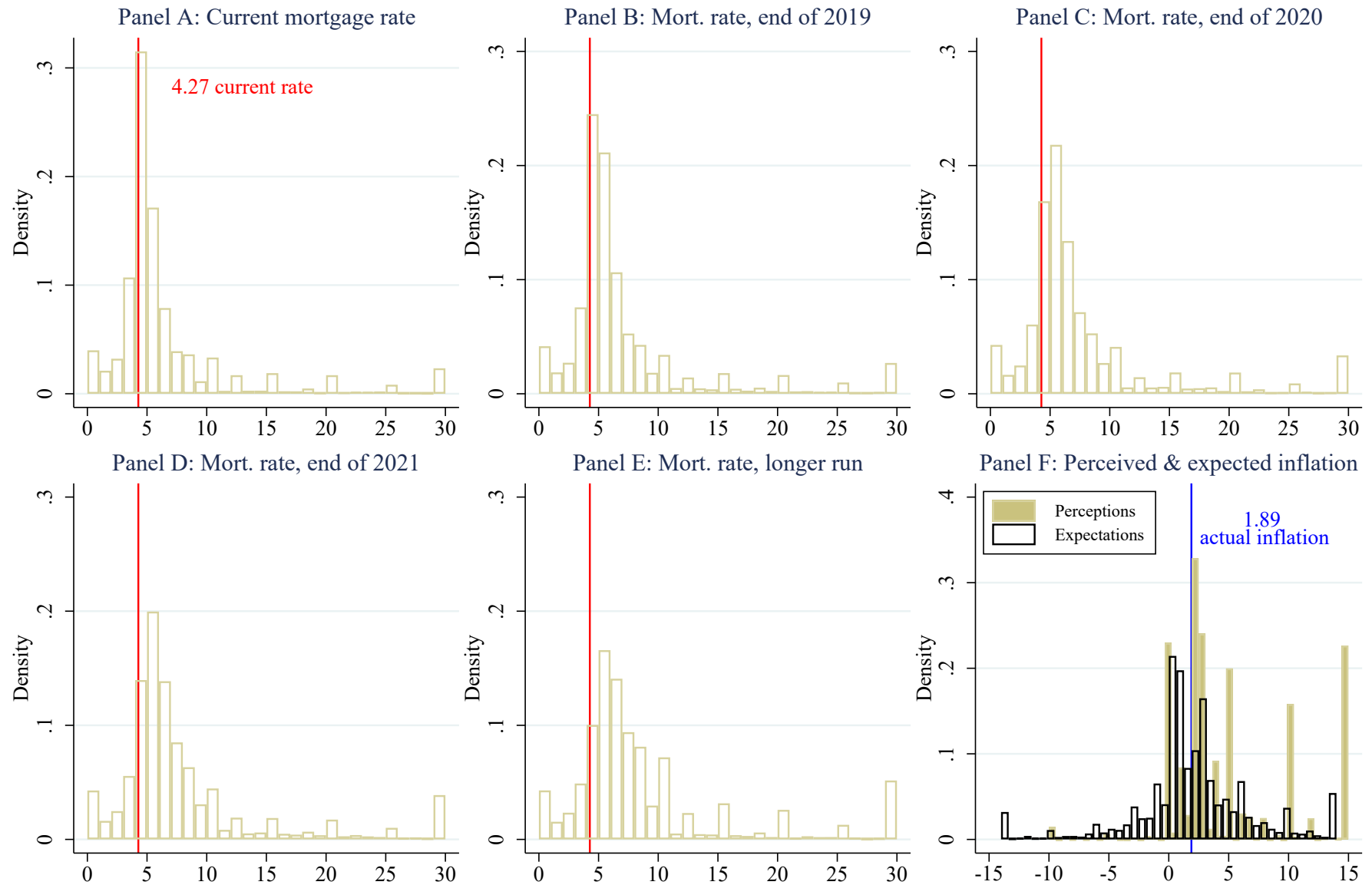
Note: The table reports instrumental variable (IV) estimates of specification (2). The first stage is given by specification (1). The dependent variable is  $100 \times \log(\text{monthly spending})$  over the last three months.  $\log(\text{monthly spending})$  is trimmed at bottom and top 1 percent. Controls as in Table 4 are included but not reported. Panels A-E use different measures of spending. Panels A and B use scanner data from Nielsen. Panels C-E use self-reported spending data from the surveys. All regressions use sampling weights. Robust standard errors are in parentheses. 90 percent confidence intervals robust to weak IV are reported in square parentheses. “1<sup>st</sup> stage F-statistic” reports the F statistic for the first stage regression. The treatment of outliers and influential observations is described in Appendix C of Coibion et al. (2019). \*\*\*, \*\*, \* denote statistical significance at 1, 5 and 10 percent levels. 90 percent confidence interval robust to weak IV is reported in square parentheses.

Figure 1. Response to current and anticipated policy shocks in the baseline Smets-Wouters model.



Notes: The figure plots impulse responses to different monetary shocks in the baseline Smets and Wouters (2007) model. The model uses parameter values estimated in Smets and Wouter (2007). “MP shock at time  $t$ ” is the case of a 25 basis points shock to the Taylor rule happening contemporaneously (at time 1). “MP shock at time  $t+5(t+9)$ ” is the case in which a 25 basis points expansionary monetary shock is pre-announced 1 year (2 years) prior, i.e., the announcement is made at time 1 but the shock only occurs in quarter 5 (9). “MP shock at time  $t+5$  (fixed FFR until  $t+4$ )” is the case of a 25 basis points monetary shock happening in quarter 5 but pre-announced at time 1, with the policy rate made to be fixed until the shock is realized. “MP shock at time  $t+9$  (fixed FFR until  $t+8$ )” is analogous to previous case but with a two-year gap between announcement and policy shock.

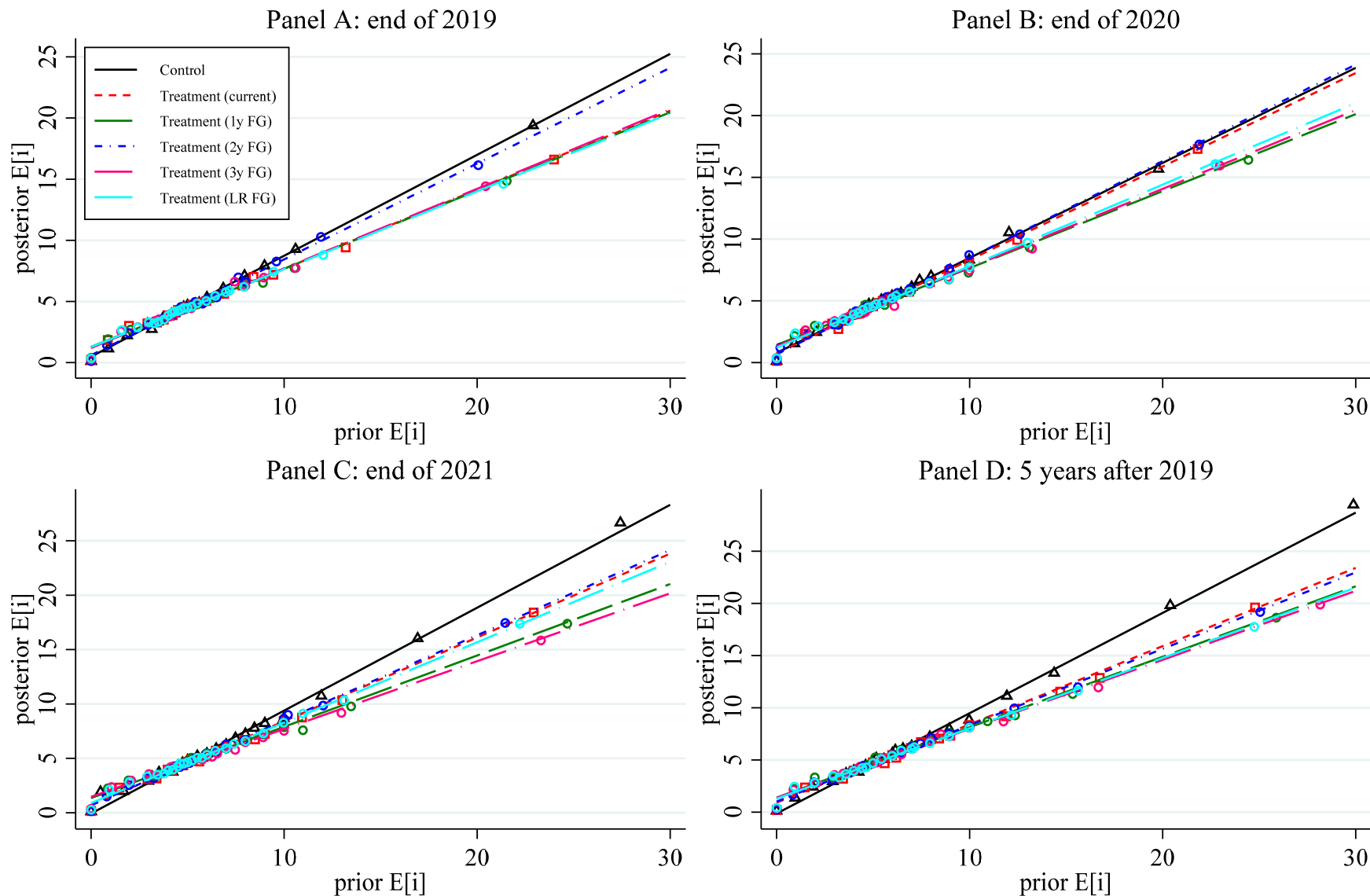
Figure 2. Distribution of pre-treatment perceptions and expectations of mortgage rate and inflation.



Notes: Mortgage rates are censored at 30 percent. Perceived inflation rate (point prediction) is censored at -10 percent and 15 percent. The blue vertical line shows actual inflation rate at the time of the survey. The red vertical line shows actual mortgage rate 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.

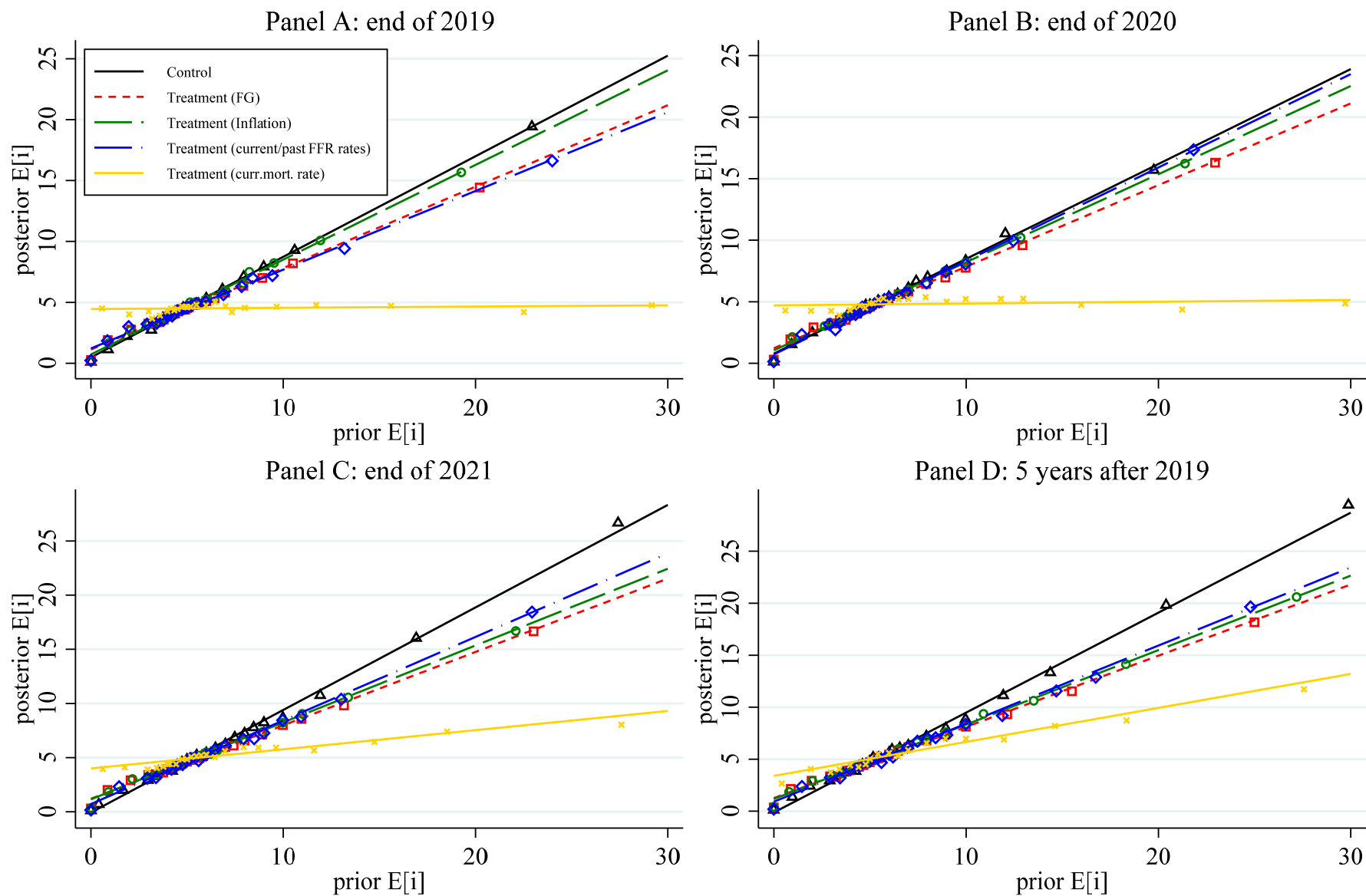


Figure 3. Response of nominal mortgage rate expectations by forecast horizon and the horizon of forward guidance (FG).



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.

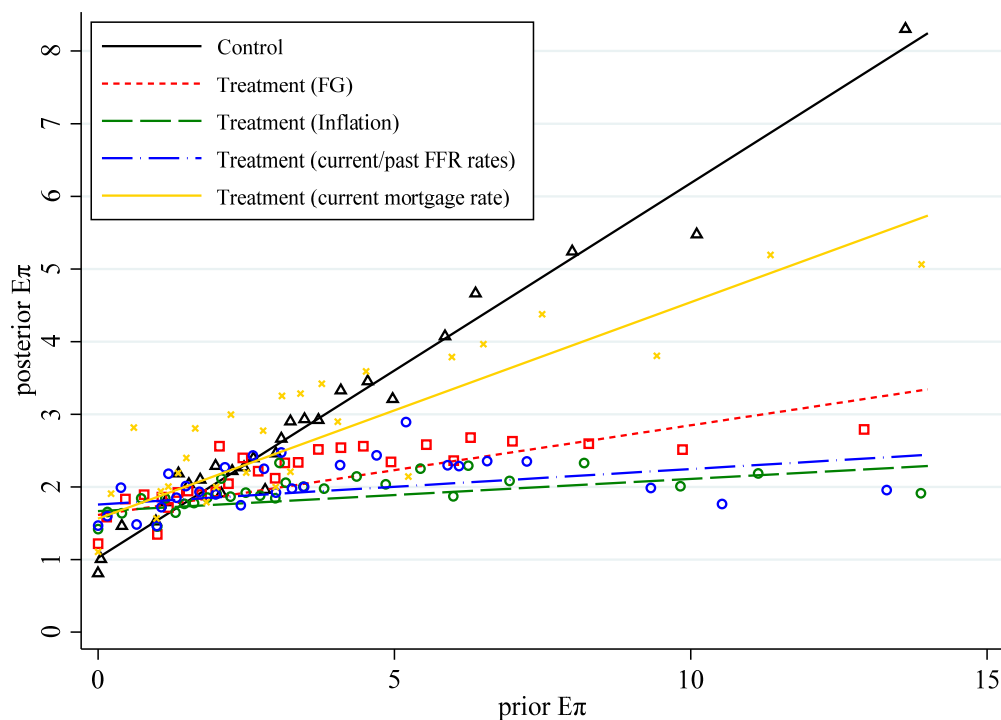
Figure 4. Response of nominal mortgage rate expectations by treatment and horizon.



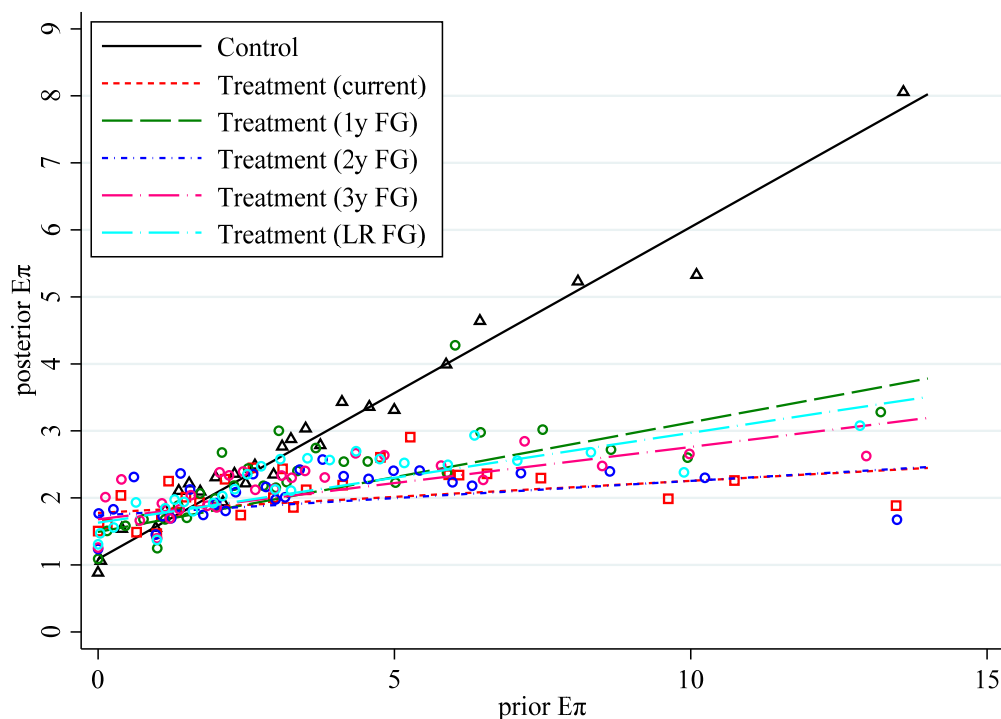
Notes: each panel shows binscatter plots for revisions in nominal mortgage rates when treatments are combined into information provision about current rates (“Current/past rates”: T3, T19, T24), forward guidance (“FG”: T4-T19), inflation (“Inflation”: T20-T23). The title of each panel indicates the horizon 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



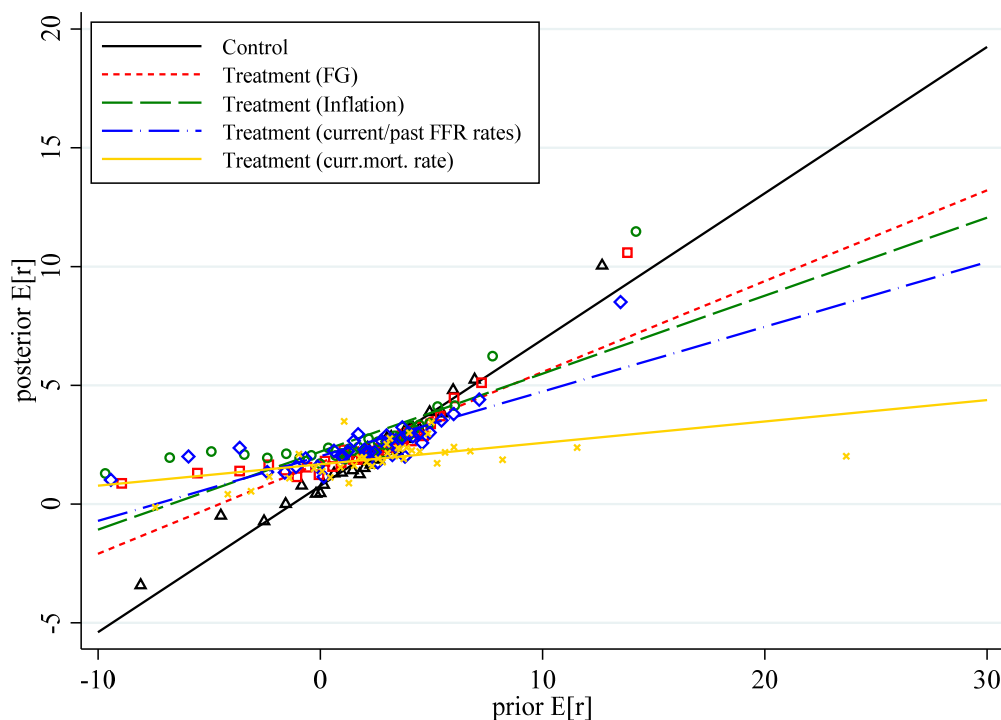
Panel B: By the horizon of forward guidance



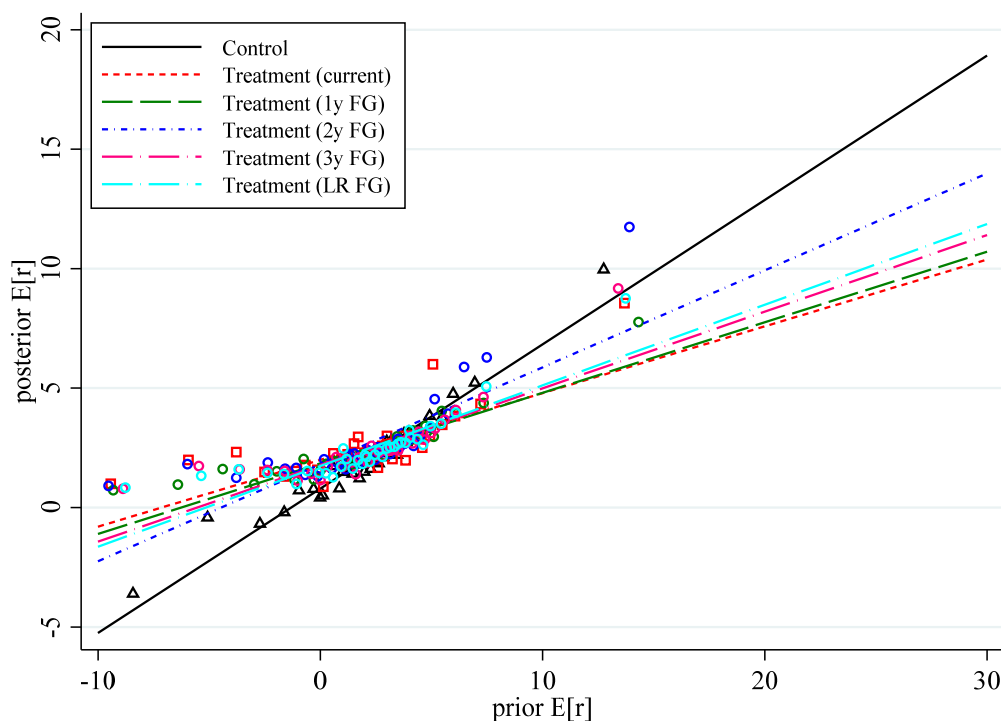
Notes: Panel A shows binscatter plots for revisions in inflation forecasts when treatments are combined into forward guidance (T4-T19), inflation (T20-T23), and current/past interest rates (T3, T19), current mortgage rate (curr.mort., T24). Panel B shows binscatter plots for revisions in inflation forecasts when treatments are combined into information provision about current rates (“current”: T3, T19), 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), current mortgage rate (curr.mort., T24). Estimated regression coefficients are reported in Appendix Table 6 and Appendix Table 7.

Figure 6. Response of real mortgage rate expectations by forecast horizon and the horizon of forward guidance (FG).

Panel A: By treatment type



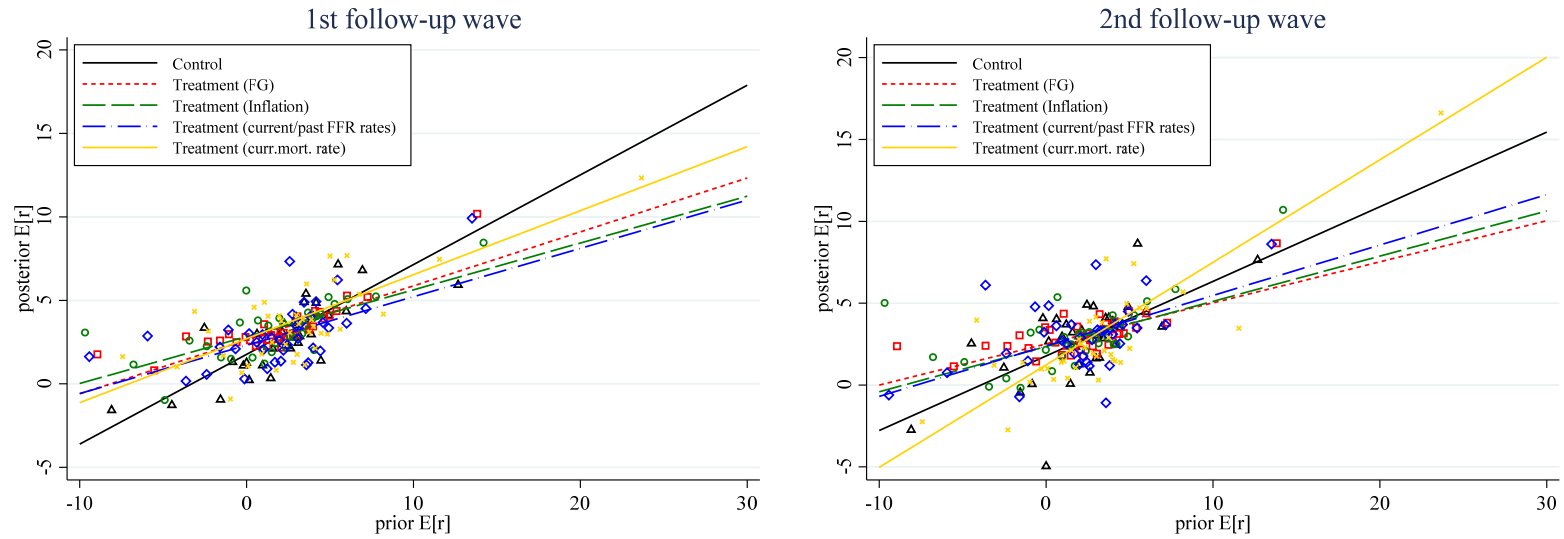
Panel B: By the horizon of forward guidance



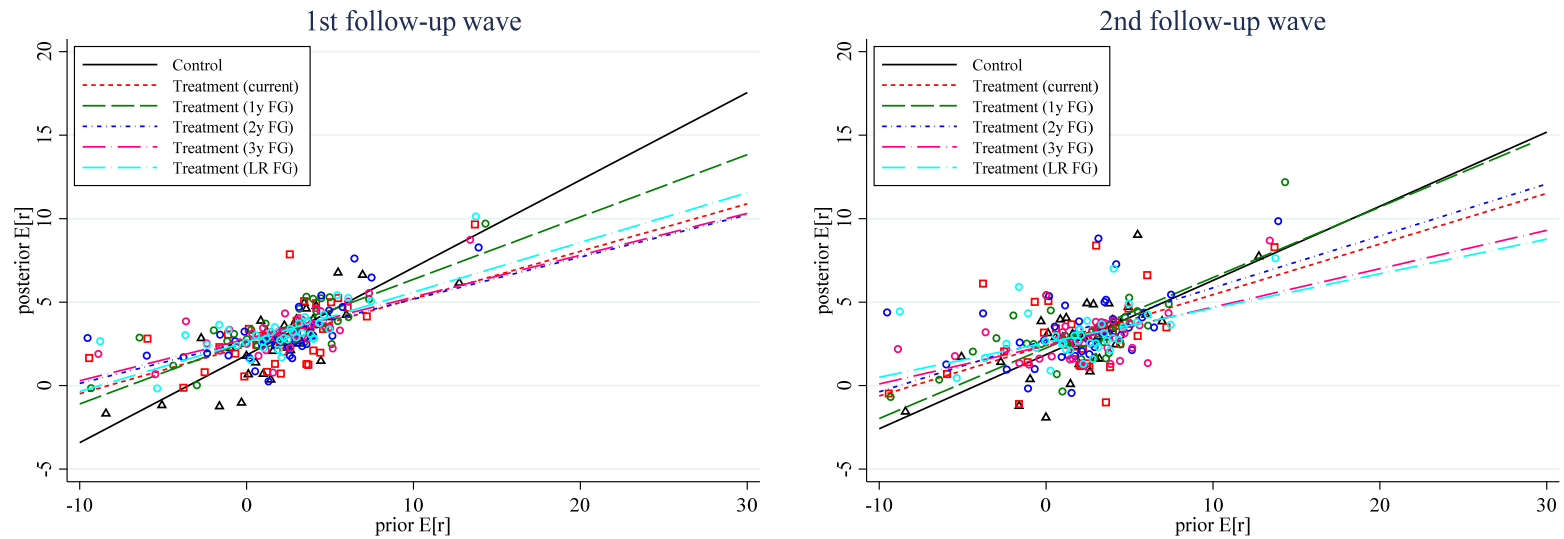
Notes: Real rate is the mortgage rate in the end of 2019 minus the current one-year-ahead inflation rate. Panel A shows binscatter plots for revisions in real mortgage rates (nominal mortgage rate minus one-year ahead inflation forecast) when treatments are combined into information provision about current FFR rates (“current”: T3, T19), 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), current mortgage rate (curr.mort. T24). Estimated regression coefficients are reported in Appendix Table 7. Panel B 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 FFR rates (“Current/past rates”: T3, T19), forward guidance (“FG”: T4-T19), inflation (“Inflation”: T20-T23), current mortgage rate (curr.mort., T24). The title of each panel indicates the horizon of the forecasts for mortgage rates. Estimated regression coefficients are reported in Appendix Table 6.

Figure 7. Response of real mortgage rate expectations by forecast horizon and the horizon of forward guidance (FG) in follow-up waves.

Panel A: By treatment type



Panel B: By the horizon of forward guidance



Notes: The real rate is for the end of 2019. Panel A shows binscatter plots for revisions in real mortgage rates when treatments are combined into information provision about current FFR rates (“current”: T3, T19), 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), current mortgage rate (curr.mort. T24). Panel B shows binscatter plots for revisions in real mortgage rates when treatments are combined into information provision about current FFR rates (“Current/past rates”: T3, T19), forward guidance (“FG”: T4-T19), inflation (“Inflation”: T20-T23). The title of each panel indicates the horizon of the forecasts for mortgage rates.

## **ONLINE APPENDIX**

Appendix Table 1. Correlation coefficients for pre-treatment perceptions and expectations.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
Perceived inflation, previous 12 months	(1)	1.00						
Expected inflation, 12-month ahead	(2)	0.13	1.00					
Perceived and expected mortgage rate for “a person like you”								
Current	(3)	0.21	-0.00	1.00				
End of 2019	(4)	0.23	0.01	0.91	1.00			
End of 2020	(5)	0.25	0.03	0.86	0.93	1.00		
End of 2021	(6)	0.26	0.04	0.82	0.89	0.94	1.00	
Next 5-10 years	(7)	0.26	0.06	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)
<b>Pre-treatment data</b>				
Perceived inflation, previous 12 months	2.89	2.35	2.87	2.42
Expected inflation, 12-month ahead	2.29	1.93	2.33	2.04
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
<b>Post-treatment data</b>				
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
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. Pre-treatment expected inflation excludes responses reporting deflation. Perceived and expected mortgage rates are elicited for “a person like you” at the pre-treatment stage and for “someone with excellent credit” at the post-treatment stage.



Appendix Table 3. Predictability of treatment status.

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:  $Treatment_i^{(k)} = \mathbf{X}_i b^{(k)} + error$  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,  $\mathbf{X}$  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  $b$ .

Appendix Table 4. Sample attrition as a function of treatment.

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

Appendix Table 5. Predictors of pre-treatment expectations and perceptions.

	Dependent variable:			
	Perceived current inflation rate	Expected inflation rate, 12-month ahead	Perceived current mortgage rate	Expected mortgage rate, end of 2019
	(1)	(2)	(5)	(6)
male	-0.314*** (0.045)	-0.018 (0.045)	-0.127*** (0.022)	-0.171*** (0.026)
age	0.081*** (0.007)	0.056*** (0.007)	0.011*** (0.004)	0.021*** (0.004)
age <sup>2</sup>	-0.061*** (0.006)	-0.035*** (0.006)	-0.008** (0.003)	-0.015*** (0.004)
employed	0.174*** (0.039)	-0.157*** (0.038)	0.043** (0.019)	0.077*** (0.022)
unemployed	0.450*** (0.098)	-0.256*** (0.085)	0.075 (0.049)	0.048 (0.059)
Household income (less than \$12,000 is the omitted category)				
\$12,000-\$14,999	0.627*** (0.149)	0.038 (0.127)	0.455*** (0.086)	0.509*** (0.104)
\$15,000-\$19,999	0.637*** (0.124)	0.398*** (0.109)	0.109 (0.067)	0.204** (0.081)
\$20,000-\$24,999	0.531*** (0.109)	0.360*** (0.096)	0.069 (0.059)	0.104 (0.072)
\$25,000-\$29,999	0.731*** (0.113)	0.371*** (0.101)	0.083 (0.063)	0.117 (0.075)
\$30,000-\$34,999	0.850*** (0.113)	0.342*** (0.099)	0.154** (0.061)	0.215*** (0.073)
\$35,000-\$39,999	0.388*** (0.113)	0.273*** (0.098)	-0.105* (0.061)	-0.069 (0.073)
\$40,000-\$44,999	0.638*** (0.112)	0.409*** (0.101)	-0.065 (0.060)	0.000 (0.072)
\$45,000-\$49,999	0.671*** (0.112)	0.097 (0.102)	-0.032 (0.059)	-0.011 (0.071)
\$50,000-\$59,999	0.735*** (0.097)	0.254*** (0.089)	-0.064 (0.054)	-0.025 (0.065)
\$60,000-\$69,999	0.508*** (0.099)	0.189** (0.091)	-0.142*** (0.055)	-0.096 (0.065)
\$70,000-\$99,999	0.376*** (0.090)	0.209*** (0.081)	-0.174*** (0.051)	-0.172*** (0.061)
\$100,000 or more	-0.162* (0.090)	0.095 (0.081)	-0.276*** (0.051)	-0.291*** (0.061)
Household size				
2	-0.056 (0.050)	-0.152*** (0.051)	0.015 (0.024)	0.020 (0.029)
3	-0.166*** (0.063)	-0.273*** (0.061)	0.025 (0.030)	0.043 (0.036)
4	-0.201*** (0.070)	-0.320*** (0.069)	0.037 (0.033)	0.003 (0.040)
5 or more	-0.134* (0.078)	-0.608*** (0.073)	-0.018 (0.036)	-0.017 (0.043)
Race (white is the omitted category)				
Black	-0.144** (0.059)	-0.391*** (0.054)	-0.061** (0.028)	0.006 (0.034)

Asian	0.324*** (0.071)	-0.077 (0.071)	-0.088*** (0.033)	-0.188*** (0.039)
Other	0.038 (0.074)	-0.343*** (0.065)	-0.067** (0.033)	-0.046 (0.040)
Census region [New England is omitted category]				
Mid-Atlantic	-0.222*** (0.085)	-0.007 (0.082)	-0.005 (0.040)	0.037 (0.048)
East North Central	0.011 (0.083)	-0.014 (0.080)	-0.026 (0.039)	0.081* (0.046)
West North Central	0.129 (0.093)	0.065 (0.091)	0.027 (0.044)	0.168*** (0.052)
South Atlantic	-0.155* (0.082)	-0.123 (0.079)	-0.011 (0.038)	0.064 (0.045)
East South Central	-0.366*** (0.097)	-0.327*** (0.094)	-0.036 (0.046)	0.048 (0.055)
West South Central	-0.203** (0.091)	-0.288*** (0.085)	0.004 (0.042)	0.084* (0.050)
Mountain	-0.200** (0.094)	-0.030 (0.090)	-0.061 (0.043)	-0.006 (0.051)
Pacific	-0.189** (0.085)	0.086 (0.082)	-0.114*** (0.039)	-0.046 (0.047)
Education of male head (more than college is the omitted category)				
No male head (or missing)	-0.428*** (0.066)	-0.196*** (0.068)	-0.098*** (0.032)	-0.102*** (0.039)
Less than high school	-0.206* (0.112)	-0.335*** (0.099)	-0.140*** (0.054)	-0.157** (0.063)
High school	-0.237*** (0.059)	-0.268*** (0.063)	-0.114*** (0.030)	-0.104*** (0.036)
Some college	-0.096* (0.054)	-0.102* (0.059)	-0.131*** (0.027)	-0.135*** (0.033)
College	0.015 (0.050)	-0.196*** (0.058)	-0.102*** (0.026)	-0.148*** (0.031)
Education of female head (more than college is the omitted category)				
No female head (or missing)	-0.688*** (0.071)	-0.361*** (0.075)	-0.134*** (0.035)	-0.213*** (0.042)
Less than high school	-1.266*** (0.130)	-0.781*** (0.115)	-0.222*** (0.071)	-0.402*** (0.083)
High school	-0.685*** (0.060)	-0.396*** (0.060)	-0.077*** (0.028)	-0.140*** (0.034)
Some college	-0.077 (0.055)	-0.061 (0.057)	-0.045* (0.026)	-0.105*** (0.031)
College	0.160*** (0.052)	0.013 (0.055)	0.000 (0.025)	-0.026 (0.030)
Constant	-0.243 (0.201)	-0.238 (0.192)	4.294*** (0.108)	4.232*** (0.130)
Observations	23,706	25,249	23,308	23,737
R-squared	0.049	0.043	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	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)
<b>Intercept</b>											
Control	1.086*** (0.072)	-0.194*** (0.024)	0.485*** (0.042)	0.784*** (0.061)	-0.064 (0.053)	-0.127** (0.054)	0.647*** (0.102)	0.794*** (0.086)	0.867*** (0.108)	1.012*** (0.097)	1.026*** (0.107)
Curr./part FFR	0.691*** (0.093)	0.710*** (0.047)	0.738*** (0.063)	-0.050 (0.081)	0.787*** (0.074)	1.042*** (0.079)	1.182*** (0.128)	1.201*** (0.119)	1.248*** (0.144)	1.162*** (0.139)	1.207*** (0.167)
1-year FG	0.407*** (0.086)	0.731*** (0.037)	0.804*** (0.056)	0.645*** (0.074)	1.413*** (0.069)	1.517*** (0.076)	1.019*** (0.116)	1.054*** (0.101)	1.107*** (0.125)	0.905*** (0.137)	0.959*** (0.150)
2-year FG	0.651*** (0.085)	0.697*** (0.040)	0.121** (0.055)	-0.118* (0.071)	0.753*** (0.068)	1.143*** (0.072)	1.033*** (0.129)	1.017*** (0.123)	1.040*** (0.150)	1.039*** (0.133)	1.075*** (0.154)
3-year FG	0.595*** (0.085)	0.745*** (0.038)	0.716*** (0.059)	0.548*** (0.074)	1.533*** (0.072)	1.508*** (0.073)	0.895*** (0.140)	0.987*** (0.106)	0.966*** (0.150)	1.038*** (0.127)	1.110*** (0.139)
Longer-run FG	0.544*** (0.079)	0.636*** (0.032)	0.791*** (0.050)	0.434*** (0.069)	0.950*** (0.063)	1.415*** (0.065)	0.866*** (0.120)	0.944*** (0.098)	1.003*** (0.119)	0.912*** (0.111)	0.954*** (0.123)
Curr. mort. rate	0.550*** (0.113)	4.466*** (0.043)	3.973*** (0.063)	3.923*** (0.083)	4.075*** (0.086)	3.524*** (0.103)	0.852*** (0.136)	0.882*** (0.124)	1.066*** (0.140)	0.906*** (0.134)	0.813*** (0.192)
<b>Slope</b>											
Control	0.496*** (0.021)	0.994*** (0.004)	0.825*** (0.008)	0.769*** (0.011)	0.946*** (0.009)	0.961*** (0.008)	0.687*** (0.051)	0.604*** (0.030)	0.626*** (0.037)	0.607*** (0.026)	0.669*** (0.026)
Curr./part FFR	-0.448*** (0.025)	-0.188*** (0.009)	-0.179*** (0.011)	-0.012 (0.014)	-0.176*** (0.012)	-0.211*** (0.012)	-0.386*** (0.061)	-0.325*** (0.044)	-0.306*** (0.048)	-0.239*** (0.040)	-0.221*** (0.043)
1-year FG	-0.332*** (0.024)	-0.180*** (0.006)	-0.186*** (0.010)	-0.146*** (0.013)	-0.290*** (0.011)	-0.286*** (0.011)	-0.332*** (0.058)	-0.309*** (0.036)	-0.291*** (0.043)	-0.150*** (0.046)	-0.159*** (0.041)
2-year FG	-0.444*** (0.024)	-0.180*** (0.008)	-0.042*** (0.010)	0.013 (0.013)	-0.164*** (0.011)	-0.229*** (0.011)	-0.273*** (0.068)	-0.198*** (0.050)	-0.152*** (0.055)	-0.186*** (0.040)	-0.195*** (0.041)
3-year FG	-0.388*** (0.024)	-0.193*** (0.007)	-0.175*** (0.011)	-0.132*** (0.013)	-0.322*** (0.012)	-0.300*** (0.011)	-0.284*** (0.078)	-0.283*** (0.037)	-0.226*** (0.056)	-0.254*** (0.037)	-0.271*** (0.035)
Longer-run FG	-0.362*** (0.023)	-0.165*** (0.006)	-0.188*** (0.009)	-0.110*** (0.012)	-0.206*** (0.010)	-0.287*** (0.010)	-0.172*** (0.062)	-0.266*** (0.035)	-0.257*** (0.040)	-0.194*** (0.030)	-0.211*** (0.029)
Curr. mort. rate	-0.220*** (0.030)	-0.989*** (0.006)	-0.816*** (0.010)	-0.755*** (0.014)	-0.770*** (0.013)	-0.634*** (0.015)	-0.612*** (0.054)	-0.520*** (0.034)	-0.535*** (0.040)	-0.407*** (0.032)	-0.323*** (0.052)
Observations	15,649	18,480	19,012	19,090	19,055	19,111	13,680	14,282	14,317	14,275	14,304
R-squared	0.126	0.918	0.852	0.838	0.856	0.852	0.398	0.326	0.381	0.397	0.466

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 FFR rate: T3, T19

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

Current mortgage rate: T24

Appendix Table 7. Response of expectations by treatment types.

	Inflation	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)
Intercept											
Control	1.023*** (0.069)	-0.188*** (0.023)	0.485*** (0.042)	0.777*** (0.061)	-0.069 (0.053)	-0.130** (0.054)	0.616*** (0.100)	0.768*** (0.083)	0.837*** (0.103)	0.969*** (0.094)	0.974*** (0.105)
Forward guidance	0.591*** (0.072)	0.658*** (0.026)	0.648*** (0.046)	0.436*** (0.064)	1.276*** (0.057)	1.391*** (0.059)	1.004*** (0.105)	0.965*** (0.089)	1.059*** (0.109)	0.981*** (0.102)	1.026*** (0.113)
Inflation	0.644*** (0.075)	0.030 (0.028)	0.243*** (0.053)	0.269*** (0.073)	1.222*** (0.067)	1.307*** (0.069)	1.440*** (0.119)	1.441*** (0.099)	1.537*** (0.119)	1.481*** (0.116)	1.491*** (0.138)
Current/past FFR rates	0.734*** (0.089)	0.649*** (0.044)	0.738*** (0.063)	-0.053 (0.081)	0.785*** (0.073)	1.037*** (0.079)	1.207*** (0.123)	1.248*** (0.115)	1.299*** (0.138)	1.211*** (0.137)	1.277*** (0.159)
Current mortgage rate	0.541*** (0.108)	4.462*** (0.041)	3.975*** (0.062)	3.931*** (0.083)	4.079*** (0.085)	3.528*** (0.102)	0.880*** (0.133)	0.906*** (0.121)	1.085*** (0.136)	0.929*** (0.130)	0.840*** (0.189)
Slope											
Control	0.516*** (0.020)	0.995*** (0.003)	0.826*** (0.008)	0.771*** (0.011)	0.947*** (0.009)	0.961*** (0.008)	0.704*** (0.050)	0.616*** (0.028)	0.636*** (0.035)	0.621*** (0.025)	0.684*** (0.025)
Forward guidance	-0.392*** (0.021)	-0.169*** (0.004)	-0.157*** (0.008)	-0.107*** (0.011)	-0.269*** (0.009)	-0.276*** (0.009)	-0.320*** (0.053)	-0.233*** (0.032)	-0.250*** (0.037)	-0.200*** (0.028)	-0.211*** (0.028)
Inflation	-0.472*** (0.021)	-0.006 (0.004)	-0.048*** (0.010)	-0.055*** (0.013)	-0.237*** (0.011)	-0.246*** (0.010)	-0.245*** (0.062)	-0.288*** (0.038)	-0.291*** (0.041)	-0.250*** (0.035)	-0.218*** (0.036)
Current/past FFR rates	-0.467*** (0.024)	-0.174*** (0.009)	-0.179*** (0.011)	-0.012 (0.014)	-0.175*** (0.012)	-0.210*** (0.012)	-0.440*** (0.059)	-0.344*** (0.042)	-0.322*** (0.045)	-0.252*** (0.039)	-0.236*** (0.040)
Current mortgage rate	-0.218*** (0.029)	-0.988*** (0.006)	-0.816*** (0.010)	-0.756*** (0.013)	-0.770*** (0.013)	-0.635*** (0.014)	-0.623*** (0.053)	-0.526*** (0.033)	-0.537*** (0.039)	-0.412*** (0.031)	-0.329*** (0.052)
Observations	18,827	22,065	22,910	23,035	23,045	23,070	16,590	17,089	17,209	17,170	17,175
R-squared	0.126	0.942	0.853	0.836	0.846	0.852	0.375	0.349	0.376	0.403	0.474

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 FFR rates (“Current/past rates”: T3, T19), current mortgage rate (T24), forward guidance (“FG”: T4-T19), inflation (“Inflation”: T20-T23). 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 8. Response of expectations by treatment types and plans to buy a durable good in the next 12 months.

	Inflation expectations		Mortgage rate expectations, end of 2020	
	Plan	No plan	Plan	No plan
	(1)	(2)	(3)	(4)
Intercept				
Control	1.613*** (0.193)	1.016*** (0.074)	1.386*** (0.101)	0.676*** (0.066)
Forward guidance	-0.031 (0.199)	0.604*** (0.077)	-0.155 (0.109)	0.522*** (0.070)
Inflation	0.224 (0.203)	0.601*** (0.082)	0.822*** (0.135)	0.014 (0.077)
Current/past FFR rates	0.273 (0.232)	0.709*** (0.097)	-0.515*** (0.144)	0.204** (0.090)
Current mortgage rate	-0.437 (0.286)	0.599*** (0.116)	3.161*** (0.160)	3.403*** (0.096)
Slope				
Control	0.268*** (0.058)	0.520*** (0.022)	0.634*** (0.016)	0.794*** (0.012)
Forward guidance	-0.125** (0.059)	-0.401*** (0.022)	0.019 (0.017)	-0.126*** (0.012)
Inflation	-0.235*** (0.060)	-0.472*** (0.023)	-0.154*** (0.022)	-0.003 (0.014)
Current/past FFR rates	-0.276*** (0.066)	-0.456*** (0.026)	0.113*** (0.023)	-0.072*** (0.016)
Current mortgage rate	0.206** (0.082)	-0.249*** (0.030)	-0.596*** (0.023)	-0.659*** (0.016)
Observations	3,321	15,507	4,177	18,850
R-squared	0.111	0.126	0.847	0.838

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 (nominal mortgage rates) by treatment.

Treatment	Current		one-year [2019]		two-year [2020]		Three-year [2021]		Longer run	
	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control	-0.193*** (0.024)	0.996*** (0.004)	-0.121*** (0.045)	0.963*** (0.009)	0.803*** (0.045)	0.767*** (0.007)	0.465*** (0.054)	0.843*** (0.009)	0.106* (0.054)	0.921*** (0.009)
<b>Relative to control</b>										
T2 (Population growth)	0.009 (0.041)	-0.008 (0.007)	0.447*** (0.058)	-0.115*** (0.010)	-0.318*** (0.064)	0.064*** (0.010)	0.293*** (0.074)	-0.057*** (0.012)	0.310*** (0.078)	-0.053*** (0.012)
T3 (Current FFR)	1.540*** (0.050)	-0.374*** (0.009)	1.533*** (0.062)	-0.344*** (0.011)	1.442*** (0.072)	-0.300*** (0.011)	0.576*** (0.069)	-0.123*** (0.010)	0.886*** (0.083)	-0.183*** (0.012)
T4 (FG: LR high)	2.287*** (0.056)	-0.542*** (0.010)	2.167*** (0.076)	-0.475*** (0.014)	1.343*** (0.074)	-0.271*** (0.012)	1.152*** (0.087)	-0.228*** (0.014)	1.708*** (0.084)	-0.326*** (0.012)
T5 (FG: LR low)	0.917*** (0.056)	-0.230*** (0.011)	1.510*** (0.069)	-0.353*** (0.012)	0.825*** (0.089)	-0.190*** (0.015)	0.390*** (0.081)	-0.087*** (0.013)	1.356*** (0.086)	-0.277*** (0.012)
T6 (FG: LR central)	2.343*** (0.052)	-0.562*** (0.009)	2.402*** (0.070)	-0.536*** (0.013)	1.965*** (0.075)	-0.419*** (0.012)	1.376*** (0.092)	-0.307*** (0.015)	0.737*** (0.094)	-0.167*** (0.014)
T7 (FG: 1yr central)	0.141*** (0.051)	-0.026*** (0.010)	1.247*** (0.066)	-0.280*** (0.012)	1.259*** (0.072)	-0.256*** (0.011)	0.933*** (0.090)	-0.173*** (0.015)	1.610*** (0.091)	-0.291*** (0.013)
T8 (FG: 1yr high)	1.754*** (0.060)	-0.415*** (0.011)	2.225*** (0.067)	-0.494*** (0.012)	0.972*** (0.066)	-0.207*** (0.010)	0.149* (0.090)	-0.040*** (0.015)	0.930*** (0.083)	-0.171*** (0.012)
T9 (FG: 1yr low)	1.445*** (0.043)	-0.353*** (0.007)	1.171*** (0.060)	-0.280*** (0.010)	1.020*** (0.076)	-0.219*** (0.012)	1.794*** (0.075)	-0.370*** (0.011)	0.546*** (0.076)	-0.112*** (0.011)
T10 (FG: 2yr central)	0.816*** (0.052)	-0.210*** (0.010)	0.982*** (0.063)	-0.239*** (0.011)	-0.134** (0.057)	0.015* (0.008)	0.871*** (0.075)	-0.191*** (0.011)	1.214*** (0.070)	-0.234*** (0.009)
T11 (FG: 2yr central-high)	0.737*** (0.046)	-0.189*** (0.008)	0.725*** (0.058)	-0.173*** (0.010)	-0.094 (0.070)	0.013 (0.011)	0.226*** (0.072)	-0.047*** (0.011)	0.610*** (0.081)	-0.116*** (0.012)
T12 (FG: 2yr central-low)	0.973*** (0.059)	-0.244*** (0.012)	0.414*** (0.071)	-0.112*** (0.014)	-0.561*** (0.065)	0.110*** (0.011)	0.168** (0.072)	-0.049*** (0.012)	0.984*** (0.089)	-0.215*** (0.013)
T13 (FG: 3yr central)	1.622*** (0.046)	-0.389*** (0.007)	2.204*** (0.067)	-0.491*** (0.012)	1.090*** (0.083)	-0.233*** (0.013)	2.068*** (0.080)	-0.412*** (0.012)	1.675*** (0.084)	-0.328*** (0.012)
T14 (FG: 3yr central-high)	2.622*** (0.060)	-0.626*** (0.011)	1.995*** (0.064)	-0.450*** (0.011)	1.599*** (0.079)	-0.331*** (0.013)	1.270*** (0.083)	-0.255*** (0.013)	2.507*** (0.089)	-0.471*** (0.013)
T15 (FG: 3yr central-low)	1.361*** (0.052)	-0.341*** (0.009)	1.371*** (0.063)	-0.329*** (0.011)	1.189*** (0.069)	-0.268*** (0.010)	0.562*** (0.083)	-0.139*** (0.013)	1.034*** (0.078)	-0.219*** (0.011)
T16 (FG: LR central-high)	0.580*** (0.038)	-0.155*** (0.006)	1.717*** (0.062)	-0.404*** (0.011)	0.597*** (0.068)	-0.134*** (0.010)	0.918*** (0.076)	-0.194*** (0.012)	1.704*** (0.085)	-0.330*** (0.012)
T17 (FG: LR central-low)	2.943*** (0.054)	-0.694*** (0.010)	0.350*** (0.075)	-0.097*** (0.015)	1.962*** (0.083)	-0.406*** (0.013)	0.593*** (0.089)	-0.141*** (0.014)	0.697*** (0.093)	-0.162*** (0.014)
T18 (FG: LR central + past FFR)	2.377*** (0.048)	-0.562*** (0.008)	0.903*** (0.078)	-0.213*** (0.015)	-0.024 (0.070)	-0.011 (0.011)	0.864*** (0.081)	-0.183*** (0.013)	0.755*** (0.092)	-0.164*** (0.014)
T19 (Current FFR + past FFR)	2.101*** (0.037)	-0.513*** (0.005)	2.243*** (0.076)	-0.505*** (0.014)	1.025*** (0.067)	-0.225*** (0.010)	1.284*** (0.075)	-0.275*** (0.011)	1.956*** (0.089)	-0.374*** (0.013)
T20 (Inflation last year)	1.768*** (0.053)	-0.413*** (0.010)	0.643*** (0.068)	-0.124*** (0.013)	0.111 (0.079)	-0.011 (0.014)	0.612*** (0.081)	-0.099*** (0.013)	0.761*** (0.097)	-0.143*** (0.015)
T21 (Inflation last 3 years)	-0.001 (0.042)	-0.005 (0.007)	1.093*** (0.065)	-0.248*** (0.012)	0.245*** (0.077)	-0.046*** (0.013)	0.532*** (0.084)	-0.107*** (0.014)	0.780*** (0.074)	-0.138*** (0.011)
T22 (Inflation last year + 3yr ahead inflation path forecast)	0.991*** (0.047)	-0.238*** (0.008)	1.128*** (0.069)	-0.248*** (0.012)	-0.013 (0.073)	-0.001 (0.012)	1.116*** (0.093)	-0.224*** (0.015)	1.053*** (0.084)	-0.203*** (0.012)
T23 (Inflation last year + 3yr ahead inflation average forecast)	0.034 (0.038)	-0.002 (0.006)	0.470*** (0.058)	-0.110*** (0.011)	0.493*** (0.082)	-0.105*** (0.013)	-0.082 (0.077)	0.023* (0.013)	0.707*** (0.075)	-0.140*** (0.011)
T24 (current mortgage rate)	4.503*** (0.042)	-0.994*** (0.006)	4.657*** (0.057)	-0.969*** (0.010)	3.791*** (0.069)	-0.728*** (0.011)	3.443*** (0.082)	-0.646*** (0.013)	3.162*** (0.078)	-0.565*** (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.



Appendix Table 10. Posterior beliefs for inflation by treatment.

Treatment	Inflation expectations	
	Intercept (b)	Slope ( $\gamma$ )
	(1)	(2)
Control	1.026*** (0.069)	0.515*** (0.020)
<b>Relative to control</b>		
T2 (Population growth)	0.425*** (0.107)	-0.159*** (0.030)
T3 (Current FFR)	0.430*** (0.104)	-0.365*** (0.028)
T4 (FG: LR high)	0.736*** (0.104)	-0.331*** (0.028)
T5 (FG: LR low)	0.447*** (0.099)	-0.393*** (0.028)
T6 (FG: LR central)	0.644*** (0.100)	-0.383*** (0.027)
T7 (FG: 1yr central)	0.455*** (0.100)	-0.333*** (0.026)
T8 (FG: 1yr high)	0.515*** (0.104)	-0.357*** (0.027)
T9 (FG: 1yr low)	0.344*** (0.110)	-0.346*** (0.030)
T10 (FG: 2yr central)	0.711*** (0.101)	-0.482*** (0.028)
T11 (FG: 2yr central-high)	0.734*** (0.100)	-0.451*** (0.026)
T12 (FG: 2yr central-low)	0.663*** (0.105)	-0.466*** (0.028)
T13 (FG: 3yr central)	0.668*** (0.102)	-0.414*** (0.027)
T14 (FG: 3yr central-high)	0.590*** (0.103)	-0.384*** (0.028)
T15 (FG: 3yr central-low)	0.676*** (0.104)	-0.413*** (0.028)
T16 (FG: LR central-high)	0.551*** (0.107)	-0.409*** (0.029)
T17 (FG: LR central-low)	0.456*** (0.107)	-0.328*** (0.027)
T18 (FG: LR central + past FFR)	0.687*** (0.102)	-0.419*** (0.026)
T19 (Current FFR + past FFR)	0.971*** (0.105)	-0.527*** (0.027)
T20 (Inflation last year)	0.683*** (0.090)	-0.484*** (0.024)
T21 (Inflation last 3 years)	0.553*** (0.088)	-0.442*** (0.024)
T22 (Inflation last year + 3yr ahead inflation path forecast)	0.754*** (0.092)	-0.514*** (0.025)
T23 (Inflation last year + 3yr ahead inflation average forecast)	0.579*** (0.096)	-0.442*** (0.025)
T24 (current mortgage rate)	0.541*** (0.108)	-0.218*** (0.029)
Observations	19,570	
R-squared	0.151	

Notes: The table reports estimates of coefficients in specification (1) for one-year-ahead inflation expectations (columns 1 and 2). 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 11. Posterior beliefs (real mortgage rates) by treatment.

Treatment	Current		one-year [2019]		two-year [2020]		Three-year [2021]		Longer run	
	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control	0.612*** (0.100)	0.702*** (0.050)	0.769*** (0.083)	0.616*** (0.028)	0.839*** (0.104)	0.636*** (0.035)	0.972*** (0.094)	0.620*** (0.025)	0.982*** (0.105)	0.681*** (0.025)
<b>Relative to control</b>										
T2 (Population growth)	0.078 (0.156)	0.060 (0.074)	0.085 (0.166)	0.009 (0.070)	0.110 (0.180)	0.011 (0.061)	-0.002 (0.163)	0.055 (0.046)	0.085 (0.173)	-0.001 (0.042)
T3 (Current FFR)	1.055*** (0.139)	-0.349*** (0.064)	1.098*** (0.138)	-0.272*** (0.049)	1.050*** (0.165)	-0.242*** (0.051)	0.893*** (0.176)	-0.158*** (0.050)	0.922*** (0.206)	-0.154*** (0.052)
T4 (FG: LR high)	0.701*** (0.128)	-0.363*** (0.054)	0.717*** (0.120)	-0.264*** (0.035)	0.742*** (0.139)	-0.236*** (0.041)	0.586*** (0.156)	-0.153*** (0.041)	0.609*** (0.169)	-0.164*** (0.037)
T5 (FG: LR low)	1.005*** (0.160)	-0.307*** (0.076)	1.089*** (0.147)	-0.269*** (0.051)	1.193*** (0.173)	-0.288*** (0.056)	0.985*** (0.184)	-0.137*** (0.053)	1.057*** (0.187)	-0.197*** (0.043)
T6 (FG: LR central)	1.076*** (0.128)	-0.464*** (0.056)	1.098*** (0.115)	-0.399*** (0.035)	0.997*** (0.146)	-0.313*** (0.045)	0.869*** (0.148)	-0.254*** (0.040)	1.168*** (0.152)	-0.362*** (0.034)
T7 (FG: 1yr central)	1.043*** (0.127)	-0.410*** (0.059)	1.021*** (0.127)	-0.295*** (0.051)	1.107*** (0.157)	-0.287*** (0.056)	1.260*** (0.148)	-0.313*** (0.044)	1.103*** (0.195)	-0.199*** (0.052)
T8 (FG: 1yr high)	1.043*** (0.127)	-0.408*** (0.058)	1.024*** (0.120)	-0.334*** (0.040)	1.138*** (0.141)	-0.341*** (0.045)	1.028*** (0.152)	-0.248*** (0.043)	1.084*** (0.185)	-0.233*** (0.046)
T9 (FG: 1yr low)	1.041*** (0.169)	-0.217*** (0.090)	1.184*** (0.124)	-0.305*** (0.039)	1.138*** (0.147)	-0.260*** (0.047)	0.737*** (0.213)	-0.047 (0.078)	1.195*** (0.158)	-0.247*** (0.037)
T10 (FG: 2yr central)	0.998*** (0.173)	-0.243*** (0.082)	0.964*** (0.163)	-0.154*** (0.056)	0.859*** (0.206)	-0.062 (0.066)	0.809*** (0.185)	-0.083* (0.049)	0.916*** (0.208)	-0.122** (0.050)
T11 (FG: 2yr central-high)	1.065*** (0.194)	-0.265*** (0.103)	1.036*** (0.203)	-0.193*** (0.093)	1.185*** (0.210)	-0.228*** (0.076)	1.242*** (0.208)	-0.255*** (0.068)	1.166*** (0.272)	-0.175*** (0.078)
T12 (FG: 2yr central-low)	1.083*** (0.164)	-0.270*** (0.105)	1.028*** (0.177)	-0.206*** (0.098)	1.157*** (0.179)	-0.207*** (0.076)	1.080*** (0.198)	-0.207*** (0.082)	1.134*** (0.193)	-0.246*** (0.055)
T13 (FG: 3yr central)	1.165*** (0.133)	-0.457*** (0.057)	1.104*** (0.147)	-0.311*** (0.057)	1.294*** (0.152)	-0.356*** (0.049)	0.989*** (0.235)	-0.215*** (0.081)	1.136*** (0.189)	-0.274*** (0.051)
T14 (FG: 3yr central-high)	0.918*** (0.142)	-0.343*** (0.070)	1.080*** (0.120)	-0.371*** (0.040)	1.297*** (0.137)	-0.397*** (0.043)	1.143*** (0.179)	-0.267*** (0.062)	1.538*** (0.148)	-0.417*** (0.033)
T15 (FG: 3yr central-low)	0.906*** (0.144)	-0.333*** (0.064)	0.861*** (0.141)	-0.248*** (0.050)	0.918*** (0.172)	-0.235*** (0.058)	0.719*** (0.191)	-0.149*** (0.063)	0.827*** (0.226)	-0.196*** (0.067)
T16 (FG: LR central-high)	1.160*** (0.136)	-0.408*** (0.064)	1.151*** (0.129)	-0.312*** (0.045)	1.208*** (0.171)	-0.267*** (0.061)	1.109*** (0.173)	-0.198*** (0.052)	1.130*** (0.206)	-0.207*** (0.058)
T17 (FG: LR central-low)	0.873*** (0.155)	-0.220*** (0.071)	0.770*** (0.152)	-0.141*** (0.057)	1.114*** (0.138)	-0.362*** (0.041)	0.773*** (0.157)	-0.156*** (0.042)	0.779*** (0.173)	-0.163*** (0.042)
T18 (FG: LR central + past FFR)	1.130*** (0.138)	-0.444*** (0.068)	1.028*** (0.174)	-0.253*** (0.091)	1.296*** (0.154)	-0.318*** (0.052)	1.253*** (0.166)	-0.270*** (0.053)	1.408*** (0.177)	-0.331*** (0.046)
T19 (Current FFR + past FFR)	1.300*** (0.137)	-0.500*** (0.067)	1.415*** (0.129)	-0.443*** (0.038)	1.537*** (0.151)	-0.425*** (0.045)	1.299*** (0.182)	-0.288*** (0.064)	1.495*** (0.196)	-0.273*** (0.052)
T20 (Inflation last year)	1.290*** (0.182)	-0.190*** (0.096)	1.435*** (0.133)	-0.318*** (0.049)	1.439*** (0.162)	-0.293*** (0.058)	1.306*** (0.176)	-0.195*** (0.054)	1.483*** (0.175)	-0.290*** (0.043)
T21 (Inflation last 3 years)	1.463*** (0.144)	-0.332*** (0.079)	1.429*** (0.135)	-0.273*** (0.065)	1.611*** (0.148)	-0.306*** (0.056)	1.547*** (0.152)	-0.275*** (0.048)	1.574*** (0.196)	-0.206*** (0.049)
T22 (Inflation last year + 3yr ahead inflation path forecast)	1.556*** (0.141)	-0.359*** (0.067)	1.583*** (0.128)	-0.297*** (0.048)	1.614*** (0.163)	-0.257*** (0.056)	1.688*** (0.145)	-0.313*** (0.040)	1.675*** (0.208)	-0.222*** (0.062)
T23 (Inflation last year + 3yr ahead inflation average forecast)	1.502*** (0.162)	-0.261*** (0.095)	1.270*** (0.169)	-0.170*** (0.076)	1.445*** (0.166)	-0.281*** (0.059)	1.377*** (0.195)	-0.237*** (0.072)	1.428*** (0.219)	-0.252*** (0.064)
T24 (current mortgage rate)	0.878*** (0.133)	-0.622*** (0.052)	0.906*** (0.122)	-0.526*** (0.033)	1.084*** (0.136)	-0.537*** (0.039)	0.928*** (0.130)	-0.412*** (0.031)	0.834*** (0.190)	-0.327*** (0.052)
Observations	17,498		17,813		17,921		17,889		17,895	
R-squared	0.419		0.371		0.399		0.443		0.487	

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 Table 12. Posterior beliefs (inflation) in the 1<sup>st</sup> follow-up wave by treatment.

Treatment	Inflation expectations	
	Intercept (b)	Slope ( $\gamma$ )
	(1)	(2)
Control	0.672*** (0.095)	0.517*** (0.026)
<b>Relative to control</b>		
T2 (Population growth)	0.131 (0.154)	-0.116** (0.045)
T3 (Current FFR)	0.112 (0.145)	-0.226*** (0.039)
T4 (FG: LR high)	-0.155 (0.147)	0.019 (0.040)
T5 (FG: LR low)	-0.021 (0.145)	-0.047 (0.041)
T6 (FG: LR central)	-0.074 (0.150)	-0.087** (0.043)
T7 (FG: 1yr central)	-0.244* (0.144)	-0.010 (0.043)
T8 (FG: 1yr high)	-0.323** (0.149)	-0.067 (0.044)
T9 (FG: 1yr low)	0.261* (0.152)	-0.223*** (0.042)
T10 (FG: 2yr central)	0.048 (0.142)	-0.158*** (0.041)
T11 (FG: 2yr central-high)	-0.411*** (0.138)	0.079** (0.040)
T12 (FG: 2yr central-low)	0.562*** (0.145)	-0.357*** (0.037)
T13 (FG: 3yr central)	0.409*** (0.150)	-0.213*** (0.043)
T14 (FG: 3yr central-high)	0.104 (0.150)	-0.117*** (0.041)
T15 (FG: 3yr central-low)	-0.068 (0.145)	-0.189*** (0.038)
T16 (FG: LR central-high)	0.005 (0.155)	-0.105** (0.044)
T17 (FG: LR central-low)	0.065 (0.151)	-0.203*** (0.040)
T18 (FG: LR central + past FFR)	0.114 (0.140)	-0.188*** (0.041)
T19 (Current FFR + past FFR)	0.176 (0.150)	-0.189*** (0.043)
T20 (Inflation last year)	0.339** (0.147)	-0.362*** (0.038)
T21 (Inflation last 3 years)	0.341** (0.151)	-0.244*** (0.038)
T22 (Inflation last year + 3yr ahead inflation path forecast)	0.461*** (0.152)	-0.246*** (0.042)
T23 (Inflation last year + 3yr ahead inflation average forecast)	0.389*** (0.144)	-0.341*** (0.039)
T24 (current mortgage rate)	0.359** (0.156)	-0.233*** (0.046)
Observations	12,395	
R-squared	0.279	

Notes: The table reports estimates of coefficients in specification (1) for one-year-ahead inflation expectations (columns 1 and 2). 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 1<sup>st</sup> follow-up wave by treatment.

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

Appendix Table 14. Posterior beliefs (real mortgage rates) in the 1<sup>st</sup> 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	1.488*** (0.103)	0.512*** (0.028)	1.503*** (0.113)	0.526*** (0.032)	1.612*** (0.125)	0.555*** (0.034)	1.729*** (0.122)	0.549*** (0.027)	1.662*** (0.177)	0.647*** (0.044)
<b>Relative to control</b>										
T2 (Population growth)	0.264 (0.168)	-0.156*** (0.040)	0.445** (0.179)	-0.193*** (0.043)	0.563*** (0.198)	-0.168*** (0.046)	0.377 (0.249)	-0.059 (0.064)	0.664** (0.287)	-0.160** (0.068)
T3 (Current FFR)	0.506*** (0.165)	-0.135*** (0.040)	0.633*** (0.166)	-0.196*** (0.038)	0.392 (0.241)	-0.052 (0.071)	0.623** (0.288)	-0.093 (0.090)	0.989*** (0.276)	-0.222*** (0.067)
T4 (FG: LR high)	0.185 (0.172)	-0.094** (0.045)	0.462*** (0.179)	-0.228*** (0.042)	0.664*** (0.202)	-0.266*** (0.049)	0.393* (0.217)	-0.135*** (0.050)	0.559** (0.273)	-0.229*** (0.059)
T5 (FG: LR low)	0.403** (0.163)	-0.185*** (0.041)	0.285 (0.178)	-0.086** (0.043)	0.331* (0.199)	-0.060 (0.048)	0.313 (0.214)	-0.048 (0.048)	0.898*** (0.270)	-0.255*** (0.061)
T6 (FG: LR central)	0.379** (0.165)	-0.133*** (0.043)	0.289 (0.189)	-0.087 (0.059)	0.588*** (0.197)	-0.195*** (0.050)	0.628*** (0.204)	-0.191*** (0.047)	0.966*** (0.249)	-0.236*** (0.056)
T7 (FG: 1yr central)	0.329* (0.171)	-0.160*** (0.045)	0.413** (0.181)	-0.183*** (0.046)	0.565*** (0.203)	-0.227*** (0.049)	0.701*** (0.200)	-0.200*** (0.042)	0.528* (0.270)	-0.168** (0.066)
T8 (FG: 1yr high)	0.406** (0.191)	-0.083 (0.071)	0.550** (0.218)	-0.122 (0.082)	0.281 (0.269)	0.015 (0.090)	0.861*** (0.251)	-0.196*** (0.071)	0.882*** (0.256)	-0.178*** (0.059)
T9 (FG: 1yr low)	0.497*** (0.167)	-0.081* (0.047)	0.589*** (0.177)	-0.134*** (0.046)	0.716*** (0.188)	-0.178*** (0.048)	0.729*** (0.185)	-0.163*** (0.042)	0.865*** (0.231)	-0.217*** (0.053)
T10 (FG: 2yr central)	0.680*** (0.164)	-0.272*** (0.041)	0.420 (0.257)	-0.093 (0.093)	0.448 (0.281)	-0.088 (0.084)	0.884*** (0.191)	-0.276*** (0.038)	0.421 (0.363)	-0.078 (0.095)
T11 (FG: 2yr central-high)	-0.034 (0.163)	0.016 (0.040)	0.004 (0.190)	-0.017 (0.050)	0.188 (0.195)	-0.052 (0.042)	0.254 (0.223)	-0.088** (0.045)	0.286 (0.240)	-0.104** (0.052)
T12 (FG: 2yr central-low)	0.682*** (0.157)	-0.257*** (0.043)	0.708*** (0.170)	-0.238*** (0.045)	0.837*** (0.184)	-0.263*** (0.048)	0.704*** (0.233)	-0.156** (0.076)	1.088*** (0.250)	-0.301*** (0.061)
T13 (FG: 3yr central)	0.509*** (0.166)	-0.210*** (0.045)	0.560*** (0.180)	-0.278*** (0.051)	0.550*** (0.206)	-0.210*** (0.054)	0.175 (0.277)	-0.012 (0.081)	0.552** (0.282)	-0.109 (0.070)
T14 (FG: 3yr central-high)	0.181 (0.155)	-0.106*** (0.041)	0.310* (0.169)	-0.168*** (0.042)	0.524*** (0.190)	-0.211*** (0.045)	0.606*** (0.190)	-0.193*** (0.041)	0.853*** (0.243)	-0.293*** (0.056)
T15 (FG: 3yr central-low)	0.727*** (0.173)	-0.120** (0.048)	0.729*** (0.206)	-0.114 (0.074)	0.681** (0.275)	-0.071 (0.094)	0.815*** (0.290)	-0.139 (0.094)	1.291*** (0.250)	-0.294*** (0.058)
T16 (FG: LR central-high)	0.336** (0.162)	-0.186*** (0.045)	0.389** (0.177)	-0.191*** (0.047)	0.152 (0.194)	-0.066 (0.047)	0.352* (0.201)	-0.162*** (0.044)	0.331 (0.293)	-0.106 (0.074)
T17 (FG: LR central-low)	0.720*** (0.164)	-0.207*** (0.044)	0.837*** (0.173)	-0.187*** (0.044)	0.845*** (0.187)	-0.223*** (0.046)	0.819*** (0.194)	-0.205*** (0.044)	0.978*** (0.249)	-0.241*** (0.058)
T18 (FG: LR central + past FFR)	0.562*** (0.199)	-0.157 (0.097)	0.770*** (0.172)	-0.257*** (0.055)	0.704*** (0.226)	-0.146** (0.073)	0.910*** (0.188)	-0.192*** (0.044)	0.717** (0.286)	-0.153** (0.074)
T19 (Current FFR + past FFR)	0.664*** (0.164)	-0.230*** (0.037)	0.638*** (0.180)	-0.197*** (0.046)	0.794*** (0.205)	-0.187*** (0.050)	0.827*** (0.234)	-0.184*** (0.060)	1.259*** (0.309)	-0.282*** (0.077)
T20 (Inflation last year)	1.026*** (0.151)	-0.258*** (0.043)	1.224*** (0.194)	-0.254*** (0.071)	1.372*** (0.247)	-0.250*** (0.087)	1.613*** (0.212)	-0.300*** (0.057)	1.542*** (0.286)	-0.266*** (0.071)
T21 (Inflation last 3 years)	0.524*** (0.174)	-0.145*** (0.051)	0.600*** (0.202)	-0.099 (0.069)	0.743*** (0.201)	-0.212*** (0.056)	0.844*** (0.198)	-0.256*** (0.042)	1.079*** (0.250)	-0.277*** (0.056)
T22 (Inflation last year + 3yr ahead inflation path forecast)	0.400** (0.158)	-0.101** (0.046)	0.349* (0.192)	-0.121* (0.069)	0.500** (0.250)	-0.153* (0.087)	0.480* (0.273)	-0.074 (0.079)	0.645** (0.290)	-0.151** (0.071)
T23 (Inflation last year + 3yr ahead inflation average forecast)	1.037*** (0.159)	-0.438*** (0.040)	0.934*** (0.168)	-0.350*** (0.042)	1.022*** (0.188)	-0.332*** (0.047)	1.030*** (0.197)	-0.302*** (0.044)	1.004*** (0.267)	-0.255*** (0.066)
T24 (current mortgage rate)	0.505*** (0.178)	-0.295*** (0.045)	0.548*** (0.184)	-0.260*** (0.042)	0.630*** (0.214)	-0.262*** (0.055)	0.303 (0.245)	-0.114* (0.062)	0.216 (0.288)	-0.136** (0.068)
Observations	11,086		11,133		11,228		11,295		11,296	
R-squared	0.312		0.324		0.377		0.366		0.428	

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 Table 15. Posterior beliefs (inflation) in the 2<sup>nd</sup> follow-up wave by treatment.

Treatment	Inflation expectations	
	Intercept (b)	Slope ( $\gamma$ )
	(1)	(2)
Control	0.531*** (0.153)	0.460*** (0.046)
<b>Relative to control</b>		
T2 (Population growth)	0.176 (0.225)	-0.043 (0.062)
T3 (Current FFR)	0.146 (0.215)	0.004 (0.067)
T4 (FG: LR high)	0.422* (0.229)	-0.119* (0.068)
T5 (FG: LR low)	-0.027 (0.224)	0.052 (0.069)
T6 (FG: LR central)	0.012 (0.216)	0.002 (0.073)
T7 (FG: 1yr central)	0.705*** (0.219)	-0.163*** (0.061)
T8 (FG: 1yr high)	-0.162 (0.216)	0.060 (0.069)
T9 (FG: 1yr low)	-0.216 (0.263)	0.082 (0.074)
T10 (FG: 2yr central)	0.048 (0.201)	-0.083 (0.063)
T11 (FG: 2yr central-high)	0.692*** (0.218)	-0.382*** (0.067)
T12 (FG: 2yr central-low)	0.608*** (0.208)	-0.217*** (0.061)
T13 (FG: 3yr central)	0.239 (0.212)	-0.231*** (0.060)
T14 (FG: 3yr central-high)	0.046 (0.225)	0.071 (0.065)
T15 (FG: 3yr central-low)	0.262 (0.235)	-0.155** (0.074)
T16 (FG: LR central-high)	0.094 (0.211)	-0.013 (0.056)
T17 (FG: LR central-low)	0.305 (0.242)	-0.130* (0.071)
T18 (FG: LR central + past FFR)	0.371* (0.212)	-0.094 (0.057)
T19 (Current FFR + past FFR)	0.132 (0.212)	-0.186*** (0.066)
T20 (Inflation last year)	0.019 (0.229)	0.098 (0.067)
T21 (Inflation last 3 years)	0.032 (0.226)	-0.030 (0.068)
T22 (Inflation last year + 3yr ahead inflation path forecast)	0.373* (0.223)	-0.143** (0.065)
T23 (Inflation last year + 3yr ahead inflation average forecast)	0.698*** (0.213)	-0.364*** (0.065)
T24 (current mortgage rate)	0.176 (0.226)	0.019 (0.065)
Observations	6,165	
R-squared	0.284	

Notes: The table reports estimates of coefficients in specification (1) for one-year-ahead inflation expectations (columns 1 and 2). 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 16. Posterior beliefs (nominal mortgage rates) in the 2<sup>nd</sup> follow-up wave by treatment.

Treatment	Current		one-year [2019]		two-year [2020]		Three-year [2021]		Longer run	
	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control	2.638*** (0.102)	0.328*** (0.019)	2.536*** (0.120)	0.357*** (0.021)	2.533*** (0.136)	0.395*** (0.021)	2.283*** (0.169)	0.468*** (0.025)	2.032*** (0.179)	0.563*** (0.023)
<b>Relative to control</b>										
T2 (Population growth)	1.228*** (0.147)	-0.290*** (0.027)	1.356*** (0.150)	-0.313*** (0.024)	1.420*** (0.198)	-0.287*** (0.030)	1.254*** (0.219)	-0.255*** (0.032)	1.818*** (0.244)	-0.335*** (0.031)
T3 (Current FFR)	-0.014 (0.179)	-0.004 (0.034)	0.228 (0.179)	-0.062** (0.029)	0.771*** (0.205)	-0.149*** (0.029)	-0.721*** (0.275)	0.148*** (0.043)	1.009*** (0.269)	-0.157*** (0.034)
T4 (FG: LR high)	0.317** (0.146)	-0.074*** (0.026)	0.252 (0.166)	-0.062** (0.029)	0.265 (0.176)	-0.043* (0.025)	0.521** (0.215)	-0.090*** (0.030)	1.220*** (0.246)	-0.213*** (0.031)
T5 (FG: LR low)	0.349* (0.185)	-0.074** (0.035)	0.646*** (0.159)	-0.148*** (0.025)	0.932*** (0.181)	-0.187*** (0.025)	-0.227 (0.269)	0.051 (0.041)	1.469*** (0.278)	-0.261*** (0.038)
T6 (FG: LR central)	0.659*** (0.167)	-0.134*** (0.031)	0.933*** (0.181)	-0.187*** (0.031)	1.001*** (0.189)	-0.172*** (0.028)	1.338*** (0.220)	-0.225*** (0.032)	1.842*** (0.249)	-0.312*** (0.031)
T7 (FG: 1yr central)	-0.844*** (0.161)	0.203*** (0.030)	-0.658*** (0.188)	0.152*** (0.033)	-0.499** (0.202)	0.096*** (0.030)	0.092 (0.252)	0.004 (0.038)	1.607*** (0.268)	-0.282*** (0.037)
T8 (FG: 1yr high)	0.806*** (0.152)	-0.185*** (0.028)	-1.494*** (0.172)	0.298*** (0.030)	-0.589** (0.250)	0.104** (0.042)	-0.309 (0.267)	0.054 (0.041)	0.638** (0.262)	-0.103*** (0.035)
T9 (FG: 1yr low)	-1.228*** (0.137)	0.289*** (0.023)	-0.458*** (0.172)	0.105*** (0.028)	-0.934*** (0.195)	0.210*** (0.028)	-0.465* (0.240)	0.118*** (0.035)	-0.184 (0.243)	0.033 (0.030)
T10 (FG: 2yr central)	0.761*** (0.155)	-0.157*** (0.029)	0.522*** (0.177)	-0.113*** (0.028)	1.280*** (0.180)	-0.239*** (0.026)	1.547*** (0.216)	-0.305*** (0.030)	2.015*** (0.237)	-0.375*** (0.028)
T11 (FG: 2yr central-high)	-0.607*** (0.159)	0.126*** (0.029)	0.285* (0.163)	-0.052** (0.027)	0.036 (0.204)	-0.008 (0.030)	0.611*** (0.229)	-0.111*** (0.033)	0.442 (0.273)	-0.070** (0.035)
T12 (FG: 2yr central-low)	-0.368** (0.157)	0.069** (0.029)	0.581*** (0.172)	-0.164*** (0.029)	-0.896*** (0.221)	0.146*** (0.033)	1.322*** (0.212)	-0.241*** (0.029)	1.941*** (0.263)	-0.346*** (0.033)
T13 (FG: 3yr central)	0.388*** (0.150)	-0.106*** (0.028)	1.166*** (0.167)	-0.261*** (0.028)	0.324 (0.217)	-0.079** (0.035)	-0.798*** (0.248)	0.110*** (0.037)	0.779*** (0.272)	-0.167*** (0.036)
T14 (FG: 3yr central-high)	-0.074 (0.134)	0.020 (0.024)	0.035 (0.170)	-0.024 (0.029)	0.493** (0.206)	-0.100*** (0.032)	0.906*** (0.227)	-0.173*** (0.033)	1.262*** (0.254)	-0.204*** (0.033)
T15 (FG: 3yr central-low)	-0.432*** (0.144)	0.093*** (0.027)	0.081 (0.195)	-0.040 (0.036)	-0.356* (0.206)	0.052 (0.033)	-0.682*** (0.222)	0.117*** (0.032)	-0.289 (0.231)	0.064** (0.028)
T16 (FG: LR central-high)	-0.171 (0.158)	0.028 (0.030)	-0.340* (0.186)	0.051 (0.034)	-0.499*** (0.189)	0.092*** (0.027)	-0.663*** (0.228)	0.137*** (0.034)	0.073 (0.267)	-0.022 (0.036)
T17 (FG: LR central-low)	-0.271* (0.156)	0.068** (0.027)	0.749*** (0.165)	-0.138*** (0.026)	1.506*** (0.229)	-0.267*** (0.035)	2.468*** (0.252)	-0.422*** (0.037)	0.356 (0.287)	-0.055 (0.037)
T18 (FG: LR central + past FFR)	1.308*** (0.148)	-0.303*** (0.028)	1.442*** (0.173)	-0.327*** (0.031)	1.418*** (0.205)	-0.292*** (0.032)	1.928*** (0.242)	-0.347*** (0.036)	2.013*** (0.248)	-0.360*** (0.032)
T19 (Current FFR + past FFR)	0.368** (0.151)	-0.069** (0.028)	0.757*** (0.177)	-0.158*** (0.031)	-0.005 (0.198)	-0.005 (0.028)	0.108 (0.253)	-0.031 (0.036)	-0.009 (0.249)	-0.002 (0.031)
T20 (Inflation last year)	0.518*** (0.146)	-0.129*** (0.027)	1.238*** (0.171)	-0.272*** (0.029)	1.460*** (0.188)	-0.282*** (0.027)	1.407*** (0.244)	-0.293*** (0.036)	1.898*** (0.239)	-0.374*** (0.029)
T21 (Inflation last 3 years)	0.730*** (0.180)	-0.170*** (0.035)	0.645*** (0.223)	-0.153*** (0.042)	0.625*** (0.223)	-0.128*** (0.034)	1.028*** (0.249)	-0.189*** (0.036)	0.705*** (0.272)	-0.142*** (0.035)
T22 (Inflation last year + 3yr ahead inflation path forecast)	-0.398** (0.172)	0.095*** (0.035)	-0.739*** (0.196)	0.145*** (0.036)	0.801*** (0.207)	-0.146*** (0.032)	0.320 (0.260)	-0.047 (0.040)	1.105*** (0.269)	-0.179*** (0.036)
T23 (Inflation last year + 3yr ahead inflation average forecast)	-0.435*** (0.153)	0.077*** (0.027)	0.133 (0.206)	-0.041 (0.036)	-0.318 (0.257)	0.031 (0.041)	-0.642** (0.255)	0.104*** (0.038)	0.463* (0.255)	-0.114*** (0.033)
T24 (current mortgage rate)	-0.966*** (0.151)	0.226*** (0.027)	-0.225 (0.160)	0.053** (0.026)	0.289 (0.196)	-0.052* (0.030)	-1.252*** (0.219)	0.235*** (0.031)	0.955*** (0.254)	-0.189*** (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 17. Posterior beliefs (real mortgage rates) in the 2<sup>nd</sup> follow-up wave by treatment.

Treatment	Current		one-year [2019]		two-year [2020]		Three-year [2021]		Longer run	
	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )	Intercept (b)	Slope ( $\gamma$ )
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control	1.657*** (0.124)	0.357*** (0.022)	1.658*** (0.130)	0.358*** (0.022)	1.861*** (0.155)	0.378*** (0.031)	2.068*** (0.176)	0.368*** (0.034)	2.118*** (0.195)	0.512*** (0.034)
<b>Relative to control</b>										
T2 (Population growth)	0.018 (0.216)	-0.195*** (0.042)	0.190 (0.224)	-0.230*** (0.037)	0.416 (0.271)	-0.236*** (0.051)	0.306 (0.296)	-0.178*** (0.059)	0.675** (0.301)	-0.319*** (0.051)
T3 (Current FFR)	-0.318 (0.213)	0.040 (0.046)	-0.482** (0.216)	0.157*** (0.032)	-0.055 (0.300)	-0.052 (0.072)	-1.101*** (0.331)	0.355*** (0.074)	-0.417 (0.322)	0.065 (0.064)
T4 (FG: LR high)	0.089 (0.230)	-0.028 (0.046)	0.164 (0.228)	-0.109*** (0.038)	0.301 (0.240)	-0.127*** (0.037)	0.071 (0.255)	-0.075* (0.040)	0.384 (0.295)	-0.242*** (0.048)
T5 (FG: LR low)	-0.086 (0.219)	-0.044 (0.047)	0.017 (0.242)	-0.092* (0.053)	0.240 (0.271)	-0.102 (0.062)	0.002 (0.273)	0.010 (0.050)	0.146 (0.320)	-0.100* (0.058)
T6 (FG: LR central)	0.190 (0.216)	-0.063 (0.045)	0.407* (0.233)	-0.129** (0.050)	0.718*** (0.256)	-0.215*** (0.050)	0.547** (0.277)	-0.123** (0.058)	0.975*** (0.284)	-0.329*** (0.045)
T7 (FG: 1yr central)	-0.248 (0.223)	0.059 (0.055)	-0.330 (0.246)	0.069 (0.063)	-0.306 (0.264)	-0.005 (0.059)	-0.290 (0.280)	0.026 (0.057)	0.360 (0.302)	-0.281*** (0.053)
T8 (FG: 1yr high)	-0.412* (0.232)	0.112* (0.064)	-0.549** (0.257)	0.132* (0.075)	-0.973*** (0.274)	0.265*** (0.071)	-0.873*** (0.287)	0.200*** (0.062)	-0.137 (0.327)	-0.132** (0.062)
T9 (FG: 1yr low)	-0.142 (0.208)	0.089 (0.058)	-0.162 (0.229)	0.079 (0.058)	-0.135 (0.264)	0.134** (0.065)	0.319 (0.278)	-0.087 (0.054)	-0.255 (0.309)	0.042 (0.051)
T10 (FG: 2yr central)	0.303 (0.221)	-0.070 (0.050)	0.276 (0.229)	-0.072 (0.044)	0.483** (0.242)	-0.158*** (0.046)	0.451* (0.262)	-0.166*** (0.049)	0.571** (0.288)	-0.216*** (0.052)
T11 (FG: 2yr central-high)	0.522* (0.290)	-0.045 (0.082)	0.648** (0.283)	-0.085 (0.064)	0.549* (0.292)	-0.066 (0.057)	0.763** (0.316)	-0.118* (0.065)	0.790** (0.389)	-0.197** (0.077)
T12 (FG: 2yr central-low)	0.038 (0.212)	-0.091* (0.047)	0.019 (0.211)	-0.157*** (0.039)	-0.591 (0.389)	0.170 (0.126)	0.229 (0.256)	-0.129*** (0.046)	0.405 (0.277)	-0.247*** (0.045)
T13 (FG: 3yr central)	0.696*** (0.223)	-0.138** (0.058)	0.751*** (0.232)	-0.238*** (0.054)	0.456 (0.316)	-0.025 (0.091)	0.314 (0.318)	-0.002 (0.075)	0.943*** (0.311)	-0.290*** (0.058)
T14 (FG: 3yr central-high)	-0.466** (0.195)	0.017 (0.044)	-0.367* (0.213)	-0.017 (0.046)	-0.482* (0.271)	0.020 (0.071)	-0.364 (0.272)	-0.031 (0.061)	-0.413 (0.377)	-0.019 (0.090)
T15 (FG: 3yr central-low)	0.378* (0.205)	-0.111*** (0.039)	0.093 (0.239)	0.018 (0.065)	-0.181 (0.258)	0.071 (0.065)	-0.209 (0.295)	0.102 (0.074)	0.298 (0.366)	-0.051 (0.087)
T16 (FG: LR central-high)	-0.366* (0.209)	0.142*** (0.053)	-0.309 (0.212)	0.073* (0.043)	-0.504** (0.224)	0.142*** (0.045)	-0.366 (0.240)	0.092** (0.042)	-0.243 (0.278)	-0.003 (0.054)
T17 (FG: LR central-low)	-0.248 (0.219)	0.116*** (0.035)	0.016 (0.256)	0.002 (0.056)	0.019 (0.285)	-0.009 (0.061)	0.463 (0.311)	-0.199*** (0.065)	0.715** (0.346)	-0.313*** (0.063)
T18 (FG: LR central + past FFR)	-0.011 (0.196)	-0.139*** (0.048)	-0.130 (0.207)	-0.068 (0.058)	-0.286 (0.339)	-0.042 (0.120)	0.247 (0.260)	-0.236*** (0.049)	0.360 (0.284)	-0.286*** (0.053)
T19 (Current FFR + past FFR)	0.377 (0.231)	-0.018 (0.065)	0.252 (0.236)	0.021 (0.062)	0.398 (0.256)	-0.042 (0.057)	0.386 (0.276)	-0.077 (0.062)	-0.477 (0.393)	0.189** (0.085)
T20 (Inflation last year)	-0.273 (0.244)	-0.002 (0.068)	-0.222 (0.261)	-0.016 (0.069)	0.031 (0.298)	-0.103 (0.076)	0.018 (0.323)	-0.126 (0.078)	-0.799** (0.352)	0.079 (0.073)
T21 (Inflation last 3 years)	-0.031 (0.240)	-0.037 (0.059)	-0.018 (0.269)	-0.067 (0.064)	-0.039 (0.275)	-0.028 (0.063)	0.207 (0.315)	-0.099 (0.070)	0.147 (0.361)	-0.097 (0.070)
T22 (Inflation last year + 3yr ahead inflation path forecast)	-0.007 (0.206)	-0.100* (0.052)	-0.425 (0.363)	0.230 (0.141)	-0.276 (0.402)	0.171 (0.131)	-0.291 (0.446)	0.172 (0.132)	0.300 (0.304)	-0.129** (0.056)
T23 (Inflation last year + 3yr ahead inflation av. forecast)	0.082 (0.322)	-0.001 (0.134)	0.033 (0.399)	0.038 (0.137)	-0.064 (0.476)	0.016 (0.149)	0.005 (0.498)	0.021 (0.145)	0.035 (0.441)	-0.088 (0.107)
T24 (current mortgage rate)	-0.520** (0.205)	0.116*** (0.036)	-0.812*** (0.232)	0.252*** (0.056)	-0.638** (0.250)	0.096 (0.059)	-1.034*** (0.275)	0.254*** (0.065)	-0.480 (0.299)	-0.062 (0.054)
Observations	5,521		5,563		5,594		5,606		5,606	
R-squared	0.318		0.345		0.362		0.377		0.377	

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 Table 18. P-value for pairwise tests of equality of slopes across treatments, current nominal mortgage rates.

Treatment	Treatment																						
	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16	T17	T18	T19	T20	T21	T22	T23	T24	
T3	.	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
T4		.	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
T5			.	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	
T6				.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
T7					.	0.00	0.00	0.00	0.00	0.25	0.00	0.95	0.00	0.55	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	
T8						.	0.00	0.00	0.00	0.00	0.72	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	
T9							.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
T10								.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.00	
T11									.	0.15	0.00	0.01	0.00	0.03	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	
T12										.	0.00	0.26	0.00	0.55	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.00	
T13											.	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	
T14												.	0.00	0.55	0.00	0.08	0.00	0.00	0.00	0.01	0.00	0.00	
T15													.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
T16														.	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	
T17															.	0.00	0.00	0.38	0.45	0.00	0.25	0.00	
T18																.	0.00	0.00	0.00	0.00	0.00	0.00	
T19																	.	0.00	0.00	0.00	0.00	0.00	
T20																		.	0.92	0.00	0.73	0.00	
T21																			.	0.00	0.67	0.00	
T22																				.	0.00	0.00	
T23																					.	0.00	
T24																						.	

Notes: These results are for column (2) in Table 3.

Appendix Table 19. Consumer sentiment as a function of real interest rate.

	Good time to buy:			
	House	Car	Large home appliance or electronics	Durable good
	(1)	(2)	(3)	(4)
Post-treatment $Ei - E\pi$	-0.003 (0.025)	-0.104*** (0.029)	-0.120*** (0.026)	-0.096*** (0.025)
Pre-treatment $Ei - E\pi$	0.002 (0.004)	0.025*** (0.005)	0.029*** (0.005)	0.022*** (0.005)
Observations	17,395	17,359	17,437	17,441
R-squared	0.068	-0.020	-0.047	-0.009
1 <sup>st</sup> -stage F-statistic	21.08	19.28	22.93	19.05

Notes: The table reports instrumental variable (IV) estimates of coefficients  $\phi_1$  and  $\phi_2$  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 column (4), 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). All regressions use sampling weights. Household/respondent controls as in Table 4 are included but not reported. Robust standard errors are in parentheses. “1<sup>st</sup> stage F-statistic” reports the F statistic for the first stage regression. \*\*\*, \*\*, \* denote statistical significance at 1, 5 and 10 percent levels.

Appendix Table 19. Response of expectations by aggregated by treatment horizon, p-value and q-values (adjusted for multiple hypothesis testing).

	Inflation	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)
Intercept											
Control	-	-	-	-	-	-	-	-	-	-	-
Curr./part FFR	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.539 (0.145)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
1-year FG	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
2-year FG	0.000 (0.001)	0.000 (0.001)	0.029 (0.003)	0.097 (0.041)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
3-year FG	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Longer-run FG	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Curr. mort. rate	0.005 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Slope											
Control	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Curr./part FFR	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.392 (0.145)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
1-year FG	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.001 (0.001)	0.000 (0.001)
2-year FG	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.309 (0.127)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.006 (0.001)	0.000 (0.001)	0.000 (0.001)
3-year FG	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Longer-run FG	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.005 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)
Curr. mort. rate	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)	0.000 (0.001)

Notes: The table reports p-values and q-values (in parentheses) of coefficients in specification (1) for various expectations when treatments are aggregated by horizon of forward guidance (FG). Q-values (p-values adjusted for multiple hypothesis testing) are computed according to Anderson (2008). Estimates and standard errors are reported in Appendix Table 6.

Aggregation treatments:

Current FFR rate: T3, T19

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

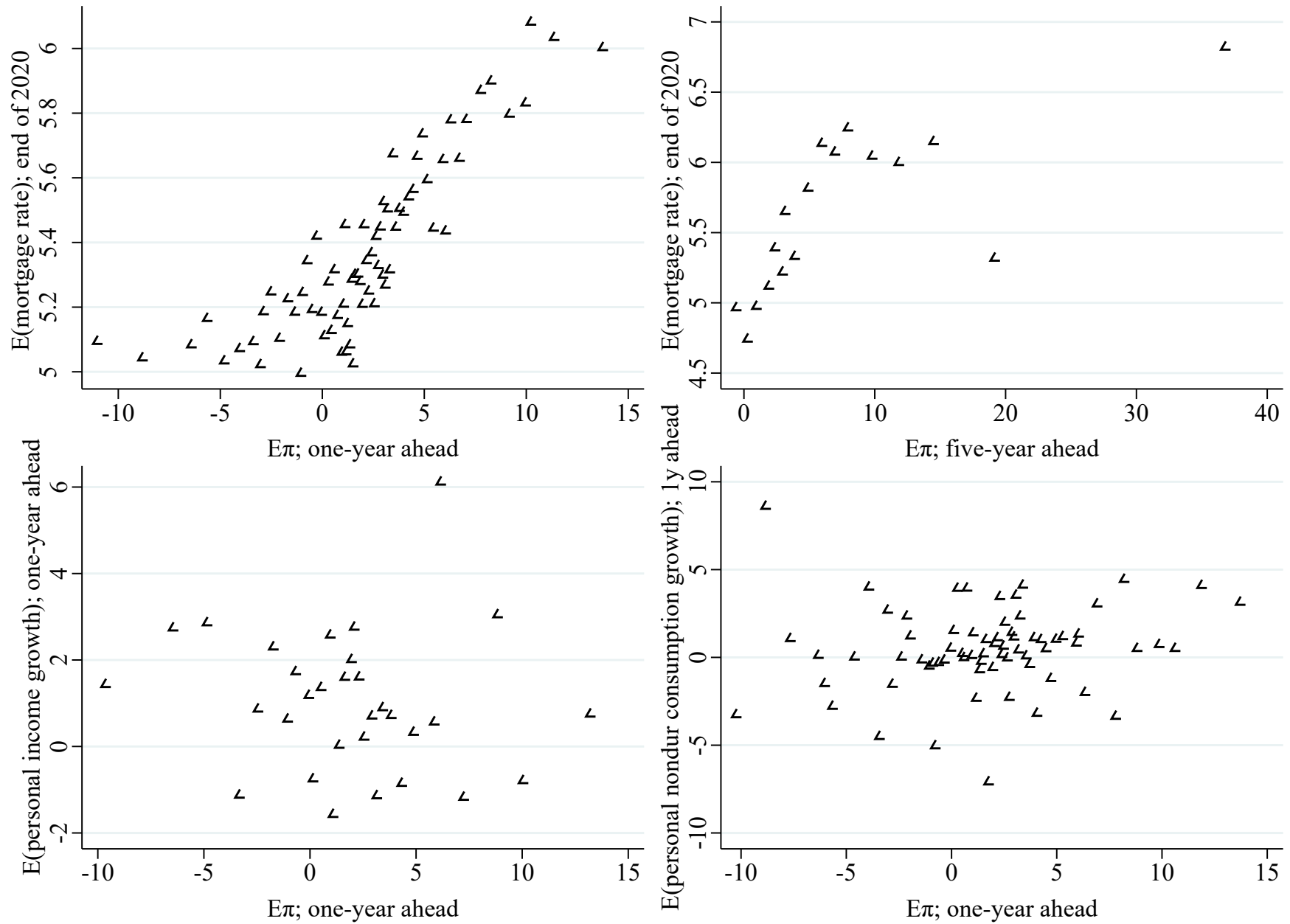
Current mortgage rate: T24

Appendix Table 20. Tests whether treatments predict households reporting deflation.

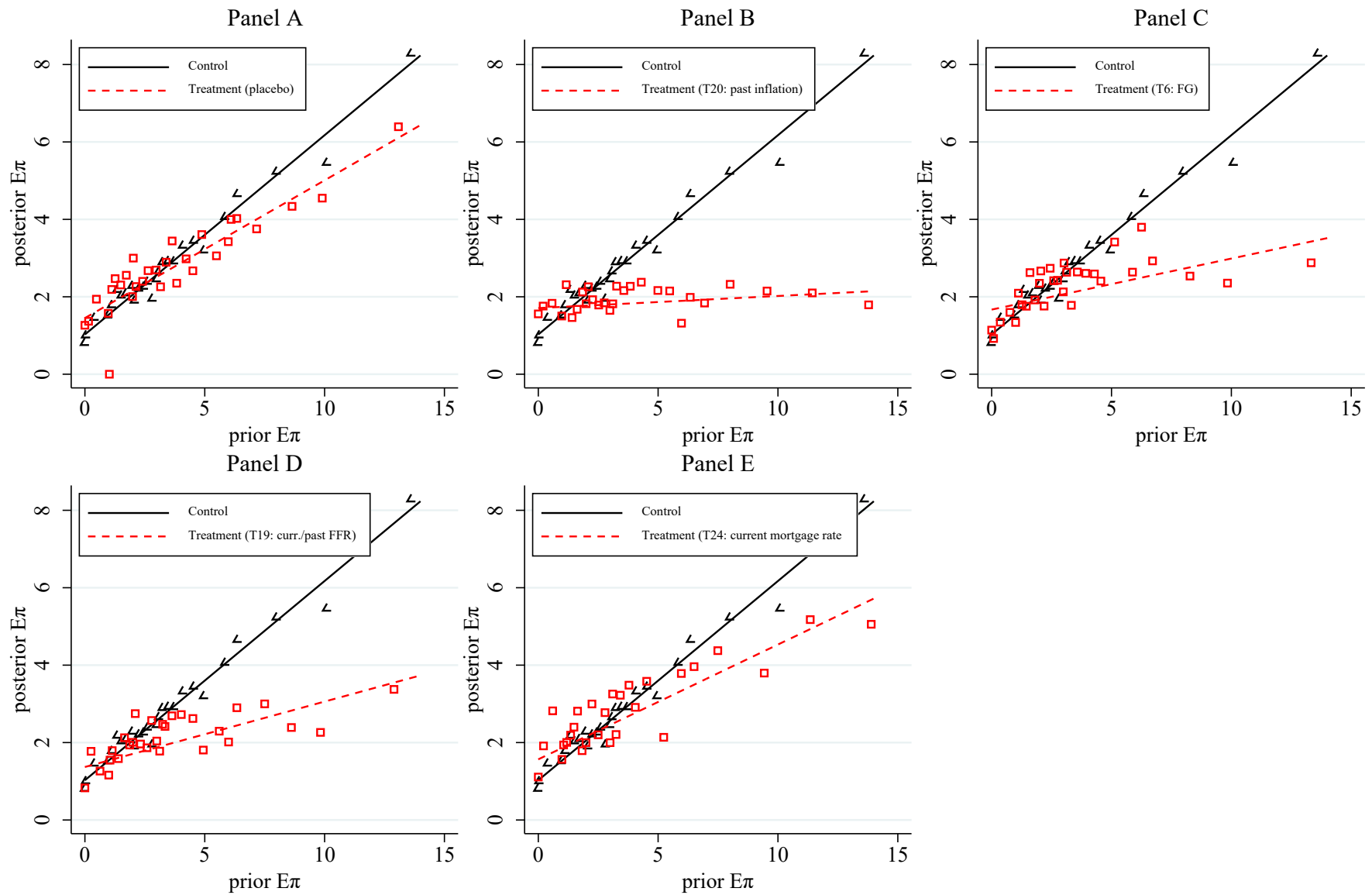
Dependent variable: respondent forecasts deflation	(1)	(2)
T2 (Population growth)	0.017 (0.016)	0.015 (0.016)
T3 (Current FFR)	-0.026* (0.016)	-0.026* (0.016)
T4 (FG: LR high)	-0.017 (0.016)	-0.013 (0.016)
T5 (FG: LR low)	0.017 (0.016)	0.017 (0.016)
T6 (FG: LR central)	-0.013 (0.016)	-0.008 (0.016)
T7 (FG: 1yr central)	-0.007 (0.016)	-0.005 (0.016)
T8 (FG: 1yr high)	-0.004 (0.016)	-0.004 (0.016)
T9 (FG: 1yr low)	0.002 (0.016)	0.002 (0.016)
T10 (FG: 2yr central)	-0.021 (0.016)	-0.022 (0.016)
T11 (FG: 2yr central-high)	-0.006 (0.016)	-0.007 (0.016)
T12 (FG: 2yr central-low)	-0.010 (0.016)	-0.008 (0.016)
T13 (FG: 3yr central)	0.002 (0.016)	0.003 (0.016)
T14 (FG: 3yr central-high)	0.003 (0.016)	0.007 (0.016)
T15 (FG: 3yr central-low)	-0.003 (0.016)	-0.001 (0.016)
T16 (FG: LR central-high)	0.009 (0.016)	0.010 (0.016)
T17 (FG: LR central-low)	-0.004 (0.016)	-0.004 (0.016)
T18 (FG: LR central + past FFR)	-0.000 (0.016)	-0.001 (0.016)
T19 (Current FFR + past FFR)	-0.004 (0.016)	-0.004 (0.016)
T20 (Inflation last year)	-0.002 (0.016)	-0.002 (0.016)
T21 (Average inflation over last 3 years)	0.004 (0.016)	0.005 (0.016)
T22 (Inflation last year + 3yr ahead inflation path forecast)	-0.019 (0.016)	-0.019 (0.016)
T23 (Inflation last year + 3yr ahead inflation average forecast)	0.006 (0.016)	0.007 (0.016)
T24 (Current mortgage rate)	-0.013 (0.016)	-0.011 (0.016)
Observations	26,891	26,891
R-squared	0.001	0.022
Household/respondent controls	No	Yes
p-values (coefficients on treatment dummies are all zero)	0.768	0.781

Notes: the dependent variable is a dummy variable equal to one if a respondent reports deflation as his/her pre-treatment inflation forecast. The regressors are a set of dummy variables for the information treatments. Household/respondent controls are included in column (2) but not reported. Robust standard errors are in parentheses. \*\*\*, \*\*, \* denote statistical significance at 1, 5 and 10 percent levels.

Appendix Figure 1. Correlation between inflation expectations and other expectations.

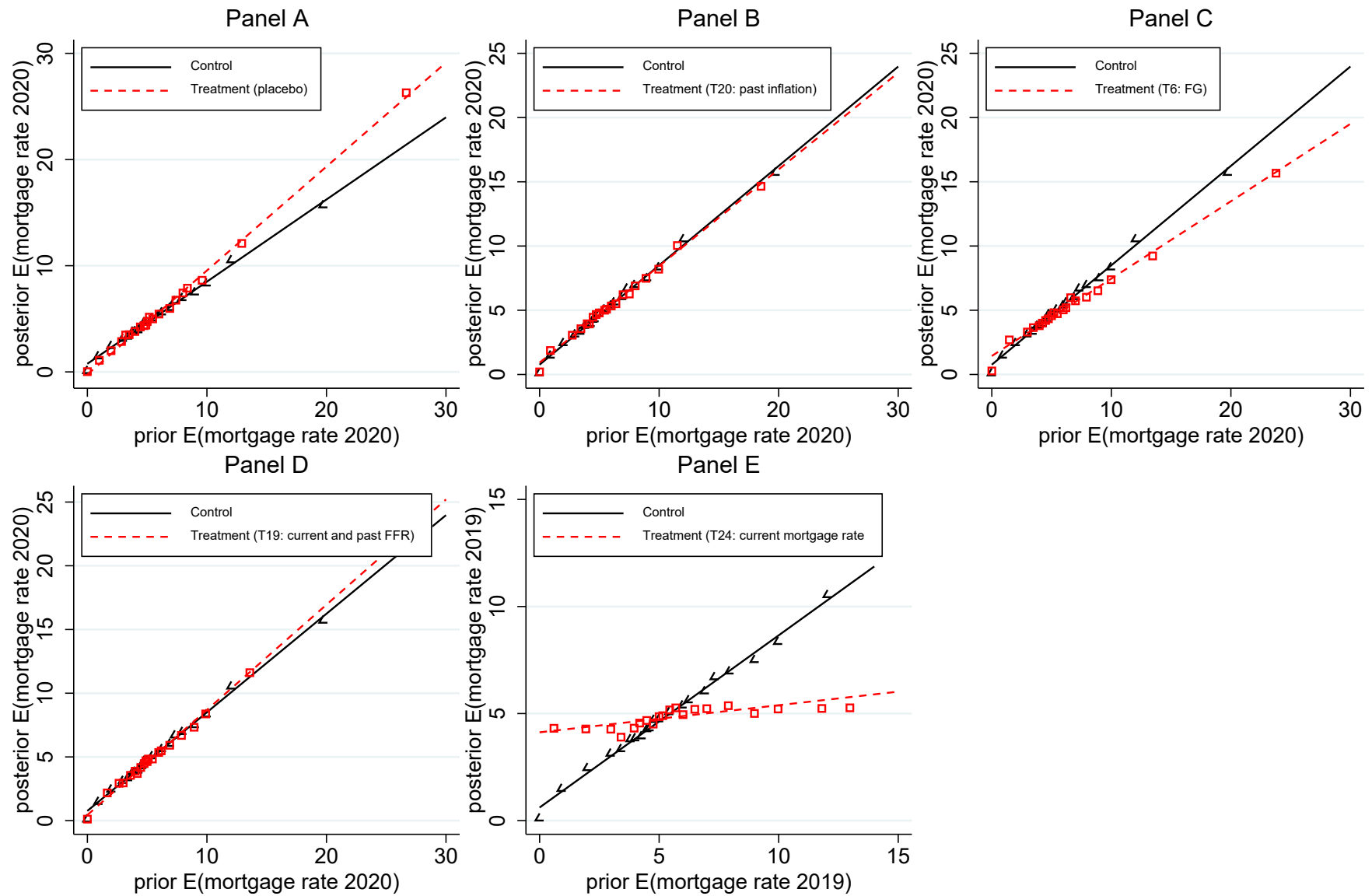


Appendix Figure 2. Revision of inflation expectations by select treatments.



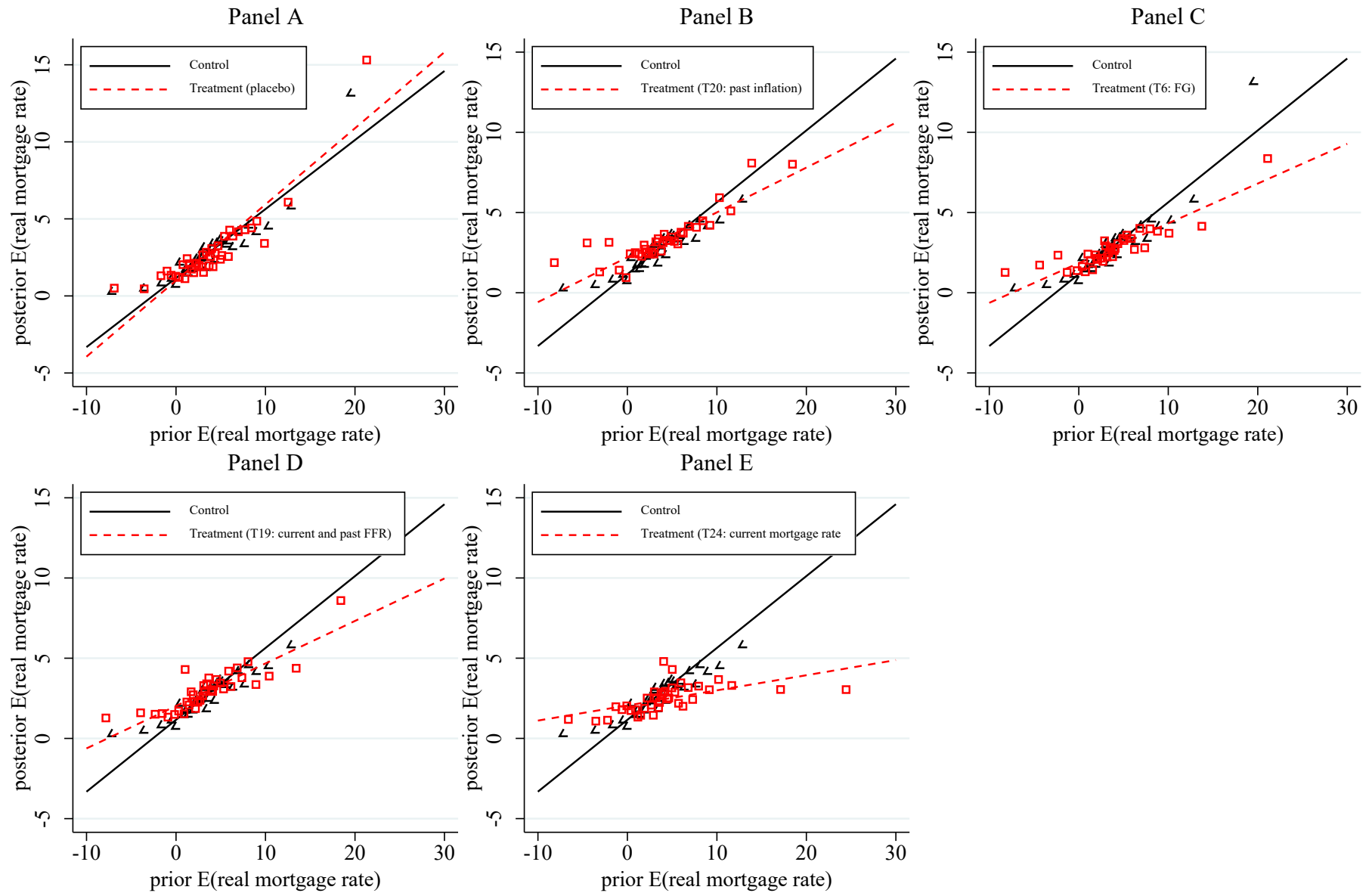
Notes: Each panel shows binscatter plot for post- vs. pre-treatment inflation expectations. Each square and triangle aggregate approximately 30 observations. Lines show fitted linear regressions.

Appendix Figure 3. Revision of 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 4. Revision of real mortgage rate expectations (end of 2020) by select treatments.

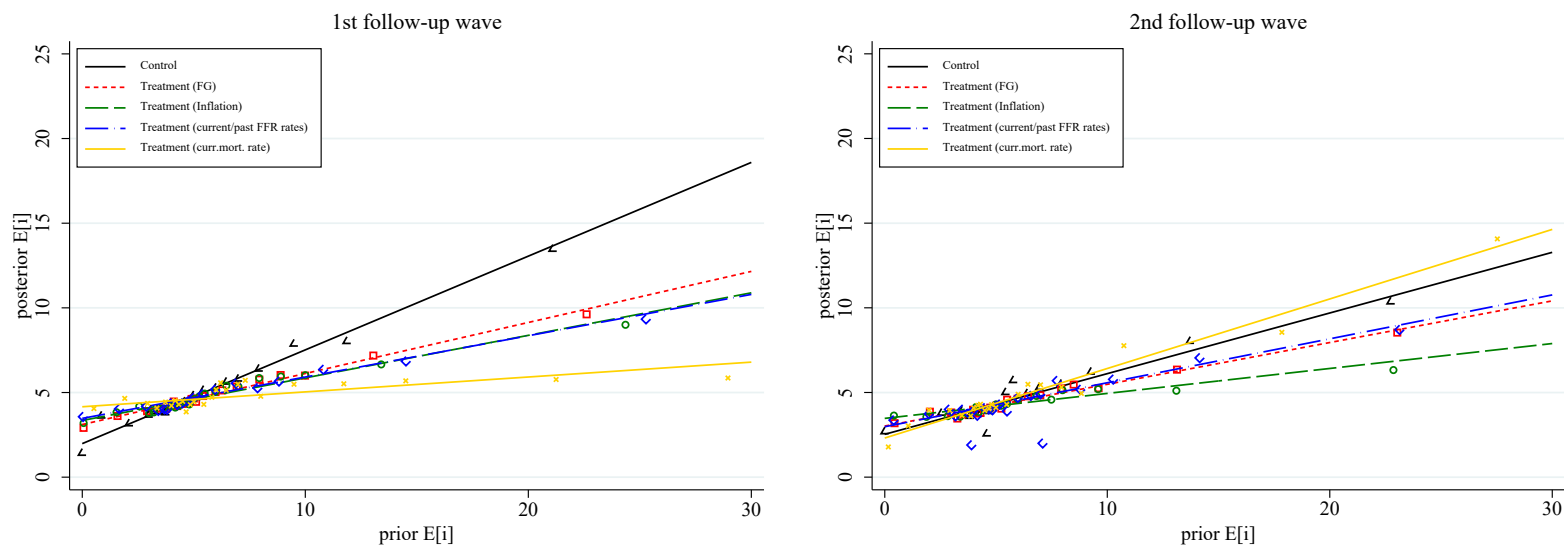


Notes: Each panel shows binscatter plot for post- vs. pre-treatment real mortgage expectations (nominal mortgage rates at the end of 2020 minus one-year-ahead inflation forecast). Each square and triangle aggregate approximately 30 observations. Lines show fitted linear regressions.

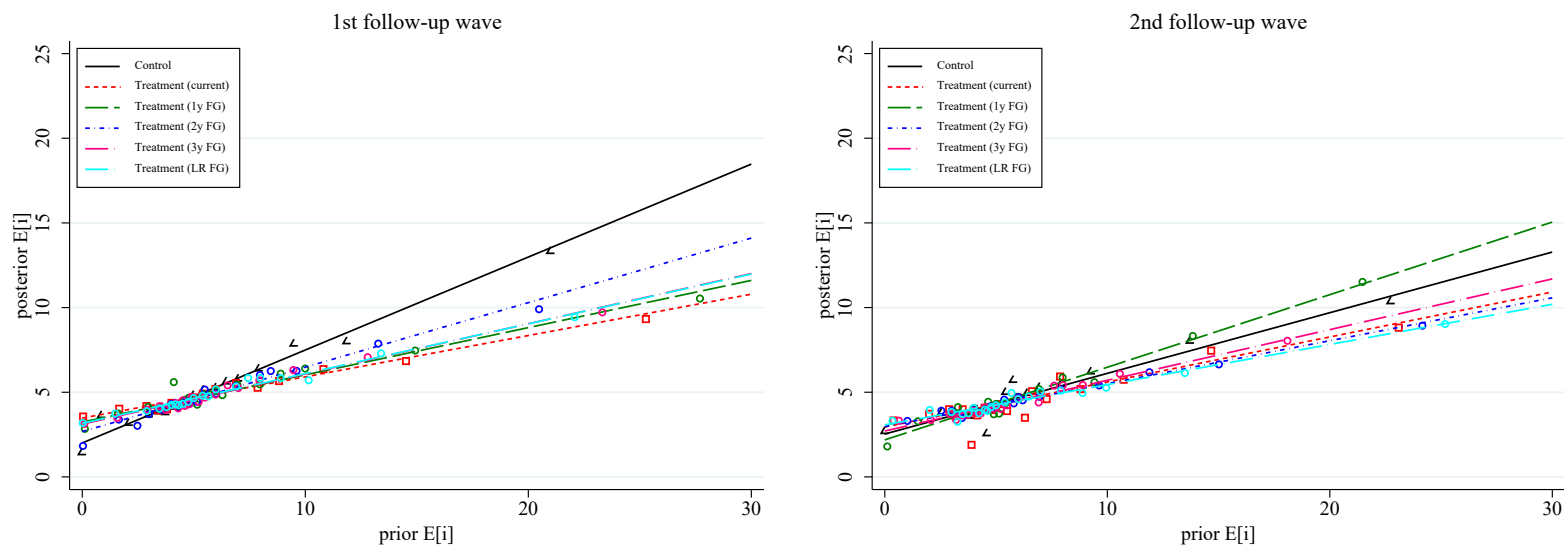


Appendix Figure 5. Response of mortgage rate expectations by the forecast horizon and the horizon of forward guidance (FG) in follow up waves.

Panel A: By treatment type



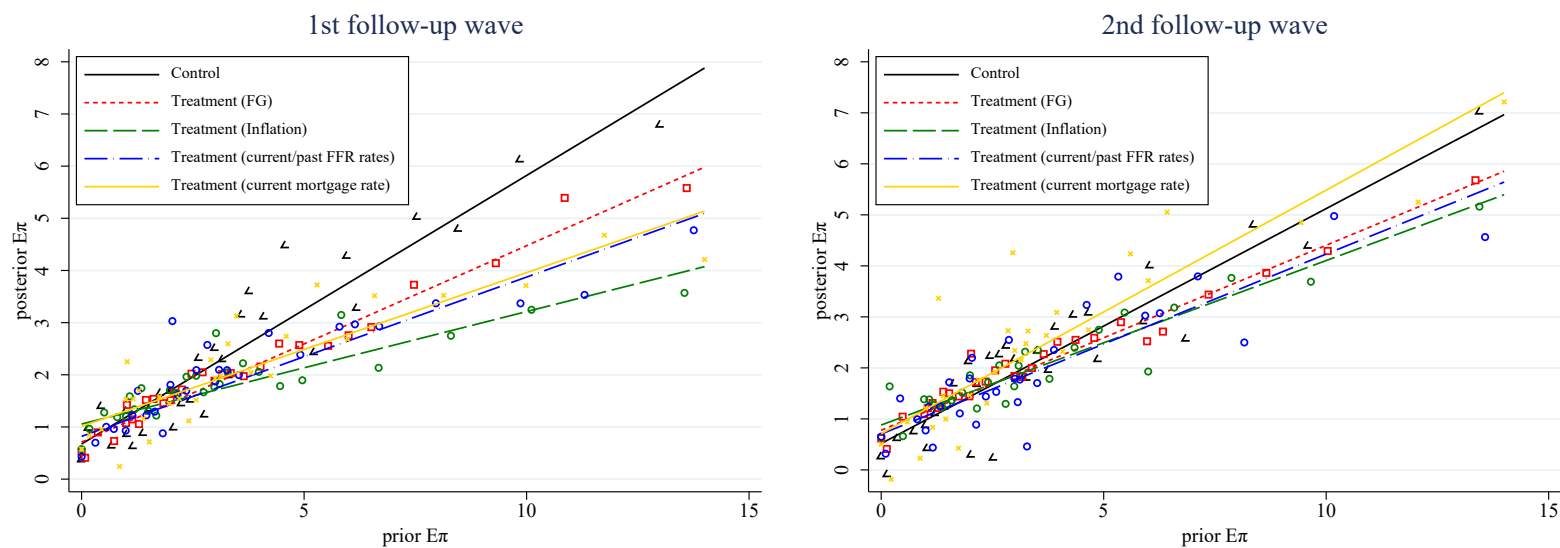
Panel B: By the horizon of forward guidance



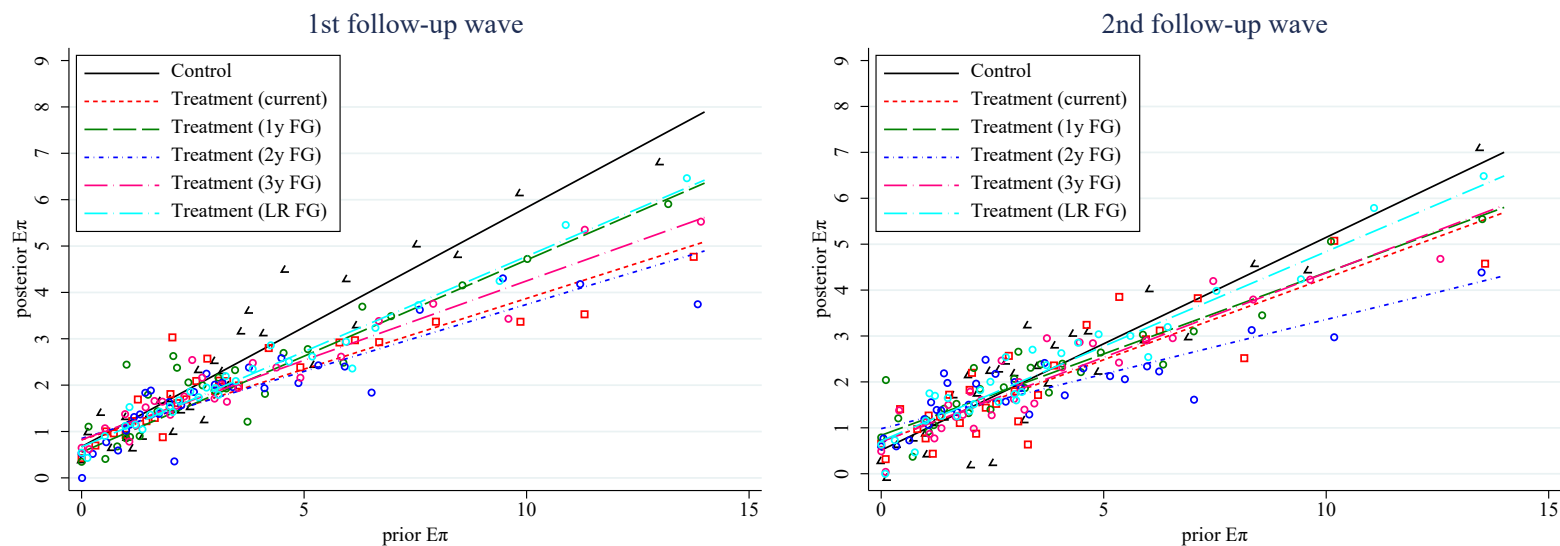
Notes: The nominal rate is for the end of 2019. Panel A shows binscatter plots for revisions in mortgage rates when treatments are combined into information provision about current FFR rates (“current”: T3, T19), 1-year forward guidance (“1y FG”: T7-T9), 2-year forward guidance (“2y FG”: T10-T12), 3-year forward guidance (“3y FG”: T13-T15), longer-run forward guidance (“LR FG”: T4-T6, T16-T18), current mortgage rate (curr.mort. T24). Panel B shows binscatter plots for revisions in mortgage rates when treatments are combined into information provision about current FFR rates (“Current/past rates”: T3, T19), forward guidance (“FG”: T4-T19), inflation (“Inflation”: T20-T23). The title of each panel indicates the horizon of the forecasts for mortgage rates.

Appendix Figure 6. Response of inflation rate expectations by the forecast horizon and the horizon of forward guidance (FG) in follow up waves.

Panel A: By treatment type



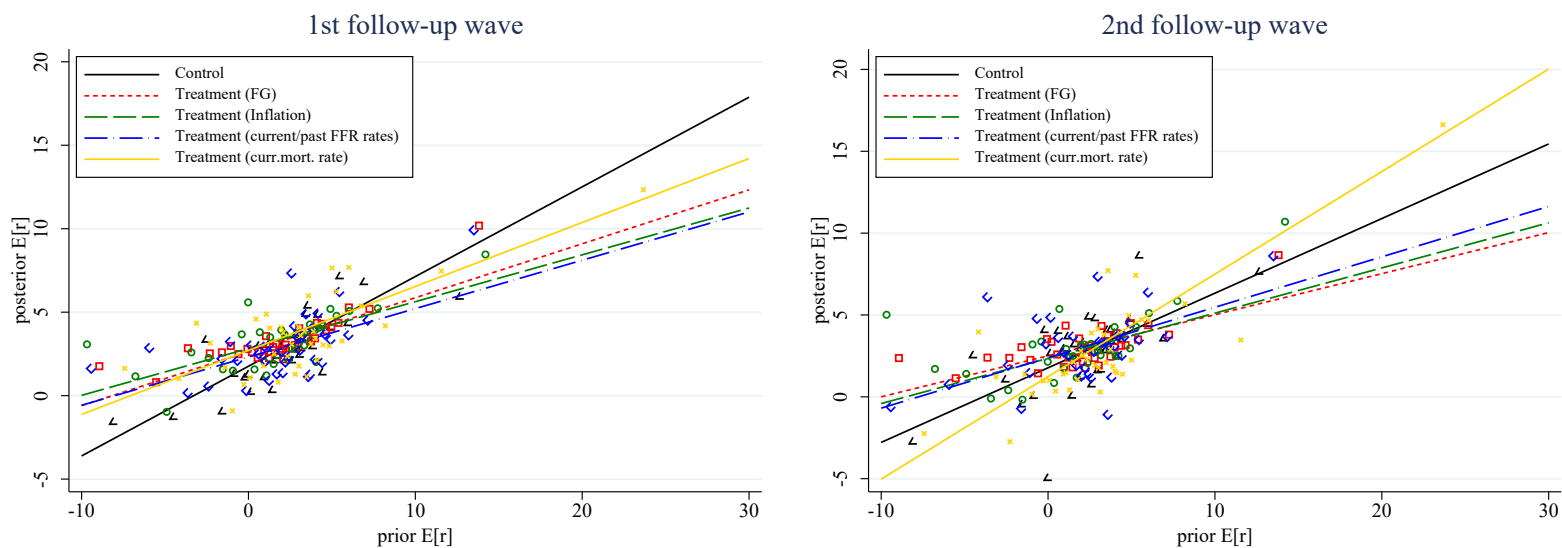
Panel B: By the horizon of forward guidance



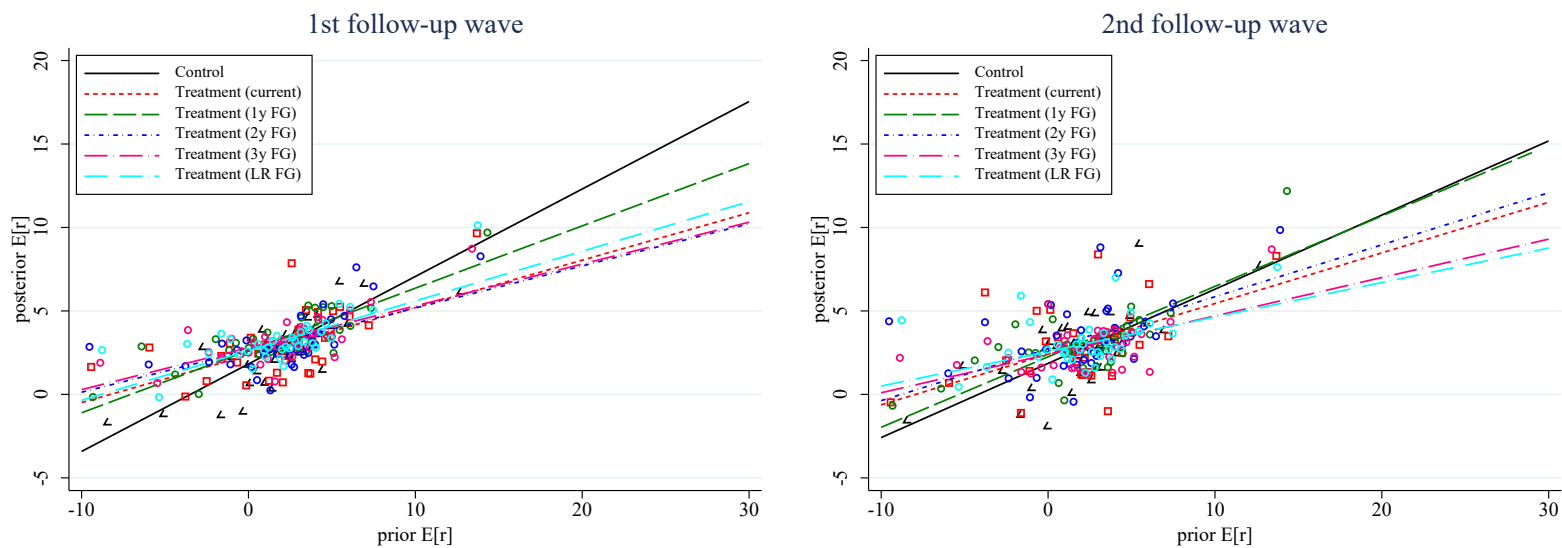
Notes: Panel A shows binscatter plots for revisions in inflation expectations when treatments are combined into information provision about current FFR rates (“current”: T3, T19), 1-year forward guidance (“1y FG”: T7-T9), 2-year forward guidance (“2y FG”: T10-T12), 3-year forward guidance (“3y FG”: T13-T15), longer-run forward guidance (“LR FG”: T4-T6, T16-T18), current mortgage rate (curr.mort. T24). Panel B shows binscatter plots for revisions in inflation expectations when treatments are combined into information provision about current FFR rates (“Current/past rates”: T3, T19), forward guidance (“FG”: T4-T19), inflation (“Inflation”: T20-T23). The title of each panel indicates the horizon of the forecasts for mortgage rates.

Appendix Figure 7. Response of real mortgage rate expectations by the forecast horizon and the horizon of forward guidance (FG) in follow up waves.

Panel A: By treatment type



Panel B: By the horizon of forward guidance



Notes: The real rate is for the end of 2019. Panel A shows binscatter plots for revisions in real mortgage rates when treatments are combined into information provision about current FFR rates (“current”: T3, T19), 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), current mortgage rate (curr.mort. T24). Panel B shows binscatter plots for revisions in real mortgage rates when treatments are combined into information provision about current FFR rates (“Current/past rates”: T3, T19), forward guidance (“FG”: T4-T19), inflation (“Inflation”: T20-T23). The title of each panel indicates the horizon of the forecasts for mortgage rates.

# Survey Questionnaire: Wave 1

## UIC Booth Economic Survey - March 2019

Please have **all household members, 18 years or older**, answer this survey.

;SHOW THIS TEXT WITH Q1

*This survey is about your household's finances and opinions about the economy. As with any of our surveys, the information you provide is confidential and is only shared in an aggregate (not individual) level.*

*Please tell us about yourself...*

;3 DROP-DOWN BOXES

1. What is your date of birth?

Month: January, February...December

Day: 1, 2, 3...31

Year: 1916, 1917...1997

2. What is your gender?

☐ Male

☐ Female

3. What is your first name?

\_\_\_\_\_

4. Over the last three months on average, how much did your household spend (**per month**) on goods and services in total and for each of the individual components listed below?

*Please enter a number between 0 and 10,000 for each category. The sum of the expenditures for the individual categories should add up to the total amount.*

Total monthly spending TOTAL [AUTOSUM] [RANGE: 0-99,999] [HAVE THIS AUTOMATICALLY SUM]

\$ \_\_\_\_\_

Debt payments (mortgages, auto loans, student loans, etc.)

\$ \_\_\_\_\_

Housing (including rent, maintenance and home owner/renter insurance, housekeeping and cleaning service, but *not* including mortgage payments)

\$ \_\_\_\_\_

Utilities (including water, sewer, electricity, gas, heating oil, phone, cable, internet)

\$ \_\_\_\_\_

Food (including groceries, dining out, take-out food, and beverages)

\$ \_\_\_\_\_

Clothing, footwear, and personal care

\$ \_\_\_\_\_

Gasoline

\$ \_\_\_\_\_

Other regular transportation costs (including public transportation fares and car maintenance)

\$ \_\_\_\_\_

Medical care (including health insurance, out-of-pocket medical bills and prescription drugs)

\$ \_\_\_\_\_

Travel, Recreation, and entertainment

\$ \_\_\_\_\_

Education and child care

\$ \_\_\_\_\_

Furniture, jewelry, small appliances and other small durable goods

\$ \_\_\_\_\_

Other (including gifts, child support or alimony, charitable giving, and other miscellaneous)

\$ \_\_\_\_\_

5. Thinking ahead to 12 months from now, how do you expect your household spending on all goods and services at that time to compare to your spending over the previous 12 months?

☐ Higher than now

☐ About the same

☐ Lower than now

☐ Do not know

;IF Q5='Higher than now' OR Q5='Lower than now', GO TO Q5a.

;IF Q5='Do not know', GO TO Q5b.

;IF Q5='About the same', GO TO Q5c.

;QUESTION WORDING FOR Q5a DEPENDENT ON CHOICE FOR 'Higher than now' OR 'Lower than now' IN Q5.

5a. How much [higher/lower] (percentage-wise) do you expect your household spending on all goods and services to be 12 months from now relative to the previous 12 months?

\_\_\_\_\_ percent [RANGE: 0-100]

☐ Do not know

;IF Q5a='Do not know', GO TO Q5b.

;QUESTION WORDING FOR Q5b DEPENDENT ON CHOICE FOR 'Higher than now' OR 'Lower than now' IN Q5.

5b. Please estimate how much [higher/lower] (percentage-wise) you expect your monthly household spending on all goods and services to be 12 months from now using the categories listed below?

☐ Less than 5%

☐ 5 - 10%

☐ 11 - 15%

☐ 16 - 20%

☐ 21 - 25%

☐ 26 - 30%

☐ More than 30%

☐ Don't Know

ASK Q5c IF Q5 = 'About the same', OTHERWISE SKIP TO Q6.

5c. You have indicated that you expect that your household spending 12 months from now will be about the same as over the previous 12 months. This could mean that the change equals zero percent or that the percent change is small. Please estimate using the categories listed below what situation best describes your situation?

☐ Over 12 months 10 percent lower

☐ Over 12 months 9 percent lower

☐ Over 12 months 8 percent lower

☐ Over 12 months 7 percent lower

☐ Over 12 months 6 percent lower

☐ Over 12 months 5 percent lower

☐ Over 12 months 4 percent lower

☐ Over 12 months 3 percent lower

☐ Over 12 months 2 percent lower

☐ Over 12 months 1 percent lower

☐ Over 12 months exactly the same as now

☐ Over 12 months 1 percent higher

☐ Over 12 months 2 percent higher

☐ Over 12 months 3 percent higher

☐ Over 12 months 4 percent higher

☐ Over 12 months 5 percent higher

☐ Over 12 months 6 percent higher

☐ Over 12 months 7 percent higher

☐ Over 12 months 8 percent higher

☐ Over 12 months 9 percent higher

☐ Over 12 months 10 percent higher

☐ Do not know

6. Suppose that you had to make an unexpected payment equal to one month of your after-tax income, would you have sufficient financial resources (access to credit, savings, loans from relatives or friends, etc.) to pay for the entire amount?

☐ Yes

☐ No

☐ Don't know/prefer not to answer

7. Which of the following best characterizes your household:

- ☐ Own our house/apartment without mortgage
- ☐ Own our house/apartment and have a fixed-rate mortgage
- ☐ Own our house/apartment and have a variable-rate mortgage
- ☐ Rent our house/apartment
- ☐ Other

8. Does your household have total financial investments (excluding housing) worth more than one month of combined household income?

- ☐ Yes
- ☐ No >SKIP TO Q9

8a. What percent of your financial wealth (excluding housing) do you invest in the following categories? Put "0" if you do not invest in a given category.

[RANGE FOR EACH ITEM BELOW: 0-100]

Checking and Savings Account, Certificate of deposits	_____ percent
Cash	_____ percent
US Bonds	_____ percent
US Stocks	_____ percent
Foreign Stocks and Bonds	_____ percent
Gold and precious metals	_____ percent
Bitcoin and other cryptocurrencies	_____ percent
Other	_____ percent
<b>% Total</b>	<u>100</u>

9. In your current job, do you...

Please select all that apply.

- ☐ Supervise 1 to 10 other people
- ☐ Supervise 11 to 50 other people
- ☐ Supervise more than 50 other people
- ☐ Make decisions about hiring/firing workers
- ☐ Make decisions about what prices to set
- ☐ Make decisions about capital expenditures
- ☐ Make decisions about wages/salaries
- ☐ Make decisions about marketing or sales
- ☐ None of the above >EXCLUSIVE

10. Do you currently plan to buy a new home, car, or other major big-ticket item (fridge, TV, furniture, etc.) in the next 12 months?

- ☐ Yes
- ☐ No >SKIP TO Q11

10a. Which of the following do you plan to purchase in the next 12 months? Please select all that apply.

- ☐ A house/apartment
- ☐ A car or other vehicle
- ☐ A large home appliance or electronics
- ☐ None of the above >EXCLUSIVE >SKIP TO Q11

;ONLY SHOW RESPONSES SELECTED IN Q10a

10b. How much do you plan to spend on the following?

A house/apartment \_\_\_\_\_  
A car or other vehicle \_\_\_\_\_  
A large home appliance or electronics \_\_\_\_\_

We would like to ask you some questions about the overall economy and in particular about the rate of inflation/deflation (Note: inflation is the percentage rise in overall prices in the economy, most commonly measured by the Consumer Price Index and deflation corresponds to when prices are falling).

11. Over the **last** 12 months, what do you think the overall rate of inflation/deflation has been in the economy?

Answer: The rate of inflation/deflation was \_\_\_\_\_ percent over the last 12 months.

If you think there was inflation, please enter a positive number. If you think there was deflation, please enter a negative number. If you think there was neither inflation nor deflation, please enter zero.

[RANGE: -100-100 ALLOW FOR UP TO 2 DECIMAL POINTS]

12. In THIS question, you will be asked about the probability (PERCENT CHANCE) of something happening. The percent chance must be a number between 0 and 100 and the sum of your answers must add up to 100.

What do you think is the percent chance that, **over the next 12 months...**

[RANGE OF EACH OPTION BELOW: 0-100 ALLOW FOR UP TO 2 DECIMAL POINTS]

- *the rate of deflation (opposite of inflation) will be 12% or more* \_\_\_\_\_
- *the rate of deflation (opposite of inflation) will be between 8% and 12%* \_\_\_\_\_
- *the rate of deflation (opposite of inflation) will be between 4% and 8%* \_\_\_\_\_
- *the rate of deflation (opposite of inflation) will be between 2% and 4%* \_\_\_\_\_
- *the rate of deflation (opposite of inflation) will be between 0% and 2%* \_\_\_\_\_
- *the rate of inflation will be between 0% and 2%* \_\_\_\_\_
- *the rate of inflation will be between 2% and 4%* \_\_\_\_\_
- *the rate of inflation will be between 4% and 8%* \_\_\_\_\_
- *the rate of inflation will be between 8% and 12%* \_\_\_\_\_
- *the rate of inflation will be 12% or more* \_\_\_\_\_
- **% Total** \_\_\_\_\_ [TOTAL ANSWERS  
FROM ABOVE]

13. What is your best guess about the current interest rate on a savings account in a bank?

\_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

14. What do you think is the current interest rate on a fixed-rate 30-year mortgage for someone like you and what do you think it will be in the future?

Current rate: \_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

At the end of 2019? \_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

At the end of 2020? \_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

At the end of 2021? \_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

In the next 5-10 years? \_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

[80% GET 1% NUMBER, 20% GET 3% NUMBER]

15. Suppose that the interest rate offered by banks on savings were hypothetically to increase by 1%. By what percentage would you change your total spending? Your answer should be a positive number if you would increase your spending, a negative number if you would decrease your spending, and zero if no change.

\_\_\_\_\_ %

RANDOMLY ALLOCATE RESPONDENTS TO ONE OF THE GROUPS BELOW:

1. Control with no information - GO STRAIGHT TO Q17 [AT LEAST 2,000 RESPONDENTS]

IF ONE OF THE GROUPS BELOW SHOW

“Before you give us your responses to the rest of the questions, we would like you to know the following.”

2. Placebo group

“Population of the U.S. grew by 2.2 percent between 2015 and 2017.”

3. Current rate, FFR

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%.”

4. Current rate FFR + high path

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 3.1% on average in 2019, 3.6% in 2020 and 2021, and 3.5% in the longer run.”

5. Current rate FFR + low path

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.4% on average in 2019, 2020 and 2021 and 2.5% in the longer run.”

6. Current rate FFR + central tendency

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019, 3.1% in 2020, 3.0% in 2021 and 2.8% in the longer run.”

7. FFR today plus 2019 projection

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019.”

8. FFR today plus high 2019

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 3.1% on average in 2019.”

9. FFR today plus low 2019

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.4% on average in 2019.”

10. FFR today plus central 2019 plus central 2020 projection

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019 and 3.1% in 2020.”

11. FFR today plus central 2019 plus high 2020 projection

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019 and 3.6% in 2020.”

12. FFR today plus central 2019 plus low 2020 projection

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019 and 2.4% in 2020.”

13. FFR today plus central 2019 + central 2020 + central 2021

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019, 3.1% in 2020, and 3.0% in 2021.”



14. FFR today plus central 2019 + central 2020 + high 2021

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019, 3.1% in 2020, and 3.6% in 2021.”

15. FFR today plus central 2019 + central 2020 + low 2021

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019, 3.1% in 2020, and 2.4% in 2021.”

16. FFR today plus central 2019 + central 2020 + central 2021 + high long-term

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019, 3.1% in 2020, 3.0% in 2021, and 3.5% in the longer run.”

17. FFR today plus central 2019 + central 2020 + central 2021 + low long-term

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019, 3.1% in 2020, 3.0% in 2021, and 2.5% in the longer run.”

18. Current rate FFR + past rates + central tendency

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. This rate was 1.0% on average in 2017, 0.4% in 2016, and 0.1% in 2015. One forecast from the Federal Reserve is that this interest rate will be 2.8% on average in 2019, 3.1% in 2020, 3.0% in 2021 and 2.8% in the longer run.”

19. Current rate + past rates, FFR

“The interest rate set by the Federal Reserve, known as the Federal Funds Rate, is currently at 2.5%. This rate was 1.0% on average in 2017, 0.4% in 2016, and 0.1% in 2015.”

20. Inflation treatment: current inflation

“Over the last twelve months, the overall inflation rate in the economy as measured by the percentage change in a consumer price index has been 1.8%.”

21. Inflation treatment: current inflation + previous two years

“Over the last three years, the overall inflation rate in the economy as measured by the percentage change in a consumer price index has been 1.6% per year.”

22. Inflation treatment: current inflation + path of expected inflation

“Over the last twelve months, the overall inflation rate in the economy as measured by the percentage change in a consumer price index has been 1.8%. One forecast at the Federal Reserve is that this inflation rate will be 1.9% on average in 2019, 2.1% in 2020 and 2021, and 2.0% in the longer-run.”

23. Inflation treatment: close to 2%

“Over the last twelve months, the overall inflation rate in the economy as measured by the percentage change in a consumer price index has been 1.8%. One forecast at the Federal Reserve is that this inflation rate will be 2.0% on average over the next few years and in the longer-run.”

24. Current fixed-rate 30-year mortgage

“The current average rate for fixed-rate 30-year mortgage is 4.6% per year.”

16. Over the **next** 12 months, what do you think the overall rate of inflation/deflation (as measured by the Consumer Price Index) will be in the economy?

\_\_\_\_\_ % [RANGE: 0-100, ONE DECIMAL]

17. What annual rate of inflation/deflation (as measured by the Consumer Price Index) do you expect over the next 3-5 years?

\_\_\_\_\_ % per year [RANGE: -100 to 100, ONE DECIMAL]

18. How much higher or lower do you think your household's total after-tax (i.e., 'take home') income will be over the next twelve months compared to the last twelve months? Please provide an answer in percentage terms.

() My after-tax income will rise by \_\_\_\_\_ % [RANGE: 0-300, ONE DECIMAL]

() My after-tax income will stay the same

() My after-tax income will fall by \_\_\_\_\_ % [RANGE: 0-300, ONE DECIMAL]

19. Nondurable goods and services include for instance food, tobacco, alcohol, gasoline, clothing, haircuts, transportation, and other small services and nondurable goods that do not last in time. By how much do you think that, over the next 12 months, your spending on non-durable goods and services will change relative to the previous 12 months?

() My spending will rise by \_\_\_\_\_ % [RANGE: 0-300, ONE DECIMAL]

() My spending will stay the same

() My spending will fall by \_\_\_\_\_ % [RANGE: 0-300, ONE DECIMAL]

20. Generally speaking, do you think now is a good time or a bad time to buy...

Very good	<input type="checkbox"/> A house/apartment
Good	<input type="checkbox"/> A car/other vehicle
Neither good nor bad	<input type="checkbox"/> Large appliances or electronics
Bad	
Very bad	

21. What do you think is the current interest rate on a fixed-rate 30-year mortgage for someone with excellent credit and what do you think it will be in the future?

Current rate? \_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

At the end of 2019? \_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

At the end of 2020? \_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

At the end of 2021? \_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

In the next 5-10 years? \_\_\_\_\_ % per year [RANGE: 0-100, ONE DECIMAL]

24. What is your best guess about the rate at which average wages in the economy will grow on average over the next 12 months?

\_\_\_\_\_ % [RANGE: -100-100, ONE DECIMAL]

22. What is your best guess about the rate at which housing prices in the U.S. will change over the next 12 months?

\_\_\_\_\_ % [RANGE: -100-100, ONE DECIMAL]

23. Do you have a paid job?

() Yes

() No

;IF Q23 IS yes, ASK Q24 - OTHERWISE SKIP TO Q25.

24. How many total hours per week do you work in a typical week?

\_\_\_\_\_ Hrs/week [RANGE: 0-168]

***You are almost done with the survey.***

25. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After one year, how much would you be able to buy with the money in this account?

() More than today

() Same as today

() Less than today

() I don't know

26. If you have \$100 in a savings account and the interest rate is 10% per year and you never withdraw or deposit money, how much will you have in the account after:

Please enter a whole dollar amount at each.

One year: \_\_\_\_\_ [RANGE: 0-999]

Two years: \_\_\_\_\_ [RANGE: 0-999]

27. If the chance of getting a disease is 5 percent, how many people out of 1,000 would be expected to get the disease?

☐ \_\_\_\_\_ people [RANGE: 0-1000]

☐ Don't know

28. Suppose you have a choice between receiving with certainty \$100 today or with certainty \$X in a week. What would be the minimum value of \$X that you would need before accepting to receive money in a week? Please choose an option below that best describes your preference.

☐ \$100 today or \$101 in 1 week

☐ \$100 today or \$103 in 1 week

☐ \$100 today or \$108 in 1 week

☐ \$100 today or \$117 in 1 week

☐ \$100 today or \$125 in 1 week

☐ \$100 today or \$133 in 1 week

☐ \$100 today or \$150 in 1 week

☐ \$100 today or \$167 in 1 week

☐ \$100 today or \$183 in 1 week

☐ \$100 today or \$200 in 1 week

☐ \$100 today or \$233 in 1 week

29. Suppose you have a choice to receive with certainty \$100 or to play a lottery with a prize of \$200. Possible lotteries differ in the probability of winning \$200. Which of the lotteries makes you indifferent between taking \$100 with certainty and playing a lottery? Please choose an option below that best describes your preference.

☐ \$100 guaranteed or a 25% chance to win \$200 and 75% chance to win \$0

☐ \$100 guaranteed or a 28% chance to win \$200 and 72% chance to win \$0

☐ \$100 guaranteed or a 31% chance to win \$200 and 69% chance to win \$0

☐ \$100 guaranteed or a 34% chance to win \$200 and 66% chance to win \$0

☐ \$100 guaranteed or a 37% chance to win \$200 and 63% chance to win \$0

☐ \$100 guaranteed or a 40% chance to win \$200 and 60% chance to win \$0

☐ \$100 guaranteed or a 43% chance to win \$200 and 57% chance to win \$0

☐ \$100 guaranteed or a 46% chance to win \$200 and 54% chance to win \$0

☐ \$100 guaranteed or a 49% chance to win \$200 and 51% chance to win \$0

☐ \$100 guaranteed or a 52% chance to win \$200 and 48% chance to win \$0

☐ \$100 guaranteed or a 55% chance to win \$200 and 45% chance to win \$0

☐ \$100 guaranteed or a 58% chance to win \$200 and 42% chance to win \$0

☐ \$100 guaranteed or a 61% chance to win \$200 and 39% chance to win \$0

☐ \$100 guaranteed or a 64% chance to win \$200 and 36% chance to win \$0

☐ \$100 guaranteed or a 67% chance to win \$200 and 33% chance to win \$0

☐ \$100 guaranteed or a 70% chance to win \$200 and 30% chance to win \$0

☐ \$100 guaranteed or a 73% chance to win \$200 and 27% chance to win \$0

☐ \$100 guaranteed or a 76% chance to win \$200 and 24% chance to win \$0

30. When making your consumption and savings decisions, how far in the future do you typically plan?

☐ I just plan for the moment

☐ 1-3 months

☐ More than 3 months but less than 1 year

☐ 1 to 2 years

☐ 2 to 5 years

- ☐ 5 to 10 years
- ☐ More than 10 years

31. ***This is the last question!***

We would like you to consider the following situation. You and another person are playing a game in which each person requests an amount of money. The amount must be (a whole dollar amount) between 11 and 20 dollars. Each person will receive the amount he/she requests. A person will receive an additional amount of 20 dollars if he/she asks for exactly one dollar less than the other person.

What amount of money would you request? [DROPDOWN MENU: \$11, \$12, \$13,...,\$20]