Monetary Policy Communications and Their Effects on Household Inflation Expectations

Olivier Coibion

University of Texas at Austin and National Bureau of Economic Research (NBER)

Yuriy Gorodnichenko

University of California, Berkeley, and NBER

Michael Weber

University of Chicago and NBER

We study how different forms of communication influence inflation expectations in a randomized controlled trial using nearly 20,000 US individuals. We elicit individuals' inflation expectations and then provide eight different forms of information regarding inflation. Reading the actual Federal Open Market Committee (FOMC) statement has about the same average effect on expectations as simply being told about the Federal Reserve's inflation target. Reading news articles about the most recent FOMC meetings results in a forecast revision that is smaller by half. This exogenous variation in inflation expectations has subsequent effects on household spending reported in scanner and survey data.

We thank the Fama-Miller Center and the Initiative on Global Markets, both at the University of Chicago Booth School of Business, for financial support for conducting the surveys. We are grateful to seminar and conference participants at many institutions, the National Science Foundation for financial support (SES 1919307), and Jonas Dalmazzo, Mathieu Pedemonte, and especially Vitaliia Yaremko for excellent research assistance. We also thank Shannon Hazlett and Victoria Stevens at Nielsen for their assistance with the collection of the PanelView Surveys. Researchers' own analyses were calculated (or derived) based in part on consumer data from Nielsen (NielsenIQ) provided through the respective

Electronically published March 29, 2022

Journal of Political Economy, volume 130, number 6, June 2022.

https://doi.org/10.1086/718982

> Since I've become a central banker, I've learned to mumble with great incoherence. If I seem unduly clear to you, you must have misunderstood what I said. (Alan Greenspan, September 22, 1987)

> Because monetary policy affects everyone, I want to start with a plain-English summary of how the economy is doing, what my colleagues and I at the Federal Reserve are trying to do, and why. (Jerome Powell, June 13, 2018)[1]

I. Introduction

Central bank communications have greatly changed in the last 30 years, as illustrated by the statements above from different chairmen of the Federal Reserve. Central bankers now announce their policy decisions, explain their reasoning, and describe their plans for the future. These new communication strategies have been targeted primarily at financial markets, both to minimize financial volatility and to shape longer-term interest rates to better achieve central banks' objectives. In this respect, they seem to have been successful, as illustrated, for example, by the effects of forward-guidance announcements on long-term interest rates (Swanson 2021).

In terms of influencing the expectations of households or firms, central banks have had the much more targeted goal of anchoring their inflation expectations.[2] Yet despite this modest objective, central banks appear to have systematically failed in achieving it across most advanced economies. Firms and households in low-inflation countries report beliefs about inflation that are far from anchored, seem unaware of even dramatic monetary policy announcements, and more generally display

NielsenIQ and Nielsen data sets at the Kilts Center for Marketing Data Center at the University of Chicago Booth School of Business. The conclusions drawn from the NielsenIQ and Nielsen data are those of the researchers and do not reflect the views of Nielsen. Nielsen is not responsible for, had no role in, and was not involved in analyzing and preparing the results reported herein. Information on availability and access to the data is available at http://research.chicagobooth.edu/nielsen. Data are provided as supplementary material online. This paper was edited by Harald Uhlig.

[1] The Greenspan quote is from Geraats (2007), who cites the *Wall Street Journal*. The Powell quote is from the press conference that day, transcripts of which are available at https://www.federalreserve.gov/mediacenter/files/FOMCpresconf20180613.pdf.

[2] Janet Yellen stated the communications objective as follows: "Put differently, the purpose of providing greater clarity about the FOMC's [Federal Open Market Committee's] longer-run inflation goal is to anchor inflation expectations more firmly. These more firmly anchored expectations in turn free the Committee's hand to more actively and effectively stabilize short-run fluctuations in economic activity." See https://www.federalreserve.gov/newsevents/speech/yellen20121113a.htm.

almost no knowledge of what central banks do (see, e.g., Bachmann, Berg, and Sims 2015; Binder 2017; Coibion et al. 2020; D'Acunto et al. 2021b). This ignorance may be a sign of central banks' success (since firms and households have little incentive to worry about inflation or monetary policy in a stable low-inflation environment), but it is unlikely to be innocuous: some of the nontraditional policies at the zero lower bound (ZLB) are thought to operate primarily through the inflation expectations of households and firms. If their expectations are unresponsive to central bank announcements and communications, as they seem to be (Coibion et al. 2020; D'Acunto et al. 2021a), then this class of policies cannot be effective. The fact that pretreatment inflation expectations are dispersed and substantially differ from the Federal Reserve's inflation target of 2% also implies that the current focus of central bank communication on financial market participants and professional forecasters limits its power to affect the real decisions of households and firms and ultimately the overall economy. Hence, understanding how central banks can communicate their policies to shape the expectations and decisions of households is especially important in times when actual inflation is low and nominal interest rates are stuck at zero. Several central banks have realized the limited power of conventional communication tools and have already started to explore more unconventional channels, such as music videos on inflation targeting by the Bank of Jamaica or the extensive use of Twitter to discuss and explain monetary policy decisions, as exemplified by Olli Rehn, the governor of the Bank of Finland. Understanding how central banks can better communicate with the general public to shape their expectations is therefore of first-order importance for the implementation of policies at the ZLB.[3]

We combine a new large-scale survey of households with a range of randomized information treatments to study how different types of communications affect the inflation expectations of consumers and ultimately their spending decisions. While randomized control trials (RCTs) have recently begun to be applied in macroeconomics (e.g., Binder and Rodrigue 2018; Coibion, Gorodnichenko, and Kumar 2018; Armona, Fuster, and Zafar 2019; D'Acunto et al. 2020), our approach is unique in the magnitude of the survey. Approximately 20,000 consumers responded to our survey, more than 10 times the size of the New York Federal Reserve Bank's Survey of Consumer Expectations or the size of other household surveys used for RCTs. This unprecedented scale allows us to simultaneously consider a wide range of different information treatments (eight different

[3] Improved central bank communication with the public could potentially also enhance the credibility of those institutions. Since households and firms in low-inflation countries are largely unaware of the central bank's policy objectives or of recent inflation rates, informing them of both could improve the credibility of these institutions in the eyes of the public (see D'Acunto, Fuster, and Weber 2021).

treatments and a control group) and explore how different characteristics of respondents might affect their response to the treatment, both immediately and in subsequent months in which we deploy follow-up surveys. The scale of our analysis is crucial for studying targeted communications since the size of conventional surveys does not yield enough statistical power to detect potentially differentiated responses for various population groups or treatments. In addition, we implement follow-up surveys 3 and 6 months later, through which we can also measure the persistence of the information effect much more systematically than previous work relying on rapid follow-ups. Finally, through a combination of survey questions and spending data from Nielsen, we are able to evaluate how exogenous changes in inflation expectations affect the spending decisions of households.

We aim to inform academic research and policy makers on how to better communicate with ordinary people using actual information releases. While we do not control the macroeconomic environment or all elements of communication (the identity of the sender, the content and complexity of the provided information, the means of communication, etc.) as one could do in a lab setting, our approach tests and provides implementable recommendations to real-world policy makers. This yields a novel set of facts about which types of information are most effective at influencing the beliefs of households, both immediately and over longer periods. We find that providing households with simple statistics about inflation, such as the most recent rate of inflation, the Federal Reserve's inflation target, or the FOMC's inflation forecast, has statistically and economically significant effects on inflation expectations: this type of information reduces households' average forecast of inflation by 1.0–1.2 percentage points. The effect on households' inflation expectations from these simple pieces of information is also mildly persistent: in follow-up interviews 3 months after the information treatment, the inflation expectations of treated households had converged more than halfway to the expectations of households in the control group and fully converged within 6 months. These results suggest that central banks cannot rely on one-off messages but have to develop a repeated communication strategy to the extent that central banks intend to manage consumer expectations through communication.

While these information treatments seem to have large effects on expectations, we find that not all information is processed in the same way. For example, a random subset of households was instead provided with the entire postmeeting statement of the FOMC. Despite its length and detail, the effect of this treatment was no larger than simply providing households with the FOMC inflation forecast, reducing the average inflation expectation by about 1.2 percentage points. Another subset of households was given a news article from *USA Today* covering the same

FOMC meeting. Strikingly, this short and easy-to-read summary of the Federal Reserve's decision and motivation had a much smaller effect on inflation expectations: about half of the other treatments. Despite being written explicitly for the general public, this media transmission of the FOMC's decision and motivation seems to have either dissipated the message or (more likely given that the article is much clearer than the FOMC statement) been discounted by households because of its origin.[4] This suggests one reason why monetary policy makers have had so little success in affecting the inflation expectations of households: relying on the conventional media to diffuse their message to the public can be ineffective because many households no longer read newspapers and even if they do, individuals discount reports from the news media. We provide direct survey evidence that households consider traditional news media to be less credible compared with social media or information from family and friends. Moreover, survey respondents view *USA Today* as being more credible than the *New York Times* or the *Wall Street Journal*.

We also study other practical elements of central bank communication. Specifically, although central banks have recently been emphasizing forward guidance and anchored inflation expectations, it is not clear whether informing the broader population about the prevailing inflation rate, the forecast of the inflation rate, or the inflation rate that the central bank aims to achieve over longer periods of time is most effective in shaping and moving individuals' expectations.[5] Strikingly, we find that all three options (past, forecasted, or targeted inflation rate) affect households' expectations in a quantitatively similar way on impact but the forward-looking information—that is, the inflation forecast and the inflation target—appear to result in slightly more persistent forecast revisions. Thus, a key contribution of our paper is that we jointly study how different forms

[4] One important caveat is the fact that besides the medium of transmission (newspaper vs. official release), the content of the pieces of information also varies. While it is conceivable that individuals do not discount the source of information but rather the specific content in the *USA Today* article, we show that this interpretation is unlikely for several reasons. First, we have two different newspaper articles as treatments in the first wave of the survey, and households react similarly to both treatments. Second, we find that individuals with lower education and lower income systematically discount the information in the newspaper article more than other survey participants, but they do not differ in their reaction to the FOMC statement. Third and most directly, we show that survey respondents view newspapers as generally less credible than friends and coworkers, direct communication from the government, or even social media.

[5] Relatedly, most central banks currently communicate only directly with financial markets. They hold press conferences after policy decisions and have Q&As to affect financial markets' and experts' expectations. Furthermore, communication with ordinary people is typically left to the news media under the assumption that individuals adjust their consumption and savings in response to changes in financial market interest rates and adjust expectations after reading the newspaper. One important shortcoming of this idealized world is that many people do not actively adjust the savings and consumption decisions to movements in financial markets (D'Acunto et al. 2021a) but also do not follow news reports.

of communication (forward- vs. backward-looking information, official government releases vs. news media) affect the forecast revision in a broad cross section of a representative population.

Exploiting the micro-level heterogeneity underlying these results sheds additional insight on the potential of targeted communication. First, there is in general little variation in terms of how different types of consumers respond to most signals: conditional on their initial beliefs (which do differ across groups), the way they respond to a common signal is broadly similar. This pattern in updating yields declines in disagreement across agents after each treatment. Consistent with this homogeneity in how people respond to a common signal, we find that the average responses of beliefs to each treatment are not driven by large changes in the beliefs of a subgroup within the treatment. The one exception to these otherwise fairly systematic responses to information treatments lies in the *USA Today* treatment: we find that low-income and low-education individuals disproportionately downweigh the article from this news source, although all groups tend to discount the news report from *USA Today*. One explanation might have to do with political perspective, but *USA Today* is a nonpartisan newspaper. Our results call for more research toward understanding how consumers interpret news from the media, such as whether all newspapers would be treated alike (e.g., *Wall Street Journal* vs. *USA Today* vs. *New York Times*), the role that the media plays in communicating news about the economy and policy to households, and which individuals acquire news via traditional media outlets. In addition, more research is needed to understand which medium is most effective for policy communication and whether the sender of the message affects the response of the broader population (D'Acunto, Fuster, and Weber 2021).

Finally, because communication matters for economic outcomes only to the extent that the information ultimately affects decision-making, we assess whether changes in inflation expectations stemming from the exogenously provided information treatments alter household spending decisions. We do so by using households' scanned purchases tracked by Nielsen as well as through follow-up surveys in which households report the amount of spending they have done across a wide range of goods and services. Higher inflation expectations arising from information treatments lead to a rise in the monthly spending of households over the next 6 months, consistent with an intertemporal substitution motive, whether spending is measured using self-reported survey data or the scanner data collected by Nielsen. This effect is strongest for those who earn more income and are more educated. However, we also find that when individuals raise their inflation expectations, they tend to reduce their purchases of larger durable goods—such as cars, houses, and other big-ticket items—over the next 6 months. In short, despite pervasive inattention on the part of US households to inflation and monetary policy, households' inflation

expectations still play a statistically and economically significant role in their spending and saving decisions.

This paper builds on a growing literature focusing on how economic agents form their expectations and process information (for a survey, see Coibion, Gorodnichenko, and Kamdar 2018; for a recent example, see Bordalo et al. 2020). It is most closely related to recent work using randomized information treatments to characterize how agents learn and respond to new information. Randomized information treatments applied to firms in New Zealand, for example, suggest that managers' expectations respond strongly to information about recent inflation or the inflation target (Coibion, Gorodnichenko, and Kumar 2018) as well as to the higher-order beliefs of other managers (Coibion et al. 2021). Coibion, Gorodnichenko, and Ropele (2020) document similarly large responses of firm expectations in Italy to information about recent inflation or the inflation target, as do Hunziker, Raggi, and Rosenblatt-Wisch (2018) for firms in Switzerland. Additional results have also been documented for households. In related work, Haldane and McMahon (2018) use randomized treatments to explore how or whether changing the presentation of the Bank of England's statements alters the public's understanding of their message. D'Acunto et al. (2020) find that households react more strongly to communication about policy targets rather than about instrument communication, especially the least sophisticated consumers, and D'Acunto, Fuster, and Weber (2021) find that women and minorities respond more strongly to communication from a diverse policy maker. Finally, Binder and Rodrigue (2018) document that households revise their long-run inflation forecasts when presented with information about recent inflation or the central bank's inflation target. The two closest papers are Armantier et al. (2016), who provide information about past food inflation and inflation forecasts of professional forecasters to a subset of individuals in a controlled survey experiment to study individuals' forecast revision, and Cavallo, Cruces, and Perez-Truglia (2017), who provide a random subset of the population information about past inflation to study the formation of inflation expectations.

Relative to this previous work, we make a number of contributions. First, the scale of our randomized information treatment is simply unprecedented relative to this literature, which among other things allows for much more precise identification of estimated effects. Second, we are able to consider a much wider range of information treatments simultaneously than in previous work, including not only the provision of simple facts about inflation but also more original treatments, such as the FOMC statement or a newspaper description of FOMC decisions. This is important because ex ante it is unclear whether households' inflation expectations react more to information about past inflation, inflation forecasts, or detailed discussions about the state of the economy. Third, we have a more

systematic follow-up of individuals than in previous work on household expectations that allows us to rule out experimenter demand effects. Fourth, we provide a placebo treatment to disentangle genuine learning from anchoring affects and spurious learning. Fifth, our larger cross section allows us to examine microheterogeneity in expectations and updating in exceptional detail. Finally, we can assess the extent to which changes in inflation expectations affect actual household spending decisions. These features of our survey (placebo treatment, jointly studying many treatments, the systematic follow-ups, the measures of spending, and the large cross section) allow us to make important contributions to the literature and inform policy making, which in times of low interest rates and inflated central bank balance sheets heavily relies on communication as a policy tool (Coibion et al. 2020).

Our work also speaks to a broader literature on central bank communication. While much of this work focuses on financial markets, as does central bank communication (see, e.g., Blinder et al. 2008), there has been growing concern about the ability of central banks to communicate with the broader public. Blinder (2009), for example, was an early voice advocating for more focus on communicating with an audience beyond experts and financial markets. Recent work has documented the shortcomings of current communication strategies. Carvalho and Nechio (2014) find that few households in the United States form macroeconomic expectations that are consistent with how the Federal Reserve makes policy, a finding largely confirmed by Drager, Lamla, and Pfajfar (2016). Binder (2017) shows that most households do not know the names or objectives of US monetary policy makers. Not only do we provide more (and larger-scale) evidence of US households' lack of knowledge about monetary policy, but we also document a novel possible source for this: a dismissal of news reports about monetary policy.

Finally, this paper is closely related to a growing body of work that provides causal evidence on how expectations translate into economic decisions. For example, Roth and Wohlfart (2020) consider how households' consumption plans respond to professionals' opinions about the likelihood of a recession, Armona, Fuster, and Zafar (2019) assess how households respond to news about housing prices, and Fuster, Kaplan, and Zafar (2021) study the spending response to unanticipated spending shocks in a survey. Coibion, Gorodnichenko, and Kumar (2018) and Coibion, Gorodnichenko, and Ropele (2020) provide causal evidence that changes in inflation expectations of firms affect their investment and employment decisions. On the household side, there is an extensive literature looking at the association between inflation expectations and either their spending or their perception of whether now is a good time to purchase durable goods (e.g., Bachmann, Berg, and Sims 2015; Crump et al. 2015; D'Acunto, Hoang, and Weber 2016; Burke and Ozdagli 2020; Drager and Nghiem

2021). We differ from these papers in the larger cross section of our sample, the fact that we have both self-reported and scanner measures of spending, and an RCT approach to identifying the causal effect of inflation expectations on spending decisions. With respect to the latter, the closest paper to ours is Coibion et al. (2019), who also use an RCT to study how the inflation expectations of households in the Netherlands affect their spending decisions. Compared with the latter, this paper has a much larger cross section of households (10 times larger), a longer time horizon over which spending is measured (6 vs. 3 months), a larger set of information treatments (seven vs. two) that provide much stronger identifying variation in inflation expectations (*F*-statistics are approximately 10 times larger), and spending data that are measured not only using self-reported survey data but also through high-frequency scanner-collected data compiled by Nielsen.

II. Data and Survey Design

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

A. Nielsen Panel

In June, September, and December of 2018, 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 AC 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. We use the scanned purchase data in section V to study how exogenous variation in inflation expectations moves individuals' spending choices. 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 household head. Panelists are recruited online, but the panel is balanced using Nielsen's traditional mailing methodology. Nielsen checks the sample characteristics on a weekly basis and performs adjustments when necessary.

Nielsen provides households with various incentives to guarantee the accuracy and completeness of the information that households report. They organize monthly prize drawings, provide points for each instance of data submission, and engage 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. The KNCP filters households that do not report a minimum amount of spending over the previous 12 months.

B. 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 in the survey did Nielsen tell their panelists that the survey they fielded was part of academic research, which minimizes the concerns of survey demand effects.

In spring 2018, we designed a customized survey consisting of 37 questions in cooperation with Nielsen: the Chicago Booth Expectations and Communication Survey. The survey also contains eight different information treatments as well as one control group. To reduce the burden of participating in the survey, some questions were asked of only a subset of respondents. We report the full survey of the first wave in the appendix (available online). Our survey design builds on the University of Michigan's Survey of Consumers, the Federal Reserve Bank of New York Survey of Consumer Expectations (SCE), and the Deutsche Bundesbank Panel on Household Finances, as well as D'Acunto et al. (2021c).

Nielsen fielded the first wave of the survey in May–June of 2018. The survey sample was 83,061 households; 24,510 individuals responded for a response rate of 26.50% and an average response time of 15 minutes. The response rate compares favorably with the average response rates of surveys on Qualtrics that estimate a response rate between 5% and 10%. The second and third waves were shorter, consisting mostly of follow-up questions, with median response times of about 10 minutes and 32,658 unique respondents for the second wave and 13 minutes and 29,348 unique respondents for the third wave. Nielsen provides weights to ensure representativeness of the households participating in the survey.

The initial wave of the survey covers a wide range of questions. First, respondents are presented with a series of questions about their demographic

characteristics, which are more detailed relative to the basic demographic information the KNCP provides. We collect information on employment status, current occupation, financial constraints, savings and portfolio choice, gasoline prices and expectations, and recent 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. Participants are then asked a sequence of questions about their perceptions and expectations of inflation. We follow the design in the recent 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 inflation 12 months in the future. We elicit a full probability distribution of expectations by asking participants to assign probabilities to different possible levels of the inflation rate. We then construct the mean and standard deviation of these expectations by using the midpoints of each bin and fixed values for the bins on each end.[6] In addition, we also ask about the perception of the current unemployment rate and the expected unemployment rate in 12 months. We do not ask about longer-run inflation expectations because of space constraints and the fact that other work has found a strong correlation between short- and long-run inflation expectations (Kumar et al. 2015).

Subsequent waves largely follow the same structure but in a much shorter form. Demographic characteristics are assumed to be time invariant. Hence, the follow-up surveys are primarily used to measure individuals' perceptions and expectations of inflation over time, as well as the evolution of their spending.

C. *Treatments*

After respondents answered the initial set of questions in the first wave, they were assigned to one of nine groups: a control group and eight treatment groups. We designed the treatments to disentangle the effects of different possible types of monetary policy communication, especially ones that provide some simple statistics that might help individuals update their inflation expectations. In addition, we also provided a placebo treatment to differentiate true learning from spurious learning possibly

[6] Specifically, we use values of −14% and 14% when respondents assign weights to bins for "less than −12%" and "more than 12%," respectively. We show in app. table 14 (app. tables 1–14 are available online) that our baseline results are insensitive to using medians of these distributions or means of generalized beta distributions applied to the bins as in the SCE.

owing to anchoring effects. Each group consists of one-ninth of the total sample that received the survey, and the treatments are randomly assigned. Appendix table 6 confirms that the different treatment groups are comparable along all major observable characteristics.

Specifically, the treatments are (i) the actual consumer price index (CPI) inflation rate over the last 12 months (2.3%), (ii) the inflation target of the Federal Reserve of 2% per year, (iii) the FOMC forecast for inflation in 2018 of 1.9% (we informed participants that the FOMC is responsible for setting short-term interest rates), (iv) the most recent FOMC statement, and (v) the coverage of the most recent FOMC decision in *USA Today*. We were also interested to see whether participants might have a Phillips curve in mind and provided the most recent unemployment numbers as treatment vi. D'Acunto et al. (2021c) document that individuals extrapolate from salient price changes to overall inflation, and hence we informed one of the treatment groups that the national average gasoline price inflation over the previous 3 months was 6.4% (treatment vii). As a placebo treatment, we provided the actual fact that the US population grew by 2% over the last 3 years (treatment viii). As required by professional standards, treatments provide only factually correct information. We report the treatments as part of the overall survey in the appendix. Ex ante it is not clear whether individuals might react more to information about current inflation, the inflation target, or inflation forecasts. Some households might extrapolate from current inflation to future inflation, and providing them with accurate information about current inflation might be most effective in shaping expectations. Other individuals instead might have fully forward-looking expectations, and providing these households with information on the forecasts of professionals or the official inflation target might be more relevant for shaping expectations. Finally, some individuals might form expectations about inflation jointly with expectations about other economic variables, such as the unemployment rate, and providing these households with information about these variables could result in the largest revision in inflation expectations (Andre et al. 2019). The presence of different information treatments for households allows us to speak to the fact that different central banks follow different communication strategies to the extent that they have any systematic communication with the general public at all.

Treatments to survey participants must be truthful—for example, we cannot implement a treatment in which we provide the FOMC statement but claim that it is actually from a newspaper. Hence, there is a limit in our ability to assess why different treatments might have different effects on expectations since we cannot always vary one characteristic of the treatment at a time. However, the large range of treatments still provides significant guidance on which forms of communication affect household expectations.

Following each treatment (as well as for the control group), respondents were again asked about their inflation forecasts and perceptions but this time in the form of a point estimate to avoid them having to answer the exact same question twice. This allows us to measure the instantaneous revision in expectations (if any) after the information treatments compared with the control group. The treatments were applied only in the first wave of the survey. In subsequent waves, respondents were again asked for their inflation expectations and perceptions but questionnaires were identical across all respondents in the two follow-up waves. The first follow-up was after 3 months and the second after 6 months.

D. Preliminary Facts and External Validity

In table 1, we present average 12-months-ahead inflation expectations and perceptions of all individuals in the survey prior to any information treatment being applied, as well as these same facts along a number of observable characteristics of the individuals. The average inflation expectation across all households is 2.5%, with a standard deviation of 2.6%. Here and in what follows we use a Huber estimator to compute moments and estimate regression coefficients. This approach allows us to remove outliers and influential observations automatically and have estimates that are robust to extreme observations in the data (as a result, the sample size for reported estimates is reduced).[7] For comparison, the average 12-months-ahead inflation expectation in the Michigan Survey of Consumers in May 2018 was 3.3% (with a standard deviation of 2.9%), while the median expectation of 12-months-ahead inflation in the SCE was 3.0%. Hence, our results are broadly in line with other surveys of households taking place at the same time, in terms of both the first and the second moments of the inflation expectation distribution.

We find that the perceived inflation rate of households in our sample was 2.5%, at a time when the annual CPI inflation rate was 2.3% (May 2018). While the average perceived inflation was therefore quite close to the actual inflation rate, there is a profound level of disagreement across households about recent inflation: the cross-sectional standard deviation of perceived inflation was 2.7%, about the same amount of disagreement as for inflation forecasts. This points toward significant levels of inattention on the part of many individuals toward aggregate inflation. As documented in Jonung (1981) for Swedish households, there is a high correlation between households' perceptions of recent inflation and their expectations of future inflation at 0.79. D'Acunto et al. (2021c) document in a more recent survey of US households that individuals' perceptions of

[7] Descriptive statistics for unfiltered data are reported in app. table 4. We apply sampling weights everywhere.

TABLE 1
Descriptive Statistics of the Survey

Sample	Pretreatment Expected Inflation			Pretreatment Perceived Inflation			Pretreatment Perceived Inflation Target of the Federal Reserve		
	Mean (1)	Median (2)	Standard Deviation (3)	Mean (4)	Median (5)	Standard Deviation (6)	Mean (7)	Median (8)	Standard Deviation (9)
All	2.47	2.40	2.57	2.46	2.00	2.66	3.37	3.00	2.73
Male	2.43	2.70	2.12	2.50	2.00	2.10	2.89	2.30	2.08
Female	2.49	2.00	2.75	2.44	2.00	2.90	3.60	3.00	2.96
White	2.50	2.45	2.59	2.54	2.00	2.71	3.36	3.00	2.74
Nonwhite	2.39	2.25	2.50	2.17	2.00	2.45	3.39	3.00	2.67
Income:									
Tercile 1 (low)	2.42	2.00	2.83	2.32	2.00	2.97	3.53	3.00	3.10
Tercile 2	2.58	2.50	2.85	2.58	2.00	2.97	3.61	3.00	3.10
Tercile 3	2.46	2.60	2.22	2.49	2.00	2.27	3.18	3.00	2.30
Enough credit	2.54	2.66	2.44	2.61	2.00	2.52	3.28	3.00	2.57
Not enough credit	2.55	2.50	2.72	2.38	2.00	2.86	3.55	3.00	2.90
Hand to mouth (HTM):									
<1 month in savings	2.56	2.42	2.62	2.51	2.00	2.75	3.51	3.00	2.79
1–6 months in savings	2.62	2.80	2.34	2.69	2.00	2.34	3.18	3.00	2.38
≥6 months in savings	2.62	3.00	2.13	2.64	2.00	2.15	3.00	2.50	2.10
Plan to buy durable	2.53	2.60	2.46	2.53	2.00	2.56	3.32	3.00	2.63
No plan to buy durable	2.46	2.20	2.60	2.44	2.00	2.69	3.38	3.00	2.76
No financial wealth	2.22	1.20	2.82	2.12	1.00	2.90	3.48	3.00	3.07
Positive financial wealth	2.60	2.80	2.43	2.63	2.00	2.52	3.31	3.00	2.53

Saving rate:									
0	2.57	2.40	2.76	2.37	2.00	2.90	3.60	3.00	2.94
0–10	2.58	2.75	2.44	2.68	2.00	2.55	3.36	3.00	2.57
≥10	2.56	2.70	2.33	2.63	2.00	2.41	3.20	2.50	2.43
Get groceries:									
Self	2.54	2.50	2.58	2.54	2.00	2.66	3.42	3.00	2.78
Share	2.45	2.35	2.56	2.44	2.00	2.67	3.36	3.00	2.71
Education:									
High school or less	2.22	1.50	2.52	2.06	1.00	2.60	3.52	3.00	2.85
Some college	2.48	2.38	2.62	2.44	2.00	2.76	3.44	3.00	2.76
College or more	2.59	2.63	2.55	2.66	2.00	2.61	3.28	3.00	2.66

NOTE.—This table reports average values, medians, and cross-sectional standard deviations of expected inflation over the next 12 months (cols. 1–3), perceived inflation over the previous 12 months (cols. 4–6), and beliefs about the Federal Reserve's inflation target (cols. 7–9). Rows indicate which subset of the sample is used. HTM indicates the amount of savings measured in monthly spending for a given household. All means and standard deviations are constructed from Huber robust regressions on a constant using sampling weights. Each row captures an observable characteristic of the respondent on which we condition.

recent inflation are disproportionately shaped by the recent price movements of goods that they purchase frequently. The associated inattention to recent aggregate inflation suggests that information treatments focusing on actual values of recent inflation might lead to significant revisions in households' expectations of future inflation.

The inattention of households extends beyond inflation to monetary policy more generally. For example, respondents were also asked what inflation rate the Federal Reserve was trying to achieve in the long run. The results of this question are displayed in figure 1. Less than 20% of respondents correctly answered 2%. Barely 50% answered a number ranging from 0% to 5%. Strikingly, almost 40% answered that the Federal Reserve was targeting an inflation rate of 10% or more, which suggests a pervasive lack of knowledge on the part of households about the objectives of the Federal Reserve. The lack of mass for answers between 6% and 9% can be attributed to the large degree of rounding to multiples of five among households (D'Acunto et al. 2021b). This is consistent with previous evidence on the limited knowledge of households and firms about monetary policy in low-inflation environments (Kumar et al. 2015; Binder 2017; Cavallo, Cruces, and Perez-Truglia 2017).

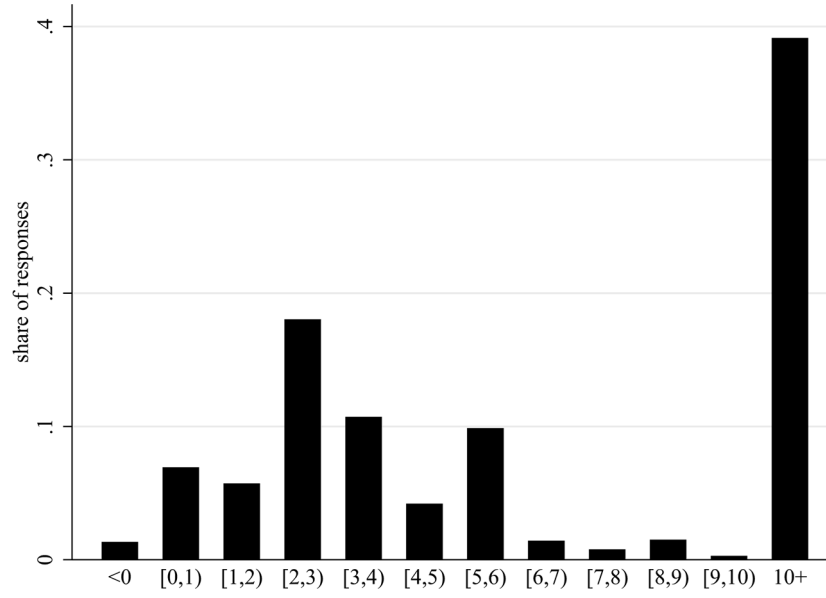

FIG. 1.—Households' beliefs about the Federal Reserve's inflation target. This figure plots the distribution of responses from individuals about what inflation rate they thought the Federal Reserve was trying to achieve in the long run. The figure includes respondents only from the May 2018 part of survey wave 1, which did not have a "do not know" option for the question eliciting perceptions of the inflation target.

Other features of the survey are also consistent with previously documented evidence. For example, we find that men have lower and less dispersed inflation expectations than women on average (as in Bryan and Venkatu 2001; D'Acunto, Malmendier, and Weber 2021) and higher-income households also have lower and less dispersed inflation expectations (as in Binder 2015), as do households with higher stocks of savings and higher savings rates, where the latter is consistent with D'Acunto et al. (2021c). Taken together, these results suggest that our survey replicates the main cross-sectional stylized facts of households' inflation expectations and therefore supports the validity of our survey as a measure of individuals' beliefs about inflation.

III. Treatment Effects of Different Communication Tools

In this section, we present and discuss how different treatments affect the inflation expectations of individuals.

A. *Average Effects on Beliefs*

To characterize how information treatments affect expectations, for each treatment group combined with the control group, we first regress the change in the inflation expectations of agents from before to after the information treatment on a dummy variable for their treatment group (equal to zero if in the control group and one otherwise); that is,

$$E_i^{\text{post}}\pi - E_i^{\text{pre}}\pi = a + b \times \text{Treatment}_i + \boldsymbol{\beta}\boldsymbol{X}_i + \text{Error}_i, \tag{1}$$

where $E_i^{\text{post}}\pi$ represents the posterior forecast of individual i, $E_i^{\text{pre}}\pi$ represents their prior average belief, Treatment_i is the dummy variable, and $\boldsymbol{X}_i$ is a vector of individual-specific controls. These include a quadratic polynomial in the respondent's age and a rich set of dummy variables for a respondent's gender, employment status, household income, household size, race, census region, spectra life style, and spectra behavior stage.[8] For the posterior forecasts of individuals, we use the forecast provided immediately after the treatment as well as the forecasts provided 3 and 6 months later in follow-up waves. In table 2, we report estimated values

[8] The last two variables are constructed by Nielsen to classify households into several types. Spectra life style has the following categories: cosmopolitan centers, affluent suburban spreads, comfortable country, struggling urban cores, modest working towns, and plain rural living. Spectra behavior stage includes the following categories: start-up families, small-scale families, younger bustling families, older bustling families, young transitionals, independent singles, senior singles, established couples, empty nest couples, and senior couples.

TABLE 2
AVERAGE HOUSEHOLD RESPONSES TO TREATMENTS

	OUTCOME: FORECAST REVISION					
	Immediate Revision		Revision after 3 Months		Revision after 6 Months	
TREATMENT	(1)	(2)	(3)	(4)	(5)	(6)
T5 (population growth)	−.218**	−.229**	−.096	−.106	.032	.049
	(.105)	(.104)	(.091)	(.091)	(.098)	(.099)
T6 (unemployment)	−.331***	−.332***	−.294***	−.321***	−.131	−.133
	(.105)	(.104)	(.093)	(.094)	(.096)	(.097)
T4 (gasoline prices)	1.479***	1.474***	−.180*	−.174*	−.151	−.170*
	(.114)	(.114)	(.093)	(.094)	(.097)	(.099)
T2 (past inflation)	−1.031***	−1.068***	−.034	−.054	.198**	.209**
	(.104)	(.104)	(.092)	(.092)	(.098)	(.099)
T3 (inflation target)	−.994***	−.997***	−.329***	−.371***	.028	.047
	(.102)	(.102)	(.092)	(.092)	(.097)	(.098)
T7 (Federal Reserve inflation forecast)	−1.072***	−1.098***	−.235**	−.227**	.139	.177*
	(.102)	(.103)	(.094)	(.094)	(.096)	(.098)
T8 (FOMC statement)	−1.193***	−1.218***	−.107	−.127	−.012	.028
	(.103)	(.103)	(.091)	(.092)	(.099)	(.101)
T9 (*USA Today* coverage)	−.444***	−.475***	−.120	−.154*	.087	.086
	(.105)	(.105)	(.093)	(.093)	(.097)	(.098)
Remove outliers	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	No	Yes	No	Yes
Observations	19,222	19,210	12,882	12,872	12,619	12,406
R^2	.047	.061	.002	.017	.002	.015

NOTE.—This table reports the average change in inflation expectations of individuals in each treatment group relative to those in the control group. Columns 1 and 2 consider the immediate change in expectations after the treatment, cols. 3 and 4 consider the changes in beliefs after 3 months, and cols. 5 and 6 report changes in beliefs over a 6-month horizon. In each case, differences in beliefs are measured relative to initial beliefs from the first wave measured before all treatments. Treatments are described in detail in the main text. For each time horizon, col. 2 uses the same specification as in col. 1 but augmented with respondent-specific controls. Results are from Huber robust regressions to control for outliers and influential observations. Robust standard errors are reported in parentheses.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

of b for each treatment group with and without these individual controls.[9] Note that b identifies the average change in expectations of agents in the treatment group relative to the average change in the control group. Including the control group is important because inflation expectations before and after the treatment are measured using questions with different wording, so the control group serves to capture any effect driven by

[9] We find little evidence of nonlinear effects depending on the prior beliefs of respondents for respondents expecting nonnegative inflation (see app. fig. 1; app. figs. 1 and 2 are available online).

wording. Because initial beliefs about inflation are biased upward before the treatment, this baseline specification focusing on the average revision provides a simple benchmark for assessing the power of each treatment on expectations. We also study convergence in beliefs below. In each regression, we use sampling weights in the regressions and use Huber regressions to control for outliers and influential observations.[10]

Consider first the placebo treatment. In this case, individuals were told that the population growth of the United States was 2% over the last 3 years, a statement of little relevance to inflation but that included the percentage 2%. This placebo helps identify the potential importance and size of anchoring effects. We find very mild evidence for contemporaneous anchoring effects: the average respondent in this group reduces their inflation forecast by 0.2%–0.3%, or less than one-tenth of the cross-sectional standard deviation of inflation expectations. These small anchoring effects have completely dissipated by the first follow-up, and the inflation expectations of individuals in this group are no different from those in the control group 3 and 6 months after the treatment.

We now turn to the direct treatments about inflation applied to three of the groups. One group was told the most recent 12-month CPI inflation rate (2.3%), one group was told that the Federal Reserve targets an inflation rate of 2%, and the third group was told that the FOMC was forecasting an inflation rate of 1.9% over the next 12 months. The effects across these three groups are very similar. On impact, all three reduce the average inflation forecast by 1.0%–1.1% relative to the control group. Hence, these very simple information treatments have large effects on the beliefs of individuals. These effects are also mildly persistent. Three months later, the average expectations of these treated individuals are still lower than those of the control group, with the effect having dissipated by about 75%. Six months later, the effects of the treatments have fully dissipated.[11] This persistence of information treatments is consistent with those observed in previous work (Cavallo, Cruces, and Perez-Truglia 2017; Coibion, Gorodnichenko, and Kumar 2018; Coibion, Gorodnichenko, and Ropele 2020; Coibion et al. 2021) and is not driven by a changing composition across waves: we find nearly identical results when we restrict our attention to individuals who participate in all waves (app. table 5).[12] Furthermore, these results indicate that all three treatments seem to convey broadly similar information to respondents, in that they adjust their beliefs in a

[10] Appendix tables 7–9 present equivalent results with alternative methods of dealing with outliers as well as using the raw data.

[11] The effect of being treated with the recent inflation rate is positive after 6 months, whereas we cannot reject the null of zero effect for all other treatments. We conjecture that this positive effect is a statistical aberration, given that little reason exists why the treatment effect should become positive over time and no such effect exists for any other treatment group.

[12] We also find no evidence of differential attrition rates across information treatments.

comparable manner despite the treatments being conceptually distinct.[13] One important difference between the treatments is the fact that telling individuals the current rate of inflation has fully dissipated after 3 months, whereas the forward-looking treatments are mildly persistent, possibly because some households perceive them as more relevant for inflation expectations in 3 months.

The transitory nature of the effect of these treatments on inflation expectations reflects the fact that the treatment itself seems to have only transitory effects on underlying knowledge. For example, when some respondents were told about the Federal Reserve's inflation target in the first wave as their treatment, their recall of this information in subsequent waves was relatively low. We illustrate this by running the same regression as before but using changes in beliefs about the FOMC's target in the two follow-up waves as dependent variables:

$$E_i^{\text{post,3m}}\text{FedTarget} - E_i^{\text{pre}}\text{FedTarget} = a + b \times \text{Treatment}_i + \text{Error}_i. \quad (2)$$

The results are reported in table 3. Within 3 months, being treated with the Federal Reserve's inflation target leads to modest revisions in beliefs about the target relative to priors before treatment. By 6 months, the effect of the treatment has dissipated and the recall of this information is close to zero. Similar results obtain for other treatments for which we measured the prior belief of respondents, which includes the contemporaneous rate of inflation and the contemporaneous rate of unemployment. Table 3 shows that respondents similarly seem to forget the provided information about each within 3–6 months. The very transitory nature of information treatments on inflation expectations therefore seems to reflect the fact that respondents are unable to remember the information for more than a few months. Therefore, policy makers that aim to influence inflation expectations of individuals might have to engage in a more persistent form of communication given that simple, one-off messages are not effective in moving expectations persistently.[14]

Going beyond these simple information treatments, the next treatment group was presented with the entire statement released by the Federal Reserve following FOMC meetings.[15] Respondents in May 2018

[13] One difference across treatments is the specific inflation rate included (e.g., CPI vs. personal consumption expenditures price index). The similarities in results across treatments suggest that households do not make much of a distinction between these measures. When asking them for their inflation expectations, we do not specify a specific measure of inflation to forecast.

[14] The mild persistence in the treatment effects after 3 and 6 months also alleviates concerns of experimenter demand effects. Moreover, de Quidt, Haushofer, and Roth (2018) show in settings similar to ours that these effects are plausibly small.

[15] The FOMC statements are available in the appendix as well as at https://www.federalreserve.gov/monetarypolicy/fomccalendars.htm. They are discussed in more detail in sec. III.B.

TABLE 3
AVERAGE EFFECTS OF TREATMENTS OVER TIME ON SPECIFIC VARIABLES BEING TREATED

	Outcome: Forecast Revision			
	Revision after 3 Months		Revision after 6 Months	
Treatment	(1)	(2)	(3)	(4)
	A. Treatment Effect on Perceptions of the Federal Reserve's Inflation Target			
T3 (inflation target)	−.343***	−.356***	−.123	−.198
	(.107)	(.116)	(.118)	(.129)
	B. Treatment Effect on Perceptions of Past Inflation			
T2 (past inflation)	−.208**	−.170*	−.206**	−.201*
	(.097)	(.102)	(.103)	(.107)
	C. Treatment Effect on Perceptions of Unemployment Rate			
T6 (unemployment)	−.224**	−.236**	−.166	−.213*
	(.107)	(.112)	(.109)	(.115)
Controls for demographics	No	Yes	No	Yes

NOTE.—This table reports the average changes in beliefs about variables being treated after 3 months (cols. 1 and 2) and 6 months (cols. 3 and 4) relative to changes reported in the control group. In panel A, we report how respondents in the group that received information about the Federal Reserve's inflation target revised their beliefs about the inflation target over time. In panel B, we report how respondents in the group that received information about recent inflation revised their beliefs about recent inflation rates over time. In panel C, we report how respondents in the group that received information about recent unemployment revised their beliefs about the unemployment rate over time. For each time horizon, col. 2 uses the same specification as in col. 1 but augmented with respondent-specific controls. Results are from Huber robust regressions to control for outliers and influential observations. Robust standard errors are reported in parentheses.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

received the FOMC statement from the March 21, 2018, FOMC meeting, whereas those who took the survey in June 2018 received the FOMC statement from the May 2, 2018, FOMC meeting. Both statements describe recent developments in the economy similarly, including that inflation had approached 2%, as well as the broader objectives of the Federal Reserve, including its symmetric 2% objective for the inflation rate. We describe differences between the two in more detail in the next section. The statements, while not exceedingly long, are written in the dense language that is typical of central bank communications. On impact, reading the statement from the FOMC has approximately the same effect on inflation expectations as the previous three treatments, reducing the average forecast by 1.2% relative to the control group. The effect of reading the FOMC statement dissipates a little more rapidly, however, having no discernible effect on expectations relative to the control group after 3 or 6 months.

Another treatment group was presented with a news article from *USA Today* covering the same FOMC meeting as the statement provided to the previous treatment group.[16] Those participating in May 2018 were given an article summarizing the March FOMC decision, while those participating in June received an article summarizing the May FOMC decision. We describe differences between the two in more detail in section III.B. Both articles, each published the day after FOMC meetings, are written in a much more accessible (and shorter) style than the FOMC statements but still transmit information about inflation and the central bank's objective. For example, the second sentence of the second article reads, "The Fed held its key interest rate steady Wednesday but noted that inflation has climbed closer to its 2% goal, paving the way for another rate hike in June." Participants who read the *USA Today* article reduced their inflation expectations by only 0.5 percentage points relative to the control group, less than half the effect of any of the other inflation-related treatments. Despite the fact that the articles seemingly transmit the same information about the central bank's inflation objective as the FOMC statement or our information treatment on the central bank's target (as well as information about the most recent inflation rate), this information appears to be discounted by households. With approximately the same objective information content but only the source of the information varying, it seems that households view information coming from the news media as being less reliable, leading them to place less weight on it when they revise their views.[17] However, its effect is relatively longer lived, in that 3 months after reading the article, the average effect on expectations remains half of its instantaneous effect, but it too dissipates fully within 6 months after the information treatment.

Of course, households can form and change their beliefs about inflation using many different types of information. To assess how other forms of information affect their views, we consider two other types of information treatments. The first tells individuals that national gasoline prices rose 11% over the previous 3 months.[18] As documented in table 2, this

[16] The *USA Today* article from March 21, 2018, can be found in the appendix and at https://www.usatoday.com/story/money/2018/03/21/fed-powell-hikes-interest-rates-consumer-loans/444986002/, and the article from May 2, 2018, can be found at https://www.usatoday.com/story/money/2018/05/02/federal-reserve-interest-rates/571004002/.

[17] We picked *USA Today* as the article source to avoid the fact that other news sources such as the *New York Times* or the *Wall Street Journal* are often perceived to have partisan leanings, which might lead some to discount the quality of the information they provide. *USA Today*, to the best of our knowledge, has no particular political association. Until 2016, *USA Today* had never endorsed any presidential candidate. In the 2016 election, the editorial board declared that it considered Donald Trump unfit for the presidency but did not explicitly endorse Hillary Clinton (https://www.usatoday.com/story/opinion/2016/09/29/dont-vote-for-donald-trump-editorial-board-editorials-debates/91295020/). The 2020 election was the first time that it officially endorsed a presidential candidate (Joe Biden).

[18] Respondents participating in the May 2018 (June 2018) part of the survey were informed in this treatment that the actual price of gasoline increased by 6.4% (11%). Consistent with this difference in the size of the treatment, we find that the average change in beliefs of

information about salient prices leads to an immediate upward revision in households' inflation expectations of approximately 1.4%–1.5% relative to the control group, even though the average household expenditure share of gasoline is only around 5% (Binder 2018). This high sensitivity of individuals' inflation expectations to gasoline prices is consistent with the evidence provided in Coibion and Gorodnichenko (2015) and Binder (2018). However, this effect is relatively transitory. Within 3 months, individuals in this treatment group have slightly lower inflation expectations than the control group, and the effect is again fully dissipated within 6 months. The extrapolation from salient prices, such as gasoline and groceries, to overall inflation expectations poses a challenge to central banks because their conventional policy tools have little direct effect on these prices, which is the reason why many central banks focus on measures of core inflation that exclude these price series (D'Acunto et al. 2021c).

Second, we provide individuals with information about the most recent rate of unemployment. All respondents in the first wave were initially asked what they thought was the current unemployment rate in the United States. Their average answer was 6.3%, with a standard deviation of 3.9%. Only 12% of respondents reported unemployment rates less than or equal to 3.9%. Hence, when respondents in this group were told the actual value of the unemployment rate in the previous month of 3.9%,[19] they were almost always being told that the unemployment rate was significantly lower than what they believed. The result was an immediate downward revision in their inflation expectation, albeit a relatively small one, of 0.3%. This is the opposite of what one would expect if households were perceiving this as a movement along a Phillips curve, in which case the reduction in unemployment would have been associated with higher inflation. Instead, they seem to hold a supply-side view of unemployment and inflation, associating higher levels of one with the other. Appendix table 12 shows that average unemployment expectations moved in the same direction as average inflation expectations for each information treatment, consistent with such a supply-side view. This is the same pattern as that observed in Italian firms (Coibion, Gorodnichenko, and Ropele 2020) or previously in US households (Kamdar 2018). Other evidence pointing to supply-side interpretations of inflation include Andre et al. (2019) and Binder (2020a, 2020b). This information effect is still somewhat visible in inflation expectations after 3 months but is also fully dissipated within 6 months.

Jointly, these results indicate that simple messages provided to households can have remarkably powerful—albeit transient—effects on their

households surveyed in June was approximately twice as large as for those surveyed in May conditional on being treated with the information about gasoline prices.

[19] Respondents participating in the May 2018 wave were told that the unemployment rate was 4.1%.

expectations. We find no evidence that the complicated and detailed information from FOMC statements have effects that are any more powerful than simply telling households what inflation has been or what inflation rate the central bank is targeting. This means that communication strategies targeting households could potentially focus on presenting them with basic facts about inflation and monetary policy without resorting to "Fed-speak." The major caveat is that relying on the media to transmit the central bank's message is unlikely to be very successful: not only do many households not follow news about monetary policy but even when exposed to news articles focusing explicitly on monetary policy decisions, these news articles seem to be heavily discounted by the public on account of their source.

B. *Interpreting the* USA Today *Treatment Effects*

The most striking feature of table 2 is probably the fact that the *USA Today* treatment has a much smaller effect than either simple messages about recent inflation, the Federal Reserve's inflation target, or the corresponding FOMC statement. To better understand this effect, we first exploit the fact that two different versions of both the FOMC and the *USA Today* treatments were presented in May and June. The two FOMC statements are broadly similar, with the most noticeable difference being the language with respect to inflation. The May 2018 version reads, "On a 12-month basis, both overall inflation and inflation for items other than food and energy have continued to run below 2 percent. . . . Inflation on a 12-month basis is expected to move up in coming months and to stabilize around the Committee's 2 percent objective over the medium term," whereas the June 2018 version reads, "On a 12-month basis, both overall inflation and inflation for items other than food or energy have moved close to 2 percent. Inflation on a 12-month basis is expected to run near the Committee's symmetric 2 percent objective." The latter makes clear that inflation was close to and expected to remain around 2%, whereas the former points to recent inflation being lower but expected to rise to 2%.

To assess whether this difference in language about inflation matters, we consider whether the revision in beliefs of households differs depending on which of these two treatments they received. The results in table 4 suggest that this language has little discernible effect: inflation expectations fell by 1.1% on average for those surveyed in May and by 1.3% on average for those in June.

The language of the *USA Today* articles covering these FOMC decisions is also somewhat different given the changing inflation outlook. In the article provided to households surveyed in May, the FOMC decision is described as follows:

TABLE 4
SENSITIVITY TO DIFFERENTIAL LANGUAGE IN FOMC AND *USA TODAY* TREATMENTS

	Outcome: Immediate Forecast Revision					
	Pooled Sample		May Sample		June Sample	
Treatment	(1)	(2)	(3)	(4)	(5)	(6)
T8 (FOMC statement)	−1.193***	−1.218***	−1.092***	−1.104***	−1.291***	−1.314***
	(.103)	(.103)	(.150)	(.151)	(.141)	(.141)
T9 (*USA Today* coverage)	−.444***	−.475***	−.581***	−.618***	−.325**	−.338**
	(.105)	(.105)	(.152)	(.152)	(.145)	(.145)
Remove outliers	Yes	Yes	Yes	Yes	Yes	Yes
Using sampling weights	Yes	Yes	Yes	Yes	Yes	Yes
Controls for demographics	No	Yes	No	Yes	No	Yes

NOTE.—This table reports the average change in inflation expectations of individuals in each treatment group relative to those in the control group. Columns 1 and 2 consider the immediate change in expectations after the treatment, cols. 3 and 4 consider the changes in beliefs for those taking the survey in May 2018, and cols. 5 and 6 report changes in beliefs for those taking the survey in June 2018. Differences in information treatments between May and June waves are described in detail in sec. III.B. For each time horizon, col. 2 uses the same specification as in col. 1 but augmented with respondent-specific controls. Results are from Huber robust regressions to control for outliers and influential observations. Robust standard errors are reported in parentheses.

** Significant at the 5% level.

*** Significant at the 1% level.

> Citing a brighter economic outlook, the Federal Reserve raised its key short-term interest rate Wednesday but maintained its forecast for a total of three hikes this year amid still-modest inflation. . . . [The federal funds rate] is still low by historical standards but it marks the central bank's fourth increase in the past 12 months and another vote of confidence in an economy that's picking up steam nearly nine years after the Great Recession ended. "We're trying to take that middle ground" on rate hikes, boosting rates enough to head off an eventual spike in inflation without derailing the economic expansion, Fed chairman Jerome Powell said at a news conference.

This article identifies that inflation is "modest" but emphasizes the upside potential to the economy and the possibility of an eventual spike in inflation raised by Chairman Powell. The June article, following the FOMC's May 2 decision to hold rates steady, takes a somewhat more ominous note:

> Inflation is creeping higher, and that's making the Federal Reserve more confident about raising interest rates. The Fed held

> its key interest rate steady Wednesday but noted that inflation had climbed close to its 2% goal, paving the way for another rate hike in June. . . . Fed policymakers have forecast two more rate increases this year, according to their median estimate, but faster inflation could trigger three additional moves.

Like the corresponding FOMC statement, this article makes clear that recent inflation was close to 2% and that its rise justified an expected path of rising interest rates.

Table 4 then considers whether the two different *USA Today* articles had differential effects on inflation expectations. We find mild differences between the two: participants in the May sample revised their inflation expectations downward by 0.6%–0.7% on average, while those in the June sample revised their expectations by 0.3%–0.4%, about half. While the darker language about rising inflation in the June article therefore seems to have some effect on how individuals revise their beliefs, it remains the case that revisions due to the *USA Today* treatment are much smaller than corresponding ones from the FOMC treatments.[20] We also note that the June article explicitly mentioned the 2% inflation target but resulted in a smaller downward revision compared with the May article that did not include a specific number. Given that the FOMC statements and *USA Today* articles broadly conveyed the same information and the *USA Today* articles did so using less jargon, the stronger effect from FOMC statements suggests that respondents discounted some of the information in the newspaper article.

To investigate the source of this discounting, we asked questions to participants in subsequent (and unrelated) surveys of Nielsen households in June 2019. These individuals were asked to rate how credible they viewed different news outlets as sources of information about the economy on a scale of one (very credible) to five (not credible). Results from more than 28,000 respondents presented in table 5 indicate that US households on average view newspapers as somewhat less reliable than television, the government, and friends or coworkers as a source of news, with social media being reported as the most credible news source of them all. We find small differences in the relative credibility of various newspapers: *USA Today* is perceived as more credible than the *New York Times*, the *Washington Post*, or the *Wall Street Journal* but less credible than the *Chicago Tribune* or the *Los Angeles Times*.[21] Hence, the discounting of *USA Today* by our survey

[20] The other treatments regarding recent inflation, the inflation target, and the Federal Reserve's inflation forecast have similar effects in May and June waves.

[21] However, respondents chose the "do not know" option for the *Chicago Tribune* and the *Los Angeles Times* much more frequently than for the other four newspapers. This may reflect a more regional nature of the *Chicago Tribune* and the *Los Angeles Times*.

TABLE 5
CREDIBILITY OF DIFFERENT NEWS SOURCES

	SCORE		SHARE OF PEOPLE CHOOSING "DO NOT KNOW"
	Mean (1)	Standard Deviation (2)	(3)
Credibility of news sources:			
Newspapers	3.07	1.16	.11
Television	2.87	1.12	.08
Social media	2.12	1.08	.09
Friends and coworkers	2.83	1.02	.10
Government	2.84	1.14	.11
Credibility of newspapers:			
New York Times	3.20	1.42	.36
Wall Street Journal	3.45	1.31	.35
USA Today	3.05	1.26	.36
Washington Post	3.14	1.40	.39
Chicago Tribune	2.91	1.34	.48
Los Angeles Times	2.92	1.36	.47

NOTE.—This table reports scores to questions about the credibility of news sources (top panel) and the credibility of specific newspapers (bottom panel). In each case, respondents were asked to rate credibility on a scale of one (very credible) to five (not credible). Column 1 reports mean credibility scores across all respondents, col. 2 reports the standard deviation of those scores across respondents, and col. 3 reports the fraction of respondents who claimed that they did not know about the credibility of each source. In total, 28,507 respondents provided their assessments.

respondents does not appear to reflect the fact that they view this particular newspaper as unreliable but rather a more widespread skepticism that traditional media such as newspapers and television serve as a reliable source of news.

There could be other explanations. For example, we cannot determine whether households focus only on certain parts of FOMC statements or newspaper articles (e.g., first paragraph, title, etc.), so we cannot assess whether there is specific language driving the difference across treatments. However, the fact that there is a large difference between the FOMC treatment and both newspaper articles tentatively suggests that it is the source rather than the content that drives the differential treatment effect. The evidence on the low credibility of traditional news media further supports this view. Another possibility is that "demand characteristics" in which respondents want to please the experimenter could lead to stronger effects for the FOMC than for news media treatments if respondents thought this was a desired outcome (Weber and Cook 1972). However, respondents were not aware of the existence of other treatments or the purpose of the information treatments. Furthermore, the fact that the relative effects on expectations are similar 3 months later is difficult to reconcile with demand effects. In short, we view differential credibility across treatments as the most plausible source of differential effects.

C. Convergence in Beliefs

While the results above describe the average change in beliefs after an information treatment, this does not fully characterize how these treatments affect beliefs. For example, if agents act like Bayesians, their beliefs after the information treatments should be a weighted average of their initial beliefs and the treatment. If their initial beliefs were symmetrically distributed around the signal, one could observe no change in average belief after a treatment, even though all households actually changed their beliefs in the expected way. However, one would still expect to see a reduction in the cross-sectional posttreatment dispersion of beliefs, since everyone moved toward the signal.

To assess whether beliefs are converging after receiving common signals, we directly quantify the weight that agents assign to signals they receive versus the weight they assign to their prior beliefs. If they act as Bayesians, the weight they assign to the signal in updating their beliefs should be the Kalman gain, and this weight should be increasing in the perceived precision of the signal. The weight they assign to their prior belief should then be one minus the Kalman gain. We assess this framework by regressing individuals' posterior beliefs on their prior beliefs. We allow for both the intercept and the slope coefficient to vary across groups since different signals have different values and are likely to have different perceived precisions, leading to different gains associated with each. The regression is given by

$$E_i^{\text{post}}\pi = a + \sum_j b_j \times \text{Treatment}_{i,j} + \sum_j \gamma_j \times \text{Treatment}_{i,j} \times E_i^{\text{pre}}\pi + \psi \times E_i^{\text{pre}}\pi + \text{Error}_i, \tag{3}$$

where i denotes the individual respondent and j denotes the different treatment groups while $\text{Treat}_{i,j}$ are indicator variables indicating which treatment was received by respondent i.

The results of these regressions, across different horizons, are presented in table 6. When looking at the control group, one would expect an intercept of zero and a slope coefficient of one since these individuals are receiving no additional information. However, since posterior beliefs are measured using point forecasts while prior beliefs are measured using distributional questions, the associated measurement error naturally leads to a coefficient on priors of less than one, and these coefficients fall over time. This provides the benchmark relative to which we can measure the weight assigned to different signals.

Consider first the results when individuals are presented with the inflation forecast of the FOMC, a signal directly comparable with their own

TABLE 6
POSTERIOR BELIEFS BY TREATMENTS

	Immediate Revision		Revision after 3 Months		Revision after 6 Months	
Treatment	Intercept (b) (1)	Slope (γ) (2)	Intercept (b) (3)	Slope (γ) (4)	Intercept (b) (5)	Slope (γ) (6)
T1 (control)	2.235***	.662***	2.281***	.268***	2.399***	.261***
	(.088)	(.021)	(.074)	(.016)	(.089)	(.020)
Relative to control group:						
T5 (population growth)	.290**	−.228***	−.670***	.202***	−.835***	.256***
	(.121)	(.029)	(.106)	(.025)	(.122)	(.029)
T6 (unemployment)	.412***	−.277***	−.186*	.029	−.195	.005
	(.120)	(.027)	(.107)	(.023)	(.126)	(.027)
T4 (gasoline prices)	2.183***	−.209***	−.185*	.061**	−.276**	.034
	(.132)	(.028)	(.106)	(.024)	(.122)	(.028)
T2 (past inflation)	.408***	−.505***	−.027	−.028	−.031	−.047*
	(.110)	(.025)	(.103)	(.022)	(.121)	(.026)
T3 (inflation target)	.238**	−.444***	−.488***	.049**	−.511***	.045
	(.109)	(.025)	(.105)	(.023)	(.123)	(.028)
T7 (Federal Reserve inflation forecast)	.102	−.458***	−.197*	.090***	−.254**	.122***
	(.107)	(.025)	(.107)	(.024)	(.128)	(.028)
T8 (FOMC statement)	.044	−.488***	−.206**	−.012	−.275**	−.006
	(.110)	(.026)	(.103)	(.023)	(.119)	(.027)
T9 (*USA Today* coverage)	.288**	−.369***	−.260**	.077***	−.394***	.126***
	(.115)	(.028)	(.104)	(.024)	(.123)	(.028)
Remove outliers	Yes		Yes		Yes	
Using sampling weights	Yes		Yes		Yes	
Controls for demographics	No		No		No	
Observations	18,897		13,155		9,911	
R^2	.269		.262		.262	

NOTE.—This table reports the slope and intercept in the following regression: $E_i^{\text{post}}\pi = a + b \times \text{Treatment}_i + \gamma \times \text{Treatment}_i \times E_i^{\text{pre}}\pi + \psi \times E_i^{\text{pre}}\pi$. Columns 1 and 2 consider the immediate change in expectations after the treatment, cols. 3 and 4 are for beliefs after 3 months, and cols. 5 and 6 are for beliefs after 6 months. Results are from Huber robust regressions to control for outliers and influential observations. Robust standard errors are reported in parentheses.

* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

inflation forecast. The associated weight on their prior belief is only around 0.2, meaning that they place a very high weight on this signal; that is, it is perceived as being very informative. These results suggest that survey participants converge in their beliefs once presented with this common source of information. Given that average priors are significantly higher than this signal, this updating also accounts for the large average

decline in expectations documented in table 2 when the treatment is received. Very similar results obtain when households are presented with information about recent inflation, the Federal Reserve's inflation target, or the FOMC statement. Strikingly, the weight on the prior is significantly higher when presented with the *USA Today* article, consistent with households treating this as a less informative signal. Information about gasoline prices, unemployment, and population growth also receive much less weight upon treatment, consistent with households perceiving these as either less informative about inflation or something that is already largely known to them.

Jointly, these results confirm that consumers respond to signals about inflation in the expected way. They systematically place weight on informative signals, leading to convergence in their beliefs upon receiving common information. They also assign more weight to signals that are perceived as more informative. While previous evidence for households has also largely been consistent with Bayesian updating, we are the first, to the best of our knowledge, to find these results for such a large group of households as well as being able to compare across a wide range of signals.

D. Heterogeneity

Do information treatments affect everyone equally? D'Acunto, Hoang, and Weber (2021) find large differences in how individuals adjust consumption plans to their inflation expectations by demographics. In this section, we investigate this question by considering whether the effects of information treatments on inflation forecasts differ along observable characteristics of respondents. Such heterogeneity can be useful for policy makers if they aim to affect the actions of specific subsets of the population—for example, those who have unusually high or low inflation expectations. We therefore regress respondents' revisions across treatment groups on a range of observable characteristics along which they differ, including gender, income (by tercile), education, race, access to and amount of available credit, purchasing plans, wealth, savings behavior, and shopping behavior (e.g., if they are the main person in the household who does the shopping or frequency of purchasing gasoline). The full set of results is presented in appendix tables 1 and 2, and summary results for observable heterogeneity are presented in table 7. In each case, we focus on the specification that includes individual-specific controls and uses the contemporaneous response of inflation forecasts as the dependent variable, but similar results obtain at longer horizons.

There is surprisingly little heterogeneity in how respondents change their beliefs in response to new information on average. For example, white and nonwhite individuals respond to information treatments

TABLE 7
HETEROGENEITY IN TREATMENT EFFECTS

Treatment	By Gender		By Income			By Education			Political Affiliation		
	Female (1)	Male (2)	Bottom Tercile (3)	Middle Tercile (4)	Highest Tercile (5)	High School or Less (6)	Associate Degree or Some College (7)	College or More (8)	Democrat (9)	Republican (10)	Other (11)
T5 (population growth)	−.31**	−.06	−.04	−.52**	−.19	−.06	−.40**	−.18	−.65***	−.01	−.08
	(.13)	(.17)	(.21)	(.23)	(.14)	(.24)	(.20)	(.14)	(.24)	(.22)	(.25)
T6 (unemployment)	−.54***	.05	−.19	−.63***	−.28**	−.30	−.28	−.39***	−.75***	−.28	.04
	(.13)	(.17)	(.20)	(.23)	(.14)	(.24)	(.19)	(.14)	(.25)	(.22)	(.25)
T4 (gasoline prices)	1.52***	1.38***	1.62***	1.06***	1.57***	1.40***	1.58***	1.45***	1.15***	1.19***	1.72***
	(.15)	(.18)	(.22)	(.25)	(.16)	(.26)	(.21)	(.16)	(.26)	(.24)	(.27)
T2 (past inflation)	−1.29***	−.53***	−1.10***	−1.57***	−.76***	−.96***	−1.37***	−.85***	−1.49***	−.73***	−.90***
	(.13)	(.17)	(.20)	(.23)	(.14)	(.25)	(.19)	(.14)	(.24)	(.22)	(.25)
T3 (inflation target)	−1.27***	−.47***	−.83***	−1.66***	−.80***	−.64***	−1.21***	−1.03***	−1.30***	−.76***	−.72***
	(.13)	(.16)	(.19)	(.23)	(.14)	(.23)	(.19)	(.14)	(.24)	(.21)	(.24)
T7 (Federal Reserve inflation forecast)	−1.25***	−.75***	−1.29***	−1.52***	−.74***	−1.21***	−1.10***	−1.01***	−1.64***	−.75***	−.96***
	(.13)	(.16)	(.20)	(.22)	(.14)	(.24)	(.19)	(.14)	(.24)	(.21)	(.25)
T8 (FOMC statement)	−1.43***	−.74***	−1.08***	−1.78***	−1.00***	−1.16***	−1.21***	−1.21***	−1.57***	−1.01***	−1.05***
	(.13)	(.17)	(.19)	(.23)	(.14)	(.24)	(.18)	(.14)	(.24)	(.22)	(.24)
T9 (*USA Today* coverage)	−.59***	−.20	−.24	−.84***	−.40***	−.17	−.53***	−.52***	−.86***	−.46**	−.19
	(.13)	(.17)	(.20)	(.23)	(.14)	(.24)	(.20)	(.14)	(.25)	(.21)	(.25)
Observations	14,225	4,997	5,902	5,676	7,644	2,748	5,177	11,297	3,882	4,320	3,439
R^2	.05	.04	.05	.05	.05	.05	.06	.04	.05	.03	.05

NOTE.—This table reports the average change in inflation expectations of individuals in each treatment group relative to those in the control group, broken down along observable characteristics of individuals. Columns 1 and 2 separate households by gender, cols. 3–5 consider where individuals rank in the income distribution of all respondents by tercile, cols. 6–8 classify respondents using the highest level of education in the household, and cols. 9–11 classify respondents based on their political affiliations. In each case, revisions in beliefs are measured using the inflation forecasts at the end of the first wave of the survey relative to initial beliefs from the first wave measured before all treatments. Treatments are described in detail in the main text. Results are from Huber robust regressions to control for outliers and influential observations. Robust standard errors are reported in parentheses.

** Significant at the 5% level.

*** Significant at the 1% level.

similarly, as do young, middle-aged, and senior respondents. There is little variation between those who are planning to purchase expensive durable goods (cars, houses, or other big-ticket items) and those who are not. Nor do we find systematic differences in responses to information treatments based on shopping behavior. Political preferences have some effect, as Democrats seem to respond somewhat more to information about inflation than do Republicans or Independents. We also consider whether there are systematic differences in responses to information depending on whether respondents have ready access to credit, whether they have any savings or wealth, and their savings rate: we again find little variation along these dimensions. Gender, however, does seem to matter. Women respond more strongly to every information treatment, including the placebo treatment of population growth, with information about gasoline prices being the only exception. The differences across the two groups are large in economic terms: women's responses to information treatments are often twice as large as men's. This may reflect the fact that men report more confidence in their beliefs about inflation, which should result in less weight being placed on new information. Income also matters for how individuals respond to information. We find that those in the middle of the income distribution of respondents (income between $40,000 and $100,000) respond significantly more to information about recent inflation or unemployment, the Federal Reserve's inflation target, the FOMC's inflation forecast, FOMC statements, and news reports about the FOMC's decisions than either lower- or higher-income respondents. Strikingly, lower-income individuals do not respond at all, on average, to the *USA Today* news report about the FOMC meeting even though they respond strongly to most other treatments. We find a similar result when we decompose households by education: those with no more than a high school degree do not respond at all to the *USA Today* news report treatment, even though they respond strongly to other information treatments.

Low-income and less educated individuals are on average systematically less well informed about inflation and monetary policy. For example, in our survey, both low-income and less educated individuals have higher average beliefs about the Federal Reserve's inflation target. Hence, one might think that monetary policy makers might be able to have the largest effects on the beliefs of these individuals by providing them with information about inflation and monetary policy. What our results indicate, however, is that these are also the individuals who are least likely to incorporate information about inflation from the news media. This implies that traditional communication strategies of central banks, which rely largely on the transmission of information via standard news outlets, are unlikely to be successful and raises the concern that purely relying on these transmission channels results in redistributive effects of monetary policy (see also Coibion et al. 2017; D'Acunto et al. 2021b).

IV. Discussion

The narrative around inflation expectations that is commonly promoted by central bankers is that (1) they are important for inflation dynamics, (2) they are anchored to the inflation target as a result of the credibility of the central bank, and (3) this anchoring is a source of economic stability. The first point was most clearly illustrated by Federal Reserve Chairman Jerome Powell when he said in congressional testimony that inflation expectations were the most important driver of inflation (see https://www.bloomberg.com/news/articles/2019-03-15/fed-puts-inflation-expectations-at-heart-of-major-policy-review). The second point was emphasized by the president of the San Francisco Federal Reserve, Mary Daly: "Once inflation was under control, the Fed committed to keeping it that way. This commitment became a well-known and accepted position that people could depend on. And it ushered the conditions that dominate today—the era of well-anchored expectations." The third step in their argument is summarized by Mary Daly simply as "when the Fed is credible, it's easier for the economic system to absorb shocks," while the mechanism underlying it is described in more detail by Chairman Powell:

> Anchored [inflation] expectations give a central bank greater flexibility to stabilize both unemployment and inflation. When a central bank acts to stimulate the economy to bring down unemployment, inflation might push above the bank's inflation target. With expectations anchored, people expect the central bank to pursue policies that bring inflation back down, and longer-term inflation expectations do not rise. Thus, policy can be a bit more accommodative than if policymakers had to offset a rise in longer-term expectations. . . . I am confident that the FOMC would resolutely "do whatever it takes" should inflation expectations drift materially up or down.

Our results, using one of the largest surveys of US households' expectations ever conducted, contradict this comforting narrative along many dimensions. We find little evidence that people know and accept the Federal Reserve's commitment to a low inflation target. Many individual respondents are unwilling to even guess what the Federal Reserve's inflation target is, and of those who do, few answer correctly. Households' average perceptions of recent inflation are quite different from actual inflation, and their inflation forecasts bear little resemblance to those of the FOMC. When presented with the most basic facts about inflation or monetary policy, their views often change dramatically. The limited evidence on US firms' inflation expectations closely resembles that of households, and available evidence from other advanced economies yields similar messages

for both households and firms (see Coibion et al. 2020 for a review). The notion that most US citizens—those individuals signing the wage and rental agreements at the heart of the mechanism described by Chairman Powell—have well-anchored expectations therefore flies in the face of the available evidence.

We view this as having a number of potentially important implications that call for both future work and renewed consideration by policy makers. First is the notion of the credibility of the Federal Reserve and comparable central banks. In an era where central banks in advanced economies are coming under intense criticism from politicians and populist movements, they should not assume that their credibility with the broader public will help protect their independence. While professional forecasters and some financial market participants may have embraced the Federal Reserve's inflation target, the broader public has not. The lack of public understanding of just how successful modern central banking has been in the last 30 years makes central banks an easy target for populist leaders. Communication campaigns that describe, in easy-to-understand messages, what inflation rate the central bank targets and how close to that target inflation has been on average could boost not only the average knowledge about inflation of the broader population but also, as a result, the credibility of central banks. Central banks, however, should not stop here but should also explain in detail the benefits of stable prices and the implications of changes in inflation expectations for economic choices. Many households in the United States perceive persistent deflation as desirable and have little knowledge about basic economic concepts, such as the consumer Euler equation (D'Acunto et al. 2021b).

A second implication of our results, and one that is more positive for central banks, is the scope for how potentially powerful communications policies toward the broader public could be. We find that simple information treatments that reach the public can easily move inflation expectations by more than 100 basis points. Relative to quantitative easing policies or forward guidance, this suggests that policy makers may be able to change perceived real interest rates of households and firms in a quantitatively important way through new communication strategies, a feature that could be immensely useful at the zero bound on nominal interest rates (for guidance on how this communication could be implemented, see Candia, Coibion, and Gorodnichenko 2020; D'Acunto et al. 2020; D'Acunto, Fuster, and Weber 2021). Doing so will require much more systematic evaluation of how different types of information affect the expectations of economic agents as well as formal models that characterize how these signals affect expectations and decisions along with their general equilibrium implications. Intuitively, the decline in both the level and the volatility of inflation since the early 1980s has lowered the benefit of being informed about inflation for households, leading to pervasive

inattention on their part.[22] To offset this force, policy makers would need to reduce the price of collecting and processing this information for households, which would require simpler communication strategies that reach individuals in a more direct and systematic manner. Our simple messages about inflation resulted in an average revision in forecasts of more than 1%. For comparison, the first quantitative-easing program (QE1) of the Federal Reserve Bank amounted to $1.725 trillion and resulted in a reduction in interest rates of only 0.34 percentage points according to estimates in Bhattarai and Neely (2018). In terms of changing perceived real interest rates, communication policies therefore have the scope for providing an important additional tool to policy makers.

A third implication for central banks has to do with the policy framework to use—for example, inflation targeting versus price-level targeting. The Federal Reserve system implemented a process of reviewing its policy objectives and procedures that led it to adopt an average inflation target in lieu of its more traditional inflation-targeting strategy. The rationale for doing so is that, when the economy is facing the zero bound on interest rates, an average inflation-targeting regime entails that inflation must be higher than the target after the zero bound ends, as this will be necessary to make up for the low inflation that occurs during the zero-bound period. The expectation of higher future inflation while at the zero bound is predicted to be stimulative in New Keynesian models since higher expected inflation implies lower perceived real interest rates and therefore higher demand on the part of households. Average inflation targeting can therefore help stabilize economic outcomes during zero-bound episodes relative to inflation-targeting regimes. However, these effects hinge on households' inflation expectations correctly incorporating the effects of the regime and the zero bound such that they anticipate higher inflation than the target after the zero-bound period ends. The absence of knowledge of what the target rate even is (documented in fig. 1) as well as the striking disconnect between household inflation expectations and recent inflation documented in this paper suggests that such a mechanism is unlikely to be effective as long as US households remain as uninformed about inflation and monetary policy as they have been.

Ultimately, the power of any communication strategy on the part of central banks hinges on how any resulting changes in economic expectations affect actual decision-making. If households' spending or other decisions are unaffected by their inflation expectations, then how the central bank communicates with households becomes a moot point. While

[22] This is consistent with the fact that households in higher and more volatile inflation environments are more informed about inflation and monetary policy than those living in low and stable inflation environments. It is also consistent with the evolution of inflation expectations over time in the United States as inflation went from high and volatile in the 1970s to low and stable in the 1980s. See Coibion, Gorodnichenko, and Ropele (2020).

this would be strongly at odds with standard macroeconomic models, the fact that households in advanced economies with a history of low and stable inflation are so uninformed about inflation and monetary policy could potentially reflect a perception by households that information about inflation or monetary policy is largely irrelevant to their decisions. We therefore turn to whether changes in inflation expectations stemming from information treatments have any discernible effect on the spending decisions of households.

V. Inflation Expectations and Spending Decisions

Do the large changes in inflation expectations generated by some of the information treatments have any effect on household decisions? We investigate this question using two sources of data. First, our surveys include a question that asks respondents to report their monthly spending on a wide variety of goods and services, including food, utilities, and so on. This question was asked both in the initial wave and in the two follow-up waves. It therefore allows us to track spending of households over this 6-month period, both overall and for specific categories of goods and services. In addition, respondents were asked in the first wave whether they expected to buy (*a*) a house, (*b*) a car, or (*c*) any large big-ticket items over the next 6 months and, if so, to report how much they expected to spend on each of those planned purchases. In the two subsequent waves, respondents were asked whether they had recently purchased any of these and, if so, how much they had spent. These self-reported spending data therefore allow us to track the monthly spending of households on both nondurable goods and services and any purchases of larger durable goods following our information treatments.

Because our survey is run on households participating in the Nielsen Homescan panel, information on their spending is also available from Nielsen based on their scanned purchases. These purchases are tracked at a high frequency but cover a relatively narrow set of goods, focusing on food and other consumer products. While more limited in scope, these data are less subject to measurement error than self-reported spending data in surveys. Scanner data therefore provide a useful check on what households report to us. Figure 2*A* shows a binned scatter plot comparing reported spending on food for survey respondents in the first wave against spending on food for those same individuals as measured by Nielsen.[23] We find a strong positive relationship between the measures. Figure 2*B* plots kernel densities of spending for the two data sources. The

[23] We apply some restrictions to Nielsen data. In particular, we drop individuals whose food spending in Nielsen is less than $20 per week or missing for eight or more weeks in a quarter.

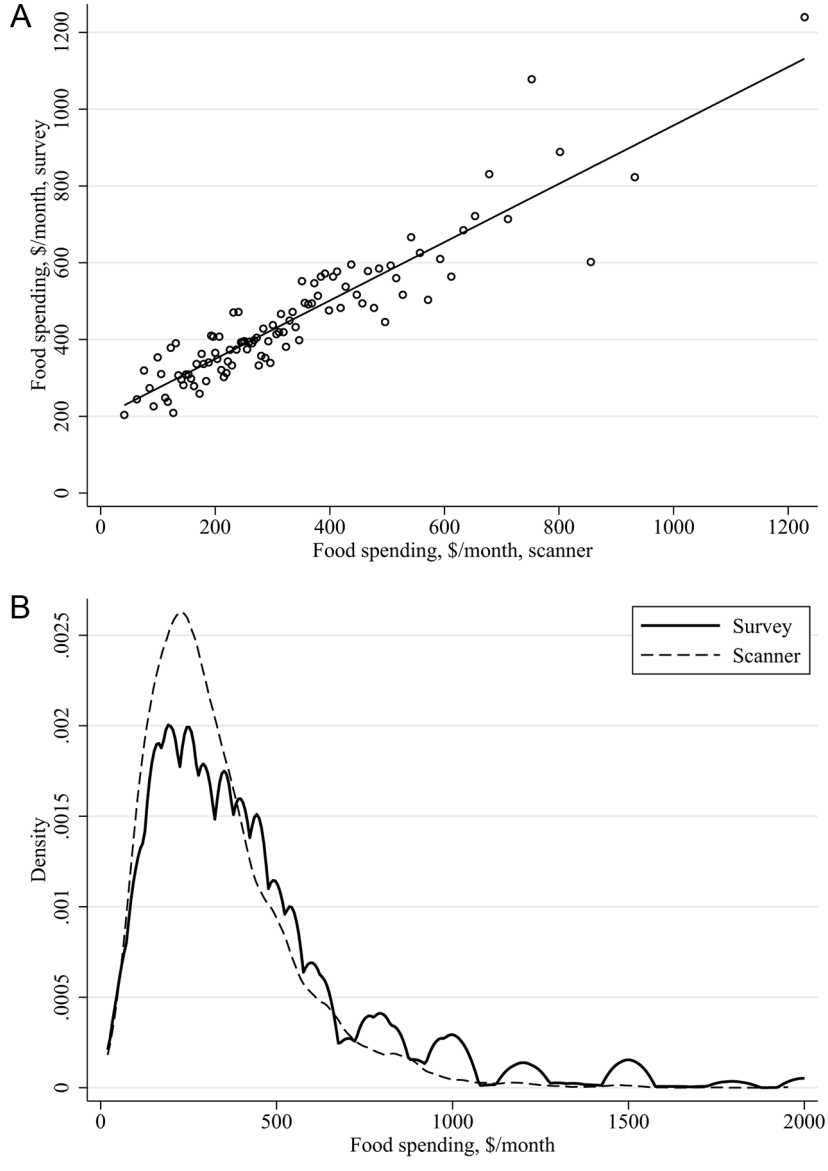

FIG. 2.—Consistency of scanner and survey spending data. *A*, Binned scatter plot of monthly food spending reported in Nielsen scanner data and in the survey. *B*, Kernel density for these two measures (rounding in survey = bumps).

distribution of survey spending measures is clearly more lumpy, reflecting the fact that most survey respondents round their reported spending. It also displays a larger tail of higher monthly spending amounts, which could reflect some undercounting in Nielsen data if respondents fail to scan all of their purchases. Overall, we view these figures as indicating that self-reported measures of spending are overall quite consistent with outside measures of spending, which is comforting given that self-reported data are the only type of information available for some categories of spending.

We begin by characterizing how changes in inflation expectations are related to households' total monthly spending (excluding large durable goods) in the following months. This is done using the following regression, which follows Coibion et al. (2019):

$$\log(\text{Spend})_{i,t+h} = \beta E_i^{\text{post}}\pi + \gamma E_i^{\text{prior}}\pi + \kappa \log(\text{Spend})_{it} + \text{Controls}_{it} + \text{Error}_{i,t+h}, \tag{4}$$

where $\log(\text{Spend})_{i,t+h}$ represents the (log) spending of household i either $h = 3$ or $h = 6$ months after the treatment, $E_i^{\text{post}}\pi$ represents the posterior inflation expectation of household i after the treatment (if any), $E_i^{\text{prior}}\pi$ represents the prior inflation expectation of household i before the treatment, and $\log(\text{Spend})_{it}$ represents the (log) spending of household i in the month prior to the initial survey wave; $E_i^{\text{post}}\pi$ is instrumented using equation (3) augmented with $\log(\text{Spend})_{it}$ and Controls_{it}. In addition, we group treatments T2 (past inflation), T3 (inflation target), T7 (FOMC forecast), and T8 (FOMC statement) into a single treatment block in the first stage since these have such similar effects on expectations. We use Huber regression in the first stage, then apply a jackknife procedure to control for any remaining outliers in the second stage of the regression, as in Coibion et al. (2019). The coefficient β provides a causal estimate of how changes in inflation expectations translate into subsequent spending decisions.

This approach has several advantages. First, it provides a simple and tractable framework for relating how ex post spending decisions across horizons vary with changes in inflation expectations, after controlling for past spending, past expectations, and observable characteristics. Second, the instrumental variables strategy helps address the possible endogeneity of inflation expectations. For example, households at time t that expect to spend more in subsequent periods may expect others to spend more as well and therefore that prices will rise, leading them to have higher inflation expectations. By using the treatments as a source of exogenous variation in inflation expectations, our approach can resolve this type of endogeneity.

To be clear, this approach is not estimating an Euler equation, as done, for example, in Crump et al. (2015), which identifies the intertemporal elasticity of substitution. Instead, our approach yields a "total" estimate of how exogenous variation in inflation expectations ultimately affects spending. This effect can reflect the intertemporal substitution channel, as in the Euler equation, but a number of other channels as well. For example, a rise in inflation expectations may lead households to expect a reduction in their future real wage, which could lead to lower spending. They could also infer that perceived changes in inflation reflect a stronger or weaker economy, which can in turn affect their risk of job loss and therefore desired spending levels. Our estimating equation combines all of these channels into a single estimate.

We begin by presenting results for total self-reported monthly spending of households in panel A of table 8 both 3 months and 6 months after the initial treatment. The first thing to note is that the *F*-statistic for the first stage is quite high (around 50), indicating that our information treatments generate enough exogenous variation in inflation expectations for identification purposes. Second, the coefficient on posterior inflation expectations is significantly positive after 3 months but somewhat smaller and not significant after 6 months, indicating that higher inflation expectations are followed by at least a brief period of higher monthly spending on the part of households. The economic magnitude is nontrivial and implies that a 1 percentage point increase in inflation expectations leads to a rise in overall monthly spending of around 1.8%, although the confidence interval around this estimate is large.

Panel B provides equivalent estimates of the response of total household spending using the Nielsen scanner data. The included categories are more limited, and the measured spending is therefore simply a subset of the total spending captured in panel A. However, the sample size is significantly larger since we are unconstrained by respondents needing to participate in follow-up waves of the survey. Between the larger sample size and the reduced noise in spending data, the estimates are much more precise. Both 3 months and 6 months after the initial wave, we find that households with inflation expectations higher by 1 percentage point have higher spending by 0.85%–0.95%, which is close to the 6-month estimate from the survey data. Hence, regardless of which spending measure we use, the results indicate that when households raise their inflation expectations, they subsequently increase their spending over at least several months.

Panels C and D provide results for food, a subset of household spending with consistent measurement across data sets, as illustrated in figure 1. We again find qualitatively similar results using either the self-reported survey data (panel C) or the Nielsen scanner data (panel D) for spending on food. Once again, through a combination of larger sample size and

TABLE 8
EFFECT OF INFLATION EXPECTATIONS ON SPENDING DECISIONS

	ACTUAL SPENDING (HORIZON, MONTH)	
	First Follow-Up Wave (1)	Second Follow-Up Wave (2)
	A. Dependent Variable: Total Spending (Survey)	
Posterior inflation expectations	1.826***	1.015
	(.690)	(.638)
Observations	6,459	6,570
R^2	.414	.414
First-stage *F*-statistic	46.97	60.06
	B. Dependent Variable: Total Spending (Scanner)	
Posterior inflation expectations	.950***	.864**
	(.286)	(.336)
Observations	13,170	13,132
R^2	.751	.696
First-stage *F*-statistic	134.8	128.1
	C. Dependent Variable: Spending on Food Items (Survey)	
Posterior inflation expectations	1.299*	.873
	(.775)	(.640)
Observations	6,626	6,748
R^2	.460	.473
First-stage *F*-statistic	50.36	63.81
	D. Dependent Variable: Spending on Food Items (Scanner)	
Posterior inflation expectations	.568**	.237
	(.266)	(.313)
Observations	13,170	13,136
R^2	.773	.708
First-stage *F*-statistic	136.3	132.8
	E. Dependent Variable: Spending on Any Durable Good (Survey, Extensive Margin)	
Posterior inflation expectations	−1.472***	−1.743***
	(.263)	(.403)
Observations	11,080	9,755
R^2	.06	.08
First-stage *F*-statistic	110.6	86.54

NOTE.—This table reports estimates from regressing spending measures (indicated by each panel) on household inflation expectations and household controls as described in sec. V. Inflation expectations are instrumented using information treatments, as described in sec. V. Dependent variables are as follows: panel A is total monthly spending reported by households in the follow-up waves of the survey, panel B is total spending measured in Nielsen scanner data, panels C and D are total spending on food as measured in survey and scanner data, respectively, and panel E is an indicator variable for whether individuals reported purchasing any large durable good in follow-up survey waves. Panels A–D include controls for past spending levels, while panel E includes a control for any intended purchase of durable good reported in the first wave of the survey. Household controls include gender of the respondent, age and age^2 of the respondent, presence and number of children, education of household head (a set of indicator variables), log household income, and household size. Robust standard errors are reported in parentheses. For each regression, we use Huber regressions in the first stage and jack-knife procedure in the second stage, as described in Coibion et al. (2019).

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

less noisy spending data, the results using the scanner measure of food spending are much more precise than those using the survey data, but even the latter point toward a statistically significant increase in spending over the first 3 months, with the effect over 6 months being insignificantly different from zero.

We then turn to whether large durable goods purchases are affected by the information treatments. Consistent with the approach used for spending measures, we estimate the following regression:

$$\mathbf{1}(\text{DurablePurchase})_{i,t+h} \times 100 = \beta E_i^{\text{post}}\pi + \gamma E_i^{\text{prior}}\pi + \psi \mathbf{1}(\text{PurchasePlan})_{it} + \text{Controls}_{it} + \text{Error}_{i,t+h}, \quad (5)$$

where $\mathbf{1}(\text{DurablePurchase})_{i,t+h}$ is an indicator variable indicating whether household i reported having purchased any large durable good (house, car, or other big-ticket item) in either the previous 3 months (for the first follow-up wave) or the previous six months (for the second follow-up wave). We control for $\mathbf{1}(\text{PurchasePlan})_{it}$, an indicator variable indicating whether the household reported in the initial survey wave that they planned to purchase any large durable good over the following 6 months. We use the same instrumenting strategy for inflation expectations.[24]

Results are reported in panel E of table 8. We find a strong negative relation between the instrumented posterior inflation expectations from the first survey wave and ex post purchases of durables from the follow-up waves. These negative effects extend to the second follow-up wave. A 1 percentage point increase in inflation expectations reduces the probability of a household purchasing a large durable good by about 1.5 percentage points. Appendix table 11 provides equivalent estimates for different types of durable goods: houses, cars, and other big-ticket items. We find negative effects of inflation expectations for both cars and other durable goods, but the number of observations for purchased houses is too small to provide reliable inference.

What underlies the differential response of monthly spending on nondurables and services versus the purchase of large durable goods? First, this is the same qualitative pattern as found in Coibion et al. (2019) for households in the Netherlands. However, because of weaker instruments and a much smaller cross section, those estimates were very imprecise and more ambiguous in nature. Here the pattern of increasing their spending on nondurable goods and services when households raise their

[24] The survey also asked respondents to report their planned and actual spending on durable goods, but many respondents chose to not report spending ("prefer not to answer," "uncertain or do not know"). As a result, the sample available for estimation of the intensive margin is much smaller. For this sample, we did not find statistically significant effects of inflation expectations on the intensive margin of spending on durable goods, which is consistent with Coibion et al. (2019).

inflation expectations, while simultaneously delaying or canceling their purchases of large durable goods, is much more clearly identified. Nonetheless, the consistency in results across settings strongly suggests that this pattern is not by chance but instead characterizes the total effects of higher inflation expectations on consumer spending patterns.

In principle, there are several forces that can make consumption move in the manner documented here. The increase in spending on nondurables and services could be a natural consequence of prices being expected to rise more rapidly in the future and is precisely the effect predicted by the Euler equation. If this is the force behind the rise in nondurables and services, one would expect it to be strongest for more educated individuals, consistent with D'Acunto et al. (2021b), who show using Finnish data that low-IQ men are less able to follow the Euler equation than higher-IQ men. We might also expect it to be stronger for those who are not financially constrained, since financial constraints can prevent the borrowing against future income needed to finance the higher spending today. In table 9, we report estimates of the response of total spending as measured using Nielsen data to inflation expectations for different subgroups of the population. We focus on total spending in Nielsen since this measure has less noise than the self-reported data and provides significantly more precise estimates as we cut the data into subgroups of households. The point estimates are consistent with less educated and lower-income individuals raising their monthly spending by less than more educated and higher-income individuals when they have higher inflation expectations, consistent with an Euler equation, although the differences are not statistically significant. The point estimates suggest that the financially constrained respondents may not able to increase their spending as much as the financially unconstrained, although again the differences are not statistically significant. We view the results of the effect of inflation expectations on monthly spending as being broadly consistent with intertemporal substitution given these patterns, but it must be emphasized that the noise in the data makes it difficult to have precise estimates as soon as we try to restrict our attention to subsamples of the data.

The postponement or cancelation of large durable good purchases in response to higher inflation expectations, however, is a priori less consistent with the standard intertemporal substitution logic. One explanation could be that, when survey participants raise their inflation expectations, they put off large durable good purchases to finance the short-term increase in spending on nondurables. One would expect this effect to be stronger for those groups that change their nondurable purchases more and for the financially constrained. Table 9 provides mixed evidence for this possibility. On the one hand, both richer and more educated respondents who raise their nondurable spending more with higher inflation expectations are also more likely to postpone their purchases of large

durable goods. On the other hand, we do not find a stronger effect on durable goods purchases for women than for men even though women are more likely to increase their nondurable spending than men. We can also observe that while Democrats are more likely to reduce their durable goods purchases then Republicans when they have higher inflation expectations, they are simultaneously less likely to increase their nondurable good spending. There could also be other explanations that are harder to test given available data. For example, as noted earlier, there is evidence that households associate higher inflation with worse economic outcomes, an effect that has been documented in Kamdar (2018), Binder (2020a), and Candia, Coibion, and Gorodnichenko (2020), as well as in table 2 after the unemployment treatment and in appendix table 12. If households associate these worse aggregate outcomes with their own future employment situation, this could make them less willing to commit to large purchases such as those covered in our durable goods questions. If this effect were particularly strong for subsets of households, such as the less educated, lower income, and more financially constrained, then this could potentially explain why these groups tend to reduce their durable goods purchases more when they have higher inflation expectations. Another possibility is if some households with higher inflation expectations believe their real wages will be eroded more, then again this could explain why they could be more reticent to commit to purchases of large durable goods.

In short, we document robust new evidence that US households tend to raise their spending on nondurables and services after they increase their inflation expectations, consistent with an intertemporal substitution motive as in the consumption Euler equation, and that this effect is particularly strong for households that are more educated, higher income, and financially unconstrained. This complements earlier evidence from Crump et al. (2015), D'Acunto, Hoang, and Weber (2016), and Drager and Nghiem (2021) but in an RCT setting combined with both survey and scanner-level data on ex post spending decisions of households. At the same time, we also find that higher inflation expectations make households less likely to engage in purchases of large durable goods. This is consistent with earlier work using surveys focusing on whether households perceive that now is a good time to buy large durable goods, which concluded that higher inflation expectations were often associated, if at all, with a negative perception of buying houses, cars, and so on (e.g., Bachmann, Berg, and Sims 2015).

VI. Conclusion

In times of low interest rates, central banks have increasingly turned to forward guidance and other communication strategies to affect economic

TABLE 9
HETEROGENEITY IN SPENDING EFFECTS OF INFLATION EXPECTATIONS

	TOTAL SPENDING (Scanner Data)				EXTENSIVE MARGIN FOR PURCHASES OF ANY DURABLE GOOD			
	Coefficient (SE) (1)	Observations (2)	R^2 (3)	First-Stage F-Statistic (4)	Coefficient (SE) (5)	Observations (6)	R^2 (7)	First-Stage F-Statistic (8)
Gender:								
Female	.986*** (.306)	9,491	.736	106	−1.170*** (.296)	8,087	.065	86.72
Male	.541 (.657)	3,679	.765	34.81	−2.247*** (.572)	2,993	.063	27.11
Income:								
Tercile 1 (lowest)	.842* (.436)	3,928	.726	50.52	−1.234*** (.317)	3,612	.031	48.67
Tercile 2	.325 (.554)	3,988	.753	32.99	−.320 (.606)	3,307	.043	29.48
Tercile 3	1.423*** (.505)	5,254	.727	51.79	−2.842*** (.551)	4,161	.07	33.12
Education:								
High school or less	.561 (.545)	1,942	.788	33.05	−.400 (.418)	1,691	.065	31.03
Associate degree or some college	1.408*** (.477)	3,561	.748	43.91	−1.699*** (.471)	3,036	.028	35.02
College diploma or more	.853* (.464)	7,667	.735	61.78	−2.009*** (.459)	6,353	.077	46.88

Liquidity status:								
Hand to mouth (HTM)	.894*	3,661	.721	39.19	−1.658***	3,185	.067	33.12
	(.512)				(.425)			
Non-HTM	1.081*	4,121	.759	32.79	−1.528**	3,511	.083	28.36
	(.646)				(.672)			
Political affiliation:								
Democrat	−.263	3,093	.734	33.27	−1.630***	2,927	.066	37.45
	(.583)				(.421)			
Republican	1.663**	3,550	.758	24.42	−.748	3,350	.106	20.69
	(.728)				(.708)			
Other	1.132*	2,590	.783	29.76	−1.312***	2,423	.06	31.31
	(.605)				(.477)			

NOTE.—This table reports estimates from regressing ex post spending measures (from time of first follow-up survey) on household inflation expectations and household controls, as described in sec. V, for subsets of the sample. Inflation expectations are instrumented using information treatments, as described in sec. V. For cols. 1–4, the dependent variable is total spending measured in Nielsen scanner data. For cols. 5–8, it is an indicator variable for whether individuals reported purchasing any large durable good in follow-up survey waves. Household controls include gender of the respondent, age and age^2 of the respondent, presence and number of children, education of household head (a set of indicator variables), log household income, and household size. Robust standard errors are reported in parentheses. For each regression, we use Huber regressions in the first stage and jackknife procedure in the second stage, as described in Coibion et al. (2019).

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

activity. However, these strategies have focused primarily on communicating with financial markets rather than the broader public. Since many expectations channels run through households and firms, central banks could also aim to affect economic conditions via direct communications to the public. The Fed Listens campaign is evidence that monetary policy makers increasingly perceive a need to communicate with the broader public. In this paper, we present new evidence that such communications can change expectations by economically significant magnitudes: simple messages about the central bank's inflation target have implications about real interest rates that dwarf those typically found for monetary policy announcements. Changes in households' inflation expectations in turn affect their spending decisions. However, we find that the effectiveness of these messages to the public is significantly dampened when transmitted via news media: households effectively dismiss much of the information content when presented to them in the form of a news article. This suggests that, if central banks want to add direct communications to the public as a new policy tool, they will have to find new ways to reach the public without relying on traditional media.

References

Andre, Peter, Carlo Pizzinelli, Chris Roth, and Johannes Wohlfahrt. 2019. "Subjective Models of the Macroeconomy: Evidence from Experts and a Representative Sample." CESifo Working Paper no. 7850, Center Econ. Studies, Munich.

Armantier, Olivier, Scott Nelson, Giorgio Topa, Wilbert van der Klaauw, and Basit Zafar. 2016. "The Price Is Right: Updating Inflation Expectations in a Randomized Price Information Experiment." *Rev. Econ. and Statis.* 98 (3): 503–23.

Armona, Luis, Andreas Fuster, and Basit Zafar. 2019. "Home Price Expectations and Behavior: Evidence from a Randomized Information Treatment." *Rev. Econ. Studies* 86 (4): 1371–410.

Bachmann, Rudi, Tim Berg, and Eric Sims. 2015. "Inflation Expectations and Readiness to Spend: Cross-sectional Evidence." *American Econ. J. Econ. Policy* 7 (1): 1–35.

Bhattarai, Saroj, and Christopher J. Neely. 2018. "An Analysis of the Literature on International Unconventional Monetary Policy." *J. Econ. Literature*, forthcoming.

Binder, Carola. 2015. "Whose Expectations Augment the Phillips Curve?" *Econ. Letters* 136:35–38.

———. 2017. "Fed Speak on Main Street: Central Bank Communication and Household Expectations." *J. Macroecon.* 52 (C): 238–51.

———. 2018. "Inflation Expectations and the Price at the Pump." *J. Macroecon.* 58 (1): 1–18.

———. 2020a. "Coronavirus Fears and Macroeconomic Expectations." *Rev. Econ. and Statis.* 102 (4): 721–30.

———. 2020b. "Long-Run Inflation Expectations in the Shrinking Upper Tail." *Econ. Letters* 186:108867.

Binder, Carola, and Alex Rodrigue. 2018. "Household Informedness and Long-Run Inflation Expectations: Experimental Evidence." *Southern Econ. J.* 85 (2): 580–98.

Blinder, Alan. 2009. "Talking about Monetary Policy: The Virtues (and Vices?) of Central Bank Communication." BIS Working Paper no. 274, Bank Internat. Settlements, Basel.

Blinder, Alan, Michael Ehrmann, Marcel Fratzscher, Jakob De Haan, and David-Jan Jansen. 2008. "Central Bank Communication and Monetary Policy: A Survey of Theory and Evidence." *J. Econ. Literature* 46 (4): 910–45.

Bordalo, Pedro, Nicola Gennaioli, Yueran Ma, and Andrei Shleifer. 2020. "Overreaction in Macroeconomic Expectations." *A.E.R.* 110 (9): 2748–82.

Bryan, Michael F., and Guhan Venkatu. 2001. "The Demographics of Inflation Opinion Surveys." *Econ. Commentary*, Fed. Reserve Bank Cleveland.

Burke, Mary A., and Ali Ozdagli. 2020. "Household Inflation Expectations and Consumer Spending: Evidence from Panel Data." *Rev. Econ. and Statis.*, forthcoming.

Candia, Bernardo, Olivier Coibion, and Yuriy Gorodnichenko. 2020. "Communication and the Beliefs of Economic Agents." Working Paper no. 27800, NBER, Cambridge, MA.

Carvalho, Carlos, and Fernanda Nechio. 2014. "Do People Understand Monetary Policy?" *J. Monetary Econ.* 66:108–23.

Cavallo, Alberto, Guillermo Cruces, and Ricardo Perez-Truglia. 2017. "Inflation Expectations, Learning, and Supermarket Prices: Evidence from Survey Experiments." *American Econ. J. Macroecon.* 9 (3): 1–35.

Coibion, Olivier, Dimitris Georgarakos, Yuriy Gorodnichenko, and Maarten van Rooij. 2019. "How Does Consumption Respond to News about Inflation? Field Evidence from a Randomized Control Trial." Working Paper no. 26106, NBER, Cambridge, MA.

Coibion, Olivier, and Yuriy Gorodnichenko. 2015. "Is the Phillips Curve Alive and Well after All? Inflation Expectations and the Missing Disinflation." *American Econ. J. Macroecon.* 7:197–232.

Coibion, Olivier, Yuriy Gorodnichenko, and Rupal Kamdar. 2018. "The Formation of Expectations, Inflation and the Phillips Curve." *J. Econ. Literature* 56 (4): 1447–91.

Coibion, Olivier, Yuriy Gorodnichenko, Lorenz Kueng, and John Silvia. 2017. "Innocent Bystanders? Monetary Policy and Inequality." *J. Monetary Econ.* 88:70–89.

Coibion, Olivier, Yuriy Gorodnichenko, and Saten Kumar. 2018. "How Do Firms Form Their Expectations? New Survey Evidence." *A.E.R.* 108 (9): 2671–713.

Coibion, Olivier, Yuriy Gorodnichenko, Saten Kumar, and Mathieu Pedemonte. 2020. "Inflation Expectations as a Policy Tool?" *J. Internat. Econ.* 124:103297.

Coibion, Olivier, Yuriy Gorodnichenko, Saten Kumar, and Jane Ryngaert. 2021. "Do You Know That I Know That You Know. . .? Higher Order Beliefs in Survey Data." *Q.J.E.* 136 (3): 1387–446.

Coibion, Olivier, Yuriy Gorodnichenko, and Tiziano Ropele. 2020. "Inflation Expectations and Firm Decisions: New Causal Evidence." *Q.J.E.* 135 (1): 165–219.

Crump, Richard, Stefano Eusepi, Andrea Tambalotti, and Giorgio Toppa. 2015. "Subjective Intertemporal Substitution." Staff Report no. 734, Fed. Reserve Bank New York.

D'Acunto, Francesco, Andreas Fuster, and Michael Weber. 2021. "Diverse Policy Committees Are More Effective." Working paper, Booth School Bus., Univ. Chicago.

D'Acunto, Francesco, Daniel Hoang, Maritta Paloviita, and Michael Weber. 2020. "Effective Policy Communication: Targets versus Instruments." Working Paper no. 2020-148, Becker Friedman Inst., Univ. Chicago.

———. 2021a. "Human Frictions to the Transmission of Economic Policy." Working Paper no. 29279, NBER, Cambridge, MA.
———. 2021b. "IQ, Expectations, and Choice." *Rev. Econ. Studies*, forthcoming.
D'Acunto, Francesco, Daniel Hoang, and Michael Weber. 2016. "The Effect of Unconventional Fiscal Policy on Consumption Expenditure." Working Paper no. 22563, NBER, Cambridge, MA.
———. 2021. "Managing Households' Expectations with Unconventional Policies." *Rev. Financial Studies*, forthcoming.
D'Acunto, Francesco, Ulrike Malmendier, Juan Ospina, and Michael Weber. 2021c. "Exposure to Grocery Prices and Inflation Expectations." *J.P.E.* 129 (5): 1615–39.
D'Acunto, Francesco, Ulrike Malmendier, and Michael Weber. 2021. "Traditional Gender Norms Distort Women's Economic Expectations." *Proc. Nat. Acad. Sci. USA* 118 (21): 1–10.
de Quidt, Jonathan, Johannes Haushofer, and Christopher Roth. 2018. "Measuring and Bounding Experimenter Demand." *A.E.R.* 108 (11): 3266–302.
Drager, Lena, Michael J. Lamla, and Damien Pfajfar. 2016. "Are Survey Expectations Theory Consistent? The Role of Central Bank Communication and News." *European Econ. Rev.* 85:84–111.
Drager, Lena, and Giang Nghiem. 2021. "Are Consumers' Spending Decisions in Line with an Euler Equation?" *Rev. Econ. and Statis.* 103 (3): 580–96.
Fuster, Andreas, Greg Kaplan, and Basit Zafar. 2021. "What Would You Do with $500? Spending Responses to Gains, Losses, News and Loans." *Rev. Econ. Studies* 88 (4): 1760–95.
Geraats, Petra M. 2007. "The Mystique of Central Bank Speak." *Internat. J. Central Banking* 3 (1): 1–44.
Haldane, Andrew, and Michael McMahon. 2018. "Central Bank Communications and the General Public." *American Econ. Assoc. Papers and Proc.* 108:578–83.
Hunziker, Hans-Ueli, Christian Raggi, and Rina Rosenblatt-Wisch. 2018. "The Impact of Guidance, Short-Term Dynamics and Individual Characteristics on Firms' Long-Term Inflation Expectations." Working Paper no. 2018-18, Swiss Nat. Bank, Zurich.
Jonung, Lars. 1981. "Perceived and Expected Rates of Inflation in Sweden." *A.E.R.* 71 (5): 961–68.
Kamdar, Rupal. 2018. "The Inattentive Consumer: Sentiment and Expectations." Working paper, Indiana Univ., Bloomington.
Kumar, Saten, Hassan Afrouzi, Olivier Coibion, and Yuriy Gorodnichenko. 2015. "Inflation Targeting Does Not Anchor Inflation Expectation: Evidence from Firms in New Zealand." *Brookings Papers Econ. Activity* (46): 151–225.
Roth, Christopher, and Johannes Wohfart. 2020. "How Do Expectations about the Economy Affect Personal Expectations and Behavior?" *Rev. Econ. and Statis.* 102 (4): 731–48.
Swanson, Eric T. 2021. "Measuring the Effects of Federal Reserve Forward Guidance and Asset Purchases on Financial Markets." *J. Monetary Econ.* 118 (March): 32–53.
Weber, Stephen J., and Thomas D. Cook. 1972. "Subject Effects in Laboratory Research: An Examination of Subject Roles, Demand Characteristics, and Valid Inference." *Psychological Bull.* 77 (4): 273–95.