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Reality Check: How People Form Inflation Expectations and Why You Should Care

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REALITY CHECK: HOW PEOPLE FORM INFLATION EXPECTATIONS AND WHY YOU SHOULD CARE

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Abstract: Household and firms' inflation expectations play a central role in macroeconomic models and policy discussions and shape observed economic choices in the data. We discuss how individual-level inflation expectations are measured, the patterns they display, their determinants, and how they impact household and firms' decisions. We conclude by highlighting the relevant open questions and why tackling these questions is important for academic research and policy makers.

JEL: D1, D2, D8, D9, E2, E3, E4, E5, E7, J1

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Ordering of authors has been randomly selected.

“[E]xpected inflation feeds directly into the general level of interest rates. Well-anchored inflation expectations are critical for giving the Fed the latitude to support employment when necessary without destabilizing inflation.” Jerome Powell, Chair of the Federal Reserve, August 2020

“Inflation expectations are terribly important. We spend a lot of time watching them.” Jerome Powell, Chair of the Federal Reserve, September 2021

1. Introduction

Central bankers commonly emphasize the role of inflation expectations in making policy decisions, as illustrated by the quotes from Jerome Powell above. Why would policymakers stress these specific expectations? In theory, how rapidly households expect prices to increase in the future should matter for how they allocate their spending over time. For example, expectations of much higher prices in the future should induce households to purchase more goods today while prices are still relatively low. Expectations about future prices also matter for firms when setting prices and wages or when deciding whether to borrow money to finance investment projects. These mechanisms imply that the beliefs of households and firms about the future evolution of prices in the economy matter for their current decisions, which explains why they receive so much attention from policymakers.

Despite the prominence of inflation expectations among researchers and policy makers, we still know little about how they are formed, their determinants, and how they affect real decisions. How do we even measure these beliefs? How do they evolve over time and across different subpopulations? What determines firms’ and households’ expectations about future prices in the economy? And do these beliefs really affect their decisions in practice, so ultimately should we care about understanding them? In this paper, we review each of these questions. First, we describe the challenges associated with measuring the expectations of households and firms in practice. Second, we present the most uncontroversial stylized facts about these expectations as measured in available surveys of households’ and firms’ inflation expectations. Third, we describe the main forces that seem to shape the evolution of inflation expectations. Finally, we review the evidence on whether/how those beliefs actually affect the decisions of both individual households as well as firms.

As we will describe, the measurement challenges are daunting. Tracking the inflation expectations of households and firms requires reaching those individuals in the first place, ensuring both a high enough response rate and a representative sample, and asking questions that yield precise answers about aggregate inflation expectations without either unduly confusing respondents with

economics jargon or providing excessive guidance that points respondents toward specific answers. While there are potential stumbling blocks at every step of the process, researchers have by now learned a lot about how to design surveys for both firms and households that can provide high-quality measures of their expectations about future price changes.

The resulting surveys, which now span dozens of countries and, in some cases, decades, yield a number of striking patterns. First, both households and managers commonly expect, on average, rates of inflation that are significantly higher than those actually experienced in their economies and those expected by professional forecasters. This pattern is particularly true for certain demographic groups and is more pronounced in countries that have experienced low and stable inflation for a long time. This positive “bias” in the beliefs of households and firms holds not just for their expectations about the future but also their perceptions about the past: they tend to believe that recent price changes have been larger than has generally been the case. Second, we detect substantial and systematic disagreement about future inflation within each of the groups we consider---households and firms. The range of expectations about future inflation revealed in these surveys is much wider than the recent historical variation in inflation: at any moment in time, some households expect very high inflation by historical standards while others expect very low inflation. The same is true for business executives and managers. We also present evidence that households and firms are not confident in their inflation forecasts, and that their expectations are not “anchored”.

Why would beliefs about future price changes differ so much? One major source of differences in expectations is the set of signals about price changes to which agents are exposed in their environments, such as those arising from recent shopping experience. A growing body of research has shown that both households and business executives form beliefs about future price changes based in part on the prices that they have recently observed. For example, in the U.S., gasoline price changes play a particularly important role, as they are easily and frequently seen, irrespective of the extent to which they affect agents’ consumption bundles. More generally, goods that are purchased more frequently, such as certain grocery items, shape people’s perceptions of broader price movements. Given that consumers purchase very different bundles of goods and purchase the same goods at different outlets, consumers will naturally observe different price changes and may therefore form conflicting views about the likely path of future prices. Other factors that have been found to be important include media coverage and policy actions. While these might be expected to move everyone’s expectations in the same way, some individuals pay

more attention to news than others or receive news from alternative news sources, which themselves may each emphasize different content. Cognitive constraints also can attenuate or amplify the response of different individuals to the same piece of information: even when receiving the *same* information, different agents may choose to pay more or less attention to the information depending on how much they trust the source or the extent to which the new information conforms to their view of the world, or might understand and interpret this information differently. All these mechanisms imply that pervasive disagreement about future price changes is unavoidable.

Of course, if beliefs about future price changes did not affect economic decisions, the evolution of those beliefs would not be a concern. But as emphasized by Fed Chair Jerome Powell, economic theory suggests that expectations of future price changes affect many economic decisions, hence the emphasis placed on them by policymakers. Recent empirical research has vindicated this view: when the inflation expectations of households or firms change, so do their economic decisions. We review this recent literature documenting how inflation expectations shape decisions and discuss the extent to which these results conform with, as well as challenge, the theoretical mechanisms commonly emphasized by macroeconomists and policy-makers. We also emphasize how this recent literature informs advances in macroeconomic theory, which we hope to see developed in future research, and open many new important and interesting questions that beget further inquiry. The wealth of new and recent data on inflation expectations and individual-level economic choices of households and firms makes these new exciting research endeavors feasible and compelling.

2. Challenges for measuring inflation expectations of households and firms

Measuring inflation expectations should be, in theory, a straightforward exercise: you simply ask a typical person to report his or her expected inflation over some horizon and then record his/her truthful, informed, unbiased response. In reality, one has to wrestle with a number of challenges with nearly every part of this “thought experiment”. We highlight the issues we find most concerning with survey design and refer the reader to Armantier et al. (2013) for a comprehensive discussion.

2.1 Sampling

In the age of declining response rates (BLS 2021) and evolving means of communication, reaching out to certain groups of the population and acquiring their consent to participate in a survey is not easy. For example, online/computer-based surveys, which offer the greatest flexibility, could be

straightforward for the computer-literate, young, and educated but often pose barriers for older individuals and minorities who may be less versed in technology or trust automated survey algorithms less than others. As a result, surveys often have to rely on a mixture of modes (online, phone, in-person) to be representative. The opportunity cost of participating in a survey also affects enrollment in a sample. This issue is particularly stark for surveys of chief executives whose time is scarce and who are only indirectly accessible through assistants. As a result, firm surveys are often based on convenience samples (client lists, club/association members, personal contacts, etc.). In short, finding a typical (i.e., representative) person can be difficult.

2.2 Wording

The actual wording of the survey question aimed at eliciting inflation expectations can also pose challenges. The Michigan Survey of Consumers (MSC) asks households to report their point prediction for the *change in the general level of prices*.¹ In contrast the Survey of Consumer Expectations (SCE), run by the Federal Reserve Bank of New York, asks households to report their expectations for *inflation*.² While inflation and the change in the general level of prices may seem equivalent for economists, which object the question elicits can differ across surveys because some populations, especially those who are not financially literate, may think about the prices in their nondurable consumption bundle rather than in the overall consumption bundle, can confuse levels vs. changes, or might be unfamiliar with the concept of inflation and have trouble using percentages (e.g., Bruine de Bruin et al. 2012). Furthermore, neither of the surveys specifies the price index respondents should have in mind while reporting their expectations. This ambiguity helps in generating a higher response rate but might introduce more disagreement in survey responses because respondents can have different beliefs about the weights used for computing inflation and include prices that are not a part of the Consumer Price Index (CPI) or other conventional price indices (Kumar et al. 2015). To avoid potential heterogeneity in responses that can stem from this issue, some surveys ask respondents to report their predictions for a specific price index (see Coibion et al. 2020 for examples), thus implicitly assuming the respondents know the index.

¹ The specific wording of the question is, “During the next 12 months, do you think that prices in general will go up, or go down, or stay where they are now?”

² The specific wording of the question is, “Now we would like you to think about the different things that may happen to inflation over the next 12 months.”

2.3 Priming

Another concern is that the survey design can inadvertently nudge (or “prime”) respondents to provide their responses in a particular direction. For example, if a respondent reports an inflation forecast that an interviewer finds unrealistic, the interviewer may probe the respondent with a clarifying question³, as a result of which the respondent may feel compelled to adjust the response toward a “more realistic” value. In some cases, probing only happens when respondents provide seemingly unrealistic inflation forecasts in the positive domain, thus inducing an asymmetry in the elicitation procedure. These follow-up questions—which are meant to reduce noise in survey responses—may therefore lead to a distorted measure of what people think about future inflation. Priming can take a variety of forms such as providing additional information (e.g., recent inflation, examples for possible responses),⁴ the list and order of possible options in multiple choice questions,⁵ using a screener question to exclude some respondents⁶, etc.

2.4 Point predictions vs. distributions

Manski (2004) popularized the use of survey questions that elicit subjective probability distribution about future outcomes at the micro and macro levels. For example, the SCE asks respondents to assign probabilities to 10 possible outcomes: “the rate of inflation will be 12% or higher”, “the rate of inflation will be between 8% and 12%”, ..., “the rate of deflation (opposite of inflation) will be 12% or higher”. One can use the reported probability distributions to infer not only a central tendency (mean, mode, etc.), which is highly correlated with point forecasts, but also the associated uncertainty in an individual’s forecast. On the other hand, responding to this

³ The Michigan Survey of Consumers provides the following instruction to interviewers, “IF R GIVES AN ANSWER THAT IS GREATER THAN 5%, PLEASE PROBE WITH: “Let me make sure I have that correct. You said that you expect prices to go (up/down) during the next 12 months by (X) percent. Is that correct?”.

⁴ For example, the Survey of Inflation and Growth Expectations, run by the Bank of Italy, provides managers with the most recent actual inflation rate before asking managers to report their inflation expectations (“The last [month] consumer price inflation, measured by the 12-month change in the harmonized index of consumer prices was equal to [IT] in Italy and to [EA] in the euro area. What do you think it will be in Italy...”). Not providing this information affects the level and dispersion of inflation forecasts (Coibion, Gorodnichenko and Ropele, 2020).

⁵ For example, the Business Outlook Survey, run by the Bank of Canada, offers only four possible outcomes for inflation forecasts: “less than 1%”, “1 to 2%”, “2% to 3%”, “more than 3%”. Coibion et al. (2020) document that offering a limited choice reduces the dispersion of reported responses. Furthermore, these options are centered on 2%, the inflation target. If a respondent is uncertain about future inflation, he or she may pick the center of the provided range. In short, responses to this question may provide a (spurious) sense of inflation expectations being anchored.

⁶ For example, while collecting households’ inflation expectations, the Reserve Bank of New Zealand uses a screener question (“What is your understanding of the term inflation?”) to exclude respondents who do not understand what inflation is. See <https://www.rbnz.govt.nz/statistics/m13> for more details.

type of questions can be cognitively demanding. Researchers document that these probabilistic elicitations induce a higher dropout rate from the survey, which might bias the inference one draws from these answers (D’Acunto et al., 2020). Furthermore, using a fixed set of bins for possible outcomes can be constraining in times of crisis or otherwise unusual times (e.g., responses can lump in extreme bins⁷) and can be prone to priming (e.g., ordering inflation bins before deflation bins can result in higher expected inflation). Moreover, these questions typically center around 0 and have narrower bandwidth around 0 than at the extremes, possibly inducing survey participants to perceive these bins being considered more likely by the designer of the survey. Finally, empirical research shows that survey participants might report distributions that feature holes, which likely reflect their inability to understand a probability distribution. To address some of these issues, Delavande and Rohwedder (2008) propose simplified visual representations of probability masses that reduce the cognitive burden for respondents who have lower numerical literacy. Moreover, Altig et al. (2020) propose asking respondents to report five possible scenarios for a given variable and then assign probabilities for these scenarios.

2.5 Panel Conditioning

Some surveys attempt to get participants to enroll in multiple survey waves. Repeated participation can be useful in many regards, since by looking at the evolution in views of a common set of individuals, one does not need to worry about a changing composition of respondents and changes in expectations can be directly used to explain changes in behavior. But one potential limitation of repeatedly surveying the same individuals about the same topic is that respondents may learn, from their very participation in the survey, about the topic they are being asked about. Commonly known as panel conditioning, this effect is typically small but in the case of inflation expectations of households, recent evidence indicates that it can be quite large. Binder and Kim (2021) document that households participating in the SCE reduce their inflation expectations by 2 percentage points on average after participating for a few months, indicating that repeat participants may no longer be considered representative of the broader population.

⁷ For example, in response to the Great Recession and the COVID19 crisis, the U.S. Survey of Professional Forecasters revised scenarios (“bins”) for possible outcomes.

2.6 Addressing the challenges

Although these challenges may appear unsurmountable, survey designers have been creative in coming up with solutions to these potential issues. For example, to build a high-quality sample of respondents, one can rely on the credibility of the government or the survey company (e.g., the response rate for a survey run by a private firm is often 10 percent or less while government-run surveys have response rates of between 50 to 80 percent). Using visual aids can help improve the response rates and quality of responses, especially for those who struggle with understanding questions or formulating responses (e.g., Delavande et al. 2011). Quantitative questions can be complemented with easier-to-answer qualitative questions. Testing various elements of survey instruments can help quantify potential biases in responses. Generally, more educated, financially-literate respondents (e.g., firm managers) are less sensitive to variations in the wording of questions. Some forms of priming could be addressed easily by e.g. randomly changing the order of questions/options or making responses more open ended.

3 Shared Facts About the Inflation Expectations of Households and Firms

In this section, we discuss several baseline facts about subjective inflation expectations that are common for both households and firms in survey-based data: (i) a systematic upward bias in numerical inflation expectations when compared to both lagged realized inflation and the average numerical expectations of professional forecasters; (ii) a large amount of disagreement about future inflation, including fat tails; (iii) high uncertainty in forecasts of future inflation, (iv) strong correlation between revisions in short-run and long-run inflation forecasts and (v) predictability in inflation forecasts from perceived inflation. These facts have been detected for both households and firms, even though their incidence appears stronger among households (Link et al, 2021). Documenting these facts and their robustness across data sets, countries, and time periods is important to guide the empirical search for the determinants of household and firms' inflation expectations and how these expectations determine real decisions, which we discuss in the next sections.

3.1 Systematic Upward Bias in Inflation Expectations

A first and ubiquitous fact related to the time series of average inflation expectations for both households and firms is a systematic positive bias. Across different data sets, countries, and time

periods, researchers have documented that the average and median numerical inflation expectations of households and firms tend to be higher than ex-post realized inflation rates as well as the contemporaneous inflation expectations of professional forecasters and financial-market participants, as measured by 1-year inflation swaps.

Figure 1 presents a summary of this fact. The figure plots the mean of the numerical inflation expectations elicited from households each month in the MSC as well as the mean response of CEOs and other business executives participating in the Survey of Firms' Inflation Expectations (SoFIE). For comparison, the figure also includes the time series of expectations extracted from asset prices by the Federal Reserve Bank of Cleveland as well as professional forecasts of inflation from the Survey of Professional Forecasters.

The figure illustrates that U.S. households' inflation expectations are systematically higher than those of either professional forecasters or financial market participants. The inflation expectations of firms also depart significantly from the latter two groups, although the extent of the upward bias varies more over time. Other work has documented very similar patterns for households and firms in many other advanced economies characterized by low and stable inflation (e.g. Candia et al. 2021b). The positive upward bias of households' and firms' inflation expectations is one of the most robust characteristics emanating from these surveys.

On top of detecting this upward bias in average subjective inflation expectations, researchers have also noted that the size of the bias varies systematically across certain demographic groups. Gender is one of these demographics: the upward bias is systematically higher for women than for men (Bruine de Bruin et al., 2010; D'Acunto, Malmendier, and Weber, 2021), a point we return to in section 4.1. Moreover, the bias falls with the level of agents' cognitive abilities (D'Acunto et al, 2019). Researchers have also found that socioeconomic status—a combination of formal education and income levels—helps to explain cross sectional variation in several macroeconomic expectations (Das, Kuhnen, and Nagel, 2020), including the size of the upward bias in inflation expectations (Bruine de Bruin et al., 2010; Angelico and Di Giacomo, 2020): Households from lower socioeconomic backgrounds tend to have systematically higher inflation expectations than others.

On the firm side, systematic differences in inflation expectations have been detected across industries (Coibion, Gorodnichenko and Kumar 2018), which pointed researchers toward considering industry-level variation as an important dimension to understand the formation of

firms' inflation expectations, as we discuss below. The position of a respondent within a firm is also systematically predictive of their inflation expectations: CEOs and CFOs have lower inflation expectations than other managers who in turn have lower inflation expectations than the average person, even after controlling for differences in education and income (Savignac et al. 2021).

3.2 Disagreement about Future Inflation

A second common empirical fact across surveys of households or firms is the large cross-sectional dispersion of inflation expectations even within the same survey waves: individuals have very different beliefs about the likely evolution of inflation in the future (Mankiw, Reis and Wolfers 2004). Figure 2 illustrates this fact by reporting the distribution of numerical inflation expectations across all waves of the MSC for households (Panel A), across all waves of the SoFIE survey for firms (Panel B), as well as for professional forecasters in the SPF (panel C) for comparison. The figure reveals that, for households and firms, reported inflation expectations cover an extremely wide range of values whereas those of professional forecasters are very tightly concentrated around the mean. This profound disagreement about aggregate inflation expectations is surprising because all agents are asked to report expectations about the same macroeconomic variable rather than about a personal-outcome variable and points towards two potential directions in terms of determinants of aggregate expectations—variation in the information sources different agents use to form their expectations and variation in economic beliefs driven by a different interpretation of economic and other shocks that all agents face.

3.3 Uncertainty in Inflation Expectations

One feature that is clearly visible in Figure 2 is the extent to which households and firms' expectations tend to be reported as multiples of 5. This form of rounding has been interpreted as a proxy for respondents' uncertainty regarding the actual level of their inflation expectations (Binder 2017). Another way to gauge the uncertainty in forecasts is having respondents assign probabilities to a range of possible outcomes for future inflation. Figure 3 presents results from doing so, focusing specifically on the probability that people assign to inflation being above either 4 or 5% in the next twelve months. For households and firms, these probabilities tend to be quite high, which indicates that they are quite uncertain about the inflation outlook. For professional

forecasters, uncertainty is much lower. This relative difference in forecast confidence of professionals relative to households and firms has also been found to be a pervasive characteristic of inflation expectations for the general public.

3.4 Short-Run and Long-Run Expectations

We have so far restricted our attention to one-year ahead inflation forecasts, which is a relatively short horizon. Some surveys also ask respondents about inflation over longer time horizons such as 5 or 10 years. These longer-run expectations of inflation can be informative about the degree to which inflation expectations are anchored, or tied to the central bank's inflation target, since temporary shocks to inflation should dissipate over such long horizons. Indeed, a common definition of "anchored" expectations is that changes in short-run inflation expectations should be largely uncorrelated with changes in long-run expectations: if one believes that the central bank is successful in achieving its target for inflation, current shocks to inflation should be offset by the central bank and long-run expectations should therefore be insensitive to short-run fluctuations.

Figure 4 presents tests of this notion for households, firms, and professional forecasters in the U.S. by plotting the correlation between revisions in individuals' one-year ahead inflation expectations with their revisions in expectations about longer-run inflation. Strikingly, there is a strong positive correlation between these revisions, indicating that inflation expectations are *not* well anchored. Shocks to the economy that lead individuals to expect higher inflation over the next year also lead those individuals to expect significantly higher inflation over the next five to ten years, indicating that people do not think that inflation shocks are short-lived.

3.5 Perceived and Expected Inflation

These results indicate that households and firms have inflation forecasts that are too high on average both in the short-run and the long-run and that they have little confidence in their forecasts. Furthermore, systematic disagreement about future inflation is detected within both households and firms. What could explain such disagreement? One possibility is that different individuals hold different opinions about how the economy works, leading them to anticipate a different evolution of prices in the future given the current state of the economy (Andre et al., 2021). Another possibility is that different individuals hold very different views about the current state of the economy, and in particular about recent inflation, leading them to predict different levels of future

inflation. The latter possibility can be assessed directly by looking at the *perceived* levels of inflation, i.e. what individuals believe has been the recent rate of inflation in the economy. To the extent that this information is publicly available, one might expect everyone to be aware of it. But in fact, the beliefs of households and firms about recent inflation display the same characteristics as their beliefs about future inflation. Indeed, it turns out that what people believe about recent inflation is one of the strongest predictors of what they predict about future inflation. This result was first documented for Swedish households in Jonung (1982) and has repeatedly verified since. Figure 5 plots this result for U.S. households and firms: those who believe that inflation has recently been high tend to be the same people as those who believe that future inflation will be high. We can therefore explain much of the variation in people's beliefs about the future through their beliefs about the past.

4. Determinants of Households' and Firms' Inflation Expectations and Perceptions

If much of the differences in people's forecasts of future inflation stem from their different views about recent inflation dynamics, where does the disagreement about the latter stem from? When households or business executives are asked about how they receive information about inflation, most report that their main source of information is their own shopping experience (D'Acunto et al. 2021b, Cavallo et al. 2017, Kumar et al. 2015), as well as family and friends. A second source that they emphasize is the news and social media. In this section, we review the evidence on these potential channels underlying differences in perceived and expected inflation and discuss additional mechanisms that have been suggested by recent research, including cognitive constraints and differences in incentives to pay attention to inflation.

4.1 Exposure to Heterogeneous Price Signals

Recent research on understanding inflation expectations has focused on the fact that households differ in the price changes they observe in daily activities, such as shopping or consuming food outside. Even if grocery bundles represent a relatively small fraction of individuals' overall consumption baskets, grocery prices changes are quite visible during one's daily activities and are heterogeneous across consumers and shopping outlets. Grocery price changes thus provide heterogeneous signals about inflation across agents. Moreover, as one might expect, recently

observed price changes play a disproportionate role in driving individuals' perceptions of broader price movements in the economy. One study, for example, documented that the average inflation expectations of U.S. households are particularly sensitive to changes in oil prices over time, which are the main determinant of the gasoline prices that are omnipresent in American life and one of the most frequently purchased items. Another recent study investigated systematically whether households' inflation expectations tend to respond to the price changes of the goods that they purchase the most. Specifically, D'Acunto et al. (2021b) make use of a survey of 60,000 Americans for whom researchers can observe the specific goods they purchase and the exact prices they pay at the weekly frequency due to the fact that these households use optical scanners to track all of their purchases. They find that households who have observed the highest inflation rates in their own consumption bundles have significantly higher inflation expectations than households with the lowest realized inflation rate. This link is driven by the price changes of the goods that are purchased most frequently by each household: someone who purchases milk frequently tends to think aggregate inflation is rising when they observe an increase in the price of the milk they purchase. Moreover, individuals tend to put a higher weight on positive price changes rather than negative price changes, which helps to explain the general upward bias in expected inflation.

Observed price changes will differ across individuals that have different grocery bundles as well as across individuals who shop at different grocery stores. When asked about which price signals they thought about when forming inflation expectations, women tend to mention the price of milk or bread, whereas men are more likely to mention the price changes of beer and gasoline. The amount of shopping agents do is also important. Individuals who report doing most of the shopping for their household typically have higher inflation expectations than those who do not. Since women are more likely to be the primary shopper within their household, the fact that they tend to expect higher inflation can be explained by their shopping habits. In other words, the difference in the average inflation expectations of men and women previously mentioned disappears once one controls for who is primarily responsible for the shopping: men who do the shopping in their household have the same average expectations of inflation as women who do the shopping, and the same is true for men and women who are not responsible for doing the shopping for their household (D'Acunto et al 2021a).

Another dimension in which observed grocery price changes might bias inflation expectations is that individuals on average are correctly informed about the current price level but

they tend to have a downward bias when recalling the past prices of the same goods (D'Acunto and Weber, 2021). As a result of this bias in memory, perceptions of inflation arising from shopping will tend to be biased upward (Bordalo et al. 2017, Enke et al. 2020). These biases are also likely to be more persistent in agents' mind in times of major shocks to their environment and the set of price signals agents observe around them (Goldfayn-Frank and Wohlfart, 2020).

The importance of observed prices in forming views about aggregate price changes is not limited to households. Firms seem to display similar characteristics with the prices that they observe in their industry. Andrade et al. (2020), for example, show that firms in sectors that have witnessed higher inflation recently tend to form higher beliefs about aggregate inflation, even when those industry-level price changes are unrelated to aggregate price changes. The importance of directly observed price changes as an individual-level source of price change signals that helps to explain aggregate inflation expectations is a pervasive finding in the literature.

4.2 Media and Policy Communication

The fact that inflation expectations are on average biased upwards and dispersed across individuals suggests that households and firms might not devote much attention to media coverage of inflation or to public announcements, such as press releases by the Federal Market Open Committee (FOMC), at least in low inflation environments. And indeed, Carroll (2003) estimates a model in which individuals update their expectations probabilistically to news coverage of inflation and finds that on average, individuals update their inflation expectations about once a year. Using data from the European Commission Survey of Consumer Expectations for Germany, D'Acunto et al. (2021e) find that the average household does not update upwards her inflation expectations to the first forward guidance announcements by the European Central Bank as theory would suggest but instead adjusted upwards her inflation expectations sharply to announcements of future increases in consumption taxes. They argue that policy complexity plays a major role in how individuals react to policy announcements. Forward guidance would require individuals to understand that keeping interest rates low beyond the time it is warranted by future economic conditions will generate inflation in the future and they should update inflation expectations today. Instead, announcing higher consumption taxes in the future directly tells households that prices will rise. Using data on media coverage, D'Acunto et al. (2021e) find that the consumption tax

announcement was heavily discussed in print and online media whereas discussions of forward guidance were relegated to specialized media sources, which most households do not access.

Focusing on the announcement of the change in the policy framework by the Federal Reserve at the 2020 Economic Policy Symposium in Jackson Hole, Coibion et al. (2020a) document that the vast majority of households did not hear any news about monetary policy in the days surrounding the announcement. The fraction of survey participants that reports having heard news about monetary policy increases only slightly following the announcement, and those that report having heard news are not more likely to pick the correct policy framework in a multiple choice question. Their inflation expectations did not differ from those of individuals who report not having heard any news. Hence, even one of the most dramatic policy announcements in recent decades did not reach most households in the U.S. Focusing on more standard monetary policy news, Lamla and Vinogradov (2019) show in daily event studies around announcements by the FOMC that announcements do not affect individuals' inflation expectations.

This line of work is consistent with the view that the current conduct of monetary policy communication is likely ineffective in reaching ordinary households, contrary to more innovative forms of engagement such as the reggae songs by the Central Bank of Jamaica or the use of Twitter as a communication tool by Olli Rehn, the Governor of the Bank of Finland.⁸ To study the potential role of communication on the inflation expectations of households and to establish causality, a growing body of work uses information provision experiments in surveys. A typical paper in this literature elicits inflation expectations, then randomly splits the sample of survey participants into treatment and control groups and provides different pieces of information such as inflation forecasts or targets to individuals in the treatment groups, and elicits posterior expectations subsequently. The updating of expectations relative to the survey participants in the control condition thus provides the causal treatment effect on inflation expectations. Coibion et al. (2021 b,c) find that, in agreement with Bayesian learning, providing information about simple summary statistics of inflation such as current, past, or expected inflation and the Fed inflation target result in large average revisions of inflation expectations of 1 to 1.5 percentage points. Providing individuals with the full FOMC press release, which contains these statistics, but also more

⁸ More generally, policy communication should be more accessible to the general public by making messages easier to understand and relate to (e.g., Bholat et al. 2019, Haldane and McMahon 2018). Blinder et al. (2008) provide an early survey of the literature on the importance of policy communication for monetary policy.

technical details and context, results in an average forecast revision of similar magnitude. The survey participants who instead received the coverage of the FOMC announcement from a media source—USA Today—revised their expectations by less than half the others. The need to read a text of several paragraphs and comprehend its content cannot explain the difference between the media condition and the treatment effects of providing summary statistics, because the FOMC announcement includes more jargon and complexity than the media article, which is explicitly written for a broader readership. The authors also show that a lack of credibility of USA Today relative to other newspapers is an unlikely explanation because USA Today ranks higher in terms of credibility for economic and business topics relative to the New York Times, the Wall Street Journal, or the Washington Post. Instead, they find that traditional news media have low credibility and attract lower trust than other sources in a representative sample of 25,000 Americans. They also show that it is especially survey participants with low income and low formal education that barely react to the media treatment, whereas they react to the FOMC statement.

Overall, the muted impact of official releases, communication, and the media on inflation expectations is consistent with individuals reporting that they predominantly rely on the price changes they observe in their own shopping when forming inflation expectations.

4.3 Cognitive Constraints

Even when individuals receive the same news about the economy or observe the same price changes, differences in cognitive abilities may shape how they interpret that information. Consistent with this mechanism, recent work has confirmed that differences in cognitive abilities contribute to shaping inflation expectations. D'Acunto et al. (2019, 2021c,d) link measures of cognitive abilities for all men in Finland from a military entrance test—IQ—at the individual level with survey data on inflation expectations and consumption plans. They find that individuals at the bottom of the IQ distribution have mean absolute forecast errors for inflation that are larger by a factor of 2 relative to men at the top of the distribution and that forecast errors decline monotonically in IQ. Relating consumption plans to inflation expectations, they find that only men above the median level of IQ increase their planned spending when they expect higher inflation. Differences in financial constraints, formal education, or income, by contrast, do not matter for these associations once IQ is controlled for. The authors also find that high and low IQ respondents think about substantially different concepts of inflation when answering surveys: low IQ respondents predominantly think

about the prices changes of a few concrete goods they have in mind, whereas high IQ respondents are more likely to think about the abstract concept of inflation and its relation with other macroeconomic variables. Jointly, these results suggest that differences in cognitive abilities play an important role in shaping inflation expectations and help inform recent advances in macroeconomic theory on how to model heterogeneous agents and agents with limited cognition.

4.4 Incentives to Gather Information About Inflation

Given the potential ease with which individuals could access information about inflation, the fact that most households and firms choose to remain relatively uninformed must reflect the fact that their perceived return to knowing about inflation is limited. But this return is likely to vary and, for some, the incentive to be informed will be higher. We have already discussed one example of this incentive effect, noting that business executives and managers tend to know more about average inflation than households but less than professional forecasters. Moreover, households with higher incomes or who own mortgages tend to have more accurate inflation expectations. There are many more examples of incentive effects that have been documented in the literature.

In the case of firms, one key determinant of the extent to which executives are informed about inflation is the number of competitors their firm faces. Afrouzi (2019) and Coibion, Gorodnichenko and Kumar (2018) document using a survey of firms in New Zealand that as firms face more competitors, their knowledge of inflation dynamics is higher. Another determinant is the number of products firms sell. Yang (2020) finds that as firms sell a larger and wider range of products, their attention to aggregate inflation increases, whereas firms that sell a more limited number of products find it sufficient to be informed mainly about their own niche market. A third determinant is how soon firms expect to change their prices: firms anticipating changing prices in the near future acquire more information about inflation to guide their pricing decisions, whereas firms not expecting to change prices for many months choose to be less well-informed.

5. Inflation Expectations and Economic Choices

From an aggregate perspective, understanding and managing inflation expectations, for example via central bank communication, matters only to the extent that households' and firms' inflation expectations affect their actual decisions. In theory, the extent to which individuals expect prices to rise in the future should matter for many decisions such as savings and consumption choices,

wage bargaining and labor supply, but also investment, leverage, hiring, and price-setting decisions. Providing clear causal evidence on the extent to which inflation expectations actually affect decisions has become an active area of research.

5.1 Inflation Expectations and Households' Choices

Intuitively, when households anticipate higher price growth in the future, they should choose to consume more today before those price increases materialize. Durable spending should be affected most, because it is easier to substitute intertemporally than non-durable spending. This theoretical prediction was first tested at the individual level in Bachmann et al. (2015) using data from the MSC. They found no association between individuals' willingness to purchase larger ticket items and their inflation expectations, on average, although a positive correlation was detected among highly educated respondents. The MSC is largely a cross-sectional dataset and large dispersion in inflation expectations might complicate the empirical analysis if level differences in average expected inflation rates exist across individuals. Consistent with this possibility, D'Acunto et al. (2021e) find that most individuals who expect higher inflation going forward relative to their baseline assessment of price changes report that now is a good time to consume and especially to purchase durable goods. They exploit a pre-announced increase in consumption taxes for identification using a difference-in-differences estimator that compares the consumption response and inflation expectations of treated households after the announcement relative to before as well as relative to the behavior of observationally identical households who were not affected by the announcement. Moreover, using data from Finland, D'Acunto et al. (2021c) find that only the top half of the Finnish population by IQ engages in intertemporal substitution when expecting higher inflation. This result is independent of financial constraints, formal education, or other observable characteristics and could be interpreted as a *human friction* (D'Acunto et al. 2021d), which limits the transmission of economic policy interventions

To further improve on identification of causal relations between inflation expectations and consumption, a recent literature uses randomized controlled trials (RCTs) to generate exogenous variation in inflation expectations, instrumenting post-intervention inflation expectations with the treatment status and using the instrumented inflation expectations to predict consumption decisions (see Haaland et al. 2021 for a recent review). Coibion et al. (2021b) use customized surveys on the Nielsen HomeScan Panel (KNCP) and find that, in both survey and actual scanner data, households

with higher expected inflation increase their nondurable consumption for up to six months after the survey intervention. Because the KNCP does not contain larger ticket items, they focus on surveys three and six months after the experimental variation to study whether higher inflation expectations induced individuals to change their purchases of durable goods. Contrary to economic theory, they find that exogenously higher inflation expectations result in a lower likelihood that individuals purchased larger ticket items in the months after treatments. Other studies also using experimental variation find similar results in the US and the Netherlands (Coibion et al. 2019, 2021c), which might be driven by individuals associating higher inflation with worse economic outcomes (Andre et al. 2021; Kamdar, 2019; D’Acunto et al., 2021c).

These findings show that households do in fact use their inflation expectations when making economic decisions. But the partially conflicting evidence across studies and across types of goods shows that the literature has not yet fully understood the mechanisms and mental models households use when relating inflation expectations to consumption decisions. Therefore, central banks that want to manage inflation expectations as a policy tool have to be cautious, because raising inflation expectations could in fact backfire (Coibion et al. 2020b). More research should be devoted to better understand the inflation expectations-consumption nexus and which channels central banks can use to reach ordinary households with their communication. Households have been shown to understand simple messages about the aims of policy interventions such as the “whatever it takes” speech by former ECB president Mario Draghi but to barely react to communication about policy instruments such as large scale asset purchases (D’Acunto et al. 2020). Moreover, the identity of the sender matters. D’Acunto et al. (2021) show that groups that have been historically underrepresented on monetary policy-making bodies, such as women and minorities, are more likely to form expectations in line with provided official forecasts when the forecasts are associated with a female or Black policymaker.

Besides the consumption and savings choices, inflation expectations should also influence individuals’ leverage decisions, their homeownership and mortgage choices (Botsch and Malmendier, 2021), as well as their wage bargaining and labor supply decisions. So far, systematic evidence for these outcomes is limited because of a lack of representative data, but a detailed map of the effects of inflation expectations on multiple economic choices is crucial to assess the potential role of expectations as a monetary policy tool. Research should make progress on these questions using customized survey data linking expectations with actual decisions.

5.2 Inflation Expectations and Firms' Choices

Firms' price-setting, labor demand, investment and leverage decisions directly depend on their inflation expectations. Firms' price-setting decisions also directly affect overall inflation but little knowledge exists for how firms pass through increases in marginal costs into prices and to which extent expectations of the overall rate of inflation shape firms' decisions. Two recent studies provide direct causal evidence that changes in inflation expectations do in fact shape economic decisions. One (Coibion et al. 2018) uses a one-time RCT of firms in New Zealand while the other (Coibion et al. 2019) uses a repeated RCT of firms in Italy. In each country, a subset of firms was provided with information about inflation or monetary policy while a control group received no such information. As with households, these studies found that the information had pronounced effects on the inflation expectations of the treated firms. These two studies then tracked the decisions of firms after the information treatments to discern how their changes in beliefs changed their economic decisions, if at all. While conceptually similar, the two studies differed in the countries considered, the duration of the information treatments (one-time in New Zealand vs. repeated over years in Italy), the monetary policy regime (Italy was at the zero-bound for part of the sample), how outcomes were measured (self-reported actions in New Zealand vs. administrative data in Italy) and the types of firms (the New Zealand study had primarily small firms while the Italian study had primarily larger firms). Despite these differences, the studies both found decisive evidence that changes in inflation expectations, induced by randomly allocated information treatments, had pronounced effects on the economic decisions of firms. Employment and investment decisions were found to be particularly sensitive to inflation expectations, while prices were only found to respond in Italy.

6. Conclusion

Inflation expectations affect the economic decisions of both households and firms and for this reason have been thrust into the limelight by policy makers for decades. Academic research has only recently caught up by documenting and understanding household and firms' inflation expectations, because the individual-level elicitation of expectations and choices through surveys has become increasingly common around the world. We now know more than ever about how firms and households form their beliefs about future inflation and how these beliefs feed into the economic decisions of both households and firms.

But much more remains to be learned. The precise mechanisms through which inflation expectations affect decisions, for example, remain ambiguous. The main drivers of the pervasive disagreement observed across agents are not fully identified. Moreover, policy-makers' ability to shape inflation expectations is understudied and still a point of contention in the literature. Macroeconomic theory also needs more empirical guidance to understand how to effectively model heterogeneous agents who form different expectations and hence make different choices. With new survey data becoming available by the day, RCT methods being increasingly accepted to provide identification, and the rebound of inflation levels around the world, the next decade promises to be an exciting one for exploring the empirical and theoretical formation and implications of inflation expectations.

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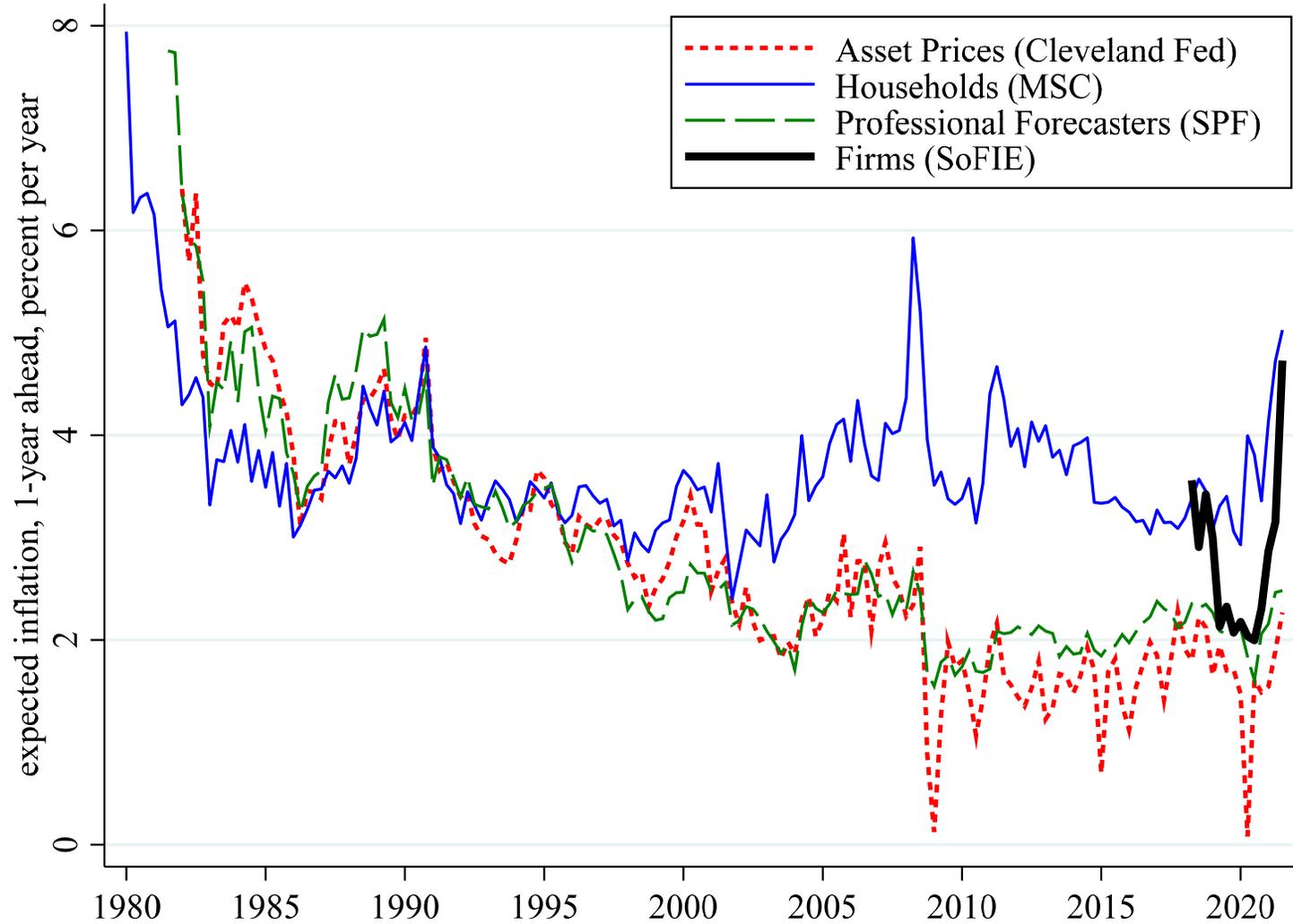
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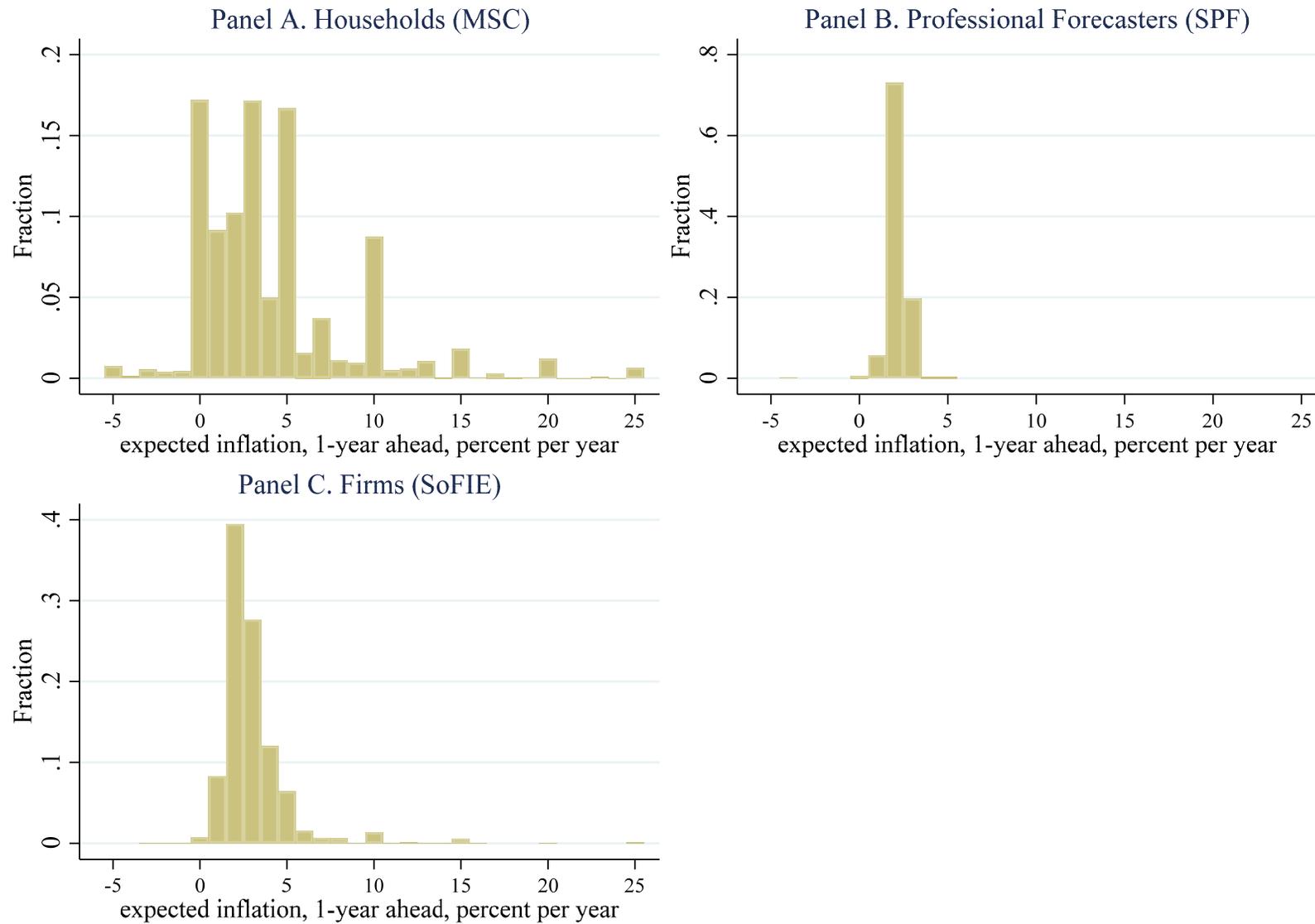
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Figure 1. Mean Inflation Expectations.



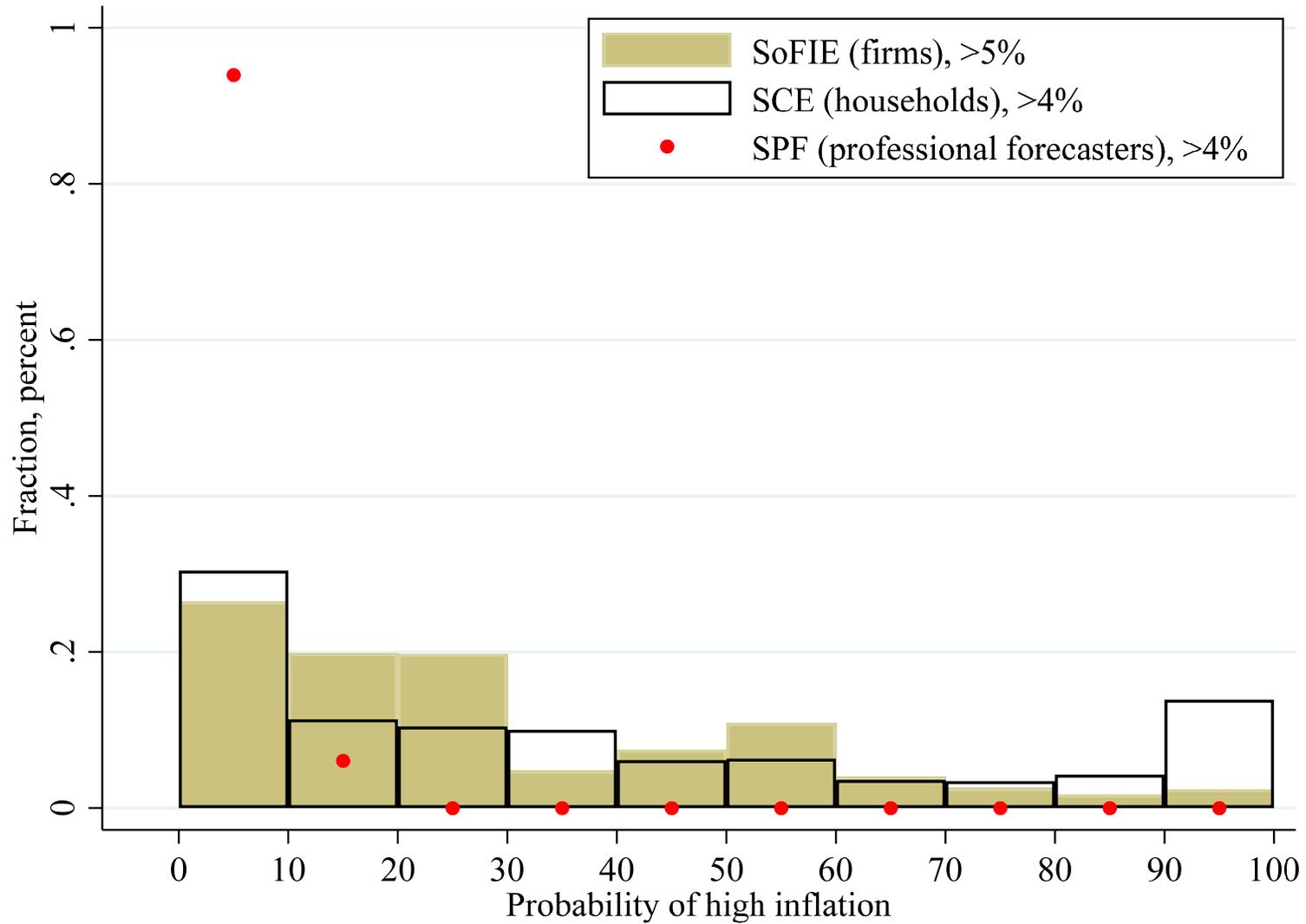
Notes: Financial markets' expectations are from the Federal Reserve Bank of Cleveland, households' expectations are from the Michigan Survey of Consumers (MSC), professional forecasters' expectations are from the Survey of Professional Forecasters run by the Federal Reserve Bank of Philadelphia, managers' expectations are from the Survey of Firms' Inflation Expectations (SoFIE). We exclude responses of households that are greater than 15 percent or less than -2 percent. Firms' expectations are from our new survey of CEOs. We exclude responses that are greater than 15 percentage points or less than -2 percentage points. All moments are computed using survey weights. Source: Candia et al. (2021a).

Figure 2: Cross-sectional dispersion in expectations



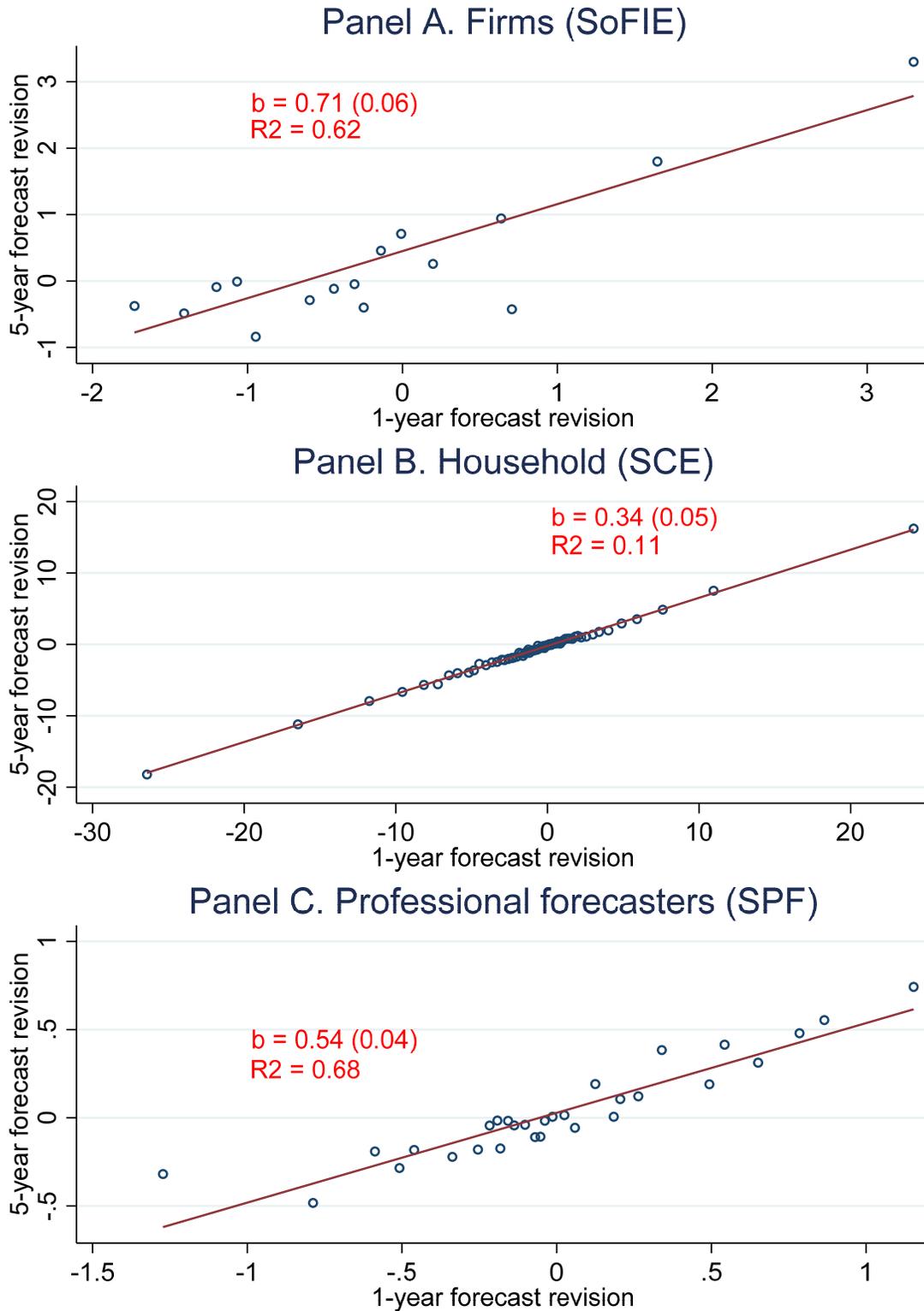
Notes: The figure reports the distribution of short-term (1-year-ahead) inflation forecasts. Panel A shows results for households (Michigan Survey of Consumers, MSC). Panel B shows results for professional forecasters (Survey of Professional Forecasters, SPF). Panel C shows results for firms (Survey of Firms' Inflation Expectations). The distributions are computed using survey weights. The sample period covers 2018Q2-2021Q3.

Figure 3: Uncertainty in Inflation Expectations



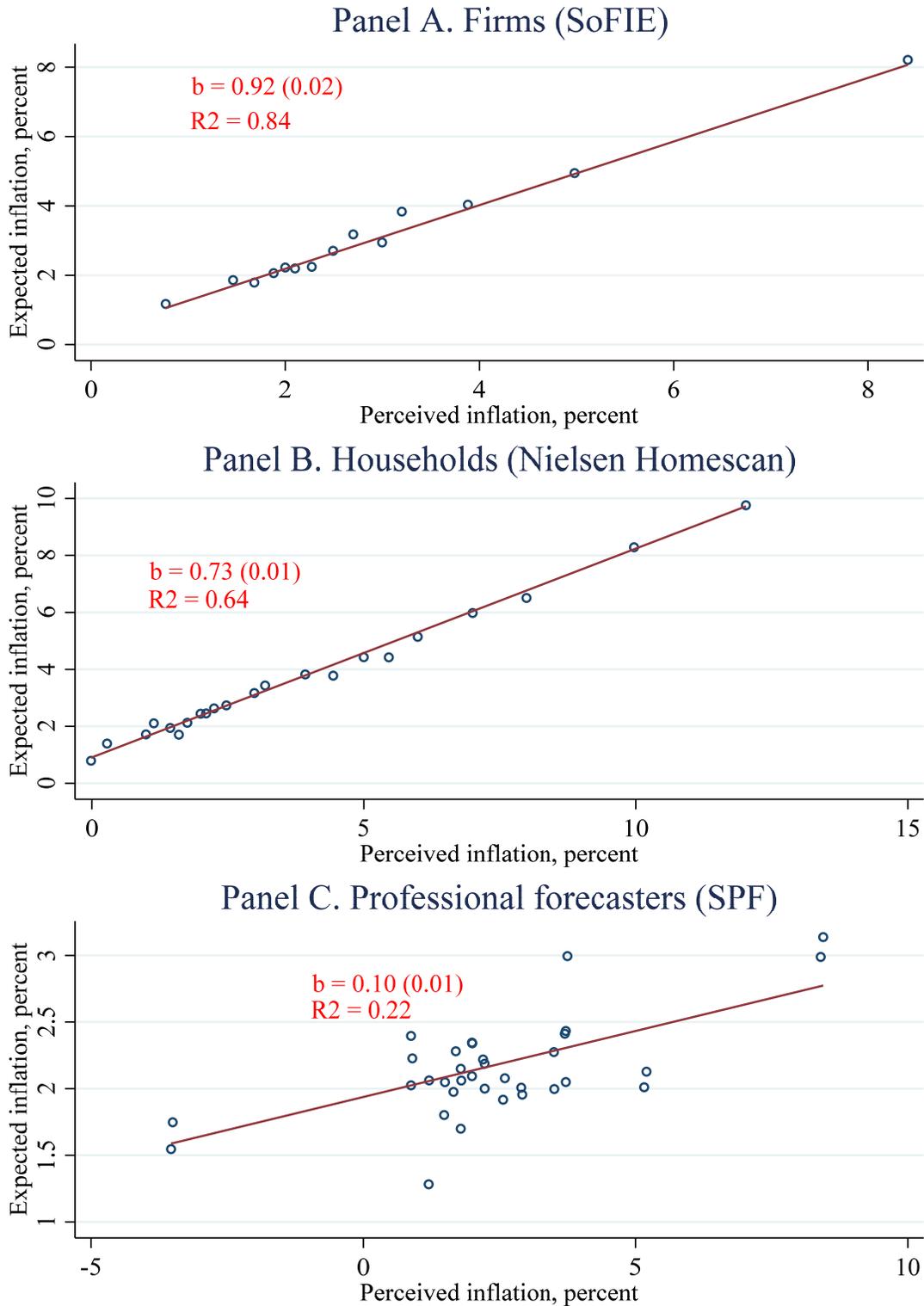
Notes: The histogram show uncertainty for expected inflation in 2019Q1. Survey of Firms' Inflation Expectations (SoFIE) reports the distribution of the probability that inflation over the next 12 months will exceed 5% while the Survey of Consumer Expectations (SCE) and Survey of Professional Forecasters (SPF) report the distribution of the probability that inflation over the next 12 months will exceed 4%. The distributions are computed using survey weights. Source: Candia et al. (2021a).

Figure 4: Correlation in Short-Term and Long-Term Inflation Expectations



Notes: The binscatters show the relationship between 1-year-ahead and 5-year-ahead inflation forecasts. The sample period covers waves 2018Q4, 2019Q4 and 2020Q4 for the Survey of Firms' Inflation Expectations (SoFIE), 2017Q1-2020Q4 for the Survey of Consumer Expectations (SCE), and 2018Q1-2021Q3 for the Survey of Professional Forecasters (SPF). Huber robust regression is used to downweigh the importance of outliers and influential observations. Robust standard errors are in parentheses.

Figure 5: Inflation Expectations and Perceptions



Notes: The binscatters show the relationship between 1-year-ahead inflation forecasts and perceptions (nowcasts) of inflations. The sample period is 2018-2021. Panel A shows results for the Survey of Firms' Inflation Expectations (SoFIE). Panel B shows results for survey responses of households participating in the Nielsen HomeScan Panel, see Coibion et al. (2021a) for more details. Panel C shows results for the Survey of Professional Forecasters (SPF). Perceptions in SPF are measured as the nowcast for the most recent (or current) quarter-on-quarter annualized inflation rate. Perceptions and expectations for managers and households are restricted to [-2%,15%] range. Huber robust regression is used to downweigh the importance of outliers and influential observations. Robust standard errors are in parentheses.