Speaking of Inflation: The Influence of Fed Speeches on Expectations*

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Abstract

We investigate how speeches by Federal Open Market Committee (FOMC) members and regional Federal Reserve presidents influence private sector expectations. Speeches highlighting upcoming inflationary pressures lead both households and professional forecasters to raise their inflation expectations, suggesting the presence of Delphic effects. While professional forecasters adjust their expectations in response to Odyssean communications—i.e., statements about the central bank's reaction to the announced inflationary pressures—households do not, leaving Delphic effects dominant. A novel general equilibrium model, in which agents differ in their ability to interpret Odyssean signals, accounts for these differential patterns.

Keywords: Central bank communication, Delphic, Odyssean, inflation expectations, textual analysis, expectation formation.

JEL-codes: D80, E31, E32, E66

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1 Introduction

Communication has become an essential policy tool for central banks. However, engaging with the public does not always produce the results intended by policymakers. Research has shown that discussing a potential outcome can sometimes reinforce private sector expectations of that outcome, a phenomenon referred to as Delphic communication (Campbell et al., 2012; Melosi, 2016; Campbell et al., 2017; Nakamura and Steinsson, 2018). This contrasts with central banks' typical goal of conveying their policy intentions or reaction function–signaling a commitment to a course of action aimed at addressing the outcome, often described as Odyssean communication.

Identifying Delphic and Odyssean effects in the data is often challenging. It is conceivable that when a Federal Open Market Committee (FOMC) member communicates their view regarding future inflation dynamics, they will also say how they intend to address it. Thus, communication carries both Delphic and Odyssean elements. Another challenge lies in the fact that the relative importance of these effects likely depends on the language used by policymakers in their communications (Lunsford, 2020). In this paper, we conduct a textual analysis of speeches delivered by FOMC members, including those of the regional Federal Reserve (Fed) presidents, to disentangle and quantify these effects.

We focus on speeches rather than other forms of communications, such as minutes or statements, for several reasons. First, unlike minutes, they are specifically targeted to an external audience; second, they constitute real-time publicly accessible information; third, they reflect a diversity of opinions and roles within the FOMC (Chair, vice-Chair, governors, and regional presidents). Finally, their time series is longer than the one for statements or the Summary of Economic Projections and is available at a higher frequency.[1]

As the first contribution of the paper, we extract a measure of the intensity with which the Fed communicates about inflationary pressures in the economy. To construct this *inflationary pressure index* we proceed as follows. First, we collect the FOMC members' speeches. Our dataset consists of about 4,890 speeches by FOMC members and regional Fed presidents from January 1995 until December 2023. Second, we split all the speeches into sentences and identify a sentence as being about inflation if it contains one of the two identifiers: inflation, or price. This gives us a total of 82,099 sentences. We then create a dictionary, that is, a collection of modifier words, based on the most common words used in FOMC speeches to characterize the identifiers "inflation" or "price".[2] Next, we score the sentences about inflation based on the modifier words. Finally, we construct the

[1] Policy statements are available following every meeting from January 2000 onwards. The Fed started to release statements in 1994 but only for meetings that were associated with a policy rate change. The SEP first appeared in November 2007.

[2] Examples of modifier words are: below (-1), ease (-1), declin (-1), muted (-1), elevat (+1), spik (+1), climb (+1), rising (+1).

monthly index as the sum of the sentences scored in a month. A high (low) inflationary pressure index simply reflects a high (low) current or expected inflation. We view our index as a proxy for Delphic communication- i.e., the part of FOMC communications referring to the inflation forecast. This interpretation is validated by the finding that the index is positively and strongly correlated with the FOMC economic projections for the one year ahead inflation.

We test whether the inflationary pressure index affects the inflation expectations of households and professional forecasters. For household expectations we use the Michigan Survey of Consumers (MSC), and for professional forecasters the Survey of Professional Forecasters (SPF). A key challenge in estimating the causal effect of inflationary pressure on expectations is the presence of several macroeconomic variables that might drive simultaneously our inflationary pressure index and inflation expectations. One way to solve the issue is to include these confounding factors as control variables in the regression analysis. However, there may be a potentially large number of such confounding factors at play.

To be parsimonious and agnostic regarding the variables that span the information set available to FOMC members and economic agents, we follow the approach by Belloni and Chernozhukov (2013) and proceed in two steps. First, we regress expectations on a large number of possible predictors, including several measures of inflation, using machine learning techniques. This procedure selects among the macro-financial variables from FRED-MD and FRED-QD data sets, assembled in McCracken and Ng (2016), the ones that have explanatory power for inflation expectations. In a second step, we regress inflation expectations on the lagged inflationary pressure index and on the controls surviving the selection procedure.[3]

We find that the inflationary pressure index affects inflation expectations of both consumers and professional forecasters. A higher index results in an increase in expectations. In particular, a one-standard deviation increase in the index (i.e. 51 more times mentioning a surge in inflation) results in an increase of 0.08 percentage points for households and 0.06 percentage points for professional forecasters. The effect, however, is quantitatively larger and more significant in the second half of the sample that starts with the Great Financial Crisis. This finding suggests larger Delphic effects in FOMC communication since the Committee has adopted a more transparent approach when communicating policy decisions.

In November 2007, the *Summary of Economic Projections* (SEP) was published for the first time at the end of an interest-setting meeting, introducing a major innovation in the

[3]An alternative approach to estimate the causal effect consists in regressing the inflationary pressure index on the confounding factors in the first step, and using the residuals from this regressions as explanatory variables for expectations in the second step. We run this exercise as a robustness check, but we note that Lloyd and Manuel (2023) shows that while in population the two approaches provide the same estimated causal effect, the so-called 'shock-first" approach suffers from the drawback of larger standard errors, which results in an unnecessarily more conservative inference.

communication strategy of the FOMC. The SEP provides policymakers' forecasts for key macroeconomic variables—growth, inflation, unemployment, and interest rates—based on their individual assessments of appropriate monetary policy. While the inflationary pressure index we construct provides qualitative information and might reflect both current and future assessments of economic conditions, these projections are quantitative and related to specific future horizons. For this reason, we add them to the second step regression as potential explanatory variable of agents' expectations. Therefore, an important contribution of our paper is that we jointly study how these two distinct forms of communication, qualitative and quantitative, affect expectations. We document that the SEP regarding inflation is able to steer inflation expectations of all economic agents. As for the inflationary pressure index, higher SEP projections result in higher expected inflation by households and professional forecasters. Importantly, our inflationary pressure index measure remains highly significant even when the SEP are included in the regressions.

The inflationary pressure index is designed to reflect the current or expected inflation of the FOMC member who delivers the speech. In that sense, this index measures the Delphic component of a speech. As such, the positive revision of the inflation expectations of households and professional forecasters is not surprising and is perfectly in line with what theory predicts (Melosi, 2016). However, it is conceivable that speeches conveying high inflationary pressures also carry a key message regarding how the FOMC member intends to tackle it. For instance, the speech may contain key remarks stressing the member's determination to fight inflation and justify an upcoming policy rate hike. According to the theory of Odyssean communications, such a commitment to fight inflation would bring about a fall in the inflation expectations of households or professional forecasters.

To account for Odyssean effects, we construct a *hawkishness index* based on the speeches of each FOMC member in our sample. This index measures the frequency of terms "inflation" and "price" relative to "unemployment." A high hawkishness index captures a stronger anti-inflation preference of the FOMC members actively speaking in a given month or quarter.[4] Our hawkishness index tracks very well an alternative policy preference measure, the Hawk-Dove balance in FOMC by Hack et al. (2023), which is constructed using textual analysis of media articles about the FOMC members. It also correlates with the policy stance score by Cieslak et al. (2023), which is extracted from transcripts of the scheduled FOMC meetings. We interpret the hawkishness index as a proxy for Odyssean communication. We find that when speeches reporting high inflationary pressures come from FOMC members with a high hawkishness index, inflation expectations among professional forecasters decrease. However, households' expectations

[4]We construct our index under the assumption that the policy preferences of FOMC members are time-invariant. This is consistent with the findings in Istrefi (2018), which, using newspapers and financial media coverage of 130 FOMC members serving during 1960-2015, shows that the large majority of FOMC members are perceived to have had persistent policy preferences—either "inflation-fighting hawks" or "growth-promoting doves"—over time.

are not affected. This implies that professional forecasters adjust their expectations in response to Odyssean communications but households do not, leaving Delphic effects dominant.

These findings echo those of Bauer and Swanson (2023a), who suggest that Odyssean communications dominate Delphic communications for sophisticated agents responding to high-frequency, financial-market-based monetary policy surprises. We show that these findings hold for professional forecasters even when monetary policy communications are measured through textual analysis of FOMC speeches. We document significant Delphic reactions among less sophisticated economic agents, such as households. While Bauer and Swanson (2023a) do not analyze the response of households' expectations to monetary policy surprises, it is plausible that the "Fed response to news" channel is weaker for households, as they arguably tend to pay less attention or to respond more slowly to national economic news.

Additionally, we find evidence that local media may serve as a key channel through which FOMC communications reach households. We construct two inflationary pressures sub-indices: a Trinity index which includes only speeches by the chairman, the vice-chairman and the NY Fed president, and a non-Trinity index, which instead includes only speeches by the regional presidents. Note that this analysis is possible because we are focusing on speeches, rather than minutes or statements, so we can identify communication by a specific FOMC member. We document that households respond exclusively to speeches by regional presidents. This result is consistent with a narrative that households are more likely to engage with their local newspapers, television or radio channels, which tend to focus on regional news, including speeches by the president of the local Fed district.

Finally, we introduce a novel structural model to disentangle the role of Delphic vs Odyssean communication and to offer a possible explanation for why sophisticated agents seem to better understand the central bank's commitment to stabilizing inflation. This model is a stylized New Keynesian model with price rigidities, augmented with the assumption that information about the state of the economy is asymmetrically distributed between the central bank and the private sector. This assumption is critical to allow for potential information transfers, thereby giving rise to Delphic effects in the model. The central bank communicates the expected inflation rate to the private sector through what is known as Delphic forward guidance. Additionally, the central bank engages in Odyssean forward guidance by announcing changes to its reaction function as well as the path of interest rates. Specifically, following inflationary shocks, it communicates extraordinary measures aimed at curbing rising inflation.

We consider two scenarios. In the first, the private sector fails to understand the Odyssean announcement and mistakenly believes that the central bank's reaction function remains unchanged. This reflects the situation of households that are not sophisticated enough to fully comprehend the strategies articulated by the central bank to combat inflationary pressures. These agents interpret an announced interest rate hike as a signal of rising inflation. In the second scenario, agents pay attention to the Odyssean announcement, arguably reflecting professional forecasters' ability to incorporate Odyssean communications—captured by the hawkishness index—into their inflation forecasts. The structural model predicts that, following an inflationary shock, unsophisticated households raise their inflation expectations, while sophisticated forecasters lower theirs in response to the more hawkish policy stance. This structural model with central bank's forward guidance is novel and provides a modeling framework that can be applied to study Delphic and Odyssean effects in general equilibrium settings.

Our paper contributes to the literature on central bank communication. Up to now, most studies have focused on transcripts and statements (Cieslak et al., 2023; Handlan, 2020; Hansen et al., 2017), press conferences after the FOMC meetings (Gorodnichenko et al., 2023), or documents that Fed staff prepare in advance of policy decisions (Aruoba and Drechsel, 2024). The literature that analyzes speeches by Fed presidents or FOMC members is limited, but fast growing. Neuhierl and Weber (2019) document that speeches of the Fed chair or vice chair predict the slope of the yield curve. Ehrmann et al. (2021) find that voting rights affect Fed presidents' number and tone of speeches, with voting members giving more speeches. They also show that speeches move financial markets less in years in which presidents vote. Swanson (2023) and Swanson and Jayawickrema (2024) document that Fed Chair speeches are more powerful than FOMC announcements to generate fluctuations in financial markets. Malmendier et al. (2021) uses speeches to test whether FOMC members' attitude towards monetary policy can be detected in the language, or tone, they use in their speeches. Istrefi et al. (2023) check whether Fed policy actions can be explained by FOMC members' financial stability concerns, captured by a financial concern index constructed on FOMC speeches. Bertsch et al. (2025) finds that Federal Reserve officials perceives financial stability as an additional policy objective. In contrast to these studies, we focus on the effect of speeches on inflation expectations and consider both sophisticated and non-sophisticated agents.

Evidence regarding the effect of central bank communications on household expectations is scant. Part of the literature on this topic relies on randomized control trials in surveys to identify the causal effects of central bank communication on agents' beliefs (Weber et al., 2025). This amounts in providing the survey respondents with some information, e.g. statements, projections, or central bank target, and studying the inflation revisions due to this information. However, these studies assume that all "treated" subjects receive the message, which might not be the case in a real world setting (Blinder et al., 2024). As contribution to this literature, we show that economic agents are indeed listening, adding to the results in Ehrmann and Wabitsch (2022). Moreover, we document that they adjust their expectations in the direction suggested by the Fed inflationary pressure index and projections. Our findings complement those in Coibion et al. (2022), which conduct a large randomized controlled trial (RCT) on US households to gauge the effects of information about the current or FOMC expected rate of inflation, the Fed monetary policy objective and the FOMC latest policy decision. We differ from this study in several dimensions. First, we study the effect of communication over a long sample, which allows us to detect changes in the effectiveness of the communication strategy over time. Second, we focus on FOMC speeches, rather than statements. Third, we consider different types of agents. Fourth, we are able to identify the effect of the monetary policy preferences of the speaker on expectations.

How can central bank deliver their message to the intended receiver? While sophisticated agents are well known to pay attention to central bank communications (Blinder, 2018), the general public is unlikely to get informed about monetary policy directly from the source. In fact, recent evidence suggests that households receive information about central banks through intermediate channels such as television, printed press, online press and radio (Gardt et al., 2021). It has also been shown that central bank communication has the potential to affect media coverage (see Munday and Brookes, 2021; Ter Ellen et al., 2022). While we do not provide definitive evidence that FOMC speeches can affect expectations through the media, we provide anecdotal evidence that media coverage of FOMC members increases when they give speeches.

The rest of this paper is organized as follows: Section 2 presents the speeches, the inflationary pressure index, the survey data and the macro data. Section 3 describes the empirical modeling framework and shows the main results. The effect of the hawkishness of the FOMC speakers on expectations is discussed in Section 4. Section 5 presents some robustness checks for our baseline results. The theoretical model is introduced and discussed in Section 6. Section 7 concludes.

2 Data and measurement

In this section, we describe the Fed speeches corpus and how we construct the inflationary pressure index from these documents. We also describe the expectations data and our set of macroeconomic controls.

2.1 Speeches and Inflationary Pressure Index

A first contribution of this paper is the creation of a database of FOMC speeches.[5] We collect speeches by FOMC members and regional Fed presidents, which were downloaded from the websites of the Fed Board and the regional Federal Reserve Banks.[6] The FOMC

[5]The full corpus of speeches is available at: www.vegardlarsen.com/FOMC_speeches_for_GLMM.csv

[6]Several speeches are available only in video format, or pdf documents. We converted all speeches into raw text to make them usable for textual analysis.

Identifiers	Additive Modifiers (+1)	Subtractive Modifiers (−1)
inflat, price	boost, climb, intensify, jump, elevat, escalate, expand, foster, height, high, increas, persist, pressure, _rise, _rising, rose, soar, solid, spik, surg, sustain, strong, strength, upward, _up_, upside risk	below, collaps, damp, drop, _ease_, easing, declin, deteriorate, diminish, down, _low, modest, moderated, muted, reduction, restrain, set back, slow, _soft, subdued, weak, fall, plummet, retreat

Table 1. Identifier and modifier terms for constructing the inflationary pressure index. An underscore represents a required space.

consists of twelve voting members. The first seven members belong to the Board of Governors of the Fed System, including the Chair. The eighth permanent member is the president of the Federal Reserve Bank of New York. The remaining four voting members are chosen from the rotating pool of the other eleven Reserve Bank presidents, serving one-year terms. Non-voting Reserve Bank presidents attend FOMC meetings.

Our sample includes all seven Governors and twelve regional presidents, regardless of their voting status. In a year with all seats filled, we would have 19 potential speakers. We collect speeches from January 1995 to December 2023, resulting in a total of 72 speaker-entries and 4,890 speeches.[7] To construct our measure of inflationary pressures conveyed in the FOMC speeches, we begin by splitting all speeches into sentences. We then select the subset of sentences containing either the root "inflat" or "price." Because we rely on string matching, this search captures words like "inflationary" or "prices". This procedure yields a total of 72,912 sentences about inflation.

The inflationary pressure index is calculated using a scored dictionary based on our reading of multiple FOMC speeches. The dictionary consists of additive (+1) and subtractive (-1) modifier terms that are applied to each inflation-related sentence. Each sentence is assigned a score equal to the sum of these modifiers. Table 1 lists the identifier and modifier terms used to construct the index.

We create a daily index by summing the scored sentences within each day. If multiple speeches occur on the same day, we sum their scores. We then aggregate the daily series to monthly and quarterly frequencies by summation. Finally, we standardize the series by subtracting its mean and dividing by its standard deviation over the full sample. Appendix A shows example sentences for several speeches and highlights the identifiers and modifiers terms found in the sentences.

How do we interpret our inflationary pressure measure? It captures the strength of inflationary pressures communicated by the speaker. It conveys whether inflation is high or low in absolute terms, such that a higher level of the index reflects higher current or

[7] The total number of distinct individuals is 70, but Janet Yellen and John Williams are counted twice because they served in different FOMC roles, resulting in 72 speaker-entries.

expected inflationary pressures.[8] The index does not express an assessment of whether the inflation outlook is good or bad, i.e. inflation is close to target or under/overshooting the target. For example, in an environment of inflation well below the target, communication about higher inflationary pressures could be perceived as a good outlook, while higher inflationary pressures in an environment of high inflation would represent a bad outlook for inflation. For this reason we do not include in our modifiers words such as *improv*, which was instead included in the dictionary of Gardner et al. (2022) to characterize the general economic outlook of FOMC statements.

The monthly series is shown in Figure 1, together with the monthly year-over-year inflation for the consumer price index, all items. Our measure positively co-moves with actual inflation, although the former seems less persistent. The index peaks in the fall of 2005, just as energy prices increase due to energy supply shocks such as hurricane Katrina. The index spikes again in July 2008, when we also observe an increase in the consumer price index driven by a surge in food prices. CPI inflation and our inflationary pressure index diverge in 2009, when inflation falls into negative territory, while our measure climbs. A combination of high growth in food and gasoline prices coincides with a high inflationary pressure index in April and May 2011. The indicator then slowly decreases and declines sharply in December 2015, as inflation runs persistently low. Lastly, the index has increased substantially since May 2021, peaking in September 2022, consistent with the rise in CPI inflation.

Table 2 confirms that our indicator captures both current economic conditions and short-term expected dynamics of inflation. Our index is positively correlated with contemporaneous measures of inflation, in particular with CPI all items and personal consumption expenditure (PCE) and to a lesser extent with oil prices. Importantly, the inflationary pressure index is positively correlated with the FOMC economic projections for the one year ahead PCE inflation. Figure 2 reveals that except for the first couple of years in our sample, the inflationary pressure index and the FOMC projections move closely together. We take this as crucial validation that the inflationary pressure index can be regarded as a proxy for Delphic communication- i.e., the part of FOMC communications referring to the inflation forecast.

2.2 Macroeconomic Forecasts

Households' expectations of future inflation crucially affect their economic decisions regarding consumption and saving (Coibion et al., 2022), housing tenure and mortgage uptaking (Malmendier and Nagel, 2016; Botsch and Malmendier, 2020), stock market participation (Das et al., 2020), labor supply and wage bargaining. We study inflation expectations of households from the Michigan Survey of Consumers (MSC), which is

[8] A positive value represents how many standard deviations the index is above average.

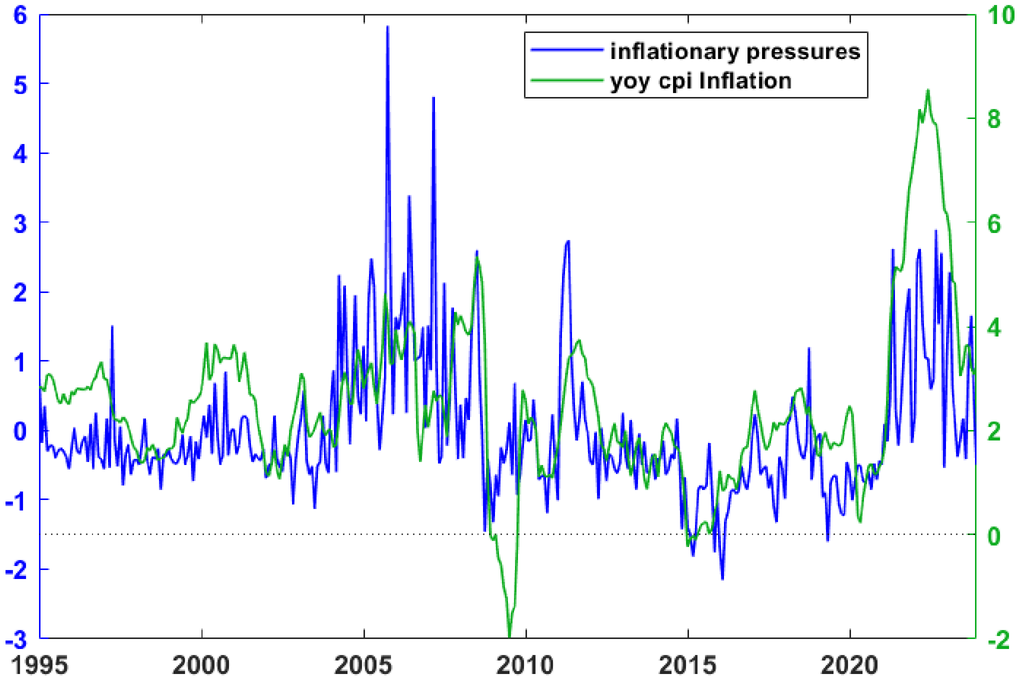

Figure 1. The monthly inflationary pressure index (left vertical axis) and year over year CPI all items inflation (right vertical axis) over the sample 1995M1 - 2023M12. The monthly index is the monthly sum of the daily inflationary pressure index, standardized to have mean zero and standard deviation of one.

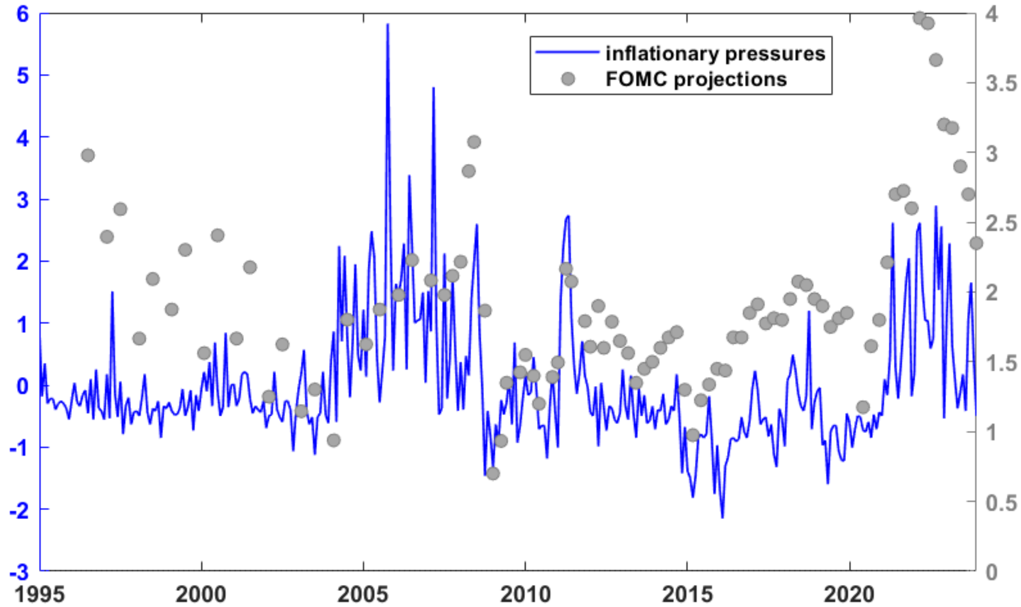

Figure 2. The monthly inflationary pressure index (left vertical axis) and FOMC projections (right vertical axis) over the sample 1995M1 - 2023M12. The monthly index is the monthly sum of the daily inflationary pressure index, standardized to have mean zero and standard deviation of one.

designed to be representative of the US population. In this survey a minimum of 500 members of the general public are contacted by phone each month and asked approxi-

	Correlations: Monthly Variables			
	CPI: All Items	PCE	Oil Prices	SEP
Overall	0.55	0.57	0.41	0.58
CPI-All Items	1	0.98	0.64	0.86
PCE		1	0.67	0.83
Oil Prices			1	0.47

Table 2. Contemporaneous correlation across monthly indices and variables over the sample 1995M1-2023M12. The oil price series is the West Texas Intermediate (WTI) - Cushing, Oklahoma. SEP refers to the one year ahead PCE inflation forecasts from the Summary of Economic Projections of the Federal Reserve Board members and Federal Reserve Bank presidents.

mately 50 questions. We take the inflation forecast as the median response to the question about price increases. The exact question is "*By about what percent do you expect prices to go (up/down) on the average, during the next 12 months?*". The Michigan Consumer Survey is one of the most commonly used US surveys in the literature (Weber et al., 2022) and is the longest time series of consumers' expectations available for the U.S.. The length of the Michigan Survey allows us to study the impact of the Fed inflation pressure on household expectations over a longer sample and over sub-samples. The interviews are conducted throughout the month, with starting and ending dates scheduled on irregular dates. The fieldwork starts up to eight days before the beginning of the reference month and ends between five days and two weeks before the month's end. Therefore, we assume households are affected by speeches given the month before the reference month.

Expectations from professional forecasters are important for monetary policy, as they are often used, for example, to estimate the slope of the Phillips Curve (Ball and Sandeep, 2018), to increase the accuracy of empirical forecasting models (Gergely and Odendahl, 2021), or to improve the fit of structural models (Del Negro et al., 2015). As a measure of professional inflation forecasts, we use the one year ahead annual median headline CPI inflation rate from the Survey of Professional Forecasters (SPF), which covers professional forecasters in a variety of institutions. The survey is available at the quarterly frequency and computed as the geometric average of the quarter-over-quarter median forecasts for CPI inflation. The deadline for the response is set on the second to third week of the middle month of each quarter. Therefore, we assume that forecasters have access to the speeches from the first month of the quarter when the forecasts are made.

The Fed conveys the forecasts of economic conditions of the FOMC members through the Summary of Economic Projections (SEP), which are the economic projections of Federal Reserve Board members and Federal Reserve Bank presidents. They reflect the individual members' assumptions of future developments and are conditional on "appropriate" monetary policy. While the inflationary pressure index we construct might capture both current and future assessments of economic conditions and statements in speeches are mostly qualitative, the projections are quantitative and related to specific short and long term future horizons. Therefore, we include them in the regression as potential explanatory variable of agents' expectations. This allows us to determine the relative effectiveness of different communication channels in managing expectations. The FOMC forecasts have been published in March, June, September and December since June 2012 but irregularly in the earlier part of our sample, till 2007. Inflation projections of the Fed Governors and Reserve Bank Presidents from July 1996 till September 2007 are obtained from the Monetary Policy Reports to the Congress, available in the months of July and February.[9] We consider the simple average of the lower and upper central tendency for PCE inflation. The projections are made for a fixed date (e.g. current year and next year) rather than fixed horizon (e.g. four quarters ahead). Following Dovern et al. (2012), we transition from fixed date to fixed horizon by taking the weighted average of the current and next calendar years, where the weights are given by the share of the forecast horizon at the forecast origin.

2.3 Macro data

Expectations of economic agents as well as the content and tone of the FOMC speeches might be simultaneously driven by recent economic developments. If so, regressing the expectations on the inflationary pressure index alone, might wrongly lead us to conclude that the index affects expectations. To address this potential issue we control for past information using a large set of lagged macro-financial variables extracted from the collection of monthly series assembled in McCracken and Ng (2016). They provide downloadable monthly and quarterly macroeconomic dataset for the United States (FRED-MD and FRED-QD), consisting of 127 and 245 time series, respectively, that cover all the main macroeconomic aggregates and a number of financial indicators. The dataset is extensively used in the forecasting literature (Granziera and Sekphosyan, 2019) and includes series capturing output, income, labor market, housing, consumption, orders, money, credit, interest and exchange rates, consumer and producer prices, energy prices and asset prices. The series are made stationary using the transformations suggested in McCracken and Ng (2016), with the exception that we use first order differences instead of second order differences. For the log-difference transformation we use the year over year, i.e. $log\,(x_t) - log\,(x_{t-h})$ where $h = 12$ for the regressions involving the MSC and $h = 4$ in the regressions for the SPF expectations. Therefore, we control for year-over-year inflation of the CPI all items as well as several sub-components of inflation. This is important because it has been documented that agents' beliefs about recent inflation is an accurate predictor of expectations about future inflation (Weber et al., 2022; D'Acunto et al., 2021).

[9] For the years 1996-1999 we use projections for CPI inflation, as projections for PCE inflation are not available.

As additional control we consider the news sentiment index proposed by Shapiro et al. (2022). This is a daily measure of economic sentiment based on textual analysis of economics-related news articles from U.S.-based newspapers. Because this index has been shown to help predict survey-based measures of sentiment such as the Michigan Consumer Sentiment Index (MCSI) and/or the Conference Board's Consumer Confidence Index (CBCI), it might also be correlated with survey-based measures of inflation expectations.

3 Inflationary Pressure Index and Delphic Effects

In this section, we discuss our methodological approach and we show how the inflationary pressure index affect the inflation expectations of households and professional forecasters.

3.1 Methodology

To characterize how the inflationary pressure index (IPI) affects expectations, for each set of agents we project one year inflation expectations onto the inflationary pressure index:

$$E_t\pi_{t+h} = \alpha + \beta \, \mathrm{IPI}_{t-1} + \gamma' X_{t-1} + u_t, \qquad \text{(Model 1)}$$

where $E_t\pi_{t+h}$ is the expected inflation rate between the current period and h periods ahead, where h equals 12 for the Michigan Survey of Consumers (MSC) monthly forecasts and equals 4 for the Survey of Professional Forecasters (SPF) quarterly forecasts, as introduced in Section 2.2. IPI_{t-1} is the inflationary pressure index introduced in Section 2.1, X_{t-1} is a set of controls discussed below and u_t is a normally distributed i.i.d. error term. We will refer to this specification as Model 1.

In a second specification (henceforth, Model 2) we also control for the FOMC's quantitative inflation forecasts, which include the Economic Projections from the Monetary Policy Reports to the Congress and the SEP, as described in Section 2.2:

$$E_t\pi_{t+h} = \alpha + \beta \, \mathrm{IPI}_{t-1} + \delta \, \mathrm{SEP}_{t-1} + \gamma' X_{t-1} + u_t, \qquad \text{(Model 2)}$$

This specification allows to jointly analyze how the two distinct forms of communication, quantitative and qualitative, affect inflation expectations.

In both Models 1 and 2, the timing of the inflationary pressure index is consistent with the information set available to the agents when the forecasts are made and it differs between the monthly and quarterly regressions. In the regressions at the monthly frequency for the MSC, the inflationary pressure index enters the regression with a one period lag, as agents forming forecasts and completing the survey in month t have information available up to (at most) time $t-1$. In the regressions at the quarterly frequency for the SPF, we use the inflationary pressure index from the first month of the quarter, as agents completing the survey in the middle of a quarter t have information available up to (at most) the end of the first month in quarter t. For the control variables we use the lagged values to take into account the publication lags of most series, so that in month/quarter t agents observe the value of the series up to month/quarter $t-1$. In Model 2 we include the lag of the SEP so that agents observe the latest release of the projections. For example, in the month of July households observe the SEP released in June, and professional forecasters, whose forecasts are collected in July, observe the SEP released in Quarter 2 (end of June).[10]

Our objective is to estimate the causal effect of the inflationary pressure on expectations. Clearly, several macroeconomic variables might drive simultaneously our inflationary pressure index and inflation expectations. Not accounting for this issue could hinder the identification of the causal effect. The literature has taken two approaches to solve this issue. The first one is to include the confounding factors as control variables in the regression analysis. The second one, called "shock-first" approach, consists in orthogonalizing the causal variable of interest and then use the shock as regressor. In our setting this would mean regressing the inflationary pressure index on the set of confounding variables, and then projecting inflation expectations onto the residuals from the first regression. While the second approach has become quite popular, Lloyd and Manuel (2023) shows that the standard errors in this method will typically be misestimated, in particular they will be larger than in the first approach, resulting in more conservative inference. For this reason, we resort to the first approach and include the relevant confounding factors as predictors. For completeness, we report results for the shock-first procedure as robustness check in Appendix B.5.

The number of potential confounding factors X_{t-1} is quite large. To retain parsimony while remaining agnostic on which controls might be relevant, we conduct the analysis in two steps. First, we regress the expectations on all the macro-financial variables included in McCracken and Ng (2016) using the Least Absolute Shrinkage and Selection Operator (LASSO). We target the tuning parameter in the LASSO estimator such that the LASSO procedure selects a number of variables equal to about 10% of the number of observations. Second, the surviving regressors are collected in X_{t-1} and are used as controls in Models 1 and 2. LASSO is a regression analysis method that performs variable selection and thereby favors parsimonious models. Therefore, it allows us to exclude unimportant variables from the regression. The two step procedure has been suggested by Belloni and Chernozhukov (2013) which shows that the estimated coefficients from the OLS regression post-LASSO exhibit a smaller bias than the coefficients estimated from a one step LASSO regression. Importantly, this holds even if the OLS post-LASSO model is misspecified, i.e. it does

[10] Note that in this regression model we drop observations for which SEP projections were not released in the previous period.

Michigan Survey of Consumers	PPI by Commodity: Final Demand: Finished Goods CPI: Commodities PCE PCE: Durable goods
Survey of Professional Forecasters	Capacity Utilization: Manufacturing CPI : All Items Less Food and Energy Real Revolving Credit Owned and Securitized

Table 3. Variables selected from the LASSO estimation of expectations on the variables included in the FRED-MD and FRED-QD dataset over the sample 1995M1-2023M12.

not include some of the explanatory variables of the "true" regression model.

3.2 Baseline Results

The variables selected in the first step of our analysis through the LASSO estimation are listed in Table 3. Households' expectations are affected by commodity prices and the prices of durable goods consistent with findings in previous studies (see Coibion and Gorodnichenko, 2015; Coibion et al., 2022). Professional forecasters are more sophisticated. They base their predictions not only on past inflation but also on capacity utilization, suggesting that they rely on a Phillips curve type relationship between inflation and labor market conditions to make their forecasts. Interestingly, they look at a measure of underlying inflation, CPI all items less food, rather than more volatile measures of changes in prices.

In the first step we selected the series that are most important in explaining inflation expectations. Next, we regress expectations on these controls and on the "soft" and "hard" information provided by the Fed, i.e. the inflationary pressure index vs the FOMC projections. Table 4 reports the results of our baseline regressions for both types of agent. In Model 1 the coefficient for the inflationary pressure index is statistically significant for the regressions that span the full sample and for both types of agent. The coefficient is positive, suggesting that a higher inflationary pressure index, which signals higher inflation, translates into higher short run inflation expectations. The magnitude is higher for households compared to professional forecasters. A one standard deviation increase in the index, i.e. an inflationary index score higher by fifty increases inflation expectations of households by 0.08 percentage points and of professional forecasters by 0.06 percentage points. To understand the magnitude of the impulse, note that an increase by fifty in the score of the index means that the pair "increasing prices" or "raising inflation", for example, is included fifty more times over all the speeches given by FOMC members in one month.

When we add the FOMC projections to the set of explanatory variables in Model 2, the inflationary pressure index retains its significance and magnitude. We find this result remarkable, because it suggests that soft information in the form of speeches has additional influence on top of quantitative information. The coefficient associated with the FOMC projections is positive, once again suggesting that signaling future high inflation increases inflation expectations, and is highly significant for sophisticated agents. The magnitude of the coefficient is such that a one percentage point higher projected inflation by FOMC members increases inflation expectations of professional forecasters by 0.20 percentage points.

We interpret this first set of results as consistent with a Delphic effect of central bank communication.[11] The inflationary pressure index is designed to reflect the current or expected inflation of the FOMC member who made the speech. In that sense, this index measures the Delphic component of a speech. Since we do not control for the monetary policy response conveyed in FOMC speeches, in our regression we tried to isolate the Delphic effects of communicating the FOMC forecasts to households and professional forecasters. Indeed, we find that Delphic effects are significant and households and professional forecasters adjust their inflation expectations in the direction signaled by the FOMC's speeches. Are Delphic effects strong enough to remain significant even when we take into account the Odyssean effects of the speeches—namely, the FOMC communications regarding the policy response? We will turn to this important question later in the paper.

The Fed communication strategy has changed substantially over time, in an effort to become more transparent. For example starting in November 2007 the economic projections of FOMC meeting participants have been consistently released to the public close to the monetary policy decision meetings, while they were published only twice a year in the Monetary Policy Reports to the Congress before then. Therefore, the ability of the Fed to affect expectations might differ over our sample. For this reason we repeat our analysis over two sub-samples: one that runs from 1995 to 2007 and a second one from 2008 to 2023. The sub-sample results show a striking difference in the magnitude of the coefficients associated with both the inflationary pressure index and the FOMC projections. After the Great Financial Crisis the FOMC's ability to affect households and professional forecasters' expectations has increased substantially, almost doubling. As in the whole sample analysis, expectations of households are the most affected by the index. We assess the robustness of our results along several dimensions: principal components as shrinkage method, shock first approach to estimate the causal effect of the inflationary pressure index on expectations, alternative data sources for household expectations, removal of outliers, and other variations in model specification. We find that our baseline results survive these checks. These exercises are documented in Section 5.

Our results suggest that inflation expectations are responsive to central bank communication, but the magnitude of the response differs across agents. In addition, we find sig-

[11] Identification of Delphic effects in VAR models is an active area of research, see, for instance, Miranda-Agrippino and Ricco (2021); Jarociński and Karadi (2020).

Michigan Survey of Consumers

	1995:m1-2023:m12		**1995:m1-2007:m12**		**2008:m1-2023:m12**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.08†	0.16*	0.02	0.25**	0.28***	0.23**
	(0.05)	(0.07)	(0.04)	(0.07)	(0.06)	(0.07)
SEP_{t-1}		0.21		-0.07		0.47*
		(0.14)		(0.10)		(0.21)
R-Squared	0.66	0.74	0.49	0.62	0.78	0.82
Observations	347	87	155	24	192	63

Survey of Professional Forecasters

	1995:Q1-2023:Q4		**1995:Q1-2007:Q4**		**2008:Q1-2023:Q4**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.06***	0.06***	0.04	0.04*	0.11***	0.06**
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
SEP_{t-1}		0.20***		0.06		0.21***
		(0.06)		(0.10)		(0.08)
R-Squared	0.79	0.86	0.75	0.64	0.87	0.90
Observations	116	82	52	23	64	59

Table 4. Baseline regressions. The dependent variables are the one year ahead expectation (median) of percentage price changes from the MSC, and the one year ahead expectation (median) of CPI all items inflation from the SPF. Model 1 includes a constant, the standardized inflationary pressure index IPI_{t-1} constructed in Section 2.1, and controls X_{t-1} selected from the LASSO regression of $E_t\pi_{t+h}$ on Z_{t-1}, with Z_{t-1} the predictors described in Section 2.3. Model 2 also includes the FOMC's quantitative inflation forecasts, SEP_{t-1}. The series includes inflation projections of the Fed Governors and Reserve Bank Presidents from the Monetary Policy Reports to the Congress up to July 2007 and the Summary of Economic Projections afterwards. The tuning parameters for the LASSO regressions are 0.005 for MSC and 0.01 for SPF. '†', '*', '**' and '***' indicate significance levels at the 15, 10, 5 and 1 percent respectively.

nificant evidence of Delphic response. In the next section, we introduce a novel semantic-based measure to extract the anti-inflation attitude of the FOMC member who gave the speech to evaluate whether these Delphic effects remain predominant.

4 Hawkishness and Odyssean Effects

FOMC members might discuss rising inflation to signal and justify the Fed's monetary policy stance, particularly an impending interest rate hike. Rational and attentive agents might anticipate the future monetary tightening and therefore not change or even lower their expectation about future inflation, even when an FOMC member reveals rising inflationary pressures in their speech. Then, the perceived attitude of the FOMC speaker towards inflation might affect how agents interpret the tone of the speech and revise their inflation expectations. In this section, we test whether the Odyssean tone in FOMC speeches can overturn the prevailing Delphic effects documented in the previous section.

To account for variations in the stance towards inflation among different speakers, we compute a measure of the speaker willingness to fight inflation, i.e. of *hawkishness*. The terms hawk and dove have long been used to describe the monetary policy leanings of policymakers. The label *hawk* refers to a policymaker more concerned about the threat of inflation and *dove* to a policymaker more focused on risks to the labor market.

To construct our index we assume that each speaker maintains their stance (hawk and dove) constant throughout their tenure. This is in line with the finding in Istrefi (2018) who documents that the large majority of FOMC members are perceived to have persistent policy preferences over time. Similar to the inflationary pressure index, our hawkishness measure is extracted from the speeches of the FOMC members and regional presidents via textual analysis. In particular, the degree of hawkishness for speaker i, denoted as $\textit{hd-measure}_i$, is computed as follows:

$$\textit{hd-measure}_i = \frac{\text{Total occurrences of the terms ``inflation'' and ``price''}}{\text{Total occurrences of the term ``unemployment''}}$$

Here, the counts are aggregated over all speeches given by speaker i. A higher value of $\textit{hd-measure}_i$ indicates a more hawkish speaker. The rationale for our measure is that, throughout their tenure, growth promoting speakers should put emphasis on unemployment and labor market conditions, while inflation fighting speakers should stress inflation and prices dynamics.

To ensure the robustness of this measure of hawkishness, we conducted a validation exercise by comparing our scores of individual FOMC members with assessments from various financial news and market intelligence sources, including Bloomberg, Reuters, the Wall Street Journal and InTouch Capital Markets. Our findings indicate a strong alignment between our scores and the prevailing market perception of FOMC members' policy preferences. Specifically, individuals ranked as highly hawkish in our index are consistently characterized as such by these external sources, while those identified as dovish in our framework align with their classification in financial media and market analyses. This consistency across independent methodologies supports the reliability of our approach in capturing policymakers' relative stance on monetary policy.

To capture the overall level of hawkishness of FOMC members who are active speakers at time t, we introduce the hawkishness index, HI_t, a time-varying measure that sums the hawkishness levels of all active speakers at that time. It is defined as:

$$HI_t = \text{sum}\left(\textit{hd-measure}_i | i \text{ speaks at time } t\right)$$

where the sum is taken over the FOMC members talking about inflation in a given period t (month or quarter), and can be interpreted as the coefficient that determines the response

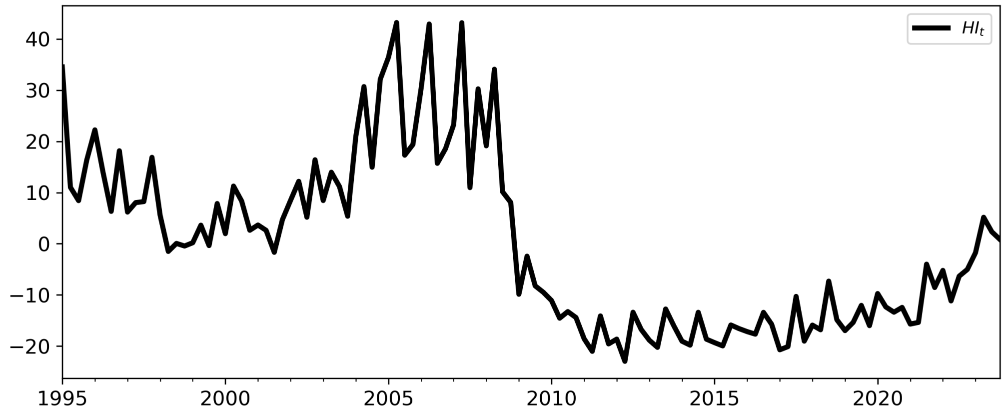

Figure 3. The hawkishness index, HI_t, of FOMC members who are active speakers over the sample 1995Q1 - 2023Q4. In this figure the index is standardized to have mean zero and standard deviation of one.

of the monetary authority to deviations of inflation to target in the Taylor rule. We compare our policy preference measure against two textual based measures: the hawk-dove balance computed by Hack et al. (2023) and the policy stance score in Cieslak et al. (2023). The former captures the FOMC members' hawkishness vs dovishness based on media articles of all FOMC members, regardless of whether they are active speakers or not. The latter instead proxies the Fed policy stance, as it extracts the collective FOMC view regarding the direction of upcoming policy changes from transcripts of the scheduled FOMC meetings. Figure 3 shows the hawkishness of speakers active in a particular month. Our measure follows quite closely the hawk-dove balance in Hack et al. (2023): it is high in the early part of the sample, decreases in the late 90s and early 2000s, rises again around the mid-2000s, tanked after the Great Financial crisis and slowly increased during the pandemic. We consider this as a validation of our index. Moreover, our hawkishness index, while correlated with the measure in Cieslak et al. (2023), shows some departures. For example, their measure falls much more during recessions, suggesting a dovish response of the Fed to macro developments. Differences with the indicator in Cieslak et al. (2023) are to be expected, since our index captures the Fed policy *preferences* rather than the Fed policy *stance*.

Rather than in the construction of a monetary policy preference measure, the contribution of our paper lies in the interpretation of the measure as Odyssean communication, and in showing how this form of communication affects inflation expectations separately from Delphic communication. Bordo and Istrefi (2023) document that the FOMC composition of hawks vs doves matters for monetary policy decisions. Here we test whether the preferences of the speakers affect how their communication about inflationary pressures are interpreted. To do so, we first define the dummy variable $HI_{d,t}$, which takes the value of one if the index HI_t is larger than its historical mean up to time t. In this way we

	Michigan Survey of Consumers		Survey of Professional Forecasters	
	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.15***	0.15**	0.12***	0.12***
	(0.07)	(0.08)	(0.04)	(0.03)
$\text{HI}_{\text{d,t-1}}*\text{IPI}_{t-1}$	−0.12	0.06	−0.11**	−0.10***
	(0.09)	(0.15)	(0.06)	(0.04)
SEP_{t-1}		0.22		0.17***
		(0.14)		(0.06)
R-Squared	0.66	0.73	0.80	0.87
Observations	347	87	116	82

Table 5. Hawkishness. The dependent variables are the one year ahead expectations (median) of percentage price changes from the MSC and the one year ahead expectation (median) of CPI all items inflation from the SPF. Model 1 includes a constant, the standardized inflationary pressure index IPI_{t-1} constructed in Section 2.1, and controls X_{t-1} selected from the LASSO regression of $E_t\pi_{t+h}$ on Z_{t-1}, with Z_{t-1} the predictors described in Section 2.3. Model 2 also includes the FOMC's quantitative inflation forecasts, SEP_{t-1}. The series includes inflation projections of the Fed Governors and Reserve Bank Presidents from the Monetary Policy Reports to the Congress up to July 2007 and the Summary of Economic Projections afterwards. The tuning parameters for the LASSO regressions are 0.005 for MSC and 0.01 for SPF. '*', '**' and '***' indicate significance levels at the 10, 5 and 1 percent respectively.

capture instances in which the Fed is communicating a preferred policy response stronger than its average response. Because we use only past values of the hawkishness index to construct the mean of the hawkishness indicator, we make sure to use only information available in real time to households and professional forecasters. Then we interact the hawkishness dummy with our inflationary pressure index and we include it as additional regressor in Models 1 and 2. The interaction term tells us by how much expectations change in response to changes in the inflationary pressure index when the hawkishness attitude of the speakers is high. Including the hawkishness leaning of the speakers as a dummy variable allows us to compare the magnitude of the coefficients associated with the inflationary pressure index and the interaction term. The objects of interest are the individual coefficients, which can be seen as the effects of Delphic and Odyssean communication, and their sum, which provides the overall effect of the Fed communication about inflation on expectations.

The results of these regressions are presented in Table 5. Introducing the interaction term does not alter the sign of the coefficient associated with the inflationary pressure index; instead, its magnitude increases for both households and professional forecasters. For households, the sign of the coefficient on the interaction term varies between positive and negative depending on the model specification and the coefficient remains statistically insignificant. One possible explanation for the variation across specifications is that including the SEP projections results in several observations being dropped from the sample. For professional forecasters, the coefficient on the interaction term is negative, statistically significant, and similar in magnitude across specifications. In addition, it offsets the coefficient associated with the inflationary pressure index.

These estimates suggest that high inflationary pressures, when communicated by hawkish speakers, do not substantially raise expectations of professional forecasters, but raise those of households. In other words, professional forecasters adjust their expectations in response to Odyssean communications, while households do not, leaving Delphic effects dominant. This differential response may stem from the fact that professional forecasters—being Fed watchers—are well aware of the individual preferences of the FOMC members delivering the speech. As a result, they are more inclined to interpret warnings of looming inflationary pressures from a hawkish member as a signal that the speaker will advocate raising interest rates, in contrast to a similarly toned speech by a dovish member. This expected future monetary tightening will lower or keep unchanged their expectations about future inflation.

5 Robustness and Extensions

We extend and test the robustness of our results across several dimensions, including variations in model specification, the treatment of outliers, the role of macroeconomic news, different shrinkage methodologies for control variables, set of keywords for the inflationary pressure index and alternative data sources for household expectations. In all the exercises we adopt the same two step procedure described in Section 3 and, therefore, allow the controls selected in the first step to differ from the ones selected in our baseline estimation.

So far we have assumed that speeches have almost a contemporaneous effect on expectations. For robustness we allow for a persistent effect by including one additional lag of the inflationary pressure index as regressor. We include an additional lag of the explanatory variables also in the LASSO regressions that select the control variables. Table 11 shows that the inclusion of the lags does not change the estimated coefficients for the inflationary pressure index or the SEP. Moreover, the coefficient associated to the lagged IPI is close to zero and not statistically significant for respondents of both surveys.

In our baseline analysis we use the median, rather than the mean expectation, as the former is more robust to outliers. For completeness we report the results concerning the mean in Table 12 for households and professional forecasters. Again, the results are very similar to the baseline, though the magnitude of the coefficient associated with the inflationary pressure index is even larger for the households in the second sample than in the baseline regression.

The inflationary pressure index shows some large spikes throughout the sample. Therefore, one might be worried that these outliers bias the estimates of the causal effect β in Model 1. To ease this concern we repeat the analysis but dropping the top 5 percent of observations with the largest deviation from the mean. These turn out to be all observa-

Michigan Survey of Consumers	1995:m1-2023:m12		1995:m1-2007:m12		2008:m1-2023:m12	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.11*	0.17*	0.07*	0.20***	0.26***	0.23**
	(0.05)	(0.07)	(0.04)	(0.04)	(0.07)	(0.09)
SEP_{t-1}		0.28†		-0.01		0.44†
		(0.17)		(0.07)		(0.25)
R-Squared	0.63	0.69	0.50	0.67	0.73	0.75
Observations	347	87	155	24	192	63

Survey of Professional Forecasters	1995:Q1-2023:Q4		1995:Q1-2007:Q4		2008:Q1-2023:Q4	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.05**	0.06***	0.01	0.03	0.11***	0.06**
	(0.02)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
SEP_{t-1}		0.23***		0.11		0.26***
		(0.06)		(0.10)		(0.07)
R-Squared	0.81	0.87	0.78	0.65	0.88	0.90
Observations	116	82	52	23	62	59

Table 6. Contemporaneous controls. The dependent variables are the one year ahead expectation (median) of percentage price changes from the MSC and the one year ahead expectation (median) of CPI all items inflation from the SPF. Model 1 includes a constant, the standardized inflationary pressure index IPI_{t-1} constructed in Section 2.1, and controls X_t selected from the LASSO regression of $E_t\pi_{t+h}$ on Z_t, with Z_t the contemporaneous predictors described in Section 2.3. Model 2 also includes the FOMC's quantitative inflation forecasts, SEP_{t-1}. The series includes inflation projections of the Fed Governors and Reserve Bank Presidents from the Monetary Policy Reports to the Congress up to July 2007 and the Summary of Economic Projections afterwards. The tuning parameters for the LASSO regressions are: 0.005 for MSC and 0.01 for SPF. '†', '*', '**' and '***' indicate significance levels at the 15, 10, 5 and 1 percent respectively.

tions with positive values. Our baseline results prove robust to this additional exercise, as shown in Table 13.

Bauer and Swanson (2023b) show that both the Fed and professional forecasters react to economic news released in the days leading up to an FOMC announcement. We then estimate again our regression Model 1 using the contemporaneous values of the controls, rather than the lagged one to account for the effect of news releases on expectations. Table 6 shows that our results hold. In fact, while Bauer and Swanson (2023b) document that the information effect of FOMC *announcements* disappear when controlling for macroeconomic news, they acknowledge that this might not be the case for other forms of communications, particularly speeches.

While in our baseline regressions we select individual control variables through the LASSO approach, in our robustness assessment we reduce the dimentionality of the control variables by shrinking the information with principal components. Therefore, we run the following regression model:

$$E_t\pi_{t+h} = \alpha + \beta\,\text{IPI}_{t-1} + \delta' P_{t-1} + u_t,$$

where P_{t-1} is a vector collecting the first K principal components extracted from the control variables X_{t-1}. Principal component is an alternative way to deal with parameter proliferation and reduce the number of regressors. We use LASSO as our baseline because it allows us to identify the specific series that are more important in affecting inflation expectations, so that we can give an economic interpretation to our controls and can compare to previous findings in the literature regarding the determinants of inflation expectations. Results for this exercise are shown in Table 14 of the appendix for a specification that includes the first three principal components. Also for this exercise we find that the inflationary pressure index positively affect expectations and the magnitude of the coefficients is virtually unchanged.

Results are similar to the baseline also when we implement the "shock-first" approach discussed in Section 3, as shown in Table 15. In this robustness check we first regress the inflationary pressure index on all the potential confounding factors, i.e. the controls described in Section 2.3, and obtain the residual u_t^S. This residual represents exogenous variation in the inflationary pressure index unexplained by contemporaneous macro and financial variables. Then, we project short term expectations on the shock u_t^S. Consistent with the theoretical predictions in Lloyd and Manuel (2023) we find that the estimated coefficients are similar to the ones in Table 4, though larger for households and smaller for SPF in the second sample, but the standard errors are much larger, resulting in fewer coefficients statistically significantly different from zero for the SPF.

As a further check, we extract an alternative inflationary pressure index where the words "deflation" and "disinflation" are added to the list of keywords. Table 16 shows that our baseline results are unaffected by this modification of the index.

Last, we rerun our regressions using household expectations collected from an alternative monthly survey, the NY Fed Survey of Consumer Expectations (SCE). The SCE is an internet-based survey of approximately 1,300 households, more than twice the number of households interviewed in the MSC. This survey asks about expected inflation, rather than changes in prices, at the one and three years ahead horizons. We do not use this survey as baseline because of its limited sample size, as the survey was first ran in January 2013. Table 17 shows that the coefficient that estimates the effect of the inflationary pressure index on the one year ahead inflation expectations is comparable in sign and magnitude to the coefficient estimated in our baseline regression for the sub-sample starting in 2008.

5.1 Reaching the General Public

How can economic agents be affected by FOMC speeches? While sophisticated agents (professional forecasters) might pay particular attention to all forms of Fed communications, non-sophisticated agents (households) likely do not. Then, at a first glance, our result that household inflation expectations are influenced by the Delphic communication of the Fed might sound implausible. We argue that our findings can be explained by the role of the media channel and the focus of households on regional developments.

Recent studies document that the public gets informed about monetary policy via the media rather than by direct channels such as the central bank's webpage or social media accounts (Blinder et al., 2024). Moreover, the media plays an important role in the expectation formation process of households for inflation (Larsen et al., 2021). Our conjecture is that households rely on media to obtain information about inflation, unemployment, and general economic conditions. In turn, the media acquires this information from communications from central banks and statistical agencies. To provide some evidence in support of our claim, we report in Figure 4 the US media's coverage of FOMC speeches in the weeks around speeches by FOMC members. Consistent with our argument, the figure reveals a significant increase in the number of articles during the week in which the speech is given. This anecdotal evidence points to the importance of the media channel as mean for central banks to reach the general public.

One possible explanation for our result is that households are exposed to local news, which are more likely to report speeches by regional presidents. Ehrmann et al. (2021) shows that speeches by regional presidents are related to regional conditions, that households might care more about than the aggregate economy. To test our hypothesis, we construct two inflationary pressures sub-indices, based on the methodology described in Section 2.3. The first sub-index is a Trinity specific inflationary pressure index that includes speeches by the Chairman, the Vice-Chairman and the NY Fed President only. The second sub-index is a non-Trinity inflationary pressure index, which includes speeches by all regional presidents, excluding the NY Fed President.[12] We regress household inflation expectations on these two sub-indices. We find that the coefficient associated with the non-Trinity inflationary pressure index is always significant and much larger in magnitude than the coefficient associated with the Trinity coefficient, as shown in Table 7. Therefore, household inflation expectations respond to the inflationary pressures communicated by the regional presidents, while they are less sensitive to communication from the Trinity.

[12] The seven members of the Board of Governors of the Federal Reserve System are therefore excluded from this index.

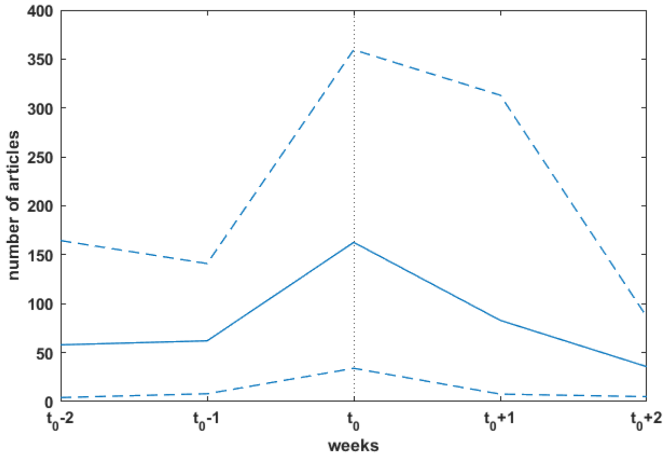

Figure 4. Media coverage. Average number of articles from US newspapers (online and paper), blogs and news websites covering FOMC speeches by all members, excluding Chair and NY Fed President, January 1st to April 10th 2023. t_0 is the week in which the speeches are given. Source: Factiva.

Michigan Survey of Consumers	**1995:m1-2023:m12**		**1995:m1-2007:m12**		**2008:m1-2023:m12**	
	Model 0	Model 1	Model 0	Model 1	Model 0	Model 1
Trinity	0.05	0.02	0.10	0.01	0.10	0.07
	(0.07)	(0.05)	(0.05)	(0.04)	(0.08)	(0.06)
Non-Trinity	0.34**	0.11*	0.14*	0.08†	0.49***	0.18**
	(0.07)	(0.05)	(0.05)	(0.05)	(0.08)	(0.07)
R-Squared	0.26	0.62	0.18	0.41	0.43	0.71
Observations	347	347	155	155	192	192

Table 7. Trinity vs non-Trinity. The dependent variables are the one year ahead expectations (median) of percentage price changes from the MSC. The inflationary pressure index (IPI) is the standardized inflationary pressure index constructed as described in Section 2, based only on speeches by the Trinity (Fed Chairman, Vice-Chairman and NY Fed President), or non-Trinity includes (regional Fed presidents, excluding NY Fed President). Model 0 includes a constant and the two inflationary pressure indices. Model 1 also includes controls X_{t-1} selected from the LASSO regression of $E_t\pi_{t+h}$ on Z_{t-1}, with Z_{t-1} the predictors described in Section 2.3. '†','*', '**' and '***' indicate significance levels at the 15, 10, 5 and 1 percent respectively.

6 A Model with Delphic and Odyssean signals

We introduce a theoretical general equilibrium model to study the Delphic and Odyssean effects of central bank communication. We also use the model to illustrate a possible explanation for the differential responses to central bank communications between households and forecasters. This explanation is based on the idea that these two economic agents likely have different levels of sophistication, reflecting their varying ability to understand monetary policy strategies and central bank announcements.

The model is a prototypical three-equation New Keynesian DSGE model with a total factor productivity (TFP) shock. The model is log-linearized around its unique steady-state equilibrium, which results in the following equations.

$$\begin{aligned}
\widehat{Y}_t &= E_t^P \widehat{Y}_{t+1} - \sigma^{-1}\left(\widehat{R}_t - E_t^P \widehat{\Pi}_{t+1}\right), \\
\widehat{\Pi}_t &= \kappa(\widehat{Y}_t - \widehat{Y}_t^*) + \beta E_t^P \widehat{\Pi}_{t+1}, \\
\widehat{R}_t &= (\phi_\pi)\widehat{\Pi}_t + \phi_x \widehat{X}_t, \\
\widehat{Y}_t^* &= \omega \epsilon_t^a,
\end{aligned}$$

where we define $\omega = (1+\eta)/(\eta+\sigma)$, with η the Frisch labor elasticity σ^{-1} denotes the intertemporal elasticity of substitution. The slope of the New Keynesian Phillips curve is $\kappa = (1-\phi)(1-\phi\beta)(\sigma+\eta)/\phi$ where ϕ denotes the degree of nominal rigidities, β is the household's discount factor. Output is defined as $\widehat{Y}_t = (Y_t - Y)/Y$, the inflation rate as $\widehat{\Pi}_t$, the nominal interest rate as $\widehat{R}_t = R_t - R$, output in the flex price economy as $\widehat{Y}_t^* = (Y_t^* - Y^*)/Y^*$, and the output gap as $\widehat{X}_t = \widehat{Y}_t - \widehat{Y}_t^*$. The shock ϵ_t^a is independent and identically distributed (iid) mean-zero Gaussian random variable: $\epsilon_t^a \sim \mathcal{N}(0, \sigma_a^2)$. As standard, the central bank steers the nominal interest rate. The parameters ϕ_π and ϕ_x denote the central bank's response to changes in inflation and in the output gap.

After some manipulations, the model equations can be written as:

$$\widehat{X}_t = E_t^P \widehat{X}_{t+1} - \sigma^{-1}\left(\widehat{R}_t - E_t^P \widehat{\Pi}_{t+1} - \widehat{R}_t^*\right), \tag{3a}$$

$$\widehat{\Pi}_t = \kappa \widehat{X}_t + \beta E_t^P \widehat{\Pi}_{t+1}, \tag{3b}$$

$$\widehat{R}_t = \phi_\pi \widehat{\Pi}_t + \phi_x \widehat{X}_t, \tag{3c}$$

$$\widehat{R}_t^* = -\sigma\omega\epsilon_t^a, \tag{3d}$$

where $\widehat{R}_t^*$ denotes the natural rate of interest.

The private sector, comprising households and firms, observes a signal regarding the future realization of the technology:

$$s_t^P = \epsilon_{t+1}^a + \eta_t^P, \tag{4}$$

with noise $\eta_t^P \sim \mathcal{N}\left(0, \sigma_{\eta,P}^2\right)$.[13] The history of signals s_t^P denote agents' private information.

6.1 Delphic announcements: the inflationary pressure index

The private sector also receives a signal from the central bank in the form of the central bank's expectations about future inflation, $E_t^C \Pi_{t+1}$. This signal is introduced to investigate the implications of a change in the inflationary index of the type we measure in the data on inflation expectations. This case is called *Delphic* as all the central bank does is

[13] This signal can also be interpreted as a signal about the natural rate ($\widehat{R}_{t+1}^* = -\sigma\omega\epsilon_{t+1}^a$).

to announce a revision to its projection of inflation. Later, we will investigate the case where the central bank provides guidance regarding how it will respond to the inflationary pressure.

The central bank's inflation expectations are based on a signal it observes in every period:

$$s_t^C = \epsilon_{t+1}^a + \eta_t^C,$$

with noise $\eta_t^C \sim \mathcal{N}\left(0, \sigma_{\eta,C}^2\right)$.

The equilibrium law of motion of the output gap and inflation can be shown to be governed by the following equations:

$$\begin{bmatrix} \widehat{X}_t \\ \widehat{\Pi}_t \end{bmatrix} = \begin{pmatrix} \alpha_x \\ \alpha_\pi \end{pmatrix} \epsilon_t^a + \begin{pmatrix} \gamma_x \\ \gamma_\pi \end{pmatrix} E_t^P \epsilon_{t+1}^a. \tag{5}$$

where the scalar α_π and γ_π are obtained by solving the model in its news-representation form (Chahrour and Jurado, 2018).[14] Note that $E_t^P \epsilon_{t+1}^a$ is not zero as agents receive signals regarding the realization of the shock in the next period—e.g. Equation (4).

The news representation of the equilibrium dynamics of inflation and the output gap in our model can be expressed as follows:

$$\begin{bmatrix} \widehat{X}_t \\ \widehat{\Pi}_t \end{bmatrix} = \begin{pmatrix} \alpha_x & \alpha_x \\ \alpha_\pi & \alpha_\pi \end{pmatrix} \begin{bmatrix} \epsilon_{a,t}^0 \\ \epsilon_{a,t-1}^1 \end{bmatrix} + \begin{pmatrix} \gamma_x \\ \gamma_\pi \end{pmatrix} \epsilon_{a,t}^1, \tag{6}$$

where $\epsilon_{a,t}^0$ is the surprise component of the technology shock or the private sector's forecast error and $\epsilon_{a,t}^1$ is the component of the technology shock that is observed in period t and is expected to hit the economy in period $t+1$. Formally, $\epsilon_t^a \equiv \epsilon_t^0 + \epsilon_{t-1}^1$.

Starting from the equilibrium law of motion of inflation in period t—roll Equation (5)

[14] The news representation of this New Keynesian model with private and Delphic signals can be obtained by replacing the signal and the signal extraction problem with the assumptions that agents receive news, $\epsilon_{a,t}^1$ in every period about the one-period-ahead realization of the shock, ϵ_{t+1}^a. In the news representation is further assumed that the realization of the shock in the next period is made of two components: a surprise component and an anticipated components (news). Formally, $\epsilon_{t+1}^a = \epsilon_{a,t+1}^0 + \epsilon_{a,t}^1$, where $\epsilon_{a,t}^0$ denote the surprise or forecast error at time $t+1$. As shown by (Chahrour and Jurado, 2018), there exists a mapping from the solution to the signal extraction problem solved by agents in the actual economy to the realizations of news and surprise shocks so that the model and its news representation are observationally equivalent.

one period forward, the central bank's expectations about next period's inflation will be:

$$\begin{aligned} E_t^C \widehat{\Pi}_{t+1} &= \alpha_\pi E_t^C \epsilon_{t+1}^a + \gamma_\pi E_t^P \epsilon_{t+2}^a, \\ &= \alpha_\pi \frac{\sigma_a^2}{\sigma_a^2 + \sigma_{\eta,C}^2} \underbrace{\left(\epsilon_{t+1}^a + \eta_t^C\right)}_{s_t^C}, \\ &= \alpha_\pi k_C \left(\epsilon_{t+1}^a + \eta_t^C\right), \end{aligned} \tag{7}$$

where the Kalman gain is as follows: $k_C = \frac{\sigma_a^2}{\sigma_a^2+\sigma_{\eta,C}^2}$.[15]

The central bank announces its forecast of inflation $E_t^C \widehat{\Pi}_{t+1}$ to the private sector and the private sector tries to learn the central bank view about the future realization of the shock. Formally, the private sector observes the following *Delphic signal* from the central bank:

$$\widetilde{s}_t^P = \alpha_\pi \kappa_C \left(\epsilon_{t+1}^a + \eta_t^C\right) = \alpha_\pi \kappa_C s_t^C.$$

Since economic agents are rational, they understand both the equilibrium law of motion for inflation (α_π and γ_π) and the precision of the central bank's signal (κ_C). Consequently, the private sector can infer the signal observed by the central bank, s_t^C, from the Delphic announcement. It follows that the private sector is aware of the central bank's signal extraction problem and accounts for it when processing the Delphic signal. However, its expectations about the future realization of the technology shock will differ from those of the central bank, as the private sector has access to its own private signal—one that the central bank does not observe. This private signal can be interpreted as a prior, available to the private sector before receiving the Delphic signal.

Taking all this into account, the private sector's expectations of the next period's technology shock, after incorporating the central bank's Delphic signal, are given by:

$$E_t^P \epsilon_{t+1}^a = \underbrace{\kappa_P \left(\epsilon_{t+1}^a + \eta_t^P\right)}_{\text{Prior expectations}} + \kappa_C \left[\underbrace{\left(\epsilon_{t+1}^a + \eta_t^C\right)}_{s_t^C} - \kappa_P \underbrace{\left(\epsilon_{t+1}^a + \eta_t^P\right)}_{s_t^P} \right], \tag{8}$$

where prior expectations refer to the private sector's expectations conditioned only on the private signal s_t^P, received before the Delphic communication takes place. The Kalman gain associated with the signal extraction from the private sector's first observed signal, s_t^P, is given by $\kappa_P = \frac{\sigma_a^2}{\sigma_a^2+\sigma_{\eta,P}^2}$. Note that if the private sector's signal were completely uninformative ($\kappa_P = 0$), then the central bank and the private sector would fully agree on the next realization of the technology shock.

The dynamics of the expected realization of the next period's technology shock in

[15] The central bank knows that the private sector has information about future shocks only up to one period ahead and hence it knows that $E_t^P \epsilon_{t+2}^a = 0$.

Equation (8) can be combined with the law of motions shown in Equation (5) to obtain the equilibrium dynamics of the output gap and inflation under Delphic communications. The private sector's inflation expectations are as follows:

$$E_t^P \widehat{\Pi}_{t+1} = \alpha_\pi E_t^P \epsilon_{t+1}^a, \tag{9}$$

where the expectation term on the right hand side is defined in Equation (8).

To illustrate the Delphic effects, assume that no shock occurs in periods t and $t+1$; however, the noise in the central bank's signal is negative at time t, such that $\eta_t^C < 0$. The private sector's prior on the technology shock is zero, i.e., $\mathbb{E}[\kappa_p(\epsilon_{t+1}^a + \eta_t^P)] = 0$. When the central bank observes a negative signal ($s_t^C < 0$), it anticipates a negative technology shock in the next period, leading it to expect positive inflationary pressure, $E_t^C \widehat{\Pi}_{t+1} > 0$. When this inflationary pressure is communicated to the private sector, they revise their inflation expectations upward to fully align with the central bank's expectations, such that $E_t^P \widehat{\Pi}_{t+1} = E_t^C \widehat{\Pi}_{t+1}$. In this example, where the noise in the central bank's signal drives the announcement, the communication is fully Delphic. This model's prediction provides a rationale for our first empirical finding: speeches signaling higher inflationary pressure lead the public to revise their inflation expectations upward.

6.2 Announcements Signaling a Hawkish Commitment

Now, we consider the case in which, following the announcement of anticipated inflationary pressure, the central bank communicates its view regarding the policy response. Specifically, the central bank communicates the expected interest rate in the next period, $E_t^C R_{t+1}$.

For the sake of argument, the central bank announces its commitment to fight the announced inflationary pressure with a response that exceeds the one implied by the baseline policy rule in Equation (3c). Formally, the stronger anti-inflation commitment embedded in the announced interest rate is $\overline{\phi}_\pi > \phi_\pi$. This type of communication focused on the reaction function constitutes a form of Odyssean communication.

We consider two cases. The first case involves an unsophisticated agent who cannot understand monetary policy well enough to disentangle the change to the reaction function from central bank's announcements. As a result, the unsophisticated agent treats the announcement regarding the future interest rate as another forecast provided by the central bank based on the baseline policy rule, ϕ_π. Consequently, the unsophisticated agent overlooks the Odyssean component of the communication—namely, the stronger anti-inflation commitment embedded in the announced interest rate. This case provides a possible explanation for the weak response of households' inflation expectations to conditional shifts in the hawkishness index we find in the data.

In the second case, we consider a sophisticated agent who can recognize the stronger commitment to fight inflationary pressure reflected in the interest rate projected by the central bank. These agents can thus disentangle the Odyssean component of the announcement—namely, the stronger-than-average anti-inflation commitment in the announced interest rate. This case serves as a possible explanation for professional forecasters' significant response to changes in the hawkishness index observed in the data.

Recall that the monetary policy rule implies that the interest rate expected by the central bank depends on its forecast about inflation and the output gap. So the central bank announces the following rate for the next period:

$$E_t^C(\widehat{R}_{t+1}|\overline{\phi}_\pi) = \overline{\phi}_\pi E_t^C(\widehat{\Pi}_{t+1}|\overline{\phi}_\pi) + \phi_x E_t^C(\widehat{X}_{t+1}|\overline{\phi}_\pi),$$

where the parameter $\overline{\phi}_\pi$ reflects the central bank's newly announced, stronger anti-inflation response.

The signal can equivalently be expressed in terms of expectations about the future technology shock by rolling forward the equilibrium laws of motion for inflation and the output gap in Equation (5) by one period, then applying the expectation operator conditional on the information held by the central bank. By plugging these expectations in the equation above, we obtain

$$E_t^C(\widehat{R}_{t+1}|\overline{\phi}_\pi) = \underbrace{\left[\alpha_\pi(\overline{\phi}_\pi)\overline{\phi}_\pi + \alpha_x(\overline{\phi}_\pi)\phi_x\right]}_{\alpha_R(\overline{\phi}_\pi)} E_t^C(\epsilon_{t+1}^a)$$

where $\alpha_\pi(\overline{\phi}_\pi)$ and $\alpha_x(\overline{\phi}_\pi)$ capture the equilibrium response of inflation and the output gap to the current technology shock conditional on all the model parameters—including the stronger commitment to fight inflation announced by the central bank, $\overline{\phi}_\pi$. The operator $\alpha_R(\phi_\pi)$ maps realized technology shocks to the equilibrium interest rate. As an equilibrium mapping, it depends on all model parameters, including the central bank's response to inflation. Note that the central bank's expectations about the next period's technology shock, $E_t^C \epsilon_{t+1}^a$, is defined as $\kappa_c\left(\epsilon_{t+1}^a + \eta_t^c\right)$.

How agents adjust their expectations following the announcement, $E_t^C(\widehat{R}_{t+1}|\overline{\phi}_\pi)$, depends on their ability to assess the degree of anti-inflation commitment embedded in the Odyssean announcement. Let us first consider the less sophisticated agent who is unable to observe the new anti-inflation attitude of the central bank making the announcement.

The unsophisticated agent's expectations regarding the next period interest rate will be updated as follows:

$$\widetilde{E}_t^P(\widehat{R}_{t+1}|\phi_\pi) = E_t^P(\widehat{R}_{t+1}|\phi_\pi) + \kappa_C\left[E_t^C(\widehat{R}_{t+1}|\overline{\phi}_\pi) - E_t^P(\widehat{R}_{t+1}|\phi_\pi)\right], \tag{10}$$

where $E_t^P(\widehat{R}_{t+1}|\phi_\pi)$ represents the expectations of unsophisticated agents before observing the central bank's announcement regarding the interest rate. These prior expectations are based on the inflation response implied by the baseline policy ($\phi_\pi < \overline{\phi}_\pi$). The expectation operator $\widetilde{E}_t^P(\widehat{R}_{t+1}|\phi_\pi)$ denotes the interest rate expected by unsophisticated agents after receiving the hawkish announcement. However, these posterior expectations remain conditional on the weaker monetary policy response to inflation (ϕ_π), as unsophisticated agents fail to recognize the policy shift. Finally, the conditioning of the signal $E_t^C(\widehat{R}_{t+1}|\overline{\phi}_\pi)$ indicates that the announced interest rate reflects the central bank's stronger response to inflation, even though agents are unable to perceive this change in the central bank's reaction function.

We can use the response of the interest rate to technology shocks, $\alpha_R(\cdot)$, to express the above equation in terms of expectations of technology shocks. In doing so, it is critical to account for how each expectation operator is conditioned on the policy response to inflation:

$$\widetilde{E}_t^P(\epsilon_{t+1}^a) - E_t^P \epsilon_{t+1}^a = \kappa_C \left(\frac{\alpha_R(\overline{\phi}_\pi)}{\alpha_R(\phi_\pi)} E_t^C \epsilon_{t+1}^a - E_t^P \epsilon_{t+1}^a \right), \tag{11}$$

where $E_t^P \epsilon_{t+1}^a$ denotes the technology shock expected by the private sector before observing the central bank's interest rate announcement. This expectation is formally defined in Equation (8). The unsophisticated agent's expectation of the technology shock after observing the announced interest rate is denoted by $\widetilde{E}_t^P(\epsilon_{t+1}^a)$. Finally, $E_t^C(\epsilon_{t+1}^a)$ represents the central bank's expectation of the technology shock for the next period. The ratio $\frac{\alpha_R(\overline{\phi}_\pi)}{\alpha_R(\phi_\pi)}$ is strictly greater than one under plausible calibrations of the model parameters.

The role of this ratio is particularly insightful in understanding how Delphic effects operate. Consider a scenario where the only shock occurring in periods t and $t+1$ is the noise in the central bank's signal in period t, denoted by η_t^C. In this case, it is straightforward to show that $E_t^C \epsilon_{t+1}^a = E_t^P \epsilon_{t+1}^a$.[16] If agents fully understood the hawkish shift in policy ($\phi_\pi \to \overline{\phi}_\pi$), the ratio would be equal to one. In this case, the central bank's hawkish announcement would not lead to any revision in the agent's expectations about the next shock. As we will discuss further in the case of sophisticated agents, the central bank's second signal pertains to the reaction function and does not convey any additional information about the state of the economy (ϵ_{t+1}^a) beyond what the private sector could have already inferred from the first inflation signal. In fact, the second announcement is not based on any additional information beyond the signal s_t^C that the central bank has already observed and communicated by revealing its view on the inflationary pressure. However, unsophisticated agents fail to correctly assess the degree of hawkishness, which is reflected in the ratio being strictly greater than one. As a result, these agents *overreact* to the interest rate communicated by the central bank, leading to a Delphic pass-through

[16] Recall that $E_t^P \epsilon_{t+1}^a$ represents the private sector's expectations after receiving the first announcement and observing its own signal, s_t^P.

from central bank expectations to private sector expectations.

To convert the expectations of technology shocks into the expectations of inflation, we use the mapping $\alpha_\pi(\phi_\pi)$, based on the unsophisticated agent's (mistaken) perception of the central bank's inflation response. The revision to inflation expectations after the unsophisticated agent observes the Odyssean signal is as follows:

$$\widetilde{E}_t^P(\widehat{\Pi}_{t+1}|\phi_\pi) - E_t^P(\widehat{\Pi}_{t+1}|\phi_\pi) = \alpha_\pi(\phi_\pi)\left[\widetilde{E}_t^P(\epsilon_{t+1}^a) - E_t^P(\epsilon_{t+1}^a)\right], \tag{12}$$

where we use Equation (9) to define agent's prior beliefs about inflation, $E_t^P(\widehat{\Pi}_{t+1}|\phi_\pi)$.

When the announced interest rate exceeds their prior beliefs—i.e., $E_t^C(\widehat{R}_{t+1}|\overline{\phi}_\pi) > E_t^P(\widehat{R}_{t+1}|\phi_\pi)$—unsophisticated agents revise their expectations about the technology shock and inflation upward. Failing to recognize that the higher interest rate merely reflects a stronger commitment to fighting inflation, these agents mistakenly infer that the central bank has observed a new signal indicating even higher inflation than initially suggested by the first announcement. Thus, the assumption of a lack of sophistication implies that both signals—the announcement of inflationary pressure and the announcement of the interest rate for the next period—are perceived as Delphic by these agents.

Let us now turn to the case of sophisticated agents who fully recognize the Odyssean nature of the second signal. Since sophisticated agents understand the model, including the central bank's new reaction function, and know the signal , s_t^C observed by the central bank, they can perfectly anticipate the announced interest rate for the next period. As a result, there is no Bayesian updating regarding the central bank's view on inflation. Instead, sophisticated agents revise their expectations of next period's inflation solely in response to the central bank's more hawkish policy reaction, which directly influences future inflation outcomes. Specifically, they adjust their expectations as follows:

$$\widetilde{E}_t^P(\widehat{\Pi}_{t+1}|\overline{\phi}_\pi) - E_t^P(\widehat{\Pi}_{t+1}|\phi_\pi) = \left[\alpha_\pi(\overline{\phi}_\pi) - \alpha_\pi(\phi_\pi)\right] E_t^P \epsilon_{t+1}^a, \tag{13}$$

where the left-hand side equation captures the revision of the sophisticated agent's inflation expectations after observing the central bank's hawkish signal. The right-hand side of the equation reflects the Odyssean adjustment. The sign of this revision is determined by the responses of inflation to the technology shock under each policy reactions—i.e., the baseline reaction , $\alpha_\pi(\phi_\pi)$ and the hawkish reaction announced, $\alpha_\pi(\overline{\phi}_\pi)$.

Importantly, there is no Delphic revision, as sophisticated agents fully anticipate the interest rate announced by the central bank. Consequently, their expectations remain unchanged with respect to the central bank's inflation outlook, and no Bayesian updating occurs.

To illustrate how the different types of agents react to the announcement regarding the future interest rate, we set the model parameters of this stylized model as follows:

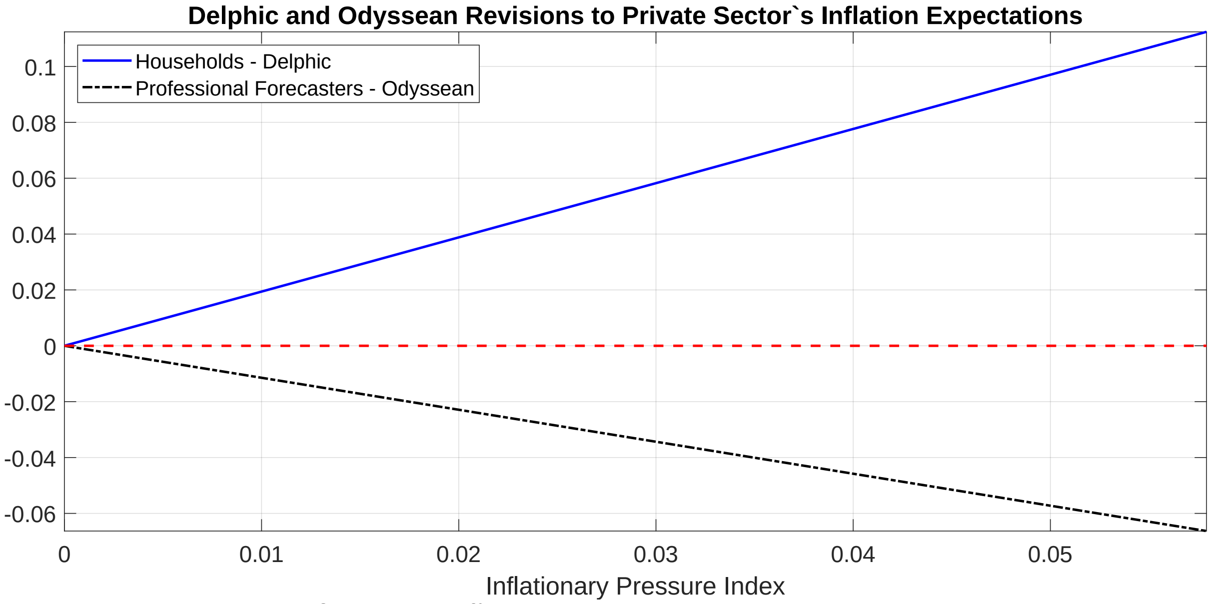

Figure 5. Delphic and Odyssean effects. Revisions in private sector's inflation expectations before and after an hawkish announcement for sophisticated agents (professional forecasters)—$\widetilde{E}_t^P(\Pi_{t+1}|\overline{\phi}_\pi) - E_t^P(\Pi_{t+1}|\phi_\pi)$—and unsophisticated agents (households)—$(\widetilde{E}_t^P(\Pi_{t+1}|\phi_\pi) - E_t^P(\Pi_{t+1}|\phi_\pi)$. On the x-axis, the inflationary pressure index, $E_t^C \pi_{t+1}$, is varied by changing the realization of the noise, η_t^c, in the central bank's signal.

$\beta = 0.975$, $\sigma = 1.0$, $\kappa = 0.03$, $\phi_\pi = 1.5$, $\overline{\phi}_\pi = 2.0$, $\phi_x = 0.25$, $\eta = 2$, $\sigma_a = \sigma_{\eta,P} = \sigma_{\eta,C} = 1.0$.

The revision to inflation expectations following the hawkish announcement is measured relative to the Delphic expectation, $E_t^P \widehat{\Pi}_{t+1}$, and is plotted in Figure 5 for both types of agents. The inflationary pressure on the x-axis varies as the noise, η_t^C, in the central bank's public signal changes.

The Delphic effects drive the revisions in the unsophisticated agent's inflation expectations, as defined in Equation (12). The blue solid line remains in positive territory, indicating that the announcement of a tighter monetary policy response leads these agents to revise their inflation expectations upward. This upward revision reinforces the initial increase in inflation expectations triggered by the central bank's announcement of inflationary pressure.

The expectation revisions of sophisticated agents reflect only Odyssean effects, as discussed earlier. After the central bank's hawkish announcement, sophisticated agents do not revise their expectations about the economic outlook; rather, they update their beliefs about the central bank's reaction function. These revisions, plotted as the black dash-dotted line, remain in negative territory, indicating that sophisticated agents lower their inflation expectations as they internalize the central bank's more hawkish response to the inflationary pressure. The downward slope of the line reflects the intensification of Odyssean effects as the inflationary pressure communicated by the central bank in the first stage increases.

7 Conclusion

Using textual analysis of FOMC speeches, this paper constructs a Fed inflationary pressure index that captures soft information in central bank communications. The findings indicate that when the FOMC signals higher inflationary pressures, both households and professional forecasters raise their inflation expectations, consistent with a Delphic effect. However, only professional forecasters revise their expectations downward when inflationary pressures are conveyed by an FOMC member with a strong hawkish reputation, highlighting the presence of Odyssean effects among more sophisticated agents while leaving Delphic effects dominant among households.

These results have important implications for monetary policy communication. Central banks can reach the general public as well as sophisticated agents. However, while central bank communication combined with Odyssean signals helps anchor inflation expectations among experts, it may inadvertently lead to higher inflation expectations among households.

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Appendices

Appendix A Speeches

Date	Speaker	Sentiment (total/example)	Example sentences: Identifiers and Modifiers
1999-10-12		-30	
	Laurence Meyer	-30/-3	*If nominal wage cuts are rare, efficiency in the allocation of resources may decline, and as a result, output might be lower at price stability than if there were some low rate of inflation.*
2004-10-29		-7	
	Roger Ferguson	-7/-1	*That should gradually return the economy to full utilization of its resources, while inflation remains subdued.*
2005-10-18		104	
	Timothy Geithner	-3/-3	*We have been through a period of relatively favorable overall macroeconomic conditions in the united states, low realized credit losses, lower volatility in output growth and relatively low and stable, long-term inflation expectations.*
	Roger Ferguson	44/1	*This substitution will mitigate somewhat, but not fully offset, the effects of higher energy prices on consumer spending.*
	Janet Yellen	35/1	*Even before Katrina, they suggested that higher prices may be here to stay.*
	Alan Greenspan	30/1	*Additionally, the longer-term crude price has presumably been driven up by renewed fears of supply disruptions in the middle east and elsewhere.*
2007-05-22		-26	
	Jeffrey Lacker	-26/3	*The markup has been relatively steady at an elevated level over the two years, which with rising unit labor costs is consistent with the rise in inflation we've seen.*
2014-11-10		-38	
	Eric Rosengren	-38/-1	*During periods when the gap is wide, the inflation rate tends to fall over time.*

Table 8. This table shows the sentiment scores for various speakers and dates, along with illustrative example sentences highlighting the identifiers and modifiers contributing to the sentiment. Blue represents identifiers, while green and red represent positive and negative modifiers, respectively.

Date	Speaker	Sentiment (total/example)	Example sentences: Identifiers and Modifiers
2015-11-12		-36	
	Stanley Fischer	-6/-1	*First, while the U.S. economy has performed relatively well–as is visible especially in our steady progress toward full employment–major foreign economies have generally experienced weak growth, along with low inflation.*
	William Dudley	-27/-1	*Avoiding a japan-like experience in which inflation expectations have become unanchored to the downside should be an important consideration in the conduct of monetary policy.*
	Charles Evans	10/1	*If instead inflation headwinds persist, I would advocate a more gradual approach to normalization than I currently envision.*
	James Bullard	-9/2	*Chief among these consequences is that the policy itself may put downward pressure on inflation in the medium and long term, rather than upward pressure as conventionally thought.*
	Jeffrey Lacker	-3/0	*While a description like this pins inflation at higher frequencies to move around, perhaps in response to a variety of relative price shocks.*
2021-05-05		85	
	Charles Evans	42/2	*I was not surprised to see such an increase, and I expect to see some further pickup in inflation in the coming months.*
	Eric Rosengren	21/3	*When people expect persistently higher inflation, it would follow that wages would begin to reflect these higher expectations.*

Table 9. This table shows the sentiment scores for various speakers and dates, along with illustrative example sentences highlighting the identifiers and modifiers contributing to the sentiment. Blue represents identifiers, while green and red represent positive and negative modifiers, respectively.

Date	**Speaker**	**Sentiment** (total/example)	**Example sentences: Identifiers and Modifiers**
2015-11-12		-36	
	Stanley Fisher	-6/-1	*Nevertheless, an extensive literature has found that the degree of pass-through of exchange rate changes to U.S. import prices is low, as foreign exporters prefer to keep the dollar price of the goods they sell in the U.S. market relatively constant.*
	William Dudley	-27/-1	*If the economy continues to grow at an above-trend pace, then I think worries about inflation remaining too low, should begin to recede.*
	Charles Evans	10/-1	*One reason is that there exist a number of important downside risks to the inflation outlook.*
	James Bullard	-10/-1	*In addition, the current year-over-year inflation rate, while low, reflects an outsized oil price shock that occurred during.*
	Jeffrey Lacker	-3/	*But this specification is hard to distinguish statistically from one in which inflation does move, perhaps slowly, toward a better anchored long-run expectation.*
2021-05-05		85	
	Charles Evans	41/1	*Yet, despite some recent price increases, achieving our inflation goal may prove more difficult.*
	Eric Rosengren	21/2	*As a result, my perspective is that the emphasis on actual outcomes rather than forecasts of rising inflationary pressures when setting monetary policy appears justified.*
	Loretta Mester	22/-1	*In particular, the general level of interest rates is lower than in the past and inflation dynamics have changed so that economic slack plays less of a role and inflation expectations play more of a role in determining inflation outcomes.*
	Michelle Bowman	1/1	*Although i expect these upward price pressures to ease after the temporary supply bottlenecks are resolved, the exact timing of that dynamic is uncertain.*
2021-07-21		-38	
	John Williams	-38/-2	*With inflation averaging below the target level, inflation expectations will also be anchored below target.*

Table 10. This table shows the sentiment scores for various speakers and dates, along with illustrative example sentences highlighting the identifiers and modifiers contributing to the sentiment. Blue represents identifiers, while green and red represent positive and negative modifiers, respectively.

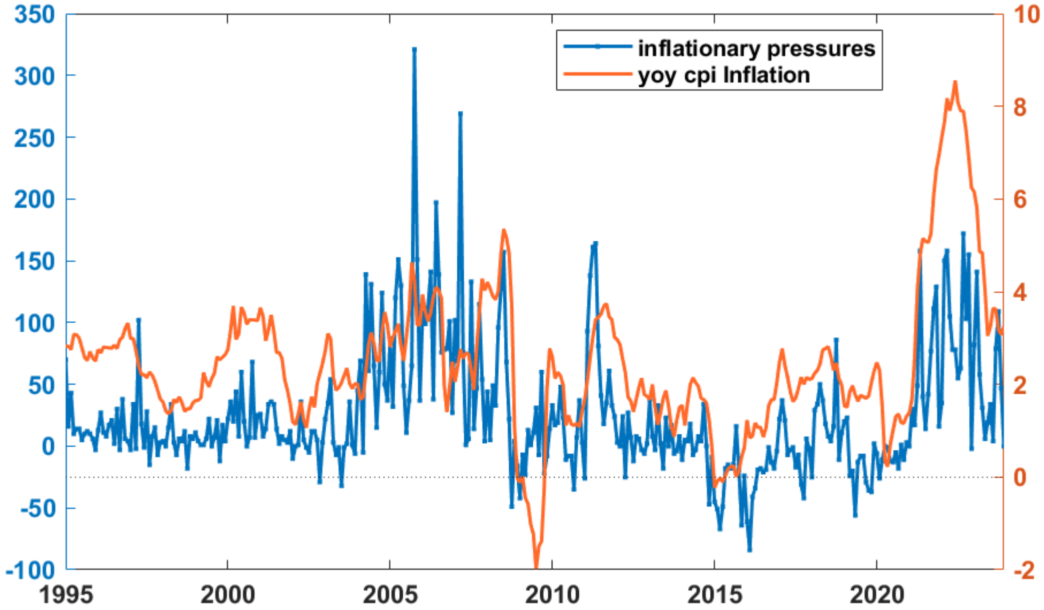

Figure 6. The monthly inflation sentiment index (left vertical axis) and year over year CPI all items inflation (right vertical axis). The monthly sentiment is the monthly sum of the daily inflation sentiment.

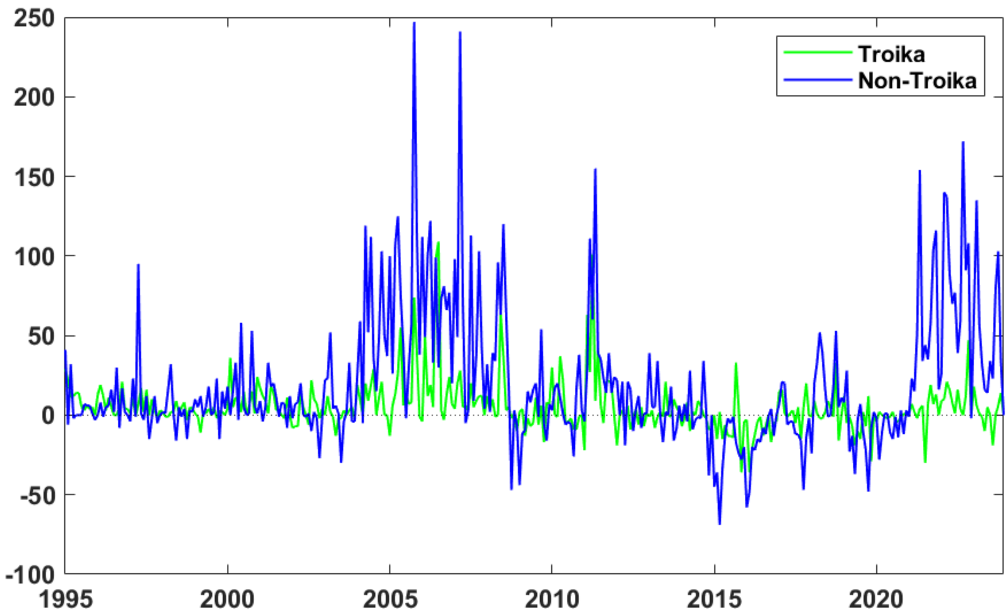

Figure 7. The monthly inflation sentiment sub-indices for Troika (the Chair of the Board of Governors, the Vice and the President of the New York Fed) and all other speakers.

Appendix B Robustness Checks

B.1 Number of Lags

Michigan Survey of Consumers	1995:m1-2023:m12		1995:m1-2007:m12		2008:m1-2023:m12	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.08	0.13	0.02	0.26***	0.23***	0.16*
	(0.05)	(0.08)	(0.04)	(0.07)	(0.06)	(0.08)
IPI_{t-2}	0.00	0.29*	0.01	0.01	0.05	0.62**
	(0.05)	(0.16)	(0.04)	(0.07)	(0.06)	(0.23)
SEP_{t-1}		0.01*		0.01		0.06**
		(0.07)		(0.05)		(0.07)
R-Squared	0.65	0.70	0.51	0.64	0.78	0.80
Observations	346	87	154	24	192	63
Survey of Professional Forecasters	**1995:Q1-2023:Q4**		**1995:Q1-2007:Q4**		**2008:Q1-2023:Q4**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.06**	0.07***	0.02	0.06**	0.11***	0.06**
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
IPI_{t-2}	0.00	−0.01	0.01	−0.07**	−0.02	−0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
SEP_{t-1}		0.21***		0.05		0.22**
		(0.06)		(0.09)		(0.09)
R-Squared	0.79	0.86	0.75	0.68	0.86	0.89
Observations	115	82	51	23	63	58

Table 11. Inclusion of Lags. The dependent variables are the one year ahead expectation (median) of percentage price changes from the MSC and the one year ahead expectation (median) of CPI all items inflation from the SPF. Model 1 includes a constant, the first and second lags of the standardized inflationary pressure index, IPI_{t-1} and IPI_{t-2}, constructed in Section 2.1, and first and second lags of controls, X_{t-1} and X_{t-2}, selected from the LASSO regression of $E_t\pi_{t+h}$ on Z_{t-1}, with Z_{t-1} the predictors described in Section 2.3. Model 2 also includes the FOMC's quantitative inflation forecasts, SEP_{t-1}. The tuning parameters for the LASSO regressions are 0.005 for MSC and 0.01 for SPF. '*', '**' and '***' indicate significance levels at the 10, 5 and 1 percent respectively.

B.2 Mean

Michigan Survey of Consumers	**1995:m1-2023:m12**		**1995:m1-2007:m12**		**2008:m1-2023:m12**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.09	0.22*	-0.05	0.28*	0.36***	0.31**
	(0.07)	(0.11)	(0.06)	(0.12)	(0.09)	(0.12)
SEP_{t-1}		0.50*		0.11		0.95**
		(0.23)		(0.16)		(0.30)
R-Squared	0.72	0.74	0.57	0.59	0.80	0.80
Observations	347	87	155	24	192	63
Survey of Professional Forecasters	**1995:Q1-2023:Q4**		**1995:Q1-2007:Q4**		**2008:Q1-2023:Q4**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.06**	0.07***	0.03	0.05*	0.13***	0.06*
	(0.03)	(0.02)	(0.03)	(0.02)	(0.04)	(0.04)
SEP_{t-1}		0.22***		0.15		0.26***
		(0.07)		(0.10)		(0.10)
R-Squared	0.78	0.86	0.70	0.65	0.86	0.89
Observations	116	82	52	23	64	59

Table 12. Mean Forecasts. The dependent variables are the one year ahead expectation (mean) of percentage price changes from the MSC, and the one year ahead expectation (mean) of CPI all items inflation from the SPF. Model 1 includes a constant, the standardized inflationary pressure index IPI_{t-1} constructed in Section 2.1, and controls X_{t-1} selected from the LASSO regression of $E_t\pi_{t+h}$ on Z_{t-1}, with Z_{t-1} the predictors described in Section 2.3. Model 2 also includes the FOMC's quantitative inflation forecasts, SEP_{t-1}. The tuning parameters for the LASSO regressions are 0.007 for MSC and 0.01 for SPF. '*', '**' and '***' indicate significance levels at the 10, 5 and 1 percent respectively.

B.3 Outliers

Michigan Survey of Consumers	**1995:m1-2023:m12**		**1995:m1-2007:m12**		**2008:m1-2023:m12**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.13*	0.16*	0.01	0.19**	0.34***	0.32**
	(0.06)	(0.09)	(0.06)	(0.07)	(0.07)	(0.09)
SEP_{t-1}		0.22		-0.10		0.46*
		(0.14)		(0.09)		(0.21)
R-Squared	0.62	0.67	0.46	0.52	0.76	0.79
Observations	330	83	147	23	182	60

Survey of Professional Forecasters	**1995:Q1-2023:Q4**		**1995:Q1-2007:Q4**		**2008:Q1-2023:Q4**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.09***	0.11***	0.06	0.10**	0.12***	0.08**
	(0.04)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
SEP_{t-1}		0.20***		0.06		0.22**
		(0.07)		(0.10)		(0.09)
R-Squared	0.79	0.87	0.71	0.71	0.87	0.90
Observations	109	76	49	20	61	56

Table 13. Exclusion of outliers: the percentage of observations excluded from the sample is 5 percent. The dependent variables are the one year ahead expectation (median) of percentage price changes from the MSC and the one year ahead expectations (median) of CPI all items inflation from the SPF. Model 1 includes a constant, the standardized inflationary pressure index IPI_{t-1} constructed in Section 2.1, and controls X_{t-1} selected from the LASSO regression of $E_t\pi_{t+h}$ on Z_{t-1}, with Z_{t-1} the predictors described in Section 2.3. Model 2 also includes the FOMC's quantitative inflation forecasts, SEP_{t-1}. The tuning parameters in the LASSO regressions are 0.005 for MSC and 0.01 for SPF. '*', '**' and '***' indicate significance levels at the 10, 5 and 1 percent respectively.

B.4 Principal Components

Michigan Survey of Consumers	**1995:m1-2023:m12**		**1995:m1-2007:m12**		**2008:m1-2023:m12**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.13^{*}	0.17^{*}	0.06	0.17^{***}	0.32^{***}	$0.16^{\dagger}$
	(0.05)	(0.07)	(0.04)	(0.04)	(0.08)	(0.10)
SEP_{t-1}		0.49^{**}		0.01		0.83^{***}
		(0.15)		(0.08)		(0.22)
R-Squared	0.59	0.71	0.47	0.64	0.67	0.76
Observations	347	87	155	24	192	63

Survey of Professional Forecasters	**1995:Q1-2023:Q4**		**1995:Q1-2007:Q4**		**2008:Q1-2023:Q4**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.06	0.07^{***}	-0.12^{***}	-0.01	0.16^{***}	0.05
	(0.05)	(0.02)	(0.05)	(0.03)	(0.05)	(0.04)
SEP_{t-1}		0.43^{***}		0.30^{***}		0.48^{***}
		(0.06)		(0.09)		(0.07)
R-Squared	0.49	0.80	0.45	0.47	0.70	0.86
Observations	116	82	52	23	64	59

Table 14. Principle Components Analysis: three principal components are included in the regressions. The dependent variables are the one year ahead expectation (median) of percentage price changes from the MSC and the one year ahead expectation (median) of CPI all items inflation from the SPF. Model 1 includes a constant, the standardized inflationary pressure index IPI_{t-1} constructed in Section 2.1, and the first three principal components of Z_{t-1}, with Z_{t-1} the predictors described in Section 2.3. Model 2 also includes the FOMC's quantitative inflation forecasts, SEP_{t-1}. '†', '*', '**' and '***' indicate significance levels at the 15, 10, 5 and 1 percent respectively.

B.5 Shock-First Approach

Michigan Survey of Consumers	1995:m1-2023:m12		1995:m1-2007:m12		2008:m1-2023:m12	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.55***	0.40**	0.39***	0.30***	0.74***	0.52***
	(0.05)	(0.09)	(0.05)	(0.04)	(0.05)	(0.10)
SEP_{t-1}		0.48**		-0.04		0.45**
		(0.13)		(0.08)		(0.13)
R-Squared	0.52	0.67	0.45	0.53	0.74	0.80
Observations	347	87	155	24	192	63

Survey of Professional Forecasters	1995:Q1-2023:Q4		1995:Q1-2007:Q4		2008:Q1-2023:Q4	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.02	0.06**	−0.07	0.02	0.01	0.01
	(0.08)	(0.03)	(0.08)	(0.03)	(0.10)	(0.04)
SEP_{t-1}		0.54***		0.39***		0.57***
		(0.04)		(0.07)		(0.04)
R-Squared	0.00	0.76	0.01	0.49	0.00	0.84
Observations	116	82	52	23	64	59

Table 15. Two Step Shock-First Approach. The dependent variables are the one year ahead expectation (median) of percentage price changes from the MSC and the one year ahead expectation (median) of CPI all items inflation from the SPF. Model 1 includes a constant, the standardized inflationary pressure index IPI_{t-1} constructed in Section 2.1, and the residual from the LASSO regression of IPI_{t-1} on Z_{t-1}, with Z_{t-1} the predictors described in Section 2.3. Model 2 also includes the FOMC's quantitative inflation forecasts, SEP_{t-1}. The tuning parameters for the LASSO regressions are 0.004 for MSC and 0.01 for SPF. '†', '*', '**' and '***' indicate significance levels at the 15, 10, 5 and 1 percent respectively.

B.6 Deflation and disinflation

Michigan Survey of Consumers	1995:m1-2023:m12		1995:m1-2007:m12		2008:m1-2023:m12	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.08†	0.14*	0.03	0.17**	0.28***	0.22**
	(0.05)	(0.07)	(0.04)	(0.06)	(0.06)	(0.08)
SEP_{t-1}		0.20		-0.07		0.47*
		(0.15)		(0.10)		(0.22)
R-Squared	0.66	0.73	0.50	0.58	0.78	0.81
Observations	347	87	155	24	192	63
Survey of Professional Forecasters	**1995:Q1-2023:Q4**		**1995:Q1-2007:Q4**		**2008:Q1-2023:Q4**	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.07***	0.07***	0.04	0.04*	0.12***	0.07**
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.03)
SEP_{t-1}		0.20***		0.07		0.20***
		(0.06)		(0.10)		(0.08)
R-Squared	0.80	0.86	0.75	0.64	0.88	0.90
Observations	116	82	52	23	64	59

Table 16. Robustness regression with additional identifiers: deflation and disinflation. The dependent variables are the one year ahead expectation (median) of percentage price changes from the MSC and the one year ahead expectation (median) of CPI all items inflation from the SPF. Model 1 includes a constant, the standardized inflationary pressure index IPI_{t-1} constructed in Section 2.1, with the additional keywords "deflation" and "disinflation", and controls X_{t-1} selected from the LASSO regression of $E_t\pi_{t+h}$ on Z_{t-1}, with Z_{t-1} the predictors described in Section 2.3. Model 2 also includes the FOMC's quantitative inflation forecasts, SEP_{t-1}. The tuning parameters for the LASSO regressions are 0.005 for MSC and 0.01 for SPF. '†', '*', '**' and '***' indicate significance levels at the 15, 10, 5 and 1 percent respectively.

	One Year Ahead		**Three Years Ahead**	
	Model 1	Model 2	Model 1	Model 2
IPI_{t-1}	0.06	0.14^{*}	0.05^{**}	0.11^{***}
	(0.05)	(0.08)	(0.02)	(0.04)
SEP_{t-1}		-0.25		-0.04
		(0.25)		(0.04)
R-Squared	0.95	0.95	0.81	0.86
Observations	127	41	127	41

Table 17. NY Fed SCE. The dependent variable is the one year ahead and three year ahead inflation expectations (median) from the New York Fed Survey of Consumer Expectations over the sample 2013M1-2023M12. Model 1 includes a constant, the standardized inflationary pressure index IPI_{t-1} constructed in Section 2.1, and controls X_{t-1} selected from the LASSO regression of $E_t\pi_{t+h}$ on Z_{t-1}, with Z_{t-1} the predictors described in Section 2.3. Model 2 also includes the FOMC's quantitative inflation forecasts, SEP_{t-1}. The tuning parameter for the LASSO regressions is 0.01. '*', '**' and '***' indicate significance levels at the 10, 5 and 1 percent respectively.